

Law, Policy, and the Convergence of Telecommunications and Computing Technologies

March 7-9, 2001

WIRELESS COMMUNICATIONS AND THE EMERGING MOBILE COMMERCE SPACE

March 9, 2001

DEAN JEFFREY S. LEHMAN: Welcome everyone back to the third day of the Park Foundation Conference. We have three wonderful panels in store today. I want to ask that in honor of the first panel, which is on wireless technology, I'd like to ask anyone with a wireless device to set it to vibrate rather than to ring. And I'm going to turn things over now to my colleague, the Dean of another co-sponsor of this conference, Steve Director who's the Dean of the College of Engineering.

STEVE DIRECTOR: Thanks Jeff. And since this is a wireless session I am going to turn off my cell phone, I'm going to turn off my Blackberry device, and make sure that my OmniSky device is on, though. Silence.

I'd like to welcome all of you to this session on Wireless Communications and the Emerging Mobile Commerce Space. Let me introduce the presenter and the discussants and then they'll all come up and speak in turn. I've asked the discussants to keep their remarks to between five and 10 minutes and our presenter will speak for 25 to 30 minutes so there ought to be sufficient time for questions.

The main presenter this morning is David Pine who's a graduate of Dartmouth College and the University of Michigan Law School. He began his career with a Silicon Valley law firm representing startup and high-growth technology companies and has also served as a state representative in the New Hampshire legislature. He has served as senior vice president and general counsel for Home Corporation, and also is vice president and general counsel for Radius Inc. In May 2000, he became vice president and general counsel of Handspring, an innovator in the hand-held computer industry.

The first discussant, somebody didn't pay attention (cell phone rings), is Ann-Marie Anderson who is vice president and general counsel and corporate secretary of Neomar, a company that develops and delivers wireless solutions, specifically for the enterprise market.

Next is Ronald Mann who's a professor at the University of Michigan Law School where he teaches various courses related to real estate transactions, commercial transactions and intellectual property. His current research focuses on software development, letters of credit and payment systems used in electronic commerce.

And finally George Vinyard who's a graduate of the University of Michigan Law School and is a partner of Sachnoff and Weaver, Ltd. in Chicago where he's the Chair of the Intellectual

Property, Internet and Technology Practice Group. So welcome all of you and let me turn it over to David.

DAVID PINE: Thank you very much. I'm very happy to be here and have the chance to participate in the conference. It's been a long time since I've been at the University of Michigan and it's really a great pleasure.

In thinking about convergence I ran across this interesting photograph of a typewriter tied to a cell phone. So I think that's a type of convergence. But there's a lot of convergence going on in the industry, the wireless industry as computing power, wireless spectrum and stronger processors all come together to enable a whole host of new devices that we'll see in the years ahead. This next slide just shows some renditions of what things might look like some day. Very Star Trek-like in their depiction. Wrist watches with video, all kinds of interesting form factors. But I actually brought some technology today, which I thought I might show you. It will only take a minute or two, because I think it's a great example of convergence. If you forgive me for showing my company's own product, I'd like to show it to you. It'll just take a second.

This is the HandSpring Visor, PDA (Personal Digital Assistant). And what's neat about this PDA it has this slot in back where you can insert other hardware devices to expand the capability of the device. You can put in a music player or a global positioning system or a modem, and our most interesting one, let's first just see if I can do this. Here's the device today. Your normal PDA, which I'm sure many of you are familiar with. It runs the palm operating system. But the neat thing I wanted to show you today was our new module called the VisorPhone where you take this little module, here. This is the phone and we're going to see convergence now. You slide the phone into the back of the device and it immediately becomes a telephone. And the cool thing about it is that it really kind of gives the user a whole new user experience. Phones haven't changed a lot in terms of their keyboards in a long, long time. You can do a lot of things on your mobile phone but it's hard to do, hard to store numbers, hard to conference with people, it's very hard to access the Internet. So this is an early attempt by Handspring to try to integrate these devices. So I'll show you a little functionality and we'll get back to the presentation. I'm turning the phone on now and hopefully it will get service here, it's looking for voice stream. We are connected. So with a PDA of course as you know you have thousands of addresses. For example if I wanted to call my cell (there's my list of numbers, it's a little hard to see). I could go to my work number, hit it with my stylus and then hit dial, (I'm calling my office in California at the moment). And when this comes up I'll show you just how easy this thing is to operate. What it allows you to do is to pick some really interesting conferencing and putting people on hold and things of that sort. These buttons are a little hard to make out but I can put this call on hold and then I can try a second call, just as quickly as I'm moving the stylus around. I can look up someone else and call them up in my address book and I'll dial another number. My other call's on hold and this is dialing a second number. And once this comes up I can connect these calls together, I can talk in between the two calls. It looks like it's come up and we'll move on to the next feature. It's a little hard to see but I have two calls now. I could start a three-way conference by hitting one button. It's pretty hard to do on your normal cell phone. Another cool thing about this device is, it also has, let me hang up, something called SMS (Short Message Service). How many people are familiar with so-called SMS messages? Not too many. Well in Europe today in

the month of December, last December, there were 15 billion short messaging system emails sent over telephones. And this device would allow you to do that as well. There's an SMS functionality built right in. I'll just show that and then we'll go back to the presentation. Well actually there's another thing. I'll show you this and move on. You can also have your wireless Internet, again very hard to see, but you could again connect wirelessly. So again an example of convergence today.

STEVE DIRECTOR: What was that first device called?

DAVID PINE: It's the Handspring Visor. The name of the device is the Visor. So yesterday at the luncheon Rick Snyder talked about the state of the technology environment and was wondering what the next big thing might be. Well a lot of people think it's this. They think it's wireless. I came across this quote from Morgan Stanley. It's just unbelievable; it's like the Internet all over again. Saying, "The mobile Internet is the most radical development since Marconi invented telegraphic radio communication in 1884. A confluence of technical leaps and devices, networks and applications is setting the stage for wireless to become the ultimate media." So there's a lot of excitement about this new technology.

Just to give you some sense for the numbers here because they really are quite astounding. Today voice is really the killer application on these devices. By the year 2002, 2003 a billion people in the world will use cell phones. Today in this country 110 million people or so use cell phones. In some countries in Europe, more people use cell phones than use wired line phones. Now the next phase is this emergence of data. We've already seen this to a great degree in Europe and Asia to date. I mentioned the SMS messages. In Japan, you may have heard about this i-mode service that they offer, which is wireless email and Internet access. Nineteen million people in Japan use that and it's a service just introduced in February of 1999. They add 50,000 people a day. In Japan more people access the Internet over telephone than they do over a PC. The emergence of data is happening.

And then the ultimate phase is when bandwidth becomes more available and people start to think about really intensive use of video and more broadband data. But one caveat, it does, after going through the Internet years, give one pause as to whether the hype is ahead of the reality. Because people still need to make money on all these technologies and it's a very expensive undertaking. When the major carriers in Europe bid for spectrum recently in the United Kingdom and Germany, they had to spend \$35 billion and \$45 billion in those two countries just to get the wireless spectrum rights. Then they have to build these networks. Meanwhile their phone revenues have been going down because voice has become much more of a commodity. So there are a lot real questions about how people will, use an Internet word, monetize these new technologies. But the technology is moving ahead as it always does and we'll see if the business models can stay up.

So the issues I wanted to cover today in terms of law and policy are threefold. I wanted to talk about first the role of standards in the wireless industry. I wanted to talk also about the scarcity of spectrum that we're facing in the United States, and also touch on privacy as it applies in a wireless world.

So when we talk about the standards, this becomes a real alphabet soup. It may be hard to read these little balloons but there's a lot of lingo and jargon in the wireless industry. I'll go through

this relatively quickly, but it can be hard to digest. The first question I wanted to address is, why are standards important? Every time a new technology emerges there's a pressure for a standard to emerge. I think later George will speak some about the intellectual property issues pertaining to standards and I know Ann-Marie knows a lot about new, emerging wireless browsers that also has a lot of competition for what technology will emerge as the leader. But the benefit of standards, of course, is that consumers can have a similar experience no matter where they are. Manufacturers can build devices that will work on different networks. There are tremendous economies of scale when you have a standard. When a company like mine, Handspring, wants to develop a product like I showed you, today it only works on one network, the so-called GSM (Global System for Mobile Communications) network, which is the predominant network in the world but is not so here. It's actually quite arduous for us to develop a product for these multiple standards.

But I'd like to just go over those a little bit and tell you where some of these standards are going. When we talk about wireless technology these are some of the key terms: analog versus digital. Everything, of course, is moving to digital today and there's two types of digital standards, so-called TDMA (Time Division/Domain Multiple Access), which is time division multiple access where you share the spectrum based on time, versus so-called CDMA (Code Division Multiple Access), which is a different type of standard where messages are coded. Similarly, a key distinction in voice and data. All the wire line phone systems are based on so-called circuit switch systems. That means you have a dedicated line every time you talk to someone. On a packet switch system, which is the emerging system for communications and we've seen it today with cable modems and DSL, it's very different. You share the network, you share the information. So these are key standards as we go forward.

I'd like to just briefly review kind of where we are and how we got there. You may have heard the words 1G, 2G and 3G. 1G is the analog cellular phone; those are what started in the very beginning. Today we're in 2G, so-called digital cellular, and you see there, there's a variety of standards. The first one, CDMA, is a standard developed by QualCom and they have extensive, extensive intellectual property rights on this standard, which make it very difficult for other companies in the field. The remaining standards on the page are all standards based on the so-called time division of the code. So in the '80s we were in the analog world, in the '90s we started to move to digital. Going forward in 2001 where we are now, we're moving in to a new phase, so-called 2.5. This is where this packet notion will come in. I'll talk a little bit about that. And then ultimately you may have heard this word 3G or third generation; this is where the broader spectrum will come to be.

In the United States, again there are these different standards that have been adopted depending on what carrier you use. This is very much unlike most of the rest of the world. This graph will show you in the yellow, that's the GSM carriers, GSM subscribers. You can see that's really a dominant standard worldwide. But in the United States it isn't. We have these three standards, TDMA, CDMA and GSM.

So I wanted to pause for a second and really ask us how did we get here and what does it say about regulation of telecommunications? In Europe there was, in the early days, there were a lot of competing different standards in the analog side of the business when it first emerged. And there was a real concerted effort by industry and government to get rid of these disparate

standards and really unify around one. So in the late 1980s the European carriers, with some prodding by their governments, adopted this single standard, the GSM standard. The results were much more rapid adoption in Europe in the early days of the telecommunications industry. Now the United States on the other hand, we would never do that. It's the Wild West. Every standard for themselves and let the market rule. So we just let the standards fight amongst themselves and the result is we have non-interoperable standards in the United States. Now with the passage of time that has become less of a concern because many of these carriers have built networks that are nationwide in coverage. But it was an issue in the beginning of the deployment of these technologies.

Going forward, again this next step is this 2.5G, I won't spend too much time with all this detail, but the whole notion behind 2.5G is that you have persistent access, that you're always connected. Today when you want to reach the Internet from your home or from a wireless device you have to dial up. But this 2.5G will allow you to always be connected, so you can have information pushed to you or you can use the resources when you need them. It will also bring greater bandwidth. Today's world it's 9.6 kilobits, 14 kilobits. We're going to move to a road with more like 64 to 100 kilobits and there's additional technologies in this phase that will take that even further. So that's really where we're kind of heading now.

Then the final phase is again this so-called 3 G where two standards are emerging. The so-called WCDMA (Wideband Code Division Multiple Access), which is wide band CDMA, and the CDMA 2000. Again this is a standard and it's really emanating from QualCom's work. So at the end of the day we'll still have two flavors of systems. Analysts foresee that the WCDMA standard will be adopted in Japan and Europe while the CDMA standard will be more popular in the United States and Korea.

I'll let Ann-Marie speak to some of these notions, but just like there are competing standards for phone protocols, there are competing standards for wireless browsers. HTML is of course the language of the Internet, Hypertext Markup Language. But there's a whole new standard that's developed which has quite a bit of following called the Wireless Application Protocol (WAP). And there are other protocols such as in Japan with i-mode. So, again, we see a lot of different standards trying to emerge.

So just to sum up this section. Again, I think it's an interesting case study in how technology has evolved and the pressures that are in the system to create standards. It's interesting to observe how different government regimes have reacted to those evolutions. A very much hands off approach in the United States while a little more active approach in other parts of the world.

DAVID PINE: My next topic is spectrum scarcity. Recently, former chairman of the FCC (Federal Communications Commission) calls this the most important issue facing the wireless Internet today. Now spectrum, or radio frequency, is a finite resource. You can't simply dig up the ground and put more wires in the ground. And we use a lot of it. We have TV stations, radios, wireless phones, satellites, military uses. And there's a lot of concern about whether we're going to run out. And there's also a lot of concern about the need to harmonize with, again on the standards issue, to harmonize with some protocols and standards that have been developed on an

international level. Importantly, the World Radiocommunications Commission, last summer, they adopted a number of proposed standards for this new three 3G network. But sure enough for the United States it turns out that most of these spectrums are already occupied. For example, analog cellular carriers are in some of the key spectrum that the world body suggests that we use. The military, very importantly, takes up a large segment of this very desired spectrum and, of course, they're not terribly eager to move off that. Similarly, fixed wireless operators have some of this spectrum and universities and churches have some of this spectrum, too, which led one analyst to say that when push comes to shove, universities and churches may not have the lobbyists they need to go up against some of these other interests. And then finally, you may recall from years past, the debate about high-definition television. Well that's yet another piece of spectrum that many people feel is given away to the broadcasters. The deal that was basically struck was that the broadcasters argued that they had this need for this additional spectrum and they would return spectrum once they migrated their systems from analog to digital. Well, as we all know HDTV (High Definition Television) hasn't gone very far and nothing will be happening there in the near term, so there's a great deal of spectrum there that is idle but is essentially locked up with broadcasters. So there's great political battles going on about that. When you think about this spectrum scarcity and these competing interests it really points to the political nature of these allocation issues. But this is a critical, critical matter for the United States as we go forward.

So to try to solve this a couple things have happened. President Clinton a couple weeks before he left office, probably in between doing some pardons or something, passed an executive order which urged the executive branches to work together to try and solve this problem. In the United States it's particularly complicated because there's two different government agencies that deal with spectrum. There's the FCC that deals with commercial spectrum and there's the National Telecommunications and Information Administration (NTIA) that deals with the military spectrum. So the goal of this order was to get these organizations to work together to see if they could figure out a way to allocate this spectrum. The issues that the government is now considering are, can you really relocate people from one spectrum to another and how would you deal with the economics of that or could these bands potentially be shared? The technical issues there can be quite complex.

Of course, there's always the private market again. Some interesting ideas have begun to emerge there. Chairman Kennard during his tenure encouraged the rule making that would encourage a private market for spectrum. So that it could be traded. This would help in terms of making sure spectrum is utilized efficiently. It might not help in making sure that our standards are compatible with the rest of the world. But there's also technical solutions. For example ultra wideband wireless is a new technology where you use a lot of spectrum but the power of your signal is so slight it appears that other signals would be background static. But it's just a very ingenious way of dealing with spectrum shortage.

So this is an issue that you may not read too much about in the press but it's going to be a critical, critical one here in the next years. And one thing that's very unclear is how the Bush administration will deal with it. In particular, there may be some tension between the Bush administration's support of a stronger military and the desire to free up some of the spectrum because, again, a lot of the spectrum is dedicated to military purposes.

My final topic, which we heard quite a bit about yesterday and I'll just touch on briefly, is privacy. There's some very interesting and special privacy concerns when technology is wireless and people are mobile. This also can be entitled the law of unintended consequences.

The FCC was concerned about people in emergency situations. It turns out that about a third of emergency calls are generated by cell phones. So rules were passed that said within timeframes evolving over the next few years that everyone carrying a cell phone, their location has to be known to emergency service providers and you have to be able to identify somebody's location within 300 feet with 95 percent accuracy. So it was a noble idea because you are really serving a social good. And interestingly enough of course the carriers thought this was terrible and they resisted it because they were fearful of all the extra cost it would entail. But they've changed their mind now because all of a sudden people realize that data about where you are is extremely, extremely valuable. So an industry is emerging to try to commercialize this. I'll talk a little bit about some of the ideas people have. For example you could be going by a Starbucks and get a coupon that maybe you should go in and buy yourself a discounted coffee or maybe a friend of yours is a block away and you get an alert that your friend is there suggesting that you get together and go to some local restaurant. Other ideas of course are travel-based information. When you're on the road and you're looking for hotel reservations or weather reports or driving instructions, these are all things that are very localized in nature. One, again it's amazing what people think of, there's a company called Digital Angel and their idea was that they would put little chips in people, in children so that you'd always know where your children are. People didn't like that idea so they're going to try and use wristwatches now.

But the fear here is, what's going to happen to all this data? Where you spend your time is very sensitive. Could someone in industry compile a profile of you based on where you go? In a recent New York Times article there was a story about a small businessman who ran a fleet of trucks in a city and he had these GPS (Global Positioning System) systems in all his trucks and he told his people basically "I know where you go." So I guess one of these guys didn't believe him because one time when he was supposed to be delivering goods he was at some kind of a strip show of some sort; boss saw it--gone. So this data is very personal and people have an expectation of privacy about it. So what will happen? There have been responses of course by industry and government already. And I think it's illustrative to observe the degree to which industry has learned from past experiences. You're probably all familiar with the opt-in versus opt-out notion when it comes to privacy rights. Industry associations in the wireless world are basically saying this has to be opt-in. You have to agree that this data can be collected. In fact, the wireless advertising association has gone so far as to say that it should be a confirmed opt-in, which means that once you give your consent the carrier would have to send you a notice confirming that you did indeed do that. So industry's trying to preempt legislation in this area. But already, of course, legislation has been submitted in this field as well.

So those are my remarks. I hope I gave you some taste for the industry and some of the unique problems that it presents. I appreciate your time.

ANN-MARIE ANDERSON: Hi, I'm Ann-Marie Anderson, Vice President, General Counsel, Corporate Secretary of Neomar. David did such a brilliant job of covering all of my issues that I

thought for a bit and I think it was a good thing. My route, obviously I'm a somewhat recent law school graduate, 1994, is pretty interesting. So I'm going to share a little bit of that with you, tell you about my company, what we do and then hit upon probably what's the most important issue that my company Neomar actually solves, which is security end-to-end for wireless transactions that David touched on a little bit.

My background, I'm one of yours. I grew up in Lansing, MI, Phi Beta Kappa from Albion College, Michigan Law School, followed my father and my sister to Michigan Law School but never did I expect to be in Silicon Valley, which explains my casual dress. I guess I'm the only true representative of Silicon Valley here today. I followed the big firm route. I was at Squire, Sanders and Dempsey until recently. It's about 1000 or 1100 lawyer firm and caught, the high-tech fever and have become evangelic on it. Read Andy Groves' "Only the Paranoid Survive" and "Silicon Boys" and was just convinced that the new economy was driving everything and wanted to find a way to combine my interest in law, kind of a DNA (Deoxyribonucleic Acid) thing in my family, high-tech and business. So I headed out to Silicon Valley and joined Neomar and at the time that I joined the company we were under 30 employees and that was just nine months ago. In the last nine months we've tripled in size, tripled in valuation and nearly tripled in revenues, which is a lot. In addition to my GC (General Counsel) role I also hold most of the functions for COO (Chief Operating Officer) and CFO (Chief Financial Officer) so you can imagine it's been quite a ride and exciting but a little overwhelming. I got to see it all. I rely on our outside counsel heavily you can imagine, Wilson Sonsini. We've done the pounding of the pavement on Sand Hill Road trying to convince investors that our wireless technology is really great. It's worked. I've been involved in raising \$20 million to date and that's just in the last 10 to 11 months. I just closed a round of \$15 million so hopefully developing a lot of new skills.

I'm going to tell you a little bit about Neomar. Founded in July of 1999, couple of PhDs in pharmaceutical chemistry and a couple physics majors who decided that wireless technology was imperative, I've got my RIM Blackberry wireless device here; I know that Dean Lehman swears by his as well. Dean Lehman and I trade messages on our RIM Blackberrys. Always on, was the device to have. So they got together and developed the browser a la Mark Andriessen but for the wireless device as well as the translation gateway. So we are really a two-product company. We've got the gateway and the browser. The way that works is that signals are sent out from the Internet, go through our gateway either located at our NOC, (Network Operations Center), or a NOC on the customer's site. For example one of our clients is CSFB, (Credit Swiss First Boston), and the NOC could be located there. It's translated, turned into wireless markup language, we are open standard so we use WAP (Wireless Application Protocol) where it could be any standard. I think David Pine talked about that. After it goes through the gateway, it then looks for our browser which is embedded on this RIM Device. Our browser is RIM compliant and Palm compliant. Probably be operable on WIN CE and other devices soon as well.

So that's kind of the history of our company and what we're doing. I'm going to try and walk you through, I'm not an expert at doing this but, give you a little feel for Neomar. This is not my laptop so hold on. I've got so much I can talk about I'm just going to keep on talking. You get a feel for our website and you can pull it up if you like, www.neomar.com.

I'm going to talk a little bit about security. Neomar, I believe, I'm pretty confident in saying this, is the only company that has end-to-end security, which is what people really clamor for. Yankee

Group, the big Boston consulting and analysis firm has said that 75 percent of all folks who do online brokerage transactions say that the most important thing, and the biggest thing missing, is having a secure transaction. The way security works end-to-end is, again, you need it on both ends. You need security, and security's defined as the software that scrambles and unscrambles through an elliptical curve, the data and information as it comes in. It comes in through the gateway, and then has to get scrambled in between the web and the gateway. Then as it leaves the gateway it has to get scrambled and unscrambled again before it actually goes out to the browser. Sounds easy but it's really not that easy apparently because we're the only ones that are doing it and that's probably the biggest concern right now.

I want to differentiate a little bit about what we do versus mobile commerce. I know this segment is dedicated to mobile commerce, which is really the deployment of consumer applications out to consumers to purchase goods and services. What we do at Neomar is critical business applications to enterprise consumers so it's browsing the Internet but also the corporate Intranet to get out critical information to company employees who are out in the field.

The last thing I'll talk about really quickly is what I think are about the nine or ten hurdles that are going to have to be faced in the next few years. David talked about some of them, to get universal acceptance and deployment of wireless Internet. I think the first one is better and faster coverage. I'm thrilled with my Blackberry but obviously it's not the fastest thing in the world. The packet switching networks, which are just being deployed, David talked a little bit about that. It's the burst of packetized data that go through different channels and allow you to have the always-on experience; are going to improve things but again better coverage and faster speed are going to be a big issue. Two, multiple technologies. We've talked about this a little bit. There's so many different standards, so many different devices, operating systems providers that there's going to have to be some kind of convergence or unification I think to get a mass deployment. Third, is the spectrum issue and I think we talked about that in great detail. Four is the big initial capital outlays. In addition to starting a new business, which I've just learned all about in nine months. In order to get a spectrum license you have to pay a great deal of money. I think that some folks estimate that to get a broad spectrum license might be in the high hundreds of millions, maybe closing in on a billion dollars.

The last important one is limiting mobile Internet content. The user experience on PDAs right now or mobile devices is not incredible. You get kind of limited access, some of it is web clipping, it's not a full stream web or Internet access like you would have on your wired computer. That benefits some companies if they want to have proprietary knowledge or ownership over their customers by owning certain content but I think we've got to get away from that. I think that companies like Neomar and others that are trying to get out more information on the Internet and a wider experience may lose money in the short run but clearly would attract more users with widespread Internet use. It's going to be improved. That's it. Thank you.

RONALD J. MANN: What I'm going to talk about is, builds on part of David Pine's talk about mobile commerce and I'm going to talk a little bit about the place where you can see mobile commerce really as a significant part of the economy already to get a sense for what we might see here in few years when we start to have it here. This is basically what I did this fall because I

spent the fall in Japan and this is the main thing that I studied over there. So the first thing, not to disagree with David, maybe I got my statistics two weeks later than him. It's growing so fast. There are now about 30 million people in Japan that have Internet-enabled mobile phones. This is in a country with a population of about 125 million. We're very proud and self-congratulatory that 58 percent of the people in the United States can access the Internet. Okay, well a quarter of their people access the Internet over mobile telephones and I would suspect that not anyplace near 10 percent of the people in this room, which is not really a representative slice of the United States, have Internet-enabled mobile devices already. It's just a completely different world.

And of those people, and not of the 30 million because this was several months ago, and several months ago there were probably only 10 million people on i-mode, about half of them are buying things so this is a market for Japan, more people buy things on cell phones on the Internet than buy things from computers on the Internet. Now the reason for that has to do with the fact that their land-line telephone costs are several multiples of what they are here, so ordinary people who aren't multi-millionaires can't have Internet access at their home. So for most people their only experience with the Internet, aside from the desktop computer at their office, is their cell phone. They buy things with it constantly. Obviously, as someone suggested, one of the main things they buy is information. Here the primary Internet merchants are people who are selling to people who sit at their desktops in their offices, their houses. People who sell information have not really succeeded very much yet. Not that they aren't going to succeed, it's just been very slow. And there are a variety of reasons for that--some of which have started to recede but which have hindered it in the past. One is there just is this obvious free-rider problem, which is if you sell someone a piece of information if it's really, really valuable then fairly quickly they can just sell it to someone else and it's hard for you to really capture the market of everybody that wants to buy it from you. Sort of the flip side of that problem is that information isn't valuable for very long. You can't charge somebody a lot for something today and then sell the same piece of information tomorrow for the same price. The price is going to degrade very rapidly. A related problem, which is one that I think is really going away, but was a problem in the design of these things, is the value of information that you're selling to people given these problems is going to be fairly low. And until very recently the payment systems for paying for things that might cost 50 cents or a dollar or two dollars were just really not compatible even with desktop computers, much less with a cellular telephone.

Now, in Japan information merchants are very successful. And this is not because they have cell phones that provide a very rich Internet experience. It's much like the previous speaker suggested, it's even more clipped. The screen on an i-mode, it is bigger than a thumbnail, but it's about the size of the mouse pad on this computer. It's a very small screen, it is a very impoverished experience, but people still pay for it. Since it's Japan certainly the highest revenue that people get is purchasing information about these various characters. Sanrio characters, the children's cartoon characters, and you can laugh and say that's not really Internet commerce but that's easy for you to say because you're not making the money. The people that sell this stuff, five million people in Japan buy this stuff every single day, well, then it's a significant market. People also buy up-to-the-minute news information. They get stock market information, various things. I don't know what I was thinking when I did this slide--the thing that all the people in my office did is many people do all of their banking, there's a lot of financial services that's done by mobile phones, this has to do also with the fact that in Japan so much of payments are made by bank transfers because people don't use checks, and you can do this all from your cell phone.

Very few people in the United States, I think, now conduct their banking at all over their cell phone. In Japan, for executives this is just very common. All the people in the office that I worked with did most of their banking and paying bills either with their cell phone or with some similar type of device. Potential markets, many of the things that Ann-Marie talked about, these things as simple as getting directions to places, this all hinges on global positioning systems and similar things. The location data is very valuable and people in Japan are already starting to use it some. Reservations at restaurants is another application that seems to be making headway there.

Now as this develops what you see is that in Japan the Internet is developing somewhat differently than it is here as far as the commerce for consumers because a much larger share of it is mobile than there is here. For my particular area of research the most interesting thing is what this says about payment technologies. There's a much more urgent demand in Japan for some way to pay for things by micropayments than there is here because not very many of us are buying things with our cell phones. We aren't paying for those things very much. And in Japan there's millions of people that are doing that. So they've had to respond to that problem earlier than we have.

The other thing's that's most interesting is, it affects the design of the cell phone. The cell phones in Japan, not only does everybody have them, but they're very small. It has to do also with they're very stylish and they come in pastel colors of various kinds and they're not going to get bigger I think. The problem is they're so small that it really rules out using a traditional credit card or debit card as a payment device because they're so small you can't put a slot into them to use a card reader. The cell phones in Europe, which many of you will be familiar with, those are a perfect size for using credit cards and indeed the cell phones in France already have a slot into which you can insert your credit card and, with the proper encryption technology, you can use your credit card to pay for something on a cell phone. That's not going to be able to work in Japan because their phones are just too small. They will have to go to some alternate device. That's really all I had to say.

GEORGE A. VINYARD: My name is George Vinyard. I want to thank Dean Lehman and Dean Director and the other sponsors of the conference for the opportunity to speak here. It's so far been a tremendous experience, and the interdisciplinary aspect is good for reasons that I'll go into. As an overview, I'll try to make some general observations. I, too, agreed with most, if not all, of what David had to say, and the other discussants. Along the way I'll try to throw in some specific comments about the presentation but I will focus most of my remarks on standards and intellectual property.

One of the things, by way of general observation, that I've noted and I always thought this but it's really been brought home here, is that this topic is huge and it's complex. It's very difficult to get any kind of overview and get your arms around it. It's always nice, I think, when confronted with that kind of situation to have a nice pithy statement that has the ring of profundity about it to kind of sum things up, at least superficially. The one that came to mind for me, in this context, contemplating the way our inevitable limitations in our own personal experiences and perceptions, perspectives and knowledge restrict our vision, I heard from an engineer, very appropriately. I forgot his name but he said something like "if your only tool is a hammer every

problem (he could have said every opportunity), begins to look like a nail." I think this is even more true if you happen to make your living as a carpenter.

I'm not a carpenter, but I'm a lawyer, I used to be a corporate lawyer, maybe still am. I'm now an intellectual property lawyer who never prosecuted and has barely read any patents, but that doesn't stop me. More relevant for this purpose, I took a little detour in 1994 when Ann-Marie was graduating. I went to work at a company called U.S. Robotics at a very exciting time. At that point it was already a \$200 million a year company, an overnight success after 17 years in business. During my first year it accelerated to \$500 million and three years later when 3Com bought us it was at a run rate of about \$2.25 billion a year. That's probably less now because of Moore's Law and the pressure to decrease cost in the industry and the greater integration of the industry. But that gives me a unique perspective, I think, on some of the issues relating to standards and intellectual property that I'll talk about a little bit later and generally a perspective on the industry from the network equipment side.

Another thing I've observed, generally, is that the use of language is really treacherous in this kind of discussion. It's easy to get caught up in the hype and the excitement of it and the title of our little presentation here about wireless communications and the mobile-commerce space reflects this. I'm glad to hear there is some wireless mobile commerce somewhere, I think it's in Japan. And even in the title of the conference generally, the reference to convergence suggests an imprecision that's probably understandable for a lot of reasons, but we need to keep it in mind when we're really trying to figure out what's going on. Convergence versus integration. I learned about convergence talking about the convergence of functions onto a single network. Take the data network and the phone network in an enterprise and put them over the same network; put those functions on the same network you don't have to duplicate. That's a little different for me than integration of products. Putting more features and functions into ever smaller, more portable boxes. And I don't know whether that makes a real difference but it is a technical imprecision in the use of the language.

Privacy versus data protection. It's instructive to me that in Europe they talk about data protection laws. In the U.S. I think for political reasons, we have a rhetorical device. Privacy rings bells with people, so we call everything privacy even if we're talking about public records of public acts. Somehow we have a privacy expectation or we want to make people think that it is there, and of course there's very good reason to be very concerned about protection of data. Calling it privacy may work politically, but it may obscure some of the analysis.

Hype is everywhere. Everything's bigger, faster, more profound and the danger there is you're focused on what's hot and the next big thing, and you lose track of some of the basics. And buzz gets stated as fact. One of the tip-offs for me is the short list of applications that people give and I'm glad to hear there are more things happening in mobile commerce. But for a long time, when we at U.S. Robotics bought Palm before it had launched a product, we had a vision of taking a handheld device, making it important and then making it mobile, using a modem of course. It took a while for that to develop but it's finally here. Along the way you kept hearing over and over that people can be anywhere and do anything at any time. But mainly the examples that were given were that you can get sports scores or you could get stock quotes. So I kept thinking, "well how big is the market of day traders?" Turns out it was bigger than anybody expected, Mobile day traders. Still I'm not sure. How big is the market for sports scores? Well there are

sports nuts and then there are gamblers. Now we talk about travel directions and global positioning, and that's the market of lost people. It may be a bigger market than we think, too, I don't know.

Wireless is clearly huge; it's all over. And the number of cell phones is staggering. It's not clear exactly what's emerging though and it's not clear how much wireless commerce there will be, but what seems clear is that it's contextual. Part of it is what you want and need from the wireless system. These different standards are also different technologies of transmission and they have different capabilities to some degree and they may or may not be adaptable for what we want. What we want may be accessibility, may be flexibility. Wireless is inside the enterprise, too. If you can use infrared to communicate between devices then you don't have to build in wiring, you've got a lot more flexible space. Just the use of the word "space" in the title--"Internet commerce space" is a little bit fanciful. I think the most relevant consideration today may be physical space. Getting back to discussions the other day about clothing and chairs, we had speakers who said the real thing is what kind of chair you're sitting in or what kind of clothes you wear when you're on the Internet. I think in mobility it's the shirt pocket. The real thing is that the device has to fit in your shirt pocket. In Japan, aside from the cost of the network, more people may be mobile because they have less space at home to spread out with that population crammed on small islands. Really important, wireless is going to be huge in places where there are no wires at all. That's where it's the cheap way to enable communications.

So two final things in the way of general observations. One is that Moore's Law doesn't apply to everything in nature and power consumption and storage is something that's important in this area. There's a small company in Chicago that I would have worked with. This is a prototype of their product--a holster for your cell phone that doubles the talk time by doubling the power. It also manages the power consumption. A lot of things in wireless phones even within the home, a lot of the failures, have to do with people not understanding how the power consumption works. A lot of the returns early on when those products were launched had to do with battery problems.

Finally, I don't know what the implications may be, but we haven't spent very much time at this conference talking about tax systems and the policy implications of all of this for taxes. There's been a lot of activity. States are very concerned just about capturing sales tax. I don't know if the added element of mobility even makes that more dramatic, but you can imagine with more people telecommuting and just being mobile, this may affect sales taxes and even income taxes. People will start having remote offices near states where there are heavy income taxes; put your employees in the state next door and let them work remotely.

Standards. A lot of it was very well covered by David and I don't have a tremendous amount to add but I'd like to reinforce it. Standards are hugely important in everything we do, but they're often invisible. They're most noticeable either when they're lacking or they're dysfunctional. We wind up confronting stupid old standards. When I was in Chicago they replaced the feed from the water main to my house and they did it with lead pipe. And that was because it was required by the plumber's union, in effect, because it's required by the building code. That didn't make me happy, but most standards are very functional and they're invisible because they work. And they're essential because they accelerate market growth; they reduce product cost many different ways; they increase, actually, competition in certain areas in terms of innovation in things that are peripheral to the standards, encourage people to bring in complementary products. And there

are economies of scale. They can save lives. You want high standard bolts in your airplane, holding it together.

And in a network environment, they're absolutely essential because of the importance of connectivity and interoperability. At some level, the systems just won't work at all if there aren't standards. Where do they come from? There are two big categories. De facto standards, some of which are prehistoric, have to do with the size of people's hands, what the convention is on how they put buttons on clothes and pockets and so forth. They are commercially successful, basically, just winning the race to be first and to establish what becomes a standard. Sony Betamax and VHS (Vertical Helix Scan), are illustrative of that. This is also illustrative of the fact that having a standard is often more important and more valuable than having the best standard. At least that's the way it's characterized. And at some point customers require certain standards to be met. Customers set the standards.

The government also does that a lot. There are government standards established for contracting and these influence whole industries. These are de jure standards. They might be private collaborations enforceable by contract, also, and I would like to say more about this in a second. IP driven standards, open source type standards, where the enforcement mechanism is essentially intellectual property law. There are quasi-official standards established by trade and professional groups. And then there are official standards, some of which are voluntary and some of which are legally mandatory. Building codes are mandatory, the International Telegraphic Union (ITU) recommendations are theoretically legally voluntary but once they're set, because they're international and it's important to have telephone communications worldwide, they become commercially mandatory.

The legal policy questions are multitudinous, and I think, are going to get more important and get more attention going forward. Who sets the standards, what processes are used, who enforces them, how they're enforced and how they get changed? One of the things about standards is they can be a bar to innovation in certain areas and they're very difficult to change because so many people get so much invested in them and the number of people who have a motivation and a will to change them is much smaller. What's the proper role of government in establishing, enforcing and changing standards as a customer, as a legislative forum and as a judicial arbiter? Standards play a role in tort liability, and, of course, they have implications for antitrust law.

And finally, there's intellectual property law. What is the impact of standards on intellectual property law, and what are the implications for standards that come out of intellectual property law? I think it's mostly a patent game, in this area at least, but there may also be copyright impacts.

A couple things about copyright that I think are interesting. There was a comment the other day about how maybe we should have shorter duration for copyright protection for software. One of the things to consider in looking at that is whether that would weaken the movement toward open source standards, Linux and others where you get it for "free" but basically if you want to use it you have to agree to do certain things in terms of how you share developments. A long period of intellectual property protection that gives an enforcement mechanism to the people who want to keep the source open against those who might try to "game" the system is worth contemplating. There are some problems too, of course, in copyright law having to do with clarity about what

counts as a derivative work when you're talking about software, and confusion in general about works made for hire and third-party creation.

In patents, there's a lot of impact on this whole area generally and on standards in particular. Patents are a very high-stakes game with tremendous uncertainty about the scope of coverage, valuation, and enforcement against other competitors. Who owns it; what are their motives? There's incredible complexity in this area. A lot of patent thinking appears to be based on a fairly simple commercial model, like pharmaceuticals where there's one patent, one product, one-to-one coverage, that's it. In communications systems the technology is massively complex, the markets are new and developing, very complicated and difficult to understand. The substantive patent law, of course, is complex, but you get an added effect of stacking. A PC is an incredibly complex device--You hook it up to a network, it's an even more incredibly complex system and there are literally hundreds of patent holders and thousands of patents implicated. And then standards are changing so fast that what may be an important feature today that helps sell the machine becomes a secondary feature later on but it still needs to be there for backwards compatibility or for basic functionality. So how do you value that?

Well, when it comes to making standards it's an incredibly complex game that gets played. The people who are the players often have big patent portfolios. There's a lot of jockeying back and forth because the question is if a particular piece of technology gets built into a standard, so that everybody has to use it in order to comply with the standard, what does that do to their vulnerability to patent attack. Many of the standards organizations don't really try to answer the question of valuation, they simply want to guarantee access. So the International Telecommunications Union, for example, will require participants to disclose whether they have a policy of licensing their patents that are essential to the practice of standards on a non-discriminatory and reasonable basis. And everybody, of course, says yes, but they won't tell you what they think reasonable is. Sometimes they don't know because the patents haven't issued yet because the patent system is bogged down and underfunded and understaffed. So you wind up with the standard getting set and three years later the patent's issued and you figure out then what counts. And of course a lot of the standards are fairly arbitrary so there's a lot of back and forth horse trading about which big patent holders get their technology into the standards. And then what do they do with it, what do they think is reasonable?

I'm running over so I'll stop now, but suffice it to say that there's a tremendous amount of uncertainty and unsettled areas of law in terms of what the remedies are when you have patent coverage of essential standards. And you have a very uneven playing field in terms of the patent holder who wants to enforce against somebody who's already adopted the standard and is required commercially to follow it. If the patent holders have the ability to shut somebody down or extract a high price pretty soon in this area you could have the intellectual property cost vastly outpacing the actual cost of production of the product. And that is something that I think will need to be resolved. Thank you.

STEVE DIRECTOR: We have several questions. The first one is, how do you see the emergence of interaction or interactivity between mobile and stationary devices, i.e. in particular

Handspring device and the television? What are the standards emerging in this area and what kind of regulations are involved in terms of spectrum and any other.

DAVID PINE: When I think about the Handspring devices, we're so focused today on mobility of the device, we really look at it as a separate piece of hardware than as something that you'd have on your desk. I'm sure many of you know you see people always trying to add more to the small Palm or Handspring device. Like an expandable keyboard to make it more like something you might have on your desk. In my experience I really see these devices going in a separate direction from those devices on your desktop. And those devices, I think, will have very different purposes. The wireless world in my opinion will never catch up with the type of capability you can have with a wire into your home. There's tremendous data rates possible there so I think there will always be some distinction. I think they'll have different purposes.

STEVE DIRECTOR: Do you expect Handspring devices or others like it to use Bluetooth technology?

DAVID PINE: Blue tooth is an interesting concept, which basically creates what people are now calling a personal area network where devices can communicate to each other so that if you look here in front of the room with all these wires everywhere, you can barely walk, that would go away. The devices would have, again, another standard so that they could communicate. That actually is an interesting point in that there's an example of where the mobile device would be linked to a more stationary device. There's some beginnings of that today, like at some airports, as I understand it, there are these wireless "stations" where you can essentially link your PDA to these special networks. So there is some of that coming.

STEVE DIRECTOR: Technology is becoming global but government law and spectrum are all local or at least national. What steps are being taken internationally to address this convergence of global commerce and technology? It's an open question to anyone on the panel.

GEORGE A. VINYARD: I don't know what steps are being taken but there is a kind of infrastructure that could be used. With the proliferation of standards and technologies, there's also a proliferation of standards bodies, or ad hoc groups, a lot of which are pretty international but there are some that are officially so. The International Telecommunications Union has been around for a long time. It was there for the telephone network which, had to be interoperable at some level internationally. The biggest problem is, it's a cumbersome process and it's also one that, perhaps it's a problem, is fairly dominated by a few very large companies that have people to send to all these meetings and have a long history of very successfully navigating the waters there. There are a lot of games that get played using intellectual property as leverage and basically in some cases using stalling tactics. Frankly, there's a big advantage in being to market early and so sometimes it's in the interest of companies not to have a standard very fast because they need to catch up if they happened to bet on the wrong technology earlier. There's just a lot of that kind of stuff that goes on behind the scenes. Maybe looking at those and trying to develop better processes and a little bit more governmental regulation from the standpoint of having an open process that's more timely and less dominated by industry, although with plenty of industry participation, would be something that would be worth doing. There's been some talk, but pretty

much just talk, about developing some kind of a mechanism for sorting out the intellectual property aspects on a collaborative basis and if that were done, if there were structure for that, it might speed things up a little bit.

STEVE DIRECTOR: Okay I'm going to read this question the way I think it was meant. If not the person who wrote it please jump up and correct me. Can you distinguish Smart Card payments versus credit card payments? I think the criteria that they'd like that distinguished is timing, in terms of timing of funds transferred, the players involved, the card readers that are used and government regulation.

RONALD J. MANN: Not in five minutes. But I can say a little bit. There's really two separate concepts for smart cards when you use that term. Literally, a smart card is just a card which normally, for obvious reasons, tends to be precisely the same configuration as a credit card, which is enhanced with a microprocessor. So, for example, you could say that my University of Michigan identification card is a smart card because it has a chip in it. If you purchase something with this card, the payment would be made effectively with what is a stored-value system. You could buy something at the Wendy's in the Union across the street. In that transaction, the way that the funds are being transferred is essentially the person has loaded the money onto the card by giving the money to an entity related to the university. And then when Wendy's provides the transaction data--which is some bits that they get off of your card--to that entity they'll get the money for it. There's relatively little government regulation of that transaction and in particular there's currently no regulation whatsoever on the people who are allowed to store the value, which is to say that it's not required to be banks, which is to say that there's no deposit insurance or other protection for the people that put the money onto the systems. It's also true that the systems are not commercially successful and that the largest systems currently are ones like this that are limited to very small environments almost entirely located on universities or military bases. In the short run, the likelihood that there would be a larger commercial use of smart cards relates to credit cards. In this country in the last three months, several of the largest issuers have started to issue enhanced credit cards. Fleet, Provident and First USA. So I got my Fleet smart card just the other day. Unfortunately the software really doesn't work with Windows 2000 and I suspect that's a problem for them since you can't use the software apparently on Internet Explorer. That's sort of a problem for its wide use at the moment. On that card, the integrated circuit is a device to enhance the security of the credit-card transaction.

Credit cards in this country are overwhelmingly the dominant source of payments on the Internet. In other countries they're a large, not dominating source, but they're also wildly insecure. Visa and MasterCard don't really promulgate the data widely because it doesn't reflect very well on their systems, but the rate of fraud on Internet transactions is probably around 10 to 15 percent. Compare that to a face-to-face retail rate of fraud on credit cards of about six-tenths of one percent. So six cents on a hundred dollars and a rate for debit cards of about 0.3 cents on a hundred dollars and \$15 of fraud on the Internet is just very difficult. And merchants have to pay for all that because that's just the way the system's set up. If you have a smart, a chip-enhanced credit card with which you make the payment, the idea is that the person when they put the card into a card reader, which I have attached to my computer, you will enter a PIN (Personal Identification Number) and then the card will only activate and allow the transaction to proceed

if the PIN that you enter matches the PIN on the card. It might be easy in a few years to use a biometric identification device but the point is that the chip in the card allows you to authenticate the transaction and it's expected that it would lower the fraud rate to something like the rate on debit cards, which is 1/20th the rate of credit cards and perhaps a thousandth the rate of fraud on Internet transactions. But those transactions are just processed like credit-card transactions and so they have the regulations credit-card transactions do, which is principally the Truth-In-Lending Act (TILA).

STEVE DIRECTOR: Okay, thanks. Do you see a new e-commerce/military board being established to work along with the FCC to cover the spectrum cost and compatibility issues that were discussed today?

DAVID PINE: I'll comment on that. I'm not optimistic that there's going to be in the end a lot of cooperation just because of the highly politicized nature of the issue. It actually was quite historic that the Department of Defense would even give any consideration to sharing their bandwidth. But I don't know if at the end of the day whether that, they'll yield much ground. One thing about a resource, when you don't have to pay for it you probably don't use it too well. To date the military has not had to pay for their spectrum. I think the political forces are going to make it difficult for some real convergence there.

STEVE DIRECTOR: Okay. The last question that I have is what role will satellites play in wireless communications? Will more have to go up?

GEORGE A. VINYARD: First, some are coming down or have come down. I think it's pretty clear the satellites that are already up are making a big difference. This global positioning thing is all off of satellites and if that system hadn't been put in place and then made available for private use a lot of the potential applications that people envision as helping to drive the commerce and mobile space wouldn't be there. But then there's always the Iridium experience where several billions of dollars were spent putting up satellites to enable a handful of CNN reporters to make phone calls from out of doors on the Steppes of Central Asia or the Amazon rain forest and they found out nobody wanted it or needed it. It all went down the tubes.

STEVE DIRECTOR: Okay, I have another question and actually this is a really interesting one because it opens up, in my mind, the whole issue of the interaction between technology and policy. Why not rely on technical solutions to multiple standard problems? Interoperable systems and multiband telephones can let consumers hedge their bets while proceeding along parallel and competitive paths. Each of you touched on that to some degree.

GEORGE A. VINYARD: Well, I think it's clear that technical solutions in some circumstances may be a problem and there's kind of a mantra that says choice is what consumers want. The

stumbling block comes with the massive investment that's required. It's not just inventing the technology; it's deploying it. There are certain constraints. Money is one, power consumption is another. And the other thing is just consumer inertia or user inertia. Until there's a standard, until it's clear what's going to be offered and how many people are going to support what's offered with complementary products, people don't make the investment. U.S. Robotics was trying to launch a 56K modem and had it ready to go and had one that worked great, but the standard was delayed for several months because other people weren't quite ready. So there were two competing modem standards. I can tell you we sold a lot of modems during that period but we would have sold a hell of a lot more if there had been an accepted standard. Everything in the press was, "Don't buy one until you find out what the standard is." Basically people just don't have time or the inclination to deal with multiple standards. Unless you make the investment to make the technological solution to multiple standards and interoperability invisible, behind the scenes, and people aren't inclined to do that, especially if there are proprietary systems where they might be buying a law suit, then it's going to be hard to persuade people to actually jump into the market and participate fully.

ANN-MARIE ANDERSON: I agree. We won't have mass adoption until there's some agreement on standards. You probably followed over the summer the WAP fracas. You know WAP is the Wireless Application Protocol. It's the standard that most of the wireless devices are working on now. The headlines in the Wall Street Journal were "Is WAP dead," "WAP is dead," and so on and so forth. Really that's the predominant language right now. I think it was Nokia, Ericsson, it was the Finnish companies that started that standard in 1997. They took a risk and I think it's going to involve, as George mentioned, a huge capital outlay and a lot of confidence and exposure to risk and appetite for risk to go with a standard whether it's the translation standard or operating standard or browser or device.

GEORGE A. VINYARD: Let me just add one thing. You may have heard in the various Microsoft reports, the endless amount that's been written about that, the term "FUD." I hadn't heard about FUD until I got into the corporate world. It's fear, uncertainty and doubt. If you don't think it is a weapon of competition or, in some cases, restraint on competition, you're sadly mistaken. Because there will be fear, uncertainty and doubt, the real thing you get from standards is certainty in terms of opening a market.

STEVE DIRECTOR: This will be the last question. It's pretty focused so David be prepared. Mobile commerce misframes the question. The question is how to connect everyone to everyone else whether through commerce or not. I-mode is exactly the wrong example. Metrocom's Ricochet and Apple's AirPort are much more interesting. Why isn't an equipment manufacturer like Handspring pushing for license free solutions that free them from reliance on spectrum owners and lowers costs of deployment?

DAVID PINE: I've followed the Ricochet over the last few years and it's an incredibly promising, impressive technology and impressive solution that they offer. But, they haven't been able to deploy it. It's only offered in a few metropolitan areas and currently their financial situation is quite dire. A company like Handspring actually we have limited resources and kind of, like it or not, to a certain degree we really have to go where the biggest market is. And that's

why our first wireless product is based on the GSM standards, the most commonly adopted standard. So I think the example Ricochet points out how hard it is for an upstart technology to actually get momentum. I-mode managed to do that, but Ricochet hasn't. So that makes it a challenging situation for equipment manufacturers.

STEVE DIRECTOR: Okay. Well please join me in thanking our panel. Jeff you have something to say? Time for the next panel.