UNITED STATES OF AMERICA
COMMODITY FUTURES TRADING COMMISSION

TECHNOLOGY ADVISORY COMMITTEE MEETING

Washington, D.C.
Wednesday, February 14, 2018
PARTICIPANTS:

Opening Statements:

CHAIRMAN J. CHRISTOPHER GIANCARLO
COMMISSIONER BRIAN QUINTENZ
COMMISSIONER ROSTIN BEHNAM

Panel I: Blockchain and the Potential Application of Distributed Ledger Technology to the Derivatives Markets

JENNIFER PEVE
DTCC

CHARLEY COOPER
R3

DAN BUCSA
CFTC

Panel II: Market and Regulatory Developments with Virtual Currencies and Related Futures Products

JERRY BRITO
Coin Center

GARY DEWALL
Katten Muchin Rosenman LLP

Richard Gorelick
DRW

AMIR ZAIDI
CFTC

Presentations: The Future of Machine Learning, Artificial Intelligence, and Computing Power

TIM ESTES
Digital Reasoning
PARTICIPANTS (CONT'D):

Panel III: Developments and Challenges with Automated Trading Technologies

LARRY TABB
TABB Group

BRYAN DURKIN
CME Group

YESHA YADAV
Vanderbilt University
of Cogen Technologies Linden Venture, L.P.

Panel IV: Cybersecurity Developments and Best Practices

NAEEM MUSA
CFTC

PHYLLIS SCHNECK
Cyber Solutions

Other Participants:

ERIK BARRY
Credit Suisse

NEAL BRADY
Eris Exchange

JERRY BRITO
Coincenter

CHRISTOPHER CHATTAWAY
Goldman Sachs

PAUL CHOU
LedgerX

PETER CURLEY
Promontory Financial Group, IBM
PARTICIPANTS (CONT'D):

RICHARD GORELICK
DRW, Inc.

CHRISTOPHER HEHMEYER
Hehmeyer Trading and Investments

BRENDA HOFFMAN
Nasdaq

MAYUR KAPANI
ICE

BRIAN KNIGHT
Senior Research Fellow

JUSTIN LLEWELLYN-JONES
Fidessa

JOHN LOTHIAN
John Lotian Co. (CTA)

TIMOTHY MCHENRY
NEX Group

ALEXANDER STEIN
Two Sigma

SUPURNA VEDBRAT
BlackRock

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COMMISSIONER QUINTENZ: Good morning everybody. If we could all take our seats please. I'm very excited to get started this morning. It is great to see so much energy and enthusiasm in the room today. It really matches my excitement around these topics and to finally have our first TAC meeting after about two years and only our third TAC meeting in four years. I was saying, if you think the market and technology has changed since then you're right, which is why we have such a robust agenda for the Committee to consider today. And it's just, it is wonderful to welcome all of our members here. I wanted to thank you for being here and, in some cases, traveling across the country or long distances to be with us today. I know that you had to rearrange your schedule on a short notice, given the cancellation of our last meeting. But we're really grateful to you for your participation.

And I'd also like to welcome some of our
new members, or all of our new members for being here. I hope you know what you got yourself into. We're excited to use all of your expertise to advise the Commission on your thoughts around FinTech and your thoughts around market developments. So, let me just actually take a quick moment to express my regret that Columbia Business School professor, Robert Farrokhnia is not able to join us today but we look forward to having him at a future TAC meeting. And before I recognize the Chairman and Commissioner Behnam I did want to take a moment to thank Dan Gorfine, the CFTC's Chief Innovation Officer, the Director of Lab CFTC and our acting chair and designated federal officer of the TAC for all of the work that he has put into this meeting as well as Jorge Herrada whose energy and enthusiasm are really contagious around these issues. A committee and a meeting and workflows are only as good as the leadership and the staff behind them and we have the best of the best here at the Agency. So thank you for all of your work.
And with that, I'd like to recognize Chairman Giancarlo and then Commissioner Behnam.

CHAIRMAN GIANCARLO: Dan will go first.

COMMISSIONER QUINTENZ: Oh we're already running afoul of protocol. So....

MR. GORFINE: Thank you. Good morning.

As the TAC designated federal officer and acting chair of this Committee, it is my pleasure to finally call this meeting to order. Before we get started though, there are a few logistical items that I've been asked to mention to the committee members and invited speakers. Please ensure that your microphone is turned on when you speak and that you are speaking clearly into the mic so that the web cast and the teleconference audiences can hear you. If you would like to be recognized during the discussions, please change the position of your place card so that it sits vertically on the table. For TAC members participating by phone, please keep your phone on mute until you are ready to speak and identify yourself beforehand. Finally, and this may sound a bit
ironic given that this is a technology committee, but please refrain from using electronic devices during the meeting. We have a full agenda before us today and we want to ensure full participation by all members of the TAC. I will turn it back to Commissioner Quintenz who will be introducing Chairman Giancarlo and Commissioner Behnam for their opening remarks.

COMMISSIONER QUINTENZ: Thanks Dan. Yes please, Mr. Chairman.

CHAIRMAN GIANCARLO: Thanks Commissioner Quintenz, thanks Daniel Gorfine, thank you TAC members and to other participants and welcome to those watching here in the room and on the webcast. Today we will examine a range of financial technology or FinTech such as market data analytics, artificial intelligence, automated trading technology, cybersecurity, distributed ledger technology, oh, and of course, virtual currencies.

FinTech and the enormous bursts of human creativity that underlies so much of it is having
a transformative impact on trading, markets and the entire global financial system. These changes have far ranging implications for capital formation and risk transfer, both here and abroad. Last week, I had the honor to testify before the U.S. Senate Banking Committee. And I said that the first element in the CFTC's engagement with FinTech and virtual currencies was to learn everything we can about the emerging technology. Good public policy and regulation can only be built on a thorough understanding of the subject matter and its potential application.

In May of last year, our Agency was pleased to announce the launch of its LabCFTC Initiative. And soon after, the appointment of our Director of LabCFTC and Chief Innovation Officer, Daniel Gorfine. In creating LabCFTC, we wanted the Agency to have the ability to keep pace with technological innovation. So LabCFTC is the focal point of our efforts to facilitate market enhancing innovation and fair competition for the benefit of the American public. But it also helps
to ensure that we can keep pace with changes in our markets and proactively identify emerging regulatory opportunities, challenges and risks. LabCFTC is situated within our office of general counsel, and that allows it to leverage the expertise of the CFTC's legal team and manage the interface between technological innovation, regulatory modernization and existing rules and regulations.

Since its launch, LabCFTC has held over 150 meetings with entities ranging from established financial service firms, to start-up companies. It has conducted these meetings through office hour sessions in New York, Chicago, Washington and earlier this year, in Silicon Valley. Lab CFTC also published its first primer last October on the topic of virtual currencies. And soon, it will be seeking to crowd source topics for potential innovation competitions. In selecting Dan Gorfine to serve as the designated federal officer and acting chair of the TAC, the Commission sought to ensure that the efforts of
the TAC and LabCFTC were mutually reinforcing. Such cross pollinization and breaking down of agency silos, helps modernize our engagement with rapidly changing markets.

Moreover, LabCFTC was formed with bipartisan support. Whatever success it achieves will be bipartisan success. In the end, we share the same goal, to support our vital national interest in maintaining the world's deepest and most durable, competitive and vibrant risk transfer markets in this digital 21st century.

So this meeting is timely. We see what is on the horizon. We must be prepared, responsible and well-informed. As we confront the challenges ahead, we will continue to look to the work and ideas of advisory groups like this one, the TAC that is meeting today. Thank you once again.

COMMISSION QUINRENZ: Thank you, Mr. Chairman. Commissioner Behnam.

COMMISSIONER BEHNAM: Thank you. I'd like to begin by wishing Commissioner Quintenz a
Happy Valentine's Day. And equally important, thanking him for convening today's meeting and for his sponsorship and most importantly, his leadership of the Technology Advisory Committee. You proposed a comprehensive agenda and I look forward exploring these issues of far reaching consequence with you, Chairman Giancarlo and the TAC today and throughout 2018. I'd also like to thank Daniel Gorfine, CFTC Chief Innovation Officer, Director of LabCFTC and the TAC's designated federal officer for planning today's thoughtful and timely agenda. Finally, I'd like to thank the panelists for sharing their time and insight. It is nice to see many familiar faces and I look forward to meeting members who I have not yet met.

Committees like the TAC and also the Market Risk Advisory Committee and Agriculture Advisory Committees which I sponsor, both contribute to the overall mission of the Commission by providing a diversity of views and a high level of expertise on matters that evolve.
rapidly and carry widespread and sometimes systemic consequences. These advisory committees ensure that the Commission remains abreast of market issues on the horizons that could revolutionize our markets in terms of stability, transparency and competition. Or, potentially disrupt markets with shock triggering liquidity events, increased systemic risk and susceptibility to fraud and manipulation.

Turning to today's agenda and the year to come, I commend the Committee for identifying and endeavoring to tackle a wide range of complex, novel and interconnected issues. Twice awarded Nobel Prize winner, Linus Pauling, once said the best way to have a good idea is to have a lot of good ideas. With that in mind and the combined knowledge in this room, I anticipate that the TAC is going to have a great year.

Leading off today's meeting are virtual currencies and their underlying blockchain or distributed ledger technologies. Given the events of the last several months, which included the
historic listing of the first Bitcoin futures contracts, the price of Bitcoin skyrocketing, the filing of multiple CFTC enforcement actions related to Bitcoin fraud and my personal education in Bitcoin, DLT, digital wallets, Ether, Ripple, proof of stake and something called crypto kitty which I understand is a blockchain collectable. It's no surprise that the TAC will be exploring these important regulatory developments.

As the CFTC continues to aggressively dive into these topics, educating ourselves, engaging with market participants and ultimately shaping regulatory themes and oversight, we must remain vigilant to transparency and accountability. To ensure that stake holders, customers and the general public may engage and have an opportunity to contribute to these sea change discussions. Pivoting to the future of data analytics, machine learning and artificial intelligence, as the agenda suggests, we need to encourage dialogue between the Commission, the industry and all other stake holders to ensure
that we provide appropriately tailored oversight and customer protections while ensuring accountability. Our regulations need to keep pace with technology. Our approach to oversight should reflect current technologies and demonstrate our capacity to participate meaningfully in the adoption of new technology.

In regard to automated trading technologies, I'm pleased that the TAC plans to resuscitate at least some of Reg AT. As I discussed and prepared remarks last week, the Commission issued proposals in 2015 and 2016 to establish pretrade risk controls in an effort to mitigate the potential dangers of an unchecked automated trading system. I'm happy to see that this issue will be discussed today as I think it is vitally important the Commission take immediate action on Reg AT as an automated trading system that perhaps runs amok can harm market participants.

As I said last week, the question of a market event, flash, crash or otherwise, is not
if, but when. I look forward to the discussion today and to future discussions with industry participants regarding thoughtful, appropriate regulation of automated trading. Inaction and regard to automated trading simply is not an option.

Lastly, I'm pleased that the meeting will close with the discussion of cybersecurity and emerging trends and best practices. As I've also said before, although each entity, private institution or government regulator must prioritize the protection and safety of its own organization. Cyber defense is an all hands on deck exercise that demands both financial and human resources to protect our institutions, data, identity and in many cases, sovereignty. To that end, cyber risk can not be viewed as a territorial exercise where we only seek to protect our own. Any attack on our government or private institutions presents broad market risk. And we must view it as such in order to address and eliminate any symptoms in a systematic manner.
With all of these interesting and challenging issues in mind, I would like to briefly acknowledge my support for the President's FY2019 budget request. Specifically, it is level setting, at least in part, the CFTC's funding mechanism with other US financial regulators. Since Dodd Frank was signed into law by President Obama nearly 8 years ago, the CFTC and its staff have done an amazing job in meeting new statutory responsibilities and duties with limited resources. Combining the CFTC's new Dodd Frank responsibilities with existing responsibilities and the continuous advent and development of new technologies including those discussed today, mean that the CFTC's overall duties will continue to grow. I'm hopeful that these challenges will be recognized and consequently supported with funding that at the least matches the President's request. Too much is at stake, and the risks to the financial system are too great. I look forward to hearing from the panels on all these important subjects and once again, I want to thank
Commissioner Quintenz, Daniel Gorfine, our panelists and the entire TAC. Thank you.

   COMMISSIONER QUINTENZ: Thank you, Commissioner Behnam, for your Valentine's Day wishes. I hope you enjoy your cupcake. Let me just quickly give my own opening statement and then we'll turn it over to Dan for the panel.

   Technological change in the derivatives market has really evolved rapidly over the last 22 months since the last TAC meeting met. I'm hopeful that we can build upon all of the robust work that prior iterations of the Technology Advisory Committee have achieved. The Committee today is going to explore five main areas, each of which exemplifies how technology is impacting the functionality of global derivatives markets and how traders participate in them. These are also areas where the CFTC can demonstrate leadership and provide effective oversight that fosters the integrity, strength and the liquidity of our markets. My intent is for the Committee to use this meeting to identify the issues, and within
each of these areas that it wishes to explore in
greater detail. With the ultimate goal of
providing the Commission with actionable,
practical advice.

In many cases, I anticipate that
subcommittees may need to be formed to enable the
kind of focused review and thoughtful
consideration to arrive at those recommendations.
The first area the Committee is going to focus on
today is blockchain and the potential application
of DLT to the derivatives market. DLT has the
potential to transform how firms handle the
execution, processing, reporting and recordkeeping
of derivative transactions. Market participants
may find that using DLT to satisfy their
regulatory obligations results in greater
accuracy, greater efficiency and less cost. But,
they may also find that like with many new
opportunities and technologies, DLT also presents
challenges. Much work remains to be done in order
to realize the full promise of DLT, from
scalability issues to the complete digitalization
of derivatives markets, to DLT's compatibility with existing CFTC's regulations. There are many facets of DLT for the TAC to consider.

Next, the Committee will focus on market and regulatory developments involving virtual currencies and related futures products. The proliferation of virtual currencies and tokens over the course of the past year, while very exciting from an innovation standpoint, does raise a multitude of legal and regulatory questions and challenges. Definitional questions about whether a particular virtual currency or token is a security or a commodity continue to be debated. In addition to these foundational legal questions, the growing demand to trade virtual currencies also elevates the risk to consumers that is posed by potential fraud and manipulation on spot platforms. I share Chairman Giancarlo's view that we should be respectful of the enthusiasm of investors for new digital currencies and meet that enthusiasm with thoughtful, balanced regulation.

The CFTC should not attempt to make
value judgements about which new products are worthwhile and which are not. The markets, investors and consumers need to decide that for themselves. However, the CFTC should aggressively target fraudulent and manipulative behavior, whether in the derivatives market or in the underlying cash marketplace. I commend the Division of Enforcement's relentless efforts on that front to protect investors and the integrity of our markets.

The current regulatory framework of virtual currencies is a patchwork of state and federal jurisdictions. As the markets for virtual currencies mature, the Commission, along with its fellow state, federal and international regulators, should ensure a rational approach to regulatory oversight, not one based on fear or inexperience. Jurisdictional gaps should be identified and addressed. In conjunction with those efforts, and as I said at last week's Yahoo Finance All Market Summit, I think some type of self-regulatory organization, or SRO, for
cryptocurrency exchanges could spur the
development of standards around cyber security
policies, data retention, protection of customer
accounts, trading practices and other issues.
Self-regulation has a long history in derivatives
markets. It is worth exploring whether an SRO
model could assist cryptocurrency exchanges to
establish and enforce standards that protect
investors and deter fraud. I look forward to
hearing from the Committee about the possibility
of such an SRO. These are only a few of the novel
issues that the Commission will grapple with as
this nascent but burgeoning asset class continues
to evolve. I hope the Committee's expertise can
assist the Commission in developing smart policies
that address the unique risks and opportunities
presented by virtual currencies and related
financial products.

Next, the Committee will address machine
learning, artificial intelligence and computing
power. We're going to have the pleasure from
hearing from Mr. Tim Estes, the President and
founder of Digital Reasoning. Digital Reasoning developed a product that uses machine learning to facilitate electronic communication and surveillance. The product uses machine learning to determine the meaning of words in emails and chats based on their context. The program is also designed to flag potentially problematic behavior of employees and mark those communications for further review. Mr. Estes will speak with us today about advances in machine learning technology and the future impact on financial markets.

Fourth, the Committee will examine the developments and the challenges posed by the modern trading environment and automated trading technologies. In the past, I have expressed my view that proposed Regulation Automated Trading, or Reg AT, was a missed opportunity by the Commission to explore the real risks of the modern trading environment. I believe the Commission should only pursue additional regulation in this space after it has identified specific risks.
associated with automated trading, examined how
those risks are being addressed through the
market's incentive structure, and then determined
if regulation can play a proper role in
alleviating those risks. Once that threshold
determination has been made, the Commission must
work thoughtfully to calibrate the costs and scope
of the regulation with the specific risks in mind
it is meant to target. The Commission should not
adopt automated trading regulations to address
amorphous hypothetical concerns or simply for the
sake of having them on the book. The TAC can
serve as a forum to reconsider the risk of
automated trading with a fresh eye. To the extent
automated trading risk can be addressed through
regulation, the Committee can look to explore what
form that regulation may take. I'm hopeful these
kinds of conversations can better inform us as to
the true risks posed by automated trading and how
we can best respond to them.

Lastly, the Committee will discuss
cybersecurity developments. I expect this
discussion will be an ongoing dialogue between the industry and the CFTC about what constitutes cybersecurity best practices. The TAC can facilitate discussions about how the Commission and market participants alike can improve data transmission, storage, archiving and disposal processes to protect against cyber threats. Thank you again to all of our members, to all of our presenters for being here and taking the time to share your expertise and vision with us and for rescheduling with us on such a short notice. I'm very excited to hear from you, let's get started.

MR. GORFINE: Great. Thank you all for your opening remarks. I would now like to build on what we just heard from Commissioner Quintenz and discuss the scope, plan and approach for the 2018 TAC. Given the emergence, development and impact of financial technologies across markets, now is the time to be forward looking and proactive. We all need to consider how we can act to ensure continued market enhancing innovation, market integrity and the leadership of our
markets. To this end, the 2018 TAC will be keenly focused on pursuing workstreams that can drive actionable feedback and recommendations to the Commission. Today's meeting will be broad and seek to highlight key issues and topics involving financial technology that merit further exploration by the TAC and potential subcommittees throughout the course of the year.

Our format today will be to begin with brief presentations by our panelists, approximately 10 minutes each, followed by open discussion and questions from our TAC members. At the end of our key substantive sections, we will consider whether the recommendation to create subcommittees for further work would be appropriate.

Before we get started with our first panel, though, I want to take a minute to recognize the work of our colleagues in making today possible. Many have contributed, though again, I do want to highlight my colleague, Jorge Herrada, who is our head of technology for
LabCFTC. Jorge has been instrumental in pulling this together and he has helped to keep me sane in going through the process of postponement and rescheduling, so thank you very much Jorge. I also specifically want to point out Michelle Ghim and Bianca Gomez in our Office of General Counsel, who have also contributed significantly to today's meeting.

With that, let's jump to our first panel discussion which will cover distributed ledger technology initiatives and their potential impact on capital markets infrastructure and a future state of regulatory reporting. Our panelists are Jennifer Peve, from DTCC, Charlie Cooper from R3 and Dan Bucsa from the CFTC. So if you'll please take the panel position, we'll get started with Jennifer, and all can move over there now. I think panel position might be a new term.

MS. PEVE: Thank you, Dan. I'm Jennifer Peve, managing director of business development, office of FinTech strategy at DTCC. I'd like to thank you for the opportunity to present to this
Committee today on a technology innovation that has really captured the attention of our industry over the last several years, blockchain or distributed ledger technology.

The rapid pace of change that is facing our industry today, while nothing new, continues to accelerate. Technology innovations such as blockchain or distributed ledgers, have great potential to bring about transformative change in our industry. In keeping up with such rapid technology innovation is both a challenge as well as an imperative as it affects so many aspects of financial products and markets. It forces financial institutions and financial market infrastructure providers to really consider how emerging technology may disrupt our business, reshape how work is done, make better use of massive quantities of data, drive cost savings and modernize our infrastructure.

In addition, there is a need to understand how supervision, oversight, compliance, rules and laws, interact during this time of such
rapid technological change. It is essential that we work together across industry organizations, technology providers, market participants, regulators and policy makers to continue the collaboration and develop best practices for technology innovations so they deliver on their promise.

DTCC has been a strong advocate for continued collaboration across the industry, and commends the CFTC for its FinTech initiative, LabCFTC, the hub for the Agency's engagement with the FinTech innovation community. Together, TAC and LabCFTC provide great avenues to furthering the public/private partnership as we as an industry continue to advance the technology and address the challenges surrounding it.

As a premiere post trade market infrastructure for global financial services industry, DTCC automates, centralizes and standardizes the post trade processing of financial transactions, mitigating risk, increasing transparency and driving efficiency for
thousands of broker dealers, custodian banks and asset managers worldwide.

DTCC is industry owned and governed and has a 40 year history of leveraging technology to drive innovation and reduce risks and cost for our clients. We continue to build on that legacy by advancing the use of technology innovations to enhance post trade processing while ensuring our applications are consistent with key policy objectives of risk mitigation, market security, certainty, reliability and efficiency. DTCC actively explores how transformative technologies like blockchain, distributed ledgers, cloud, robotics, machine learning, artificial intelligence, can all enhance the post trade process by further mitigating risk and reducing costs.

In January 2017, DTCC announced it would replatform the trade information warehouse for credit derivatives using a combination of cloud and distributed ledger. The TIW is a repository which provides life cycle event processing
services for approximately 98 percent of all
credit derivative transactions in the global
marketplace. There are four main drivers for
adopting the combination of cloud and distributed
ledgers in technology for TIW. The first was, TIW
needed a technology renovation. Second, the
preexistence of standardized process flows and
data models for credit derivatives. Third, it
provided DTCC and the industry an opportunity to
operationalize the technology on a business with
appropriate and meaningful scale, while also
mitigating risk and driving cost efficiencies for
market participants.
And lastly, we had industry commitment.
The decision to move forward was made in
collaboration with client design partners who saw
long term value in moving to the combined cloud
and distributed ledger platform. The project is
being led by IBM with Axoni providing the
distributed ledger infrastructure and smart
contract applications and R3 acting as an advisor.
In addition, we continue to work closely with our
client design partners, financial market infrastructure, such as IHS Markit, and industry standard bodies such as ISDA, the International Swaps and Derivatives Association, throughout the development and implementation of this effort.

The initial phase of the project has been focused on two key objectives. First, to minimize the change and impact on market participants and second, to ensure the quality of the solution, such that we minimize any potential for operational risk to the industry. Post go live, we will roll out future phases of the project which will focus on node administration and adoption, allowing clients and other industry participants the option to adopt nodes and become more active participants of the network.

As with any technology innovation, operationalizing the technology with appropriate use cases, helps to strengthen the solutions and can often highlight limitations of the technology that must be addressed. Our work on the TIW project over the last year has given us a great
deal of real world experience in developing a replacement for a critical industry wide mainframe application. We've learned what works, what doesn't work. We've seen the technology's limitations and discussed work arounds or trade offs with our technology providers and our design partners. And we understand that this is still very much a work in progress.

One of the most important aspects of deploying any distributed ledger use case is an understanding of the distributed ledger architecture. There are a variety of distributed ledger architectures and it is important to perform due diligence on each and really examine how the various approaches meet the needs of a specific use case, as well as any potential trade-offs.

Three examples of components of distributed ledger architecture that one should examine include, data, privacy and sharing. Really understand how is the data propagated and to whom, what mechanisms are used for data
privacy. For example, data may only be
distributed to counterparties who are party to the
trade. But now consider how validations on things
like a trade identifier are accomplished when data
is propagated in many disparate distributed
ledgers. There are also potential implications
for participants who initially elect non-nodal
access to a ledger network, and over time decide
to then adopt a node. How do you think about and
how do you migrate data from a non-nodal access
point to a full on node.

Data storage: Where is data stored? On
chain, off chain and what implications are there
for meeting any data retention policies that
exist, whether you're a network operator or you're
a participant on the network? Smart contract
functionality: What level of confidence and
skills do you have in the language supported? How
much functionality will be performed on chain
versus off chain? And what, if any, latency is
introduced because of the use of the smart
contracts and where the functions are performed?
Other items include things like governance model, interoperability, scalability and performance. DTCC appreciates the Commission's efforts to harmonize technology standards and best practices and encourages the Commission to continue this important work. In addition, DTCC recommends that the Commission consider the following initiatives. Promoting common global data standards and interoperability for distributed ledger technology. A common set of global standards could promote widespread implementation and facilitate interoperable systems, thereby helping to prevent the creation of silo systems. Second, recognize the importance of and facilitate discussions concerning the establishment of governance framework for certain FinTech initiatives. The Commission and policy makers globally could partner with industry leaders to provide guidance in the establishment of such governance frameworks. I would be remiss if I didn't mention standards as another component of distributed
ledger implementation. The development of common standards and protocols required to support rearchitected practices and processes is critical when implementing DLT. Distributed ledger technology can enforce the use of standards and improve the delivery of data but it does not normalize or transform the data. One of the initial use cases DTCC explored was regulatory reporting. DTCC's global trade repository is the only non-commercial global provider of transaction reporting services for the CFTC and six other jurisdictions across the globe. The GTR maintains approximately 40 million open OTC derivative positions per week and processes over 1 billion messages per month.

Distributed ledger combined with other technology innovations such as artificial intelligence, have the potential to allow for more comprehensive transparency into the swap market, provide supervisors with enhanced oversight of the markets and a deeper understanding of risk on a real time basis. Ultimately, a more efficient
regulatory reporting framework. Advancing the application of distributed ledger to support regulatory reporting is heavily dependent on the global consistency of critical data elements. And therefore, regulatory harmonization of swaps data reporting requirements on a domestic and international basis should remain the key focus for the industry.

DTCC supports the efforts of projects such as ISDA's common domain model, a project around standardizing the industry's representation of derivative trade details and related processes, as well as IOSCO's critical data elements. It encourages all in the industry to work toward data standards.

In conclusion, innovation requires learning and experimentation. We remain optimistic about the future of distributed ledger or blockchain. We continuously and actively experiment with the technology, ensuring that distributed ledger initiatives align with and support our business goals and objectives and
deliver client value. We understand that
distributed ledger technology is a nascent
technology, but it is evolving rapidly, and the
challenges we have today will be solved tomorrow.
Significant industry commitment is required to
realize the potential of distributed ledger, as
changing industry business models takes time.
Much of the value in the use cases being explored
comes in changing the business processes, not in
the actual use of the technology itself. And
distributed ledger technology's success, defined
by implementation timing, participants' ability to
adopt, business value it brings will vary greatly
by region and use case. Thank you.

MR. GORFINE: Thank you. Mr. Cooper.

MR. COOPER: Thanks very much.

Commissioner Quintenz, thank you very much for
your leadership at the TAC and for inviting me to
participate today. And to Chairman Giancarlo and
Commissioner Behnam for your bipartisan leadership
of the Committee, I think it's really important.
I would be remiss if I didn't also make a comment
to the staff of Commission. I'm an alumnus of this building and the amount of work that goes into pulling something like this off and the broader initiatives of the Commission across enforcement, market surveillance, et cetera, rests heavily on the shoulders of a small lean staff that does a hell of a job. So, a shout out to those guys here in the room.

I'm going to go totally off script, which is not surprising for me. But I was thinking, I was on the plane down and I had this sort of -- I read the agenda and I thought, I'm going to fit right in the agenda. And then I got off the plane and I thought no, probably not. I think there is a more, I don't know about controversial, but there is a part of a conversation I think we need to have with the private sector and the regulators and how we can work together that I think is often not fleshed out as much as it could be. So if you'll permit me, I'm going to go a little off script.

We live in this really interesting time
where technological innovation and rapid
technological innovation is something that's
assumed. And we have an attention span problem.
This is a day in the age of Twitter where we have
massive tax policy debates in 140 characters and
we don't watch three hour movies anymore, we watch
things on our handheld devices on the subway on
the way to work et cetera and our attention span
gets less. But we also get to this point that we
think technology evolves at all levels as rapidly
as your smartphone. Right, I got a new phone the
other day, and I'm not kidding, 24 hours later in
the morning, there was a notification on my phone
that I needed to update my software, because
apparently the software that was on the phone I
bought the day before was not the latest version.
And we tend to think the technology will evolve
that quickly. And blockchain is, I think,
suffering in some ways from this expectations game
that Satoshi, the initial White Paper on Bitcoin
that came out in January 2009, nine years ago
seems like a long time, and you would figure out
by now that blockchain would have taken over the
world. Well, smartphone technology or certain
types or retail technologies don't operate in the
same way that large scale, enterprise grade,
overhauls of the way systems and processes work in
not just financial services but in all sorts of
businesses that blockchain could be applied to,
don't change that quickly.

The first email was sent in 1971. That
was before I was born. I graduated college in the
mid-90s and I didn't have an email account. There
was an intranet account at Georgetown and I think
I got sent homework assignments on it which I
didn't really do which is not a surprise. But, if
you think about it in that context, the internet
that was conceptualized in the 40s and 50s,
really, began in some ways in the 70s and didn't
become mainstream until the 90s. Now, I'm not
saying that blockchain is going to take that long,
but my point is when we're having these
conversations and people are wondering where are
we in the evolution, why is it taking so long, why
are you doing all this experimentation. And you take a step back, you actually realize, things are happening really quickly from a large scale perspective. And the potential impacts of this technology in financial services, specifically in derivatives but broadly across all hosts of asset classes, is massive. This isn't a software update on a smartphone, right? This is a much bigger deal. This frankly goes to the very way in which capital markets operate. And if we are right, if companies like DTCC and ourselves and some of the others around this table are right, this could represent over the next five to ten years, a wholesale change in the way that all these markets operate and consequently the way in which you all at the Commission do you jobs. This is a big deal.

So that leads to the next question which is, okay, well, recognizing this is a big deal and recognizing change is happening at whatever pace is, where are we now? What the hell does that mean in 2018? 2018 is the year it's about to get
real. And what I mean by that is, commercial deployments, at scale, in the marketplace, of distributed ledger solutions, by regulated financial institutions, across asset classes. And I can give plenty of examples of that and happy to talk about that in some detail. But, there have been years of proofs of concept and people are bored with them and experiments and tests and whatever and people don't seem to think that's interesting. Well, that all served a purpose, right? Before we launch a commercial product into the marketplace, that market participants and regulators use, you damn well better make sure the thing works, right? And that's what the testing was about and that's what the proofs of concept were about. But now we're at a point where real applications are going to be put in the market and actually, live trades are being done as in the past couple of weeks on our platform and others, some of which is going to be made public in the next few weeks. But this is beginning, now we're real, okay? And this is going to come to an
example of what we're doing and this plea that I'm
going to make to the Commission.

One of the things we're working on at R3
is regulatory reporting. Now, regulatory
reporting is enormous, right? You go across all
the different asset classes that are covered in
capital markets and non-capital markets. I mean,
all sorts of different -- every type of financial
institution. Whether they're a retail bank, an
investment bank, a global transaction bank, a
merchant bank, you name it, has requirements to
report to you or some other regulator in their
home jurisdiction, what types of activity they're
doing, and they all have different standards and
they different ways of aggregating data and what
types of information does or does not need to be
given. It's a big headache. So, it's not like,
we're going to go from no regulatory reporting to
blockchain regulatory reporting overnight. It's
not like the industry shifts like that.

What we believe is going to happen is
you're going to start seeing focuses on specific
asset classes, proving the model. Actually, so
one of the things that Jennifer talked about,
instead of DTCC going from no blockchain to
blockchain overnight, they're focused on the trade
information warehouse and CDS work within that
part of the organization, to make sure that it
works before they make this wholesale transition,
right? We think that makes sense. There's not
this light switch that goes and suddenly the world
wakes up to blockchain.

But to successfully do that from where
we're sitting, we need to take you all along on
that journey with us. That's why the work of the
TAC and the CFTC Lab and the rest are so important
to what we're doing. But there is a level beyond
that and this plea will come in a second to get
you involved. One example of what we're doing is
a regulatory reporting application that we're
building in conjunction with RBS, Santander and
the FCA in the UK. Now, we're still scoping the
exact project, what the application will look like
and what their level of involvement will be, but
they were involved in a proof of concept that we did at the end of last year. It focused just on the mortgage market in the UK. Like I said, a discreet set before you extrapolate out in a bigger way. But this was an example of a federal government regulator in a major country, not just sitting back and listening and getting up to speed on things. They were in the lab with us with technologists and with regulatory specialists and with subject matter experts helping us develop a proof of concept that could be turned into a commercial product and giving advice on that.

That's a very specific example. And the agenda talks about regulatory reporting, about that, but this could be extrapolated out in all sorts of different things that effect regulators from KYC, to risk management to you name it. The Monetary Authority of Singapore is involved in so many blockchain initiatives, I frankly can't keep track. Almost two years ago, the Bank of Canada issued an instance of the Canadian dollar on blockchain technology. Now, that was in a test
environment. But, just to give you an indication of where they were, that was the summer of 2016. One of the things that we feel is really, really critical is getting regulators involved in that journey with us. Because at the end of the day, the worst mistake we could make as private sector entities is to build something that we think is really cool and absolutely fantastic and robust and we get ready to launch it and we come knock on your door and then we tell you and you look at us and say, well that was a really nice try but it doesn't work for the following five different legal or policy reasons. Well then, we've wasted millions of dollars in development, we've wasted time and energy only to find out that what we want to provide to the marketplace that would be a benefit to market participants, runs afoul of the goals, both the spirit and the letter of the regulations and the law in which you guys operate.

We want to pull you guys in, and so this is the plea. Put bluntly, we would ask as passionately as possible, for the U.S. regulators
and members of the agencies and departments of the U.S. federal government to become even more active than you already are. CFTC, the CFTC Lab, I think, is one of the only but it is certainly the most robust or most well-known of all the regulatory efforts in this space. You're leading the way compared to many of the other different regulators in Washington. But I can tell you, there are federal governments around the world in industrialized nations that are way outpacing the U.S. government. And that's a concern. Because fully a third of our clients, our partners, our investors, our members, whatever you want to call them of R3 -- we lead this consortium of over 200 financial institutions and technology companies--are U.S.-based or U.S.-headquartered. They report to you, and they report to the Fed, and they report to the SEC, and they have all sorts of different regulatory regimes they need to take into account.

What that means is, their competitors in Europe or Asia or in other places where regulators
are outpacing the U.S., are gaining an edge. And we would suggest, we're a U.S.-domiciled company but we're global, right? We're headquartered here, but we have more people abroad than we do here in the U.S. now. We're involved in a level of sophistication and actual active involvement from different regulators around the world, to a level we don't see here in the U.S. yet. So the plea is to the extent that we can up that engagement. And actually, Chairman Giancarlo, I mean, really a thought leader in this space, a number of the different comments that you've made publically like, get in there guys. We need to take this seriously, we need to promote innovation. We could not agree with you more and we want to take you on that journey with us. Because again, if we don't do it right, we're going to mess ourselves up, but we're also going to mess up what you all are trying to do, and we're going to mess up your mission. This technology is not just for the private sector. If this technology is built appropriately and
deployed appropriately, it will make your jobs
easier. It will make you more effective
regulators.

And active participation here, I'm not
talking about just start writing a whole bunch of
regulations before we know what the technology is
or is capable of, that's not what I'm talking
about. I'm talking about technological and
business involvement where we bring you all into
this journey with us so you really begin to
understand and experiment with the technology and
help us to develop it in an appropriate way that
meets your needs as well as the private sector
needs.

So, I'm going to leave it at that,
because I know we'll probably have a ton of
questions, whatever.

I know that probably didn't answer the
topic on the agenda, but I thought this is a forum
that, it just, I wanted to use it to throw myself
at the altar and beg for whatever I can. So there
you go. Thank you very much.
MR. GORFINE: Thank you. Mr. Bucsa.

MR. BUCSA: So Charley, here's my card.

It looks like we'll be talking and I now get to follow up that very impressive, off the cuff, remarks with a buttoned up speech from a regulator. So, I'm a Deputy Director within the Division of Market Oversight. I'm in charge of reporting and data policy. My part of the agenda is meant to present a regulatory perspective on DLT use in reporting. Now, for the disclaimer, the views I'm about to share are mine and mine alone. They don't represent the Commission, any Commissioners or any other staff at the Agency.

I'm pleased to see some familiar faces around the room. I want to welcome the new members of TAC on this fine Valentine's Day. But, more important than Valentine's Day is that today is when pitchers and catchers report for most major league baseball teams, especially my beloved Chicago Cubs. Since baseball is in the air, I want you to consider the careers of Jamie Moyer and Rafael Palmeiro as we juxtapose America's
pastime with the possible application of blockchain to regulatory reporting. Feel free to Google those players during my remarks. I won't mind at all.

Similar to when these players were Cubs, DLT is relatively nascent and carries both potential and uncertainty. How the Cubs reacted to the risks and rewards of the two players serves as a reminder of how not to approach DLT for reporting. We need to take the time and make an effort to evaluate the costs and benefits of DLT, and whether it makes reporting better, cheaper and easier. From my perspective, the benefit of the TAC is to be forward looking and have industry advise the Agency on technological innovation. By forward looking, I mean years into the future and not the next news cycle, election or market shock.

The Chairman has expressed the desire to transform away from being an analog regulator of digital markets, and that is not expected to happen overnight. The TAC is not the place for incremental steps and small measures but we
encourage you to think big. I don't wish to focus on slight improvements in efficiency in the near term, but whether we reshape the reporting regime via a five to ten year DLT strategy to enact a significant win that helps market participants, regulators and those that depend on the price discovery and hedging our markets provide.

The futuristic visions of regulatory oversight must contemplate how to incorporate DLT as it continues to improve and mature. The Commission must stay abreast of technological developments, while creating a rule set that does not stifle innovation, facilitates experimentation and protects the markets. The onus is on market participants hoping to take advantage of future technology to keep us informed, work in lock step with regulators, and consider regulatory needs during, and not after, development of applications. Trying to adapt a system to meet regulations as an afterthought is often costly and inadequate. The CFTC having a seat at the table affords us the opportunity to provide input and
minimize the burden of regulatory requirements. The Commission must ensure that its regulations remain technology neutral as much as possible, instead, requiring market participants to comply with principles without prescribing how these must be met unless necessary.

As the requirements of Commission regulations will apply to market participants, regardless of the technology they utilize, creators of FinTech and those that intend to use it, should consider compatibility of the regulations from the onset, or, if rules need to be reevaluated for novel technologies. Contemplating this interaction regarding blockchain between regulatory agencies and those they oversee, prompts the following questions that require further study. Could DLT benefit reporting parties and the regulatory community concurrently? Would DLT provide regulators with the market visibility necessary to fulfill our mission? What would the future state of reporting look like? Can the TAC help us determine if our
rules are permissive of new technologies and if not, where friction points exist? Despite this list of questions, we are encouraged the regulatory use of technology could offer three significant advantages.

First advantage: Better regulation through technology. DLT brings exciting potential from making reporting systems more reliable, more automated and less resource intensive. The evolution of DLT could allow regulators to access data automatically and seamlessly from reporting entities every time a trade is executed or posted on a particular blockchain without the need for human intervention or the use of intermediaries. This functionality could increase the speed with which regulators access data and improve the reliability of said data. More specifically, Commission access could be incorporated into distributed ledgers of reporting parties. This would allow for the Commission to be more nimble and efficient as it is up to date on market events as they happen, allowing for near real time
oversight of markets.

Second advantage: sharing of data and greater access via DLT. As the financial crisis demonstrated, the derivatives market is interconnected and global in nature, requiring regulatory coordination. Access to data across jurisdictional boundaries is a prerequisite part of the process. The TAC could explore how to apply FinTech to resolve the silo approach of the U.S. regulatory system. The CFTC could collaborate with other authorities on leading development of best practices to support regulator nodes on distributed ledgers. Imagine a set up where DLT helps transcend the fragmented regulatory structure by providing reference to a single, validated record of all financial information. Some of you are likely required to provide data to various regulators in an uncoordinated fashion. Those same regulators duplicate their efforts to ingest, validate and parse that overlapping information. From the regulators' viewpoint, jurisdictional turf wars
over collection and access to data, protracted negotiations over data sharing agreements, harmonizing data sets that were structured differently and transfers of sensitive required data would be remnants of a bygone era. Agencies would no longer be privy to only a sliver of a firms' activities, or subject to delays based on snapshots in time. Instead, every U.S. financial regulator whether tasked with market manipulation, monetary policy or systemic risk, would have immediate access to all the data available on the blockchain and be allowed to make fully informed decision based upon a holistic view.

Third advantage: reporting via blockchain. DLT should also bear fruit from the perspective of the market practitioner with reporting obligations. Firms can no longer be subject to providing piecemeal data, sometimes duplicative and often sensitive, to various regulators. Market participants would be absolved from having to create new systems to maintain and transmit records, transpose data utilized in the
regular course of business to match regulatory formats, complete an expansive list of forms and connect to and sometimes pay for intermediaries to report. While the Commission is disinclined to mandate the adoption of promising, yet relatively untested and undeveloped FinTech, the aim is to maintain fertile ground for innovation, and allow the germination of applications in the regulatory space.

Since the Agency would not force the use of DLT, the CFTC would leverage the transition of the new technology if and when market participants, on their own accord, decide to transition to a new way of doing things. Blockchain will most likely only be adopted for reporting if individual firms decide that it decreases burdens and presents a viable cost/benefit scenario or return on investment.

Staff will not be recommending that the Commission make that investment choice for firms and decree their technology development plan. The ensuing issues that need to be resolved are not
meant to dissuade focus on FinTech but are intended to highlight unknowns that need to be confronted while tempering enthusiasm that regulatory reporting via DLT is both a definitive and near term deliverable.

The first unknown: Standards and interoperability. The Commission's potential use of FinTech is affected by a number of variables that could erode the benefits of incorporating these technologies. The use of DLT will need to be subject to uniform standards that allow staff to successfully access and analyze the data. The current perception is that data itself and the methods of its transmission are not sufficiently standardized to be fully utilized by the Commission as a litany of blockchain consortiums and startups are operating. The same issues that plague the inception of any reporting stream would manifest themselves with inconsistency of format and allowable values if the design of distributed ledgers is not coordinated.

With a multitude of DLT solution
providers vying for market share, interoperability across blockchains becomes a concern for regulators. Without consistency, and if too many types of distributed ledgers persist, instead of the limited divergent data sources the Commission grapples with currently, we could be saddled with attempting to accommodate dozens of different distributed ledger data schema. Data as disorganized as this would be nearly unusable by the Commission, which would render moot the benefits of using DLT. In parallel with how the industry would not compel market participants to utilize FinTech, the CFTC would likely not be willing to build interfaces for both DLT and traditional data ingest in our business model with our budgetary constraints.

Second unknown. The CFTC retasking itself to use DLT. Even if interoperability develops, the approach such as the ISDA common domain model, will the CFTC have the wherewithal from a technology, expertise and resources perspective to understand and consume information
on the blockchain. The CFTC has expended time, money and intellectual capital to build tools based on existing data sources and delivery methods. The Agency is able to accomplish tremendous work with the current data setup. Before pursuing DLT, the TAC would need to advise on the development of a long term technology plan. This must include a determination of if and how the Agency could allocate funding to rebuild its' technology infrastructure and analysis methods to take advantage of FinTech as the mechanism of the future. Overpromising and underdelivering on blockchains, could prove to be a risky proposition if not planned appropriately.

Another challenge presents itself if DLT cannot make itself attractive to all entities with reporting obligations. It is conceivable that large, sophisticated and technologically advanced players will embrace FinTech, discern that it is in their best interest to apply it and blockchains become the lynchpin of some parts of financial activity. At the same time, it is equally
plausible that some entities with reporting
obligations reach the opposite conclusion and
decide not to abandon their existing systems and
expend time and money for DLT. The CFTC would
then be in the unenviable position of maintaining
duplicative means for accessing data.

It is relatively easy to suggest that
DLT be applied via sound bite or a blurb on social
media. But it appears harder to figure out the
details and implement the plan by answering the
questions raised today. The takeaway is that we
should try to explore the technology and fully
evaluate its long term merits. We should not
dismiss the role that it can play in the
regulatory space since it is new and unproven,
similar to young Jamie and Rafael.

So why don't I bother you with
references to ball players in the last 1980s. The
Cubs lacked the vision to appreciate what they
could eventually become. Patience quickly ran out
as doubt overshadowed confidence and both players
were shipped out of the organization in the same
trade. Moyer had a fast ball barely topping 80
mph and durability issues with chronic shoulder
trouble. Critics worried that Palmeiro would
never hit for power to justify a starting role.
When it was all said and done, Moyer was a major
league starter for a whopping 25 years, an
all-star and a World Series champion. Palmeiro is
only one of five players in the history of the
game with over 500 home runs and 3000 hits, both
magic numbers in baseball.

The lesson this teaches us is that while
uncertainty exists in the blockchain for reporting
discussion, we should not repeat the Cubs' mistakes
and ignore the technology or shy away from carving
out a new path. Instead, we should welcome the
challenge as growing pains can be overcome and
lead to success if nurtured correctly. I'm not
advocating that we dismiss the regulatory
applications, but highlighting issues that need to
be resolved. At the same time, we must be
cautious not to go all in without being cognizant
of risks. We need the TAC's expertise to inform
us if we are thinking of the right ecosystem for DLT and reporting. Have we identified the appropriate challenges? How do we mitigate the concerns if the Commission were to proceed down this road? To sum up, if the feeling is that its' adoption could benefit both market participants and regulators by decreasing burdens, increasing standardization and improving the immediacy of market oversight, then we should take advantage of the tremendous opportunity of this exciting technology. Thank you.

MR. GORFINE: Thank you, Dan. I'd like to thank our panelists. And I will say as a Red Sox fan, I prefer to think of Jamie Moyer in Boston. But anyway, with that, I'd like to open it up now to some questions and just open discussion amongst members. But have in mind, what are the potential work streams that we would think could be the subject of a subcommittee during the course of the year. And then we'll consider whether we would want to recommend the creation of a subcommittee. I'll throw out a
first question, you're welcome to pick it up or
ask your own or make your own statement. But, to
pick up on what Dan had mentioned, what are folks
thoughts in terms of the current business case to
adopt DLT or these types of ledger technologies?
Is there currently a business case and what do we
expect adoption to look like? What is the pace of
adoption going to be? And, if you could do the
name tag vertical, on the, then we can go, we'll proceed
that way.

MR. OCHERET: Chuck Ocheret, NEX Group.
I mean, we're a market provider of all kinds of
services and I'm primarily focused on DLT efforts
surrounding post-trade services. The number one
thing, I mean, in talking to lots of other people
in the marketplace, that we get from distributed
ledger technologies, are very different from sort
of the broader spectrum of what people have been
interested in for blockchain initially. We don't
need things like anonymity, we don't necessarily
need truly trustless consensus. In fact, that's
not really what you want. There are two things
that we really get. We get this notion of proof
of existence and non-repudiability. Which means,
if we publish a result out to the world, we can't
take it back, or we can prove to the world that
we've published it. People know that it's been
published and it has never been tampered with.
So, you know, nobody can say, you never published
that, we can prove that it existed and that we can
never take it back once we've done it.

That seems to be the two primary things
that people are really, really concerned about. A
lot of the services that we provide are, you know,
valued added proprietary services that require,
you know, tremendous amounts of computation or
tremendous amounts of external data. So things
like smart contracts on the blockchain aren't
really feasible. You know, that's where things
like, you know, Corda from R3 does some things,
does some of the thinking correctly. But those
are the primary things that people seem to really
care about. They want to have this one version of
the truth or they want to have a source of one
version of the truth that everybody can be sure
has never been tampered with or hasn't been
changed in an non auditable way. I mean, you can
obviously change your record as long as there is a
record of all the history. So those are the
things people seemed to be most concerned about
and that's the primary thing people want seem to
want to get out of this.

MR. GORFINE: Thank you. And I'll go to
you, Mr. Knight.

MR. KNIGHT: Thank you. So, I wanted to
tee off something that Mr. Cooper said about the
regulators coming along on the journey. Not to
take away from that vision because I think there
is a there there that should be considered, but I
want to flag some of the potential questions that
we should be asking when we're talking about that.
In particular, you know, if we're going to have
the regulator at, serve as kind of a consultant
to the firms, how do we make certain that that's
fair? Like we wouldn't want a world where the
regulator serves as a consultant to R3 and none of
R3's competitors, because that would give R3 a significant advantage.

We also need to be thinking about how are we going to avoid -- or, put it this way -- how do we have a situation where, we wouldn't want to have this be mandatory. Right, like the only way you can come to market is if you contract, if you get a consultancy with the regulator. I mean, presumably we want a world where people can still in good faith develop a product and then bring it forth and see if it works or not, face whatever regulatory consequences they may face.

And finally, we should be thinking about, when we structure this, you know, and no disrespect to our very gracious hosts here. But like, we don't a world where the regulator is like a vampire, and once you let them into your house, you're powerless to stop them. We need to be thinking about, how are we going to, how do the regulators use their data, or what is going to happen with that data. If the regulators have access to data, how can it be used, under what
terms and how is that structured. Which is all to say that I think there is certainly something to be said for the regulator being engaged early and in a collaborative way, but we need to make certain that it is done well.

MR. GORFINE: Thank you. And Ms. Yadav.

MS. YADAV: Great, thank you so much to the panelists for a very insightful set of presentations. My comments really were in relation to thinking about and getting a sense from you about the integration of DLT technology into the workings of the clearing house. And in particular, looking at the many new risks that clearing houses are facing, following Title VII. And the advantages or potentially the risks that are be created by DLT in relation to settlement risks and counterparty risk in that regard. Obviously the implications of this will extend much wider in that context. For example, in relation to margin requirements, in relation to how regular reporting is going to happen. More broadly, of course, I just wanted to understand
more precisely, how some of the latency issues in
relation to DLT reporting data robustness and so
on might translate into an impact, eventually
going forward the operations of clearing house and
risk mitigation in that regard.

MS. PEVE: So there were a lot of
questions in there. I think I'll start with, I
think, as a clearing house of equities
transactions, fixed income and equities, I think
one of the challenges that we face when we look at
distributed ledger technology right now is the
performance and scalability aspects. So addressing
and understanding, you know, how many transactions
you need to process in a second, what kind of time
to clear and settle, you know, requirements you
need to meet and ensuring that whatever platform
you're exploring, experimenting with can support
that type of volume. Not only the volume that you
transact on per second basis, per day basis, but
also what peak volumes you might need to hit in
order to address any regulatory requirements. So,
I think that's one of our biggest challenges.
I will tell you that DTCC processes upwards of 25,000 transactions per second, in clearing equities, and that's something that we don't believe currently a distributed ledger can support. And that's not just instantiating the trades, but you have to consider putting the trades on the blockchain, the actual process by which those transactions are validated, what kind of processes are also being run on the blockchain and any latency involved, how many nodes can you scale up to before you see any, you know, degradation in performance. So, there's lots of, and that is not all of the factors that go into it, but there are lots of different architecture components that really help define how well a ledger runs. And again, each ledger, it is really important to look at multiple different flavors of those ledgers, because they all have different capabilities, right? And then you can start to play with some of the levers to better understand what works and what doesn't work.

In terms of risk, I think, you know, a
distributed ledger can certainly assist with, you know, reducing settlement and counterparty risk but it's not a, it's not the only solution, right? And again, I think for clearing houses, there is, because of the performance and scalability challenges, it is some time before they are, you know, likely to be adopted in that capacity. And then on the reporting side, I think, you know, absolutely there is a great use case for it, but it is so dependent upon the harmonization of the data standards on a global basis that until we can address those data elements and standardization around those data elements, it makes it difficult. Not impossible, you know, technology can solve things every day, right? So, then certainly there is likely to be workarounds but you have to evaluate are workarounds going to be worth the outcome versus, you know, standardizing the data elements and getting a more streamlined input and output.

MR. GORFINE: Mr. DeWaal.

MR. DEWAAL: Thank you. Again, with
everybody else, I commend this meeting. I commend
the work of the Commission and Dan in particular
for organizing this. You know, one reaction and
then one question. So, Charley, when you talked
about why, you know, you talked about the
evolution of the distributed ledger and the
blockchain as being slow, I agree with you. But
the reality of life is you've got step back. The
blockchains, I'm not sure there is one blockchain
out there, but the blockchains out there were
developed initially as decentralized distributed
ledgers. And so the rules of governance are still
evolving. The way to change any particular
blockchain requires a consensus. That isn't
necessarily the most rapid. And maybe over time,
the process of governance will improve and maybe
the methodology of consensus will get a little bit
closer and better and things will pick up.

And I guess that leads me to just an
observation. So I think that, at least what I'm
hearing today, really there is two types of
distributed ledger technologies in play right now.
There is the decentralized distributed ledger technology where nobody in particular necessarily runs it and it is just the cryptography and the encryption and the mathematics that hold it together and the rules of whatever the system is. And then there is the private or permissioned distributed ledger that relies on the technology. You know I wonder if Jennifer or Charley or Dan have a view regarding the viability of both models. Is there a place for both decentralized distributed ledger technology and the multiple of blockchains and the multiple of opportunities that are out there or is it only, are we only speaking about the permissioned.

And one of the reasons I mention that is because most of the applications that I see, most of the consortiums that I see today are the big folks. They are folks who are trying to take advantage for existing businesses. To the extent you're looking at some of the decentralized applications that might be sitting on top of the Ethereum chain. They are the innovators, they are
the new guys. They're trying to figure out a new way of doing something. Are there different approaches, is there different viability for both?

MR. GORFINE: Thank you. I'm going to take two more questions or comments, Mr. Durkin and then we'll come over to Mr. Stein.

MR. DURKIN: My question, first of all, thank you for your presentations. You all did an excellent job. I want to just jump on a theme that Jennifer, in particular, has been underscoring. And I think we walked a similar journey together with the trade repository services and the requirements that came via legislation as well as the requirements from the CFTC. And that is, data standardization and harmonization is extremely important. I mean we, at the CME Group, while we think blockchain has promise for the financial services sector and we ourselves are continuing to explore various applications for our core business. We also feel it's incumbent upon all of us to pay attention to the work and the opportunities associated with
joining various initiatives to help us understand
and be part of driving the standards, the policies
associated with this technology.

For example, we're a longstanding member
of the Linux Foundation. In fact, we've been
actively engaged in developing their hyper ledger
initiative. And part of that goal is committing
ourselves to fostering open standards, encouraging
diverse participation of market participants,
cultivating the highest standards and protocols as
this technology evolves. So trying to be at this
in the formative stages, I think, is an imperative
and an opportunity for the TAC to be focusing on
this as part of a possible subcommittee.

We're also part of the PTDL which is the
Post Trade Distributed Ledger Group and this is
based out of London. It is made up of the largest
global banks, the exchanges, the clearing houses,
the custodians and global regulators. And we've
been brought together and we were one of the core
founding members to understand, how is this
technology going to emerge, how could it possibly
be applied in terms of distributed ledger
technologies to our industries and our businesses
that we represent. We also continue to support
fixed protocol initiatives and we serve on the
fixed digital currency and blockchain working
group as the co-chair and member of that. So the
point being made here, there are opportunities,
this is evolving. We do think that there are
applications in various ways and we commend the
Commission for taking this topic on and would ask
that you consider it as a possible subcommittee.

MR. GORFINE: Thank you, Mr. Stein.
MR. STEIN: Thank you. So we laud the
Commission and this group for looking at this
exciting technology. It clearly has dramatic
potential. However, I'd also like to point out
that technology on its own rarely solves a
problem. And I encourage this group, when you're
thinking about the application of blockchain
technology, we equally think about how to get it
adopted. In a proof of concept in a white room,
you can do lots of interesting things. But we
have a very sophisticated expensive financial infrastructure. So an equal amount of thought and work on how to get adoption is important.

And also I'll say that those like DTCC and the CFTC, the infrastructure, the regulators, are most likely to be the source of the driving vision. There are members of the ecosystem, the buy side, that are unlikely on their own to create a standard that everyone will magically rally around. And so I encourage this group to embrace the full ecosystem and the buy side, in particular, as part of these discussions to ensure we both have a path to adoption and one that takes into account the varied perspectives of the different participants.

The last point I'd make related to some of this discussion, is there is a lot of hyperbole in blockchain and a lot skepticism as well. I think it behooves us to take a practical approach to look at these innovative concepts that Satoshi truly had some breakthroughs. Not in the underlying technology, but in how to combine known
technologies and look to figure out what is the
most practical solution so that we can achieve
what Dan Bucsa described as the efficiencies and
the clarity without undermining the ownership and
control of the intellectual property that I
believe Brian mentioned. Thank you.

MR. GORFINE: Thank you all of our
panelists and thank you for the comments and
questions posed. I think that basically to
summarize this conversation, I think we've just
hit the tip of the iceberg. There is much to
explore in terms of potential promise, as well as
challenges and real world challenges. So I think
based on what appear to be a number of trends or
themes or work streams worthy of further
exploration, I would, as the acting chair, move
that the TAC recommend to the Commission that it
consider creating a subcommittee on distributed
ledger technology. Is there a second on that
motion? There are many seconds on that motion.
Are there any questions or comments before we move
to a full vote? Okay, and if not, I will now call
for the vote on the motion. All those in favor of recommending to the Commission that the Commission consider creating a subcommittee on distributed ledger technology, please say aye.

COMMITTEE: Aye.

MR. GORFINE: All of those opposed, please say nay. Are there any abstentions? Okay with that, the motion carries.

And we will now turn to our next panel.
It was well set up by Mr. Stein, talking about Satoshi and virtual currencies. So, our next panel will discuss virtual currencies, related Futures products and market and regulatory developments and challenges. Our panelists are guess speaker Jerry Brito from Coin Center, Gary DeWaal from Katten Muchin Rosenman and Richard Gorelick from DRW and Amir Zaidi from the CFTC.
So if our panelists can take their position, we will begin with Jerry.

MR. BRITO: Mr. Chairman, Commissioners, Mr. Gorfine and members of the TAC Committee, thank you very much for inviting me to speak here
today. My name is Jerry Brito and I'm the executive director of Coin Center. It's an independent non-profit based here in D.C. that is focused on the public policy issues that affect cryptocurrencies and open blockchain networks like Bitcoin and Ethereum.

Over three years ago, I had the privilege of presenting to the Global Markets Advisory Committee, then chaired by Commissioner Wetjen, at the first public meeting about Bitcoin and cryptocurrencies that the CFTC had held. The focus of that early meeting was on explaining what was Bitcoin and blockchain technology, how it worked and what were its social, economic and regulatory implications. We've come a long way since then and we've seen cryptocurrency technology and networks grow and capture the imaginations of technologists, entrepreneurs, investors and policymakers in a big way.

What I'd like to do today is give you an update on the developments we've seen in the technology and in public policy in the three years
since that first meeting. So let's start with the technological developments. The most obvious change looking at the landscape of cryptocurrency technology today is the proliferation of new cryptocurrency networks and tokens over the past few years. Three years ago, there were only a small handful of open blockchain networks in existence, with Bitcoin, the first cryptocurrency, being the 800 pound gorilla with almost 100 percent market share. Since then, many new cryptocurrency networks and tokens have been developed and today, there are over 1500 tracked by Coin Market Cap, which is an industry website.

Some of these are essentially copies of Bitcoin with few if any improvements or real differences to distinguish them. Others are remarkable efforts to extend the breakthroughs developed in Bitcoin to accomplish new things and allow for new applications. Ethereum, launched just two and a half years ago, is one of the most promising cryptocurrency projects to emerge since Bitcoin and today it accounts for 20 percent of
the market cap of all cryptocurrencies. Whereas
Bitcoin's design goal is very simple and
conservative, to be the first and foremost peer to
peer electronic cash, Ethereum's design goal is
incredibly ambitious. To be a decentralized
global computer on top of which one can run any
number of applications. From prediction markets
and personal identity systems to insurance
contracts and crowd source hedge funds. Indeed,
of the 1500 token projects I mentioned earlier,
about 600 do not run on their own blockchain
network but exist on top of Ethereum.

Another set of new cryptocurrency
networks are those like Zcash, Monero and Dash,
which aim to improve Bitcoin's design by adding
privacy protecting features. Privacy and
fungibility are two of the most salient futures of
cash but are missing from Bitcoin. These new
cryptocurrency networks use advanced cryptography
to allow consumers to keep their transactions
private and selectively disclose these
transactions as they wish or else are compelled to
through legal process or are required through regulation. It also turns out that private transactions are very important to financial institutions who have been experimenting with their own DLT solutions and have found that simple blockchains like Bitcoins are too transparent. Projects like J.P. Morgan's Quorum, an enterprise focused closed blockchain solution that is looking to incorporate technology from Zcash to keep transactions confidential to the involved parties, but verifiable to the larger network.

Finally, how these networks can scale to accommodate the thousands of transactions per second that would be necessary for global adoption, is a major technical challenge that has been one of the main focuses of developers over the past couple of years. Bitcoin today tops out at about 10 transactions per second. But employing second layer solutions like the Lightning Network or the Rating Network on Ethereum, can potentially allow for massive scaling by allowing for secure, off chain transactions and only using the
blockchain for settlements. This technology has
been developed over the past couple of years and
the first working networks launched this year.

Let me turn now to developments and
public policy over the past three years. The top
issues facing cryptocurrencies are consumer
protection, securities regulation, tax policy and
anti-money laundering regulation. Let's take
those in turn. Regulation of actors in the
cryptocurrency ecosystem to ensure consumer
protection, has been done primarily through state
by state money transmission licensing. The policy
rationale here is that if a business is taking
custody of consumer funds, even if it's just
momentarily, in order to provide a financial
service, they pose a risk of loss to consumers.
To address that, they must first receive
permission from the state, typically after passing
a background check, posting a bond and meeting
other requirements, before they can engage in
business. Two problems emerge with this state by
state regime.
First, is that firms must seek a license in every state in which they do business, in which they have customers. Which, for an internet business, means every state, even though it is made, the firm is made no safer to consumers when it passes its 50th background check then when it passed its first. Not only is this an inefficient and burdensome regulatory impediment to inherently interstate commerce, the state regulators have been generally slow to interpret and clarify how its licensing requirements apply to cryptocurrencies.

Second, because these laws were typically written decades ago, they are not written in terms of custody which is the risk they seek to address, but instead, in terms of transmission because before the invention of Bitcoin, custody was inherent in transmission. Cryptocurrency networks, however, allow one to perform many different activities that could be construed as aiding the transmission, and thus potentially covered by licensing requirements, but
which never involved custody and thus a risk of
loss by a third party. Operating as a minor or a
node on the Lightning Network or offering a
non-custodial wallet service are all examples.

Just under three years ago, the State of
New York created a technology specific license
called a BitLicense which has been universally
panned by the cryptocurrency and legal
communities. Since then, other states have
amended or interpreted their statutes with varying
degrees of success. More promisingly, the Uniform
Law Commission has developed a Uniform Virtual
Currency Business Regulation Act that is excellent
and is now being considered by several states.
Unfortunately, attempts at state by state reform
don't scale. State by state money transmission
licensing additionally has no provision for market
supervision for exchanges which is increasingly of
interest to federal policy makers. I was
therefore happy to see SEC Chairman Jay Clayton
and Chairman Giancarlo in a recent Wall Street
Journal op-ed say they would "support policy
efforts to revisit the state by state regime."

Speaking of the SEC, how the securities laws apply to cryptocurrencies is the next pressing policy question that has emerged over the past few years. Many of the hundreds of tokens that have proliferated recently, have been sold in so-called initial coin offerings, also known as ICO's, to investors who buy them with the expectation of profit based on the efforts of the party that is selling the tokens and their promises to build infrastructure through which the tokens will eventually have utility. Such tokens are clearly securities, and the SEC through investigative reports and enforcement actions, have begun to make this quite clear. It is important to note, however, that while many crypto tokens are securities, not all are. And I was very gratified to hear Chairman Clayton several times in a recent hearing, draw distinction between cryptocurrencies on the one hand and tokens that have been issued as securities on the other.

Cryptocurrencies like Bitcoin are
commodities, of course, as the CFTC has previously found. Questions remain, however, about the border between these categories and about how one can responsibly sell future tokens to investors.

Anti-money laundering was the first area of regulation intersecting with cryptocurrencies that prompted a federal response in the form of FinCen's 2013 Virtual Currency Guidance. It is therefore no surprise that it is one of the most developed and stable policy areas. The rules here are pretty clear. If you are a cryptocurrency exchange or similar intermediary, you are subject to the Bank Secrecy Act and its obligations. And generally, all U.S. based exchanges comply with these rules. Over the past three years, we have seen FinCen issue supplementary guidance and engage in enforcement actions providing greater clarity. Offshore rogue exchanges, however, continue to be of concern to law enforcement.

Finally, on tax, the IRS issued in March 2014, guidance finding that cryptocurrencies like Bitcoin are treated as property for tax purposes.
Which means, gains from sale or exchange are taxed as capital gains rather than ordinary income. However, unlike traditional government issued currencies, property does not have a de minimis exemption law. This means that each time you buy a cup of coffee with Bitcoin it is a taxable event and you are technically required to record, report and pay taxes on any gain that you experience, even if it is just a few pennies. This obviously introduces friction that undermines potential for using cryptocurrency for day to day payments or micro transactions.

Last year, representatives Polis and Schweickert, co-chairs of the congressional blockchain caucus, introduced legislation called the Cryptocurrency Tax Fairness Act that would create a de minimis exemption for personal transactions under $600. It is a lot like what exists for foreign currency. There are many other policy questions that remain open in tax and in other areas of law, but those are the highlights and I'll stop there. And I look forward to your
questions. Thank you.

MR. GORFINE: Thank you. Mr. DeWaal.

MR. DEWAAL: Great, thank you, Dan. And thank you, Jerry, for completely anticipating everything I was going to say. I am going to completely speak on the fly. So last year at the FIA Law and Compliance conference, I had the privilege of leading the kickoff panel with Kimberly Johns. And it was entitled, Memory Lane, Those Who Forget History are Doomed to Repeat It. And I'm going to take one brief diversion to talk about something that probably occurred before most of the people around this table became part of the industry. And I'm going to take you back to the 1970s. And in the early 1970s, the CFTC didn't even exist, the Commodity Exchange Authority oversaw this business and options on enumerated domestic agricultural commodities were banned. There was need for these products, hedgers, commercial users had reason to want to use these products but the products were generally banned in the United States.
Commodity markets became very volatile in the early 1970s. And there became quite a market in world commodity options and they were traded in London and unfortunately, some bad guys decided to start offering and selling them in the United States. It caused quite a problem. Bad firms, Goldstein Samuelson ended up being put out of business, folks lost their money. And frankly, among other reasons, this is why this Agency began. The Commodity Exchange Act was amended, the definition of commodity was expanded so that it included not only the traditional enumerated commodities that were under the oversight of the old Department of Agriculture, but lots of other things, plus it gave the potential for expansion. And the CFTC took that authority when it began operations and it used that authority go after the bad guys who were dealing with the commodity options space.

Sadly, despite bringing something like 55 injunctive actions between its formation and 1978, it couldn't keep up with the bad guys.
Moreover, there was confusion out there. What where these products? Are they securities, are the commodities? Sound familiar? Well, the reaction then fortunately is not what this Agency is doing today. For three years, this product was banned in the United States by the CFTC as well as then subsequently by Congress. And it was not until a pilot program was reannounced in 1981 and then some of the exchanges came around and proposed specific contracts to be traded on designated contract markets, that options trading began again in 1982. Now, all these years later, nobody thinks about commodity options as a problem. These are valuable tools used daily by commercial users, by producers, by hedgers. They are traded through on exchange contracts regulated by the CFTC. They are traded also OTC and no one thinks about them as a problem, they only think about them as a solution. But once upon a time, they were seen as a real problem and this Agency dealt with it, and not at that time, in a good way.
We now fast forward. Bitcoin started trading in 2009. I'm not going to go over again the evolution of the laws. I think Jerry did a great job discussing the situation out there right now. But my concern is, is that unless there is some sort of rationalization process, it will impede the development of not just coins, coins are critical to the decentralized ledgers. They don't exist in a vacuum. They are the mechanism in proof of work blockchains where miners are rewarded, in proof of stake blockchains where fees are paid. Okay, these are the way that you incentivize folks to keep the system together. If you're only talking about centralized ledgers, sure, you don't need to worry about coins. But if you think that there's validity in decentralized ledgers and you think that the guys who are working on these Dapps that are sitting on top of the Ethereum blockchain, you know, may have some good ideas. These have to be thought about carefully.

Now I just want to say a couple of
things about where the state of legislation is.
The states absolutely began with the money
transmitter rules and that's predominately where
most of the states are today. New York State came
up with the BitLicense which, I agree, hasn't been
warmly received. Six, I think there are six folks
out there that are either regulated as limited
purpose trusts, effectively applying the BitLicense
rules, or separately in New York State.

Last week, New York State said you know what,
we're going to expand the requirements about
people with BitLicense and we are going to get
into the requirements dealing with oversight and
manipulation and fraud, et cetera.

But it's not the BitLicense replaced the
money transmitter requirements, it's both. And
it's not like anyone is talking about
implementation of this new Virtual Currency
Business Act replacing money transmitters. Maybe
it will happen, but we're talking about potential
additional regulations at the state level. Oh,
and by the way, if you haven't caught the news in
the last couple of weeks, Massachusetts, New Jersey, Texas and North Carolina, the state security Commissioners have started bringing actions against so-called prohibited ICO's where there wasn't registration of securities. So we're now seeing a third branch potentially of states getting involved in this space. That's not a good environment.

I just want to spend a few seconds on the SEC's oversight. There is a very, very famous case, you hear it all the time, and it's been mentioned in a number of the SEC enforcement actions, the Howey case. And it talks about the fact that something is an investment contract, namely a type of security, if it is an investment, an enterprise with the expectation of profits through the managerial or entrepreneurial efforts of others. Howey actually uses the word substantial efforts of others but over time, the SEC certainly has just talked about the managerial or entrepreneurial efforts of others. And that's been a rule that the SEC has relied on to recently
go after the Munchie Dapp and is using to go
exercise jurisdiction on some other ICO's and
prohibited securities. And I agree, in most
circumstances, a lot of the stuff out there
absolutely looks like a security, something that
needs to be registered or issued but is exempt.
But not 100 percent.

If you think about the application of
the Howey test to common things, suppose you
bought a Tesla and one of the first Teslas out
there. And you bought it because you know that
Musk was going to be out there pushing this thing
and saying it is great, it's wonderful, it's
exciting. Well sure I'm buying it, but there's
not too many places I can actually plug in my
Tesla. I'm getting it for the investment value. I
know that's first edition. Is that car a security
because I'm expecting somebody else to promote it
and there is hype going on about it? Privately
issued gold coins. People buy them, people hold
them, people expect to resell them for a profit.
Are those securities because the minters are
promoting those?

Ultimately there has to be some clarification. The distinction between a commodity, the distinction between a security may seem from a common sense perspective, clear, but there are very, very important issues around those that I think that this Committee could very much help clarify and move the regulatory discussion along. And hopefully that is something that we can do and I certainly would look forward to participating in that.

MR. GORFINE: Thank you. Mr. Gorelick.

MR. GORELICK: Thank you very much.

Let's see if we can get this presentation working as well. While we're getting this going here, I'm just going to do a brief introduction. So I'm Richard Gorelick. I am the head of market structure at DRW Holdings. I appreciate the opportunity to participate in this important dialogue as a member of the Technology Advisory Committee. I've been on this Committee since it was reconstituted in 2010 and I welcome the
I was previously a co-founder and the CEO of RGM Advisors, a trading firm in Austin, Texas that was an active participant in a variety of electronic markets. Since DRW acquired RGM, trading businesses in September and I joined DRW, I have had the opportunity to learn about a variety of new markets, including this rapidly developing market for cryptocurrencies such as Bitcoin. The Commission has asked me to share a little bit about the market structure for the cash and futures markets for cryptocurrencies today and that's what I'm hoping to do momentarily here, let's see.

MR. GORFINE: And as you pull that up, at least for members, it is in your materials. You will see a printout of the presentation which we'll hopefully have up on screen in a moment.

MR. GORELICK: There we go. Thank you very much. So I'll start off by noting that I'm using the term cryptoassets. And this is intended to be a real broad term. A lot of the time we're
talking about cryptocurrencies but as it turns out, a lot of these are not, in fact, something that we would widely regard as currencies. They have very different characteristics. Some of them might be in fact crypto securities as we have talked about, some of those might be utility tokens or other things, I'm trying to use a broad term of cryptoassets.

DRW has been active in this crypto ecosystem for a number of years. DRW recognized Bitcoin and the underlying technology as an opportunity in 2012. Cumberland was founded in 2014 as a subsidiary and a Bitcoin trading desk which has been uniquely positioned between the traditional financial industry where DRW has participated for a couple of decades and the nascent cryptoasset space. Today, Cumberland specializes in providing two sided institutional size liquidity to counterparties around the world. Cumberland also manages a long portfolio of cryptoassets and pursues various strategic opportunities in these emerging markets.
So that's why we're involved and why I'm here today to talk to you about it. I already spoke a little bit about terminology. Bitcoin was the first cryptoasset launched in 2009 and today, as we've heard, over 1500 different cryptoassets exist.

The volumes, the trading volumes and the market caps of these coins are still skewed toward Bitcoin and a small handful of others as these charts indicate. Bitcoin, Ethereum, Ripple and Bitcoin Cash are the top, both in terms of volume and market cap and the volume drops off considerably and market cap beyond those.

In terms of the size of the market, the market has grown considerably over the last year. This chart starts in January 2017 and what you can see is that the overall market cap has gone from approximately 0 at this scale up to as high as over 750 billion in December and recently settled in the 400 billion plus range over the last couple of days. At the same time, the trading volumes of these coins has gone up from approximately 0 on
this scale to between 30 and 60 billion dollars of value per day. And so because of the sort of the shape of these curves and the trend and the increase in both market cap and volume, particularly at the end of last year, that's why there's been so much attention on this space in the last several months.

Another thing to note in terms of market dynamics over the last year and a half as Jerry discussed a little bit is that at the beginning of last year, this was a market that was completely dominated by Bitcoin, over 85 percent of the market cap for cryptoassets was in Bitcoin at the beginning of last year. Over the course of the year, there was much more diversification. As much as we talk about the major runup in Bitcoin prices last year, it actually underperformed a number of these other coins. And so the result is by, in current periods, about 35 percent of the market cap is accounted for by Bitcoin.

I want to talk a little bit about the trading conventions for cryptoassets. It's truly
a 24/7 market. It trades all night, all weekend, it trades on holidays, it just trades around the clock. Other markets like FX talk about being a 24/7 market but do take some time off occasionally, this is really around the clock. A couple of the interesting dynamics, very small price increments. So generally for a Bitcoin which trades in the, you know, let's say, $9000 range as of today, the tick increment, the price increment, is one penny. So it's much smaller than a lot of the markets on the equities and the futures side that we're used to for assets that trade at that price level. And at the same time, the lot size is very small. There is really essentially no limit on the smallest size that you can trade of a Bitcoin. Right now, it is a point seven zeros and a one of a Bitcoin. It is also known as a Satoshi. I think it's, if I've done my math right, it is one one hundred millionth of a Bitcoin is the smallest size that can trade in. Often you see very small sizes on the trading screen. The combination of these tiny price
increments and these very small lot sizes for
trading, in this spot market means that you have a
highly fluid and often very thin order book on the
exchanges that trade.

I'm going to talk a little bit about the
spot exchanges. There are over a hundred
exchanges around the world that trade Bitcoin and
other top cryptoassets in what I'm calling the
spot market. And you know I put exchanges in
quotes because it doesn't really fit into the
regulatory framework of how we traditionally think
about exchanges in more mature and more regulated
markets like the futures markets and the equities
markets around the world. The largest exchanges
include a number of exchanges around the world. I
think the important thing to note here is that
they're not all based in the United States.
Bitfinex is based in Hong Kong. Coinbase, their
G-Dax exchange is based in the U.S. Bitstamp was
founded in Slovenia and then subsequently moved to
UK and Luxembourg. And as you go down the list,
you notice that there is Japan, there is
Singapore, there is various UK and European presences. This is truly sort of a global market. And as I mentioned our trading desk, Cumberland, we're an active participant on a number of exchanges that have meaningful trading volumes.

The Korean exchanges received a lot of attention in the last couple of months and they've grown in importance. In December, it was reported that about 20 percent of the world's cryptoasset volumes were in South Korea. This was the third biggest market in the world after the U.S. and Japan. New regs went into effect at the end of January that had the impact of slowing that down a little bit, but we'll have to see how things play out over time. But that's a lot of discussion about the Korean exchanges in recent months.

Generally speaking, I think trading on these spot exchanges can be challenging, particularly if your goal is to trade across multiple spot exchanges. It's difficult to weave together liquidity across multiple exchanges and jurisdictions due to a number of factors.
Technology on these platforms is very
non-standard, particularly if you're coming from
the traditional financial industry, these don't
look like the normal protocols that we're used to.
There are concerns about deceptive trading on
these platforms like wash sales and spoofing and
other types of market manipulation. There's not
standard best practices. Every exchange does
their own thing in a different way and we're
really behind the ball in sort of developing
standard ways of doing business with these
exchanges.

Banking relationships have been fickle.
And what's happened here is that exchanges have
had hard times getting banking relationships in
various jurisdictions. Sometimes they get them
and then they lose them and they move them around
and that has created difficulty at times moving
money in and out of these venues. Because of the
need to post both money and coins at all of the
exchanges on which you want to trade, it's very
capital efficient to trade across multiple
exchanges. There are obvious well-known concerns about cybersecurity and concerns about the transparency at the exchanges about who runs these exchanges, what their financial wherewithal is, what their practices are and what exactly they're doing on exchange. And then it's slow, it can be very slow to move money and coins in and out of these various exchanges.

You know, on top of that, the fees are higher than we're used to in sort of more mature financial markets. So there's a lot of challenges in dealing with these spot exchanges.

Another thing to note is that it often appears that the markets are crossed. Meaning that it looks possible that you could just buy on one exchange for less than you could just sell on another exchange. The Korean exchanges, for example, had a period of time that sort of mostly has gone away since the new regulations have gone into effect at the end of January where the pricing on the Korean exchanges for Bitcoin was much higher than the prices on other markets. At
the bottom of this screen, you see an example of
just a quote that I pulled a few weeks ago where
on Bitfinex, Bitcoin was trading at about 12.6
thousand dollars and on a major Korean exchange,
Upbit, it was trading at 15.3 thousand dollars.
In theory, crosses like this should be eliminated
by arbitrage. And I think a lot of people look at
this and say wow, there's a lot of money to be
made just by arbitrage. But there are structural
reasons for these prices differences including the
limitations and delays and difficulty in getting
in and out of these exchanges and that needs to be
kept in mind.

Algo trading is another topic that I've
been asked about. It is developing in pockets of
the crypto markets. But most exchanges today are
hosted in the cloud and as a result, low latency
is not yet a significant differentiator in these
markets. The latencies, the times that we
generally hear about for trades to execute are in
the seconds to tens of seconds range at this
point. While people are trying to speed that up
in areas, that is not a dominant feature of the market yet.

Over the counter trading in this market is very important. A meaningful portion, I've had difficulty on getting firm estimates of exactly how much, but a meaningful portion of all cryptoasset market volumes are occurring away from these exchanges. Many are with over the counter traders. DRW's subsidiary Cumberland trades with counter parties in the over the counter markets in institutional size. I think the advantage is for some market participants of trading in these over the counter markets, is that the ability to trade in large institutional sizes, the abilities to get competitive, all-in pricing and the ability to quickly settle and get paid usually in less than 24 hours are all features of the over the counter market that may be advantageous relative to the sort of difficult to weave together, exchange space.

Bitcoin futures launched in December.
The CFE launched Bitcoin futures on December 10th,
the CME followed on December 17th. And our view is that other exchanges are likely to launch cryptoasset based futures contracts in the coming months. The creation of these products is a real positive for the cryptoasset industry. It demonstrates the overall maturity of the business as an asset class. It's very good to have established and regulated exchanges involved with the landscape. Our view is that as new products are launched in the future and as new exchanges get involved, we would like to see a good healthy dialogue between the exchanges and both the financial community and the cryptoasset community that will trade and participate in the development of these markets.

Challenges remain with the settlement mechanisms. The first round of settlements went relatively smoothly but we continue to have concerns that the way that these futures contracts are pegged to these cash markets which are less transparent, could result in dislocations in the future and this is something we're watching
closely and hoping to work with the exchanges on as things go forward. We've expressed our view that we would like to see physically settled cryptoasset contracts to help deal with some of these concerns. We recognize that that may be a little bit longer in coming.

Quick comparison of the CFE and the CME products in terms of the market structure there. The contract size on the CFE is one Bitcoin while it is five Bitcoins at the CME. That sort of helps normalize your view about the size of these markets. The open interest at the CFE is about 6000 contracts, about 2000 at the CME. CME is a little bit larger if you look at it in terms of Bitcoin terms. Daily volumes are comparable at between 5 and 15000 Bitcoins worth of contracts at each exchange. Both are cash settled with different settlement mechanisms. The CFE settlement mechanism relies on the auction price on the Gemini spot exchange while the CME settlement mechanism relies on a price average across four spot exchanges at present. Tick
increments are also much bigger than we see in the cash market. On the CFE product, it's a $10 per Bitcoin tick increment and $5 on the CME. This compares to one penny on a lot of the cash markets.

In terms of foreign regulation, Chairman Giancarlo's gone through in some of recent speeches and detailed a lot of the regulatory approach overseas and it is very different. I think the important thing to note is that these are truly global markets, it is truly a global asset class. So the ability of any one regulator in any one jurisdiction to do a lot in this space is limited by that sort of global nature. That's not to say that we shouldn't try, we certainly should, but we need to do so in a way that is respectful of the fact that there are other markets and other jurisdictions where this trading occurs.

Governments around the world are trying to figure out how to regulate Bitcoin and other cryptoassets with various approaches. China
banned some exchanges in September. As I mentioned, recently the new regulations in South Korea are requiring trading through what they're calling, real name bank accounts, to improve on some of the anti-money laundering and KYC concerns. Japan has been really a thought leader in this space and has put forth regulations that require exchanges to register and apply to the FSA for authorization. And the last time I checked, there were over 15 exchanges that had registered and were being supervised under this new regulation in Japan. France recently announced a formation of a task force to propose a new framework for regulations in this space.

My other members of the panel here have done a good job of talking about the U.S. Regulatory guidance. But I will concur that while there's been a lot of guidance and a lot of investor education in recent weeks and months from the CFTC and the SEC, there is still room for improved clarity around what the rules are. Particularly around some of these definitional
issues about what is a security, what is a
commodity, what is an asset, you know what are the
rules and how do we determine what is what.

So my overall proposal for the
regulatory approach is that the U.S. should adopt
a smart principles-based regulatory framework that
encourages professional and responsible market
participants to build and invest in cryptoasset
businesses in the U.S. To do so, the market is
going to require more certainty as to the legal
status of these cryptoassets, better guidance
about how financial institutions can provide
services to the cryptoasset businesses and zero
tolerance for fraud, scams and abuse. And I
commend the CFTC and the SEC for recently making,
getting very involved in this space and talking
about their view that that's their primary focus,
is to make sure these markets are safe for all
participants coming in. I'm going to suggest a
TAC working group to look into these issues in
depth to make specific recommendations to the CFTC
consistent with this approach. Thank you.
MR. GORFINE: Thank you very much. Mr.
Zaidi.

MR. ZAIDI: Thank you. Thank you for
having me today. My name is Amir Zaidi, I'm the
Director of the Division of Market Oversight here
at the CFTC, and I've been asked to talk a little
bit about a related aspect to this whole
conversation is our recent retail commodity
transaction interp, specifically, the actual
delivery exception to our jurisdiction over these
retail commodity transactions and, more
specifically, with respect to virtual currencies.
Before I start, I will also give the standard
disclaimer that these are my own views, since I
see our general counsel staring at me.

As you all know, there are several well
established platforms in the U.S. as my panelists
have gone over, engaging in U.S. retail investors
in a growing number of virtual currencies that are
available for trading. As previously noted by the
Commission, the underlying cash marketplace for
virtual currencies remain largely unregulated, and
the CFTC has limited statutory authority over them. We do have anti-fraud, general anti-fraud authority. The Commission also has statutory authority to treat these certain leverage, margin or finance retail commodity transactions as if they were a commodity futures transactions. This means that certain virtual currency platforms offering these retail commodity transactions to U.S. retail investors must register with the Commission as DCMs. This also means that trading in such transactions may also trigger Commission registrations for certain intermediaries and asset managers. Like I said, the Commission's jurisdiction over these retail commodity transactions includes an exception when actually delivered to the purchaser, actual delivery to the purchaser occurs within 28 days from the date of the transaction.

As per relevant Commission and jurisdictional precedent, a finding of actual delivery is focused on possession and control. Accordingly, the proposed interpretation attempts
to properly recognize when a purchaser has sufficient possession and control over virtual currency in retail commodity transactions. The main point of this proposed interpretation is to clarify that actual delivery of a virtual currency, to qualify for that exception from the Commodity Exchange Act, requires purchaser freedom to utilize the commodity purchased no later than 28 days from the date of the transaction.

At this point, the seller and any platform involved should no longer be able to prevent, use or otherwise take away any amount of that virtual currency purchased using leverage or margin. The Commission notes that it drafted this proposed interpretation with a balance in mind, to avoid impeding upon market enhancing innovation while ensuring integrity for U.S. retail investors when the transaction falls within the Commission's jurisdiction.

So the baseline interpretation, in the proposed interpretation, contains two primary factors required to demonstrate actual delivery.
The customer having the ability to take possession and control of that entire quantity of the commodity, whether it's purchased on margin or using leverage or any other financing arrangement. And the second, to use it freely in commerce both within and away from any particular platform no later than 28 days from the date of the transaction. And secondly, the offeror and the counterparty seller, including any of their respective affiliates or other persons acting in concert, with the offeror or counterparty seller on a similar basis not retaining any interest in or control over any of the commodity purchased on leverage, margin or other financing arrangement at the expiration of 28 days from the date of that transaction.

The interpretation goes on to note four examples to further elaborate on this baseline interpretation. In the example one, it requires a full blockchain audit trail demonstrating that the transfer of the virtual currency from the purchaser to the seller within 28 days from the
date of the transaction, when a platform is involved to intermediate the platform would transfer the purchased virtual currency to the purchaser within that 28 days. In example two, there is a little bit more flexibility, allowing certain virtual currency platforms the ability to offer wallets for use by their customers and to act as the depository if the purchaser agrees, while ensuring that the platform ultimately gives up any control over the purchased virtual currency once that 28 days has passed from the date of the transaction.

In example three, it provides that mere book entries are not enough to demonstrate that actual delivery occurs; something more will be necessary to conform to the baseline interpretation. And then the final example explains that actual delivery must have actually occurred at some point. This means that actual delivery is not satisfied if the transaction is simply rolled, offset, netted out or otherwise cash settled. We also have a, obviously, this is
a proposal so we're asking for comment. The Commission asked multiple questions to the public to further refine the interpretation. A few examples: the Commission asked about the meaning of certain terms such as title, depository, control. Further, the Commission asked about the adequacy of that 28 day delivery period, the restrictions on liens beyond the 28 day period and the potential for a unique regulatory regime for these types of transactions. The comment period is still open until March 20th, I believe, so another month to get your comments in and we'd appreciate those and look forward to reading them. Thank you.

MR. GORFINE: Okay, great, thank you and I'd like to thank our panelists. You walked through market developments, existing legal regulatory questions and challenges, trading activity, and then a view from the CFTC, so thank you. I want to open it up again to questions and discussion so you can start thinking of comments and again please place your card upright if you
have a question or comment. Before I do that
though, I'd like to actually turn to Mr. Durkin
and Mr. Chou to talk a little bit about recent
updates with respect to Bitcoin futures and
Bitcoin options trading that's been taking place
on your respective exchanges. I'll start with you
Mr. Durkin.

MR. DURKIN: Thank you Mr. Gorfine and I
just want to compliment the Commission for it's
efforts and leadership in the successful launch
and introduction of our Bitcoin futures contract.
I also want to compliment Commissioner Behnam for
his leadership with the MRAC and the discussion of
this topic a few weeks ago.

To bring you up to date, as the world's
largest futures and regulated marketplace, we did
feel that CME was a natural home for the
establishment of our Bitcoin futures contract.
One of the key strengths of our offering was
predicated on our already successful Bitcoin
reference rate, which we introduced in November of
2016, and that reference rate was introduced to
provide greater transparency to this spot Bitcoin market. Now, the Bitcoin reference rate is a once per day reference rate based on the U.S. dollar price of Bitcoin and it aggregates as it was alluded to here: data from four exchanges, be it Bit Stamp, GDACs, ITBIT, and Kraken.

That real time reference rate aggregates demand for buying and selling Bitcoin and it's brought into an aggregate of an order book, which reflects the real-time, again, U.S. dollar price of Bitcoin. So we were pleased that we were able to introduce that some 14 months ago, which then brought us on to the launch of our contracts.

So the contract was launched on December 18 and to date we're averaging approximately 1,397 contracts daily, which translates into 83 million notional. Sixty-five percent of that volume has traded during U.S. hours, 35 percent of that volume is traded during non-U.S. hours. We have over 900 unique accounts that are routinely trading across all of our client segments. Market maker volume has been approximately 27 percent of
the product since launch. 73 percent of the volume is non-market maker customer volume. Retail customers have represented approximately 13 percent of the volume. The buy-side is representing approximately 15 percent of the volume, props around 70 percent, banks, a little bit over 1 percent.

Seventy percent of the volume, since launch, is U.S., 30 percent of the volume represents non-U.S. Our open interest is 1,936 contracts or the equivalent of 81 million in notional, and that open interest is growing each day and that has been the case since launch. We have very active quoting, volume and open interest across all of the expirees, which is very exciting in the context of the buildup of the contract.

And we're very pleased with the risk management associated with this contact. So, it was very fundamental to us that we implement a variety of risk management tools, such as higher margin levels, position and price limits, product controls, to appropriately manage and aggressively
manage the risk of this contract. And I'm very
proud and pleased to say that every single aspect
of that has performed according to standard.

MR. GORFINE: Thank you. Mr. Chou, I
believe I may you have some slides that perhaps
Amir is going to power for you over there.

MR. CHOU: Thank you Amir, and I really
appreciate the assist on this one. So first I
want to say that the agenda is really fantastic in
that obviously the topics are very timely but also
very synergistic. If you deal with things like
distributed ledger technologies and Bitcoin,
obviously cyber security is going to be something
that's top of mind as well. So I hope that as we
go throughout the rest of the day we can bring
back some of the topics that were discussed this
morning in a way that those things can interface.

So my name is Paul Chou, I'm the CEO
co-founder along with Zach Dexter and my CTO and
actually my wife here, Juthica, happy Valentine's
Day. She's very forgiving about this kind of
thing.
And we started LedgerX four years ago and we're currently a swap execution facility and derivatives clearing organization registered with the CFTC. And our focus is entirely all crypto-currencies. And in particular what we focus on is derivatives around physically settled crypto-currencies, so in a sense you actually get the underlying Bitcoin or other digital currency that the contract actually references.

So this first slide up here, you know, on the surface LedgerX looks no different from any other kind of clearinghouse operation you might imagine. We take dollars for sure, and our specialty is we also get crypto that's actually pledged to the clearinghouse to underlie a lot of derivatives trades that interacted on our SEF.

So when we talk about things like physical delivery in settlement, what we mean is that they actually send it to a clearinghouse address that only we control. So that the DCO at that point has full positive control over all of the crypto that we manage. And an example the
transaction might be, for example, a customer comes in and wants to buy a call option. You know they send U.S. dollars to us. We have a customer that wants to sell a call option against Bitcoin. They deposit Bitcoin to the DCO entity, we hold it for them and at the expiration of the call option, if the customer chooses to exercise then we pick the strike price, give to the call seller and actually deliver the underlying Bitcoin. So that's like a really key point for us because a lot of our customers need the underlying Bitcoin for a lot of their operations.

So what I'll note is that I think Bitcoin and other digital currencies have like a really great future in terms of collateral. It always struck us as a great collateral instrument. You can send it to us 24/7, 365, you don't have to worry about banking hours; in fact, a lot of our customers send Bitcoin send Sunday at 4p.m. and within a few hours they're actually able to trade with that collateral in hand, so I think that's a very powerful use case.
There are certain customers of ours and clearing members that don't ever deposit dollars at all. They can send Bitcoin to us through all manner or variety of swaps and transactions and options and then when they're done convert it to Bitcoin and actually withdraw it to their personal account.

So this I think was like a very fascinating use case, what crypto currencies can do that other things can't because they've essentially not even touched the U.S. banking system at that point. So it's something that we think we do very well especially at LedgerX because the physical settlement of it is actually quite important. Next slide please.

Alright, so I want to go over a little bit about the different players in the ecosystem. There are a lot of things that are really not that different from normal commodity markets. Bitcoin has natural longs, it has natural shorts, it has long-term investment managers, and it has like short-term traders and market makers as well.
So, I always try to emphasize to people that we can use a lot of analogies with other commodity markets for the participants that do work in the Bitcoin ecosystem and there are many. So a classic example, for a long-holder, natural long, would be a miner. So this individual or institution has spent many years investing in infrastructure, designing specialized chips, paying for the electricity behind that and also employing people and you get a commodity as a result.

So it's not too different from say like a British Petroleum that also invests U.S. dollars in infrastructure and gets what's sort of evolved to oil commodity out and they have those price risks as well.

So what a long-holder might do is to take the Bitcoin that they've actually mined over the years and do collar rights against them. That's a very classic trade for this sort of thing.
That way they can get U.S. dollars today, we hold a Bitcoin as collateral against those collar rights and they can use those U.S. dollars essentially to invest in research and development for their next generation of chips or to expand their factories and stuff like that.

Long-holders obviously are very interested because Bitcoin is potentially like an uncorrelated asset class to like most other asset classes. What we've seen over the last couple of years in financial markets is that things tend to be moving a lot more together than people would like and adding some portion of your portfolio to crypto could be very valuable addition to what you do.

And finally market makers are obviously attracted to things that move and things that have quite a bit of volatility and in Bitcoin and digital currencies we have volatility in spades; it moves a lot. And so I think there are a lot of traditional people who used to trade nat gas or other commodities that are now looking at crypto
as a way to make markets and sort of capture
spreads around them. Next slide please.

Okay, so this is a particular trade I'll
highlight and one of the things that we're seeing
in the market that was covered by various news
outlets. And basically it was done from our
public reporting. There was an individual that
bought 1 million dollars worth of premium. So
that's not 1 million dollar position, that's a
million dollars worth of call premium. That
Bitcoin by the end of December of this year would
be above $50,000, so, you know, we're starting to
see some distributional views that very
sophisticated market participants have.

So, to give you a sense of scale, if
Bitcoin were to end at $50,000 by the end of this
year, the entire market cap of Bitcoin, not even
any other digital currencies, would be about a
trillion dollars. So you know, as the Commission
and the Technology Advisory Committee do look at
this, we are starting to have oversight over
something that could be, one day, a
trillion-dollar market cap entity. And that's really important to put that out there.

More importantly, options -- that's what we specialize in -- also give us a view of what market participants think is the riskiness of Bitcoin going forward. So even if you have no intention of actually trading options on Bitcoin, say you only trade spot Bitcoin, this gives us an unprecedented tool of market forward expectations as to how much it's going to move and therefore risk managers who are looking at their spot positions, can scale their positions accordingly. And that's something that visibility I think has been kind of lacking for quite some time now.

Next slide please.

I talked about other things that LedgerX has seen in terms of trading, what I want to mention is something that all of these unique things about Bitcoin that we're seeing in clearing. Most of the people here on the committee have probably heard of things like hard forks. Bitcoin is software, so every once in a
while somebody develops a new version of the software and if you're holding Bitcoin in November, you might be holding two different coins, two coins, in December based on a hard fork.

So this graph up here in this photo is basically all the hard forks that happened for Bitcoin in December alone. So you can see that if you held one BTC you have a plethora of other coins down the line.

So it's almost like a dividend in some sense but it provides a lot of interesting and unique challenges for a clearinghouse, because you list a put option, for example, on Bitcoin and it expires in a year, and the put option holder wants to exercise it and put the underlying to it, what are you asking them to put? Was it just the original coin or is it some subset of the coins that forked over the last couple years?

And so we have, as you might imagine, very rigorous conversations about this exact issue with our clearing members. Some choose to just
withdraw their Bitcoin from our clearinghouse before a fork happens, some people don't believe that the other forks will actually have value and so people are constantly doing different strategies to manage this and take the risk.

But I wanted to highlight this as something that's unique to crypto currencies and also something that's unique for, as the industry develops, best practices for this and other questions that the Technology Advisory Committee is sort of uniquely suited to address and establish best practices and industry standards.

Thank you.

MR. GORFINE: Thank you, Mr. Chou. So, I do want to open it up now to questions or comments or statements from our members. Again with an eye towards what are some potential work streams that this committee may consider. Let's see. I see Mr. Curley.

MR. CURLEY: Thank you very much, Dan for having me on the panel and to the Commission as well. So I wanted to focus on a couple of
points that were referenced at least in passing by
the panel. The first is custody, and custody is
something that is really taken for granted and
really fundamental to both consumer protection and
to the functioning markets.

So that's something that we definitely
see as an area that could merit some attention by
something like the TAC in the following sense that
there are differences between what custody means
for different types of assets. So we experience a
lot of questions about people who ask why am I
becoming a bank for this reason?

It's because there is a recognized
regime for trust companies or banks that can
perform custodial functions but the observations
often times for these parties is really -- they're
proposing to do something very different than what
the banking supervisor would otherwise be asking
them to do. They're facing technology challenges
different because of the nature of the assets
they're holding.

And it's often a very diverse set of
assets, tens hundreds of Bitcoin and equivalent
crypto assets that they might be wanting to deal
with and therefore it's kind of a different
problem than custodying a security or cash, other
types of assets that have more traditional
structures.

So that's definitely something I invite
the panel to be honest, whether they are
experiencing similar things, and that with the
second aspect being related to it and that's
accounting. So again, accounting being a
challenge that we see as parties facing pretty
regularly in terms of what the accounting
standards are, how to deal with the keys without
undermining the anonymity or other features of the
platform.

But again, fundamental to assuring that
assets are there when they're expected to be and
that the value that it represented in derivative
or other markets is tied to something that's there
in fact.

MR. BRITO: To custody what I would say
is, it is a question that so many different laws are required or predicated on whether you have custody or not. And that's an open question of what constitutes custody, I think part of the actual delivery question is about that.

What I would recommend to the TAC is that they look at the Uniform Law Commission's Virtual Currency Business Regulation Act, which has a little to do with what you're doing here, however this committee of the ULC spent two years thinking about this.

The licensing in that Act is, turns on custody and they developed a definition of control, this is what they call it. And we think it's the best that we've seen, so I would recommend that you look at the definition of control in the ULC Act when thinking about custody.

MR. GORFINE: Okay, I'll go the Mr. Knight next.

MR. KNIGHT: Thank you and thank you to the panel for a great presentation. I would
recommend that the TAC consider a working group to look at regulatory rationalization in the space. And one area, one sort of deeper question I think we should wrestle with is, given the sort of flexibility and versatility of virtual currencies or assets have shown and the fact that we're wrestling over the terms indicates it, it's like the story of the elephant and the three blind men, right?

You're looking at -- the regulators are looking at it from different perspectives and thinking it's a different thing and you find this elephant regulated by the tusk, tail, and trunk regulators all at the same time. And so one thing we might want to look into is whether or not the functional approach that we generally use makes sense, or if some other approach where the fact that it is a virtual asset in and of itself is what drives a regulation versus what is the underlying economic reality that the virtual asset is being used to conduct.

And I don't say that to think that the
virtual asset specific view is necessarily the
right one, but we should at least contemplate it.

MR. GORFINE: Thank you and maybe we'll
just work down the line. Ms. Yadav, we'll start
with you, and then I see a few cards up and we'll
just work down.

MS. YADAV: Thank you so much again to
all the panelists, really fantastic presentations.

One question that I'd be interested in getting
some more clarity from the group is in relation to
the question Paul sort of mentioned, the existing
volatility of the assets.

In addition we've obviously seen a
number of events happen externally, for example,
the hack of the Japanese exchange, we've seen
China crack down on exchanges, Korea cracked down
on exchanges, in addition obviously in the
Ethereum blockchain we saw the DAO hack as well as
the resetting that followed.

All of these have sort of unpredictable
sort of disruptive events that are happening
within this marketplace. To what extent are the
exchanges that are transacting on Bitcoin referenced assets and/or the clearinghouses that are dealing with collateral pertaining to Bitcoin and other crypto assets? How are they supposed to protect themselves against the costs and potential volatility that's going to be exerted by these unpredictable, uncontrollable events that are happening, seemingly uncontrollable events that are happening in this space?

And to this question I think it would be interesting to think about how new this question, in fact, is, and in that context to what extent do exchanges need new tools, clearinghouses need new tools, and new ways of thinking, and are modelling the kind of risks that are coming up in this space. So, that's really one question that I think would be an interesting one for the working group going forward.

MS. VEDBRAT: So I have two questions. One, Paul, you showed how many forks have taken place like just in one month alone, so, I would be interested to learn a little bit more on what
causes the forking and do you have any depth of
insight into how many times a particular Bitcoin
could potentially fork?

And then the other is much more for the
working group, and that is actually to have a
better understanding for the broader market if
they have exposure to like Bitcoin or Bitcoin
futures.

Recognizing that currently some of the
offerings are comingled from a default fund
perspective with existing contracts, so is that
the safest way for participants that may not
directly be participating for existing assets that
they may be participating in or should it be a
segregated model or perhaps like some sort of
additional collateral that may need to go into the
default fund? But that's probably something that
the working group could look at more holistically
for these markets for these products.

MR. CHOU: Yeah, so let me talk briefly
a little bit about both of those questions.

Bitcoin is a very unique commodity for sure,
right? It's the only thing that I can think of that if there's a fundamental architecture flaw or quantum computers break the underlying cryptography overnight, it's a commodity that can go to zero and stay at zero forever. So that's extremely risky.

For oil you can always burn it for heat, for wheat you can always mill it for food. Bitcoin is still in its infancy, so those risks for sure have to be considered. And whether to segregate them or not is I think a good question that I think people should talk about in terms of the clearing function.

In terms of forks, essentially forks can be limitless. Basically anybody around here can create a slightly different version of Bitcoin today. The real question ends up kind of like circulating around whether it will have any value or not.

So, there are more high profile forks than others, just because people believe in the technical merit of those four coins and therefore
other changes will actually support trading those forks so you can monetize it. But if a fork goes unnoticed, there's no way to actually monetize it.

And so it's a complicated question for us again because of our derivatives business and long dated nature of some of our contracts because you have to see, okay do we believe this fork is going to be supported and if so is it going to have wide support with other spot exchanges, is it only going to be, you know, purchased, available in a Chinese exchange that a lot of our customers can't get to?

So those are all questions that we have to think about extremely carefully so it is complicated but I always liken it to what a special dividend is sometimes for stocks. Obviously when Microsoft issued their one time special dividend, a lot of options and futures were manually adjusted, the strike price-wise, to accommodate for that and I sort of suspect that we'll see something similar going forward with Bitcoin, too.
MR. GORFINE: Mr. Stein was smart. He heard my rule that we're just going to go down the lines so then your card went up, but no we'll go to Ms. Peve and then Mr. Stein.

MS. PEVE: Just briefly, it seems as though there could be a good opportunity to create somewhat of a framework around the different types of digital currencies if you will and even looking -- if you look at digital assets that's nothing new to our world.

Digital currencies could include things like points and gaming tokens but crypto currencies as well. And then when you breakdown crypto currencies you can look at types that have exchange of value versus utility and just understanding how those play against something like a points program where you can buy goods and services. You know, in any airport now you can use your points to pay for food and drinks, et cetera. So I think there could be an opportunity to just kind of outline a framework around how these crypto assets fit into the umbrella of
MR. DEWAAL: It's actually a very, very interesting observation, so we get asked a lot times, clients ask us to speculate as to what is a particular crypto asset and so we look at a number of different characteristics today. We look obviously at was this crypto asset issued as part of an ICO, was the ICO before or after the actual project was launched, what was the purpose of the underlying technology for the coin? In fact, does the coin have utility outside of the technology of which it's supporting, meaning is it used in currency?

So we start looking at number of different characteristics and I think it's an excellent point and I think it's something that the regulators are going to have to look at going forward. It's not just -- the issue isn't whether it's been issued in an ICO or not, as I said I think you can stretch the Howey Test way too far to include everything if you want, and that's just meaningless.
But I do think there are criteria and there's probably even mathematics, there's probably even quantum data. One thing is, is that, keep in mind this agency does have experience in this area. Today there are futures contracts based on stock indices and depending on whether the stock index is considered broad based or narrow based it falls basically under the jurisdiction exclusively of the CFTC or shared jurisdiction with the SEC.

And these industries change. Everybody knows about the 21 day DOW order, but there was a 21-day order before that against an international exchange because in fact the characteristic of their index had changed and they weren't keeping track of it and it moved into a different regulatory environment.

So there is precedent for coins that might change characteristics and for monitoring it and recognizing that it falls under a different regulatory scheme.

MR. GORFINE: Mr. Stein?
MR. STEIN: So despite all of the excitement and growth and the numbers, Paul, you shared, institutional involvement still remains quite low and one of the key drivers there is regulatory clarity. Obviously, what are these things? That's very important. Another one that we hear over and over again is how do the AML, the OFAC rules affect this space? I highly encourage the committee to look at those areas as well because without a solution there, a lot of the infrastructure that supports the institutional investor isn't coming into the marketplace.

I would point to the success of a member organization like FINRA and how well self-policing has kept up the standards so that anti-money laundering rules and regulatory compliance are enforced. There may be an opportunity in this space to do something similar. Thank you.

MR. GORFINE: Yes, please. Mr. McHenry.

MR. MCHENRY: Yes, is there any concern about the concentration in the mining function? I understand they're responsible for maintaining the
block ledger. I understand that there's a great deal of concentration in terms of mining amongst four or five large organizations so I was just wondering if that's an area that needs to be regulated as well or what your thoughts were on that.

MR. BRITO: So mining concentration is certainly an issue. It's something though that I think naturally over time we'll see this concentration become diffused for several reasons. One is that the number one input to mining is electricity. And so miners are going to be seeking the cheapest sources and most efficient energy sources they can. And so while we have seen that a lot of mining activity happens in China where there's a lot of excess hydro activity.

For one thing we've seen an assist from the Chinese government in essence, pushing mining out of the country so we're going to see it go elsewhere but also we're seeing a lot, a race to find efficient sources of energy around the globe.
We're seeing it in Iceland, we're seeing it coming up in Nevada, we're seeing it in Washington state. And so, you know, I think that's going to drive that. I think also the folks that are building the technology fully recognize the risk there and are looking for technological ways to address it as well.

MR. DEWAAL: The other thing is, keep in mind that the mining issue only really exists in a proof of work blockchain. So if it's a proof of stake where there's different methodologies of deciding who's going to conclude the block and get the fees associated with that, mining becomes less of, is not an issue.

MR. GORFINE: Okay, if there are no further questions or comments, I would say based on this robust discussion and I think we've identified a number of worthy work streams or maybe perhaps too many worthy work streams, I would move that TAC recommend to the Commission that it consider creating a sub-committee on virtual currencies. Is there a second?
MR. CHATTAWAY: Second.

MR. GORFINE: Okay. Are there any questions or further comments at this time? Okay, I will now call for the vote on the motion. All those in favor of recommending to the Commission that the Commission consider creating a sub-committee on virtual currencies please say aye.

COMMITTEE: Aye.

MR. GORFINE: All those opposed please say nay. Any abstentions? Okay, with that, the motion carries and remarkably at this time we're going to be able to keep with our agenda, which I didn't think we were going to be able to do time-wise as we got started here but TAC will be taking a one hour lunch break. We will resume again at 1:30 p.m. So thank you all.

MR. GORFINE: Okay, I would like to call the TAC meeting back to order and being our next session with a discussion of advances in machine learning and artificial intelligence and their current and future impact on markets, market participants, and regulators.
Our presenter today will help us think about the role of technology in our markets and will help us set the stage for our next two panels, which address automated trading and cyber security. With that, our presenter today is Tim Estes, President and Founder of Digital Reasoning. I'll turn it over to you Tim.

MR. ESTES: Thank you very much. First I wanted to thank the CFTC for the invitation to come and present. It is a really remarkable set of people here around the table. The visibility you have into one of the fastest changing industries in the world is also quite interesting to see how you dialogue about those things. How you end up trying to drive the adoption of change.

So what I came to talk about today was really artificial intelligence and how it's applied in this industry. In an area that I think is going to be very interesting to you, particularly in terms of how conduct risk can be managed in very, very different ways than it traditionally has been managed.
This is an area that clearly for some time and judging by the rate and frankly the volume and the size of certain fines and activities, it feels like technology for all of its innovations has not turned back the tide yet. And I want to give some hope.

So today what I hope to do is tell you a story that is interesting and is true, so stories that are true in AI are really important, you'll find that there aren't as many as you think. With any great hype wave there is reality and there is all these hopes and we're going to talk enough hopefully about where hope has turned into real outcomes that will potentially make our markets safer, will make our population and the American people and investors around the world feel more secure with legitimate reason.

So, without further ado, I'll just kind of just jump into it. Some of this is a little bit of the story of the company I was really proud to build from college years, 17 years ago. And so I'm a very proud UVA grad and Wahoo and I am very
happy to hopefully represent that well. I'm in Virginia and I live actually in Tennessee so the other group that I'm very proud to represent is Nashville. I think we have at least one person here on this panel so AI Nashville and a Wahoo are part of the personal story and let's jump in to the more interesting story about how technology is changing in the industry.

So this is very interesting graphic that came my way about a little over a year ago. Those that are in investment research and finance might know what this is, this is the mentions in earnings call of Artificial Intelligence because it turns out that almost every public company is an AI company now if you listen to earnings calls.

So just like every bank in now a FinTech company, it looks like everybody else is moving to be an AI company or both. So what is AI actually being used for and I won't get too far into what Artificial Intelligence is because I think it's better explained how it's applied because the truth is Artificial Intelligence is just software
the way it will be done in the future and the way
the story will be done today.

There will be no software that does not
have AI in it within a decade. All of that will
be commoditized. And so, imagine systems where
the code you write today may look different and
change without you or your IT infrastructure
changing it, and that being the norm. We have a
transformation of looking at this as engineering
and looking at it more like biology, of systems we
can manage by training or perturbing but not
because we can connect all these dots anymore.
They will be too complex.

And so we are entering a phase that
moves beyond kind of an early phase of computer
science, it's going to be very different. Now,
where is this applied today? Most of the
application of Artificial Intelligence in the
world is getting people to use more of their
attention to look at advertising. To spend time
watching TV, online, to spend time checking your
newsfeed, whether the news is true or fake.
And what's interesting is that that's because there's a heritage from the West Coast and other places of using technology that way. And I put this out there because I want this to be little bit of a call to arms particularly for the generation that I've grown up in, maybe the next generation younger than me, that there are places to use this that are far more interesting.

One of the things that we do outside of this domain is we're very pleased and very honored to be involved in fighting human trafficking. So Digital Reasoning partners with THORN and runs the largest anti child sex trafficking system in the country. And Ashton Kutcher testified about this about a year ago, so we view that as one use case where AI can do great things for good. And I think that this is a case, in terms of monitoring our markets, which is equally interesting.

We started Digital Reasoning in a post 9/11 world of an unlimited amount of chatter with all kinds of risks in it that people did not know what was wrong until it was way too late. And
that was a world that many of us that grew up around that time, and I was getting out of college at that time, sort of swore to never let happen again. And I know many people here that are based out of New York, you're in banking but many of you had experiences, had direct knowledge of people, and have similar conviction.

And so that is something that was very deep and driving us. Now, that learning about language is going to come into play here. Because it turns out that human language, human communication is potentially the most interesting signal that any machine has ever had. Why is it so interesting? It's actually how we educate every child we have. And if we want machines to be more human-like we have to educate them and that means they have to understand us, they have to understand our language; that is our great resource.

So now taking that background to Wall Street, the country obviously experienced a very interesting and similarly traumatic event, though
not violent, but traumatic in a lot of the ways with the crash in 2008 and all the consequences that came out of that. And at the company we built, Digital Reasoning, we saw that there would be need there as well.

So a few years later, 2 or 3 years later, I will credit the financial institutions, some of which are here in the room, with a vision to actually say could you use technology to understand human language, what people are talking about, who they're talking to, when they're talking, what are the behaviors that are involved in those conversations, what do they show?

In a world where people are looking to apply Artificial Intelligence, there basically was belief that all the processes that were human orientated could start to be understood and used for all kinds of new applications and one of the biggest ones was around risk.

So I will go into that. What we're seeing now is broad adoption in financial services on the concept of AI amidst belief that it will
transform this industry. And I want to talk very concretely, against all this hope, there still is kind of a giant suspicion of our institutions that manifests in sometimes in very extreme ways that has to be improved upon, that has to show there's been a change.

And when we see the data that emerges from very recent scandals, the last 2 to 3 years, we find that in chats, in emails, in content, our egregious behaviors, that if we had known what people were talking about we would have easily seen what they were going to do.

So, the number one premise that emerged from our work in Wall Street starting early around 2012 and 2013 with people like Goldman Sachs, Credit Suisse, and others, was if you wanted to predict human actions you must first discover human intentions.

This is a very unusual thing for an action to happen before someone expresses an intention. We generally call it being a sociopath. For normal human beings that actually
want to just get richer and don't care about the rules, they express things that show that's what they intend to do. If it's a complicated situation such as price fixing and manipulation of markets, it can't be done by one person very often, which is why we had so many collusion scandals and issues in the last several years.

So I think what we found was that the same thing that could find aliases of bad guys and different types of intelligence to prevent them from attacking our troops aboard or our people here at home, that that technology could find very subtle indicators of intent inside communications inside banks. And that finding those indicators was a way to preempt these things from happening.

So in 2012 we started working with several of the leading banks in the world such as Goldman Sachs, UBS, and we, over the last several years actually implemented some technologies that I'll show that apply teaching a machine about language, that apply that approach, to find certain kinds of conduct which previously no
machine could see, and much less could a machine process at scale of billions of emails a year.

So we would not have known, frankly, that that is the place we could have been helpful and served a more valuable purpose without the guidance of these parties. So I want to start by saying some of our leading institutions made this investment, not as a direct reaction, to trying to comply or deal with consent decrees and other types of activities, they knew they could do better and they went out and searched and they found it, and the invested, and they built this preemptively where they could.

And some of that work has been broadly recognized. Recognized in terms of how we take essentially military orientated technology and moved it forward.

So let me get into the meat of what this is. A lot of this was backdrop knowing this was a public meeting and to give a little bit of the story. The biggest barrier to the adoption of Artificial Intelligence today in any sense is the
investment and process to educate a machine from data.

There are a myriad number of technologies and techniques that can take well formatted and well-organized data and build models, which can predict things and scale those models across a lot of data. The hard part is we don't have the curriculum to educate the machine in nearly all cases and the data we want to educate it on is generally highly sensitive and highly protected. For good reason; it's customer information, it has deep, personal, private information in it, so we have had to figure out ways to accelerate the education of machines to make this type of approach economically viable and effective.

When you read about large AI failures, systems that cost 60 plus million dollars and take multiple years and don't deliver something, you'll see more of these on the news. When you have this much excitement, if you follow the Gartner Hype Cycle, it is generally followed by a trough of
disillusionment they call it. And I have a hunch that 2018 will see a little more disillusionment than hope because how can we have more hope and hype than today?

And I want to kind of give hopefully this advisory committee some ideas about what we've seen and I don't say it in a definitive way if this is the case, I can only state what we have seen and where we have seen some effectiveness.

But what we have seen is, if you make the investment in educating the machine, not by sheer brute force, but by building a process that allows you to know where the data is in an enterprise, in a financial services institution, it allows a way to get the most yield from human time, which is very precious to teach a machine, you can show much faster effectiveness of AI on almost any problem.

So starting from that high level, let me go a level deeper into what we had been doing. We had tried to take this automation approach of teaching a machine and we have used examples and
unfortunately still one of the very best data sets available of a lot of bad behaviors, ENRON email. So those that have worked in this space know this data set very well. It's occasionally fun to find something that you never heard brought up before, but teaching a machine how to figure out that there's an attempt to conceal by deleting references to very specific information, it's a kind of subtly that previously wasn't possible.

We know concealment, secrecy are generally leading indicators of other kinds of behaviors, which this Commission actually has to run enforcement actions against.

So, to put those pieces together, the first big piece that I wanted to make kind of clear in terms of our judgment of what's important in this space is the technology to educate the machine and being able to focus on how you teach machines. For education of machines will become an increasingly bigger issue.

The next part is, we're getting beyond what I'd call the transistor era of AI, where you
have little building blocks, individual analytics
that do certain things being very interesting.
There are many options for most of these analytics
and just as people rarely compete on transistors
anymore, we're moving up a stage to the CPU of AI.
Of integrated systems, much like a brain has very
different functions that have to work together and
share information and electrical signals across it
to function as a person.

These AI systems have many different
components. They are designed with pieces that
flow information from one to the other. Pieces
that deal with signals coming in, context that's
accumulated over time, what we would generally
call global knowledge, the using of knowledge
that's global to reinforce how you predict
something that you're seeing again new.
And it's that local and global that
complete integrated system that becomes more and
more human like because these systems, the secret
of these systems ultimately is they have
infinitely scalable memory compared to human
beings. When this works the way it should whether it's a year from now or 5 years from now, I do not think it's 10 years, almost nothing that has happened in the past that was a problem should ever happen again if we have access to the information to feed the machine. Because it should see with perfect recall what has happened in the past.

And that is a, I'll use that to seed a the question to this whole group later of what is important to teach a machine never to forget but what we have seen is that if you look at this integrated system vision, a critical part of it is understanding human language. So a lot of our investment outside of how you teach a machine in general is what can you do with human language.

And I'll give you a very direct kind of walk through. So when you're dealing with communications, which are honestly probably the most interesting part of determining what happened, because if you have an email or chat where someone clearly said something, there is
very little debate after that. It's not circumstantial, it's not a behavioral pattern, and so we will get these kind of chats, that's been where a lot of this bad behavior's been for the last 4 or 5 years, some in email but more and more in chat.

And we will pull out the metadata, who talked to who, when it happened, what the building blocks of words are that are used, beyond that what are things that are groups like Electronic Trading, what are phrases that the system infers, what kinds of entities come up? People? Quotes? Activities? Monetary units?

And then being able to take whole regions of text based on previously seen examples and extrapolate that these words together, not because of this specific word, the legacy systems that are in place today, what are called Lexicon based systems, that is how they work. What Digital Reasoning built first with banking was taking examples and having the systems figure out what was similar even when almost none of the words
match or none of the words match, which is what a
human can do because a human knows this words is
similar to this word, without having big giant
dictionary in the sky.

And so we have built up the way to find
these key indicators and then to show them in
applications, what we call intelligence
assistance, and now that's very much like a human
reading these emails, reading these chats, and
triaging it to know what's important. And systems
today that have 99 percent false positive rates
and consume a lot of resources are now moving into
systems that have one tenth those false positives
or recall rates of 75 percent on certain models.
So just revolutionizing this entire area because
the system can figure out how to disqualify things
that are false positives.

And now we've moved beyond that to go
not just against text, we're now doing this
against audio communication. That's the next
frontier. The ability to get accurate transcripts
from traders talking with dialects, in trader
speak because with a true machine learning system, you can actually learn the language model, if you will the domain, the education of a certain area and have the system learn it from the customer's data.

So this is one of the last piece of the puzzle is the ability of it to learn from customers' data is ultimately the ability to empower every customer to take the best practices they have in terms of enforcement, teach a machine and scale that. And that is very different. Now we're no longer going to be human resource limited with high end experts for investigations. In theory those investigators could teach a machine and what they see can be seen everywhere.

As I mentioned earlier, we have learned how to build certain models of conduct using a process that defines, finds data, represents that information, predicts on it, and evaluates it, and does things like boasting. As you've seen in your own activities in your own enforcement actions, it is remarkable how people will do something
terrible and they actually brag about it on coms later. Why? Because the systems in place weren't watching.

So, I've talked you through a little bit of the process of how you would go through and use the language of things like chat to find certain kinds of issues. But that's just the beginning really. When you find an issue in a chat, it only really makes sense if you can put it into context of what a person's done over time. Because these things are rarely a single event in terms of talking about something and leading exactly to the market manipulation event. There is normally a buildup. There is something to the effect of interest in a deal, followed by secrecy, followed by changing the venue to an unmonitored communication and then moving forward from there into the terrible activity to make themselves money and then to hide it.

And whether it's volatility indices that are potentially attempting to be manipulated or it is FX and Libor as we have seen in the past, the
instrument may change; the intentions of the human being do not. That's just the latest thing where the rules haven't been written yet. So to be proof, proven out against the future is to understand intent because humans don't change.

Now clearly this group is right at the forefront of trying to drive change through enforcement. I thought I would bring up a very recent one. And without isolating any particular group or bank because there are ones for a lot of people have happened in the last 2 or 3 years. I thought it was interesting to look at the kind of language that it's almost hard to believe a computer could recognize. But the language of, okay but what sort of level do you want to push it to? That in the context of the surrounding language can actually trigger a machine to say this needs to be looked at. And it can now.

So to prove it, we actually ran some CFTC transcripts that were provided from cases and we had to look at traders that had been, I guess, what is the old phrase? Names have been changed
to protect not the innocent in this case. But
this is real data; this is data that you've used
in your investigations.

As you see, when people type in chat
they don't really care about getting the spelling
right. And when people type in chat they'll use
odd slang like whack it. But when you see a deal
and then you see people acting in a certain way
with some examples, the system can flag certain
events.

And I don't act like this is easy, I
don't act like this is trivial, in fact there's a
reason a 17 year old company that took 10 years or
R and D in the defense and intelligence community
to show even the beginnings of these capabilities
that banks would then invest in and try. And it
took many years working with banks, with their
expertise to begin to teach a system to do this.

And I think that's why you'll see the
disillusionment because many people will promise,
as we like to say, often imitated but never
duplicated, many people will promise but there's
real hard work. And if this was easy, then I do believe that banks would absolutely deploy it and some of them are very aggressively, but it is not because it's easy. It's because they're willing to put in advanced technologies to prevent future risk.

And so we have run some of your chats and we found certain collusion and boasting events with the models we have and we would hope that the kinds of data that we're running today live in about half of the top ten investment banks in the world, where visual reasoning is in production use today, that this is going to eventually prevent some of the activity because as we understand human intention and behavior through language and through other types of data we can actually begin to preempt some of the behavior that has actually made us all not very happy.

So I did want to end by saying we love certain partners in this process, we work closely with partners like NASDAQ and being able to pull together other data, market data because language
is a piece of the puzzle. We argue it's one of the bigger pieces because it tells you where the smoking gun is but it's part of behavior and as we get into behavior you'll end up looking at other things.

And so this is all converging to something, which is around what we call holistic surveillance. And from holistic surveillance from many different channels, text and audio and market behavior and eventually a behavioral perspective that sees every individual over time and looking for changes in that individual's behaviors, attitudes. It opens up the door to many things, and it opens up the door particularly to avoiding the activities versus reacting to them.

So I'll leave you with a couple of questions. The first is now that we have seen what is possible in some of these places, and as they work to adopt it, we do believe that the traditional approaches of using large list of words, what are called Lexicons, is a failed legacy technology. We believe there are other
approaches that are also still failing us today
and I would, I guess my curiosity is, how long
when an innovation is shown and proven out, is it
reasonable to wait to say that it's a new
standard? A year, two years, five years? How
many things have to happen?

So that I'd love to have because I think
it has to be reasonable. It is not free, it is
not easy, but obviously given the import of this,
that is a question I would love to have, the panel
potentially jump in on.

And then the second question is how, are
there ways that we can start to better enable,
safeguard, the ability of all of our members,
people in this industry, to share models so that
they can learn from one another. If educating the
machine is the hardest part, then you would expect
if we can create some levels of exchange of
derived knowledge, not data, I want to be very
careful, I know there's a whole other challenge in
sharing data, but if there is a way to share
learnings and operationalize them, what are ideas
around that area?

Because we think once a few banks start to get some traction with this and show the outcomes of this new approach, that it should, those things should be available to be shared and no bank, no buy-side firm should worry about potential risk with them trying to do a good thing.

So I'll leave you with those two questions and I'm happy to answer any question that you have about this. I haven't touched on areas of revenue, areas of where profiling customers, finding insights, market color, there are so many applications of AI in this space, but I didn't want to focus on one. I think there's plenty of depth there. And I guess at that point, I'll end my opening remarks and just say thank you for your time.

MR. GORFINE: Thank you very much, Tim. I mean the goal of your presentation was to be thought provoking and it was certainly that. And you start thinking about the application of these
technologies in the use case that you described
and there's many other potential applications or
use cases of this type of machine learning
technology so it certainly is quite thought
provoking.

But you posed some questions, which is
great because it makes my job easier, so maybe
I'll start with Charles, if you want to kick off.

MR. COOPER: I'm actually going to ask
another question instead of responding because I'm
out of my depth here on AI. Where do you think we
are in terms of the expectations versus reality
mismatch? We talk about a lot about hype cycles;
you talked about the period of disillusionment I
think was the expression you used. Where is AI
now versus where people think it is and how long
do you think it will take to get to where people
think it is?

MR. ESTES: So I think about it in terms
of what are the kinds of use cases where it can be
effective today and then what are the promises use
cases where people are going to have to break a
few picks before they see the gold.

The number one use case today where it can be effectively used is in triage. A sufficient level of judgment about many kinds of data to say this data is not worth human attention and this data is. So I think there are all kinds of use cases, whether it's in sales, whether it's in risk as we described, that is something that I expect that will be ubiquitously adopted and could dramatically create productivity gains among many fields in banking.

Now let me give you an example of where I think maybe some expectations have been set and maybe they won't be met. Thirty years ago, actually I would even go back as far as 45, 50 years ago with the first wave, there was a renaissance theory called Expert Systems where you could teach a system many, many, many things and create rules and scenarios and the system was there essentially as the collective knowledge of all the people that taught it to help people make better decisions.
I think for 2 or 3 reasons how hard it is to educate that machine, how hard it is to back test some of its judgments in certain contexts, the lack of transparency and new deep learning models, other kinds of areas, it's going to take some time before effective expert systems in the new AI return the value that has been promised.

And so my belief is that triage will be adopted very radically but I think some people will take big bets on building giant expert systems with lots of knowledge and be disappointed in what they really produced. We've seen this already in healthcare and I think it's really hard to teach a doctor to be a better doctor because what doctors taught that system ends up biasing what that system comes up with and then doctors start rejecting it and people don't adopt it.

So you have to think about all the human dynamics because human nature doesn't really change and having something do the grunt work for you, people love. Once they trust it. And the second part is, it telling you to do it
differently than you're doing it, that's a harder thing to pull off.

So and then do you enforce that from the top down even if you know it works, let's say you know and your expert system is better than most of your employees. Do you enforce and tell your employees I don't care about your judgment anymore? There's going to be things that society has to work out and I think that's what will hold back some of these things.

And there will also be a lot of things where we commoditized that transistor level of AI but without systems you're going to have a lot of people try running whole programs on a set of transistors barely wired together and it doesn't really work in real data.

So that will be the other side, so if you haven't realized how to test it on actual data versus the test data because a lot of these big advances in AI like in image recognition, you know the cat detector that Google had and others, you all may have seen, those advances happened because
we had done massively curated data sets where we could teach the machine.

And those same models run against different types of data prove radically less effective. So the generalization of the machines is still very much a work in practice which is why the most advanced work in places like Deep Mine are focused on very different techniques than just supervised education or if we focus on reinforcement where its' environment continued to educate it but we're still very early in that actual science.

MR. GORFINE: We're going to have time for 2 more questions or comments but let me go to Christopher.

MR. CHATTAWAY: Thank you again Tim for presenting. That's good to hear that Goldman Sachs is a client. I had a question; you spent a good amount of time on surveillance, or conduct surveillance. I'm specifically responsible for electronic trading in the FICC businesses and in that context where you're building automated
systems that need to have very discrete and reproducible behaviors, how do you foresee AI influencing the sort of trading decisions made in those businesses?

MR. ESTES: I think that's actually, so, I mean the easy answer is the humans that are making the decision, I can see AI being kind of the chief filter ahead of the information that drives that decision making. And I think the step after that is going to be how do you have all that knowledge come together to where you can actually have a shared discussion that has a virtual construct.

So I think essentially going from radically augmenting the information that's important to make decisions to essentially creating committee decisions where the machine is a partner and then looking at a lot of data, and a lot of outcomes over time, you'll probably over a 3 to 5 year horizon I think, not a 1 to 2 year, you'll look at can we let the machine do some of its own strategies?
Now there are a lot of risks in that, like actual decisions based on data that are not just sort of heuristical decisions. And I know actually this already happens in the market, so this is not science future this is present, but the present is very dicey. So I think that we have work to do to figure out how that would be managed to regulate it and it's going to take sandboxes to get there. So that's my hunch is probably the 3 levels.

We're going to go from triage to autonomy over time. The question is how long and what are the safeguards between those two endpoints.

MR. GORFINE: Okay so let's take two final comments or questions. We'll go with Yesha and Supurna.

MS. VEDBRAT: It's actually a question on something that you've asked of us and that is about how do companies comes together to help increase the sharing or enhance the intelligence of the surveillance system, what are you thinking?
Is it like the phrase is that our individual teachings may come up with, help to create a library of sorts or what are you thinking in that context just so that I have a better idea?

MR. ESTES: Well I'm actually maybe three steps behind you in sort of thinking that far in implementation. The three steps are, are there essentially safe harbors that allow banks to experiment with exchanging derivative artifacts from data? Where they don't, basically they're lowering their risk threshold to try, because I actually think it's the legal and the concerns that hold it back. It's not actually technology.

So I think that if there was encouragement to have the freedom to try and some safe harbors for that, you would see a natural sort of adoption of the market to try to create network effects on key issues. But I just think right now there is just a lot of risk aversion to the possible side effects and if we can make an impact there at a governmental level then I think the market will take care of the problem because
MS. YADAV: Thank you Tim. We actually discovered that we're next-door neighbors in Nashville.

MS. YADAV: So thank you so much Tim. So I guess some of the questions that we've talked about in this panel already are related to new products. Very new asset classes are being created.

Looking at cryptoassets, and so on, that are very, sort of, nascent history. So in the context of these very new products, how do you deal with AI when there is really no data or the data has been created and the history of the data is very new and it's very hard to discover what filter mechanisms and statistical modelling you need to make sense of that data.

And particularly given that the marketplace that we live in, sourcing that data from these very specialist FinTech firms is
probably very expensive, so how do you overcome that issue? And one interesting point that you made which was fascinating, which is that we want to make machines human-like in certain respects, and I can see why that would be really important as Supurna was saying about surveillance and looking at language, but what about when it comes to training?

As Christopher was saying, maybe we want to get rid of humanity in relation to that. So how do you make that determination between what parts of human beings we want and what parts of machines we want at a certain point in time?

MR. ESTES: Yeah so I actually think that the questions are very related. So to go to the first point, the strategy we've taken ultimately was about finding human behavior by finding intentions that run ahead of behavior and that is independent of products.

So we think that if you look for human risk, whatever the current thing is, even if there's not much data on that, there's still
plenty of data about people doing bad things with other products. So I think we have a little bit of insulation there, I don't necessarily want to say we have full, I think it makes more structured data or metadata driven detection system much, much more difficult because those require data of that kind and if it doesn't exist it becomes a problem.

So I think that there's good proxies for the new data by looking intentions. Now to me that's a great case of a human judgment being implemented in AI that we'd want to model, which is find the parts that are invariant and focus on getting those first, and then work on the more subtle areas. So, I think that's a strategy, that's a humanlike principle.

Let's take an example of humanlike principle that we don't want, that we want to avoid as much as possible, prejudice and bias and mistakes. So in those areas we want the objectivity AI can bring and the transparency of it, so that's where I think that you actually have
an ability, so if you think, if AI is essentially just a label for educating machines, transferring knowledge that's in data and in human heads and judgments against that data and move that into a model or a set of models, a giant family of models, like I think right now we talk about models in terms of few things, a few patterns, there will be thousands to millions of models, like little brains running in all of our industries not too long from now.

And that's why it will become impossible for us to really look at it like code engineering problem, it will be more like a bunch of cells and knowing what type of things to perturb the system with to make the cells do certain things. So basically I think engineers will become more like doctors.

Having said that, in this case what you want is you want still some of those engineering properties to have audit and reporting. I mean we can't really dump our brains out onto a table, we wouldn't know what's in the stuff in here. We
have to have it write out like a lot of -- you
give a test, right, how do you explain what
somebody knows? You test them.

But what if you have nearly infinite
processing and storage? Well, you can run a test
which is almost entirely exhaustive, so something
that a human could not actually sustain to go deep
into all the things they know of why they did
something, you could have a machine just keep
going and going. So it becomes a lot like
inductive proof in math, and I think that there is
sort of a next way of looking at this, which
essentially is more in the inductive space, but
it's such scale that it becomes approximately
certain.

And that will be where it's kind of
between human, where it's not fully certain
because it's not just deductive, it is learning,
it's adapting, but it's at such ridiculous
inductive scale that you know that it's
essentially true as much as we know many things
are true. So that's my guess.
MR. GORFINE: Thank you very much Tim, we appreciate it. And this is actually a very good segue to our next panel topic, so I would now like to turn to the next topic on our agenda in which our panelists will discuss developments, challenges, and risks around automated and algorithmic trading technologies and potential areas for regulatory consideration. Our panelists are Larry Tabb of Tabb Group, Brian Durkin of CME, and Professor Yesha Yadav, a CFTC Special Government Employee and Professor of Law at Vanderbilt University.

We're going to start with Larry and we're going to rely on a very, very advanced technology called the telephone. So Larry should be on the line right now and he has a presentation that he'll walk us through. Larry, I hope you're there.

I'm told Larry is on. Larry, if you're there and you can unmute?

MR. TABB: Unmuted, can you hear me?

MR. GORFINE: Yes, we can. Excellent.
MR. TABB: Okay. Okay, great, thanks.

I want to thank the Commissioners, the Chairman, my fellow TAC members. I'm going to kind of do an algo trading level set for you. So the agenda, you know that I'm going to go through pretty quickly on the next page. Your type of algos, common differences between futures and equities, where speed fits in, a little bit about MiFID II but not too much, and a little on algo regulation.

The next page, slide 3, it says three types of algos across the top. The way I look at the market, even though it's way more complicated than this, there are three general types of algos. The first is alpha generating algos. It's about 54 percent of total equity trading volume. So a lot of it is market making liquidity provisioning. The other side of liquidity provisioning is basically finding opportunities and picking off liquidity providers. And then there are a lot of arbitrage algos used to keep futures and cash together. Options, cash, your ETFs, and futures and cash, and basically keeping everything in
line, you know, price-wise.

On the other side, the next set has quantitative strategies. They tend to be more technical. Very much, you know, data-driven. We think this is about 16 percent of total equity volumes. Of that we think about five percent would be categorized as HFT. About 11 percent is non-HFT. This is more on the equity side.

And then there are execution algos. There are buy-side algos. You know, we're reviewed at about 45 percent of buy-side flow directly goes through algos. And then a lot of the trading that goes through high-touch brokers get wind, you know, gets put into algos. After that it's a very large percentage of the buy-side flow winds up going through some sort of algo, again on the equity side.

If you go to the next page, this is kind of a chart between the difference between equities and futures. Generally, on the futures side, the bottom right, products generally trade one product in one venue. They trade on exchange there's one
queue. It's kind of hard to do things over the counter. And the queue is, you know, first come first served.

On the equity side there's a tremendous difference. There are 12 exchanges, soon to be 13. There are roughly 33 equity ATS's. There are roughly 35 major brokers and market makers providing quotes to institutional investors. There's eight major wholesalers that are providing retail execution, and four ping networks which is basically an electronic market maker.

So from an equities perspective, there are roughly 92 routing decisions, where do I go and how do I trade and how does each of these different venues operate? So it's a much more complicated, and to a certain extent, there's 45 formal queues to be first in line. And especially on the equity side with order protection, becoming first is very important to how you get executed.

So the next page, slide 5, when equity -- when liquidity is fragmented, the tick size is really important, basically fragmentation in tick
size basically means that speed becomes really, really important, because there's a lot of arbitrage between all of these different venues. And where to become the top of queue, where can you get queue positioning becomes very important. And depending upon your strategy, you may want to be at the top, or you maybe want to be in the middle, or there's a lot of jockeying around.

So small size and being very quick becomes really, really important, and to a certain extent many of these venues have different charging mechanisms. So there's a big gain in terms of, not gain gain, but there's, you know, in theory, as to where do you want to be in the queue, and not just the queue in one platform, but the queue across the holistic market. And that has a lot to do with whether you're lit or dark, or what the pricing model is, and where, how aggressive do you want to be in terms of posting your liquidity, and how visible do you want to be.

I said when there are multiple venues, or queues, speed becomes really, really important.
That's not as much so in a futures world where there's fewer queues because to a certain extent, you know, if you want to be top of queue in a futures market, you've got to get to the front and then size, it becomes you either, you know, your larger order basically stays there longer until it gets filled. Or the person who wants to jump that queue needs to pay a much higher tick size to get in front.

So in the equity side, speed becomes incredibly important. Speed becomes important in futures, basically, to tie cash and futures together.

If you go to slide 6, also depending upon your architecture and what you're trying to accomp -- or depending upon what you're trying to accomplish, architecture means a lot. So on the left side of this picture you have a typical buy-side trader or even a buy-side execution algo trying to determine where do I want to be to get the price that's being displayed. So I have to collect market data from all the different venues,
put them all in order, determine where do I want
to route.

Whereas if you're in an alpha algo
architecture, basically, a market maker, a lot of
times they're co-located at all these venues and
you're dealing with a very small time delay, you
know, just reading one venue, reacting to that
venue, providing liquidity, and taking liquidity.
So generally, market maker algos operate much
quicker than buy-side algos.

Slide 7 really talks about MiFID, talks
about unbundling. That's really, you know, and
then you're looking because of my research gets
unbundled, I have to pay for it separately,
enables the buy-side trader to really take more
control over their execution process. Within
MiFID II there's a very significant change
especially in the equity market structure side.
Tries to ban broker dark pools and limit dark
trading. Requires a lot of buy-side end of day
reporting, and then they wind up with
exchange-trade derivatives clearing, you know,
being much more open but that's postponed to 2020.

The issue here that I want to make is really around market structure regulation and really, that third major bullet. You know, because ESMA wanted to really try to push more liquidity into lit pools, they tried to -- they banned broker dark pools, and tried to limit dark MTFs, but they've opened up a channel called systematic internalisers which is going to, you know, pretty significantly change the use of capital, how systematic internalisers and market makers interact with the buy-side. And it's going to pretty dramatically impact how the European market center acts.

And I use this to kind of talk about regulation, which is kind of the next slide. You see your little logo there. And if you go to slide 9 where I have kind of my thoughts on regulation, and here I'm kind of, you know, probably going to upset a bunch of people. But my thoughts on regulation are that, you know, I think the regulators, you should be trying to create a
level playing field not pick winners and losers or business models.

Focus on transparency, fairness, systematic risk, clearing. Focus on ensuring that the market is fair, clearing margin safety, things like that.

The other thing where I don't think the regulators have focused enough on is transparency. And increasingly, as the market moves to becoming more automated, the issue of time stamps and clock sync becomes increasingly important where instead of markets or regulators determining how we want our market to work, and how we think that if we do these changes the market will react, it becomes, if you look at where the regulators have kind of forced the market to move, very often that's not what exactly happened.

You know, you have MiFID trying to close down dark pools, but now it opens this whole systematic internaliser process, which that's a whole other discussion. You've got the implementation of SEFs in the US trying to create
limit order books. And we're not seeing a whole lot of use of those real-time limit order books. You have the US options market even though it was regulated a long time ago. You're creating -- you're seeing in the options market just overwhelming amounts of data and challenges and quoting, you know, 600,000 instruments on a real-time basis over 14 exchanges.

You wind up with some very unintended consequences which, actually, gets to my last slide is, you know, my bottom line on market structure regulation is let's be able to measure stuff. If we can measure stuff, if we can get down to fine enough grain time stamps, if we can get the clock sync right, we can really better understand how my broker is serving me, and whether they're actually doing a job.

And if they aren't, well then, you know, I can switch brokers, or pressure them to do a better job. Whereas if I wind up having sweeping market structure changes, very often they're not going to really turn out the way we wanted them to
turn out. And so that's kind of the end of my two cents of pontificating.

So like the carpenter said, you know, the carpenter adage goes you measure twice, cut once. I think our topic should be measure twice, regulate once. Let's make sure that we know what we're, you know, where we're going before we wind up implementing tremendous change. And with that, I'll put myself on mute or be on the call.

Thanks.

MR. GORFINE: Thank you, Larry. I think actually on the list here we have Mr. Durkin next.

MR. DURKIN: Thank you very much. First of all, thank you Commissioner Quintenz for overseeing and revitalizing the technology advisory committee. Chairman Giancarlo, thank you so much for your support on the importance of this. Mr. Gorfine, very excited about your leadership in this whole program. Commissioner Behnam, thank you so much for your support as well.

I say that because I have an over
seven-year history, at least, with the Technology Advis
Advisory Committee and the work of the CFTC
particularly in this regard. And if you go back
and look at my comments over those years, they've
been very consistent in the context of applauding
the CFTC for its leadership in this regard and in
this evolution of these markets and the automation
of trading. Because you have been leaders in this
regard in bringing this community together of
esteemed colleagues to help inform policies,
guidelines, and principles has been very
formidable in what I believe to be the leadership
that the futures industry represents. So thank
you for that.

The efforts that you all, and we have
all, undertaken together over this journey have
led to some very important and highly notable
principles-based guidance involving a wide range
of subjects that directly impact and are related
to the advancements and technology, and the
progression to an increasingly automated
environment in which we all operate. Among this,
this guidance has informed our industry. It's informed the Commission. I'll go so far to say it's informed the globe, and the context of risk management, pre and post-trade protocols, system safeguards, access to colocation facilities, messaging policies, and most recently, regulation AT.

Now it's not at all surprising that traders today have increasingly turned to automation to optimize trade execution, and to increase their operational efficiency, and enhance risk management. With the development of automated trading, algorithmic trading has unquestionably emerged, contributing to significant volume and growth across all asset classes in providing greater liquidity, tighter bid-ask spreads. This liquidity generated by the traders in these markets in turn is relied heavily upon all types of market participants to achieve their risk management and their investment objectives, and allows them to do so at a lower cost.
It's very important to recognize that algorithmic trading, like non-automated trading, engages in a variety of activities such as market making, arbitrage, hedging, and employs many diverse strategies in each of these contexts to achieve their risk management objectives. A significant proportion of algorithmic traders active on CME Group markets, they contribute substantially liquidity, undoubtedly, by providing continuous markets in our products.

A major benefit of proprietary trading that I would like to remind all of us of, or, as has been referred to, professional trading firms, was highly demonstrated and very publicly demonstrated in the October 15th, 2014 US Treasury market flash rally where proprietary trading firms played a key role in the liquidity provisioning and price discovery during a highly significant and highly volatile market condition.

During the period leading up to and including most of that volatile period of that day, proprietary traders, or commonly referred to
PTFs, increased their trading activity in the ten-year Treasury note futures market. They provided the majority of the order book liquidity at a tight bid-ask spread, and in contrast that day, during that most volatile period, bank dealers widened their bid-ask spread, and generally pulled back their participation.

Now it's important to note that, while the event itself was highly significant, continued pricing spurred on by prop traders, or PTFs, filling that void that was left by other participants, allowed the general market population to continue transacting even during the most volatile period of that day leading to a much more orderly marketplace. Now the criticality of proprietary traders extending liquidity during this important market event should not be lost. And it's something that I would argue that this committee should take a look at going forward for the following reasons.

As we evaluate the impacts of new regulations on these markets, regulations must be
appropriately tailored to our markets. Capital treatment for proprietary traders, for example, who make markets in exchange-traded derivatives, ignores the actual risks and correlations between the positions of participants offering liquidities on both sides of the market.

More specifically, they lack the recognition of delta adjustments for options and recognition of netting sets for options positions which ultimately results in a reduction in liquidity during stress conditions. This happens by applying inappropriate costs to market maker exposures, and this is a direct result of the supplemental leverage ratio.

Now we recently observed the impacts of this treatment in the equity derivatives markets where spreads on the S&P options on February 5th and 6th widened significantly more during similarly stressed markets in the past. Now based on our market intelligence that we've received, we understand the widening of the bid-ask spreads to be primarily driven by capital costs, again,
associated with the leverage ratio.

Now what is our role as CME Group or as an exchange in automated trading? Well, I assure you that the CME Group shares, as I'm sure all of our colleagues around this table, share a common objective of promoting transparency and integrity in our financial markets, and doing so in a manner that preserves the vibrancy, the competitiveness, and the leadership of our global markets.

Unquestionably market integrity is one of the cornerstones of our existence. I assure you it is a cornerstone of the existence of CME Group's business model, and our company employs substantial human resources, technological capital and capabilities to protect and continually enhance the reliability of our markets, and also to mitigate the potential for market disruptions through the usage of its risk controls and the systems safeguards that have been developed over the years.

Our protections against spoofing and other market abuses are integral to these efforts.
We view that CME Group has been a leader in promoting integrity, efficiency, and transparency of global financial markets. We've done so deeply with the guidance of the Commission and the work that's been done with the Technology Advisory Committee over these last seven years.

We appreciate the importance of ensuring that risk management and regulatory frameworks keep pace, keep pace with the rapid technological advancements that have characterized the evolution of our markets in recent years. We've developed a wide array of capabilities to manage risk and volatility and to mitigate market disruptions. And these are applied at all levels of market participants, all levels of market participants.

These protocols include Globex credit control, price banding, maximum order quantities, messaging controls, stop logic, functionality such as circuit breakers, price protection points, and kill switches. Now each of these is outlined in some form or fashion underscore guidance and principles that have been the good work of this
group over these years. And to drill into these a
little bit more deeply, just so we have an
appreciation of how far this industry has come,
when we speak of Globex credit controls, these are
pre-execution risk controls that are provided.
And they enable our clearing firms to set credit
limits for every executing firm.

   It's a requirement that our clearing
firms utilize these controls. It's not an option.
Our credit controls, which every clearing firm
utilizes, includes mechanisms such as order
blocking, order cancellations, automated email
notifications, and these can be set at various
levels and thresholds.

   We also employ a tool called Cancel On
Disconnect that will cancel all resting orders in
a book for a market participant that happens to
get disconnected from our system. Price banding,
this applies to all of our products. All orders
are subject to price verification levels. Bids at
prices well above and offers well below the market
fall outside the contract's band and they're
automatically rejected by our system.

Maximum order quantities, every product has predefined maximum quantity per order. This step ensures that the order is not exceeding this limit. If the maximum quantity is exceeded, the order is rejected by the system.

Messaging controls, these controls limit the rate at which firms may submit mass quotes and can block orders from entering the system if the volume thresholds or the order quantities are exceeded.

Stop logic functionality, stop logic can automatically halt the market for a predetermined period of time in order to help prevent extreme market volatility and price deviations. When it was triggered on May 6th of 2010, that infamous day, stop logic was the mechanism that reversed the course of the Flash Crash by halting the market for enough time for liquidity to be replenished.

Circuit breakers, in our equity indexes and energy products circuit breakers halt trading
for a period of time when a specified level is
reached. In addition, the utilization of daily
price limits prevents trading at prices higher
than or lower than limits that are pre-set by our
company.

    Price protection points, protection
points act as a control against excessive price
swings in an illiquid market. These points
prevent market and stop orders from being filled
at significantly aberrant prices because of the
absence of sufficient liquidity in that market.

    Kill switches designed to allow clearing
firms a one-stop shutdown of our CME Globex
activity at the most granular level of a market
participant. Additionally, more recently, we've
just introduced inline credit controls that allow
for account-based limits that can be set at a
highly granular product level.

    Taking a look at more recent activity, I
just wanted to end by referencing how these
markets are continuing to grow and evolve and
having capabilities such as what we've outlined.
Capabilities that have been the predicate of the good work of this committee has enabled these markets to be global leaders.

CME Group's markets this past week as investors turned to these markets to manage and to hedge the largest cash market drop since 2011. In all instances, our market worked as designed. These protocols that I outlined worked as designed. Our risk mitigation tools and processes were utilized extensively throughout the week. They worked as designed.

Our systems performed well with large volumes and open interest. Total open interest records were achieved last week of 129.5 million contracts on February 6th. New daily volume records for options of 9.2 million contracts on February 6th. The last record in that regard was the US presidential election.

Equity futures and options reached several records during the week of February 6th at 10.7 million contracts. The innovation, the advancement, the engagement of this Commission and
the Technology Advisory Committee has played a very formidable role in the leadership of our US futures markets, and having the protocols in place, and the system safeguards in place to keep pace with the innovation of technology and automated trading.

And so I feel very strongly about where we are today and the opportunities associated with how this committee can continue to help us evolve and keep pace with that change. Thank you.

MS. YADAV: So my sincere thank you to Vanderbilt's own Chairman Giancarlo, of course. To Chairman Quintenz, to Chairman Behnam, Commissioner Behnam, and of course, to Director Gorfine, for the incredible privilege of having the chance to serve on this committee, it really is a tremendous honor to be here and to have this time amongst such terrific colleagues.

In addition, I'd, of course, like to thank the incredible staff here at the CFTC for all their hard work and tremendous thoughtfulness in putting this wonderful program together. It
really is a fabulously cohesive and thought-provoking program that I think will give us an incredible volume of work to get on with in the time going forward.

So given the incredible activity that we’ve had over these past few weeks in the marketplace, it is actually a good time to step back, to stop looking at the tickertape every single minute, and to stop doing our breathing exercises, and to have a chance to actually go back in time. And I thought I might take you guys back to what seems like prehistory now which is August the 1st, 2012.

And that was another weird and problematic day on Wall Street as many of you will remember. And that was a day in which Knight Capital, an HFT market trading firm, experienced what can only be described as a bad technical glitch. Instead of sending out 212 orders, test orders, into the New York Stock Exchange, a failure of Knight Capital to update the software system on its router caused the system to unleash
several million orders into the marketplace resulting in Knight Capital accumulating losses of around $450 million in just 45 minutes time for a firm that only had around $360 million in cash and other assets.

And these weird, anomalous, costly, and disruptive events seem to be growing in frequency in our marketplace. We can't forget, obviously, as Brian mentioned the infamy of the Flash Crash when a trader sitting in London in his parents' basement managed to contribute to events that eventually led to the crashing of the US stock market for a period of time.

In addition, and perhaps more mundanely, we have seen flash crashes in the trading of individual stocks, individual securities in the future markets, sudden disappearances of liquidity that are unexplained, costly, and they create a sense of anxiety amongst market participants as to how market robustness is supposed to look like in our leading markets.

And really I thought that it would be
interesting for our committee and for market participants, regulators, and policy makers to think deeply about how we might lever our legal system in ways that can encourage and deter bad and disruptive behavior from taking place in the first place. As well as for the legal system to be utilized in ways that can create mechanisms, that can help make participants whole, to compensate participants in the event that these disruptions end up happening.

Now one concern that has been highlighted in the research that I have been doing is that the legal system is increasingly unfit and poorly adapted to dealing with the risk created by high-speed, highly automated trading in a very interconnected market. Now as many of you know, if you're lawyers, of if you watch "The Good Wife" and/or "Law & Order" that the legal system is basically underpinned by three very fundamental standards of liability that underpin much of the rulemaking that happened within these venerable walls, as well as, of course, across regulatory
agencies across DC.

When we think about strict liability, strict liability makes you liable irrespective of fault. You are liable for all the losses that arise as a result of your bad and disruptive conduct, right? And this kind of liability is designed to deter and punish extremely dangerous, disruptive kinds of activities that can create large costs and large disruptions in society.

Then we have the workhorse of the legal system, and that is negligence-based liability. Negligence-based liability punishes unreasonable behavior and makes you liable for the foreseeable consequence of that behavior, and when we're dealing with negligence, that is really one of the linchpins of our regulatory system. The reasonable standard, the reasonableness standard undergirds much of rulemaking today across regulation in the securities marketplace.

And then, of course, we have our most serious standard of liability which is intent. Intent or highly, grossly negligent conduct that
is manifested in cases of fraud, of manipulation, that is really regarded as being the most expressively bad kind of conduct that we can perform, and that is punished by an intent-based standard of liability. And all of these core fundamental guiding standards of liability are increasingly poorly adapted to the marketplace in which we live in which is governed by high-speed, highly automated algos in a market which is deeply interconnected, where the seriousness of the harm can seem to be far in excess of the actual nature of the act itself.

So when we look at algos, in order to be able to transact in milliseconds and microseconds, we need to make sure that algorithms are preprogrammed in advance of trading, right? Because as Charles mentioned earlier today, we're too distracted, we're too dumb to be able to follow along in real time. And as a result, of course, we need to make sure that our algorithms are preprogrammed in advance of trading to be able to deal with the permutations, the different
events, the different dynamic that will happen in an ever-evolving marketplace with changing prices.

And therefore, the fact that we have to preprogram algorithms, the fact that we have a predictive dynamic that underlies much of trading today, where algos essentially have to transact independently in real time in accordance with their programming means that systematic random error is almost endemic to trading today. That algorithms can easily misfire. Algorithms can easily fail to react to information in a way that we might expect them to. Algorithms may fail to perform as programmed in circumstances that are unusual because, essentially, they're constrained by their programming, and we cannot possibly expect traders to take into account every single eventuality that may possibly arise in that program ex ante.

So we have preprogrammed algorithms that create a dynamic, whereby systematic error is endemic to their operation. In addition, as we all know, as we all know, today's markets are
incredibly interconnected. As Larry mentioned in his presentation, we have venues both in the equities as well as derivatives space which are able to synchronize very rapidly to new information that comes in.

So as finance scholars have repeatedly shown, markets today are incredibly efficient at reflecting new information at the prices at which securities are trading. In addition, of course, that means that errors, misfires, and disruption can also potentially amplify and cascade as they move through the system of venues such that an original bad act, an original harmful event can seem far, far more serious as it's amplified rapidly across the marketplace in the prices and in the dynamics that exchanges and other venues have to deal with when they're dealing with cascading events in the market.

And these two dynamics make it very hard for the legal systems core standards of liability to work as intended. If we think about strict liability, for example, strict liability where
you're liable irrespective of fault is very
difficult to apply in a market in which systematic
random error is endemic, right? We cannot
possibly expect, we cannot possibly imagine that
traders will be able to build systems capable of
safeguarding against every possible eventuality or
circumstance in an evolving market environment.

In addition, the negligence standard,
too, our very core of the regulatory framework is
straining. When we think about actions like
Knight Capital or even the Flash Crash, actions
that seem remarkably innocuous, remarkably
expected in certain senses, can cause incredibly
costly harm to the marketplace as a whole. And as
we've sort of thought about the discussions
throughout the day today, the increasing
electronification of our marketplace, the
increasing automation of our marketplace means
that we might see an increase in these kinds of
glitches and events happening such that it gives
us some room to think about how we should
recalibrate, rethink, reimage, reconfigure the
reasonableness standard to deal with the kinds of harms that we are facing in today's marketplace.

If we think about our own lives, control, alt, delete are my favorite keys on the keyboard. You know, these kinds of glitches happen all too often. So how do we reconfigure, rethink, deal once again with a reasonable standard -- a reasonableness standard when we are in an environment of a highly automated, highly electronic, and a marketplace in which preprogrammed high-speed algorithms are becoming the norm?

Now finally, and perhaps most interestingly from a philosophical perspective, particularly given Tim's earlier presentation, very insightful presentation earlier, how do we think about intent in this market? Right, when we look at automated trading, we look at machine learning algorithms that are effectively designed to reprogram themselves in response to new, incoming information. What do we do about intent?

Behavior that to us would seem bad,
undesirable, intentionally malicious may, to
certain algorithms, be considered as being
profit-generating, as being effective, as being a
useful arsenal in their trading technology. And
when algos are trading with other algos, how do we
capture our vision, our understanding of harm,
intentional, and bad behavior within the
programming of highly automated machine learning
algorithms?

Now one big gap, given these gaps that
are left in the law, the cost of these gaps are
going to be left to be borne by market
participants, exchanges that have redouble their
monitoring efforts are those who have to pick up
the costs when firms do not have the resources,
when their actions are too serious and too costly
relative to their conduct to make whole those who
are in the marketplace. And so someone has to
pick up the tab. And that tab is either other
market participants and/or it is investors who
have to discount the capital they put into the
market to reflect the risk of having to protect
themselves.

More broadly, obviously, seen from the perspective of this agency that has done so much to lead international rulemaking in financial regulation, this is an area which remains underexplored, under thought, and in which guidance from us, guidance from our markets can really inform and lead the global dialogue both publicly as well as privately in thinking about and configuring and calibrating new ways in which to bring the law up to speed with the pace of technology that is currently underpinning trading and securities markets today. Thank you very much.

MR. GORFINE: Okay. I want to thank our panel, and with that we will open it up to questions, thoughts, or reactions to what you heard from the panel. And again, I'd like to keep in mind the idea of potential work streams that this group might consider. Let's begin with Chuck.

MR. OCHERET: I wanted to thank the
Commission and also the panel for this whole event. But these really resonated with me although I'm not really working in this space right now, most of my career was spent doing high-frequency trading at big banks and hedge funds.

And it's fantastic to see the effort that CME Group has put into automated tools and kill switches and things like that. And I would just like to say I have always been appalled at most of the larger organizations I've been at how few controls there were, or how much -- how little transparency there was even within the organization in the face of different kinds of failure scenarios.

So I mean, this is not unique to trading. I mean, this is a general technology problem, and this is true in any kind of system with massive concurrency and distributed elements, and, you know, the same thing applies some of the blockchain things we were discussing earlier. And at one of the major organizations I was at, when
something were to fail, you know, it could be a hardware failure. It could be a software failure. It would take hours or days to resolve the situation and figure out what had gone wrong.

Until we eventually completely automated things so that if, you know, a switch failed in the data center, the head trader would get a dialogue on his desk saying these are the options you should trade to our connection to the New York Stock Exchange being down, or something like that.

The other point I wanted to make was, and this was actually what was a question I was going to ask in the AI session, having built a lot of artificially intelligent or pattern recognition-based algos, one of the things that a lot of the newer technologies, especially the deep-learning neural network technologies lack that were present in a lot of earlier technology, or some of the earlier technologies, was this notion of explainability. When something goes wrong because the algorithm is adapting or because a new situation occurs, there's no explainability.
There's no way to understand why did it make that decision, and sometimes -- because at a certain point, it's just numbers. It's all these linear equations and you're trying to figure out, well, we trained it, and here's some coefficients.

You know, they don't explain themselves. They're just doing dot products at very high speed. But I think it's something that we should hold people to a higher standard to.

MR. GORFINE: Okay, Mr. Curley.

MR. CURLEY: Thank you. I wanted to ask a question of Larry Tabb if he's still available on the phone. In particular, his slide 6 where he references that execution algos are typically slower than proprietary algos, and then has the added feature of it being kind of hardwired into the system. And is the emphasis really, is that different in futures markets where there's more a single queue than a multi-queue dynamic. And then second, does that really result in a form of structural disadvantage for parties using execution algos, maybe disproportionately
customers, in the sense of the -- a small
difference making a big difference in terms of
actual realized results in trading. Because that
would, even in a system where you kind of
prioritize fair process over fair result and kind
of the way MiFID is challenging now, but that
would suggest there's even a fair process concern
if those types of differences exist in terms of
tracking between execution and the proprietary
algos.

MR. GORFINE: Larry, if you're there and
you were able to hear the question, please, go
ahead and jump in.

MR. TABB: Hello, hello, hello?

MR. GORFINE: We can hear you well.

MR. TABB: Okay, good. In terms of
futures customer orders versus equities customer
orders, that problem isn't as big a deal but
depending upon where the execution algorithm is
and how the data is structured and read, it could,
you know, it could be impactful, but not generally
as impactful as on the equity side where there's
so many routing decisions to be made.

Now the question is, is this a good thing or a bad thing? Or does this, you know, create, a, poor outcomes for customer orders? That's harder to say because it's really difficult. We had a business for a while before it spun off that was really measuring equity execution. And just getting the normalized information, even down to one millisecond was very difficult, and actually, to really get an accurate representation, you really needed to get into the microseconds, and maybe ten microseconds, or sometimes, even single-second, or single-digit microseconds. And none of the brokers really had the ability or I'm not sure they even had the ability to measure or, you know, monitor at that level.

On the other hand, the customer orders have another advantage that the market makers do not have, and it's that they know the full size. And so and to a certain extent, knowing exactly what you're trying to accomplish that this is
really only 200 shares of a half a million share order, actually the buy-side has tremendously more information than the market makers do. So as well as this is a symbiotic relationship in that the market maker's providing liquidity. If they do not get fair outcomes then they widen their quotes. So it really is kind of a cat and mouse game.

And that said, what I believe and what I said in my presentation that's really important is just a much better mechanism to measure and benchmark execution speeds. Because then you'll have a better understanding of whether you're being treated fairly or if there's a problem that we should be worried about. And so unfortunately, it's really difficult to answer that last question, but I believe that both sides have advantages in different ways and it is a symbiotic relationship between the liquidity provider and the taker.

And if the takers have an advantage, the market makers would go out of business. And if
the market makers had a super advantage, then the
investors would clearly see harm in terms of
getting executed. With that said, I believe
better, more fine grained time stamping and better
computer sync would help that.

Now I would like to provide or ask --
provide a comment myself on the last presentation
from the professor from Yale. I think we've come
a long way, you know, and I don't think we should
always be worried about errant or aberrant algos
and their impact, but I think the exchanges and
the regulatory agencies have done a really good
job in terms of implementing kill switches, and,
you know, limits, and circuit breakers, and things
like that, to stop the market from poor reaction.

Now does that impact the legal system?
No, but I think it limits some of the damage that
occurs.

MR. GORFINE: Okay, thank you. We'll
take two more questions or comments, Mr. Heymeyer
and then Mr. Chattaway.

MR. HEYMeyer: I'd like to start by also
chiming in and thank you all for providing the forum and for all of the work that went into the decision, of course, of cancelling and then rescheduling. So thank you all very much. The presentations today have been terrific, and this is a subject that I find challenging and tricky because of my days when I was Chairman of the Board at NFA when the first ATS drafts came out.

It gets very tricky in trying to figure out where to draw the lines and where the net gets cast as to what is an automated trading system and what isn't. There are retail traders that use a lot of the independent software vendor-type systems that employ pretty simple automated tools that quickly fall into the category of automated trading system depending on how the wording of the rules is written.

And so it gets very tricky and very challenging to try to legislate the particulars of rules like this. We do a lot of low-latency automated trading, and we spend copious amounts of time going over our software-release protocols,
our risk tools. As Larry said, there have been a lot of advancements. It still makes me worry about it all the time that some kernel of an operating system goes down and there's something that we've missed.

I agree with Larry that the exchanges have made huge strides and if you ask the prop trading, the principle trading firms, I think they are unanimous that the best situation is the better and better the exchange tools get. Not in any way to put the responsibility on the exchanges, it's the trading companies who use the tools. It's their responsibility to manage their risk.

But as those tools become more and more granular down to the tag 50 at the CME level, and the CME's made great strides in being able to calculate what in the futures business, over in the equities business is buying power with their GCC limits, or per product risk limits, and those tools continue to get better and better. It's very competitive, as we've talked about today, the
technologies, and the speed of these things is breathtaking. But it's provided tremendous value in liquidity to the US Treasury market to try to finance all of that debt. The liquidity is deep, and so those tools have become better and better.

And the best setup, I think for everybody, is if the exchanges continue to do that. That's the ideal situation, because legislating, while there's a real temptation to do that, because it scares all of us, it gets very tricky in exactly how to do that. And so it's a tough balance, and it's a challenge, and it's tricky, and it's a very good public policy debate. But I do tend to think that these technologies, as the exchanges have gotten better and better, in the futures markets, I'm not as sure about all of those venues that Larry was talking about in the equity markets that make it so complex. But because you've got central limit order books, the technologies have come a long way.

MR. GORFINE: Thank you. Last comment, Mr. Chattaway?
MR. CHATTAWAY: Thank you. Yeah, I completely agree with the comments from Larry and Mr. Heymeyer over here. I just wanted to emphasize that the standard shouldn't be to build perfect systems. Software and hardware will fail and always fail. I think the standard should be to ensure that market participants have a framework around controlling and mitigating those problems so that they don't have external impact.

MR. GORFINE: Okay, thank you very much. So I think based on the panel and the discussion and the range of, potentially, worthy items for this group to explore, I would move that the TAC recommend to the Commission that it consider creating a subcommittee on automated trading. Is there a second?

MS. VEDBRAT: Second.

MR. GORFINE: Okay. Any questions or comments? All right. I will now call for the vote on the motion. All those in favor of recommending to the Commission that the Commission consider creating a subcommittee on automated
trading, please say aye.

COMMITTEE: Aye.

MR. GORFINE: All those opposed, please say nay. Are there any abstentions? Okay. The motion carries. I'm getting better at this procedure here.

So before we take a break, I believe the Chairman has a few remarks he'd like to make?

CHAIRMAN GIANCARLO: Just briefly. I'm not going to be able to stay for the final session, so I just wanted to just give a closing remark now if I could. And actually I wanted to give sort of a correction, an observation, and a reflection. And the correction is that the professor is from Vanderbilt not Yale, Larry Tabb. We've got an upgrade there so just wanted to make that point.

MR. TABB: I'm sorry about that.

CHAIRMAN GIANCARLO: There was an observation I heard before that regulators were referred to as vampires in the house. I've heard regulators called a lot of things, and I've
probably called them a few things myself, but a
vampire is one that's new to me. So I have to
reflect on that.

MR. KNIGHT: Point of order, I said we
don't want regulators to be like vampires in that
you let them into the house and then you can't
stop them. No, no. I'm not accusing regulators
of being vampires, let the record reflect.

CHAIRMAN GIANCARLO: Thank you. And I'm
glad I gave you a chance to clarify that so rumors
don't spread. So that's great. So we get that
sorted out. The one sort of reflection I just
wanted to make is I think it was Tim Estes
referred to, he said technology has not yet turned
back, and I think he was referring to bad behavior
in the marketplace, and I think he say yet.

I thought the yet was quite remarkable.
I must say there's a lot about technology I think
is absolutely remarkable and transformational and
can bring a lot of good. But I'm not sure ending
bad behavior is something it can do. I think as
long as there are human beings anywhere in the
market, our role as regulators is to try to find
them, punish them, take them out of the
marketplace, but the strange thing is they come
back -- they or their friends come back some other
time. So I think that the ongoing battle that
regulators and self-regulatory organizations and
good players in the market, we all have together,
is to find those bad actors and take them out.

Unfortunately, they will always be there. If technology limits the number of them,
that's great, but I think that's probably not one
that at least I personally have on my hope list.
I think that the process of getting rid of bad
actors just still falls on us as humans to find
them and take them out of the marketplace. And I
think as long as there are markets they will
attract. There's the old story about the bank
robber. When they asked him why he robs banks, he
says well, that's where the money is.

Why are there bad actors in markets?
Well, maybe that's why because that's where the
money is, and I think our job, as the good actors,
is to take them out of the marketplace. Anyway, with that, I want to thank you all. This has been a great, great day today. It's another great advisory committee meeting this year by the new Commission. So I tip my hat to Commissioner Quintenz who put a lot of time into this, and it falls on the heels of a great MRAC meeting just a week before. So thank you all for very much. Have a good break and we'll see you all soon.

Thanks.

MR. GORFINE: Okay. Thank you very much, Mr. Chairman. So with that we're going to take a ten-minute break. I want to try to stick to this schedule since it is Valentine's Day and folks will want to head out after the last panel. Let's return back at 3:25 if we can for our last panel.

(Recess)

MR. GORFINE: Okay. I would like to call the TAC meeting back to order and begin our final panel on emerging trends and best practices with respect to cybersecurity. Our panelists are
Naeem Musa of the CFTC and Phyllis Schneck of IBM, of Promontory IBM.

Let us begin with Naeem.

MR. MUSA: Good afternoon. Thank you for the opportunity to address the Technology Advisory Committee. As Commissioner Behnam mentioned in his opening remarks, cybersecurity is an all hands on deck exercise. As a regulator of financial markets, we are laser-focused on protecting our data from cyberattacks.

Cyberattacks continue to rise and tactics are getting more sophisticated, utilizing the combination of hacking, malware, and social engineering. In my role as the Chief Information Security Officer for the Commission, I meet monthly with our Chairman to review all recent cyber incidents and agency responses as well as review all recent cyber incidents and agency responses.

In addition to that, I meet on a regular basis with the Commissioners to discuss our progress and our cybersecurity program and review
with them all new trends in cyber threats. We have heard multiple panel participants comment on cybersecurity risk of data transmission, storage, hackable trading platforms, and virtual currency wallets.

While we believe that technology-driven innovation is and will continue to enhance markets, we also recognize the paramount importance of cyber security and data security practices that can help to safeguard the system underpinning innovation -- the system underpinning such innovation. According to the Verizon 2017 breach, or data breach report, private sector financial service organizations were the most targeted victims.

Representatively, quarter of all confirmed breaches, while other sectors reported more incidents, over 40 percent of incidents impacting financial services organizations resulted in breaches more than any other sector. Cybersecurity remains one of top compliance risks for financial firms. According to the same
report, 88 percent of industry compliance officers
surveyed view cybersecurity compliance and
identity theft as the most challenging compliance
topic.

To echo the words of our Chairman,
cybersecurity is undoubtedly the most important
single issue facing our markets today in terms
market integrity and financial stability. We are
all in this together and it's critical that we
work together in a private-public partnership to
combat cyber threats. CFTC seeks to leverage
every resource available to us across Federal
government and private industry.

CFTC is constantly reviewing and
updating our cybersecurity protections to guard
against the growing threat of breaches. We can't
get comfortable or rest on our laurels with our
past successes of preventing or avoiding breaches.
CFTC takes nothing for granted.

The cyber threat is persistent and
ever-changing. It has rightly been said and it's
not a question of if, it's a matter of when, when
a breach will take place. In addition to
collaborating with other financial regulatory
agencies, CFTC also works closely with the
Department of Homeland Security and the National
Institute of Standards and Technologies to bring
in leading technologies and frameworks for
combatting cyber threats. We are committed to
seeking opportunities to utilize artificial
intelligence, machine learning, and automation to
strengthen our ability to combat the constant
morphing nature of cyber risk. CFTC has adopted
the NIST cybersecurity framework as a model for
how we deliver cybersecurity services and how we
mature our protection of information assets.

When adoption began in the late 2016,
our leadership team recognized the ability of the
cybersecurity framework to provide standards for
managing and reducing cybersecurity risks,
organizing capabilities around five functional
areas of identifying risk, protecting against it,
detecting it, responding to it, and then
recovering from a potential breach.
Just as in the case of public and private organizations, CFTC needed a comprehensive structure for making informed decisions about risk, as well as informing budget and strategic planning to ensure we are prepared for the road ahead. In addition, my team has established a dedicated security metrics program to better inform stakeholders across our organization to promote awareness and structure from making informed risk-based decisions and managing cybersecurity risks.

These metrics provide additional visibility that go above and beyond the federal reporting guidelines under FISMA. As a result, our organization has achieved a green score card for all five functional areas under the security cybersecurity framework. CFTC has taken steps to ensure that the organizations responsible for delivering cybersecurity services within the Office of Data and Technology is functionally aligned with the cybersecurity framework. We are constantly assessing our current state of maturity.
and the pathway for the desired state of maturity for each service including planned projects, acquisition of technology, additional personnel, and the corresponding budget required to achieve each road map.

In September 2016, the CFTC unanimously adopted system safeguards and cyber resilience standards for clearing houses, contract markets, swap execution facilities, and swap data repositories. At a minimum, all organizations should focus on governance, risk assessment, access rights and controls, data loss prevention, vendor management, training, and incident response.

As our CFTC Chief of Staff Michael Gill has previously stated, we recognize the great expertise in cybersecurity within the firms that we regulate. And proactively seek ways to support their frontline defense in cybersecurity and cyber resilience. In addition, our Chairman has recently agreed to chair a new board-level taskforce on cybersecurity for the International
Organization of Securities Commissions, IOSCO.

It is critical that cybersecurity be a priority for all regulators, and we believe IOSCO can play an important role in helping market regulators around the world improve their cyber resilience practices. In conclusion, I am interested in hearing from the committee on how we can better share information and improve how we better collaborate around this indiscriminate challenge that we all face.

When I hear the words all hands on deck, with regard to cybersecurity threats, I interpret that as the need for all of us to proactively collaborate on work together. Thank you.

MR. GORFINE: Thank you, Naeem.

Phyllis?

MS. SCHNECK: So good afternoon. I'm Phyllis Schneck. I'm noting my nametag here. I thank you for adding my middle name. My whole life anyone that uses my middle name is because they're mad at me. So it's a privilege to be here. I very much appreciate the opportunity to
address this committee.

I've been a nerd my whole life, studied high-performance computing early on for tornado modeling, how you use compute power and that's grown. We went into cryptography. Here I am in cyber. I showed my father how to hack a few machines. He said please use that gift well and don't do any more bad things. We had a talk on ethics about 20 years ago and here we are. All of our world is connected. I can tell you back in my first world in the private sector as a chief technology officer for global government work for a major cyber provider, everything is connected including government to government. Your electric grid is talking to your refrigerator, to your hairdryer, to your car.

Moving into running my most recent former role, running the operational defensive cyber mission for the US government as a deputy undersecretary at Homeland Security over cyber and comms, you can see the day to day, minute to minute incident response at any moment. It's not
just if and when, it's happening. And I'll keep
this part brief because I'm sitting between you
and Valentine's Day, but the idea is as computers
are connected, computers are not smart. They're
just fast.

They fetch instructions off what we all
call memory, and they just execute it. They don't
stop and think should I do this. Somebody else is
supposed to have thought that through, and we
haven't. We haven't built security into that. So
now we face -- it's not about cybersecurity. I
tell people in ten years I don't want to have a
field of cybersecurity. It's about everything
else. It's about the financial world that you
drive every day, the electric world that our power
companies drive, and daily life.

And we're using this great new
technology, and we should enjoy it, but we need to
protect it by design. And as you have everything
being a computer, you all drove here in one today.
Everything is executing instructions without
thinking about what it's doing next. So at some
point, whether it's how those instructions get to the machine, how they're put into it, how they're crafted, or at the time of execution, somebody needs to put some logic into that, and/or, and I give you and, look at as they are being executed, what does this mean?

You won't stop everything. You won't see everything, but you should start to detect things. And that's where we get into two areas, our current threat landscape, and what we can do about that. In my current role, leading the global cybersecurity practice for Promontory Financial Group, an IBM company, that's a longer mouthful than my full name, what we do is we look at how do you not only take the role of compliance, but make that security.

They're not the same. You can check a bunch of boxes, and they're very important boxes. I give you that. They're very important, but the bad guy knows what those boxes are. We have to go above and beyond that to get to resilience. So what we look at is when, as an industry, when you
are investing in regulating, or on the other side, in being compliant, look at that from an area of how does this make me more resilient.

      Anyone that tells you you're going to prevent a cyberattack or they can prevent one for you, run away. It should be about how am I going to detect it, and how am I going to be resilient? I believe very much in communicating with regulators early and often. I come from a world, in the nerd community, where in the cyber operations center we all speak Klingon. I actually know a few words, and as events develop, we're looking as an industry as when do those get reported up to executives? It used to be that you're trained not to go upstairs with that until you have your full story. Now it should be, now that we have new technology to put data together faster, you have a better idea of when something's happening.

      And I urge our customers and everyone I talk to, bring it up there faster. Learn to speak English and translate what you're seeing in cyber
ops into English that someone can say this might be an event that not only I'm seeing, but all of my colleagues are seeing. And this work in public-private partnership that Naeem mentioned and others have mentioned, that transcends competition. The financial sector is phenomenal at sharing information that protects the entire sector.

When you look at what people like to call the internet of things, everything is connected. That thermostat in your house, Alexa, they're listening to you. Not in a good or bad way, that's up to you. But it's all about what is the data that's being transported. Do you have any idea of how it's being transported, and we bring these devices into our workplaces. Do we understand what data could get on them? Do we understand what they're connected to? Is there a router in a wire closet for the guest wireless that somebody operates to help somebody out that nobody knows about that's now connected up to something that runs something operational in a
These are all issues we've looked at, and in my prior life we looked at control systems inside federal buildings, and we said, what are dangers in a random router, for example, being somewhere that talks to the elevators? So not to put a Hollywood movie on this, but understanding that in every sector, financial especially, everything is connected.

You look at high-performance computing, the world is going toward fast compute power. So Dan -- I promised Dan I would mention a couple of the emerging technologies, especially your favorite one, and I'll get there in a moment, but when you -- we heard algorithms mentioned in the previous panel. I would push back and say, yes, the algorithms are getting better and better, but sometimes you can't undo them. Sometimes they're mathematical transforms.

I have sat in that seat where somebody said how did you get to that number and you can't. And what the industry is able to do is put
together billions of data points of threats that we see all over the world. Threats that come off that box that sits at the edge of your network that blocks the bad guy from getting in, that box is able to tell your ops center and the ops center of the company that built the box, and those companies use the speed of computing to put that together just like a weather forecast. In my old, old life forecasting tornados, what this is coming together to look like. The only difference between cyber and weather is the chaos.

So the bad guy controls the cyber and everything else controls the weather. But the cyber is actually harder because someone else can dictate it, believe it not. So as all these things come together it's going to be about the power of computing, the power that powers that high-speed trading, making sure it's accurate, not only with the length of the wire and the kind of fiber, but who is able to adjust it at a pace faster than you can detect them, and what are you going to do about it. And the last part is the
most important, what's the resilience?

   How does the sector bounce back from

that and self-correct? On the algorithm side some
of that math can get torn apart and some of it
cannot. And I think that's -- you sparked my
interest today. That's a huge area that I think
the nerd community can look at for you in a better
way. So at what point are we liable for the
decisions that are being made, and what point are
we not? Some of it can be taken apart, some of it
can't.

   Compliance is turning to resilience.

   It's not only did you check the boxes, I'll say a
few nice things about the NIST framework because
its' birthday of five years I think was yesterday,
believe it or not. And that was built with the
private sector and government together. And a
little bit of humor, the private sector sent the
folks to make that framework, not the ones they
would normally send to days and days of government
meetings, which tend to be the people companies
can just hemorrhage and they don't care. Very
candid for the end of your day, they sent really
good, smart people to build that because it was
the way that we could get public and private to
work together, forgive me, without regulating
because that was problematic in many, many sectors
for a lot of reasons.

Putting together the best of technology
with the best of what government needed and it
provides a very good, it's not everything, but a
very good baseline that people tend to truly
appreciate, because it's understandable. The
technology that Dan begged me to raise is our
friend quantum computing, the big Q. People say
that will outdo blockchain, it will outdo
cryptography.

These are interesting claims, but there
is a little bit of truth to the last one. So for
those who want a little bit of nerdom at the end
of your day, the whole idea is that you can be in
multiple states at once. So if you have an atom
or you have a state, and you have -- they actually
call it a Qbit in the community. It doesn't know
what state it's in kind of ever. So if you think
about the ability to run through every possibility
instead of having to find one in several billion,
at that point, there is at some point in the state
of that atom that it will click, and you'll find
the possibility. And that will literally enable
you to "guess a key".

I'm being very simple here. And if you
can find a mathematical number, then you break
cryptography. Now we are quite a ways from that,
but not decades. I would say about one decade.
Some of this is already being implemented. That
doesn't mean you don't encrypt things from now
until ten years from now and say I give up. It
means please do encrypt things.

When the bad guy gets in and takes cases
and cases of your data home to another planet,
you'll be able to be the one on the news that
says, great, but it was encrypted, they got
nothing because we were prepared and we were
resilient. But going forward, we need to look and
understand these new technologies.
Blockchain cryptocurrency, cryptocurrency is just based on the ability to spin up lots of computers all over the world and have them use their power to create numbers that equate to currency because it's valuable. So it doesn't -- it's not a question of which currency, it's a question of how the technology's applied. My personal opinion is the best use of the ledgers, which is what they call blockchain, is in tracking.

So anyone who's flown and uses one of the airlines that has the track my bags application, this is my favorite thing. I'm not as angry by the time the plane lands because I knew the bag didn't get on the plane, but at least it's getting tracked. They can do the same thing with vegetables now. So finding the E.coli in the spinach, that could have taken hours not weeks. A lot fewer people would have gotten sick.

They do it with shipping, and expanding a lot of that work, it's all based on computing power and the ability to track the cryptocurrency.
They call it cryptocurrency because it's just spinning up a lot of computing power to do a lot of fancy math to enable you to claim not only the transaction, but the actual currency.

All of that is pretty much already here. So my message is threefold. One is let's continue working with you to take compliance to mean resilience. Use the investment that customers and financial institutions are making in compliance to actually be cyber resilient. And I would demand that of them as a regulator, and many already are, and it's nice to see that because you're helping.

I think the second part is look at the technology you're using. Almost everything you buy today is wicked connected. That's a favorite phrase, not technical, but if you look at it, it's got a USB somewhere. If you plug your cell phone in at an airport in one of those USB stands, please don't ever do that again. Those are actually little computers and they can transfer data right onto your phone. Just use the plug.

But think about every device you have
where it's connected, and the last part, think about where data flies all over. The ability to compute so quickly takes disparate datasets and puts them all together now, and creates newly available information from bits of data that were never available to be mined and analyzed before, and creates all new issues in privacy and compliance. All of a sudden new data, new information, new tracking is available that we never imagined.

So security and the thought leadership that you're putting in now needs to go into everything we do forward so that we are ahead of the game. And we're close now but we need to be ahead of the game with quantum and blockchain and there will be many, many things following. So thank you, again, very much for having me here today and the work that you do.

MR. GORFINE: Thank you so much, and thanks to both of our panelists. I'd like to open it up again to questions and discussion items. Hopefully, that's not me that's making that noise.
Phyllis, can you -- let's see if that helps it.

It does. Okay. And I'm just going to tee up for consideration in picking up on this last thread, with all of these emerging area -- emerging technologies that we've talked about today, are there unique cybersecurity concerns and approaches that you all are thinking about?

And on a related point, you know, are there emerging best practices that are either available, that could be kind of consolidated by a group like this, or could a group like this help to create best practices in some of these nascent areas? So I'll throw that out there and any other thoughts or questions as well. Chuck, we'll start with you.

MR. OCHERET: I obviously talk too much. Thank you guys very much. Those were great presentations. This is an area that's near and dear to my heart, and actually, this is one of those cross-cutting concerns that basically brings together everything we've talked about so far today.
One of the things I'm doing is building a whole machine learning as a service platform, and a lot of the data that we want to supply to that platform is all this data that's coming in from all these participants, you know, thousands of connections from participants all over the industry. And we need to really protect that data, but we also want to design predictive analytics and all kinds of other things. So how do you defend against leakage of that data or people seeing things that they shouldn't see? So it's -- we put an awful lot of thought into how we redact parts of the data, how we anonymize data, how we prevent, you know, people from anonymizing the data on two different days, and then being able to correlate things across anonymized datasets to do traffic analysis and say, well, this one is obviously that bank or -- so it's an enormous cross-cutting concern.

One of the things that always jumps out is there, you know, any security measure that you take is great until you learn that it doesn't work
anymore, or that somebody's figured out how to get past that. So no one security measure works. You have to have multiple layers and multiple ways to audit, and as you said, it's not a matter of necessarily stopping it always, but detecting that it's happened and being able to then respond to that quickly. I guess that's mostly what I wanted to mention.

MR. GORFINE: Okay, any other questions or comments from the members? Oh, I'm sorry, yes, Mr. Barry.

MR. BARRY: I'm sorry, I just wanted to reiterate that, I appreciate that the nerd community is on our side here and trying to help out. But as we talk about kind of the move to distributed ledger technology, and a lot of the work that LabCFTC is doing is looking to bring some financial technology partners into the fray as well.

And I think this is a whole lot of data that's going to be available to people, so I think we need to be mindful of the entitlement to that
data, how we access it, do we anonymize it. The enormous benefits across operational settlement and regulatory reporting are immense. So I think we have to go there, but we just need to be extremely mindful from the start about how we set these standards, and, you know, that's going to be a top one consideration, not something that we think about after the fact.

So I think definitely a subcommittee that is focused on this topic would be definitely recommended.

MR. GORFINE: Okay. Well, I will pick up on your recommendation there, and based on this discussion, I would move that the TAC recommend to the Commission that it consider creating a subcommittee on cybersecurity. Is there a second?

MR. OCHERET: Second.

MR. GORFINE: Okay. Are there any questions or comments? Okay. I now call for the vote on the motion. All of those in favor of recommending to the Commission that the Commission consider creating a subcommittee on cybersecurity,
please say aye?

COMMITTEE: Aye.

MR. GORFINE: All those opposed please say nay. Are there any abstentions? Okay, with that the motion carries. So I'd like to thank very much our panelists and, at this point, I'd like to turn this back to Commissioner Quintenz.

COMMISSIONER QUINTENZ: Thanks very much, Dan. First, congratulations of your proficiency with Robert's Rules of Order. You did a great job today. I guess I'd turn it over to Commissioner Behnam for any closing remarks.

COMMISSIONER BEHNAM: Thank you, first and foremost, thank you, Commissioner Quintenz, for your leadership, holding this meeting. Echoing the Chairman's comments, a really fantastic day where I think we all, at least speaking for myself, learned a lot and raised a lot of new questions which we have to address in the months and years ahead.

Thank you to Dan Gorfine, from my experience with MRAC and working with Alicia
Lewis, the DFO there, we know this is a lot of work so congratulations and well done. A couple of things that I just want to point out, and I'll keep this brief, a couple of analogies that were raised, first off, I love the baseball analogy. But I think it's worth pointing out that one of the gentlemen who was used eventually got sort of at least suspected or was alleged to have performance-enhancing substances. So a fresh reminder that as we create these incubators, as we create these labs, as we create these sandboxes, it's important that we keep, you know, bad actors, manipulation, customer protections, fraud all on mind which I know we do. It's a priority for everyone at this table, but we have to beat that drum over and over again so that we support innovation, but also do it in a responsible way so that above all else integrity is maintained and kept for the markets.

The other analogy which I think Charlie mentioned was that the journey analogy which I think is great in the sense that we have to do
this together. Obviously, public-private partnerships were mentioned several times. One thing that I thought of, though, is as we do this together, which we should, and I think the Chairman has demonstrated his willingness to do this time and again for the past few months, I think it's important, at least from my standpoint, that you all coalesce around some core principles and some core ideas. Because there clearly will be differences in terms of your business models and what your interests are. And I think it was mentioned earlier that none of us want to be picking winners and losers here. So for us to be good policymakers, and I think for the Hill as well, because eventually, you know, I think we all believe they're going to have to get involved in terms of statutory changes, it's going to be important to understand that there are some baseline principles that you all agree on, that may not be the optimal, but as a standard they're the best for the industry moving forward, and we
can build off of those.

So I think that's an important element to think about as a lot of ideas were thrown around today, productive ones, good ones, but things that I think we have to digest and sort of analyze before we make final decisions on how to move forward. So with that, thanks again to everyone on the panel. Look forward to 2018 and more important discussions, a lot of great subcommittees brought into order today so looking forward to discussions and the recommendations that come out of there. So thank you, again, Commissioner Quintenz, and Happy Valentine's Day.

COMMISSIONER QUINTENZ: Thank you, Commissioner Behnam. And I'd like to thank Chairman Giancarlo for spending such a good chunk of his day with us, and to Commissioner Behnam for spending the entire session with us. I'd like to echo the Chairman's comments that technology is a bipartisan issue, but the work of this committee, and I think the work of all the advisory committees, isn't owned by us. It's owned by you.
And we look forward to all of the good work, and it's going to be a lot of work, but all of the good work that's going to be done over the next 1, 2, 6, 12 months, possibly even longer, around some great conversation that we had today. And I'd like to bring up something that I think Tim mentioned about hope versus reality. And I think it's fun to talk about hope and the possibility, and it gets us excited, but at the end of the day it comes down to work. And understanding what we need to do to realize, you know, that vision, and I'm excited that I think, at least in some ways, this is where that work is going to get done. So thank you all for your participation and for your future commitment to getting into that work so, and, Dan, great job. Thank you. So I'll turn it back over to you.

MR. GORFINE: Thank you.

COMMISSIONER QUINTENZ: And for those of you that were too shy to eat your cupcakes on camera, feel free to do that when the lights are off. They're more in the back of the room. Don't
let them go to waste. Thank you.

MR. GORFINÉ: We were actually going to
count to three now and all take a bite at the same
time. All right, well, thank you all again for
attending this TAC meeting. It's been incredibly
interesting and productive. With that, I'd like
to wish everybody a Happy Valentine's Day and this
meeting is adjourned.

(Whereupon, at 3:58 p.m., the

PROCEEDINGS were adjourned.)

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CERTIFICATE OF NOTARY PUBLIC

DISTRICT OF COLUMBIA

I, Carleton J. Anderson, III, notary public in and for the District of Columbia, do hereby certify that the forgoing PROCEEDING was duly recorded and thereafter reduced to print under my direction; that the witnesses were sworn to tell the truth under penalty of perjury; that said transcript is a true record of the testimony given by witnesses; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this proceeding was called; and, furthermore, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

(Signature and Seal on File)

Notary Public, in and for the District of Columbia

My Commission Expires: March 31, 2021