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December 3,1998
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Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Notice of Ex Parte Presentation
RE: CC Docket #98-146. Memorandum Opinion and Order and Notice of Inquiry for Commission's action to promote deployment of advanced Telecommunications Services

Dear Ms. Salas:

Simon Strategies, LLC, on behalf of MindSpring Enterprises, Inc., hereby submits for filing in the above-reference docket its notice of additional written materials based on an oral presentation that took place on October 29, 1998.

The attached materials respond to questions raised by Robert Pepper of the Plans and Policy Office. These materials are in reference to issues pertaining to 706 requirements of the Telecommunications Act of 1996.

In accordance with Section 1.1206 of the Commission's Rules, the original and one copy of this notice are being filed with the Secretary and additional copies are being served on all participants.

Please date-stamp the attached duplicate upon receipt and return it via the messenger for our records. If any questions arise concerning this matter, kindly contact the undersigned.

Respectfully submitted,

Greg Simon

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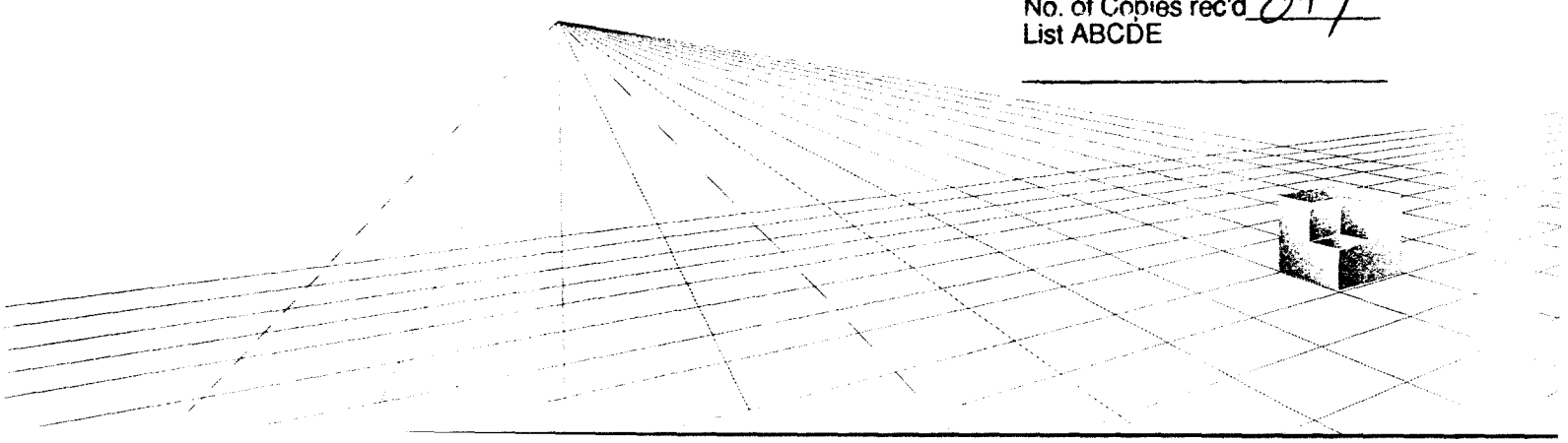

Using cable modems to provide multiple-carrier networks

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November 10, 1998

In this paper, I discuss how one can use cable modems to provide a network amenable to the use of multiple carriers. It turns out that using cable modems to allow consumers choice with respect to their service and network provider is a simple matter from a technical point of view, and that there are many ample precedents in the Internet's history which illustrate how one might go about achieving such a goal. This paper explains the few technical hurdles and examines some of these precedents.

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5. About this document

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1. What are cable modems? Cable modems are ethernets!

In order to understand just how easy it is to use cable modems to provide subscribers access to multiple network providers, it helps if one first understands a little about what cable modems are and how they work.

1.1. The first "cable modems" were pure ethernet devices

The first cable modems were 10-broad-36 devices. 10B36 was part of the original ethernet standard, which defined several physical media on

top of which ethernet would run. The two most well-known of these are 10-base-2, or "thinnet" which uses a smaller coaxial cable, and 10-base-T, the common ethernet standard which is in many offices and even homes today. 10B36 was a standard for putting these same electrical signals over a different physical medium, namely, the larger coaxial cables found in cable TV systems. These "cable modems" were actually very popular on college campuses; they were widely used, e.g., at the University of Florida to provide network access over the cable TV wiring infrastructure in the 1980s.

1.2. Even the MCNS standard is clearly an ethernet standard

The now-dominant cable-modem standard, MCNS, first had to compete with IEEE 802.14, which came out of the IEEE's 802 (ethernet) group. The primary reason why MCNS won and 802.14 lost was that cable vendors grew tired of the IEEE's slow rate of progress, a common complaint with the IEEE. Because their differences were mostly administrative, MCNS retained most of the technology features of the 802 family of network protocols.

For example, MCNS devices have a MAC address, the unique station identifier for each network node used in ethernet. MCNS uses ARP, a protocol for associating MAC addresses with IP addresses; ARP is another feature of IP networks running on ethernet. The only thing different between MCNS and other ethernet forms like 10bT or 100bTX is the speed and the underlying physical transport. Both of these vary among the many forms of ethernet which share ethernet's name. Ethernet can run at 10, 100, or 1000 megabits/second; it can run on twisted-pair cabling, fiber-optic lines, or even coaxial cable. Cable modem devices are no different from 10bT than 10b2 is.

Perhaps the most direct indication of how MCNS cable modem networks are ethernets can be found in the MCNS standards themselves, specifically "Radio Frequency Interface Specification" (SP-RFI-I03). This document reveals how MCNS networks are architected, and it reveals the following design decisions:

+ Section 3.5 states, "The Data Link Layer is divided into sublayers in accordance with IEEE802"; IEEE802 is the IEEE's overview of the ethernet standard.

+ Section 3.5.1 states that MAC addresseses are associated to IP addresses according to IETF RFC 826. This RFC is entitled: "An Ethernet Address Resolution Protocol, or, Converting Network Protocol Addresses to 48 bit Ethernet Address for Transmission on Ethernet Hardware".

+ Section 6.2.1.3 states "Within an octet, the least-significant bit is the first transmitted on the wire. This follows the convention used by Ethernet"

+ Section 6.2.2.1 states "The MAC sublayer MUST support a variable-length Ethernet/ISO8802-3]-type Packet Data PDU."

+ Appendix D specifies "The MAC sublayer will provide the following services, consistent with [ISO/IEC15802-1]." (ISO/IEC 15802 is the

> ISO version of the IEEE specification of the MAC portion of the ethernet standard.) The services which must be consistent with this ethernet standard are: MAC-CM-802-DATA.request, MAC-CM-DIX-DATA.request, MAC-CM-ATM-DATA.request MAC-CM-802-DATA.indication, MAC-CM-DIX-DATA.indication, MAC-CM-ATM-DATA.indication and MAC-CM-DATA.acknowledgment.

Throughout the MCNS specification, one is reminded again and again that, aside from the raw electrical encodings, virtually all of the methods used to move data across cable modem network are ethernet. It is no different from 10-base-T than 10-base-2 is. Cable modem networks retain all of the fundamental characteristics of ethernet, including the MAC algorithms, collision detection, carrier sense, etc. It's fundamental approach to transporting frames is the same one that Bob Metcalfe came up with in the late 1970s: send a packet and, if someone else sends a packet at the same time, wait for a random interval and try again.

If it looks like a duck, walks like a duck, and uses duck standards to make their products cheaper and faster to market, then it's a duck. Cable modem networks are ethernets.

2. Can multiple network providers offer service cable modem networks? Yes!

Ethernets are the prototypical multiple-access networks. When the IETF wrote a tutorial on how IP works (RFC 1180), they used ethernet as the example because:

> Although internet technology supports many different network media, Ethernet is used for all examples in this tutorial because it is the most common physical network used under IP. (page 3)

It turns out that cable modem networks, being as they are ethernets, are much more IP-friendly than are even modems, the dominant form of IP access in use today. Surely, if any medium is friendly to being used as a multiple-access IP network, one would think that it is ethernet.

One would be correct in this thought. Technically, ethernets, like almost any other multiple-access network, allow the use of multiple IP networks and multiple IP routers over a single layer-2 infrastructure.

Here are two easy ways to allow multiple service providers to use the same cable modem network to offer service.

2.1. How to provide multiple carrier access on a pure layer-2 network

Say that a given cable modem network is layer-2 all the way to the headend of the cable network, that is, machines on the network at the headend and machines in the customer's home or office are directly visible to each other over the cable modem network. Under this

scenario, if the customer machine wants to reach a machine at the headend, then he sends out an ARP request which the headend machine hears, and the headend machine sends an ARP reply which the client receives directly.

The only difference between this scenario and the single-provider scenario is that authentication and machine configuration are slightly different.

Under this scenario, the ISP provides the network vendor with knowledge of their customers, very similarly to the way in which ISPs provide modem network vendors with knowledge of their customers today. When a user powers on his machine his machine sends out a standard DHCP request. DHCP is a standard protocol used by default in Windows and often used in office environments to manage PCs. The user basically asks the server "I am user tlewis@mindspring.com; how should I configure myself?" The server looks up user tlewis@mindspring.com, sees that he is a mindspring subscriber and gives him the following configuration information:

+ IP address: an IP address which MindSpring has assigned

+ Default router: a MindSpring router located in the cable network's headend office

+ DNS server: a MindSpring DNS server located somewhere on MindSpring's network

+ web cache: a MindSpring web cache

Compare this with cable-modem network vendors' present plans. They plan on having their customers call into a DHCP server in an identical manner and for the DHCP server to return the following info:

+ IP address: an IP address which the cable modem network vendor (CMNV) has assigned

+ Default router: a CMNV router located in the cable network's headend office

+ DNS server: a CMNV DNS server located somewhere on MindSpring's network

+ web cache: a CMNV web cache

As one can see, the differences between these two approaches are not too great. The technology to do these directory lookups in the DHCP server and return the appropriate information is trivial; MindSpring already has an implementation internally.

2.2. How to provide multiple carrier access on a hybrid layer-2/3 network

If cable-modem network vendors are deploying hybrid layer-2/layer-3 networks, where there is an IP router between the customer and the headend of the cable network, then the network provider can not simply

point the user at the ISP router, since the customer can not see the ISP router.

The way to solve this problem is that cable network providers can blindly route traffic based on originating IP address to the appropriate upstream router for final routing. This way, customers can use their ISP's facilities for network access and content caching, and the network providers, who are very interested in providing quality service, can be held accountable for how good of a job they do in providing these services. Otherwise, the setup is the same as the pure layer-2 setup, above; authentication must still become multi-vendor-friendly.

Knology plans on using this arrangement in seven of the markets which they serve in order to allow ISPs competitively to offer internet service over their networks. Mindspring is conducting a trial on Knology's Montgomery, Alabama network using this arrangement. I conducted the initial test personally and on-site; this arrangement has worked and is working in Montgomery to allow MindSpring to offer competitive internet services. This is proof by example that this sort of arrangement is possible and practical.

3. No! Should consumers be forced into a one-size-fits-all Internet backbone solution?

One approach which allows multiple network providers to offer internet service off of a single cable modem network would be to mimic the arrangement used by modem port vendors, such as GridNet and GTE, today. Under that arrangement, customers of multiple ISPs dial into a single bank of modems in a single city. They are assigned IP addresses out of a single pool. They all use the same backbone connection to reach the Internet. They each go their separate ways, however, to reach their ISP for mail service, news service, etc. Under the analogous cable modem network arrangement, all customers in a given city would use the cable provider's facilities to reach the Internet, and only sending traffic to their ISP for mail service, news service, etc.

Superficially, these two approaches are similar; in both cases, customers use the network provider's facilities, not the ISP's, to reach the Internet.

But there is an important difference. In the former case, the primary network cost is for the phone lines and modem facilities, and the customer experience is drastically affected by modem-related issues such as busy signals, connect speeds and the like. Internet backbone cost is a marginal expense in this formula, and it is naturally limited by the speed constraints of a modem connection.

In high-bandwidth environments like cable-modem networks, network connectivity goes from being an afterthought to the forefront of the customer experience; simultaneously, it becomes a primary network expense. Bandwidth availability replaces access speed as the prime determinent of the quality of the customer experience in always-on, high-bandwidth environments. This is why telephone providers are building their DSL networks in such a way that the ISP is responsible

for Internet backbone service to the customer.

This one-size-fits-all solution to cable modem networks has this major flaw, i.e., that it would not allow the participating ISP's to compete based on backbone connectivity or caching characteristics. For example, some customers would perhaps prefer a somewhat slower and less robust backbone connection, but at a lower price. Other customers might prefer to pay a premium price for a connection that can guaranteed "quality of service" parameters for real time applications like videoconferencing. Others might require "virtual private network" characteristics, and be willing to pay for that. If ISPs are squeezed into a "one size fits all" model of backbone connectivity, customers will suffer a very serious lack of choice. As we move to the high-speed world of the future, with its more varied applications, these characteristics will become more and more important. ISPs should be allowed to offer a choice on these questions to customers.

4. Are there any real technical hurdles? None of which I am aware...

4.1. Authentication? Not a problem.

All existing authentication infrastructure for cable modem networks extends easily into a multi-provider environment. In addition, we have mechanisms at the IP level, most prominently IPSEC, which allow us to provide even more stringent authentication than what the cable modem vendors are able to provide.

4.2. Network access control? No worse than under existing plans.

In truth, network access control is another weak area of MCNS. However, the fact that a customer uses a MindSpring router instead of a CableCo router to get his packets onto the Internet does not mean that the customer can any more easily get access to CableCo's cable network.

All of the mechanisms which the cable companies have in place to limit access to their network will work in a multiple-provider environment.

4.3. Added complexity? No more complex than today.

MindSpring has agreements with Gridnet, PSInet, and BBN for MindSpring customers to use their modems to access the internet. We deal with authentication, network access, usage limiting, abuse/spam issues, quality of service issues, and all of these other issues inherent in using other people's networks, and we deal with them smoothly and on a daily basis. There is no reason that we could not co-operate with the cable companies on a similar basis, and with a similar degree of success.

4.4. Multiple providers require multiple CATV channels? Nope.

While one approach to allowing multiple providers onto a cable

infrastructure is to give each one his own channel and let him run his own network on that channel, I have outlined above two scenarios under which multiple providers can be allowed onto the network without requiring this step. While I am sure that ISPs would be happy to discuss the unbundling of cable network elements, it is not necessary to allow multiple providers onto a single cable modem network. The Knology example proves that this is the case.

4.5. How to regulate bandwidth consumption? Same as today.

Leaving aside the fact that cable providers have no good answer as to how they plan to regulate their own customers' potentially-unlimited bandwidth consumption, regulating other providers' customers consumption is very easy. Simply monitor all bandwidth which goes into and out of the ISPs network port and charge the ISP some reasonable fee. The ISP can then pass these costs down to their customers and regulate their usage.

4.6. How much additional equipment would this require? Very little.

In the case of Knology, their router in Montgomery was sitting off of an ethernet switch. In order for us to be able to offer service off of their network, they had to provision us a port off of that ethernet switch at a cost of less than $100. If cable providers are not switching their cable modem traffic onto an ATM or conventional ethernet network, then they would have to give headend cable modem ports to ISPs, which might be slightly more expensive. Under no circumstance, however, should offering this service be more expensive to the cable vendor than the cost of their equipping their network with a backup router.

5. About this document

This document can be found at
http://www.mindspring.com/~tlewis/cm.html.

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