

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION

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SPECTRUM POLICY TASK FORCE

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UNLICENSED SPECTRUM AND EXPERIMENTAL LICENSES
PUBLIC WORKSHOP

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THURSDAY,
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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

The workshop was held at 9:00 a.m., in the
Commission Meeting Room, Federal Communications
Commission, 445 12th Street, S.W., Washington, D.C.

PRESENT:

MS. LAUREN VAN WAZER	FCC
COMMISSIONER MICHAEL COPPS	FCC
DR. PAUL KOLODZY	FCC
DR. ROBERT LUCKY	FCC
DR. MICHAEL MARCUS	FCC
MR. MICHAEL CALABRESE	New America Foundation
PROF. LAWRENCE LESSIG	Stanford Law School
MR. DEWAYNE HENDRICKS	Dandin Group
MR. DAVID REED	Reed.com
MR. PETER HADINGER	TRW Space & Electronics
MR. WILLIAM CHAMBERLAIN	Group Cobra Electronics
MR. ROBERT PHANEUF	Harmonix Division of Terabeam
DR. KEVIN NEGUS	Proxim
DR. PIERRE deVRIES	Microsoft Corporation
MR. PATRICK LEARY	Alvarion
MR. DUDLEY FREEMAN	UniGo Communications
MR. ART REILLY	Cisco Systems
DR. VANU BOSE	Vanu, Inc.
PROF. RAMESH RAO	San Diego Division, California Institute for

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PRESENT: (cont.)

MR. CARL STEVENSON	Radio Regulatory Technical Advisory Group
MR. DAVID HILLIARD Fielding	Wiley, Rein &
MR. LARRY SOLOMON	Shook, Hardy & Bacon
MR. MICHAEL LYNCH	Nortel Networks
MR. GREG BUCHWALD	Motorola
MR. LEO HOARTY	Dotcast
MR. PAUL ROOSA	NTIA
MR. BRUCE FRANCA	FCC

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P-R-O-C-E-E-D-I-N-G-S

(9:07 a.m.)

MS. VAN WAZER: Good morning, everyone.

My name is Lauren Van Wazer, and I'm the Deputy Director of the Spectrum Policy Task Force. Welcome to the first of a series of four workshops addressing issues relating to Spectrum Policy. This public workshop will address Unlicensed Spectrum issues and experimental licenses.

We are fortunate this morning to be joined by Commissioner Copps, who has some introductory remarks. But first I want to say that we are providing sign language interpreting services, and if there's anyone who needs such services, if you could let us know. Thank you.

COMMISSIONER COPPS: Thank you, Lauren, and good morning to everybody. I very much appreciate the opportunity to be here. I want to thank all of the participants in today's session, and all four sessions, for taking the time to assist the Commission in really one of its top priority items. And I'd especially like to thank the people who traveled long distances to be here today. I've recently traveled some long distances myself, and today is the first day back in the

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1 office. We just got back from Alaska and from the
2 NAWICK meetings in Portland, and I had a chance to
3 glance at my desk this morning, and I'm afraid I'm
4 not going to be able to stay here all morning, but
5 I do want to hear a part of the session. And you
6 can be assured that we will be following up on the
7 record of this very, very closely.

8 I'd like to thank Paul Kolodzy and
9 Lauren Van Wazer, and the whole Commission team for
10 their very hard work on this task force, and on all
11 of these ongoing issues.

12 This task force will really be
13 successful to the extent of its ability to tap the
14 best and the brightest thinkers from across the
15 land, and it obviously has been successful in doing
16 that, obtaining ideas from academe, from public
17 interest groups, businesses, government, and
18 interested individuals, wherever they may be found.

19 We need all the help we can get on how best the
20 Commission can perform its spectrum management and
21 spectrum allocation responsibilities amidst all the
22 technological changes, and convergences, and
23 demands that are out there. These are new times,
24 and we need new thinking.

25 I think the problems of the last 12

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1 months demonstrate the cracks in our system, and
2 demonstrate that we need all the help we can get.
3 There are insufficiencies in our auction process,
4 and they have become quite manifest over the course
5 of the past 12 months. They're holding us back.

6 There are imperfections in the
7 marketplace and it appears that relying solely on
8 the market to yield economically optimal results,
9 and socially optimal results, without attention to
10 the imperfection to the marketplace won't work.
11 Plus, it defies, I think, all economic theory,
12 common sense, and our statute to expect that to
13 happen.

14 Our auction process is, most would
15 agree, better than what went before it, better than
16 freezing existing users and technologies in place,
17 better than having the Commission choose winners
18 and losers through beauty contests, but there have
19 to be some fixes at a minimum.

20 There are some new ideas out there on
21 spectrum use, on flexibility, and higher efficiency
22 management. We also have the unlicensed model. I
23 believe in the unlicensed model. It has produced
24 results at a time when there are few bright spots
25 in telecom. It won't work everywhere, but we

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1 should determine how we can expand its use. We
2 should have a better idea of where it can work, and
3 we should be working on finding new Unlicensed
4 Spectrum.

5 I also believe in the power of new
6 technologies, especially those that address the
7 spectrum crunch, like software-defined radio. We
8 should ensure that our rules encourage such
9 innovation through flexibility, and by allowing
10 competition rather than undermining it by allowing
11 our rules to be used as the tools of stagnation and
12 consolidation.

13 I also want to point out the particular
14 importance of coming up with a better understood
15 standard of harmful interference. Our current
16 obscurity on what constitutes harmful interference
17 leaves incumbents, and new licensees, and
18 manufacturers without the certainty they need to
19 conduct their business resulting, obviously, in
20 under-investment, protracted and wasteful
21 regulatory proceedings, and time consuming
22 litigation.

23 We may not be able to come up with the
24 perfect engineering definition of harmful
25 interference, but I think we can come up with a

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1 clearer legal standard. Even if we fail, I think
2 just the intellectual exercise of going through a
3 proceeding on what constitutes harmful interference
4 will help us better understand the issues, and help
5 our stakeholders to better understand the
6 challenges that we face. I've been advocating this
7 for a long time now, as some of you know, and I'm
8 pleased that we're going to be addressing this
9 issue at a later session.

10 Finally, once this task force has
11 completed its work this fall and published its
12 report publicly, the Commission should rapidly
13 commence a Formal Notice of Inquiry using the
14 insights we gain here to determine what changes to
15 spectrum policy should be made. We must have that
16 kind of Commission follow-through, because
17 otherwise we will be left in muddy waters and the
18 hard work done here would, to a large extent, be
19 wasted.

20 At the same time, I like the idea of an
21 ongoing Spectrum Task Force to keep the Commission
22 and its bureaus focused on spectrum priorities, and
23 to provide an easily identifiable and user-friendly
24 access point for our stakeholders in private
25 sector, and throughout the country, so you have a

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1 tremendously challenging agenda, but also a
2 tremendously promising opportunity to give us a
3 really badly needed helping hand here at the
4 Commission. There is no higher priority, as I said
5 at the outset, than trying to get a handle on
6 spectrum management, spectrum allocation.

7 The last year has shown that we have a
8 long, long way to go so I, for one, and I know I
9 speak for all of my colleagues and the chairman in
10 saying that we are delighted that you have taken
11 the time to be with us to share your expertise with
12 us, to give us the benefit of your good judgment.
13 So thank you very much, and I will not delay the
14 proceedings further, and will allow you to get to
15 work, but I thank you for the opportunity to
16 welcome you here.

17 MS. VAN WAZER: Thank you, Commissioner
18 Copps, for your thoughtful remarks. I'd like to
19 introduce Dr. Paul Kolodzy, who is Director of the
20 Spectrum Policy Task Force.

21 DR. KOLODZY: Thank you, Lauren, and
22 thank you, Commissioner Copps for your wonderful
23 remarks. Welcome to one of our first -- actually,
24 our first of four workshops that are going to be
25 conducted by the Spectrum Policy Task Force.

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1 First of all, I'd like to thank
2 personally Lauren Van Wazer, and all of the staff
3 who have worked very hard over the past few weeks
4 to organize this event. It wouldn't have happened
5 without their dedication, and so I really do thank
6 them.

7 Second of all is, I want to thank all
8 the panelists who have taken out of their valuable
9 time to come here and talk about this very, very
10 important topic, and try to get interaction with
11 the community at-large. And third, I'd like to
12 thank all the people who have braved the very hot
13 August weather of Washington, D.C. to come to this
14 meeting, to actually be participants in this
15 process.

16 The next eight days, and it's going to
17 be one heck of a set of eight days, the Spectrum
18 Policy Task Force is going to hold four workshops
19 on Spectrum Policy. The Task Force encompasses
20 such a large scope that we needed to break the
21 investigation into four separate areas to allow for
22 sufficient time for all the important issues and
23 ideas.

24 This work shop on Unlicensed and
25 Experimental Licenses will be followed tomorrow by

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1 a workshop on Interference Protection. On Monday,
2 we will hold a workshop on Spectrum Efficiency, and
3 then finally next Friday, on Spectrum Rights and
4 Responsibilities.

5 The Spectrum Policy Task Force was
6 formally announced by the Chairman in June of this
7 year. The objective is to look for better ideas on
8 Spectrum Policy. This investigation is forward-
9 looking to determine what, if any, changes are
10 needed to bring spectrum regulations to the
11 realities of the 21st Century. The Task Force is
12 looking across all the uses - a partial list is
13 provided here on the slide - in order to understand
14 that there are integrated approaches that can apply
15 to Spectrum Policy.

16 New technologies that can provide
17 flexibility and agility of our wireless devices are
18 facilitating increasingly dynamic uses of the
19 spectrum, and those uses are actually being
20 operated in a very increasingly dynamic
21 marketplace.

22 What are the potential building blocks
23 for new policies that will address these new
24 realities? Hopefully, this workshop will shed some
25 light and bring out some ideas for those building

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1 blocks.

2 The organization of the Spectrum Policy
3 Task Force is shown on this slide. Lauren Van
4 Wazer is my Deputy Director of the Task Force.
5 Special Counsel is Maureen McLaughlin, and Senior
6 Technology Advisor is Mike Marcus. The Task Force
7 Council consists of senior members of each of the
8 bureaus and offices within the Commission, that
9 have a focus on Spectrum Policy, the Wireless
10 Telecommunications Bureau, International Bureau,
11 Media Bureau, The Office of Plans and Policies, and
12 the Office of Engineering and Technology. There
13 are four working groups, each conducting a workshop
14 and headed by one of the members of the Task Force
15 Council.

16 The Task Force published a public
17 notice in June that consisted of 29 questions
18 relating to each of the primary areas, to provide
19 valuable input to each of the working groups. We
20 received over 140 comments, and over 40 additional
21 reply comments. The interest level is very high,
22 and many ideas and points of view were provided in
23 the comments. I know. I've read all of the
24 comments myself.

25 It is hoped that the workshop will

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1 provide a forum for a dialogue between the
2 different perspectives and a spirited interaction
3 with the public. I really want to focus on that
4 spirited interaction.

5 I don't want to delay the start of the
6 workshop any longer, so I'll try to end by saying
7 thank you again, and welcome for coming. I would
8 like to introduce the panel moderators for this
9 morning's sessions. Mike Marcus is the Associate
10 Chief for Technology in OET at the FCC. Mike,
11 could you -- who chairs the Experimental and
12 Unlicensed Working Group. And Bob Lucky, who is
13 the Corporate Vice President of Applied Research at
14 Telecordia Technologies. We are very glad to have
15 Bob as a Co-Moderator today, and I would like to
16 turn over the mike to him. Thank you.

17 DR. LUCKY: Good morning, everybody.
18 I'm looking forward to this workshop, and to try to
19 get as many opinions and as much wisdom out on the
20 table as we can. Sometimes opinions and wisdom are
21 the same thing, sometimes not, but we'll accept
22 either.

23 We have a panel up here, and let me
24 just introduce them very briefly, starting with
25 Dave Reed. Dave is a consultant in one of the

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1 Internet pioneers. Bob Phaneuf from Harmonix,
2 Larry Lessig from Stanford. Larry, raise your
3 hand. Dewayne Hendricks from Dandin Group. You
4 can raise your hand too. It's okay. Peter
5 Hadinger from TRW, Bill Chamberlain from New
6 American - no, that's -- sorry, you're Cobra.

7 MR. CHAMBERLAIN: Correct.

8 DR. LUCKY: And finally, Michael
9 Calabrese from -- you're New America Foundation.
10 Exactly, what is New America Foundation, if I might
11 ask.

12 MR. CALABRESE: A non-profit public
13 policy institute here in Washington, D.C.

14 DR. LUCKY: Thank you.

15 MR. CALABRESE: Fairly new, three years
16 old.

17 DR. LUCKY: Okay. Now I'm going to
18 rely primarily on the panel, but we will welcome
19 comments from the floor at all times, and that's
20 what we're here for, to try to get as much
21 information as we can in today's session.

22 I don't want to spend a lot of time
23 setting up the issue, because I think you wouldn't
24 be here this morning if you didn't know something
25 about Unlicensed Spectrum. It's been a -- you

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1 know, as an engineer it's been a wonderful thing to
2 see what has happened in these bands in recent
3 years. Millions of wi-fi cards are being sold.
4 We see a ground-swell, an uprising of a whole new
5 infrastructure based on this, and it's tremendously
6 exciting at such a bad time in the industry to see
7 such wonderful things happening.

8 But on the other side of this, you
9 know, I heard just the other day someone said well,
10 you know, you can't really depend on this though,
11 because anybody can use it, and it's unlicensed
12 and, you know, can't use that, so you do hear that
13 kind of thing. And on the FCC's Technological
14 Advisory Council, you know, we've been wrestling
15 with the new technologies that seem to change the
16 dynamics of spectrum allocation.

17 There are people who say spectrum is
18 really infinite with -- the capacity is really
19 infinite, and there are those who say it's very,
20 very limited. And you can see both views at
21 different times. We've got ultra wideband
22 software-defined radio that can move around and
23 have the agile. We've got multi-input/multi-output
24 processing that has dramatic gains in capacity,
25 adaptive antennas, things that didn't exist some

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1 years ago when spectrum was regarded as very
2 precious.

3 Bran Ferren, one of the members of our
4 advisory council, said he bought - I don't know if
5 he really did this, but he said it - he bought a
6 DC-to-light receiver and he sat out in the parking
7 lot, and then he tuned it across the whole band,
8 and he says what you hear basically is nothing.
9 And then suddenly you hit like one of the cell
10 phone bands and it's just overwhelming. And then
11 you hear nothing. And the paradox is that, you
12 know, it seems that there's nothing out there
13 except in these narrow, narrow crowded bands, and
14 yet in many cases people own these pieces of
15 spectrum. And the issue that always faces the FCC
16 is, you know, efficient use of that spectrum. And
17 so, that's what we're here to talk about today.

18 We often worry about the tragedy of the
19 commons. We're here to talk about the commons, and
20 I always have this image in my mind of the sheep
21 eating up all the grass, but there are
22 technologists here who would say that perhaps each
23 sheep can bring its own grass, and that's the way
24 this works. So my Co-Moderator, Mike Marcus, and I
25 will ask some questions, and we'll address them

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1 first to the panel. But again, anybody out there,
2 there are many people in the audience, and I see
3 some out there that I know are very knowledgeable,
4 and I think there are a lot more that I don't know
5 who are very knowledgeable. Please, we're here to
6 gather as much information as we can, so please
7 don't hesitate to raise your hand and speak up.

8 So we have some generic questions here.

9 The questions themselves are rather innocuous but
10 I hope they lead us onto paths of discussion that
11 bring out the real issue, so I'll start with --

12 DR. MARCUS: I'll say a little bit
13 about the format. We're going to ask one or two
14 questions to the panelists, and then before we go
15 onto another topic, we're going to ask the audience
16 if they either have questions or statements that
17 they want to make. Please, we don't want long
18 statements, and particularly, we don't want long
19 statements on things that we've already gone over
20 in the record. This is a public meeting that's
21 being taped. There are transcripts, so don't worry
22 about ex parte issues, say whatever you want, but
23 we don't want long statements that are already
24 well-documented in the record.

25 DR. LUCKY: Say whatever you want, but

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1 bear in mind this is being webcast and recorded,
2 and here are the reporters, and -- but say whatever
3 you want.

4 DR. MARCUS: But keep it short.

5 DR. LUCKY: But do keep it short, and
6 we'll try to work on that. So let me start out
7 with the first generic question, you know. What
8 has been good and bad about Unlicensed Spectrum in
9 recent years? And, in fact, I'll address it
10 specifically to Larry Lessig, just to give a start
11 here, Larry. What's good about this? And if you
12 might think of something that's bad, if you don't,
13 somebody else will.

14 PROF. LESSIG: So there's technical
15 questions that are raised by Unlicensed Spectrum,
16 and I'm not going to address those. I think what's
17 good about Unlicensed Spectrum relates to what I
18 think is the core issue that the FCC has got to
19 think about in this context, and that is, not the
20 technical questions, but the political reality of
21 how the interaction between FCC policy and
22 competition policy affects the innovation in this
23 market.

24 There's a good history of the FCC,
25 there's a bad history of the FCC. And the bad

1 history of the FCC is, the FCC being used by
2 private interests to protect themselves against new
3 innovation. And the structural feature of
4 Unlicensed Spectrum, which is so critical against
5 the background of this history, is to the extent
6 there's Unlicensed Spectrum that can be protected
7 for development and innovation outside of the
8 traditional structure. That provides protection
9 for new innovation against interests that might be
10 threatened by that new innovation, so there might -
11 - there's lot of debates about what's possible
12 here, what good Spectrum Policy, what the ideal
13 Spectrum Policy will look like, what the ideal
14 technology for spectrum will look like.

15 The fundamental thing I think is most
16 striking about this is that technologists say we
17 don't know. We really don't know what the best
18 architecture will look like. In a context where we
19 don't know, the most important thing for the
20 government to do is to set up an environment where
21 competition and technological development can
22 develop without fear of retaliation from those
23 whose ox might be gored by the next great idea for
24 how to use spectrum.

25 DR. LUCKY: Okay. Let me just follow-

1 up on that a little bit, we don't know stuff. Dave
2 Reed, I think you might comment about that. You
3 are a technologist.

4 MR. REED: Right.

5 DR. LUCKY: What would you put in the
6 category, we don't know about this?

7 MR. REED: Well, actually, I think I
8 coined that term, "We don't know", in this space,
9 which is, I think, important.

10 What I've been trying to point out,
11 about 10 years ago I started asking myself the
12 question, as wireless technologies started to
13 really proliferate in the computer industry, is
14 there some limit to what we can deliver using
15 wireless technologies in terms of data
16 communication and so forth? Most of my engineering
17 colleagues said well, I'm pretty sure there is --
18 there's probably some limit, and we'll run into
19 it, so we better start worrying about that limit,
20 and how we're going to get around it, or how we're
21 going to allocate the Spectrum Resource.

22 What I discovered, because I'm the
23 naturally curious type is, I went to the theorists
24 and I said, is there a theoretical limit here? And
25 they said well, now that you asked the question,

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1 I'm not sure I know the answer. And I started
2 systematically trying to ask this question, if you
3 have a network of radios in a space like this room
4 that are able to do anything they want to do, or a
5 space like the whole United States - if they're
6 able to do anything that we technologically can
7 imagine doing, is there a limit to the amount of
8 phone calls you could carry over that network, the
9 amount of data communications you could provide,
10 and so forth? And the conventional wisdom is that
11 spectrum limits that.

12 What actually limits that, it turns
13 out, is the architectures that we use. The
14 spectrum itself - you might imagine there's an
15 ether out there that there's only so much of - the
16 spectrum out there itself does not limit us in any
17 fundamental way. In fact, as Bob pointed out with
18 the grass analogy, as you add systems to a network
19 sharing the same region of spectrum, theoretically
20 the capacity does grow without limit. The question
21 is, so does it grow as far as the number of users?

22 That's the question we don't know. The technical
23 answer is we know, at least, that we have the
24 spectrum grow as the -- the capacity of the
25 spectrum, the number of bits, or phone calls or

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1 whatever, can grow with the number of users in the
2 sense that they bring their own grass with them as
3 they start adding radios to the system.

4 What we don't know is whether that
5 limit, whether it grows linearly or proportionally
6 to the number of users, or whether it sort of
7 tails-off on a per user basis, so that each new
8 user just brings a little less than the previous
9 user. And that's an active area of research.
10 There's reason to believe that it doesn't tail-off
11 but, in fact, you know, the best theorists are
12 working technologies, protocols, and architectures
13 to try to meet that, and achieve that. We've
14 already demonstrated systems that achieve the basic
15 idea of increasing with the number of users.

16 DR. LUCKY: But you would say the good
17 thing about unlicensed spectrum is it allows the
18 experimentation to take place.

19 MR. REED: Exactly. The biggest
20 barrier to exploring the space is that there's
21 essentially no invest, or very little investment in
22 new wireless technologies that don't meet the needs
23 of incumbent users of the spectrum, so there's lot
24 of investment, you know, in say things that will
25 help the cellular operators, or things that help

1 the television broadcasters and so forth, you know,
2 do a better job. There's no investment in these
3 new things, because the applications they enable
4 are early experimental, and so forth. So what, in
5 fact, the Unlicensed Band, the 802.11 Band has done
6 for us is, it's provided a playground where new
7 applications and new uses, such as new ways to
8 connect to the Internet, and new services in the
9 home, the connect devices, you know, have a place
10 to be developed and experimented with, without the
11 overhead of, you know, the cost of presenting an
12 economic case to the Commission that this is the
13 best use, or even finding the money to buy
14 spectrum at auction, should that be the question.

15 DR. LUCKY: Let me follow-up on that,
16 and turn to Dewayne Hendricks. You know, I've been
17 in network development and research for a long
18 time, and one of the rules that we sort of always
19 had was that you can't both experiment with the
20 network, at the same time as you're providing
21 service with it, you know. And yet, here in these
22 Unlicensed Bands, people want to provide real
23 service, but at the same time, we want to allow
24 this experimentation to take place. Now is this
25 compatible?

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1 MR. HENDRICKS: I think that it is. I
2 mean, if you look at the use of the unlicensed
3 bands since they were instituted in 1985, you've
4 seen a broad development of broad -- it took three
5 years before the first device was certified under
6 the 1985 rules. And since then things have really
7 taken off, and you've seen a broad breadth of
8 devices that do a lot of different things. In
9 fact, nobody, I think, really knows how many
10 devices are out there, and what they are actually
11 doing.

12 But to address your question, I think
13 what we've seen is that starting about 1992, you've
14 seen people offering services. I mean, there have
15 been wireless ISPs as early as 1992, I've seen
16 documented, and they continue to operate. I mean,
17 there were never publications or websites on the
18 net that document the experience of these people.
19 They've been around since the mid-90s offering
20 services, and quite successfully, and they're
21 making profits. So I think that the -- Metricom,
22 until its recent demise, is a good example of that,
23 that existed through the 90s until fairly recently.

24 And there are others like Metricom with similar
25 business models, but nonetheless, you can still

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