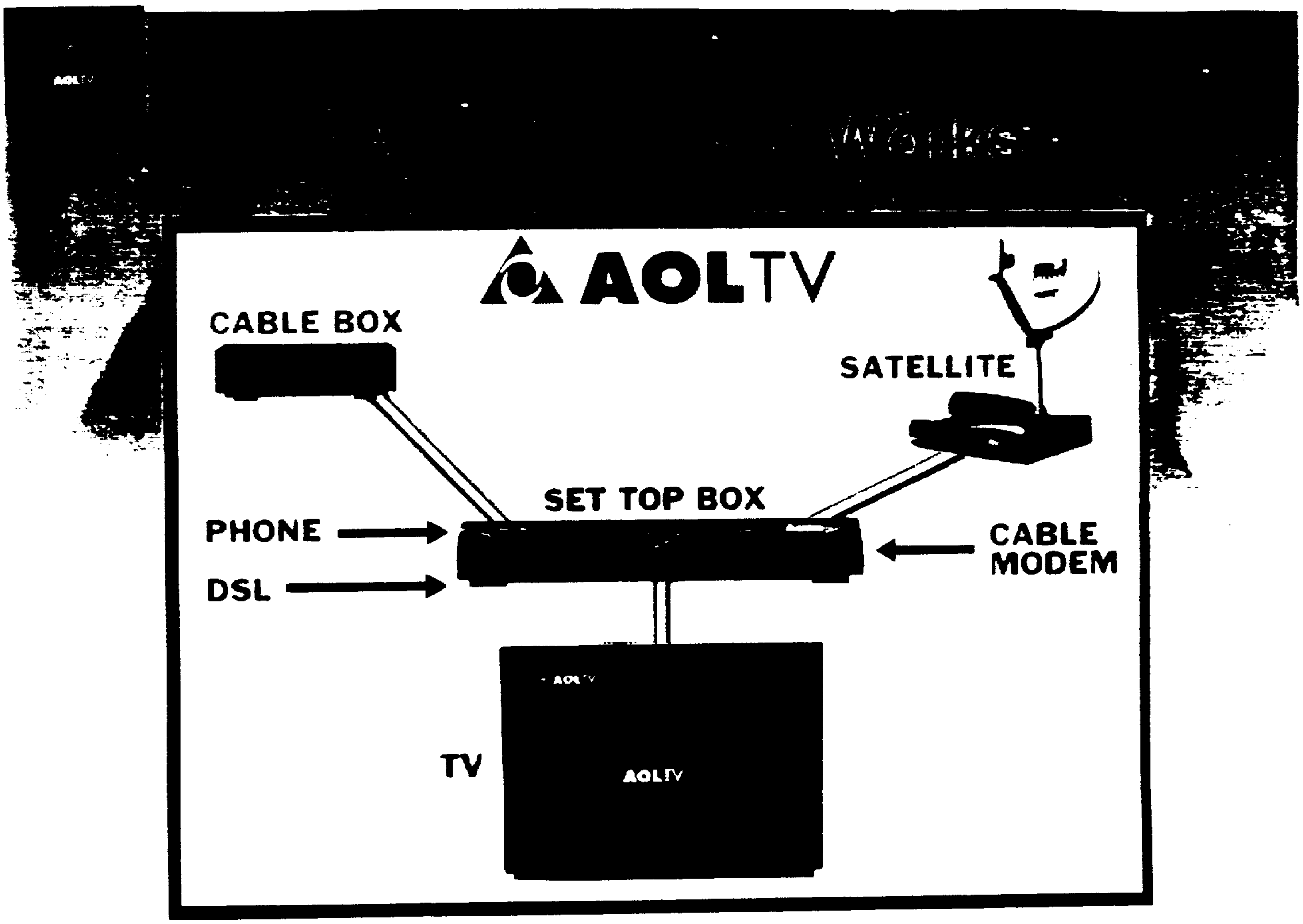
AOL TV

- Interactiv[illegible] consum[illegible] everyday lives
- People want convenience of interactivity across multiple devices for easy access
- Research shows consumers already going online while watching TV

Mass market consumers ready for interactive TV


AOLTV
CABLE BOX
SATELLITE
SET TOP BOX
PHONE
DSL
CABLE MODEM
TV
AOLTV

AOL(2)000470

AOL TV

[illegible]

- [illegible] multi-tasking
- Brings popular AOL features to TV experience
- Makes television easier to navigate
- Provides TV industry new platform for its interactive content and ad/e-commerce
- Commits to open standards and consumer choice

The AOLTV experience driven by consumers

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AOLTV

Extending Best of Interactivity to TV:

⇒ Convenience Features

⇒ Virtual Channels Offer More Consumer Choice

⇒ Community of 23 Million AOL Members

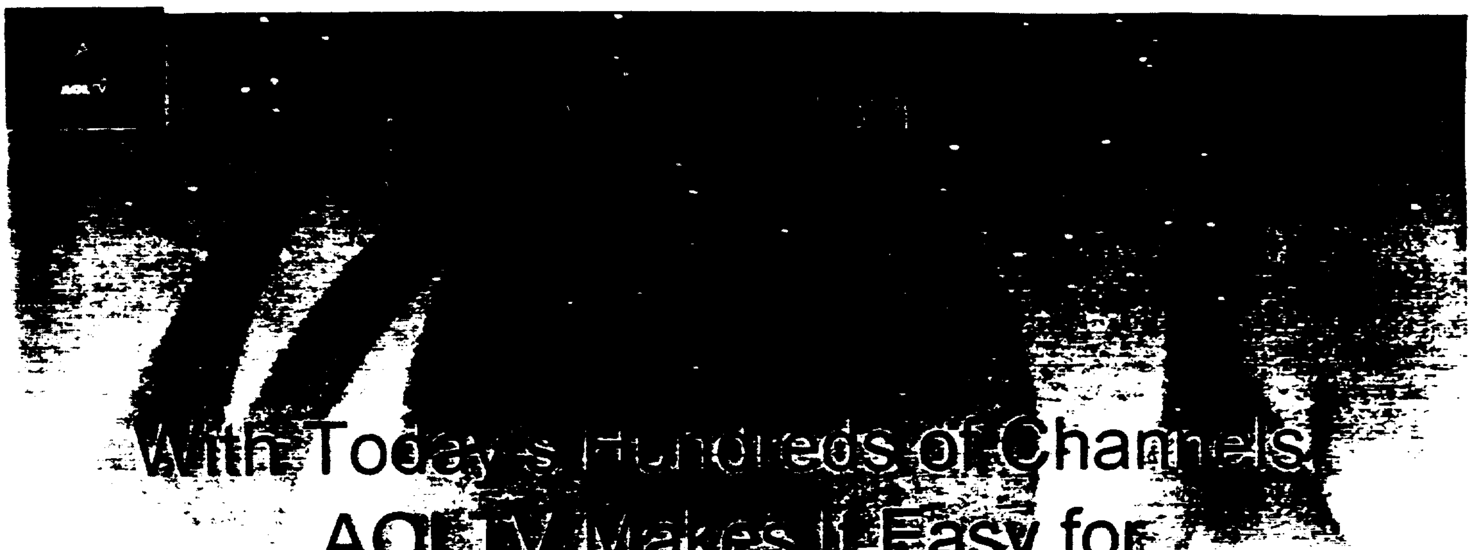
⇒ Content and Ad/E-Commerce to Complement TV Programming

AOLTV will make the television more useful and valuable device for home and family

AOL TV

[illegible] AOL TV

- Navigation [illegible]
- Your AOL Features designed for TV
- Enhanced TV



With Today's Hundreds of Channels, AOLTV Makes It Easy for Consumers to Find What They Want to Watch . . .

TV Will Be Surfable Again!

AOL TV

[illegible] television [illegible]

[illegible]ate

AOL TV Program Guide enables consumers to:

- Organize TV channels by category
- Explore new Virtual Channels
- Request on-screen reminders for favorite shows
- Automatically set VCRs to tape programs
- Review program summaries 3 days ahead of time
- Access via any device connected to AOL

Others program guides already being developed:
14 million consumers using DirecTV's program guide

AOL TV

[illegible] Experience

- AOL [illegible]
- AOL E-mail
- AOL Buddy List and Instant Messaging
- You've Got Pictures
- AOL Calendar
- AOL Parental Controls
- AOL Favorite Places
- AOL Portfolios

And it's up to consumers to decide how and when to use these convenient features

AOLTV Supports ATVEF Streams and Access To the WWW on TV Without a Commercial Relationship Required.

AOL TV

AOL TV Enables TV Programmers to Provide:

- In-depth background for news and sports programming
- Interactive polls
- Chats with TV stars
- Emergency information during natural disasters and other public service announcements

AOL TV

[illegible] programming

AOL TV Enables TV programmers to:

- Offer e-commerce opportunities linked directly to the shows on screen
- Extend the impact of television ads
- Generate new advertising revenue streams
- Build an exciting new generation of interactive content

AOL TV

[illegible] standards

- Open standards-based content will be accessible on other interactive TV services
- Licensable software from Liberate Technologies
- Support for set-top boxes that accommodate multiple interactive TV services

Open standards key to growing entire interactive TV industry

AOL

[illegible]

- [illegible] both TV and interactive programming
- Seeking to partner with all broadcast and cable TV networks
- Non-discriminatory listings of channels in Program Guide categories
- Viewer controls what is on the TV screen - e.g. picture in picture, resized picture

Consumers will decide success of this new industry

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AOL TV

[illegible]

Building a Large Audience

This Will Occur by Providing Consumers with the Most Choice and Diversity Possible in TV and Interactive Content.

AOL

AOLTV

Open Standards

Consumer Driven

Enabling Platform

Telcordia Technologies

Formerly Bellcore...
Performance from Experience

Telcordia Technologies Document
Contract Number 41098
Revision 91, 12/1/99 12:15:00

Implementing Open Access over Cable Systems
Test Plan and Experimental Results

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Executive Summary

This paper presents experimental laboratory measurements that validate how multiple ISPs can serve consumers over the hybrid fiber-coaxial (HFC) facilities of cable operators, as described in a companion document " Implementing Open Access Over Cable Systems - A Technical Perspective" [OpenTech]. The work focuses on the technical solutions that would readily allow multiple ISPs to serve customers on an HFC network using standard DOCSIS [DocsisV1.0, DevMIB] equipment.

The laboratory measurements presented here are based on off-the-shelf equipment from four networking vendors (3Com, Cisco, Nortel and Redback). The test plans included six different network configurations, representative of the widest range of possible designs that would be deployed by cable operators using standard DOCSIS products.

The report demonstrates the technical and administrative viability of an *open access* policy, whereby the following goals would be achieved: (1) equal opportunity for consumers to choose their service provider; (2) equal opportunity for multiple service providers to reach all consumers with differentiated service offerings; and (3) no cost, service, or performance discrimination against the consumer for exercising its choice of service provider.

The solutions to support multiple ISPs over HFC cable broadband networks must account for the following factors: (1) the cable HFC plant is a shared medium, meaning that the traffic from several end-users share the RF spectrum (6 MHz channel down and the return RF); and (2) the IP traffic must be directed appropriately to each one of the multiple ISPs sharing RF spectrum. So when the upstream IP traffic from an end-user's cable reaches the cable head end, the IP packets must be sent to the corresponding ISP depending on the originating customer. Similarly, the IP traffic coming from the Internet at large must be delivered to the correct cable modem.

This report presents laboratory measurements and test results that validate the technical requirements that must be fulfilled in order to enable multiple ISPs on a broadband HFC cable network. The technical tests are detailed and rigorous, intended to be read by experts in the technical design and operation of cable modem systems. The test results address six different network configurations built in the laboratory. These include:

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- Two test networks based on policy-based routing, this option routes packets to the appropriate ISP using the source IP address as the unique identifier;
- Two test networks based on Virtual private networks (VPNs) and IP tunnels, creating virtual dedicated connections over the HFC network between the customer and the ISP. This is a solution appropriate to routed (layer 3) access networks; and
- Two test networks based on Point-to-Point Protocol over Ethernet (PPPoE) encapsulation which is a protocol analogous to commonly employed protocols for dial-up. This is a solution appropriate to bridged (layer 2) access networks.

These test results provide direct confirmation that the technical implementation of an *open access* model is feasible using existing standards and products. The conclusions presented in Table 2 provides the reader with a convincing summary, at a glance, of the experimental demonstration. The test results successfully demonstrated all the needed *open access* requirements for six different network architectures, representative of cable modem deployments small and large, using off-the-shelf networking products from five leading vendors. The test results indicate that tunneling solutions tend to be preferable, but it is also possible to use policy-routing schemes. This study does not attempt to pick one solution over another, as it is intended to demonstrate technical feasibility. The evidence presented here will provide important guidelines to specific open access design decisions that will be optimized to the particular conditions of each *open access* implementation.

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1 Introduction

This document describes a set of network design models and a test plan to verify the requirements for Equal Access for multiple service providers. Various system designs are described. The general model for HSD services over CATV infrastructure is illustrated in Figure 1.

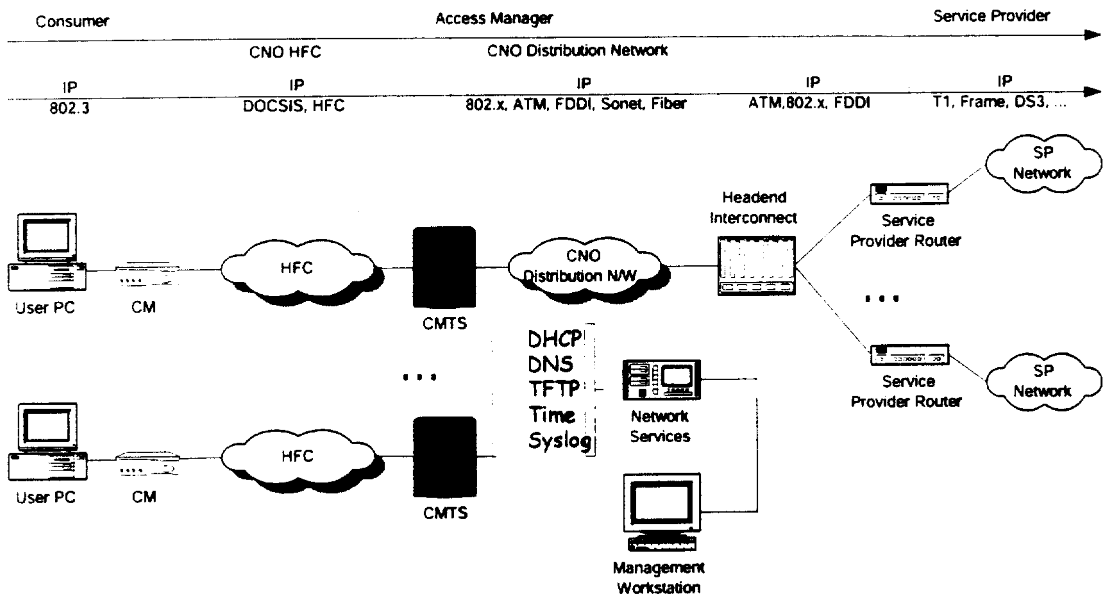

Figure 1 General structure of HSD services over CATV infrastructure

Figure 1 illustrates the network technology employed, the ownership, and responsibilities of each segment of the HSD system. The next section describes more specific models. The view taken was described in the companion document " Implementing Open Access Over Cable Systems - A Technical Perspective" [OpenTech]. This identifies three parties:

1. Cable Network Operator (CNO) - owns the HFC plant infrastructure, maintains a force to service those facilities and provides channel space and connection points to that RF environment. In addition, the Cable Operator might own and maintain a distribution fiber network within its franchise area to deliver programming to its HFC access network. The Cable Operator may or may not own the IP networking equipment.
2. Access Manager (AM) - Manages the local (or regional) IP networking service. They are responsible for Layer 2 and 3 network service. configuration, and management in the Access Network. The AM may have designed the IP network layered over the Cable Operator's plant. Also, the AM will be responsible for basic IP networking services that enable traffic to flow. The AM may or may not own the IP networking equipment.
3. Service Provider (ISP) - Manages the global IP networking service. The ISP has a direct relationship with the end-customer to provide

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content applications, and support services (e.g. help desk). The ISP manages its pools of IP addresses and provides session authentication for its customers. There may be multiple ISPs of multiple services.

The choice of access techniques to support Equal Access depends in large part on the implementation of the CNO Distribution Network. This is the portion of the system that interconnects CMTS units to a headend traffic aggregation point (Headend Interconnect) which serves to access required network services, system management, and Service Providers point of interconnect.

The companion document, [OpenTech], contains certain key technical requirements. The focus of this document is to demonstrate that these requirements can be met if conventional and accepted system design practices are followed.

1.1 General model

There are two design elements that strongly influence the system architecture of CATV-based broadband delivery systems: the distribution network design, either routed or bridged, and the type of CMTS units employed in the HFC delivery part. CMTS units can act as routers or as bridges.

A routed distribution network is characterized by the presence of one or more IP router hops between the CMTS devices and the Headend Interconnection. This is illustrated in Figure 2.

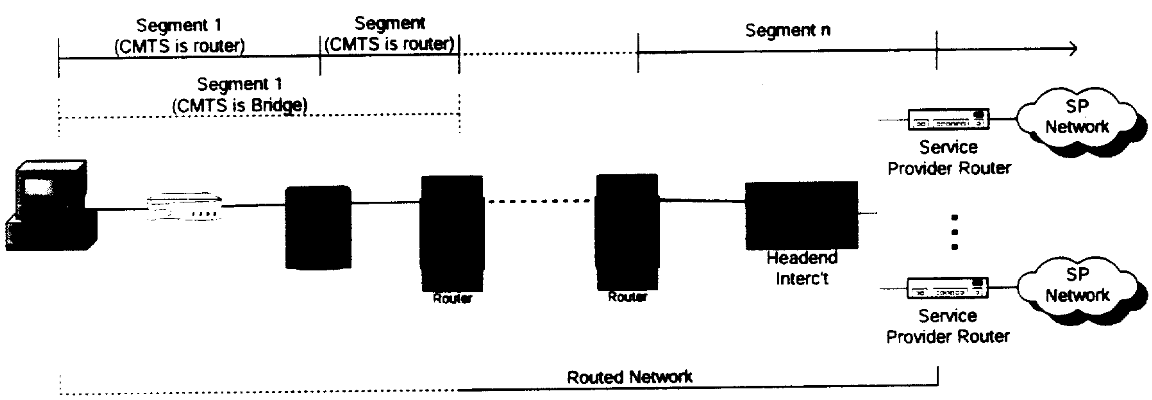

Figure 2 Routed distribution network model.

The first network segment in a routed distribution network may be from the Consumer PC to a CMTS that acts as a router. Or, if the CMTS is a bridging device, the first hop is to a router that the CMTS connects to.

A bridged distribution network design implements an IEEE 802 MAC domain that includes the Consumer PC and Service Provider Routers. This type of design is illustrated in Figure 3.

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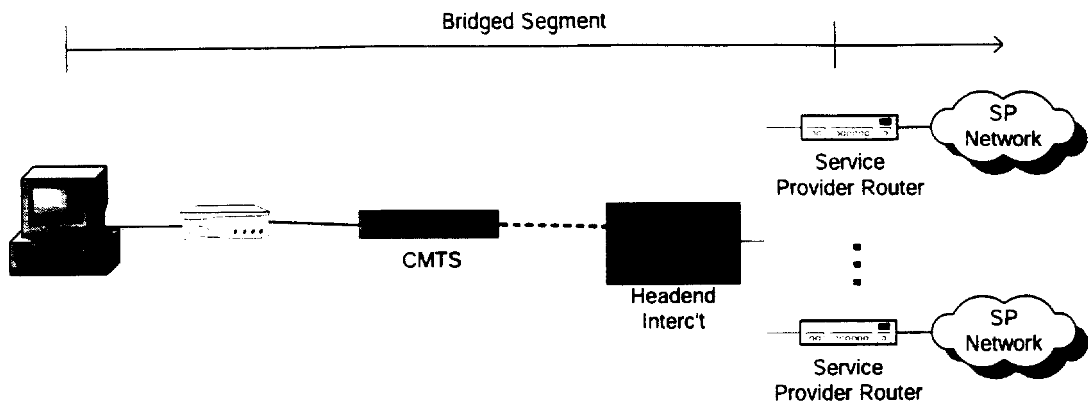

Figure 3 - Bridged distribution network model.

The companion document [OpenTech] identified only two relevant implementation techniques: Policy-based routing and Tunneling for separating traffic destined for multiple service providers.

These three dimensions Network type, CMTS type, and Access technology, lead to eight implementations that may be possible. However, policy-based routing is not a particularly attractive solution for large routed networks due to the need to implement it in every router. The result is that there are six solutions that might be implemented. Table 1 summarizes the access implementations that are examined in this test plan.

		CMTS Type	
		CMTS is Router	CMTS is Bridge
Network Type	Routed Network	Tunnel (L2TP)	Tunnel
	Bridged Network	Tunnel	Tunnel
		Policy Routing	Policy Routing

Table 1 HSD implementation solutions.

1.2 Test Plan Outline

The requirements outlined in the companion document [OpenTech] include operational, business, and technical requirements in support of Equal Access. The test plan outlined here does not address the business requirements, and only where applicable for system control does it implement a process or technique that is necessary.

The key technical requirements are listed here and explained in the context of the Lab Network. Following sections contain a set of tests and scenarios that indicate whether the requirements are met.

Req 1. The AM **must** provide one or more IP transport classes that are available to all ISPs on equitable terms.