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Closing Keynote Presentation

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Co-Inventor of Ethernet & UT Austin Professor of Innovation

I'm all nervous about calling this a keynote. So if you don't mind, I'll sit down and that'll lower expectations.

So let me begin by thanking the Computer History Museum and PARC and MEF and NetEvents for pulling all this together in this celebration of the 40th. Of course it was intention all along that it would be more than a celebration of the 40th. I'm not a Professor of Innovation, so I thought it'd be useful if we collect and gathered some lessons from the Ethernet history about how to innovate. I thought it'd fun - we all thought it'd be fun to sing some of our unsung heroes, because many people have invented Ethernet. And then we thought it'd be good to have a party, and we had one of those last night. Strange party wasn't it? Yes. Well I knew almost everybody there; that's strange. Usually I'm just in the corner and I don't know anybody, but this was amazing.

And then these industry briefings, because even though Ethernet is 40 years old, it is not dead. And apparently it is blooming. It is blossoming. And so there's something like $100 billion industry for us to pay attention to, and that's what we're doing today.

And here's some evidence that the Ethernet, whatever Ethernet is, it is not dead. And here are some of the ways in which it is not dead. We heard from Erin Dunne earlier today that the traffic now being carried by carrier Ethernet, between carriers and their customers, now exceeds all the legacy access methods before, more than private line, more than T1, more than ISDN and frame and ATM, etc. And you saw her charts. Not only has it past all the legacy, it keeps going up, like this.

I asked Nan to quantify what's happening at MEF and he had some numbers at hand. This year there'll be $70 billion worth of carrier Ethernet equipment and services sold, expected to be $100 billion by 2017.

And then I hope you've all heard of the Verizon news today. So on this very day, or maybe it was yesterday, Verizon announces the simultaneous availability of 120,000 new office buildings with gigabit Ethernet fibre service under FiOS.

But wait, there's more. The MEF has today introduced - or this week introduced a new committee, the operations committee, whose purpose is to speed the provisioning and, this is the way I put it, to speed the provisioning and settlements among multicarrier networks. In other words, if you want to connect all your offices around the world, you can't do it through one carrier; you've got to go through multiple carriers. And that needs automating and speeding and MEF is taking that up. So merely having that, as Nan put, we have too much Ethernet now, it's a problem. We have to learn to manage it better.

But wait, there's more. We also heard the formation of the Cloud Ethernet Forum, a formation and its association with MEF. Well that's great news. That's one of the new challenges, one of the new killer apps of the internet's plumbing is to support cloud computing. And it's a very positive sign that a group of significant industry players have formed to pursue to sort that out, that new killer app, the cloud.

And in a previous panel we worried about whether all this networking was going to become a commodity. You remember that? Wasn't it like a problem? It was put like a problem that it would all become a commodity. It's our goal to make the internet a commodity, to make Ethernet a commodity. In 1984, when I was on the public road show, taking my company 3Com public, all the press and analysts wanted to know - were warning us that 3Com's sale of Ethernet was about to be commoditised, this was in 1984, and that basically our company was doomed because the commoditisation was just around the corner. Well they were really wrong about that. So 3Com had 5 billion in sales in 1999, a few years later. More importantly, it was our goal to lower the cost and make it invisible. You want your networks to be cheap and invisible and we've gone a long way toward succeeding at that goal. What they also didn't notice that even though our prices for Ethernet were going down exponentially, our costs were going down even more exponentially. So I remember gross margins at 3Com were going up during the commoditisation of the Ethernet mix in those days.

But wait, there's more. So we just heard about HP results were just announced, financial results, and the stock took a big jump up. And it was entirely because of the 14th straight quarter of robust growth in the networking division, which contains what company? What company is part of HP networking? That would be 3Com, yes. And I actually cornered Bethany Mayer and got her to actually say that to me, and I asked permission to tell you that 3Com's the most successful acquisition that HP has ever made. So I'm pushing, you know that HP are the initials of the founders, and now my company's sort of part of that. So I'm pushing to have HP renamed, HMP. No.

So another thing we were doing yesterday and today and especially last night was singing our unsung heroes. And there are a lot of unsung heroes in this 40-year-old enterprise. Of course, last night we voted Andy Bechtolsheim the most recent top hero of the day, and wasn't he graceful and smart? And Judy Estrin was there, and Henry Samueli, and Yogen Dalal and Bill Hawe and Dave House. Radia Perlman

was sat at this chair. It's been so long I'd forgotten what a delight she is. She will not let go of any detail. And even thought something's [a cluge], if it works, it's okay with her. And I remember her coming up with the spanning tree algorithm, a key development in the evolution of Ethernet.

Norm Abramson was here, inventor of a lower network from which Ethernet was derived. Pat Thaler was here. Pat and Geoff Thompson, both heroes of the IEEE standardisation effort, they were here. Howard Charney was here. Do you all know who Howard Charney is? Yes, he's relatively unsung, but a bastion of our community at 3Com, at Grand Junction and now at Cisco.

Glen Ricart is here, right there, another one of the heroes. And I'll return to Ignite in a moment. Bob Belleville was here. Now he's unsung. He's the guy who, with Steve Jobs looking over his shoulder, took Ethernet on this slight divergence to a think called AppleTalk. And it took years to talk Apple back up into Ethernet. Of course now they're taking it out again. Well they're filling it up with what I call wireless Ethernet. I think the rest of you call it WiFi.

[Belleville] was here. Gordon Bell was here, John Shoch. I've added Dan Pitt to the list of Ethernet heroes, although he was a token ring guy, he's one of the better token ring guys. And now he's championing this software-defined network thing, sort of, although Andy Bechtolsheim - but that's another beautiful thing about the Ethernet enterprise is how fiercely competitive it is and how snarky the - you remember Juniper was being snarky with Cisco and we were being snarky with - Andy Bechtolsheim was disparaging OpenFlow, and that is just so Ethernetty. Of course, after we were unified by token ring, but as soon as that was gone, then we turned on each other.

So as I mentioned earlier, I'm a Professor of Innovation, and really am looking for lessons to profess. And professing innovation is a tough job, but somebody's got to do it. I guess one of the problems is everybody's doing it. Every politician in the world that travels around promoting innovation, innovation is now one of those unfortunate buzzwords, like SDN. Innovation, what is it? But let me make some observations about the innovation process.

For example, there is a short form of the story of Ethernet. It was born in the ARPANET community, supported by ARPA, a government agency, at universities, in my case MIT, Harvard and Stanford. Then Xerox PARC took over and supported it for a very long time and it blossomed. That's sort of here it got invented. And then VC stepped in to create an Ethernet and several Ethernet companies. Then the strategic partners formed up with the venture-backed start-ups, DEC, Intel, Xerox, HP, Siemens, NEC all joined in that early consortium to promote this new innovation.

And then of course there are the early adopters. I always mention the early adopters. Those are the customers who buy stuff from start-ups. And I took Ethernet to Germany and they asked me what part of Siemens I was from. And when I went to Japan, they asked me did I work at NEC. But when I was in the United States I could sell Ethernet cards to major US corporations, god bless early adopters. They helped feed the innovation process. We need to cherish them.

And then there's another observation is the role of the Ethernet brand, there is very little agreement about what the word Ethernet means. Some people think it means CSMA/CD on half-inch coax, running at 2.94 megabits per second with 8-bit addresses over a kilometre. And any departure of that spec, it's not Ethernet any more. Obviously we don't subscribe to that here. I think Ethernet has become a brand and a brand is a promise. And what Ethernet promises and why major US corporations use the Ethernet brand is it has this model behind it, a model that seems to work. And we want to support the model and keep participating in it.

And let me describe that short model. So the brand communicates a process which, at its core, has a de jure standard. So god bless the IEEE 802. Actually god should bless 802.3, not 4 and not 5, just 3. Alright, 802. And then there's the fierce competition that I've already mentioned, which is very much a part of the Ethernet models. As soon as Ethernet was licensed to the world, 3Com bought a license in order to buy and sell, and they can sell Ethernet, but so did 100 other companies in the same week. And then we were off to the races. And that fierce competition really can get unpleasant at times but it drives things forward and it's a part of this model. So when you have the Ethernet brand, you're expected to be snarky on panels at conferences to your competitor to the right or left.

Then there's the interoperability ethic of the Ethernet brand. It used to be that standards had conformance. What would you would do is you're write this standard and then you would get everyone to conform and then you'd build test equipment to test conformance. And what we learnt is it doesn't work because standards have too many options. So it's all too possible to be conforming and yet not interoperate with anybody else. And the Ethernet started at the very beginning with an interoperability ethic as opposed to a conformance ethic. So there were whole conferences formed called Interop. And we went there with our cable and the cable ran across the convention centre and we all tapped into it and then we bragged to our customers how we were compatible with all the other stations on that network. That was interoperability, not conformance per se.

And another part of the brand is rapid evolution of the standard. The point was amply made, there were many versions of Ethernet. Which one are we talking about? Well some of that is diversity of application, but some of it is the unfolding of time which causes new standards to be created. So the rapid evolution of the Ethernet standard is certainly part of that brand. And yet there's this penchant for sticking with the installed base. So this law that I really like, called Metcalfe's law, says that the value of a network goes as the square of its size. So when you introduce a new technology, do you abandon the installed base? No. You invent things like auto-negotiation that make you automatically compatible with the previous generation. So backward compatibility is an ethic of this Ethernet brand.

Let's see, I also, in listening to the conference, heard some worry about the innovation in process, because you remember in that Ethernet model, Xerox PARC was all important. And Mr Spencer argued that corporate research wasn't what it used to be. It was almost like PARC didn't exist. Of course it is. I was just there. Yes, I'll be there this afternoon. So PARC is still there. But I guess what they're talking about is

like the massive Bell Labs, which had 25,000 employees and the Watson, those are not playing the role they used to. And I guess the debate there is whether we should go back and create some more monopolies to create laboratories, because only monopolies can afford research laboratories, or should we do what I'm proposing, especially now that I'm a professor at the University of Texas at Austin, is we should do our research at research universities, which is my point of view. And why should we do research at research universities? Because students, and it's the business of universities, to graduate students as student are the best vehicles for innovation. They graduate and they take these ideas out into the world.

And then we heard from Norm Abramson who couldn't even remember whether he invited me to Hawaii in 1973. Did he think I just got on a plane and I flew to Hawaii and I knocked on his door? He invited me to come there and study the Aloha network, and I'm forever grateful for that even if he can't remember it. And he also taught me something. He thinks Ethernet used coax because of the FCC. Did you hear him say that? Well I want you to know, I respect that he remembers it that way, but the problem, the reason we couldn't use radio and Ethernet is we were going to go 300 times faster and the radios he had were already this big. And we had to get our thing onto a card this big. So there was no chance of it being radio, whether the FCC gave us the frequencies or not. But it's interesting that he remembers that it was the FCC that was the obstacle, and I need to pry into that some more.

And that brings us to another question about technology. So you heard about CSMA/CD, which the IEEE officially removed from the standard, I think, last year roughly. Is that right, Geoff? Two years more?

Geoff Thompson - Member of IEEE 802 Executive Committee

A revision or two ago we changed the name of the standard from all the gobbledegook about CSMA/CD to what it should have been all along, which is standard for Ethernet.

Bob Metcalfe

But were CSMA/CD actually removed from the technical part of the standard?

Geoff Thompson

No, no, it's still in there.

Bob Metcalfe

It's still there?

Geoff Thompson

Oh yes. We have our backward compatibility. It is our ethic. And besides, it's a real pain in the neck to take anything out. That's why it's six volumes at 4,000 pages.

Bob Metcalfe

So here's the - trying to speak at an innovation theoretic level, CSMA/CD was one of two things, either it was just a bad idea. It's the sort of thing a computer scientist comes up with when he's trying to solve a network problem, just a bad idea.

Geoff Thompson

Actually I think it's something different. If I may, Bob.

Bob Metcalfe

Well anticipate my second answer. Go ahead.

Geoff Thompson

Communication systems, be they for matter or data, have a historical set of characteristics. And they start out half duplex, when they require - when they're starting up and requires outside investment. And then when they get successful and have enough traffic, they can fund their internal expansion. A rail road puts in a second set of tracks and goes full duplex. At that point they no longer need access control. And Ethernet's the same way.

Bob Metcalfe

Yes. But let me add a third possibility, which is memory was a penny a bit in 1973, so these big [cahunking] hubs with all that memory, where there collisions occur in the member, and not very often because there's so much memory because memory is so cheap, that is a condition that did not exist in 1973. So the third alternative is that some technologies come and go because they're transitional. That is we felt it was important in '73 to share the medium, but that turned out not be to so important when we had all the LSI in the world and all the memory in the world and much higher bandwidth. It all changed.

But from an innovation point of view, I think there are transitional technologies that come in and serve their role and then eventually they're replaced, either because we have the money or because the technology or the context of the applications have evolved.

Next is this 'build it and they will come' ethic. So the Ethernet brand has this 'build it and they will come' ethic. Do you know how we determined how fast Ethernet should be the first time? Was it because we had a marketing requirement space that indicated that 2.94 megabits per second was exactly the bandwidth that we needed? No. The answer was the card was this big. And Dave Boggs, who I think is here, there he is, he found a CRC chip to do a 16-bit CRC to check the packets. And there was room for it on the card. But where were we going to put the clock? There was no room for the clock. Oh wait a minute, there's a back plane. And on the back plane is the system clock. Let's just use that clock. How often does it tick? Every 170 nanoseconds. But we're using Manchester encoding which means each bit is two ticks. That means each bit is 340 nanoseconds if we use that clock. 340 nanoseconds

happens to be 2.94 megabits per second. That's how we decided how fast it was going to be.

And then going to 10, you may have heard yesterday there was considerable doubt about whether we needed 10 and then 100. And then when somebody referred to good old classical gigabit-per-second Ethernet. Well when that came along, it was too much. Now 10 appears to be too much. 40 is too much. 100's too much. Terabit's going to be too much. And yet the Ethernet brand has gone forward. Build it and they will come.

And who will come? And this is where Ignite comes in. Well the new apps, the unanticipated apps that will be enabled by having all this new bandwidth. And of course they only come with a little help. In the case of the internet, ARPA funded people to develop new apps for the ARPANET. And US Ignite is an effort of the National Science Foundation to do pretty much the same thing, which is we're now gig-ifying the internet. And what new applications will be enabled? And Ignite is trying to trigger or foster that. Do I have this right? Yes, thank you. So Ignite is feeding into this 'build it and they will come' ethic of the Ethernet brand.

Now let me end with one more observation, unless you want to ask questions. We're way over. Do we have any time? Carry on.

So Moore's law. You heard on this stage from Henry Samueli, who is no dummy, that Moore's law, it had about 15 years to go. And of course then we all noticed that we'd heard this before. In fact, we heard this story; Gordon Moore said it every few years. He said we had 10 years to go. But here's what's true about Moore's law. There's another part of the Ethernet brand which has to do with bandwidth elasticity. It's like the 'build it and they will come' model. Every time we create more bandwidth, people use it. They gobble it up. So there's elasticity. Build more, more comes.

What I observed in that discussion is that Moore's law and bandwidth elasticity are the same thing. See Moore's law relates to Ethernet in two ways. Moore's law creates the demand for bandwidth by making the machines all faster and want to do more and therefore they need more bits to travel. And Moore's law also enables us to build the networks to serve that traffic. So there's two ways in which Moore's law interacts with this bandwidth elasticity. So what I think I learnt from an innovation point of view here was that this bandwidth elasticity principle that we've relied on to build it and they will come, that'll end the day that Moore's law ends. I'm not saying Moore's law will end in 15 years, but whenever it ends and peaks out, then I think that's when we should begin to worry that the bandwidth elasticity will run out.

So those are the collected thoughts I had. Are there any questions or comments? Yes, sir.

Alan Weissberger - IEEE Communication Society

Alan Weissberger, IEEE Communication Society. I wonder if you could enlighten the audience about what I believe are two crucial aspects of the history of Ethernet that were not covered in this conference. The first is the five or so years it took you to get from 3 megabits to 10 megabits and what role Ron Crane played.

And then the second one is the role that you played in making 3Com survive amongst all those Ethernet start-ups, [Cyber and Bass] and Cisco and so forth in the mid 1980s.

Bob Metcalfe

Well Ron Crane, I failed to mention his name already. Ron Crane is an unsung - a relatively unsung hero.

From the floor

[Inaudible] nominated Ron and Geoff and they got an award that IEEE Santa Clara Valley Section gave them a couple of months ago.

Nan Chen - President MEF

Yes, Todd and Dave and I had nominated the two of you.

Bob Metcalfe

So maybe Ron is just a little bit sung, but he deserves to be sung more. I'm reluctant to say this with Dave Boggs sitting in the room, but Ron Crane sort of picked up where Dave Boggs left off. I invited Dave to join 3Com Corporation and he decided to stay in research. So Ron Crane joined 3Com Corporation and sort of picked up the mantle. And then he was the one who led in the bringing of, from 3Com's point of view, the bringing of Ethernet to the IEEE. So, for example, he worked on twisted pair and - oh, he's the guy who built most of the first Etherlink. The Etherlink was the first network interface controller for the IBM PC, which was enabled by a chip called the [CEEP] chip. And Ron was the chief engineer of that. That was a killer product. That took us from hundreds of units a month to millions of units a month.

Dave Boggs, do you want to say something kind about Ron Crane?

Dave Boggs

Ron has forgotten more electrical engineering than I ever knew. He was exactly the right person to help you take Ethernet to the next level. So you were really lucky.

Bob Metcalfe

My principal contribution at 3Com Corporation was to keep the company from firing Ron. Well occasionally we had adult supervision of our company and dressed well and showed up at meetings on time, and they would - I am referring to the ceiling tile story.

Actually I think the lightning story is better, but I could tell you the ceiling. So we had the Etherlink. Have I mentioned that the Etherlink was the product that really made 3Com Corporation from hundreds to millions a month? And Ron was building it. We had put the Ethernet transceiver, which was Ron's specialty, right on the card, so there was all this analogue passive stuff mixed in with the digital stuff. And Ron had the card and manufacturing was waiting for the specs so they could build them, and we had already announced it and Businessland was planning to sell it to all these

PC owners. And Ron was working on it in his cubicle. So they kept sending me go find out what Ron's doing.

So I would go visit Ron. And one day I walked in and he had all these instruments in his cubicle. And the ceiling tiles right above his office had been flipped over. And what Ron was doing was measuring the sound reflectivity of the ceiling tiles. He wasn't actually focused on working on the Etherlink as our cash was dwindling towards zero and our market, Ron, Ron, the Etherlink, not the ceiling tiles. He said well, the sound is annoying me and I'm sure it annoys everyone else in our company and I think we need some work on this. And I detected that the reflectivity - you, Bob, chose the wrong ceiling tiles for this building and we need to get new ones. So I agreed on the spot that we would get new ceiling tiles. And as an interim measure we would flip them over to expose the hairy side, which also absorbs sound. So we flipped them over to get Ron to go back and focus on the Etherlink so we'd get it out.

Yes, Dave?

From the floor

Ron was really the, as far as I'm concerned, the inventor of 100-megabit Ethernet too. Let's see if I can remember.

Bob Metcalfe

Yes. But before that, the lightning thing happened.

From the floor

You first.

Bob Metcalfe

So after we got him back on the Etherlink, he'll deny all of this, by the way, but after we got him back on the Etherlink, still the card wasn't being handed over to manufacturing. So they sent me in again to find out what was going on. And Ron was finishing up the circuit that would protect the Etherlink from lightning strikes. But I pointed out to Ron that in the marketing requirements document that we had carefully written for the Etherlink, there was no mention of lightning. Our customers had never mentioned they wanted lightning protection on the Etherlink. But Ron wanted to have lightning protection. And Ron gets what he wants. So he delayed release to manufacturing even more and everyone was pulling their hair out. And finally he handed in the card and we made them and people bought them.

And one of the groups that bought them was a huge bank in New York City with a tall skyscraper. And they bought like 1,000 of our cards, which is the biggest order we'd ever received. But they were shrewd. They also bought 1,000 of our competitor's cards. And they filled their building with both sets of cards. And you know now what happened next. Lightning struck the building and fried all of our competitor's cards and ours kept working, whereupon we received an order for another 1,000 cards.

From the floor

Let me just finish the story about Ron and 100-megabit Ethernet. Back in the early '90s, Ron Crane and I and Howard Charney and others were meeting regularly, trying to think up an idea [in the] company. And after many interminable meetings we reluctantly decided on an idea of mine which was to build some Ethernet test gear for IT guys to diagnose problems. So we were sitting around Larry Birnbaum's kitchen table, I think, one morning and meeting again about the idea. And I forget who said it, but somebody said, you know, this isn't really very sexy. Can't we make it go faster? And I said well, no, you've got speed of light problems with collision detection and all that. And I explained it again. And then Ron quietly said, well, actually that's not a problem any more. And he explained that somebody else was - right, what? Yes, but somebody else was doing 100 megabits.

Bob Metcalfe

No, the big difference was that we had designed Ethernet to go a kilometre.

From the floor

Oh, it was FDDI. It was CDDI, that's right. He had been consulting on the adaptive equalisation of a chip to run copper-distributed 100 megabit Ethernet, 100-megabit FDDI over copper. And he figured it out and solved it. He said it's not a problem. They can go 100 metres over category 5 cable at 100 megabits per second. Problem is solved. All you need now is switches. And so Howard looked at everybody and ran for bleachers with that, and that became Grand Junction Network.

Bob Metcalfe

Thanks, David. The second question had to do with how did 3Com, given that everybody had access to Ethernet technology, how did 3Com win in those days. It's very simple. We had a time machine. And we had, the group of us, had gone into the future at Xerox PARC. And we lived there for eight years and we knew what the future looked like. And then in 1979 we flew back into the present and we knew what the future was going to be, and it was buildings full of PCs. Whereas Ralph Ungermann and Company and others, who were a little further ahead in other dimensions, they were much too practical. And they used Ethernet, for example, to do dumb terminal concentration and switching, whereas 3Com Corporation knew that the future was not terminal concentration; the future was personal computers. So we focused on doing PCs.

Then when the PCs came in August of '81 with the IBM PC principally, we had a card that plugged into it and they didn't, because they had been focused on shorter-term more practical things. And they had not had the benefit of the time machine. They didn't know what the future was going to look like.

From the floor

So what do you feel about 100VG-AnyLAN and what is your feeling about [ADDI] also.

Bob Metcalfe

I didn't understand the question.

From the floor

Sorry.

Bob Metcalfe

VG-AnyLAN? Well there was a big catastrophe surrounding that. The Hewlett Packard company, from which many of the employees of 3Com had come, a fine company, especially now that 3Com has acquired it, they developed a thing called - they eventually called it VG-AnyLAN, but they were starting out by calling it Ethernet, fast Ethernet or another version of fast Ethernet. The word Ethernet had been associated with this technology.

And I was a columnist for InfoWorld at that time and I had to write an opinion every week, 605 words by Thursday night. So when we wrote this new technology from the Hewlett Packard company probably works and is perfectly fine, but it is not Ethernet. And I'm in charge of what's Ethernet and what's not Ethernet, and that is not Ethernet. You know, a snarky column, whereupon the next day the Hewlett Packard company cancelled all advertising with all the publications of the International Data Group for all time. And I called up Mr McGovern who owns IDG and I apologised for my column. And Mr McGovern said I read your column. It was perfectly fine. They'll be back. And two days later they were.

But VG-AnyLAN's gone now isn't it? Yes. And it was a fine technology. It wasn't? Geoff doesn't think it was.

Geoff Thompson

VG-AnyLAN couldn't do full duplex, which became the discerning difference when the market moved to 100 meg. Hubs went away, switches came in, [WIF] switches came full duplex and VG-AnyLAN was a half-duplex technology. It went away very quickly.

Bob Metcalfe

Thank you.

From the floor

That's just the beginning of the problems with VG-AnyLAN. I walked out of my fair share of meetings when they were trying to propose that. But we'll just leave it alone. It never got anywhere. It wasn't that great an idea.

The other thing to note why fast Ethernet 100-megabit Ethernet was like falling off a rock is to do, as you heard me mention before, we had four semiconductor chip efforts underway. And at that time we thought gee, with the current CMOS process, with no tweaks or special binning or anything, what if in the simulation we just run the exact design at a higher speed, clock speed? What speed would it be? And by just closing your eyes and changing a parameter in the simulation it was 80% of the way to 100 megabits, by doing nothing. And so we said oh, there will instantaneously be ten 100 chips without - we don't even have to do a new CMOS process or binning or any special thing. And so it really was the water flows downhill the easy way and the obvious way. And that made it inevitable.

Well, this in particular was just drafting on that. It wasn't advancing Moore's law. It happened when it was possible to happen. And that is the continual message.

Bob Metcalfe

It was the beauty and simplicity of the CSMA/CD design that made that scale-up possible. Don't you think, Bill? Yes. Other questions? Are we done?

Thank you very much.

[End]