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10   LIGHTNING ROUND 3:

11   5G & BEYOND: REVOLUTION OR EVOLUTION? ... AND WHAT'S

12   NEXT?   WITH PAUL STEINBERG

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16   Salamander Resort

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1   Lightning Round 3 -

2   5G & Beyond: Revolution or Evolution? ... And What's

3   Next?

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5   MR. STEINBERG: Good afternoon. Hello. There

6   is somebody out there, that's good to know. So I'm

7   Paul Steinberg, Senior Vice President of Technology at

8   Motorola Solutions. And I measure my career at

9   Motorola in Wireless-Gs, and I'm bit about three. So,

10 I'll let you work that out. I know what you're

11 thinking. Let's be honest. Great. I'm tired. It's

12 late. I've heard a lot. Here's a boring technology

13 guy, just what I wanted to hear more about. So anyway,

14 I'll try to be brief and make this as painless as I

15 possibly can. So, my topic is build as 5G and wireless

16 technologies. But I'm going to build on a lot of the

17 themes we heard earlier, in a particular, the point

18 Cara made about software. And so, I'm going to talk

19 about 5G and a little bit about 6G. But I'm also going

20 to talk about cloud. I'm going to talk about

21 artificial intelligence. And I'm going to try to bring

22 that together in terms of what it means for critical

1 communications.

2   So, first 5G. 5G, is it an evolution? Or is

3 it a revolution? It's an evolution. I don't think

4 there's any doubt. Although, if you look at all the

5 ads we're inundated with on the weekends, they might

6 say something different with all due respects to my

7 carrier friends. What is 5G? It fits all the 10

8 rules. It's 10x the bandwidth. It is 10x the

9 improvement in terms of efficacy. It is 10x the

10 reduction in cost, and it came in about 10 years. So

11 that checks all those boxes. So, the biggest thing

12 it's doing is it's promising enormous amounts of

13 bandwidth from megabits per second to gigabits per

14 second. How is it doing that? It's doing that by

15 accessing a whole bunch of spectrum. We actually hit

16 the speed of light in terms of information modulation

17 with 4G. The only way you get more through the pipe is

18 to make the pipe bigger. You make the pipe bigger with

19 spectrum.

20   So, an analogy. You think about a water hose

21 or a fluid hose, obviously, the bigger the diameter of

22 the hose, the more stuff goes through it. You add more

1 spectrum, you get more through it. The problem or the

2 trade off is the spectrum that's available is high band

3 spectrum. It's in the 10s to 100s of gigahertz. So,

4 what happens with that is that spectrum doesn't

5 propagate. It doesn't penetrate. It starts to

6 approach Wi-Fi like behavior. So, you get this

7 massively big pipe, massively big hose. But it

8 actually gets much, much shorter. The more spectrum

9 you use up in the bands, the less bandwidth you get.

10 So that's a challenging trade off.

11   So, how do carriers -- how are they dealing

12 with this challenge? So, technology head of China

13 Telecom actually summarized it best. So first of all,

14 they're saying 5G is expensive from a CapEx point of

15 view. Carriers always say that. The second thing, it

16 is proving to be very challenging to deploy to access

17 that spectrum. Coverage is a problem. So, they're

18 needing more cell sites than they thought. Third, the

19 cell sites are actually consuming 3 to 4x the energy of

20 the equivalent 4G site, so I don't want something I

21 don't think anybody expected. So you put all this

22 together, and it's getting costly. So, the industry

1 will work through that, and it will be okay. The other

2 thing that they said is, we haven't found a killer app

3 for it beyond, you guessed it, the internet. That's

4 okay. The internet is a very good killer application.

5 It served us well for a long time.

6   What is 6G? 6G looks to be more of the same.

7 It looks to be, let's go to terahertz, and let's go to

8 terabits per second. It may be no different. It may

9 be from a range of no more from me than to this front

10 table, but it will still be very, very fast. So

11 looking at immersive technologies, looking at solving

12 your propagation problem by putting repeating

13 technology and things like window frames, so to repeat

14 indoor with outdoor. So, solving problems of 5G with

15 6G is mostly what I hear now. If truth -- if it placed

16 a form, it'll come in about 10 years or the end of the

17 decade is when we'll start to see 6G. But the key is,

18 it's being defined now 10 years before anybody actually

19 even tries to put it into play. Okay. So, that's kind

20 of the wireless landscape really quickly.

21   Let's talk a little bit about cloud. So what

22 does cloud have to do with this? So, a lot of people

 1 think cloud is simply the ability to rent a computer

 2 and storage at scale. And it is that Infrastructure as

 3 a Service. But more importantly, it is the ability to

 4 leverage an enormous amount of software platform as a

 5 service, software as a service. That gives us an

 6 enormously complex, but enabling leveraged platform to

 7 build new stuff on. It's also the ability to deploy

 8 and scale and monitor these new applications. So, Marc

 9 Andreessen said, software is eating the world. Cloud,

10 I would submit to you as allowing the world to be

11 defined and embodied in that software at scale. The

12 network itself is now being embodied in cloud. The

13 network itself is now a software, and not appliances.

14   So, the interesting symbiosis is, the cloud

15 needs the network to move things around. The network

16 needs the cloud to be. So, things are different now

17 than the old days when we used to just connect

18 computers with networks. Now, there's actually an

19 intricate relationship. Artificial Intelligence. We

20 talked a lot about that today. So, where does AI fit

21 into it? It will be as pervasive in products as

22 compiling technology is to make the products to --

1 it'll be infused in everything. It will leverage the

2 enormous amounts of data. So, Palmer talked a lot

3 about humans not doing a great job at mundane tasks.

4 And oh, by the way, the humans tend to be very

5 expensive, and not doing a great job.

6   We need AI to solve and sort through all of

7 this data. I've seen estimates that last year as a

8 human race, we created 59 zettabytes of data. So a

9 zettabyte is one with 21 zeros after it. So, what is

10 that besides a really big number? I saw an estimate of

11 the number of grains of sand on Earth. So, imagine

12 every desert and every beach and imagine you could add

13 up all those grains of sand. It turns out that one

14 zettabyte is about a 100 times more than that. So, we

15 created that much data as a human race last year alone.

16 And of course, like everything else, that's growing

17 exponentially. A lot of that is video, a lot of that

18 is audio and unstructured data. We need the AI to make

19 sense of it. So, those are the three key ingredients

20 that we have to put together.

21   So if I think about, you know, how does that

22 all fit together. Let me assemble the pieces here just

1 a little bit. So, we have the ability to move enormous

2 amounts of content, video, media, whatever the case may

3 be highly with high resolution in a mobile environment.

4 That's a good thing. We heard earlier this morning, a

5 very powerful message that the importance of video and

6 police reform. So, if a video is -- if a picture is

7 worth a 1000 words, I would say a video is worth a

8 million. And so we can move a ton of it now. The

9 second important thing we can do is we can now position

10 the compute where we need to. 5G brings along this

11 thing called mobile edge compute. It's kind of a

12 solution looking for a problem. But really what it is

13 is it allows the cloud to be extended further out,

14 instead of, you know, just a few regions and a few

15 availability zones extended to the very edge. So that

16 gives us latency opportunities. That gives us

17 different ways to think about efficiency and ways to

18 think about reliability. So, we can do that.

19   So now, we can use artificial intelligence to

20 watch the video, to listen to the audio, and to find in

21 there what really matters to surface that in a way

22 that's meaningful. And oh, by the way, we can use AI

 1 to look at and listen to electromagnetic spectrum. And

 2 it's not just finding the oh, where is that person? Or

 3 where does that event that occurred? With machine

 4 learning, AI can learn patterns of life. So over time,

 5 it understands what is normal. Once it feels normal,

 6 it can actually identify abnormal. And that becomes

 7 very interesting, especially in the security forces.

 8 And we can interoperate the communications, so that we

 9 use the best network. And I'll get more -- get back to

10 that in just a second. I can submit to you that it's

11 not a world of a network. It's not the 5G network.

12 It's not the 6G network. It is a confluence of

13 networks. Satellite or non terrestrial networks,

14 purpose built networks, such as tactical radio, land

15 mobile radio, and of course, the broadband networks,

16 they all work together to create an answer. And then

17 finally, we can take all that and power a workflow to

18 create an outcome that's intelligent, that's guaranteed

19 to be communicated. And it actually gives us the

20 ability to place people in different locations relative

21 to where they would otherwise had to be. A lot can be

22 done remotely now.

1   So, what's Motorola's take on all this? So,

2 what I've just described to you is, I think of it as

3 not mission critical communications, which we have done

4 for 90 years or more. It's really now about mission

5 critical intelligence. And so all those things I spoke

6 of, certainly, communication is very important, but

7 it's not the only thing now in the entire stack. And

8 if you also think about this notion of hybrid networks,

9 we just learned an important lesson with Hurricane Ida.

10 It turns out that in the areas of impacted area down in

11 -- down south where the hurricane came on shore, FCC

12 reports it about 28% of carrier network sites were

13 down. And not just for a few minutes, for days. 60%

14 of carrier network sites were down in the areas that

15 had to be evacuated. Again, not for minutes, but for

16 days. What first responders have used for a long time,

17 land mobile radio was unimpacted. It did what it was

18 supposed to do, which was a good thing. So, our first

19 responders could communicate, could help people and

20 solve and help solve problems in a dire need.

21   So the message is, you need to put these

22 together in a meaningful way. FirstNet was mentioned

1 earlier. I look at other countries in the world trying

2 to solve this problem. United Kingdom, South Korea,

3 they all said, I'm just going to throw away the network

4 that's purpose built to do this, I'm going to replace

5 it with a broadband network, either purpose built or

6 with a carrier network. U.K. has been trying to do

7 that for 7 years, and they have still not succeeded.

8 FirstNet, in my humble opinion is getting right.

9 They've said, look, broadband is an important enabler.

10 Let me -- let that do what it does. Let me bring it to

11 first responders in a meaningful, efficient way that it

12 is accretive. Let me not try to displace what they

13 already have. And let me focus on interworking the

14 two, so that the two become one. So, FirstNet has got

15 it right. I don't know of any place else in the world

16 yet that is quite gotten it correct.

17   So, adding software definition to the radio.

18 So, the radios need to become flexible. So, it's not

19 about what a particular piece of hardware does. It too

20 as an appliance. So, we basically have some radio

21 products, part of the DoD 5G consortium that was

22 mentioned earlier, where we have a radio that's the

1 size of a paperback book that can actually modulate I

2 think about 20 different waveforms. So yes, 3G, 4G,

3 5G, GSM, Wi-Fi, tactical radios, land mobile radio,

4 just change the software in it. That's all you have to

5 do. And it takes a matter of seconds to actually do

6 that. So, increasingly defining these capabilities in

7 software. Motorola has invested about 4.5 billion in

8 acquisitions in the last couple of years -- in the last

9 5 years. All those acquisitions were in the area of

10 secure video, video surveillance, mobile video, command

11 center workflows and software and cybersecurity.

12   So, think of this as a stack. The networks

13 allow people to communicate. The action that's

14 important is that workflow on top, and a big part of

15 that is video. And again, that platform has to be

16 consumed by -- augmented by artificial intelligence to

17 improve the workflow. Just video alone. It's

18 estimated that by the end of this year, there will be 1

19 billion video surveillance and security systems

20 deployed or cameras deployed on the earth. About half

21 of them in China, the other half actually scattered

22 across. Now, interestingly enough, according to the

1 report I read, the U.S. has more video cameras and more

2 video security cameras deployed per capita than any

3 country on the earth. So, I didn't know that. I did -

4 - would not have guessed that. I would have guessed

5 even China would have won there too. But they have a

6 lot of people, obviously. There will be 45 billion

7 with a B cameras in the world within about 2 to 3

8 years. So, that's about seven cameras per person on

9 the planet. Think of all that video. No way in heck

10 can human beings find what matters in that video in the

11 time that they have. That's why our focus on AI and

12 ML.

13   And then finally, cybersecurity. So, I had an

14 epiphany. I don't have that often. It doesn't happen

15 often. So, maybe it was just something happened one

16 day. But many years ago, land mobile radios, the

17 mission critical networks that have to work always.

18 The businesses better -- their businesses on first

19 responders better safety and security on. They have to

20 work. They always have to work. They're engineered in

21 very special way so that they fail in a very, very,

22 very clever, degraded, but graceful way. And for the

1 longest time, they weren't interesting from a cyber-

2 point of view. Who wants to attack one of those?

3 There's no money in there. There's nothing to be had.

4 There's nobody to exploit. They don't really touch the

5 internet. They're pretty, pretty, you know, pretty

6 small threat surface.

7   But you think about it. As nation state

8 actors and as other people, terrorists got more

9 organized, starting using cyber as an offensive threat.

10 What better way to magnify the impact of what you're

11 doing, whether it be kinetic or whatever else, and by

12 preventing people that need to from calling for help,

13 and preventing the people that can help them from

14 communicating with each other? So we went from, in my

15 opinion, not interesting to cyber, the ground zero.

16 So, we invested very heavily in cybersecurity as well.

17 So in conclusion, I don't think the answer is a

18 technology. I think it's a confluence of technologies.

19 And the vast majority of this is defined in software.

20 Increasingly so, even the networks. About all you need

21 that's in hardware is to stick the light in the fiber

22 or to modulate the airwaves. The entire remainder of

1 it is malleable and flexible. So, that's first

2 important realization.

3   The second important realization is AI is an

4 imperative. It's not separate. It's all part of the

5 stack. And cloud is an enabler of that. Many

6 countries are trying to figure out now, how do I deploy

7 sovereign cloud because there's very few cloud service

8 providers at scale in the world. Google, Microsoft,

9 Amazon are the big ones. So, you see things like in

10 Singapore, in Germany, where they're actually doing

11 partnerships. I think it's inevitable that Chinese

12 will try to get into the cloud service provider

13 business because that's the new control point in the

14 technology. Whether they will get in, whether they

15 can, I don't know.

16   Finally, my message is, we need help from

17 government in terms of responsible, organized,

18 definitive direction and guidance. So, Motorola has

19 grabbed on to some of the surveillance technologies,

20 license plate recognition, facial recognition. Why do

21 we do that? It's very clear to us that there's much

22 more good that can come from that than harm. Is there

1 a downside? Of course. If misused, of course. We

2 don't want the headline Motorola technology used for

3 egregious human rights violations and country acts.

4 But we need some guidance from the government in terms

5 of what's okay and what's not. So, we have some

6 certainty of where to innovate, how to innovate, we'll

7 build a product responsible in that regard. So, I

8 think the national security did a report -- National

9 Security Council did a piece on AI, which I thought was

10 a very, very good. I think, candidly, the EU is

11 getting it wrong by trying to regulate AI as a

12 standalone entity.

13   So I think innovation, we talked a lot about

14 that today. It's when oftentimes, serendipitously,

15 things come together in a way that actually solves an

16 important and impactful problem. So all the things I

17 talked about, I think it's not any one of them. It's

18 all of them together that unlocks the future of the

19 United States safety and security in the world. So,

20 thank you very much.