FIFTH EDITION

1991 Phillips Fiber SOURCE BOOK™

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SWITCHED DIGITAL VIDEO

An Outlook for 1997 and Beyond

by Kevin W. Lu

The dichotomy between switched digital video (SDV) and hybrid fiber/coax (HFC) is rapidly becoming a theme of the past. That's because other up-and-coming wireline or wireless alternatives, such as asymmetric digital subscriber line (ADSL), fiber-to-the-home (FTTH), multichannel multipoint distribution service (MMDS), local multipoint distribution service (LMDS), and direct broadcast satellite (DBS) are also being considered by many access network planners to meet a growing demand for bandwidth-thirsty services in addition to digital video. These include high-speed Internet access, telecommuting and broadband data services for small offices or home offices. Selecting a particular architecture for near-term deployment depends, more than ever, on a multitude of factors including business strategies, bandwidth requirements, demographic and geographic areas, embedded plant, life-cycle costs, and market competition. In view of these latest developments, what is the outlook on SDV for 1997 and beyond?

Near-Term SDV Deployment

The acronym SDV is often used interchangeably with all-digital fiber-to-the-curb (FTTC), or to describe digital FTTC networks with analog fiber/coax overlays. There have been numerous SDV field trials, both domestic and abroad. During 1996, support for near-term SDV deployment grew rapidly in the US. For example, in July 1996, Bell Atlantic contracted with the Lucent Technologies and BroadBand Technologies (BBT) partnership to supply FTTC equipment [1-3]. The contract over the next six and a half years includes BBT's Fiber Loop Access (FLX®) 2500 technology, which is part of Lucent's SLC 2000® Access System with FLX switched digital video. Initially, the FTTC/SDV equipment will support voice only. Digital video broadcast capabilities will be added by the third quarter of 1997, and fast Internet access, high-speed data and interactive multimedia capabilities will be added in late 1997 or early 1998.

The BBT FLX system has already been implemented by Bell Atlantic in Dover Township, New Jersey. Starting in 1997, Bell Atlantic expects to upgrade about 600,000 to 800,000 homes per year to FTTC/SDV, fulfilling the plan to convert 6.8 million homes in six target areas within ten years. The ramp up is expected to take a year and a half. The equipment will be used first for a system in Philadelphia, with other systems to be built in Baltimore, northern New Jersey, Norfolk (VA), Pittsburgh, and the Washington, DC, metropolitan areas. The plan could expand to a total of nine million homes over the next few years, depending on the cost of the technologies.

NYNEX, on the other hand, selected NextLevel Systems in October, 1996, to provide FTTC technology as part of its video plans for about one million lines in Boston, MA, New York City, Long Island and Westchester County, NY. The five-year contract includes NextLevel's NLevel³™ System which uses ATM transport to provide a host of telephony, ISDN, Internet, data, and video services over FTTC. The upgrade could expand to an additional plan for four million lines, depending on how well this deployment progresses [4-5].

Near-Term FTTH Deployment

While FTTC/SDV is gathering momentum over dense areas in the east coast, FTTH is re-emerging in midwest rural areas [6]. Since the cost of a copper loop (or coaxial cable) for rural areas increases significantly with loop length, one way to provide service cost-effectively is to deploy fiber deeper in the plant. Suppliers such as Advanced Fiber Communications, E/O Networks and Optical Solutions are addressing progressively less-dense applications with their distributed DLC, FTTC or FTTH solutions. Several independent telephone companies, such as East Otter Tail Telephone in Perham, MN, Federated Telephone Cooperative in Alberta, MN, Rural Telephone in Lenora, KS, and Wilson Telephone in Wilson, KS, have used field-trial equipment from Optical Solutions based in Bemidji, MN.

In December 1996, Rural Telephone, based in Lenora, KS, completed construction of an FTTH system in two nearby towns, Hill City and Bogue [7]. Rural Telephone now provides improved

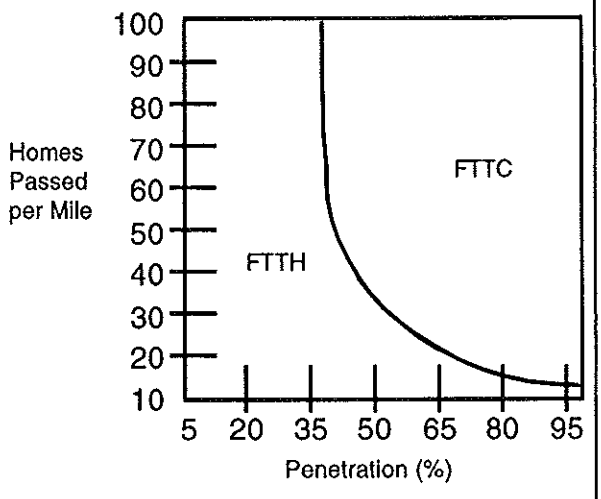


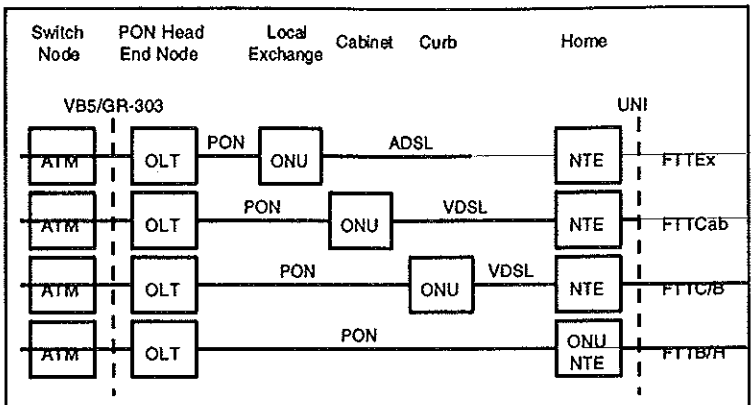
Figure 1: *Bellcore's analysis indicates that FTTC costs less than FTTH in high-density and high-penetration areas. In contrast, FTTH costs less than FTTC in low-density or low-penetration areas. The line separating two domains reflects the installed-first-cost crossover between FTTH and FTTC, thereby providing network planners a basis for deploying cost-effective full-service access networks.*

services to 1,517 customers, or 96 percent of the existing customer base in Hill City and Bogue. Many residents are receiving one-party service for the first time.

Why has FTTH rather than FTTC been selected for near-term deployment in rural America? A key finding of a recent Bellcore study shows that when the population density is less than about 12 homes per mile (see **Figure 1**), FTTH is less expensive than FTTC/SDV at any level of service penetration [8]. This cost parity results from the stranded capacity for the curb-side FTTC equipment due to the drop range limitation, non-uniform distribution of houses, or limited service penetration. Bellcore also analyzed recent technology advances that indicate FTTH may be economical sooner than commonly believed [9].

A Family of Full-Service Access Networks

As support for near-term FTTC/SDV or FTTH deployment was building in the US, NTT in Japan disclosed its plans to deploy FTTH by 2010, with extensive cost cutting to bring the costs for fiber installation to the same level as for metallic cable installation in 1997 [10]. NTT has also joined forces with British Telecom (BT) and five other European PTTs to define, at a high level, the world's first standard full-service access network (FSAN). On June 20, 1996, BT, in cooperation with six other PTTs and nine international manufacturers, sponsored a conference in London to present the results of a year's collaborative effort [11]. The FSAN encompasses a family of FTTx architectural variants such as fiber to the exchange (FTTEx), fiber to the cabinet (FTTCab), FTTC, fiber to the building (FTTB), and FTTH (see **Figure 2**). Subsequent to the conference, the FSAN group has grown to a total of ten partners: BellSouth, BT, Deutsche Telekom, France Telecom, GTE, NTT, Telecom Italia, Telefonica, Telstra, and Swiss PTT. The FSAN rollout plan is to start around 1998 with initial volumes at about half a million broadband lines per year for two years, then 2 million in year 2000, and about 4.5 million annually from the year 2001 to 2010.

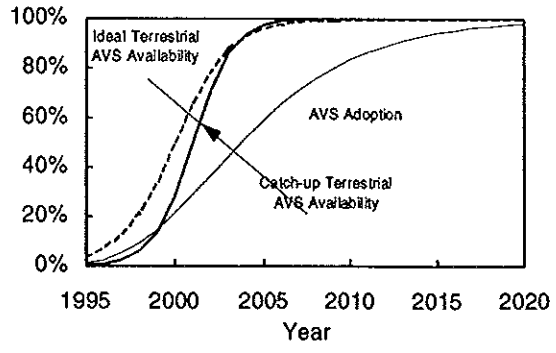


ADSL:	Asymmetric Digital Subscriber Line
FTTEx:	Fiber To The Exchange
FTTCab:	Fiber To The Cabinet
FTTC/B:	Fiber To The Curb/Building
FTTB/H:	Fiber To The Building/Home
NTE:	Network Termination Equipment
OLT:	Optical Line Termination
ONU:	Optical Network Unit
PON:	Passive Optical Network
VDSL:	Very-high-speed Digital Subscriber Line

Figure 2: *The common network elements being specified by the FSAN group. All scenarios are based on ATM PONs, and for FTTC/Cab/Ex, xDSL technologies are used on the copper plant interfaces between network elements can then be standardized across the scenarios, allowing the reuse of functional elements within the interface units.*

An Outlook on SDV

FTTC/SDV and FITH based on ATM PON technology now belong to the same FSAN family of FTTx architectural variants. More and more, SDV is being viewed as a common full-service access platform encompassed by FTTCab, FTTC, FTTB, and FTTH. Nevertheless, selecting a particular architecture from the FSAN family for deployment depends on a multitude of factors, including bandwidth requirements, business strategies, demographic and geographic areas, embedded plant, life-cycle costs, and market competition.



Source: Technology Futures, Inc.

Figure 3:
Advanced video services (AVS) are those using digital compression in transport and requiring set-top decoder boxes at the customer location. The forecast for AVS adoption is derived from the historical analogies of radio, television, color TV, pay cable, VCR, and CD player. The forecast for the ideal terrestrial AVS availability is based on the historical analogies of cable adoption lagging behind availability. Terrestrial AVS providers need to match the ideal availability curve to obtain their fair share of AVS customers. Otherwise, lacking an alternative, customers will adopt direct broadcast satellite (DBS). The curve between the two reflects an attempt to catch up with the ideal curve.

The forecasts for advanced video services (AVS) by Technology Futures, Inc. [12] indicate that it is already too late for potential terrestrial AVS providers to match the ideal availability curve since terrestrial availability today is nowhere near 10 percent (see **Figure 3**). Lacking a terrestrial AVS alternative, early adopters did follow the AVS adoption curve by selecting DBS. Therefore, an alternative terrestrial availability curve has been projected to reflect an attempt to catch up with the ideal curve. In view of the latest developments described above, both FTTC/SDV and FTTH will continue gathering momentum in domestic and international markets throughout 1997. The outlook for SDV will be brighter than ever when the worldwide FSAN deployment starts to roll out in 1998.

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