

1 by those who develop the standards for these kinds  
2 of devices, where as was pointed out, the cost of  
3 computational power and the ability to do fairly  
4 complicated signal processing, and adapt  
5 dynamically to a time frequency geographic location  
6 environment, and basically, find all of the holes  
7 in the spectrum out there that aren't being used,  
8 and use them on a packet-by-packet basis even,  
9 perhaps. You know, the period could vary, you  
10 know, from small fractions of a second to, you  
11 know, hours or days when chunks -- significant  
12 amounts of spectrum are lying fallow because  
13 they're allocated to specific uses under this  
14 property rights sort of allocation model, and they  
15 can't be used by other systems.

16 By going away from this property rights  
17 model and allowing this sort of dynamic sharing,  
18 that's where the additional bandwidth for the  
19 future applications can come from in many cases.  
20 You run into the issue of how you deal with the  
21 incumbents who are, you know, going to try and  
22 assert their property rights and, you know, keep  
23 those pesky new-comers out because of concerns of  
24 interference, but that's where you get into the  
25 etiquette thing, where this -- you know, with a

1 relatively minimal set of rules that describes  
2 perhaps the behavior of an etiquette, or some basic  
3 requirements for an etiquette like - okay - you're  
4 going to share in a band that is nominally used by  
5 these people, and you're going to use little bits  
6 and pieces of time and frequency space adaptively.

7 You will listen for the primary user and avoid  
8 them, and I think that's a very powerful model for  
9 the future.

10 DR. MARCUS: Okay. Thank you very  
11 much. Vanu is a designer of these types of things,  
12 and perhaps more hands-on than some of the other  
13 people here. Could you say a little bit about when  
14 you think these things will be available, and how  
15 powerful fancy protocols might be in the next  
16 couple of years?

17 DR. BOSE: All right. I -- so there's  
18 two categories of devices in this case,  
19 infrastructure and what we'll call client devices,  
20 whether they're in your hand, fixed local devices  
21 or even in a car. And the technology track varies  
22 on the two cases.

23 On the infrastructure side, the  
24 technology is basically ready today. There are  
25 less constraints in terms of power and size that

1 make it feasible to implement these systems in  
2 infrastructure devices today.

3 Now the cost isn't necessarily all that  
4 low at the moment, but this is really a chicken and  
5 egg problem. For example, to do the kinds of  
6 things we're talking about, and maybe not just in  
7 one band but across bands. Like maybe you'd want  
8 to look at the 900, the 2.4 gig band, and the 5.8  
9 band and be able to grab the chunk you wanted at  
10 the time for the application you wanted. Well,  
11 that requires a very, very agile front end.

12 Now technically, there is no real  
13 barrier to building those front ends, but business-  
14 wise nobody is going to invest the 20 to 30 million  
15 dollars required to build one of these chips,  
16 because there's no market where you can currently  
17 use it, so the technology is ready. There needs to  
18 be the incentive for people to see there's a market  
19 for this, and that the rules will allow us to use  
20 these. Not only allow us, but it will be  
21 preferable to do it, in order to push the  
22 technology along.

23 On the hand-held side, things are  
24 further out because power dissipation is a number  
25 one factor. Inherently, when you build a device

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1 that's more flexible, it's going to take more power  
2 than something that's single function. Okay?  
3 Anything that's single function you can always  
4 optimize for one purpose and make it low power.  
5 But I think in three years, you'll start to see  
6 some devices and certain applications, and in five  
7 years the technology will be viable for things like  
8 cell phones.

9 MR. LEARY: May I make a brief comment?

10 DR. MARCUS: Yes.

11 MR. LEARY: To expand, I think it's  
12 important as we get started here to kind of  
13 establish some definitions as I -- at least as I  
14 perceive them. I've read all the comments from  
15 everyone, at least on this particular panel, and  
16 most of them center around the concept of wireless  
17 as broadband.

18 I think it's very, very important to  
19 recognize, as Vanu just commented, that there's  
20 infrastructure and then there's client devices, or  
21 as what we might say, the last mile versus the last  
22 hundred feet. And it's important for people to  
23 recognize that those two technologies, as they  
24 exist today are -- although they have, share a  
25 lineage, they're extremely different at this point.

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1 And it might surprise people to know that in the  
2 wireless broadband base where you're doing last  
3 mile, creating coverage over a broad geographic  
4 area, that there is not one company today that uses  
5 wi-fi based technology in scale within their  
6 technology to do this sort of thing.

7 Our's, maybe, is relatively close, but  
8 you have Proxim's Multipoint, Tsunami, Mind Breeze  
9 Access and many, many others out there in the  
10 marketplace, and none of these are wi-fi based.  
11 And it's important that we don't get maybe carried  
12 away thinking that that is the predominant, you  
13 know, technical savior out there for unlicensed  
14 that exists in probably its best application in the  
15 last hundred feet, whether that's in a public land,  
16 or in someone's, you know, private network.

17 DR. MARCUS: All right.

18 PROF. RAO: So the comment I want to  
19 make is that as services get deployed and the  
20 uptake goes up, it'll be important to keep in mind  
21 that there'll be competing systems that you'll need  
22 to simultaneously collaborate and compete in this  
23 space. And I want to sort of make sure that the  
24 rules that govern the forms of collaboration that  
25 are allowed in the Part 15 keep up with the

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1 increased sophistication of how these things  
2 happen. So, for example, right now if I'm not  
3 mistaken, 15.247.8 prescribes exactly what kind of  
4 frequency hopping you can do, and what kinds of  
5 frequency hopping you cannot do, even for the  
6 express purpose of avoiding collisions. I think  
7 these sorts of things have to be revisited if it turns  
8 out that there are more higher level notions that  
9 allow for open competition between competing space.

10 I think we have to remain open to that.

11 DR. MARCUS: Let me ask Dudley one  
12 question. You mentioned the problem you have with  
13 antennas. As the only one on the panel who  
14 actually operates these systems commercially, are  
15 there any other regulatory problems that the FCC  
16 might be able to fix?

17 MR. FREEMAN: I think one of the fine  
18 points that we have to establish either  
19 independently or through the FCC, sometimes our  
20 database and registration situation so that all the  
21 paths that are put up around the country, there's a  
22 database you can go to and try to coordinate. It's  
23 very, very important that we do it today. And I  
24 think it's important to do it today before we open  
25 up more bandwidth, because it's even going to be

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1 twice as bad as it is now.

2           What we're finding is we go out and do  
3 frequency coordination. We coordinate with our  
4 tower providers. We coordinate the entire path  
5 once it's engineered. There are many, we'll say  
6 cowboys out there who just point and shoot. And I  
7 think it's important to get the manufacturers  
8 together with the customers or with some type of  
9 coordination protocol, whether it be with the  
10 Wireless Communications Association, with someone  
11 like Comsearch or one of those organizations, that  
12 can pull together or take this information, put it  
13 into a database so people aren't stepping on one  
14 another. And I think it should be done sooner.

15           DR. MARCUS: Okay. Pierre, and then  
16 we'll go to the audience.

17           DR. deVRIES: Yes. I mean, to pick up  
18 on this point coordination, one of the reasons why  
19 we've been very interested in the space is we look  
20 at the broadband networking to the home situation,  
21 and we feel that we need to find additional ways to  
22 provide broadband capacity. So one of the things  
23 that I think was pretty commonly mentioned in the  
24 previous panel was it was good to say let's do  
25 networking, let's do packet networking.

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1           And once we start thinking about that  
2 problem the question arises well, you know, what  
3 situation are we in, and where are we going? And I  
4 think where we are now is that the FCC in large  
5 part, I think, assumes that the devices that  
6 radiate are dumb, more or less. So essentially you  
7 say what are the characteristics of this device,  
8 and so we'll set the characteristics of its device,  
9 and then when it's out in the field, we're done.

10           What's changing is the devices are  
11 becoming smarter. They have more and more  
12 processing power, and they can, in fact, react to  
13 the situation they find themselves in. I've  
14 actually spoken to some vendors who are inside each  
15 of their little access points building databases of  
16 the environment that they find themselves in, and  
17 what the other radiators are, so that this kind of  
18 coordination, there may be centralized  
19 coordination, but there also needs to be  
20 coordination everywhere.

21           We have these smart devices. We need  
22 to get to a point, or we need to have part of the  
23 park open to devices that work well together. And  
24 that they actually take into account what else is  
25 out there.

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1           The reason why we have to do that is  
2           that it's not just, you know, systems where there  
3           are administrators. WE're very excited by what's  
4           happening in 802.11, and one of the things that we  
5           see thee is that it's customers, citizens going out  
6           and putting their money on the table, and buying  
7           their own devices. They build their own networks,  
8           and in some cases, there are administrators, but  
9           these people are volunteers. And over time, if  
10          we're really going to get adoption of these  
11          technologies, you need to be able to go to, you  
12          know, the retailer of your choice, buy the device,  
13          bring it home and it will just work together with  
14          all the other devices that are out there. And in  
15          order for that scenario to play out, and we think  
16          it's essential that we enable that, we need to have  
17          smart behavior. We need to get onto the Moore's  
18          Law curve of these devices.

19                 DR. MARCUS: Okay. Thank you very  
20                 much. We'll now take questions or statements from  
21                 the audience. WE're willing to be a little  
22                 flexible in the subject matter. We wish that you,  
23                 within reason, try to keep it so this general  
24                 question of what type of rule changes might be  
25                 needed either to enhance Part 15, or to enhance the

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1 protection of systems from Part 15. And please  
2 give your name and affiliation at the beginning of  
3 your statement, and we'll start in this corner.  
4 We'll try to alternate sides.

5 MR. SNYDER: If I could ask the  
6 question I asked before. What is the FCC doing in  
7 relation to coordinating possibly GPS and  
8 Unlicensed Spectrum to have variable power levels,  
9 directionality, so that if you're in a rural area,  
10 you're not stuck with the limitations of the power  
11 levels of wi-fi and whatnot? Is that an issue on  
12 the table?

13 DR. MARCUS: Well, fortunately my boss  
14 would like to answer that, and I'm sure he has the  
15 right answer.

16 MR. THOMAS: Yeah. I'm Ed Thomas for  
17 those of you who don't know me, Chief of the Office  
18 of Engineering and Technology. Your question --  
19 the way I read your question is, what are we doing  
20 to take advantage of the fact that the spectrum is  
21 not heavily used, say in rural areas, and more  
22 heavily used in metropolitan areas?

23 MR. SNYDER: Just to modify that, we're  
24 talking about a specific coordination problem using  
25 the intelligence of the satellite to coordinate

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1 with your S-Shield system, so it's --

2 MR. THOMAS: Well, let me tell you what  
3 we're considering.

4 MR. SNYDER: Yeah.

5 MR. THOMAS: Okay. First of all, the  
6 direct answer to your question, are we specifically  
7 looking at GPS to do that? The answer is, we  
8 haven't thought of that yet, and now we have,  
9 because you described it. What we are looking at  
10 is the possibility, and please underline the word  
11 "possibility", and it says, shall we have different  
12 rules in different geographies, albeit, because of  
13 the demographics. There's a lot of spectrum  
14 available in the middle of a cornfield in Iowa, as  
15 compared to downtown Manhattan. And obviously,  
16 downtown Manhattan is probably more congested than  
17 some places out at the end of Long Island, so we  
18 are considering that. How you do the location, we  
19 haven't gotten that far yet, so all I could tell  
20 you is, it is under active consideration. It's  
21 being addressed by the task force that Paul heads  
22 up. Okay?

23 DR. MARCUS: As one who also read th  
24 comments, those of you who read the poor guy from  
25 Wisconsin who was trying to get data back from his

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1 rural lake. When I get away from underneath this,  
2 it turns out Part 5 licenses, which we're going to  
3 talk about next session, can be used both  
4 experiments in radio technology, but also for  
5 experiments in support of other things. And the  
6 answer to the poor guy in Wisconsin, can he get  
7 more power for it, and his particular way of doing  
8 experiments is, we believe he can apply for a Part  
9 5 license. And for that particular narrow case, I  
10 think we've found a near-term solution, but that  
11 doesn't solve the more general problem. But we've  
12 noticed in the comments, a lot of people raised  
13 that, and it certainly is getting some attention  
14 now.

15 Okay. A question on this side. One on  
16 this side. Okay. A question on that side.  
17 Nobody can think of any way to improve Part 15?

18 MR. LEARY: Have people obey the rules  
19 as they exist. That's the first step.

20 DR. MARCUS: Okay. My colleague, John  
21 Reed, who was here earlier, he left. But I guess  
22 maybe no need for him to stay because everything  
23 he's done was very good. All right. Vanu.

24 DR. BOSE: Yeah. I have a comment that  
25 gets to your initial question, which was, you know,

1 are there -- do the Part 15 rules sort of preclude  
2 the introduction of certain new technologies or  
3 services? The answer is absolutely yes, but it's  
4 important to know what they are, and know whether  
5 we want to deal with them in Part 15.

6 Fundamentally, there's two kinds of  
7 services that Part 15 does not deal well with. If  
8 you need service that needs guaranteed  
9 availability, so public safety communications, you  
10 wouldn't want to do that over Part 15, because in  
11 an emergency everyone else is going to turn on and  
12 you can't guarantee any minimum bandwidth.

13 The second that it doesn't do well with  
14 is if you have a system that requires guaranteed  
15 minimum latency. Okay? There's no latency  
16 guarantees. There are certain kind of  
17 communication you can't do or control, but for data  
18 networking, for a lot of things like cordless  
19 phones it works fine.

20 Now interestingly, there was a lot of  
21 discussion about the Internet in the first panel,  
22 and those are the same two kinds of communication  
23 that the Internet doesn't actually deal all that  
24 well with. Anyone who's tried doing Internet  
25 telephony knows there's certainly no guaranteed

1 minimum latency, but it kind of works most of the  
2 time, so the same way your cordless phone kind of  
3 works most of the time. And, you know, there are  
4 certain applications where guaranteed availability  
5 is required, not only public safety, but for the  
6 people who have large revenue paying customers who  
7 want to do that.

8 And so, the existing Part 15 rules  
9 wouldn't incorporate those kind of services very  
10 well. You'd have to go to a different set of  
11 rules, and I guess I want to throw open the  
12 question is, do you think it's possible to get a  
13 set of rules or an etiquette that could -- does one  
14 size fit all?

15 DR. MARCUS: Art.

16 MR. REILLY: Okay. I'd like to comment  
17 on an earlier point first, and maybe come back to  
18 that. With regard to the discussion about, you  
19 know, the rules and the adequacy of them with  
20 respect to registration, I just would point out, I  
21 think one of the great successes of the wireless  
22 land is due to the visionary drive of the FCC in  
23 recognizing that by having unlicensed, and putting  
24 it in a position where you could innovate, but  
25 you've also provided the user with an opportunity

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1 to meet their needs with a minimum of overhead  
2 associated with the purchase, the registration, et  
3 cetera, of the product is very important. And as  
4 we've talked about in the first panel and this  
5 panel, I think everyone sees the benefit of moving  
6 in a direction towards having, you know, etiquettes  
7 of some sort in order to, you know, improve  
8 mitigation techniques. So I think the technology  
9 is driving us, you know, away from the interference  
10 issues, and so issues of registration and other  
11 techniques like that that would provide either a  
12 barrier, an obstacle that the user would have to  
13 consider in making a purchase is one that I would  
14 not favor, but rather to build on what we already  
15 have and to try to look for new opportunities.

16 In fact, I think as we look, you know,  
17 at additional spectrum that the FCC is considering,  
18 we may need to look to see whether we can extend  
19 that innovation that the FCC has introduced by  
20 perhaps having, you know, licensing rules that  
21 provide the same sorts of opportunities, where  
22 there is a minimum opportunity or expectation of  
23 interference, where you go to processes that are  
24 licensed, but have a much more expedited process.  
25 So I think we'd be moving in the wrong direction if

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1 we're looking to, in fact, register or license with  
2 regard to the spectrum that we're currently talking  
3 about. Thank you.

4 DR. MARCUS: Anyone else on the panel?  
5 Dudley.

6 MR. FREEMAN: I think that registration  
7 is important because we're finding as we build out  
8 that standard components that are being bought off  
9 the shelf are being modified by, shall we call  
10 underground amplifier manufacturers. I think Mike  
11 and I have a discussion about this many times where  
12 people go out and buy a much bigger amplifier and  
13 stuff it into a Pringle's can, and bang, they're  
14 radiating the entire neighborhood much further than  
15 they were supposed to under the rules of Part 15.

16 By registering them, knowing where  
17 they're located and where they're operating makes  
18 the system work a lot better, whether it's done  
19 outside the FCC, or whether it's done with an  
20 outside association like the Wireless Association,  
21 and/or it's done between the manufacturers, makes  
22 it a lot easier.

23 MR. LEARY: With respect to  
24 registration, you know, it's something that, you  
25 know, we tossed around quite a bit. We try to

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1 identify our own operators out there, and even  
2 though, you know, we sell to them, the nearest we  
3 can come up to is okay, there are somewhere around  
4 600 of these guys. How many each of them have in  
5 their own network is hard to say, anywhere from a  
6 couple of thousand down to two. But we think there  
7 is a case that can be made, not for licensing, but  
8 having some sort of requirement that people that  
9 are operating for-profit networks declare  
10 themselves.

11 I'm not talking about people, you know,  
12 at their home, or schools, or whatever, but people  
13 operating for-profit networks should have maybe  
14 some requirement. There is no right to use a  
15 spectrum in a business, perhaps it's a privilege,  
16 that they should have some means of declaring  
17 themselves, maybe lat longs of where they have  
18 their wireless pops out there, and maybe the nature  
19 of their equipment, and that goes into a  
20 centralized database. Maybe one that's public  
21 friendly, so the public can access it in terms of,  
22 perhaps, finding service, so there are different  
23 ways that you can structure that. But right now,  
24 we're trying to solve a problem which no one is  
25 able to quantify or entirely qualify, and that's a

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1 problem.

2 DR. MARCUS: Would the government add  
3 value to this, or could -- industry want to do it?  
4 Could the industry just do it itself?

5 MR. FREEMAN: The question is, is  
6 getting everybody in the industry to want to do it.  
7 So you have to -- I think the FCC has to set the  
8 tone.

9 MR. LEARY: I think it could be done  
10 under -- you know, it could be done under contract,  
11 perhaps, with very little --

12 DR. MARCUS: Okay. We're about to go  
13 to the next topic, but does anyone in the audience  
14 have comments on this particular -- on these  
15 issues? I will go over -- someone --

16 MR. SNYDER: A general spectrum  
17 etiquette issue, it seems to be that the world's  
18 great innovator in Unlicensed Spectrum is the U.S.  
19 Military right now, and with their software-defined  
20 radio, as I understand it, they've got a zero to  
21 gigahertz type of device. And, of course, when  
22 they go to Iraq and other countries, they don't  
23 have a license, so they go in and opportunistically  
24 use Unlicensed Spectrum where they need it. And my  
25 question to the panel is, are there any lessons

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1 from what the U.S. Military is doing very  
2 creatively in using Unlicensed Spectrum? Of  
3 course, a very different model than what we're  
4 thinking about here for us. And in particular, why  
5 not take their software-defined radio and say hey,  
6 that will be our unlicensed device. It will go up  
7 and down every unused, you know, unlicensed thing,  
8 and this is the type of thing we'll use. Are there  
9 any lessons from the U.S. Military for us here?

10 DR. NEGUS: Yeah. There certainly are.  
11 In fact, when I met Paul was he gave a  
12 presentation on that exact project at DARPA and the  
13 research that they're doing. And my comment to  
14 Paul, the first time I met him was, you are doing  
15 exactly what my customers want to buy. There is no  
16 question that that is exactly the device that we at  
17 any of the commercial wireless land manufacturers,  
18 or outdoor equipment manufacturers, that we can  
19 build that. We don't necessarily can build it in  
20 every way, shape and form today, but Moore's Law  
21 means we build it in two years, four years, six  
22 years, have better and better characteristics,  
23 cheaper and cheaper. So what is holding us back is  
24 we are not the U.S. Military where we can  
25 unilaterally say gee, I have found -- I am in rural

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1 Wyoming, and I found 800 megahertz of spectrum here  
2 that I can use at this instant in time. I'll just  
3 go ahead and do it. Okay?

4 That's what's really holding us back,  
5 and that's really the regulatory breakthrough,  
6 because the technology is going to be able to  
7 exploit all the dimensionality of the spectrum  
8 access issue, the ones that I discussed earlier.  
9 So what we need is a change from the FCC from  
10 regulating frequencies to regulating spectrum  
11 access, and that means regulating across these  
12 various dimensions, including time, space, spatial  
13 orientation, geography, frequency, and coding.

14 DR. deVRIES: Not only do I think we  
15 need to learn from the U.S. Military, I think, you  
16 know, we need to find a way to work with, and live  
17 with the U.S. Military. There was a lot of talk  
18 this morning about, you know, do you need extra  
19 spectrum, and if so, where are you going to find  
20 it? And the 5 gigahertz band there are  
21 opportunities there in the middle of the band to  
22 use the spectrum where there are military uses.  
23 And a number of people are trying to understand in  
24 detail what the military's requirements are there,  
25 what kind of interference they're worried about.

1           And there are definitely indications  
2           that the kinds of things we talk about in terms of  
3           spectrum Etiquette, seeing what's there, and if  
4           there's something that you will interfere with,  
5           backing off will, you know, address those issues.  
6           But it becomes more interesting than that too,  
7           because the DARPA projects very often talk about  
8           mesh ad hoc networks, and these are the kinds of  
9           networks where, you know, somebody turns up with a  
10          radio. It finds all the other radios, and it  
11          places nicely together with them, which sounds a  
12          lot like the problem that consumers have when they  
13          buy radios, and the problem that consumers have  
14          when their neighbors have radios, or microwaves, or  
15          other things. Which takes us to the issue of, you  
16          know, what is the role of the FCC in these kinds  
17          of, you know, unlicensed bands.

18                 I think not only should it be a  
19                 question of allowing unlicensed bands for  
20                 experimental uses to find new technologies, but  
21                 also we should be experimenting with new kinds, new  
22                 permutations of how people are allowed to use the  
23                 bands. And specifically for data networks, if we  
24                 said that there was a kind of what we're calling  
25                 it, license by compliance where, you know, packet

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1 data networks would operate, that might be able to  
2 allow neighbors to play well with each other, not  
3 have to worry about rogue cheap microwaves or  
4 whatever the red herring of the day is.

5 DR. MARCUS: All right. It may be that  
6 we've driven all the hardcore license people out of  
7 the room, and everyone thinks unlicensed is  
8 wonderful, so let me raise a variant of this  
9 question about the military radio. Military radios  
10 are in an uncooperative environment, and have to  
11 figure out what's going on. And if they make a  
12 mistake and land on say an Iraqi frequency, it's  
13 not the end of the world, because if you're  
14 shooting at them, who cares if you land on their  
15 frequency occasionally.

16 And on the other hand, if you are a  
17 licensed user in an adjacent band, an occasional  
18 accident is a lot more annoying, so could the panel  
19 say something about the ability of radios to  
20 passively figure out what the holes are and the  
21 reliability. However, also in the civil  
22 environment, you don't have to be purely passive.  
23 One could have radios that instead of looking for  
24 holes passively, have more interaction with other  
25 users to find the holes.

1 MR. STEVENSON: Yeah. I'd like to sort  
2 of amplify what Kevin was saying. I had a briefing  
3 at DARPA last Friday, and was very pleased to see  
4 the work that they are doing there in this  
5 opportunistic flexible use of spectrum. It  
6 resonated very, very well with the sorts of things  
7 that IEEE 802 suggested in our comments, and I  
8 think they were pleased to see that, you know, we  
9 were thinking along the same lines.

10 They're looking, I believe, to avoid  
11 conflicts between non-government use and government  
12 use of the spectrum by using this sort of  
13 technique, as well as doing their opportunistic  
14 thing in some foreign battlefield where they have  
15 to go in and set up, you know, networks with no  
16 setup time, and find the holes where they can live.

17 Part of the problem again is how do you  
18 deal with the incumbent licensed users who feel  
19 that they have a property right to keep you out?  
20 The Commission ultimately, I think, will have to  
21 mandate that these licensed users accept this sort  
22 of an underlay and efficient use of unutilized  
23 spectrum. And it sort of also plays into a  
24 question that you asked about how do you deal with  
25 legacy receivers?

1 I don't think that in the sort of  
2 environmental direction that I'm suggesting we need  
3 to go in, that you can go permanent, you know,  
4 forever protection to all of the existing legacy  
5 technologies. And I would not suggest that you  
6 pull the rug out from under people that have made  
7 an investment in things, but things get replaced  
8 with some, you know, useful lifetime replacement  
9 cycle. And the Commission could provide some sort  
10 of incentives or mandates, perhaps, that would  
11 require incumbent users to effectively upgrade  
12 their technology, and be more robust, and more  
13 cooperative, and more efficient in their use of the  
14 spectrum. And this together could promote more  
15 sharing.

16 DR. MARCUS: One more comment from the  
17 panel, and then we'll go on to the next step of  
18 topics.

19 DR. BOSE: Yeah. I'd like to follow-up  
20 on actually your response to the original question  
21 on the military software radio. My company is  
22 actually involved in that project and, I mean, what  
23 you described is the sort of ultimate vision, which  
24 isn't there yet, but is certainly working towards  
25 it. But I think Mike's point is right, that the

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1 way you want to use it in a commercial setting  
2 versus a military setting is different, but that  
3 doesn't affect the underlying technology.

4 The same basic technology can be used  
5 with a different protocol or different etiquette to  
6 serve the kind of commercial needs that you were  
7 getting at, so I think the military has done us a  
8 favor there in advancing some of the technology  
9 development. Now we need to figure out the  
10 etiquettes and make the rules such that these can  
11 be used in the commercial environment.

12 DR. LUCKY: Okay. If there aren't any  
13 more questions, I mean, we ran out of questions.  
14 It's just more of the same, and I'll get to you  
15 back there in a minute, if I may. But, you know,  
16 I'm sitting here kind of confused.

17 The thing is that we've been talking  
18 about how there should be rules, but there should  
19 be no rules, everything is changing. The FCC has a  
20 problem is that they have to do something, and  
21 we've painted a blank canvas here that makes it  
22 almost impossible to do anything, so I'd just like  
23 to get a lot more specific just for a minute, if I  
24 can, to kind of clear up my own confusion.

25 Let's just suppose, as a thought piece,