Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Inquiry Concerning High-Speed Access to the Internet over Cable and Other Facilities	)	GN Docket No. 00-185
	)	
Internet Over Cable Declaratory Ruling	)	
	)	
Appropriate Regulatory Treatment for Broadband Access To the Internet Over Cable Facilities	)	CS Docket No. 02-52

DECLARATION OF GARY DONALDSON

1. My name is Gary Donaldson. I am Director of HFC [Hybrid Fiber Coaxial] Design at AT&T Broadband. My responsibilities include corporate standards for outside plant design from optical node to the subscriber tap. I have worked 29 years in the cable industry, and have held my current position since September, 2000.

2. The purpose of this declaration is to address the comments of various municipal interests in this proceeding claiming that cable modem service places additional burdens on the public right of way. In particular, I will respond to the report by Andrew Afflerbach and David Randolph of Columbia Telecommunications Corporation ("CTC") entitled *The Impact of Cable Modem Service on the Public Right of Way* (June 2002)) ("CTC Report"), which is attached as Exhibit G to the Comments of the Alliance of Local Organizations Against Preemption.

3. Traditionally, cable networks have been constructed with a "tree and branch" architecture. Such networks have five major parts: (1) the headend, which processes broadcast, satellite

and locally-originated signals for distribution to subscribers; (2) the trunk lines, which are high-capacity coaxial cables[1] that carry signals from the headend to (typically) a bridging amplifier for feeder cables; (3) the feeder cables, which distribute signals through neighborhoods; (4) drop lines from "taps" on the feeder cable into the individual customer premises; and (5) subscriber terminal equipment such as set-top "converters." As the network branches, its signal power is split to send down each branch. Signals decrease in strength as they propagate through the coaxial cable, and a cascade of amplifiers must be deployed throughout the plant to restore the signal power. The more branches there are in the distribution system and the longer the mileage of the plant, the more amplifiers are needed. There are technical limits on the numbers of amplifiers that can be added to the system without degrading signal quality to an unacceptable level, because amplification adds noise and distortion to the system.

4. As fiber optic technology improved, and as demand for more bandwidth grew, cable operators turned to HFC architectures in upgrading their networks by the end of the 1980's. Optical signals can travel many times farther over fiber than electrical signals can over coaxial wires before needing amplification. Thus, HFC is a more "passive" architecture that requires less active componentry (such as amplifiers and power supplies) in the public right of way. HFC architectures improve operational efficiencies, expand channel capacities, increase reliability, improve signal quality through the significant reduction of noise and distortion, and enable operators to provide reliably a variety of two-way services (including

[1] Alternatively, in the past some systems have employed point-to-multipoint microwave systems to obviate the need for long coaxial cable trunks with their attendant cascades of amplifiers – despite the fact that performance was marginal even in optimal conditions, and often subject to outages due to heavy rain.

video-on-demand ("VOD"), near-video-on-demand ("NVOD"), interactive television ("iTV"), telephony, and cable modem service)..

5. As a general matter, cable operators initially turned to HFC designs for reasons of operational efficiency, in order to take advantage of improved fiber performance and also the improved performance and reduced cost of optoelectronics. Significantly, this was well in advance of the advent of cable modem service or the commercial Internet; indeed, to some degree the development of advanced services was caused by experience with HFC designs and a recognition of their potential.

6. Business imperatives in the video market for expanded premium, pay-per-view, and VOD services also provided an impetus for HFC architectures. The practical limit for a typical 550 MHz coaxial network, before signals are attenuated below marketable quality, is roughly 80 analog 6 MHz NTSC channels. In order to increase channel capacity, more bandwidth must be pushed through the network. Signal attenuation is greater through coaxial cables at higher frequencies, and thus more (and more closely spaced) amplifiers would be needed. Fiber optic technology provides a means for overcoming these physical limits. Indeed, although the municipal commenters focus on cable modem service, in a typical network upgrade in which AT&T Broadband increases capacity from 80 to 130 channels, 46 of the added channels might be for video services (plus 2 channels each for telephony and cable modem service).

7. The HFC architecture also facilitates the delivery of higher-bandwidth two-way services, both cable video services (such as VOD, NVOD, and iTV) and cable modem service. Cable systems with traditional tree & branch coaxial plant are technologically capable of providing cable modem service; technicians can simply activate a return path for two-way service by installing return path amplifier modules that virtually all amplifiers placed in the network in recent decades can readily accommodate. The problem with all high-bandwidth two-way services over traditional architectures is the difficulty of delivering quality, reliable service because upstream channels on cable networks are traditionally noisy environments (as noise and interference from each subscriber is funneled upstream). Modern HFC designs push fiber deeper into the system than first-generation HFC networks and establish more fiber optic "nodes" typically serving smaller areas of 500-1,000 homes (and sometimes fewer). Such HFC designs essentially transform a single cable system into a more "granular" network of smaller subsystems, which are not only more reliable – a malfunction at one will not impair the others – but allow much higher bandwidth and signal quality. Reducing outages and improving signal quality are particularly critical in competition with DBS rivals in the video market. Thus, it is clear that the HFC network upgrades of recent years, and any accompanying right-of-way burdens, are not attributable to cable modem service, and would occur even in the absence of that service.

8. The CTC Report appears to concede that, in order to expand channel capacity significantly while maintaining signal quality of video programming, it is efficient for cable operators to build HFC networks. Report 2, 20. Its principal claim is that cable operators were driven by the desire to provide advanced two-way services to segment their network into smaller nodes

(*i.e.*, build a more granular network) in order to achieve the signal quality and service reliability that those services demand in an increasingly competitive market environment. Report 2.

9. As an initial matter, the claim that segmentation of the network into nodes under 1,000 homes is driven by the desire to build advanced two-way services capability is not true. HFC architectures are more operationally efficient than older tree-and-branch architecture because they reduce active components, power loading, and maintenance and repair costs, and improve signal quality and subscriber experience. The continued advancement in the state of the art of active optical components, resulting in higher performance at lower costs, has been further instrumental in making fiber-rich networks economically attractive. Decisions on node size in network upgrades are driven by cost considerations, and the positive effect on advanced services capability is regarded as a side benefit. Generally, because of operating efficiencies and the business imperative of achieving signal quality and reliability that is competitive with DBS providers, reducing node size below 1,000 homes would be cost-justified regardless of advanced services.

10. Moreover, issues of future congestion are not solely driven by cable modem service, but by the entire range of two-way services (including advanced two-way video services like VOD and NVOD, which consume more downstream bandwidth than cable modem service).[2]

---

[2] The CTC Report never directly addresses this point. It draws a distinction between "'video' or 'video-only' cable services" and "advanced two-way services," and then asserts that HFC upgrades are attributable to the latter. Report 1 & n.1. The Report defines "'video' or 'video-only' cable services" as "both analog and digital cable services, including traditional broadcast, pay-per-view, and multiple channel programming (such as sports events with choice of camera angle or audio)." *Id.* 1 n.1. Tellingly, the Report never defines what it means by "advanced two-way services," or where high-bandwidth, two-way video services (like VOD or NVOD) or cable telephony would fall.

11. There are a number of other points made in the CTC Report or other Comments that are either inaccurate or overstated:

A. CTC Report p.6: The Report states that because advanced two-way services require more bandwidth, more amplifiers may be necessary. But that general proposition does not apply if an operator takes fiber deep into the network (*e.g.*, by reducing node size). Greater segmentation of the network will *reduce* the number of required amplifiers by allowing each to operate at higher Radio Frequency ("RF") levels, thus expanding the "reach" of each device. For instance, AT&T Broadband typically sees about a 15% reduction in the number of amplifiers when we reduce our node size from ~500 homes/node to ~250 homes/node. The reduction in amplifiers (and thus amplifier pedestals in the right of way) underscores why it is misleading for the municipalities to focus on the additional *node* pedestals associated with granular HFC systems. Depending on the node sizes and other factors, there may be a net decrease in total right-of-way pedestals because there will be fewer amplifier pedestals in such a system.

B. CTC Report p. 8-9: The claim that fiber construction to provide redundancy is sometimes double the existing plant is overblown. All that typically is involved is to simply "close the loop" by optically linking two remote hubs together. Typically, the amount of extra fiber construction to effect this closure is more on the order of 20-25% -- and, as stated above, even this limited additional construction is neither caused by, nor necessary for, cable modem service.

C. CTC Report p. 9: The Report contends that network upgrades may increase hub size. But hubs are almost exclusively built on private easements, *not* in the public right-of-way. Hubs are sometimes constructed on public property, such as schoolyards and water tower sites, as a result of reciprocal agreements between the cable operator and the LFA and/or other public agencies, but in such cases there is no burden on the utility right-of-way. [3]

D. CTC Report p. 10: The CTC Report states that "[e]xtensive equipment in the public ROW is necessary to provide advanced two-way services," and proceeds to claim that "[p]ower supplies must be constructed in the ROW to power the new services and increase the level of reliability in the event of commercial power operations [*sic*]." Additional power supplies are often required to support lifeline telephony (where uninterrupted network power must be provided to support additional terminal equipment at the customer's premise), but they are not required for cable modem service. The extra network equipment attributable to cable modem service is confined to the headend and hub facilities, which are almost invariably located off the public right of way.

E. CTC Report p. 10: There is absolutely no basis for the claim that "[a] typical rebuild of the late-1990s or early 2000s increases the number of power supplies by a factor of three in the public ROW." First, even supporting network-powered customer premise equipment for lifeline telephony does not triple a system's required power load. Second, cable operators almost invariably take the occasion of an upgrade to replace

---

[3] The CTC Report on page 16 cites an equipment vault in Skokie, Illinois as allegedly belonging to AT&T Broadband. AT&T Broadband has identified the vault depicted in Photograph 8, and has verified that it in fact belongs to RCN Communications. AT&T Broadband maintains no similar facilities in Skokie.

their 60VAC power supplies with 90VAC units, thereby increasing the energy delivered to the network by 50% and expanding the coverage footprint of individual power supplies. Accordingly, a network upgrade to provide cable modem service but not lifeline telephony should in fact, upon completion of the upgrade, *reduce* the required number of power supplies on a properly engineered system.

F. CTC Report p. 10: I disagree with the claim that "redundant optical components" significantly increase the number of power supplies. Typically, optical redundancy is carried only down to the hub level, which are buildings with their own self-contained power plant. Optical nodes in the outside plant have minimal impact on the power loading, since there is usually only one node for every 500 to 1000 homes. Additional optical modules internal to the nodes will only increase their power consumption by about 50-100 watts - again insignificant. And in those cases where fiber is taken even deeper, the nodes replace RF amplifiers, resulting in a net decrease in the number of active devices (and thus in power requirements).

G. CTC Report p. 11: It is an overstatement to say that "cabinets and pedestals will increase in number and size as more advanced two-way services are provided over the system." The number of cabinets and pedestals is driven chiefly by the number of homes served by a system. Regardless of the availability of "advanced two-way services," an underground cable system will generally need a pedestal in front or in back of every 2-4 homes. Any added cabinets and vaults that are required for fiber cables and nodes are a function of the HFC network, and are not solely attributable to cable modem service.

H. CTC Report pp. 13: The Report would appear to significantly misrepresent the physical size of the power supply cabinet depicted in Photographs 6 & 7. The text claims that "Starpower's cabinets… are the size of a refrigerator…". Photograph 6 gives a particularly good impression of scale by comparison with the car parked at the base of the pole. I would (generously) estimate that the cabinet's size is on the order of 36"h x 30"w x 18"d, dimensions which are generally consistent with 6-battery power supply cabinets, and which must certainly fall far short of the major kitchen appliance referenced in the Report.

I. CTC Report pp. 19: The Report claims that "[p]ower passing taps are constructed for each residence or business served, in order to enable the provision of power to support such advanced services as telephony," and that "[t]his construction exists solely for the provision of cable modem and advanced services …." This claim is misleading at best. The only reason that power-passing taps are ever installed is to support network-powered primary line telephony (circuit-switched or voice-over-IP). Their power-passing function has absolutely no relevance to conventional cable modem service. Operators that are not interested in offering primary-line telephony would not install these taps because each one carries about a $15-$20 premium. In any event, such taps are not significantly different in size than conventional taps, and therefore place no additional burden on the public right of way.

J. CTC Report pp. 19: There is no conceivable basis for the claim that additional fiber receivers and lasers burden the right of way. These modules are located *inside* the node receiver, and so do not take up any additional space in the right of way.

K. City of New York Comments at 30: The City argues that the 500-home nodes are "required" to provide the requisite downstream bandwidth capacity for "fully functioning high-speed cable modem service." To the contrary, multiple nodes usually share a common downstream channel on the HSD terminal in a hub. An operator might plan at initial service launch to have a physical service area of approximately 6,000 homes sharing the same downstream HSD channel[4] (whether there are twelve 500-home nodes, six 1,000-home nodes, or three 2,000-home nodes).

12. Finally, in claiming that cable system upgrades place additional burdens on rights of way, the localities ignore upgrades' countervailing benefits to municipalities (and to consumers), such as replacement of rusted street furniture with new equipment, reduced customer-service complaints to LFAs, and reduced burdens on the right of way attributable to repairs, due to improved network reliability.

VERIFICATION

I, Gary Donaldson, declare under penalty of perjury that the foregoing is true and correct. Executed on August 6, 2002.

____

Gary Donaldson

---

[4] The actual number of HSD service users is invariably far smaller than the physical size of the service area, particularly at the time of initial service launch. Hypothetically, traffic assumptions might support a 10% subscription rate at a 10% peak simultaneous usage rate, or 6,000 homes x 10% x 10% = 60 simultaneous HSD users. As HSD traffic increases, operators have several techniques available to maintain perceived service quality – by adding HSD carriers, increasing the bandwidth per carrier (upstream carrier only) and increasing the rate of bits-per-second-per-hertz – without necessarily having to make the network any more physically granular.