THE BROOKINGS INSTITUTION

THE EVOLUTION OF VIDEO STREAMING AND DIGITAL CONTENT DELIVERY

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P R O C E E D I N G S

MR. WEST: Good morning. I'm Darrell West, vice president of Governance Studies and director of the Center for Technology and Innovations at the Brookings Institution. So I would like to welcome you to our discussion on video streaming and digital content delivery. So we are webcasting this event so we'd like to welcome our viewers from around the country and those watching from outside the United States. We are archiving this so anyone who would like to view this after today will have an opportunity through the Brookings website at Brookings.edu. We also have a set up a Twitter feed at #TechCTI, that's #TechCTI. So if you wish to post any comments during the forum or pose any questions you are welcome to do so.

Now we all know that today is a time of great change in telecommunications. There are new digital platforms that have emerged that stream videos and voice over the internet and deliver content via tablets and smart phones. And these systems have expanded the multi-platform mix for communications, entertainment and commerce. And at the same time an Internet of Things based on sensors and machine-to-machine communication offers the potential to forge new relationships between customers and businesses. So there are many opportunities in this move to a multi-platform world. Today we have put out a paper that looks at the future of video streaming. Hopefully each of you were able to pick up a copy on the way in. If not, they are out on the table outside. And for our web audience the paper is at the Brookings website at Brookings.edu. And just briefly we argue that there are a number of different models with the potential to become more flexible, adaptive and cost effective, but government officials need to promote innovation that maximizes the benefits of new developments. We need to make sure that vulnerable populations are able to reap the benefits of the technology revolution. And today we're going to be hearing from people

who operate in different parts of this new ecosystem to get some of their ideas about the path forward.

So we have brought together an outstanding panel of experts to discuss these topics. To my immediate right is John Donovan, who is a senior executive vice president at AT&T Technology and Network Operations. He is responsible for the company's technology and global network including the company's mobile broadband network. His responsibilities include oversight of the company's global information and network technology strategy, network planning and operations and global supply chain. That actually sounds like three or four jobs.

MR. DONOVAN: Yeah.

MR. WEST: I'm sure on some days it probably seems that way too. (Laughter) Derek Aberle serves as president of Qualcomm, Inc. and in that position he is responsible for oversight of all the business divisions across the organization as well as the company's global market development and marketing groups. He serves as a member of the company's executive committee and helps to drive the firm's overall global strategy. And prior to his current role he served as executive vice president of Qualcomm, Inc. and group president as well as president of Qualcomm Technology Licensing. And he was responsible for overseeing the company's technology and IP licensing business as well as its earlier stage businesses in wireless health platform display and wireless charging.

Jeremy Legg is senior vice president of Business Development and Multi-Platform Distribution for Turner Broadcasting. He oversees the product distribution strategy and is responsible for digital content rights acquisition and developing content strategies. He spearheads business development with technical and digital partners and helps to implement the company's TV everywhere strategy across Turner's portfolio of

networks. Previously served as VP of Business Strategy and Development for AOL, Inc. and there he was responsible for developing and maintaining strategic alliances with telecom and broadband providers. And in the interest of full disclosure I also should let you know Jeremy is a former student of mine from Brown University. I can't really tell you anything about his academic performance because that of course is protected by federal privacy laws but I can tell you he was well above average in his performance.

MR. LEGG: He actually agreed to go back and redo some of my grades for participation. (Laughter)

MR. WEST: It's amazing what you can do on these retroactive things. But obviously he's done very well since Brown.

But I'd like to start with John. We obviously have seen an explosion of video streaming. The way in which people consume digital media is changing very dramatically. So the question for you is what does this mean for internet networks, how are the networks evolving to meet the skyrocketing demand?

MR. DONOVAN: Well, I think that there are a number of things that are coming together that really change everything about networking and the technology that underlies it. If you look since, oh, let's just say the last six years the growth in mobile is up about 50,000 percent on our network. So you start -- say, okay, I have a giant trend towards mobile. Then you look and you say well now video is there. Video is exploding as the primary use of the network. Globally it's over 50 percent of network consumption and, you know, we at AT&T and collectively as the U.S. market tend to lead a number of those trends. And so there's a video explosion. You mentioned earlier the Internet of Things which is a very different kind of network. It's small chatty packets running up and down. So I have these big sticky bits of video, I have these little chatty packets, I have everything moving from the ground to the air. So we have been forced to fundamentally

rethink the technology that delivers it. We've had to change most of the processes that we manage internally because the speed and the pace of change that's happening in the consumer and business marketplace. And importantly our people have to change. You know, we spent -- we're a company -- I think Brookings Institute in a couple of years is going to be 100. It's a baby. We're 136. So, you know, you have legacy and people do things certain ways. We now have to go back and retool a workforce that's, you know, near a quarter of a million strong to go do things in this new environment. So it's challenging in every dimension, the people, the way we manage the business, and then the underlying technology that we built.

MR. WEST: Okay. Excellent. So, Derek, John is mentioning this explosion of mobile. You of course are in the middle of the mobile revolution and we've seen an explosion of mobile traffic, not just in entertainment but education, healthcare and a number of other areas. So how are mobile companies responding to this traffic increase and how is it affecting the capacity part of it?

MR. ABERLE: Well, I guess we're probably the relative baby in the room. Qualcomm's only about 30 years old. And we've seen actually a tremendous change in the industry over the last 10 years. When you think about your smart phone just over the last five years how much that has progressed in terms of the computing power and the data speeds, as well as just, you know, the ability to do video well on these devices. All these trends are kind of coming together at the same time. And so we're working very hard across the industry to help address the explosion in data traffic, the move to mobile. And even within our own space as we think about kind of the core for Qualcomm historically has really been more around, you know, smart phones and tablets. But now you're seeing us really expand out into new verticals like automotive and healthcare, the Internet of Things. So when you fast forward to the future the

demands on the network are just going to increase over time. So, you know, we put a lot of investment in the network side of technology as well and that's a big part of the focus for us is in addition to obviously needing more spectrum to satisfy all this demand. You know, there's a lot of innovation left ahead in terms of driving new technology on the network side. And so we've got a pretty tremendous amount of investment there and I'm sure we'll probably talk about that a little bit more today. But those are the technologies that I think we'll need, you know, to complement what has been done on the mobile innovation, really to help drive, you know, the network forward as we move ahead.

MR. WEST: Okay. So, Jeremy, you are -- you focus on entertainment. You are one of the leading content providers between HBO and Turner Broadcasting itself. What is the state of content distribution now and how are these multi-platforms being used in distribution?

MR. LEGG: I guess what isn't changing in content distribution at this point? You know, I'm the guy that's making their lives difficult by cramming all the video onto these pipes. So I mean everything from the advertising models that we have in terms of how we aggregate audiences and we sell advertising, it's forcing us to look at almost becoming distributors in a certain way. You know as TV everywhere has progressed and we now distribute through our own applications as well as those of our distribution partners. We're distributing the video ourselves; we didn't used to do that. We're now having to look at becoming more of a software company. I mean we were a content creation company that's migrating to be a content creation company that's also a software company. We're looking at an industry from a distribution perspective that's obviously consolidating, right. I mean the number of pay TV homes has, you know, flattened out. There aren't candidly that many more paid TV homes to get. So you naturally end up with situations where there's industry consolidation that begins to

happen as well. So from one week to the next my job changes depending on which part of the company that we're actually talking to. But I will say that, you know, at the end of the day for the consumer the number of choices that they have as to where they want to watch and how they want to watch is simply expanding more and more. I mean we are simulcasting our television feeds on iPhones, on android devices, through Xboxes, through, you know, other connected devices that aren't just set-top boxes as we've traditionally done, you know, over the history of the television industry. The way we acquire rights from studios has changed. The analogy that I basically have been using when asked a question like this is that we have essentially created a parallel universe. You know, we distribute our video through the managed video network and the last mile historically, now we're distributing essentially that same set of content through the broadband pipe over the last mile as well. For the consumer at the end of the day they don't really care about the distinctions between the two things. However the devices that render that content do care about the distinction between those things. So you're ending up with a software layer on the devices that render the video, whether it's coming from the managed video network or it's coming from the broadband network, that we now have to be very attuned to because it impacts advertising and measurement and content delivery in ways that it didn't used to.

MR. WEST: So I'll throw out a question for the entire panel and nay of you want to jump in you can do so. Each of you have talked about the investments in the network that each of your company's is doing and I'm just curious how do you see the future of broadband and mobile in terms of content delivery? What are the investments you're making in the network and how is this affecting the consumer experience? Any of you who want to address that? And don't everybody speak at once.

MR. DONOVAN: You guys are looking at me. Yeah, no. I think they're

doing that based on capital budgets. (Laughter) You know, over the last six years we spent $119 billion in capital transforming our network. And I think that's the largest number of any company in America. And we're not the lone rangers. I mean the entire industry is moving down this path. And I think the investment profile changes and as strange as it sounds with that large number every year it's really a challenge to fit the wants and needs of this transformation into that large bucket of capital that we spend. I'll also point out that the challenge isn't, you know, investing out in front of technology as these guys can tell you. You know, technology gets cheaper by one and a half percent every month. You can see what's coming so you sort of have to balance it. The right technology at the right time is what you need to land. And so it's a very big challenge because when we move to an app driven economy, when Jeremy's company says they're a software company, I used to be able to say I have so many of these devices, they look like this, they consume that, and now you hit a don't walk sign in the city and all of the sudden I have megabytes of demand that are. Now the light turns green, it says walk and then, poof, everybody puts their phone back in their pocket, walks across the street and my demand just vanished. So it's a big challenge to try to get these things right both geographically, time of day and to manage this investment in a way that you're catching a consumer demand that is a combination of a big tsunami wave that we talked about earlier, but then has day to day change that the software companies are driving.

MR. WEST: So, Derek, how do you see the future of broadband and mobile?

MR. ABERLE: I think pretty similarly. I would say our investment is really in this space most focused around trying to develop technologies that most efficiently allow companies like John to use their spectrum. And so, you know, we're looking at things like densifying the network through -- you've heard of a small cell

deployments and really helping to get the user closer to the base station. You know, we have a lot of investment in things like what we call carrier aggregation technology which allows the operators to use kind of disparate bits of their spectrum aggregated together to drive more capacity. And then some unique things around broadcast too. I think that's an area that we think in the future could be pretty interesting. Not having a dedicated broadcast channel or network even but something that's dynamically adjustable for various events or scenarios where you want to deliver one piece of content to a large group of people instead of it multiple times over individual streams. So, you know, we're looking at a lot of those things to really help, you know. Spectrum is an important thing; we will need more spectrum. But then being able to use that spectrum as efficiently as possible is really kind of where we focus the network investments at Qualcomm.

MR. WEST: Jeremy, how do you see the future?

MR. LEGG: Yeah, I mean we obviously far fewer network investments than, you know, John does for example but we're making investments in places that five years ago I don't think anyone ever thought we would. So we're making investments in CDNs and CDN capacity and we never thought that we would do that. You know, for an example is we recently broadcast March Madness. I hope all of you watched; appreciate your viewing. But we did about 69 million video streams just on line for March Madness in this year's tournament. We have to figure out a way to deliver that video. That's just through the app, that's not television viewing or time shifted viewing on DVRs. We never though that we were going to be in a position to try and have 69 million lives video streams of basketball. We're fortunate that we are but it creates challenges about how we do it. So the types of streaming relationships that we have with CDNs or, you know, MLBAM or iStreamPlanet or other companies that provide streaming services, as well as building out software layers on the end consumer devices. I mean that's really the place

where probably the biggest technology investments are going on. We have to render this on an iPhone, we have to render it on an Android, we have to render it on a Windows phone. And we have to figure out ways to insert advertising into all of those associated platforms as well as plug them into all kinds of different elements of social media so the consumers, you know, utilize -- we have to build basically experiences that are device specific. When a consumer watches something on an iPhone or a tablet they don't just want the same experiences they otherwise would have on a television set. They want to use the form factors of the devices to do things that you can do on televisions set presently. Well, that takes software engineering to be able to do that. So, you know, those are the big places that we're making investments beyond the obvious things that we do around investing in content rights.

MR. DONOVAN: You know, it also forges some new kinds of partnerships. I remember back when you first made the decision to do that, you know, you guys called us and said we want this to be a really good experience. And it was during the time when our network wasn't performing real well through the explosive growth that we saw. And we had to sit down, and I remember the joint planning meetings at the time, I was the chief technology officer, to say okay what's the app going to do? What's it going to behave like? You don't know which teams are going to win so you don't know where your demand's going to be. But we had to sit and say, okay, well let's plan it out and how do you do it and what things can you do to be more efficient on the network to improve the experience for everybody, how can we manage the network. And, you know, those were conversations -- I remember when you first called it was like what? What are you guys doing in the network business? But as long as I have you on the phone, can we get you to fiber feed into our super head offices --

MR. LEGG: Yup.

MR. DONOVAN: -- so we think we can make the video quality on a linear TV better, right? And we kind of worked through a bunch of dimensions because as you say you drive a lot of the demand onto the network and there are choices that you make that if they are harmonized to the choices we make it just makes for a better experience.

MR. ABERLE: It's a great point. I mean even just how we promote on television to what devices we drive consumers to have an impact on him. You know, for example, I'm sure none of you do this, but the Thursday opening round game that starts about noon when you pretend you're eating lunch but you're not really and you've got your desktop open. Well, you know, that's putting a burden on a different set of networks than when you go home later and watch it at home or if you happen to be out of the office and you're watching it on a mobile device, well that's a different form of delivery. And so you have to plan against all of those different things and, you know, what Charles Barkley says on air, if he says, you know, go to your iPhone, you know, people do. Then all the sudden it changes how consumers view it.

MR. WEST: So we're seeing, you know, much greater demands on the networks. Derek, you mentioned this spectrum problem. So could you talk a little bit about the nature of that problem and how we can address that? What do you see as the things we need to do?

MR. ABERLE: I think it's probably multifaceted. As I said before, you know, we're basically, you know, we believe we do need more spectrum. We see this explosive, you know, demand coming, you know, whether it's video or other data. John gave some stats on how quickly, you know, the data has grown on mobile. And we threw out this thing that we talk about is the 1000X data challenge over the next 10 years. And you can really only get there through a combination of -- you can't just get there with

spectrum and you can't just get there with new technology. It's going to have to a combination of the two. And so that's really what we try to focus on, driving the right decisions from a spectrum standpoint, but then also having the technologies available to make that spectrum really, really efficient. And the small cell and densification of the network, you know, is a big piece of what we think is important. I think AT&T is really leading there as well. But, you know, it's going to be a whole suite of different technology solutions I think given all of the dynamics that are playing out in terms of the uncertainty of where the data is going to be delivered or the content is going to be delivered over the various kinds of networks. And we're just really trying to be there both on the mobile side as well as technologies that help improve the efficiency.

MR. WEST: And, John, what are the barriers that you see?

MR. DONOVAN: Well, you start with spectrum. Spectrum is the oxygen; nothing lives without it in the mobile world. So you have to start there. And then I think that the technology evolution is a managed process. We do the stuff in the infrastructure and in the infrastructure we still have in wireless 2G networks out there and people that are very fond of phones or alarm systems that are set up on 2G. And right now I'm getting, you know, an order of magnitude more efficiency on my latest network, LTE. So there's -- how do you migrate customers to free up capacity so that you can continue to meet the ever growing demands? So there's that dimension. And then I'll -- the earlier point that I made is really relevant here is that the ecosystem that decides what people want to do needs to be a participant and an actor in the play. You can't just simply throw something up and have it generate ineffectively the demand for, you know, video. And so, you know, there is the technology of software, there's the technology of the app layer. That's an important dimension that's not well understood right now because it interacts with a network and in fact a lot of the network performance now is driven by the decisions

that software developers or application developers make as much as it is the network that I have and the capacity. But to Derek's point the lifeblood is spectrum. It's not only the capacity it's also the performance of the network so it is central.

MR. WEST: So, Jeremy, on the content provider side what are the biggest challenges that you see and the things that are --

MR. LEGG: At the highest level the biggest challenge is is that, you know, the television industry is essentially now distributing content on devices that we don't make or control. You know, historically we've distributed it through set-top boxes which our, you know, distribution partner while they may not have owned those companies significantly influenced how that hardware was built. And it was generally built in a relatively consistent way across the different distributors. We're not in a position where decisions that Apple makes impacts us, decisions that Microsoft makes impacts us. And we don't necessarily have control over those decisions and in most cases we don't have control over those types of decisions. So it opens up then this whole universe of business problems and technology problems that are, you know, we are only recently now beginning to confront. So things like how do you measure the advertising, how do I -- you know, I'm selling advertising on a television set for March Madness but I'm also selling it on line. How do I aggregate the viewers, how do I communicate to an advertiser where their ads ran and who actually watched them? It's very different systems and very different ways of distributing video to those folks. It also creates problems as it relates to how you -- what business models you're going to distribute the video under. So TV everywhere is a business model where it's free to the end consumer. On all these associated mobile devices there's no incremental fee as long as they're paying their underlying television subscription. Well, those are two entirely different systems, you know. Historically your set-top box was a conditional access system, right. I mean you

turned it on and essentially all that set-top box did was verify if you paid your bill. And if you didn't pay your bill you got the scrambled feed and if you did pay your bill you got the channels that you subscribed to. Well, iPhones don't have that conditional access system, you know, X-boxes don't have that conditional access system. So you have to build it and you have to build it at a software and app layer, device to device. And, you know, Apple has some very definitive ideas about how IOS is going to work. And Google has very definitive ideas about how android is going to work. And there are lots of demands upon those companies from all kinds of -- you know, they're not just video delivery platforms, they have all kinds of different software that lives and rides on those. And so they have all kinds of decisions that they have to make, how they're going to operate those operating systems or build those operating systems and make available the software development tools.

So, you know, these are challenges which we feel that, you know, we've done a pretty good job meeting but at the same time they've been big challenges. They aren't things that the industry I sit in have traditionally had to confront.

MR. WEST: So, John, we're obviously in the middle of this big technology transformation in terms of content networks. AT&T is in the midst of an IP transition from copper wires to fiber optics. You have two experiments running in West Delray Beach and also Carbon Hill, Alabama. So how can we protect consumers during this time of transformation, particularly senior citizens, the disabled, people who live in rural areas, people who in certain cases may still depend on copper wires for emergency services?

MR. DONOVAN: Yeah. Let me start by saying that the technology evolution exists for all of our platforms. So in television more and more is coming over the top, more and more is being streamed. I have an architectural change that we've got

to make. You look at the mobile network. I talked about 2G to 3G to LTE, that technology. Now in the wired network -- and by the way, you know, the average packet of the mobile network only travels now 2.3 miles. When I arrived at AT&T six years and two months ago -- but who's counting -- it was about a little over five miles. So to Derek's earlier point we're serving from closer and closer. So it's becoming more and more of a wired network. So what you highlight is in the wired network what's the evolution and the evolution is moving into an IP world. And already the services that IP can provide are better and they're being voted on by the customers. In large quantities we're losing the old land lines and rotary phones that were really the foundation of our business. You know, the customers are migrating away from those at a pretty torrid place. And so what we're trying to do in a couple of jurisdictions is under a microscope look at how one would manage the transition providing a service that is equal to in all regard but better in many, many ways and then manage through the transition that one takes. So it's no different when someone had to give up their startac when we went from analog and digital to mobile and it's going to be no different two years from now when they have to give up their flip phones and go towards more of a smart phone feature. There are doing to be some transitions and we picked a couple of geographies where it had characteristics that we wanted to look at. The mix of the consumer, the demographics of the consumer, and the trajectory that it was on. And what we want to see is what do we need to do to facilitate a soft landing in those environments. And so what we've started in each of those, an intense dialogue with the community. We let them know what we were doing, we let them know why we were doing it, we let them know the benefits of it and now we have to manage through a multi-year transition where we get our technology ready but we also importantly figure out how we care for customers, how we explain the transition, look at how they view this transition to make sure that it's comfortable for them. So it's

one of the -- for each of our platforms it's one of the big technology evolutions that we've got to get to get our cost structure right, to give people the capacity they need for this insatiable desire to do the things that are becoming commonplace in the household.

MR. WEST: So, Derek, we're also seeing an expansion in terms of machine-to-machine communication. There's growing use of centers and various type of wearable devices. What are the opportunities that you see in those areas and how's that going to affect the consumer experience?

MR. ABERLE: You know, I think if you look at it, you know, there's been some discussion in the last year or so about whether innovation is actually slowing down in our space and we see exactly the opposite which is there has been a tremendous amount of innovation in the devices that we carry around with us every day. As I said at the beginning, you know, how quickly that that has come across has been pretty remarkable. But now you're going to continue to see innovation there as well as just many, many more connections. And, you know, we are already seeing very good adoption of mobile technologies into the automotive sector. And healthcare is an area that we spent a lot of time on over the last five plus years. That's starting to really take off as well. And then just, you know, even the, you know, the many, many sensors. We talked about sort of this notion of digital sixth sense where there's going to be many sensors around you in your environment that you're constantly interacting with. And really the technologies that are going to drive that are ones that make the information relevant and useful so that you're not bombarded with so much data that none of it is useful. And I think there's going to be tremendous innovation there in terms of utilizing all of the connections and the sensors that are available to drive unique user experiences in the future. And there's some platforms that us and others have been investing in to really help drive that.

MR. WEST: And, Jeremy, does any of this affect what you're doing on the content side in terms of machine-to-machine, the emerging Internet of Things, sensors? Does this affect how you're thinking about the future?

MR. LEGG: Well, we hope people watch television through their clothes. (Laughter) It would be another, you know, way to aggregate viewing. But, you know, the internet of things from a video perspective doesn't impact us as much as it obviously would, you know, at these guys' companies. But the thing that is impacting us in terms of the proliferation of access points is that we're having to change the way we acquire rights and in some cases change the types of content that we make available to people. You know, there's been an expectation set now for consumers that they're going to have access to an entire season of a show whether they're standing on the moon or they're in the middle of Manhattan. They want to be able to have every device, whatever one they're watching on, to know where they left off. So if they left off 20 minutes in on this device, they want to pick up this other device, have that device recognize them automatically and pick up at minute 21. I understand why they want all these things, I want them too but it's partnership with companies like these in order to actually make some of those things happen. You know, you have to -- there's a level of data that we all need access to in order to deliver those types of experiences. You have to know who the person is. You know, you don't have to know their name and their address but you have to have an identifier effectively to be able to deliver video to consumers across these platforms, to deliver those types of experiences to them. It also is changing the way that a lot of programming works. So, you know, historically you've seen a lot of repeats on television. The stacking of seasons in the current season which is obviously that Netflix has probably popularized the most is generally serialized programming. One episode -- it's a Game of Thrones kind of scenario, one episode builds upon another episode, builds

upon another episode. Well, that actually changes the way we program our networks because serialized programming doesn't repeat very well, right. You watch that episode, you're unlikely to go back and watch it again. Well, that means that there's another space you have to fill on that network. You can't run a rerun of a show that someone might watch twice because they're only going to watch that show that one time. That has actually fairly, you know, dramatic impacts upon the type of programming we choose, how we program it, where we make it available and how we monetize it, right. I man your monetization opportunity on a serialized show is different than it is on a procedural show, you know, which Law & Order or something like that, people will watch any episode of Law & Order from Season 15 to Season 9, to, you know, it's just if it happens to be on. So all of these things have, you know, big impacts to us in terms of how we program those networks, where those networks are made available.

MR. WEST: Actually we don't have that problem at Brookings. We find people watch our panels time and time again.

MR. LEGG: Time again. That's good, that's good. (Laughter)

MR. WEST: They just love it.

MR. LEGG: Perfect application for broadcasting.

MR. WEST: Exactly. I have one last question for the panel and then I'll open the floor to questions from the audience, and that concerns the recruitment of workers for this new world in which we are encountering. And so I'm just curious how you're finding the workers, are there shortages in particular areas, and how as a country we should try and improve this stem pipeline?

MR. DONOVAN: Well, I mentioned earlier I'm not a worrier but I lose sleep over having to transform 150,000 people in technology of a 245,000 person company and pivot their skills. And you can't just say it's the new, let's go get a bunch of

new folks. I have people that built our company, that have been there 30 years. They have degrees in mathematics from the best schools and now to say we're going into, you know, you need to be a big data scientist. This isn't training, this is re-skilling at the fundamental level. So now I've got to take a person and say you are 300 hours away from being relevant. How do you fit that in? Do you have the will to do it? Do you have the skill to do it? And those for me -- I -- that literally is the biggest problem within AT&T in this big transformation that we've got because our demand alone if we said out with the old in with then new would create a problem on a national level because you don't have 150,000 people of these skills ready to deploy. And so we as a company -- and I don't want to say it's just technology at 150,000, it's 243,000; we're doing massive technologically advanced programs, collectively with other companies, selectively ourselves, and with the latest technology of massive open, online courses with universities to do a re-skilling. And this re-skilling right now is one of the biggest programs I've ever seen in my life.

MR. WEST: Derek?

MR. ABERLE: Yeah, I think there's a number of interesting challenges that we face. You know, we're obviously a global company and, you know, we've got I think -- I don't know what the exact stat is but more than two thirds of our employees are engineers and, you know, the skill sets to John's points that are important to us they do shift around. But more importantly just attracting, you know, the best and the brightest people to fill those spots, you know, there's a tremendous amount of competition worldwide now, you know, for the best talent. And, you know, for us we just need to make sure that the rules are in place and the framework is in place to allow us to attract, you know, the best people no matter where they're from. And, you know, that's an area I think that we, you know, that we continue to focus on. And it's not easy for us to -- you

know, I think there's some companies where the skill sets maybe are a little more fungible where you can scale up and down your workforce rather quickly or move skill sets around. And for us that's a pretty challenging thing given the types of employees that we need to drive our technology.

MR. WEST: Jeremy?

MR. LEGG: Yeah, I think on our side it's, you know, we're having to hire a type of employee that we haven't had to hire previously. You know, we're hiring software engineers. We need software engineers. You know, if you want to have -- attend a meeting that's somewhat amusing is, you know, you put creative people from the studios in the room with the software engineers, right. (Laughter) And they talk about how they're going to distribute content, what type of content they're going to make. We never used to have meetings like that. You know, I mean it was, you know, okay I'm going to create this show, it's going to get broadcast over the satellite and it's going to be on people's television sets. Now the creative people are sitting with the software engineers and saying well, look I want the show to do this but then I want all this metadata attached to the show so that the consumer can do this and do this and do this. So it's just in a radically different way of approaching what types of people you're going to have in the company.

So we've done a whole host of things, right. We've, you know, had reach outs within our local Atlanta community to try and foster the development of wireless engineers, partnerships with Georgia Tech and other local universities. We've opened a San Francisco office that we now staff with software engineers. We look now across the globe in terms of how we deliver content and where we're going to source these types of employees from. You know, we don't have an insatiable appetite for software engineers but we have a pretty strong one and I don't see that changing, you know, in the future.

That same transition is happening from our distribution partners as John talked about. We have a very big relationship with AT&T on the U-verse side as well as with Comcast and others. If you've seen recently what Comcast has deployed with their X1 X2 platforms, some of the things AT&T U-verse has deployed with their platform, there's a big application software layer associated with that and, you know, that's the type of employee that the industry is targeting and there aren't enough of them.

MR. WEST: Okay. Let's move to questions from the audience. So if you have a question just raise your hand. There's a gentleman in the back. And we'd ask you to give your name and your organization. And no speeches, questions please. Yes, microphone is on.

QUESTIONER: I want to bring the (inaudible) ruling in this whole discussion. And for John, you know, the Netflix signing the S and As with Comcast, with Verizon, do you think the same trend applying to the wireless site too and what implication especially on the capacity side for other users on a quality of service basis? Second part I just -- for the entire panel, just your philosophy on the Aereo ruling which is being litigated in the Supreme Court.

MR. DONOVAN: On the first part of the question, I mean there's a lot of details about the recent FCC activity that we just have to learn about. We're in discussions with Netflix and, you know, certainly are in the midst of the dialogue and so I feel like, you know, we have always been at AT&T an advocate of an open and transparent and, you know, and an open internet and we, you know, have been supportive all along. We reiterated that support last year. So, you know, there's a lot of details we need to learn and we'll, you know, have a view once we see those details.

MR. LEGG: I didn't really hear the second part of that question.

MR. WEST: Aereo.

MR. LEGG: Oh, is it Aereo?

MR. WEST: Supreme Court.

MR. LEGG: Yeah, you know, on the Aereo side of things as a content provider it's obviously hard to look at that and, you know, think that someone can essentially take your networks without a license and start to distribute them. From a Time Warner perspective, you know, we have cable networks not broadcast networks so we're not part of that, you know, component of the case. But, you know, I think, you know, the decision the Supreme Court makes here as it relates to cloud DVRs and the distribution of that has a pretty profound -- the potential to have a pretty profound impact upon how networks are packaged and how they're distributed. And so, you know, we're waiting just like everyone else to what that ruling actually is.

MR. WEST: Other questions? Someone right back there.

QUESTIONER: Hi, my name's Oua; I'm in the communication culture and technology program at Georgetown and I have a question. We've been talking a lot about investments and consumers and what role do colleges and universities have as consumers, or should they be themselves content providers? And what type of interactions and collaborations should we see?

MR. LEGG: You know, the interactions that we have with universities as it relates to the content that we produce and the content that people consume there is generally fairly specific to a number of our brands. So, you know, the Adult Swim brand for example is quite popular amongst the millennial generation. We have a lot of CNN content distribution through CNN Student News and other things that we do through universities. It's always been a challenge to distribute content through universities because they've essentially been private networks in terms of how we actually get content to the universities themselves. The internet is actually providing some interesting

mechanisms to be able to now distribute content to universities as well as have packages of networks that are packaged in slightly different ways than we would have to a general household for example that we now are starting to make available through universities.

MR. WEST: But what about the flip side of that? Universities as possible content providers?

MR. DONOVAN: Well, they --

MR. WEST: Like everybody wants to be a content provider today.

MR. DONOVAN: That's happening today. If you look University of Texas has the Longhorn Network that they've launched, the SEC has launched has launched a network. And so in the beginning you start around sports because sports are the most real-time-oriented on the higher value end of the spectrum. But I think just generally as -- you know, I don't produce the content and I'll maybe get reprimanded here by Jeremy -- but there's just more of a fragmentation of the kind of content that you want to see. So there's a lot of viewership at 60 and 100,000, you know, where it's very niche oriented, whether it's a sports team -- we think of it, you know, the Washington Redskins here, you know, is certainly a far bigger audience that it might be for, you know, Georgetown field hockey, but there is an audience for a lot of this type of content. And so the better --

MR. WEST: You haven't seen the Redskins lately I don't think. (Laughter)

MR. DONOVAN: I'm a Steeler fan. You're right. (Laughter) But I think as we get better at curating and recommenders and understanding context to present in a simple form things that you're likely to watch then all this complexity can fall. And think that's really -- there's business models attached to history and complexity and what you're talking about today is a new world and in this new world we have to start with the

familiar, address the business models and walk our way to the new. And that's really the march that we're on.

MR. LEGG: Yeah, I don't think I answered your -- I didn't understand your question in that context. I mean the places where, you know, students and particularly young people are participating in the content generation process has largely been through MCNs. You know, folks like Maker Studios. Obviously YouTube is providing a significant amount of that. So content companies like ourselves certainly look to that both for relationships with some of that talent as well as ideas for programming that we might think make sense to bring up to the next level of distribution, whether it be through our networks or through On Demand. Studios--in particular if you look at some of the things that Warner Brothers does, is trying to embrace that audience. We have big -- we recently just made a big announcement about a relationship with Machinima. Enormous amounts of user generated content that are flowing through that as well. So it's increasingly -- it's both a source of content and a source of relationships that we traditionally haven't pursued, but it's also increasingly becoming a new distribution platform for content itself. So it's inbound and outbound. These are essentially now content platforms that you interact directly with consumers on.

MR. ABERLE: Yeah. And I think our expectation too is that just throughout education there's going to be more of a shift to the use of mobile technology as well as video. And in particular in the emerging regions where we don't have as much infrastructure in place today and most people, they're getting their first access to mobile -- or to broadband through a mobile broadband connection. We do think there will be more content delivered through those channels related to education.

MR. WEST: In the very back there's a question.

MR. LIPPMAN: I'm John Lippman from the International Broadcasting

Bureau. Is there any country around the world that's doing it right or that we should look to as the model for video streaming and content delivery? South Korea?

MR. LEGG: In all honesty I think people are looking to us. You know, it's not that other countries aren't pursuing this. I mean certainly some of the more wired countries like South Korea for example have, you know, made enormous strides particularly in the gaming category and some of the content that they produce there. But, you know, a lot of the business models around media and content distribution get established here and then, you know, are kind of transported through licensing arrangements and content licensing arrangements with distributors internationally. We're doing as good a job as anyone, I can say that. I mean the amount of investment that's going into this space domestically is enormous. Our international operations are making significant investments in this as well. But it's hard. I mean, you know, this is -- you know, I go back to my point about, you know, distributing on devices that we don't make. And that is a pervasive problem across the world. It's not one that's just limited to the United States.

MR. WEST: You had a follow up on that?

MR. LIPPMAN: How about from a technology point of view.

MR. DONOVAN: I'll take that. From a technology point of view I think the United States is leading. And, you know, this isn't the sort of crowd where you're going to jump into deep technology but earlier this year we announced we were going to software-defined networking which heretofore was never -- was only done inside data centers by web-savvy companies. And we announced we're going to take the entire wide area network and transform to software-defined networking. The entire world is watching. There's a real interest that the rest of the globe has in how we resolve this problem because we have more willing combatants if you will that are in the game, we

have a lot more dialogue, but really importantly we've made the investment. And if you look, I mean for us a pro investment environment when you're making investments that run a decade is really important. And so when you have the ability of players to lead an investment cycle the access of technology and wireless -- and I'll be interested to see if Derek agrees with this -- I think shifted from Europe and Asia to the United States and I think it's in the last five years. And I think the wireless world now centers around the United States and I think the innovations that are occurring in there are predominantly led by the technology community in the United States.

MR. WEST: Okay, Derek, your opportunity to agree or disagree.

MR. ABERLE: I would say I largely agree. I do think that, you know, especially the shift from 3G to LTE, the U.S. really did take, you know, a significant leadership position in mobile as compared to kind of where Europe is at historically. You know, South Korea and Japan obviously have always, you know, pushed technology but I do think when you look at, you know, the services and all the other stuff that's been put together here in the U.S. we really have put ourselves in a leadership position. From our standpoint, kind of where we sit in the ecosystem things have shifted around a little bit. I would say that outside of Qualcomm there really aren't too many U.S. companies investing in a lot of this core technology and some of that investment has shifted more to Asia over the last few years. But on sort of the operator side I would agree with John.

MR. WEST: So you mentioned -- if I could just follow up on that question -- you mentioned that South Korea and Japan as places that have led in the past. Are there things we could learn from them either on the public sector side or just, you know, how the countries are thinking about innovation in general?

MR. ABERLE: Well, I think they have one advantage which is, you know, geographically they're quite a bit smaller. And so it allows them I think to move

their networks in some cases more quickly than others. But, I don't know, John may disagree with that.

MR. DONOVAN: No, I don't at all.

MR. WEST: You know, there's way too much agreement on this panel.

MR. DONOVAN: Yeah. (Laughter) Well, you can pick other subjects like, you know, IP and stuff and we'll disagree a lot. But the -- I do think that some of the countries that we might for a short period of time get technology envy over really it's just the evolution of the who's the first in the water on the next wave. And so if you have a wireless network that has the number of subscribers that are roughly equivalent of the United States packed into geography the size of California then you're going to be able to justify anything. Small fractions multiplied by large numbers over short spaces equals really good investment profile. But I view the health as, you know, what's happening at the user end. Do the users -- is it affordable, are they taking the new stuff on, is it building an ecosystem, are the app developers doing the work? But if you look right now at a developer in a garage in Eastern Europe or in India what's the first market they want their apps to hit? It's this market here. You know, if you can make it here you can make it anywhere. So that's where I think the health of the ecosystem is best measured, by the proliferation of what we see, by the consumption of it, the affordability. And so you see smart phones, we're very deep into the penetration cycle in the U.S. You look at apps and usage and the affordability, it's a really -- I think it's the global success story on technology and certainly in wireless.

MR. WEST: Other questions? Right here. I have a microphone coming up to you.

MR. SWIADER: Hi, I'm Larry Swiader from the National Campaign to Prevent Teen and Unplanned Pregnancy, one of those new crop of content producers.

And my question is about quality and how you -- consumers have accepted the trade off for access to -- increased access but accepted that drop in quality in terms of, you know, music listening or in video content, and so I'm wondering how you all think about quality and opportunities for premium experience.

MR. LEGG: I guess I'm a little confused by the question. Are you talking about, you know, video quality from a technology perspective or content quality?

MR. SWIADER: I'm talking about video quality and opportunities for better video quality, whether that's new technologies and expanding those to like 3D viewing or just better viewing or streaming, there are no hiccups in the streaming. You mentioned something about picking up where you left off and different devices but are there other ways about thinking about quality on -- whether that's on a device or at home or in a special space or, you know, maybe it's in a stadium. I don't know; I'm just wondering if there are other ways that you think about quality that might be interesting.

MR. LEGG: Well, you know, the dilemma that a company like us has is, you know, quality -- video quality, let's address that piece specifically, varies so much or the demand for it varies so much based on the type of event that it is, right, and the scale of the event, right. So in the general entertainment space, you know, a consumer's expectation of quality is very different on an On Demand episode that they watch on line for example versus something like March Madness where they want crisp HD video that's going over a mobile device because they're watching their favorite team. We always have the dilemma and, you know, John will certainly probably attest to this, how much capacity build out do we do given that those events where the demand is so high is infrequent whereas the rest of the time, you know, people are recording it off of a DVR or they're, you know, or they're watching it online or they're watching it on a mobile device, where there are relatively few people watching as compared to a March Madness event.

So what we're having to do is form technology relationships that we didn't previously have, you know, with companies like AT&T and CDNs like Akamai and Limelight and others in order to actually have special space carved out for us for those events so that we have the capacity to meet the video quality demands of the particular event. Those are things that we never had to do because we never had to distribute the video, you know. I mean it was always done through our distribution partners and that's still something that we've done -- you know, that we do, you know, a significant -- you know, the vast majority of our viewing still comes through those particular platforms but we're now in a position where we have to figure out how to plan for that across these other types of devices. But consumers' expectations of video quality are so different. I mean for user generated content they're willing to watch something that's completely grainy and those are the things that you get on your phone that people share around all the time. You know, we've even had experiences on YouTube for example where consumers actually prefer the video that isn't as high quality as the professional produced stuff, you know. So we'll be encoding video at these incredibly bit rates to make available there but they think the one's cooler that was actually cut off of TV and is a two minute clip, you know, that somebody ripped off TV. So it's a very hard problem to solve.

MR. DONOVAN: Yeah, I think just as you think about generating content quality is in the eye of the beholder so go into the data. There's things that I could tell you that as a person of my age it's shocking to me. I'll give you an example, education on video, the smaller the screen the higher the retention. That blew me away. It blows me away that as we look at that stuff that you get better results because for some reason the younger generation, the smaller screen, mentally they lock in and have more focus. So when you start to look at this -- another example is, you know, apps. People don't want financial apps to present instantly because there's a view it must be insecure. They

want to see the wheel because they think there's all this security stuff needs to go on; this has to got to check with that and they've got to check with that and we've got to make sure this is like hyper sensitive. And then you present it, it's like, whew, thank heavens. So fast is fast, slow is slow except when you put it all together into an experience for you. When you hit your demographic you're going to find that quality could be any number of things. And so, you know, my view I -- my daughter is in the field and I could advise anything in technology, I told her get into user design, this interactive design because that right now is as hot a field as there is anywhere is to match the content and the purpose with the screen and the user. Neat stuff, really.

MR. WEST: So you mentioned small screen. Google Glass, is this for real? (Laughter) Is this going to have any impact on what any of you do?

MR. LEGG: I have to be honest, I commend the technology, you know, in the sense that, you know, they're doing things as it relates to technology that I haven't seen done before. I don't think people are going to watch our shows through Google Glass. I think they're going to pull out their mobile device or they're going to watch them on television. There are probably some applications, for example, in news as it relates to being a content provider for a network like CNN where you can see some applicability there, but from a, you know, video content distributor it's a bit harder to see the fit. I think there are probably other industries, obviously in healthcare and other places where there's probably a better fit.

MR. DONOVAN: As a technologist, you know, the United States put a man on the moon before we put wheels on suitcases (laugher), and before we had curved shower curtains that didn't blow and stick to you. You know, these moon shot technologies, you love them because what it does is you don't know where it's going to end up but every once in a while the hope and dream part of technology and really

pushing it brings behind it a whole lot of little things. You know, Netflix did the -- they had a prize of a million dollars for improvement in their recommender algorithm and folks in our labs won it. And so when you look at this there were 134 countries represented, the field of recommenders on the mathematical side during that contest grew 36 fold. So was the contest a great idea? Don't know. Did the company get the benefit of it? I don't know. But I love the idea that the data science filed specifically and recommenders attracted a bunch of mathematicians that wanted to be part of a moon shot. So I love moon shots.

MR. ABERLE: I do think wearables is going to be a big category in the future but we're so early in the cycle that, you know, we don't really know what is going to be the most interesting application. There's going to be a wide range of things there too. And, you know, just from a technology standpoint when you think about the types of things that are being developed, you know, we're doing a lot of work around, you know, computer vision and machine-to-machine learning and augmented reality solutions. And so you can see a lot of these pieces coming together. You know, the first ones are never going to be the best ones but you've got to start somewhere. And I think you've seen a lot of interesting things come out over the last year and they're just going to get more interesting over time.

MR. WEST: You know, one of the biggest innovators in this area actually is the American military in terms of instructional videos, augmented reality, simulations for instructional purposes. I mean they are ahead of big parts of the U.S. --

QUESTIONER: They're pretty good at actual reality too. (Laughter)

MR. WEST: Other questions? Back there there's a gentleman with his hand up.

MR. WELGRUM: Hi. Thanks for this discussion. I'm Michael Welgrum

from the Department of Health and Human Services. Talking a little bit about the future, each of you kind of have a piece of the future. Five years and ten years down the road what is your one or two tips about what you would see as technology that we're just getting a grasp on and how it will -- and content as well, how we'll be watching and learning about things in the future?

MR. LEGG: Well, I think -- here.

MR. ABERLE: No, no, no, I was just going to say you always get these hard questions don't you?

MR. LEGG: Yeah. Yeah. Well, it's like, you know, tell me what's going to happen in 10 years and I'm struggling to tell you what's going to happen in a couple of months given the pace of change. But, you know, look, I think -- let me give you an -- let me attempt to answer that question. You know, we recently released a product called CNNx. And I swear this is not a product pitch but it's an example of technical capabilities on how consumers can watch, right. You typically would go to CNN.com, you would watch a video clip, you might read a text story associated with the news, and then when you would turn on your television set you couldn't really interact with the content at all. I mean it's a simulcast feed, you're going to watch it, maybe you DVRd a particular show or what have you. What we decided to was to say okay, we've got to change -- the way consumers want to consume news now is changing. They want to be able to get to a specific topic. So what we did is we actually staffed in our studios 24/7 people that annotate the video. Now the video player doesn't know that the video is, right, so we annotated the video. We then used a cloud DVR to record the network 24/7 and delineate every segment of every show that occurs 24 hours a day, 7 days a week. What that now enables the consumer to do is to tune into the simulcasted feed of CNN and go to any segment of any show in real time, literally as it's being said on air. So you want to

know what Anderson Cooper was saying seven minutes ago, it's right there; you want to know what he said fourteen minutes ago, it's right there, you just touch it. You can go to that specific segment. And then because the video is annotated all related content to that particular segment from around the web, from CNN itself is provided to the consumer where they can go to the social conversation on Twitter, to the social conversation on Facebook, other companion content video or text associated with that. And it's all done in real time. So, you know, that's an example of how I know we're going to have to think in the future. You know, applicability of things like that certainly I can see extending to sports. In the general entertainment category I basically think consumers want to watch great programming, you know. I think you want to sit down and you want to watch a particular episode and you want it to be great. You know, Game of Thrones is a great series, consumers like it. We have to figure out how to make those topically relevant years and years from now, but I don't know that the technology changes great storytelling.

MR. WEST: Derek, what are you watching for five and ten years down the road?

MR. ABERLE: Not specific to content but I actually, for me personally I think the place where we can see a tremendous amount of innovation is bringing mobile technologies into healthcare and we're very early in that cycle right now. But there's been so much focus put on this over the last few years for good reason, both in terms of trying to control cost in the developed regions and increase access in emerging markets that really I can't see any other platform that can deliver what we need to deliver across the globe in terms of improving healthcare. So I think there'll just be a tremendous amount of investment in innovation that goes into that space over the next five years. I don't know exactly what the end state looks like there but I know it's going to be a lot

different than what we have today.

MR. DONOVAN: Five year horizon what I'm most excited about is my things coordinating with each other. I don't want to go look at the weather to figure out if I should take an umbrella. I want my umbrella connected to the web and I want it to glow a color on the way out the door so that I don't have to think about it. I want my dryer to coordinate with the power company and be energy efficient on its own. I want my schedule to determine, you know, to coordinate with my car so I don't have to type in navigation. So the removal of steps is my five year horizon. That's my dream in life. My 10 year version is I'd like to see the software developers get together with the deep scientists and I would like all of the apps -- the collective knowledge to be put into apps that are real time that would allow us to take most of the impediments that we're born with and level the playing field. Nobody should be mathematically impaired because you should have onboard capabilities to deal with math. And you shouldn't be language impaired. You should have those things on your fingertips. And so 10 years from now I actually believe it, I believe that you're going to be able to take most of the things that you're not good at and be good at it.

And I'm going to give you a flip side, as I was listening to Jeremy the one thing I worry about is with all the complexity simplification comes and with simplification a curator arrives and I don't want a curator, I don't want the Web curated, I don't want -- it's fascinating and you laugh for a little while and you get these things that figure you out, then all of the sudden everything I'm looking at is presented in a relevant fashion. And then I say well, where's the quirky stuff, where's the stuff that makes me be different than me, and then you don't stretch. And I worry about that and so, you know, in my dream world the five year and ten year horizon are beautiful places but there are some bumps in the road and I think one of them is complexity curated equals a narrowing and I'm back to

being taught something.

MR. WEST: So in your five year time horizon you want to take humans out of computing and have the machines talk to one another to your benefit?

MR. DONOVAN: Think of it as steps removal, right. If you think about all the things that happen, just think about what it used to be to get a map and figure out where you're going and what you did on a long trip versus a short trip and getting direction from someone. And is the white house that, you know, you turn at or is it the picket fence? And so we got Mapquest and we said oh, this is so great. So I can type it in and then I take all of the writing steps out. And now you get it and you say well now I don't have to take it on paper and print it. I take that out, put in a mobile phone, then I put it in the car. And I'm saying why doesn't it go directly from my -- like why do I have any involvement whatsoever? (Laughter) So I want to be involved in less and less, right. And so right now I'm just engaged in too many things. I'm trying to get my social network smaller, get fewer friends, deeper relationships. So I'm running countertrend on all of this stuff by the way.

MR. WEST: So, Derek and Jeremy, John gave an example of something that he's worried about, what are each of you worried about?

MR. LEGG: You want to start it then?

MR. ABERLE: Nah, fire away.

MR. LEGG: I'll worry about something other than what you're worrying about.

MR. ABERLE: You have enough worries that you can change on the fly.

MR. LEGG: Yeah, yeah. We interchange our worries, exactly.

MR. ABERLE: You know, I guess the thing that I worry a lot about is just -- especially from a U.S. perspective, remaining competitive globally. And, you know,

there's so many things going on across where we operate in the ecosystem that continue to have the right incentives in line for driving the types of investments we make. I mean we're investing 20 percent of our revenue every in R & D which is, you know, enormous. And, you know, we can only do that and satisfy our shareholders as long as they believe that there is a return to those investments. And, you know, it's very, very competitive when you're trying to take you technology around the world. And so I think to me making sure that the U.S. -- as we like to call it a knowledge based economy -- you know, we aren't doing things here that undercut the ability for us to remain relevant, you know, worldwide where a lot of the growth is going to come from frankly.

MR. WEST: Yeah.

MR. LEGG: Yeah, I'll divide into sort of two categories, right. There are obviously in the media industry given what's going on all kinds of worries that we have around business models and how we make money in the future and all these types of things, but those are all pretty well documented. The thing that we worry about the most is is finding enough great storytellers. I mean creating hit programming is like drilling for oil. You know, you get a lot of dry wells before you ultimately get a show that's a hit, right. It's hard to make a Game of Thrones. I mean that's really, really hard not only to secure the rights for it but to find the creative talent to tell stories like that. You can't bottle it and resell that kind of stuff; there's very few people that are able to do that. And the playing field in terms of who can now distribute content and who can make networks available is larger than it's ever been, right. It's not four broadcast networks, it's not four broadcast networks plus a couple hundred cable networks. The ability for people to tell stories and deliver those, you know, via the internet or other platforms is becoming unlimited. And we're going to have to make sure that our voice remains relevant now and well into the future to make sure people want to watch our programming. You know,

at the end of the day for a content company it's really pretty simple, right. You want to put things on television or on a phone or a tablet that people want to watch, you know. I mean you want to get paid for it and there's all these technical challenges and all these other things, but as the content creators always remind the business folks like myself and the company, you've got to have a show that somebody wants, you know. They've got to like it or guess what, it gets cancelled after two episodes.

MR. WEST: Up front, we have question. There's a microphone coming up to you.

MS. RUSSELL: Thank you. My name's Carrie Russell, I'm from the American Library Association. I wanted you to if you can talk a little bit about the challenges and opportunities you see in meeting the needs of people with disabilities.

MR. WEST: Good question.

MR. LEGG: You know, one of the things that we've, you know, been leading the industry on is closed captioning. So we've had to make sure that closed captioning is available on the platforms by which we distribute both our simulcasted content as well as our On Demand content, and we've done that. You know, as we move forward there are new rules that are being considered about additional closed captioning for short form clips and other things and if those get decided that we need to do that we will certainly do that and proceed in that fashion. So it's now essentially part of the workflow as to how we distribute content; it's a core requirement of distributing video.

MR. ABERLE: I would say for us, you know, we have a number of initiatives under way where we really try to look at the benefits of bringing mobile into different environments. And we've talked about education earlier, you know, healthcare more broadly, but in particular with the disabled and elderly we've had a number of programs where we've done to try to show, you know, the power of kind of remote

monitoring and access to information, especially in some rural parts of the U.S. as well as some of the emerging markets where there's much less access to healthcare. And I think those things as I said before are very powerful broadly across healthcare but I particular in that segment.

MR. DONOVAN: For us the FCC passed a rule a couple of years ago that requires us to take all of our products and ensure that they meet a requirement and right now I think our process by which we do that is world class. Last year we had 11,000 requests come through the front door of that organization to make sure that it was well designed and properly designed. So for us it's part of everything that we produce; it's part of our standard process the same way we have a regulatory checklist. We have a checklist item that we go through a process and so most of the things that we do are carefully thought out against all of those dimensions.

MR. WEST: So Jeremy was mentioning closed captioning. I have to announce one complaint I have on this front, not with Jeremy but with TV stations. They have so much stuff on the screen now that they often cover up the closed captioning. So like if I'm at the gym watching something or just -- it's hard so I wish they would work on that.

Other questions? Actually, maybe we could go over here. There's a gentleman over here.

MR. GAULD: Hi, my name is George Gauld, I'm an attorney in private practice.

MR. WEST: If you could hold up the microphone.

MR. GAULD: Sure. John, just one comment. Your idea of curation I think is right on point. It was well worth coming here just to hear that. My question is really more about you all sort of assume very much a broadcast kind of construct for the

network of a single point of content origination and distribution out to many points. I noticed an article I believe last week or the week before about Netflix considering a peer-to-peer construct. Is there anything -- do you see the broadcast kind of construct going away? How do you feel about peer-to-peer constructs, obviously leaving aside the sort of more nefarious aspects of it? But if I could get some comments on that. Thank you.

MR. LEGG: We've actually used peer-to-peer to deliver video for several years so it's not a new thing for us. You know, it was a mechanism to optimize bandwith and be able to get, you know, video delivered over multiple platforms. You know, we're pretty flexible in our approach. We don't have a -- we don't look at peer-to-peer and say well that's the solution and you should always use peer-to-peer. But, you know, the network business and, you know, obviously John, you know, runs one of the largest ones in the world, is changing, you know, pretty dramatically so, you know, the need for it is in some ways less than it was before because there are different types of relationships that you can have with network providers that have minimized the requirement for it. You know, obviously the primary thing that it was generated from were more nefarious things and so, you know, that sort of goes without saying we're not a big fan of its use for the purposes of content piracy.

MR. ABERLE: I think there's actually pretty interesting potential play there. You know, we've actually been investing in this technology we call LTE Direct which is actually part of the LTE standard and it provides peer-to-peer communication. Assuming you could get, you know, comfortable with all the digital right management issues, I think that could be one in various situations where whether it's locally generated content on the device that you want to share which has much -- you know, doesn't really have those issues, or actually commercial content. I think that can be an interesting way to deal with, you know, load issues on the network in various time.

And then the point I talked about earlier with LTE broadcast which is, you know, not a dedicated broadcast network but part of the LTE network, being able to dedicate whether for sporting events or whatever it is. You know that there's a bunch of people in a given area that want to watch the same thing at the same time and being able to dynamically tune your network to provide that content one time, I think those types of things are pretty powerful and have a place somewhere down the line.

MR. DONOVAN: It's -- there's a lot of complex technology that is involved here and I mentioned earlier the business models. I mean when you look at today's world there's situations when you need to move a tennis ball through a straw and that's not an easy thing to do. So you innovate and you say let's preposition it and reassemble the tennis ball on the other end of the straw where you have a bigger pipe and it can fit through. But there are other things that are in the business model. So if you look at, you know, Jeremy's world today I have to move a physical copy per person of everything that gets DVRd and 40 percent of it never gets watched.

MR. LEGG: That's not our programming though, that's the other guy. (Laughter)

MR. DONOVAN: No, yeah, the other guys' programs; exactly.

MR. LEGG: Right.

MR. DONOVAN: Exactly. For hours.

MR. LEGG: Right.

MR. DONOVAN: So, you know, it is a complex ecosystem, we're all involved and we're all in the middle of the discussion and people want to promote their own positions and that's natural and they'll do it. But at the end of the day you have to march the policy alongside the practical nature of what the consumers are doing alongside the business models that get you there because every night between the hours

of 7:00 and 9:00 when my network is at its peak usage in the home I'm sending physical copies that are being recorded on a DVR that will never get watched. But the business model, you know, calls for that. And so, you know, it's a complex subject where you can't jump right to peer-to-peer because there are certain things that have digital rights management and we need validation and did you pay your bill and, you know, are you subscribed to that. And that complexity wherein lies a lot of debate and discussion. And it needs to occur because we're going into a new world and the new world is very, very different than the world any of us grew up in.

MR. WEST: So you mentioned the word policy. So we are doing this event in Washington, D.C. Each of you live outside of Washington, D.C. If you had some time with President Obama and there was opportunity to give him one bit of advice what would it be? I know it's hard to narrow it down to one thing, but.

MR. LEGG: Wow. Yeah, that's a big one. I'm not sure any of us want to answer that question. (Laughter)

MR. DONOVAN: No, I'll jump in. I don't mind answering any question. I think when you look at the industry of communications, media and entertainment investment is critical. So if we can get policies such that we can create certainty then investment follows, and with investment comes jobs and with jobs comes, you know, results. And then we maintain world leadership. And I think that's an important cycle that we have to carefully nurture so that we don't end up having any constituency disrupt that in a way that would threaten it. And I think Derek talked about it earlier whether it's his big R & D dollars or our big capital dollars, frankly it's roughly the same percentage it's just different accounting. Those flow to certain returns and your shareholders expect it. And money is fungible to move across countries and here and there and that ecosystem of investment we need to sustain. And that has to be carefully thought of in this industry

because we have global leadership.

MR. ABERLE: I knew I should have gone first; you took my point. (Laughter)

MR. DONOVAN: Then just say "ditto".

MR. ABERLE: Yeah. I'll just ditto plus one other thing which is, you know, it's all about balance as we know. I mean there's -- you know, that's the point of trying to reform policy is balance all the interests that are involved. But I also think, you know, we have -- you know, our administration, our government has a responsibility to, you know, understand how they're viewed externally. And then there's certainly places outside of the U.S. where statements that are made by -- whether it's regulators here in the U.S. or others, you know, that may not be intended to hit that result are picked up and then built upon, you know, to try to achieve an agenda that might be different in some other places outside of the U.S. So I think we have to - -while we're trying to debate what's the best result here in the U.S. we also need to be thinking about what is the impact of the things that are being said and done by our government outside of the U.S. and how that impacts U.S. business.

MR. LEGG: Yeah, I think I'm going to punt on the policy question and just say I hope he does his brackets on March Madness on TBS next year. (Laughter)

MR. WEST: Okay. We have time for one last question. There's a question back there.

QUESTIONER: As an end consumer we have plenty of choices on TV, we have choices on voice, on wireless side, when it comes to broadband on average we have at the most two among the cable providers there are. They could be U-Verse or FIOS. How do you make this better clearly on the, again the FCCs ruling on the (inaudible) the broadband guys are the huge prizing power now and this is exactly what

the (inaudible) when he was in D.C. in March was complaining a lot. And, you know, back to John is how do you make the wireless networks as an alternate broadband (inaudible) and knowing that and how so (inaudible) 30 gigabytes of data which is clearly not possible from the wireless side of the business?

MR. DONOVAN: Well, it sounds like the same question you asked the last time reconstituted so maybe I should just give you the same answer reconstituted. (Laughter) No, you know, when you look at the supply and demand, you know, they're -- we're in a business where there's an economy of scale and if you look at the consumers in the U.S. the price curve on a per bit basis and on a per consumption of anything has gone down at a level that's the envy of the rest of the world. And so you have a natural propensity to scale. And then the question is how in the ecosystem do you innovate and how do you balance innovation versus the benefits of scale and costs. But if you look at things like smart phone penetration and you compare this to the rest of the world and then you look at the average consumption and the number of apps that people consume, the system's working, it is working. And so I do think that at any point in time you're going to have players and actors in this play who will look for policy advantage to assist their business model and that's natural. And I think that's why Washington has what it has a political system that engenders that debate. But it is a business that at its infrastructure level with real estate, concrete, fiber, digging ditches, electronics, technicians, hard hats, real jobs, well paying jobs, that stuff operates at a cycle and at a pace where scale matters. And it matters and it manifests into lower costs and more choice for the customer. So the choice isn't always going to be measured -- the quality of that choice by the numbers of providers of various services, it's by the utility that it's providing, the proliferation of innovation on that utility, and what my cost is doing every year. And that's the balance that as an industry we must strike.

MR. WEST: Okay. I will make that the benediction on this event. (Laughter) But I want to thank John, Derek and Jeremy for sharing your views with us and I thank you very much for coming out. We really appreciate it. (Applause)

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither 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.

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