

**THE STATE OF NEW HAMPSHIRE**  
**BEFORE THE**  
**PUBLIC UTILITIES COMMISSION**

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**Rural Carriers' Petition for Investigation** )  
 )  
**Into the Regulatory Status of IP Enabled Voice** ) **Docket No. DT 09-044**  
 )  
**Telecommunications Service** )  

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**PREFILED DIRECT TESTIMONY OF**  
**DAVID J. KOWOLENKO AND BETH CHOROSER**  
**ON BEHALF OF COMCAST PHONE OF NEW HAMPSHIRE, LLC**  
**AND ITS AFFILIATES**

October 9, 2009

1 **Q. Please state your name, position and business address for the record.**

2 A. David J. Kowolenko, Division Vice President Voice Services, Comcast, North  
3 Central Division, 25 Industrial Drive, Chelmsford, Massachusetts.

4 A. Beth Choroser, Senior Director of Regulatory Compliance for Comcast's voice  
5 service operations, One Comcast Center, 1701 John F. Kennedy Blvd., Philadelphia,  
6 PA 19103.

7

8 **Q. Mr. Kowolenko, please describe your employment responsibilities.**

9 A. I am responsible for developing and deploying Comcast's voice service operations in  
10 eleven Northeastern and Midwestern states, including New Hampshire. Among other  
11 things, I am responsible for network design, deployment, voice traffic management,  
12 product and feature implementation, provisioning, capital expenditures and budgeting  
13 for the Comcast voice operations throughout the North Central Division.

14

15 **Q. Ms. Choroser, please describe your employment responsibilities.**

16 A. I am responsible for a wide variety of regulatory and business matters for Comcast's  
17 voice business, including both state and federal compliance for operational affiliates  
18 that provide voice services in all 37 states and the District of Columbia where Comcast  
19 operates.

20

1 **Q. Mr. Kowolenko, please describe your background and experience.**

2 A. I have worked in the communications industry for over 20 years, including the past 13  
3 with Comcast and predecessor companies. Prior to my current position, I was  
4 responsible for Comcast's Eastern Division Voice Operations from October 2003 to  
5 November 2006, where I oversaw the initial deployment of Comcast's interconnected  
6 Voice over Internet Protocol (VoIP) service called Comcast Digital Voice (CDV).  
7 From December 2002 to October 2003, I had responsibility for Comcast's New  
8 England Region as Vice President of Advanced Products, overseeing Voice (circuit-  
9 switched voice service branded as Comcast Digital Phone) and High Speed Data  
10 operations. I began my career in the communications industry at Southern New  
11 England Telephone in 1986. Although I have not testified at a hearing before this  
12 Commission, in 2007 I filed testimony in New Hampshire Docket DT 07-027. In  
13 2008, I filed testimony in DT 08-013 regarding Comcast's certification in the TDS  
14 territories. I have also participated in technical sessions in Docket DT 07-011  
15 concerning the transfer of Verizon's New Hampshire assets to FairPoint.

16 I hold a bachelor's degree in Computer Science from Eastern Connecticut  
17 College and a Master's Degree in Computer Science from the University of New  
18 Haven. I also hold Associate of Science Degrees in Electrical Engineering, Data  
19 Processing, and Computer Systems from Thames Valley State Technical College (now  
20 known as Three Rivers College) in Norwich, Connecticut.

21

1 **Q. Ms. Choroser, please describe your background and experience.**

2 A. I have worked in various capacities in both the communications and electric utility  
3 industries. I have worked in Comcast's voice business since 2000, holding positions of  
4 increasing responsibility, including promotion to my current position. From 2000 to  
5 2003, I was the Manager of Regulatory Compliance for the company's start-up  
6 commercial voice business, Comcast Business Communications, LLC. I had  
7 responsibility for tariffs, billing compliance, interconnection, regulatory reporting, end-  
8 user taxation, and surcharging. From 1997 to 1999, I was with ATX  
9 Telecommunications where I held various positions with responsibility for billing  
10 specifications, revenue assurance, end-user taxation and regulatory matters. From 1985  
11 to 1988, I worked for New England Electric System as a rate analyst and later as staff  
12 assistant to the Chief Operating Officer. In those roles, I performed cost of service  
13 studies, fuel cost studies, oversaw budgeting for the NEES Chief Operating Officer,  
14 and testified in regulatory hearings before the Massachusetts Department of Public  
15 Utilities.

16 I hold a Bachelor of Arts Degree from Pennsylvania State University and a  
17 Master of Business Administration from Syracuse University.

18

19 **Q. What is the purpose of your testimony?**

20 A. In response to the petition of the rural carriers of the New Hampshire Telephone  
21 Association, we provide a factual summary of how Comcast provides interconnected  
22 VoIP services in New Hampshire.

1 **Q. Please provide background information about Comcast Corporation and its**  
2 **affiliates (collectively “Comcast”), including Comcast’s network and the services it**  
3 **offers in New Hampshire.**

4 A. Comcast is the largest cable multi-system operator in the United States. In the past  
5 decade, encouraged by the federal policy of promoting deployment of broadband  
6 services through a deregulatory environment, Comcast has invested billions of dollars  
7 to upgrade its network infrastructure. It has built a national and local network through  
8 which it can offer a variety of advanced services, including, but not limited to, video  
9 programming, high-speed Internet access services (often called “cable modem”  
10 services) and VoIP services. Comcast currently has 23.8 million cable customers, 15.3  
11 million high speed Internet (HSI) customers and 7 million VoIP customers nationwide.  
12 Comcast has built its network entirely with its own risk capital, and without any rate-  
13 of-return guarantees or universal service fund subsidies.

14 Comcast’s NorthCentral Division headquarters is in Manchester, New  
15 Hampshire, and its 1500 employees work and live in the communities it serves. At a  
16 time when other companies have decreased their investment in communications, since  
17 2003, Comcast has invested \$220 million to expand its networks and bring advanced  
18 services and competitive choices to its New Hampshire customers. Comcast’s facilities  
19 pass approximately 418,000 New Hampshire homes.

20 In addition to its fee-based services, Comcast also provides complimentary  
21 broadband services to schools, libraries and Boys & Girls Clubs. In 2008, Comcast

1           contributed \$593,000 dollars in cash, public service announcements and in-kind  
2           services to New Hampshire libraries, schools and nonprofit entities.

3

4   **Q.    Which Comcast entities are involved with the provision of voice services in New**  
5   **Hampshire?**

6    A.    Because video, VoIP, Internet and telecommunications services are subject to different  
7           regulatory obligations at both the state and federal levels, and because the FCC has  
8           recognized that interconnected VoIP providers need local exchange carrier partners to  
9           perform necessary functions such as telephone number acquisition and porting,  
10          Comcast has established in each state in which it operates a separate  
11          telecommunications carrier affiliate that provides telecommunications services to the  
12          public. In New Hampshire, that affiliate is Comcast Phone of New Hampshire, LLC  
13          ("Comcast Phone"). In addition, Comcast IP Phone II, LLC ("Comcast IP") offers  
14          retail, interconnected VoIP service to residential and business customers in New  
15          Hampshire. We describe both services below.

16

17   **Q.    What services are provided by Comcast Phone, and what is its regulatory status?**

18                 Comcast Phone is a competitive local exchange carrier (CLEC), certified and  
19                 authorized by this Commission to operate in the New Hampshire territories of Northern  
20                 New England Telephone Operations, LLC d/b/a FairPoint Communications-NNE  
21                 ("FairPoint") and the TDS Companies (i.e. Kearsarge Telephone Company, Merrimack

1 County Telephone Company and Wilton Telephone Company).<sup>1</sup> Pursuant to that  
2 authority, Comcast Phone has entered into an interconnection agreement with FairPoint  
3 to exchange traffic (both directly with FairPoint and indirectly with other competitive  
4 local exchange carriers) in areas served by FairPoint. In addition, Comcast Phone has  
5 entered into an interconnection agreement with the TDS Companies, which was  
6 approved by this Commission in DT 08-162, Order No. 25, 2005 (Aug. 13, 2009).

7 Comcast Phone files with the Commission and posts on Comcast's website  
8 ([www.Comcast.com](http://www.Comcast.com)) an Exchange Rate Schedule that includes the following service  
9 offerings: Single Line Business Service, Schools and Libraries Network Service, and  
10 an Access Service Guide for Interexchange Carriers. Comcast Phone also offers Local  
11 Interconnection Services (LIS) in New Hampshire to interconnected VoIP providers.  
12 Affiliates of Comcast Phone in other states offer similar services. The terms and  
13 conditions of the LIS offering are available for public inspection on the Comcast Phone  
14 website ([http://www.comcast.com/corporate/about/phonetermsofservice/circuit-](http://www.comcast.com/corporate/about/phonetermsofservice/circuit-switched/statetariffs/newhampshire.html)  
15 [switched/statetariffs/newhampshire.html](http://www.comcast.com/corporate/about/phonetermsofservice/circuit-switched/statetariffs/newhampshire.html)). LIS is a local exchange carrier service that

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<sup>1</sup> *MediaOne Telecommunication of New Hampshire, Inc. Petition for Authority to Provide Local Telecommunications Services*, Order No. 23,088, DE 98-208, 88 N.H. PUC 680 (December 15, 1998), authorized MediaOne Telecommunications of New Hampshire, Inc. to provide service in the territory of FairPoint's predecessor, Bell Atlantic. By letter dated April 17, 2001, MediaOne Telecommunications of New Hampshire, Inc. notified the Commission of a name change to AT&T Broadband Phone of New Hampshire, LLC, which in February 2003 changed its name to Comcast Phone of New Hampshire, LLC d/b/a Comcast Digital Phone. *See Comcast Phone of New Hampshire d/b/a Comcast Digital Phone*, DT 08-162, Order No. 25,005 at 3 n.1 (N.H. PUC Aug. 13, 2009); *see also, Comcast Phone of New Hampshire, Application for Authority to Serve Customers in the TDS Service Territories*, Order No. 24, 938, DT 08-013 (N.H. PUC. Feb. 6, 2009) *rehearing denied*, Order No. 24,958 (N.H. PUC. April 21, 2009).

1 offers customers both exchange access and telephone exchange service calling  
2 capabilities. Comcast Phone provides LIS in New Hampshire through an agreement,  
3 entered into pursuant to the posted LIS guide, to its affiliate Comcast IP. Each month,  
4 Comcast Phone sends carrier access bills (CABs) for originating or terminating traffic  
5 in New Hampshire to approximately 25 intrastate and interstate interexchange access  
6 customers.

7  
8 **Q. What compensation does Comcast Phone pay to other carriers for**  
9 **terminating traffic originated by Comcast IP in New Hampshire?**

10 A. Comcast Phone pays local exchange carriers (LECs) reciprocal compensation for traffic  
11 originated by Comcast IP Phone's customers that terminates within local exchange  
12 calling areas or mandatory extended local service areas, as defined in the incumbent  
13 LECs' tariffs. When a local call terminates to a FairPoint subscriber, Comcast Phone  
14 pays FairPoint \$0.0007 per minute of use pursuant to its interconnection agreement.  
15 When a local call terminates to the subscriber of any other LEC in New Hampshire,  
16 Comcast Phone does not pay any terminating compensation because all of its  
17 arrangements with other LECs are bill and keep. This includes the recently-approved  
18 interconnection agreement between Comcast Phone and TDS. For non-local traffic,  
19 Comcast Phone pays intrastate or interstate terminating switched access, either directly  
20 or indirectly, for traffic originated by Comcast IP Phone's customers. When Comcast  
21 Phone sends IntraLATA toll traffic to FairPoint over direct interconnection trunks,  
22 Comcast Phone directly pays FairPoint intrastate switched access pursuant to

1 FairPoint's New Hampshire access tariff. When Comcast sends IntraLATA toll traffic  
2 to LECs other than FairPoint in New Hampshire, it can route the call through FairPoint  
3 as described above, or it can use its vendors' interexchange carrier (IXC) facilities and  
4 services. In the latter situation, the vendor pays intercarrier compensation charges to  
5 the terminating LEC on Comcast's behalf.

6  
7 **Q. What services are provided by Comcast IP, and what is its regulatory status?**

8 A. Comcast IP provides retail, interconnected VoIP service as that term is defined by the  
9 Federal Communications Commission under 47 C.F.R. § 9.3<sup>2</sup> to residential and  
10 business end user customers in New Hampshire. The service is marketed to residential  
11 customers under the brand name "Comcast Digital Voice" (CDV) and to business  
12 customers under the brand name "Business Class Voice" (BCV). Comcast IP began  
13 providing CDV and BCV in New Hampshire on or about June 2005 and December  
14 2007, respectively. CDV and BCV customers access the service using the "last mile"  
15 broadband facilities (Hybrid Fiber-Coax Network or HFC) provided by Comcast's  
16 locally franchised cable television operating affiliates.<sup>3</sup> For purposes of this testimony,

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<sup>2</sup> 47 C.F.R. § 9.3 defines interconnected Voice over Internet protocol (VoIP) service as a service that: (1) enables real-time, two-way voice communications; (2) requires a broadband connection from the user's location; (3) requires Internet protocol-compatible customer premises equipment (CPE); and (4) permits users generally to receive calls that originate on the public switched telephone network and to terminate calls to the public switched telephone network.

<sup>3</sup> Comcast has four franchised cable affiliates in New Hampshire: Comcast of New Hampshire, Inc.; Comcast of Maine/New Hampshire, Inc.; Comcast of Massachusetts/New Hampshire,

1 we will refer to both CDV and BCV services as “Comcast VoIP” unless there are  
2 meaningful differences between the residential and commercial services, in which case  
3 we will refer to them individually by name.

4 Comcast IP, and other Comcast VoIP affiliates, provide interconnected VoIP  
5 service in 37 states plus the District of Columbia. In not a single one of those states are  
6 they subjected to traditional state telecommunications service regulation. As an  
7 interconnected VoIP service provider, Comcast IP is, however, subject to the regulatory  
8 jurisdiction of the Federal Communications Commission (FCC). The FCC has not  
9 subjected interconnected VoIP service providers to the full panoply of federal  
10 telecommunications carrier regulations, rather, it has selectively and thoughtfully  
11 imposed only those regulations deemed necessary to advance key objectives, while  
12 maintaining the light regulatory touch needed to promote continued deployment of  
13 advanced services. These include requirements related to number portability, E-911,  
14 CALEA, CPNI safeguards, disabilities access, discontinuance, federal Universal  
15 Service Fund contributions, and Regulatory Assessment Fee contributions. Comcast IP  
16 is in compliance with each of these FCC requirements; in fact Comcast IP was in  
17 compliance with these requirements before the FCC issued its mandates.

18

1 **Q. Please provide background information regarding the development and**  
2 **deployment of the CDV and BCV services.**

3 A. Comcast has made a significant investment in building its infrastructure to support  
4 advanced and integrated services. CDV and BCV are perfect examples of how  
5 Comcast's advanced network was successfully leveraged to deploy new services  
6 quickly and economically.

7 The deployment of Comcast VoIP has been made possible by recent  
8 technological developments, including those made by the cable industry's nonprofit  
9 research and development arm, CableLabs®. CableLabs® has developed technical  
10 solutions for efficiently leveraging the two-way Hybrid Fiber-Coax (HFC) networks  
11 that cable providers like Comcast have built. First, CableLabs® developed the Data  
12 Over Cable Service Interface Specification (DOCSIS) which is the technical basis for  
13 Comcast's High Speed Internet (HSI) offering. Following DOCSIS, CableLabs®  
14 developed the PacketCable specification for delivering advanced, real-time multimedia  
15 services over the DOCSIS-enabled two-way cable plant that had been built over the  
16 previous decade. PacketCable network specifications use IP technology to enable a  
17 wide range of multimedia services such as IP voice, multimedia conferencing,  
18 interactive gaming, and general multimedia applications. CDV and BCV are just two  
19 of these PacketCable-enabled applications.

20 Comcast introduced its interconnected VoIP service as a public offering in  
21 2005, which was around the same time that the United States Supreme Court issued its

1           *Brand X*<sup>4</sup> decision affirming the FCC's ruling that IP-based service offerings would not  
2           be subject to traditional telecommunications common carrier regulation. The *Brand X*  
3           decision was preceded by two FCC cases, *Vonage*<sup>5</sup> and *Free World Dialup*,<sup>6</sup> in which  
4           the FCC ruled that two different types of retail VoIP service offerings would be exempt  
5           from state public utility/common carrier regulation. While the Free World Dial-Up  
6           decision did not deal with interconnected VoIP, the Vonage decision did – specifically  
7           addressing VOIP services operated by cable providers. Thus, when Comcast launched  
8           its interconnected VoIP service, it reasonably believed that the service would be subject  
9           to the regulatory treatment outlined in the above-referenced decisions, and has  
10          structured its business accordingly.

11

12   **Q.    Please describe the current state of CDV and BCV deployment.**

13    A.    Comcast now has more than 7 million VoIP customers nationwide. What makes this  
14          success impressive is that it has come during a period when wireline voice service  
15          providers are losing customers to mobile phone competitors. (Current estimates are  
16          that more than 20 percent of U.S. households are now wireless-only).<sup>7</sup> Comcast's VoIP

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<sup>4</sup> *Nat'l Cable & Telecomms. Ass'n v. Brand X Internet Servs.*, 545 U.S. 967 (2005).

<sup>5</sup> *In re Vonage Holdings Corp.*, Memorandum Opinion & Order, 19 FCC Rcd 22404 (2004).

<sup>6</sup> *In re Petition for Declaratory Ruling that Pulver.com's Free World Dialup Is Neither Telecommunications nor a Telecommunications Service*, Memorandum Opinion & Order, 19 FCC Rcd 3307 (2004).

<sup>7</sup> See Stephen J. Blumberg & Julian V. Luke, Division of Health Interview Statistics, National Center for Health Statistics, CDC, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, July-December 2008*, at 1, 5 (Table 1) (May 6, 2009)

1 service's success is due to its high value, integrated and feature-rich service offerings  
2 that are beyond the technical capabilities of providers of traditional telephone service  
3 ("plain old telephone service" or "POTS") – both in terms of their features and the  
4 extent to which those features are integrated.

5 Comcast's VoIP service has also been very successful with New Hampshire  
6 consumers in large part due to Comcast's investment in its network which enables it to  
7 offer high value "triple play"<sup>8</sup> bundled offerings. Comcast also works closely with the  
8 Public Utilities Commission's Consumer Affairs Division to ensure that any customer  
9 complaints or escalations are appropriately handled. Escalations to Comcast from the  
10 Consumer Affairs Division for issues related to Comcast's VoIP service are typically  
11 quite low given the number of customers, and Comcast's Customer Care group works  
12 diligently to resolve any matters to the customer's and to the Commission's  
13 satisfaction.<sup>9</sup> We pride ourselves on being responsive to the Commission – with  
14 respect to consumer issues, network issues and emergency responsiveness.

15  
16 **Q. What New Hampshire programs does Comcast support?**

17 A. Comcast IP – in accordance with federal regulations – provides Enhanced 911 and  
18 Telecommunications Relay Service (TRS). To support these very important services,

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("CDC NHIS Report December 2008"), available at  
<http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless200905.pdf>.

<sup>8</sup> Comcast's "Triple Play" offering consists of a bundled package of three services: VoIP, high speed internet and video.

<sup>9</sup> Comcast has recorded 68 consumer complaints escalated to Comcast from the Consumer Division year to date 2009.

1 Comcast IP pays the required 911 fees to the State of New Hampshire, and Comcast  
2 Phone remits TRS fees to the Trust Fund Administrator on behalf of Comcast IP.  
3 Comcast IP also collects and remits the Communications Service Tax pursuant to RSA  
4 82-A for its CDV service. Comcast Phone, on behalf of its customers (including  
5 Comcast IP) also pays the utility assessment under RSA 363-A, based on end-user  
6 revenues.

7  
8 **Q. What other consumer benefits are there from CDV?**

9 A. Comcast's VoIP services have brought considerable consumer benefits. As will be  
10 discussed in detail below, Comcast's IP network provides for more efficient  
11 communications than does the Public Switched Telephone Network (PSTN), as well as  
12 integrated advanced features, enabling Comcast to offer significant value to its  
13 customers. Economists estimate that competition from cable VoIP providers like  
14 Comcast has brought direct consumer benefits of \$4.0 billion to the cable companies'  
15 subscribers and \$19.5 billion in indirect consumer benefits due to the competitive  
16 response of the ILECs, for a total of \$23.5 billion of consumer benefits from 2008 to  
17 2012. *See* Michael D. Pelcovits & Daniel E. Haar, Microeconomic Consulting &  
18 Research Associates, Inc., *Consumer Benefits from Cable-Telco Competition* (Nov.  
19 2007) (attached as Exhibit 1). In New Hampshire, the consumer benefits from cable  
20 VoIP competition are estimated to be over \$533 million during that period, but have  
21 already been calculated to save New Hampshire customers almost \$62 million in 2007  
22 alone. *Id.*

1 **Q. Please describe a POTS call and the PSTN.**

2 A. POTS calls are routed over circuits dedicated to each individual call. These circuits  
3 begin as dedicated end-office loops (twisted copper wire pairs) which connect the end  
4 user's telephone to the telephone company's switching equipment. From there,  
5 individual calls are aggregated onto larger circuits using time division multiplexing  
6 (TDM) techniques. POTS calls traverse the public switched telephone network, which  
7 gets its name from the need to establish an individual end-to-end circuit to transmit  
8 each call and from the switching equipment that makes this possible. The dedicated  
9 call paths required for PSTN calls are resource-intensive and costly compared to  
10 modern IP networks.

11 PSTN calls also require a separate signaling network (the "SS7 network") to set  
12 up the end-to-end circuit. In addition, SS7 signaling transmits other call-related  
13 information, such as the calling party's number (CPN), which is necessary to establish  
14 the jurisdiction of the call for billing and intercarrier compensation purposes.

15

16 **Q. Please describe how the routing of Comcast VoIP calls differs from POTS.**

17 A. Comcast VoIP services were designed for delivery on the national converged  
18 infrastructure that supports all of Comcast's services, including Internet and video.

19 While Comcast's VoIP application allows it to provide functionalities that are similar to

1 traditional telephone service offerings, Comcast VoIP is technologically different, even  
2 though some features of the user experience may mimic POTS.<sup>10</sup>

3 One of the major differences is in the way the network carries and routes  
4 information. Comcast's converged network is based on carrying information in the  
5 form of data packets in Internet Protocol (IP). Any kind of information – video, text or  
6 voice – can be digitized into data packets that travel efficiently over IP networks. In  
7 the case of VoIP, a piece of equipment at the customer's premises known as an  
8 embedded multimedia terminal adapter (eMTA) formats electronic signals from the  
9 customer's handset into IP packets for transport on Comcast's network.

10 VoIP packets are grouped or sequenced so that they arrive at their destination in  
11 the correct order. Routers (specialized computers) regulate the flow of data packets at  
12 various points within the network. In contrast to the centralized PSTN in which all  
13 users within a local exchange are directly connected to a single switch location, IP  
14 routers have no fixed routing tables. And unlike a TDM SONET network, which is a  
15 ring architecture dealing with physical connectivity and predetermined paths, IP  
16 networks dynamically update themselves by communicating autonomously with other  
17 routers to find the best available paths over which to transmit data packets. There is no  
18 certainty that IP packets will follow the same path for a continuing stream of data or  
19 session; and if the underlying connectivity is broken or if congestion arises, a wide

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<sup>10</sup> For example, when a CDV customer picks up the handset to place a call, the CDV network does not generate a dial tone from a central office. That customer, will, however hear a sound created by the embedded multimedia terminal adapter (“eMTA”), not the network, which sounds similar to a dial tone.

1 array of alternative paths could be employed without the user – or even the internet  
2 service provider (ISP) or VoIP provider – knowing it. This system facilitates the  
3 efficient use of network resources, as many different communications can be routed  
4 simultaneously over the same transmission facilities.

5 Because they do not require dedicated pathways to route traffic, packet switched  
6 networks do not require separate “out-of-band” signaling networks to “set-up” the call  
7 transmission path. Instead, each packet has an address header, which the router reads  
8 in order to make its routing decision. Likewise, each packet contains other call-related  
9 information (for caller-ID, billing and other purposes) similar to what is transmitted by  
10 the SS7 network for TDM calls.

11 Comcast VoIP does not require SS7 signaling to set-up dedicated call paths on  
12 the IP network, rather Comcast accesses information stored in databases to populate  
13 various data fields in CDV IP packets. Indeed, Comcast VoIP call routing makes use  
14 of information stored in electronic domain name system (DNS) databases in order to  
15 populate data fields and route traffic. For example, on the PSTN a 10-digit North  
16 American Numbering Plan Administration (NANPA) telephone number routing  
17 scheme has been established to route calls from calling-to-called parties (*i.e.*, NPA-  
18 NXX-XXXX). Comcast IP also assigns its end-user customers 10-digit NANPA -  
19 conforming numbers. But IP networks do not route traffic based on NANPA numbers.  
20 Instead, traffic on IP networks is routed based on the IP address associated with  
21 individual computers on the network. Thus, Comcast maintains DNS or ENUM  
22 (electronic numbering) databases that associate IP addresses with 10-digit “telephone

1 numbers” so that telephone numbers can be “translated” into IP addresses in order to  
2 route calls that remain end-to-end on the Comcast network or terminate on other IP  
3 networks with which Comcast directly interconnects. This process works much like the  
4 DNS look up functionality used to route traffic on the World Wide Web.<sup>11</sup>  
5

6 **Q. What is the eMTA, and what is its role in Comcast’s network?**

7 A. The eMTA is customer premises equipment (CPE) deployed by Comcast to its VoIP  
8 customers. As it is deployed by Comcast, it has three main functions. First, it provides  
9 the end user a high speed data connection for accessing the Internet (for example,  
10 checking email, surfing the Internet or downloading content). For this reason, it is  
11 typically installed close to the customer’s computer. Second, the eMTA is the device that  
12 formats the analog voice signals created by the handset into the IP packets for routing on  
13 the Comcast network. Third, the eMTA is the “home” for the IP address that allows the  
14 network to communicate with the eMTA for the proper routing of Comcast VoIP  
15 packets. Currently, Comcast owns the eMTA and leases it to the customer for a fee. In  
16 the near future, customers may have the option to purchase their own eMTAs from  
17 Comcast.

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<sup>11</sup> The only difference is that the domain name look-up servers on the Internet translate the alphanumeric names of specific websites (such as “[www.comcast.com](http://www.comcast.com)”) to the IP number of the destination site. In the case of Comcast VoIP call routing, 10-digit telephone numbers are translated into IP addresses. Whereas a 10-digit telephone number is actually the “address” of a station on the PSTN, on Comcast’s IP network (and other VoIP-capable networks), a 10-digit telephone number is really just a convenient “name” for a location – like [www.comcast.com](http://www.comcast.com) – whose actual network address is specified using the Internet addressing convention of xxx.yyy.zzz.qqq, where each element of the address is a number from 0 to 255.

1 Comcast's cable affiliate owns the "last mile" of plant, typically coaxial cable,  
2 connecting the user's home to Comcast's fiber network. Per FCC regulations,<sup>12</sup>  
3 Comcast's cable network typically begins twelve inches outside the customer's home,  
4 although there may be some variation based on the unique architecture of particular  
5 dwellings. Data therefore enters Comcast's network after the eMTA inside the  
6 customer's home has already processed the customer's voice signal and converted it into  
7 IP data packets.<sup>13</sup>

8  
9 **Q. What is the path for VoIP information on Comcast's network?**

10 A. After the IP packets leave the eMTA, the data packets that are destined for the public  
11 Internet over the high speed data connection and the Comcast VoIP data packets both  
12 travel over the same Hybrid Fiber-Coaxial cable (HFC) network, which runs from the  
13 customer's home to the Comcast headend. The headend is the Comcast facility where  
14 the HFC network terminates and contains the electronics that support the Comcast  
15 infrastructure. All of the packets, whether voice or data-related, travel to the cable  
16 modem termination system (CMTS) located at the Comcast headend. The CMTS is an  
17 interface that connects the local HFC network with Comcast's managed IP network.

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<sup>12</sup> 47 C.F.R. § 76.5(mm)(1).

<sup>13</sup> When installing CDV or BCV, technicians disconnect the customer's wiring from the telephone company's Network Interface Device (NID). The eMTA is typically located inside the customer's premises. Depending on preference, customers can plug a telephone directly into the eMTA or Comcast can activate the inside wiring to access the service.

1           The destination of the VoIP data packets is then determined by Comcast's soft  
2 switch. For New Hampshire, all CDV packets on the network are controlled by the soft  
3 switch located in Chelmsford, Massachusetts. BCV packets are controlled by  
4 geographically redundant soft switches in Philadelphia, Pennsylvania and Denver,  
5 Colorado. Comcast has dozens of soft switches deployed around the country.

6           The soft switch is the heart of Comcast's VoIP network. It performs a variety of  
7 functions including the selection of processes/features that can be applied to a call and the  
8 provision of routing instructions for a call within the network based on signaling and  
9 customer database information. For example, the soft switch performs the database  
10 query that correlates ten-digit telephone numbers with IP addresses and populates the  
11 Comcast VoIP packets accordingly. The soft switch determines whether a call is  
12 intended for another Comcast VoIP customer and, if so, manages the routing of the call  
13 on Comcast's network by managing the transfer of the call to other network elements, as  
14 appropriate. The soft switch is also responsible for communicating with off-network  
15 databases in order, for example, to retrieve calling name information stored in off-  
16 network SS7 databases when Comcast terminates calls. The soft switch also  
17 communicates with the SS7 network in order to set up routing instructions for traffic  
18 exchanges with the PSTN.

19           If a Comcast VoIP call is destined for an end user on the PSTN, the soft switch  
20 communicates with the SS7 network to set up a dedicated TDM (trunk) call path for the  
21 routing of the call on the PSTN. The call also must be converted from the IP protocol  
22 used to route Comcast VoIP traffic on the Comcast network to TDM. For most VoIP

1 calls originating on Comcast’s New Hampshire network that are destined for the PSTN, a  
2 component of the network managed by the soft switch called a “media gateway”  
3 performs this key net protocol conversion function.<sup>14</sup> The media gateway for the New  
4 Hampshire market is located at the same location as the soft switch, in Chelmsford,  
5 Massachusetts. The media gateway refers to both the hardware and its embedded  
6 software (media gateway control protocol) that converts the data from IP to TDM. The  
7 soft switch looks up the IP address of that dedicated call path (trunk) to route the call. It  
8 is at this point – after the call has been converted to TDM – that it is handed off to  
9 Comcast Phone, which routes the call to Comcast Phone’s point of interconnection with  
10 FairPoint Communications in Concord, New Hampshire. For some calls originating on  
11 Comcast’s New Hampshire network that are destined for the PSTN, Comcast uses a  
12 vendor to convert the traffic into TDM and terminate the calls on the PSTN.

13 In New Hampshire, calls to customers of other cable VoIP providers are also  
14 converted from IP to TDM – either by Comcast IP’s media gateway or by a Comcast  
15 vendor – and routed via the PSTN. Some calls – between Comcast’s own customers,  
16 and, in some other markets, calls between Comcast’s customers and those of other VoIP  
17 providers – stay “IP all the way” and do not traverse the PSTN. We will discuss those  
18 calls in more detail below.

19

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<sup>14</sup> A “net” protocol conversion is where voice data exits the network in a different format from the one in which it entered, i.e. TDM to IP, or IP to TDM. *See infra*.

1 **Q. What are the similarities and differences between Comcast's VoIP service and**  
2 **non-facilities-based VoIP services, like Vonage's?**

3 A. Comcast VoIP and services like Vonage's – typically called “over the top providers”  
4 because their traffic “rides” third-party broadband networks, including (presumably)  
5 Comcast's – have much in common. First, both are interconnected VoIP services as  
6 defined by the FCC, and both are subject to the same set of FCC regulations discussed  
7 earlier in this testimony. Second, both are essentially software applications that utilize  
8 the capabilities of broadband networks and the services of partner telecommunications  
9 carriers to exchange traffic with end-users on the PSTN, obtain access to telephone  
10 numbering resources, porting and access to 911 networks, among other functions. While  
11 CDV uses the services of its carrier affiliate (Comcast Phone), providers like Vonage  
12 purchase such services from third-party carriers. BCV relies on a combination of  
13 Comcast's own services and those purchased from third-party vendors.

14 Third, because of the IP nature of the service, both Comcast VoIP service and  
15 over-the-top VoIP offer customers a variety of advanced, wholly integrated services,  
16 including the ability to manage dynamically services and features over an Internet portal  
17 as well as the ability to listen to voicemails, view call logs and manage vertical features  
18 from any Internet connection.

19 Fourth, Comcast's VoIP service and over-the-top services both have the  
20 capability to offer customers a choice of telephone numbers from a variety of U.S. rate  
21 centers. While Comcast's VoIP service currently assigns telephone numbers that  
22 correlate to the physical location of the traditional PSTN rate center where the customer

1 and the eMTA are located, that reflects a business choice, and not a technical limitation  
2 of the offering. Comcast viewed geographically relevant number assignment as an aid in  
3 providing PSTN-equivalent E-911 services. Under the new National Emergency  
4 Number Association (NENA) standards such as “i2,” this kind of numbering consistency  
5 will not be necessary. Also, while Comcast views many aspects of the existing access  
6 charge regime to be in need of reform, as a business matter Comcast did not want to  
7 entangle its VoIP service offering with ongoing debates about such reform. From this  
8 perspective, geographically “appropriate” numbering assignment helps to allay the  
9 concerns of third-party carriers interconnecting with Comcast Phone that Comcast Phone  
10 is seeking to avoid access charges.

11 In addition to the fact that over-the-top services typically offer non-geographic  
12 numbers to customers where Comcast VoIP does not, an over-the-top service is typically  
13 marketed as nomadic, meaning the terminal adapter can be moved and plugged into  
14 different locations for use. The Comcast eMTA will also continue to function if moved  
15 within a certain geographic area, and while Comcast could offer a fully nomadic service,  
16 its VoIP service currently precludes moving the eMTA to a new location without  
17 coordinating that move with Comcast. Finally, Comcast VoIP differs from over-the-top  
18 services in that it relies on the Packet Cable/DOCSIS specification which, among other  
19 things, assures that Comcast VoIP has a high level of call quality. Conversely, over-the-  
20 top services are sometimes described as “best-efforts” services.

21

1 **Q. What is “protocol conversion,” and where in Comcast’s network does protocol**  
2 **conversion take place?**

3 A. Protocol conversion allows customers whose data is generated in one communications  
4 protocol (for example, IP) to communicate with users who send or receive information  
5 in a different communications protocol (for example, the protocol used by traditional  
6 telephone networks to send and receive calls, the TDM protocol). Protocol conversion  
7 of voice communications between TDM and IP, and vice versa, is a critical element of  
8 Comcast’s VoIP services, and make Comcast’s VoIP services commercially desirable  
9 by enabling its customers to communicate with users of the PSTN, as well as users of  
10 other VoIP service providers with whom Comcast does not directly interconnect (and to  
11 whom calls must often be routed through the PSTN). All calls between Comcast’s  
12 customers and customers on the PSTN undergo a net protocol conversion between the  
13 Internet Protocol used on Comcast’s network and the TDM protocol used on the PSTN.

14 For most intraLATA CDV calls in New Hampshire, this net protocol conversion  
15 is conducted by Comcast’s media gateway located in Chelmsford, Massachusetts.  
16 BCV uses geographically redundant soft switches located in Denver, Colorado and  
17 Philadelphia, Pennsylvania. Calls from users of the PSTN to CDV New Hampshire  
18 customers are generally handed from FairPoint to Comcast Phone in TDM at an  
19 interexchange point in Concord, New Hampshire. Comcast Phone then carries the calls  
20 in TDM protocol to the CDV media gateway in Chelmsford, Massachusetts, which  
21 converts the calls to IP for routing on Comcast’s IP network. Calls from New  
22 Hampshire CDV customers to PSTN users in New Hampshire generally go the other

1 way: they are carried in IP on Comcast's converged regional area network to the media  
2 gateway, which then converts them from IP to TDM and hands them in TDM to  
3 Comcast Phone, which in turn carries them in TDM to the interconnection point with  
4 FairPoint. For some toll intraLATA calls between Comcast's network and the PSTN,  
5 Comcast uses vendors to transport the calls to the terminating carrier in TDM.

6 Not all Comcast VoIP calls are routed to the PSTN. Some stay "on net." For  
7 example, a call between two CDV customers will never leave the CDV network and will  
8 be routed in IP throughout its entire transmission. In addition, in some other markets –  
9 although not in New Hampshire – Comcast has "peering" arrangements with other cable  
10 VoIP service providers and exchanges traffic in IP format with these providers. In those  
11 markets, this traffic is routed "IP all the way." However, Comcast does not have peering  
12 arrangements with other cable VoIP providers in New Hampshire. Therefore, calls  
13 between Comcast IP's New Hampshire customers and New Hampshire customers of  
14 other cable operators' interconnected VoIP services are not carried through peering  
15 arrangements, and traverse the PSTN as do calls terminating to FairPoint in New  
16 Hampshire.

17  
18 **Q. How is the user experience of Comcast's Digital Voice Service different from**  
19 **POTS?**

20 A. As we discussed earlier, there are some superficial similarities between the user  
21 experience with Comcast's VoIP services and POTS – such as tones that appear to be  
22 dial tones and numbers that appear to be traditional telephone numbers – even though

1 those features are not required by the Comcast network. Comcast provides these  
2 features in order to make it easier for former POTS users to acclimate to Comcast's  
3 VoIP service. There are many other areas, however, where there are major differences  
4 between the user experience with POTS and with Comcast's VoIP service. One key  
5 difference is that Comcast's IP network allows Comcast to deploy a host of advanced  
6 service offerings integrated with its VoIP service. These enhancements are continuing to  
7 evolve due to the myriad possibilities opened up by the IP nature of the service.

8  
9 **Q. Can you please describe some of the integrated product offerings made possible by**  
10 **the IP nature of Comcast VoIP?**

11 A. Comcast's VoIP service offers features, functions and capabilities that go well beyond  
12 those available with traditional circuit-switched telephone services. For example, CDV  
13 is tightly integrated with Comcast's SmartZone<sup>TM</sup> Communications Center, an innovative  
14 online application (made possible through IP technology) that integrates key features of  
15 CDV, high-speed Internet and video services. SmartZone<sup>TM</sup> was launched in January  
16 2008, taking the place of Comcast's Digital Voice Center. CDV customers can access  
17 Comcast's web-based SmartZone<sup>TM</sup> from *any* Internet connection – to manage their  
18 communications interactively, setting up features and functionality of their service like  
19 call forwarding or call screening, and viewing lists of calls that were dialed or received.  
20 In addition, SmartZone<sup>TM</sup> integrates both email and voicemail. CDV customers can  
21 listen to their voicemails online – again from any computer with an Internet connection,  
22 or with certain applications, via their cable television connections. Using the

1 SmartZone™ Communications Center, Comcast customers can send and receive email;  
2 check, manage and even forward voicemails from any PC; manage a single address book;  
3 and in the future, remotely program DVRs. Customers can also access personalized  
4 information such as weather, news reports and stocks, and perform local searches on their  
5 phones. A similar web portal is available for BCV customers.

6 CDV customers also have the ability to use and interact with features of CDV  
7 service and SmartZone™ using a mobile telephone or handheld device. Comcast  
8 released its Application for the iPhone® and iPod Touch® in July 2009. The Comcast  
9 Application allows users – from their iPhone® mobile phone or iPod Touch® device – to  
10 access the call logs from their CDV line, directly call or send text messages to callers on  
11 the CDV call log, view as “visual voicemail” (i.e. graphically displaying information  
12 about each message) any voicemails received on their CDV line, listen to those  
13 voicemails, and send them as attachments to email messages using their Comcast email  
14 addresses. It also permits CDV customers to forward their home phone calls to their  
15 mobile phone, sync contact lists between their mobile phone and CDV line, as well as to  
16 check television listings and watch movie trailers for Video on Demand offerings  
17 available through Comcast’s video service. Many of these functionalities are also  
18 available for mobile phones other than the iPhone® through a dedicated mobile website,  
19 accessible to any CDV customer with a data-enabled mobile phone, at  
20 <http://m.comcast.net>. In order to activate the Comcast iPhone application, all the user has  
21 to do is download the application from Comcast’s web site at

1 <http://www.comcast.net/iphone/>. These enhanced offerings are all made possible by the  
2 IP-enabled nature of Comcast's VoIP service.

3 "Universal Caller ID" is yet another example of the kind of advanced service  
4 offering available to customers as a result of the IP nature of the service. It permits the  
5 user to view caller-ID information on a traditional caller-ID device, a television set or a  
6 computer screen. In order to activate Universal Caller ID, all the user has to do is  
7 download the application from Comcast's web site.<sup>15</sup>

8 Within the next few months, Comcast will launch an Enhanced Cordless  
9 Telephone, or HOMEPOINT, integrated with CDV that will allow a CDV customer to  
10 check email, view voicemail and obtain information on sports and weather on the home  
11 phone handset. Moreover, these functionalities will be integrated across platforms,  
12 permitting customers to access these services through the television, their Internet  
13 account, or the phone. HOMEPOINT is currently in market trials and is scheduled to  
14 launch in early 2010.

15 Comcast is working on the implementation and rollout schedule for additional  
16 products, as well as further enhancements to Comcast VoIP. Because of the dynamic  
17 nature of IP-enabled technologies, enhanced communications products integrated with  
18 Comcast VoIP are always evolving and converging.

19 **Q. Does this conclude your testimony?**

20 A. Yes.

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<sup>15</sup> See <http://www.comcast.net/callerid/>. This service is available no additional cost because of the flexible Internet Protocol basis of the Comcast VoIP platform.