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**New Catalysts for Change
THE GADGET'S GOT IT – THE PENDING EXPLOSION IN MOBILE DATA
Panel**

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14:00–15:15, PEPSICO CAFÉ**

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Moderator:

John Thornhill, Deputy Editor, The Financial Times

Panellists:

Andrei Dubovskov, President, MTS

Mohammad Gawdat, Vice President of Emerging Markets for SEEMEA, Google

Artem Kudryavtsev, President, TransTeleCom Company CJSC

Vlad Martynov, Chief Executive Officer, Yota Devices Ltd.

Duncan Mitchell, Senior Vice President, Emerging Theatre, Cisco

William Savage, Vice President, Intel Corporation

Front row participants:

Luis Martinez Amago, President for EMEA, Alcatel-Lucent SA

Dmitry Maselsky, General Director, Ericsson

Denis Sverdlov, Deputy Minister of Telecom and Mass Communications of the Russian Federation

J. Thornhill:

Good afternoon, ladies and gentlemen. Welcome to this panel. My name is John Thornhill. I am the Deputy Editor of the *Financial Times*. It is a great pleasure to be here in St. Petersburg today. The theme of this panel is: The Gadget's Got It – The Pending Explosion in Mobile Data. I am not quite sure why we have used the word 'pending' because there has already been an explosion of data.

Now, when I got my first mobile phone, it was in the late 1990s. I was working in Moscow at the time, and there was always a big fight in the office as to who was going to get to use the mobile phone on that particular day. According to some forecasts, there will now be more mobile connected devices in the world this year than there are people, so there is no need to share anymore. Last year, mobile data traffic grew by 70% to 885 petabytes per month. The share of 4G is growing very rapidly, and the fastest growing markets in the world are in the Middle East, Africa, and Asia.

This mobile data revolution has massive implications for the telecommunication and computer industries, as well as other information providers. What does it all mean? We are very grateful today to have a panel that is bursting with petabytes of brain power. To figure it all out, I shall call on our panellists to help explain the world. We will try to tell a story about what is happening in the data world. For a brief overview of what is going on, I am going to start with Mr. Duncan Mitchell CBE, Senior Vice President – Emerging Theatre, at Cisco.

D. Mitchell:

Thank you, John. Good afternoon, everyone. I would like to take just a moment, if I may, to put a little bit of context around some of the predictions I would like to make shortly. I would like to start by saying that when I entered this industry, about three decades ago, 9.6 kilobits per second was considered to be a very fast data connection rate indeed for an enterprise class fixed network. At the same time, the International Telecommunication Union (ITU) was setting out a grand vision, saying

that all people ought to have access to a mobile telephone, to drive social and economic development.

Since then, of course, the speed of connection and mobility have taken on a life of their own. We are now in a position where the average connection from a smartphone is 200 times faster than that original connection. The average connection out of a network-connected Tablet is around 400 times faster than the early networks of the 1980s.

What that has meant to us is that the average smartphone user is producing data in excess of 300 megabytes each and every month. When thinking therefore about what is generating this debate – the topic of this session being: The Gadget's Got It – then looking at the latest Cisco Visual Networking Index Report just released, it says that what is driving this revolution is absolutely the smartphone. So, indeed, I think that the gadget has got it.

It would be true to say that smartphones currently only represent around 20% of all of mobile phone handsets deployed worldwide. However, it is also very much worth noting that they produce more than 90% of the data traffic on the mobile Internet; traffic on smartphones is currently growing at about 80% each and every year.

On top of that, 4G is starting to have a very real impact. We observe that 4G users transmit something like 20 times more data traffic than non-4G users. Of course, as these devices become more powerful, faster and their applications more relevant to our lives, we think that that is going to fuel an ever-increasing volume of data traffic as we move forward.

It has already been mentioned that in the last twelve months, data traffic levels have risen by around 70%; the figure is actually something in the region of 900 petabytes of data being transmitted every month. To give you some sort of benchmark to scale 900 petabytes, that is twelve times the load on the entire global Internet at the turn of the millennium in the year 2000, when the dotcom boom was at its absolute peak – an incredible amount of data.

However, if we look forward now, to 2017, where our Visual Networking Index (VNI) Report is focused, I would like to read out specifically some of the key facts so that I do not get them wrong.

The first prediction is that by 2017 there will be 10 billion mobile-connected devices. Some of those will be machine-to-machine; some of those will be laptops; some will be tablets; many will be smartphones. We expect that the average mobile connection speed will have increased sevenfold and that the 4G will now represent something like 10% of all mobile handsets and around 50% of data traffic across the network.

In addition, of that traffic, we think that around two thirds will be video-based applications, so a big shift into the type of applications that we are using.

I already mentioned that currently the average smartphone generates something in the region of 300 megabytes of data a month. We believe that by 2017, that will be nearer three gigabytes of data on a monthly basis. To cope with that, we are going to have to find ways of offloading enormous amounts of data traffic from the macro network onto WiFi and small cell technologies. In fact, the number that we think needs to be offloaded on a monthly basis is around 21 exabytes of data. Quite a phenomenal level of data that needs to get off the macro network. If we do not do that, it is our belief that the compound annual growth rate over five years would be 74% on the macro network, which probably is just not going to work.

If you think all of this is a little bit far-fetched, that these numbers seem very grand, then I would to ask you to cast your minds back about a decade and a half ago, when Cisco said that we felt the Internet was going to change the way that people worked, lived, learned and played. At the time, a lot of people thought: "That is a very grand statement." However, I would ask you all to reflect on how over the last 15 years the Internet has massively impacted the lives you lead.

We have done that by connecting about 1% of the electronic hardware on the planet. We believe, as we move forward, that we are all going to enjoy the experience of the 'Internet of Everything', where we connect not only people but processes, data and events to the Internet.

Why that is going to be important economically? It is believed that this year, with the 'Internet of Everything' in its infancy, the 'Internet of Everything' will likely drive around USD 600 billion of profits for companies around the world.

On that basis, whether you want to look back as far as three decades, whether you want to look back just a decade and a half, or just twelve months, the scale of change is incredible and accelerating. I would not, personally, be surprised if we reflect back on this particular session in years to come and say that these predictions were, quite frankly, grossly understated.

J. Thornhill:

Thank you very much, Duncan. That was an excellent overview, and that sets up the debate.

I would now like to turn to Mr. Vladislav Martynov, President at Yota Devices; fast developing Russia's first smartphone. So he is producing the gadgets that have got it.

V. Martynov:

Thank you, John. I would like to start by listing some basic questions that every company in the mobile industry today should ask themselves: what comes first? Is it the gadget, or is it content? What is the real driving force behind the evolution of technology and the overall user experience in mobile communication? Is it mobile data or the manufacture of the gadget?

We all know that Steve Jobs had a tremendous understanding of these trends. I think it is important today to ask these questions because we are leaders, followers or outsiders, depending on how well we understand these trends.

The first iPhone was a game-changing moment for the mobile phone industry because it opened up new opportunities for data exchange, for the consumption of all kinds of content. However, the field is not static in our industry. Today, the vast amount of content and data forces us to fundamentally change the way gadgets are manufactured; to change the ways we offer them to consumers to manage, access

and use mobile data. From this perspective, I believe that the evolution of data exposure will continue.

We know that data traffic doubles every year and will probably double every year for the next few years. It will have a tremendous impact on the gadgets themselves and on the ways they should be. For example, one of the key problems for the enablers is networking and gadget performance. As I speak, we are continuously presented with a lot of data which are probably not important. For example, when I use the phone, I check data several times a day. Some studies show that people, on average, wake up the phone and check certain data 150 times a day, but only 10% of that data is relevant to what we need. Basically, it is a huge distraction.

Another problem is the battery life. We know that all kinds of applications and content consume and drain the battery. That presents a problem for device users. We are trying to find a solution for that at our company, by the way. Some of you may have heard that we are working on a device called the YotaPhone, in which we have introduced an energy-saving electronic paper display on the back of the phone handset that does not consume as much battery as a digital display. However, what is also important is that it is always on; you can stream any relevant data on the back of the display; it is always there. From our perspective, this has substantially changed the way users consume the data and it has changed it for the better.

In conclusion, what I am trying to say is that this exposure to data is having a huge impact. The gadget industry is close to another game-changing point in mobile communications. Cisco, and other manufacturers of gadgets, should think about how to offer their consumers better, more intuitive, hassle-free ways to consume data. That is one of the key trends we believe in at Yota Devices.

J. Thornhill:

Wonderful. Thank you very much, Vladislav.

I would now like to turn to Mr. Artem Kudryavtsev, President at TransTeleCom, one of Russia's largest communications operators.

A. Kudryavtsev:

Thank you. I represent a fixed-line operator and it seems that we have nothing to do with mobile data traffic. That, however, is only at first glance because all that data that is consumed by our users on fixed-lines, on a home laptop or mobile device, finally travels to the backbone that connects the main telecom hubs all over the world.

We can see that data traffic has been growing exponentially during recent years. Previously, we used to think that it should stop at some point. We do not allow our workers to use the Internet on their personal devices at their workplace, nor are they permitted to watch video content while at the office. We believed that because the population is not growing so fast that we will reach a plateau and that mobile video will not grow.

However, this is not actually happening in our practical life because of gadgets. With the video gadgets available, we have all started to consume video on the go, not only when we have a connection to WiFi or a fixed-line network. The volume of video content consumption is still growing.

In addition to the general population, machines have also started to talk to each other, transferring data to each other. Machines, of course, are much less emotional in their communication and much more concise in their discussions. Still, they consume a lot of capacity and we have no control over the population of machines. Very soon, their population will be ten to fifteen times bigger than the population of the world. They will consume more data traffic, talk to each other and distribute our videos and our photos between them without our participation.

Secondly, there is a topic that I would like to touch on briefly. There is a serious problem around the monetization of that data traffic. Mobile operators have invested heavily in hardware, material networks and landlines to subscribers, mobile operators, and fixed-line operators as well. People are beginning to consume. What they consume is not the capacity of their connection; they consume content; they consume services; they consume video and buy products. The operators are not actually a part of that value chain; they do not get any reward from the data traffic

going through their networks. For example, Apple's platform does not allow anyone to buy or consume or to purchase anything without sharing in that platform. At the moment, that business model is not applied to the business relations between mobile operators or fixed-line operators and content providers.

This is a major issue that should be solved in the upcoming years in order for us to sustain our networks and deploy new technologies to face the challenges we all have in data growth.

J. Thornhill:

Thank you, Artem. I am very interested in the point that you made about machines talking to each other, and I would like to come back to that as an issue later.

Mr. William Savage, General Manager Product Development Division at Intel, I wonder if we could have your views, please.

W. Savage:

Yes, thank you. It is an interesting challenge, and we have queued up a few perspectives on the challenge. Each of them of is fuelled by the silicon inside, at least from one perspective, so the smaller transistors and the advanced systems are in your devices, your servers, your networks and your base stations. This creates and drives the capabilities to do amazing things in devices because battery life gets longer as they get smaller and need less power. If you can imagine the devices that Mr. Duncan Mitchell referred to, that go beyond smartphones, maybe wearable devices, the Google Glass, or a watch or some other device that is always with you and always connected and giving you the information and generating that data traffic across the networks. When you think about devices like that, not only on people, as also mentioned by Mr. Mitchell, but also on inanimate objects. For example, there are monitors in parking lots that tell you whether a parking space is occupied. They are also connected to the Internet. All of these things generate more data.

This creates a challenge for the whole computing industry, not only on the device side but also on the networking side, the data centre. I was talking to a government minister here in Russia earlier, about one of the largest challenges for data centres, such as Google or Facebook. The question here is whether they can they get enough power to run the data centre. There is an idea here, in Russia, that there is the extra capacity from the nuclear power plants in northern Russia which will supply plenty of electricity for a portable data centre.

Anyway, those are the challenges that we are facing. As consumers, we are all excited about the capability that these new gadgets create; the infrastructure that our friends at Cisco or Google, among others, are creating. We all take advantage of that and it gives us a richer life. Our job at Intel is to keep driving our technology, as well as the rest of the industry, so that those silicon devices can advance and create that richer experience.

I will share one other observation from our perspective. The smartphone consuming data is based on standards to a significant extent. The way in which phone connections are made – those are standards at work. When someone shares a video with you, it comes in a standard format so that you can display it. Text messages have standards. However, in these other Internet devices all the things that are connected, there are no standards. There is no standard on how, for example, parking lots process 'empty parking spaces' and report them to the Internet. However, as consumers, would you not like to see on your car display, when driving in a large city, where there are available parking spaces and what the lowest price is? These things are all possible but only if we have some standardization in the same way we have in phones.

When you think of the possibilities for the future, what you should expect from technology leaders, like the folks on the panel here, is that we will work together and collaborate in open and horizontal ecosystems to accelerate growth in order for all of us to benefit from that accelerated growth; not only the business people who generate or manufacture the products that drive this, but also the ordinary consumer, with improved experiences and enriched lives.

J. Thornhill:

Thank you very much, Bill, for talking about the possibilities of the future. If I were to put you on the spot and ask you if you had to name it, what is the next big thing? What do you think it would be?

W. Savage:

That is a really good question. We have a new CEO at Intel, and one of the first organizational changes is that he assigned someone to form a group, which does not have an official name yet, but he described it as the 'you-are-the-next-big-thing crew'. So we have someone assigned to figure out the-next-big-thing. I think it is trending to smaller, more compact devices. Wearable devices may be the next-big-thing beyond the smartphone. What that wearable device is, however, I am not certain.

J. Thornhill:

Thank you. Talking of the next-big-thing, there is no company that embodies this more than Google. I wonder if I could ask Mr. Mohammed Gawdat, Vice President Emerging Markets SEEMEA at Google, to give us his perspective on this debate.

M. Gawdat:

I was actually going to talk about the next-big-thing, so thank you for leading into that. I will start from Mr. Mitchell's comment. I find it fascinating that we tend to underestimate the future all the time. When Cisco came out 15 years ago and said that the Internet is going to change everybody's life, or when Bill Gates said there would be a PC on every desk and in every home, somehow we tend to go: "Yeah, not possible".

I am going to make a bold statement here. Our prediction is that by the year 2020, every human being on earth is going to be connected. Today, only one third of the world's population is connected. Now, that is quite a bold prediction, if you like.

However, in a typical Larry Page way, targets are made to be missed, so maybe it will be the year 2021, not 2020. It does not matter, right? Now, 2020 sounds quite futuristic, but it is just seven years away. If you want, it is half of the age of the Internet. Now the reason we predict this is because of what we call 'transformational forces'.

Humans normally look at the data that is given to them, and they fail to notice what can be completely transformational, what can completely change the game in terms of how things progress from here. If you take today's data and extrapolate that, it does not look like in 2020 you can connect 5 billion more. However, if you actually take some of the transformational things that are happening and factor those in, it becomes quite interesting. I will try to describe it in four areas.

We are at the vortex of four very interesting forces driving the way forward. One is the type of users. The second is their usage pattern – what they use those devices and connectivity for. The third is the availability of those connections, and the fourth, of course, is cost and price. I will briefly go through them one by one and try to give you a few examples.

With all due respect to everybody in the room, we are the older generation. However, we are the ones that grew up with videotapes and CDs and all of that strange stuff. My kids are not part of that at all. They are very, very different human beings. They are connected all the time. They use a second screen and a third screen and a fourth screen; they do not ask their friends and fathers; they ask Google, or Yandex in Russia.

So what do they do – this generation which is coming into play? This generation today is the one that is going to take over. My son always teases me by saying, "In your lifetime, the US President will be one that sends smiley faces and Laughing Out Loud to the rest of the world." So when you think that they are taking over, and with their approach to devices and being connected all the time, this force is going to change a lot of things.

Add to this the devices they use. We tend to believe that the device itself is going to morph drastically. Wearable devices will become a very interesting thing. When I

talk about transformational forces, what normally happens is that one person comes up with an idea and everybody else follows, and then we end up with a 'butterfly effect', as they call it. Think of something like this – we go out and say “Google Glass”, Apple goes out and says “A watch”, and everybody else will come up and say something else – ‘Fitbits’ and wearable computers of all sorts.

The idea of a wearable computer is not device-only; it is the fact that it becomes an extension of your brain in many ways. I do not know if you have had the pleasure of using the Google Glass. It is incredible to just ask that thing any time about what you want to do, and it gives you an answer. In many ways, it is just an extension of your brain, like when we used calculators at school. In the future, you are just going to say, “What is 448 multiplied by 765?” and something will give you the answer.

When you think about those usage patterns, they become almost indispensable after a while. Just as you sleep with your mobile phone next to you, people now sleep with their Fitbits on their arms. It is going to become extensively transformational.

The third one that we believe is going to completely change everything, is connectivity. I talk about Google technologies because they are what I am aware of. However, there are many more out there. If you think about something like what we announced last week – Project Loon. Project Loon aims to give connectivity to the two thirds of the world's population that are not connectable today. Once you can give them that connectivity, and you give them the device, then hopefully those people will start to do so many things that will not only double or quadruple the usage of the network today, but will probably be multiplied by a hundred. It is similar to the impact of digital cameras as different from film-based cameras.

As you put all of that together, of course, then economies of scale come into the game, and economies of scale drive prices down. We had a target, a couple of years ago, of giving a smart device to everybody in Africa at less than USD 100. We can provide devices today that are less than USD 60. Will there be a time when a device will be less than USD 15, USD 10? Will you be able to have a device that is almost disposable? Absolutely. In your lifetime? Absolutely, it will be then.

Put all of that together, and the transformational forces become very different. In the year 2020, every one of us will have a computer stuck to them somehow, connected to the network all the time, on every inch of earth. We will be able to use that in so many ways that you have never even thought of yet. If you feel that a Bluetooth headset is a little strange, get ready because it is going to get into science fiction – seriously.

J. Thornhill:

Fantastic, thank you for that futuristic vision. To conclude the formal panel discussion here, I would like to call on Mr. Andrei Dubovskov, MTS President and CEO.

A. Dubovskov:

Hello! What a great discussion! Unfortunately I did not get to hear it from the beginning, but I understand where the speakers I have been able to listen to are coming from.

I believe we are looking at a binary future. I think we have to understand that there will be a split. Demand for communication between individuals is here to stay. We have not seen the kind of substitution many people had predicted. After all, as the networks grew, everyone thought people would stop communicating with each other, and would only exchange information with machines, using specific communications resources to talk to each other.

So as I said, we are looking at a binary future. On the one hand, we must meet the demand for communication between individuals, between protein-based organisms. On the other hand, we are moving towards a massive, incredible, breathtaking future based on demand for communication between people and machines. So Google Glass, and all the technologies aimed at accessing information here and now, without having to connect to anything, are the second aspect of our future.

As far as the first aspect is concerned, I think it is high time we discuss this particular topic. I believe that pretty soon, gadgets in and of themselves will seem to

us just as anachronistic as, say, the audio tape and the compact disc seem today. I think we are close to the point when communication between protein-based organisms will move into the realm of telepathy, no matter how science fiction that might sound today. In my opinion, trends in telecoms and biology will converge. You will no longer have to reach for a specific gadget in order to contact someone: instead, you will need to switch your brain to that person's wavelength.

That is my vision of the future. I understand that this thought might seem shocking to some of you. But trust me: we will meet again 10–15 years from now, and we will see how right I was. Thank you.

J. Thornhill:

Thank you very much, Andrei. Now we are going to have three respondents to the panel. Then I would very much like to open it up to questions from the floor. Please get ready to ask questions.

We will start with Mr. Luis Martinez Amago, who is the President EMEA at Alcatel-Lucent. One of the areas that we have touched upon, but have not really explored, is the issue of connectivity and storage. How we are going to ensure that we have sufficient capacity and coverage? Could you address that issue in particular?

L. Martinez Amago:

Thank you. I think we realize that smartphones are one of the contributors to increasing the capacity of networks. However, we really believe that more than the smartphone, it is this type of device. This type of device requires not only more capacity than ever because there is more use of video, but also requires more storage space in the network. We cannot take all of the content here. It should be somewhere.

These places, which are normally data centres, or cloud computing, need to be accessed. This is the challenge of creating the network, which some of the operators are addressing. It is a challenge to monetize this increase in capacity, as well as the architecture of the networks. There are two aspects to this. One aspect

is access. Until now, we have considered telecommunication networks as being of two types – fixed and wireless, and the fixed is either a copper cable or a fibre, and in wireless it is macro sites – these big towers with antennas. This type of device is creating a very continuous type of access, in which the difference between fixed and wireless is merging. We are going to see different types of architectures putting wireless in the home; WiFi connected to our fibre optic cables, or having small cells, not only the macro but small cells, reach the different devices wherever the users are applying them.

This creates a challenge for us. The people providing the technology and for the service providers because the normal architectures are being questioned. This is in the area of access.

At the core, we define a concept which is the programmable network. Today, networks are specialized to a certain extent. We have a network for voice; we have a network for fixed broadband that carries IPTV; we have a network for the wireless services. This will be over very soon. The networks will be unique, serving all types of access and all types of services. They need to be programmable because we will not know, and the service providers will not know, where the users are and what services they are going to use.

The networks will be flat and will be full IP end-to-end. Then they need to be able to be programmed, not by the operators, by human beings, but the network needs to configure itself to give the capacity and the services to the different subscribers. This is starting now. I think it is a new concept, and we are going to see within the next three to five years a complete revolution in the way we, as the innovators within technology, and the service providers, the ones that are investing – we are going to see a revolution in how the networks are constructed.

J. Thornhill:

Thank you very much. I would now like to turn to Mr. Denis Sverdlov, Deputy Telecommunications Minister for Russia. In particular, I wondered if you could address some of the issues that have been raised here about how government

cope with this massive explosion of data, how it handles it, how it can regulate the industry, and how it can provide enough power for data centres in remote parts of Russia.

D. Sverdlov:

Thank you very much. When we talk about the value chain, of course users visualize the connection through the device they hold in their hands. This is certainly a value we can all see and understand. But entire industries are involved in making sure that this device in consumers' hands works well.

It is important to note that although 4G is referred to as Long-Term Evolution, in reality it is not an evolution, but in many respects a revolution, because the speeds already offered by 4G today have changed many things. It is already a full-blown IP network. Even voice communications are supposed to occur in the form of voice over IP. This is a significant architectural departure from how voice communications worked on previous generation networks.

As soon as voice communications begin to work differently, the operator faces a different financial structure: it has to tackle the issues of how to charge for those communications, how to sell them, and how to monetize them. The base station receives money because the device is almost connected. This is a fundamentally different financial structure.

If we look at an average Russian operator, today each base station earns around RUB 600,000 per month, because only one in 50 users utilizes this resource. As soon as the device is almost connected, the situation changes: one in 10 devices is always online, which results in higher loads and lower profits. For the operator, this is a fundamentally different financial structure. It involves different devices, and a search for fundamentally different scenarios. In the past, we thought we had to prepare and download many things in advance, but in time, more and more content will be consumed online. This changes absolutely everything.

The good news is that this revolution promises to bring many positive changes. Everyone wins here. The user wins because this will be a completely new scenario,

with fundamentally different rules of the game. It will affect everything: e-government; access to education; and everything to do with knowledge, health, safety, and the exchange of money. In other words, every aspect of our lives will change in some respects to become more convenient. We as individuals will benefit from this. The vendors win because their new solutions will be in demand. And the state wins because many processes will become more effective. Everyone wins.

In my opinion, the real risks, the biggest challenges in terms of the entire ecosystem, will fall on the shoulders of communications operators. They will have to find a balance between continuous investment in the infrastructure on the one hand, and decreasing profits per unit on the other. They will have to find a solution.

Our job as regulators is to help the operators find this solution. As far as we can see, we have work to do in two areas. The first area involves developing the communications infrastructure: it is our job to create the conditions which will ensure a more effective and cheaper infrastructure. This includes access to both monopoly infrastructures and the physical infrastructure: all channels and methods of utilizing the infrastructure; in other words, any solution aimed at using this infrastructure effectively.

The second goal is to regulate as few technical aspects as possible in order to clear the way for progress. Many countries still very clearly regulate the way voice must travel over the networks. We truly believe that today, how voice traffic travels over networks is no longer all that important, as long as it does travel. The technology of that is up to the operators and vendors to solve. We as regulators should not limit them in this regard.

To sum up, we see two challenges before us: on the one hand, to ensure that industry regulation is as technologically neutral as possible, and on the other hand, to create the conditions for an improved infrastructure that will support as far as possible the impact of the communications ecosystem on the community.

J. Thornhill:

Thank you very much, Denis. And now finally, I would like to call on Mr. Dmitry Maselsky, General Director at Ericsson Russia.

D. Maselsky:

Thank you very much. I would like to briefly reflect on what we have been saying here and highlight three points which I believe are quite important.

When we talk about gadgets, of course for us, connected devices are primarily what we are looking at. We know that right now, there are about 6.3 billion connections to networks in the world. We know that about 15% of these are smartphones. What we are looking at is really a big growth in that respect – 4.5 billion in just five years.

We will see massive growth in the number of people using smartphones; using the devices in a very different way. That is a revolution in a way that brings an impact to the infrastructure. What we see at Ericsson, as a company that manages about 1 billion subscribers in the networks around the world, what we see is that behaviour. We can see a big change, and we see that things are coming. It is not possible to predict what the next step is going to be when this big wave comes because innovative applications and innovative devices are actually coming to the network.

As in every revolution, the first wave is the infrastructure that is rolled out. The second wave is how this infrastructure is being used. We are now looking at the 3G infrastructure and at the LT infrastructure. We think that in five years from today, 3G will be available to approximately 85% of the world's population. The LT will be available for about 60% of the population, and that is again a massive change. Then we will be talking about the availability of that infrastructure, and then new devices that are coming in, which will be possible to use in good and new ways.

Different industries will benefit from it, of course, and that is actually a significant insight. For those industries that start to understand this now, this is an opportunity for them to take advantage of this phenomenon. We know that some industries, like the automotive industry, are now transforming the way in which they manage cars. For example, Volvo is using connectivity now in a very different way. The notion of a device, a gadget, is being transformed as well. The car is a gadget of the future

because it is going to be connected; the connection is there. From their point of view, it is not a thing in your hand; it is actually anything.

I would like to refer to what Mohammed was saying. To a degree, everybody will have a connected device in 2020. However, it is not everyone; it is going to be everything. If it is from the business point of view, if it is from the kind of personal need point of view, if it makes sense to be connected, it will be connected. The cost of this will not be an issue. And that really creates and opens up all kinds of innovation for different industries. I very much look forward to seeing how the industries will use it. Thank you.

J. Thornhill:

Thank you very much for that. I think a number of speakers have touched on this, that the Internet, in particular, is not just connecting people but also objects, or machines, and that we are seeing the development of smartsensors, as you were saying.

I wonder if anyone on the panel would like to pick up on this? How quickly is this going to develop? There are a number of companies like GE, who are investing very heavily in this area. Duncan, would you like to talk about this? I know that this is an area that Cisco is involved in.

D. Mitchell:

As previously mentioned, we expect to see 10 billion connected devices by 2017. Some of those will be people using laptops or smartphones or other devices, but a lot of this will be machine to machine, and an awful lot of this will be about the 'Internet of Everything'.

If we think of the change that has happened in our lives, over the last 15 years with the Internet, and we accept that 1% of things are connected, think about the change that we could drive by 2017 if we just got 10% of things connected. However, we would argue that, over time, we will get everything connected.

Just this year alone, as I mentioned, we think the Internet of Everything has an economic value of USD 600 billion, plus profits, not just to technology companies but to all companies around the world. That could be anything, from wearable devices that we already talked about, whether those be spectacles with information, or it could be information on telemetry coming out of cars; it could be WiFi hubs sitting in cars. It is going to be interesting to have things like machines in industry tell us how they are performing and tell us when they are going to have a problem.

As somebody who spends a lot of time on aircraft, I would love to have all of that telemetry coming out of the aircraft in real time, giving us lots and lots of information about when the aircraft is going to have a problem.

I do not know exactly how many and by when, but our view is that if we have only scratched the surface with 1% and if we think that we have 10 billion in the next five years, then it is going to be billions and billions and billions over a period of time.

J. Thornhill:

Great. I would like to now open the discussion up to questions from the floor. Does anyone have a question? The gentleman in the front. Could you just say who you are, where you are from, and who the question is addressed to, please.

From the floor:

Hello, I am from Moscow State University. My question is to Mr. Mitchell. One of the most important parts of new gadgets is the operating system. We now have the competition between closed systems like IOS and open operation systems. I would like your perspective on what we will see in the future. Thank you.

D. Mitchell:

I am probably not the best person to answer that, other than to say that as an owner of many gadgets, I have many different operating systems on the gadgets that I use. I do not think that it is about operating systems. I think it is about the fact that we will all choose the gadgets that are important to us, which operating systems feel most

important to us. The reality is that all of these devices, whether they be smartphone-based, tablet-based or machine-to-machine-based, will just continue to pour out ever more data.

As the device that we choose to use an operating system on – which might be a smartphone – becomes faster, more powerful, more relevant to our lives, the amount of data is going to be enormous just from there. However, when you start to think about an industrial manufacturer making something that they then sell to you, where you do not have an operating system choice, that is the manufacturer's decision. When you think about continuous streams of data, think about six to ten constant streams of data coming out of a motor car before you even think about the WiFi hub for the users who do make a choice in the car. I cannot tell you that I know which operating system; I can say that whichever operating system it may be, there is going to be an enormous amount of data, and I do not think it is ever going to stop.

J. Thornhill:

Thank you. Are there other questions? The lady at the front, please.

From the floor:

I have a question for Mr. Gawdat. If we are talking about mobile computing and Google, is Google+ and generally the idea of mobile computing a kind of venture for Google? Or does Google consider it as a prospective major business direction for the company? Thank you.

M. Gawdat:

In general, we do not tend to think of business opportunities and business ventures. What Google has been doing for the last seven or eight years has mostly been what we call 'disruptive'. It is not a great word, but by 'disruptive', what we are trying to do is to change the mindset around how something that is really carved in stone is not the best way to do things.

The concept of Google Glass is just a demonstration that wearable computing is an interesting idea, that even that little gesture of having to switch on your device and go through passwords to find out something that is happening, is a total waste of time. If you multiply it by the number of gadgets that are available in the world, just multiply that by 10 seconds each time, by 80 times a day, and you realize how much humanity is wasting on unlocking screens.

What we think is important is that by the very idea of having computing on a person all the time, we are completely disrupting the way we look at industries.

Now, Google sometimes disrupts and creates a product that works, and many times disrupts and creates a product that fails completely. If you remember Wave or Buzz, those were horrible products. However, they created ideas that were slightly different in the way we can do things.

Now, once you have that disruption, then other leaders in the industry follow. As we said, look at all of the cars that have now to be connected and be available all the time. However, also look at the possibility of going back to the operating system, of having things connected that do not even have technology on them. In the past we used to say: "Stick an RFID to a milk carton and that milk carton becomes connected." With wearable devices, that milk carton is connected by just looking at it.

All of this is completely disruptive. It is not about Google selling Google Glass: if Glass fails, it does not matter because the wave has started, and wearable computing is going to happen, either by Google or by somebody else.

D. Sverdlov:

Would you allow me to comment on one thing? I completely agree with this approach. No one can predict with absolute certainty what the future will look like; no one can say, "I will create this product, and it will become popular, and everyone will use it." Many of today's highly popular products came about by accident. You have to try 100,000–150,000 things before you come up with an invention so impressive that it changes people's lives. It is even more important to create

conditions that foster the creation and implementation of these ideas, and to build an environment that nurtures people in that direction. This is how we move forward. I believe we cannot hope to invent one single thing that can change everything. I do not think it works that way.

J. Thornhill:

Are there any more questions? While people think, I will ask one myself. What underlies the whole debate that we have been having here, is that everything is going to become integrated and more interconnected? However, to what extent is that actually going to be true?

We have seen in recent weeks that there are major concerns regarding security and privacy in the United States, with the whole Prism programme, which sparked a lot of debate. I do not think that I have ever been on a panel that has got this far into the discussion and talked about massive growth without anyone mentioning China. To what extent does China become involved in this, or does it see that it wants to create its own, separate ecosystem of information? Does anyone want to take this on? Is it right to assume that we are going to become increasingly integrated, or do people think that there is going to be a backlash, both from governments and from people.

D. Sverdlov:

If you do not mind, I would like to comment on that. Information technologies and communication create a lot of opportunities but they also create a lot of risk and security issues as well. We need to address both of those things. We need to understand that, with all the value we get from all the connected mobile devices and all this information that is available, we also need to think about the security issues. Right now that is one of the biggest threats and challenges. It is extremely important to find the right balance between those two things.

J. Thornhill:

Thank you. William, do you want to come in on this?

W. Savage:

Yes, I would like to reiterate that we have a responsibility in this area as technology providers. It is our perspective at Intel that we imagine some large, disruptive security problem to be just around the corner, which would set back the technology industry many years, and also interrupt our product sales. We have a responsibility to take security forward, to increase the security of devices, as well as the backbone and infrastructure, and pay attention to privacy as well.

The European Union has done this more than other geographical region. The United States has to step up in that respect. However, as technology providers, we have a responsibility to find technical solutions that will secure people's lives and let this growth and potential, that we have talked about, not move backwards five years when we are faced with a dramatic problem.

J. Thornhill:

Can you be more specific on that, when you say that there are technical things that companies can do to secure privacy? What do you have in mind?

W. Savage:

There are hardware technologies that will combine with the software, that runs on top of the hardware, to secure the devices and the information they hold. Right now, most of the solutions that we have are software ideas running on standard hardware that are not robust. Ironically, the bad guys wanting to get at the information are actually advancing more quickly than the good guys trying to protect our information. It is a combination of each of our capabilities at Intel – our silicon and hardware design, hardened networks, pay stations – each of these can play a role in making a more robust system that is not as vulnerable as it is today.

J. Thornhill:

Thank you. Artem, please go ahead.

A. Kudryavtsev:

The security of the Internet is a very serious issue. There is one very subtle psychological aspect to that, especially when we talk about the new generations like those who are now children.

I have noticed that my children do not pay much attention to security when they are surfing the Internet. I think this is because whatever they use – the iPad, the iPhone – they all look very beautiful and are very convenient to use. Perhaps in their minds, whatever looks beautiful and is convenient always has a feeling of being reliable. That creates a feeling that whatever happens on your beautiful device is forever secure and that there cannot be any kind of leakage or any interference in that.

We cannot change that attitude on a wide scale. This is why we have to implement some technologies or hardware that can identify the user, maybe via biometrics such as like fingerprints or retinal scans, to be sure that no one except the specific person who owns that information or device can use it.

If we do not do that, then in five to seven years, there could be a great crash in personal data because all the personal data is being accumulated on search networks, in cloud computing networks. All these passwords and means of access, if users do not pay enough attention to hiding them from the bad guys, it can get into a mess. Our grandchildren will not find any photos of their grandparents because there is nothing on paper and whatever was in the cloud disappeared in the cloud.

J. Thornhill:

Are there any other questions? Yes, there is a question from a person at the back.

Y. Kudryakov:

Yuriy Kudryakov, Unicom 24. I have a question: what future, if any, do you see for non-mobile Internet?

D. Sverdlov:

If you would allow me to respond, I would say that it definitely has a future. Our Ministry believes that it is very important to improve the cable infrastructure. We have a programme, published on the website 2018.minsvyaz.ru, which talks about planning for the future at least 10 years in advance, and about bringing fibre optics into every household. This is exactly how we put it. It is not about the final number of computers or about speed: we cannot predict with 100% certainty what will happen even in the near future. In this respect, we must create conditions which ensure that the infrastructure that is in place will work no matter what the future holds.

We are already seeing 4K resolution television, and five years ago, we were talking about 8K resolution television – which will likely become a reality. To offer 8K resolution television without compression, we need a bandwidth of 600 Mbps. A copper cable cannot handle these bandwidths. It has physical limitations. In this respect, it is crucial for every household, literally every dwelling, to have fibre optics. Of course, we can change the device depending on how technology evolves: we can install various routers or active equipment. But it is crucial to create, right from the outset, an infrastructure that will last into the future.

Therefore, the short answer is that non-mobile Internet also plays an important role, especially since currently, the main Internet content is video, and large TV sets are still the preferred medium for watching video. The difference is that in the past, TV sets were not connected to the Internet, and now they conveniently are.

D. Mitchell:

It depends on how you define the two. One of the statistics that I used earlier on, is that we believe that already we are going to need to be offloading 21 exabytes of mobile data traffic on a monthly basis onto fixed-line, fibre-based networks, through the use of WiFi and small cell technology. There is a place for both, and even if the users themselves are highly mobile, the way that we actually get that information transferred around the world will be a mixture of mobile and fixed technology.

A. Kudryavtsev:

In my opinion, and I am the only fixed-line operator here, whatever we do on the Internet in our homes should go on a landline, meaning, a fixed-line. Whatever consumption we have at home – which is mostly high quality, high resolution video – the mobile network, even the 4G network, cannot support many users on the same station streaming different, on demand, videos at the same time. For that, for sure, we need a fixed-line.

Whatever networks we now build, they can support up to 100 megabits per second per subscriber, and that is more than enough for two to three TV sets in a house watching HD video.

Of course, that will not be enough capacity for the next generation of HD video, but I hope it will not be a question of the very near future. Over the next ten to fifteen years we will still need to get used to watching high resolution video only.

With the development of high-speed Internet, all these questions of security of our homes and offices with video cameras that can broadcast whatever is going on in your house or office when you are not there – all that data should be transferred to the cloud for an intelligent system to process that data; it should send you alarms about intruders or water leaks. For that, five to seven cameras should broadcast online video feeds to the main server. This needs considerable capacity connected to your home. That is why a fixed-line will continue to exist even though it is in competition with mobile technology, but it is not going to die for sure.

J. Thornhill:

Thank you. If there are no more questions, then I shall ask the last one. However, it is a very big question. It picks up on something that Mohammed was saying – the prediction that everyone on the planet will be connected by 2020. I recently heard your colleague, Mr. Eric Schmidt, also say that by that time all the world's human knowledge would be digitized and, therefore, be available to everybody.

In other words, everybody on the planet will have access to all known or published human knowledge. What does that mean for the world? Mohammed?

M. Gawdat:

I do not know why I say those things, but yes, I agree. Think of it this way, with all due respect, when a question is asked in Russian, I need a translator. Think of the fact that, today, when we say around 97% of the world's information is digital, what that means is that it is actually available but it is not truly accessible. If I only speak English, I do not know what the Russian Internet says. Think of little technologies like machine translation therefore, which is now reaching 96% to 97% accuracy. We have changed a tiny thing, and everything is breaking open.

If you imagine, for example, that all the information that a Harvard student used to be able to access just ten years ago, is made available to that person in Africa or in India or in the outskirts of Russia, and assuming that all human innovation comes from an innovative person armed with the right knowledge, imagine what that will do to our economies; imagine what that will do to our productivity.

Over the next few years, technology will provide something that is so incomprehensible that perhaps even the rules of equality around the world will change – the questions around China keep coming up. I tend to believe that there will be forces coming from all over the world. Russia, in the personal computer or mainframe days, did not produce a large portion of the applications. In contemporary mobile days, Russia, CIS and India produce a significantly disproportionate amount of the apps that are on mobile devices.

Even intellectual copyright – that is happening simply by empowering a different technology, changes completely. It seems to me that there will be an empowerment of any smart person to compete in a global economy just by making the information available. In many ways, most of the old information is already available, but there is still so much more that is going to come. In many ways, I actually think that by 2020, that prediction is also going to come true.

J. Thornhill:

Great. Would anyone else like to comment on this? Duncan.

D. Mitchell:

I would say that over the last fifteen, even twenty years or so, since the first commercially available browser was with us, the Internet has made an incredible difference. It has had a positive impact on my life by enabling me to access knowledge that I did not have easily available to me before. If that is through connecting 1% of the things in the world, I would love to see what happens when we have everything connected and we have all of the knowledge in the world at our fingertips. I think that is going to be a real life-changer for us all.

D. Sverdlov:

Obviously, I agree with the speakers on the issue of information available on the Internet. But I would like to note another aspect. Despite the fact that companies like Yandex and Google do a huge amount of work in the area of searching, search relevance continues to decrease dramatically as the sheer volume of information continues to grow. You can easily find the answer to the simple question, "Where is Kinza Restaurant located?" But it is still very hard to find the answer to the question, "Where is there a nice Italian restaurant in this neighbourhood?" This is because the meaning of the word 'nice' is unclear: nice for me, or nice for someone else? We have an immense volume of information, and the more it grows, the more we face the issue of relevance, for which, unfortunately, we have yet to find a comprehensive solution.

J. Thornhill:

We will call it a day there. We have heard a fascinating debate on the future of technology. I do not know about you, but it is always refreshing to hear this sort of stuff rather than talking about financial crises all the time.

We have learned that everyone is going to be connected; there is going to be a huge revolution called the 'Internet of Everything', not just the Internet of People; that we are all going to be walking wearing computers and Google Glass is just the beginning. We have heard that there are also going to be huge challenges in this new world, not just huge opportunities.

It remains to me to thank all the members of our panel for a very stimulating debate.

Thank you.