TFI's extensive research into forecasting key telecommunications technologies reveals a serious need to shorten lives now. Projections for new services demand show that a ubiquitous, broadband, digital network will be needed by the LECs in the 2010-2015 timeframe.

TFI's studies of LEC investments reveal that the average remaining lives of current network assets are appreciably shorter than current regulatory prescriptions. Analysis of cable TV companies reveals that their effective remaining depreciation lives average 3.6 years. A sampling of interexchange carriers and competitive access providers produces an average of 5.7 years. CAPs, IXCs and cable TV companies are rapidly entering competition with the local exchange carriers, and do not possess a large embedded copper cable network which is significantly underrecovered. In contrast, LECs regulatory prescriptions result in average remaining lives of 8.1 years.

TFI finds the ranges of lives which the FCC prescribes for LECs to be totally inadequate. Past regulatory practices have improved the status of the LECs' reserves, but current life ranges prescribed by the FCC produce serious on-going underrecovery. Because current lives imply recovery beyond 2020 (and 2030 for copper cables), a serious shortfall will continue to grow which requires expedient regulatory action. Current technologies being used for telephony services will be obsolete long before the time frames implied by FCC lives, which means existing LEC regulated investments are already severely under-

depreciated. Likewise, the LECs' regulatory depreciation expense has been severely understated.

The local exchange carriers recognized these conditions during the 1993-1995 time frame by discontinuing FAS 71 regulatory accounting practices for financial reporting purposes. In doing so, they have increased their depreciation reserves by $38.9 billion, using more realistic lives for network assets based on technology and competitive factors.

MiCRA's comments provide no insight into this issue. MiCRA assumes the very answer it attempts to question by using FCC-prescribed lives to test the appropriateness of FCC-prescribed lives. With respect to the technologies involved in the provision of telephony, MiCRA is concerned only with the LEC copper distribution networks, implying that the copper-based technologies will always remain economic for the provision of telephony services. This completely ignores on-going network evolution due to technological change, market demands and competition, and incorrectly presumes that LECs should not be allowed to compete in the provision of new services using modern facilities.

1. INTRODUCTION

In this paper, Technology Futures, Inc. (TFI) addresses the comments submitted by Microeconomic Consulting & Research Associates, Inc. (MiCRA) on behalf of MCI in CC Docket 94-1, Price Cap Performance Review for Local Exchange Carriers. MiCRA's comments conclude that (1) the Regional Bell Operating Companies (RBOCs) have improperly assessed their depreciation requirements; (2) RBOC depreciation reserves have improved substantially since the early 1980's, to the extent that virtually no deficiencies currently exist; and (3) RBOC concerns over depreciation reserve deficiencies stem from a strategy to have current telephony customers pay for RBOC entry into new and expanded services, allegedly with advanced technologies not needed to provide voice services.

As demonstrated below, MiCRA's conclusions are without merit. MiCRA's conclusions hinge on incorrect assumptions concerning the lives of telephone plant that ignore the substantial technological, regulatory and market changes that are transforming the telecommunications industry. MiCRA's conclusions are proven wrong by the results of extensive studies conducted by TFI which reflect actual technology changes experienced in the telecommunications industry from 1985 to 1995, further technology changes forecasted through 2015, and the effects of increasing competition and changing market demand on the economic lives of local exchange carrier assets during that period. TFI's studies show that the economic lives for technology-based telephone assets are significantly shorter than the lives underlying the currently prescribed depreciation rates for such plant.

In Section 2 below, TFI summarizes the results of its studies and the implications that those results have for LEC[1] depreciation requirements. TFI also discusses the relationship between LEC depreciation lives and decisions to discontinue accounting under FAS 71 for financial reporting purposes. TFI demonstrates that other telecommunications firms, such as cable TV operators, long distance providers and CAPs that are and will be competing head-to-head with telephone companies in local markets are permitted to depreciate comparable or identical plant over far shorter lives than regulators allow the LECs. Finally, in Section 3, TFI points out the fundamental errors in MiCRA's arguments and demonstrates that there is no rational basis for MiCRA's conclusions.

2. TECHNOLOGY CHANGE, COMPETITION AND DEPRECIATION LIVES

As noted, TFI has conducted extensive studies of LEC technology assets (i.e., those assets most affected by technology changes) since the mid-1980's. These studies significantly expanded then-existing technology forecasting techniques to include such advanced procedures as substitution analysis, trend analysis and computer-based modeling. The studies listed in Appendix A to this paper, present past and future technology changes and fully support TFI's conclusions regarding the need for more realistic (shorter) depreciation lives for LEC telecommunications investments.

[1] Although MiCRA addresses depreciation issues exclusively from the standpoint of the RBOCs, the serious under-recovery of depreciation expense that currently exist, and which will be aggravated if the FCC fails to change its depreciation policies, affects other LECs as well.

One recent study, Depreciation Lives for Telecommunications Equipment, updated and summarized the results of all previous TFI studies with respect to the LECs' key technologically impacted investments. Four sections of this study are presented in Appendix B to this report. The following table, taken from the report, sets forth TFI's recommendations on the lives for technologies in today's LEC networks. With the exception of Analog Switching equipment which is acknowledged by regulators to be a dying technology, these lives are appreciably shorter than the lives underlying today's FCC depreciation prescriptions for nearly all carriers. The reasons why these lives are shorter is discussed in the following sections.

Table 1
TFI EQUIPMENT LIFE RECOMMENDATIONS

Technology	Recommended Industry Average Remaining Life (1/1/95)	Corresponding Projection Life
Outside Plant		
Interoffice Cable, Metallic	2.9	
Feeder Cable, Metallic	7.0 to 7.8	
Distribution Cable, Metallic	7.5 to 10.2	
Metallic Cable, Averaged	7.0 to 8.7	14 to 16
Cable, Non-Metallic, All Types	-	15 to 20
Circuit Equipment		
Analog	2.8	6 to 9
Digital	3.7	8 to 9
Switching Equipment		
Analog	2.8	-
Digital	6.3	9 to 11

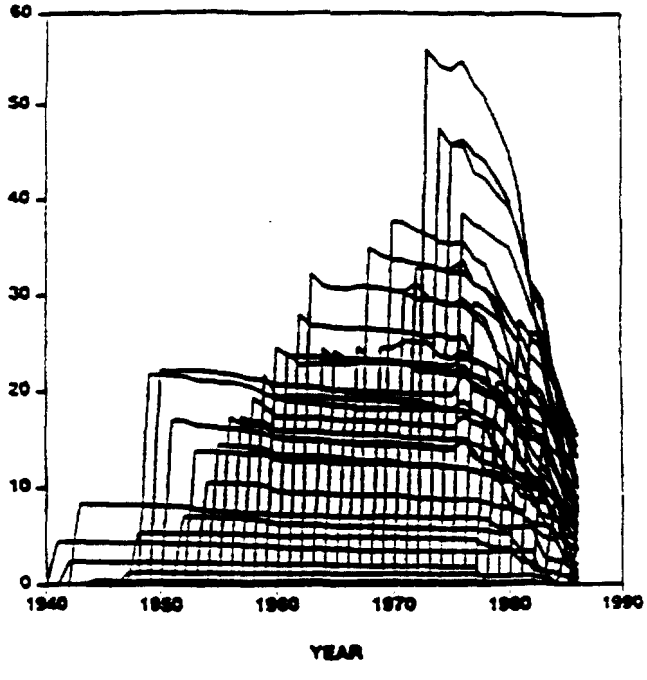
a. Avalanche Curves

The lives recommended in Table 1 reflect a phenomenon which has come to be known as the "Avalanche" curve, the effects of which are detailed in Appendix B to this report, page 8. Briefly, this curve explains the nature of many technology changes which LECs have experienced to date, and is a pattern which will be followed on most technology-based investments in the future. The "avalanche", which reflects the rapid obsolescence of such investments, occurs because technology substitutions tend to begin building smoothly but reach critical mass in just a few years. The precise date of an avalanche onset is hard to predict, especially on the basis of mortality data (i.e. accounting retirements). Further, it is difficult for periodic regulatory depreciation reviews which focus on historical data, to keep up with the rapid pace of technological change. Therefore, regulators generally will not acknowledge an avalanche until it has already begun, which is too late in the economic lives of the investments. Current regulatory methods allow a "catch-up" of the depreciation of assets only after the avalanche is already under way. This delayed catch-up becomes a "back-end load" in the LECs' depreciation expenses. While not an obvious problem in a monopoly environment, this back-end loading of LECs' operating costs becomes a severe problem in a competitive environment, including a period of transition to competition. Technology forecasting methods, on the other hand, are much more successful in predicting an avalance, since they are based on early adoption patterns of the new technology. Technology substitutions projecting the pace of adoption of the new technology are far more relevant than retirements of the old. Therefore, accounting retirements do not determine the proper economic lives or costs of the existing investments.

The avalanche effect is illustrated in Chart 1 below. Crossbar Switching technology existed in local exchange networks beginning in about 1940. Millions of dollars were invested each year in this technology, until the late 1970s, when the avalanche began to occur. During the subsequent 10 years, tremendous retirement activity took place. This resulted in serious depreciation reserve problems for companies which required huge amortizations at the very end of the investment life cycle.

Chart 1
AVALANCHE CURVE

Vintage Survivor Curves
1940-1985 Crossbar Vintages
Plant in Service (Million Dollars)



Source: Bellcore

TFI predicts, consistent with its average remaining life (ARL) projections for LEC plant contained in Table 1, that virtually the entire local exchange network will be subject to this type of avalanche. Multiple technology substitutions are even likely for some network components. For existing LEC networks, this process is already underway. All single, and some multiple technology substitutions should be completed by 2015, and possibly much sooner in light of new federal and state legislation and regulation, and the LECs' losses of customers and revenues caused by the market entry of CAP, IXC, wireless, and cable providers.

b. Discontinued Regulatory Accounting

TFI's conclusions regarding the need for shorter telephone plant depreciation lives is confirmed by the recent actions of the seven RBOCs and other price cap LECs to discontinue FAS 71 accounting for financial reporting purposes. The Financial Accounting Standards Board (FASB) issued FAS 71 to address issues related to companies accounting for the effects of regulation, by allowing regulated companies to follow regulatory accounting rules for external reporting purposes that differ from Generally Accepted Accounting Principles (GAAP). The FASB also issued FAS101 to outline criteria for discontinuance of FAS71. In the last few years, individual LECs recognized that Commission lives could no longer be utilized as realistic for external financial reporting purposes.[2]

[2] FAS101, Regulated Enterprises-Accounting for the Discontinuance of Application of FASB Statement No.71, pg. 5802-5803; Criteria to discontinue FAS71, include deregulation, changes in regulator's approach, increasing competition, and regulatory actions "that limit the enterprise's ability to sell services and products at rates that will recover costs.....".

The LECs that discontinued FAS 71 accounting generally did so to reflect changes in regulation and increasing competition in their respective serving areas.[3] Each LEC made substantial adjustments to its depreciation reserves, collectively totaling $39 billion, to reflect inadequate depreciation caused by past regulatory practices. These huge adjustments, shown in the Table 2 below, and the depreciation lives that the LECs now employ to ensure compliance with GAAP and Securities and Exchange Commission financial reporting requirements, completely refute MiCRA's arguments in this proceeding that there is no depreciation reserve problem.

[3] See, for example, Bell Atlantic News Release, August 15, 1994. "Effective August 1, 1994, Bell Atlantic has discontinued regulatory accounting under Statement of Financial Accounting Standards No. 71, "Accounting for the Effects of Certain Types of Regulation" (FAS71). After assessing its regulatory and competitive environments, the company has concluded that it no longer meets the requirements for continuation of accounting as a regulated entity. The conclusion is based on the belief that it can no longer be assured that prices can be maintained at levels that will ensure recovery of the net carrying amount of existing telephone plant and equipment, which has been depreciated over relatively long regulator-prescribed lives.

Table 2
FAS101 DEPRECIATION RESERVE ADJUSTMENTS
(Billion $)

Company	Amount
Ameritech	$ 3.7
Bell Atlantic	3.5
BellSouth	4.9
Rochester	0.2
GTE	7.2
NYNEX	3.6
Pacific Telesis	4.7
SWBT	4.7
SNET	1.2
US West	5.2
TOTAL	$38.9

c. Depreciation Practices of Competitors

TFI has reviewed available information on the depreciation lives prescribed or allowed by the FCC for various telecommunications companies/industry segments. These lives are presented in Table 3 below:

Table 3
COMPARATIVE LIVES OF TELECOMMUNICATIONS
(Lives in Years)

Plant Category	Cable TV	AT&T	LECs	TFI
Distribution Facilities	10-15 (Coax & Fiber Cable)	3.4-15(Metallic Cable)	20-30(Metallic Cable)	14-16(Metallic Cable)
Circuit Eqpt	7-14	2.5(Analog) 7.2(Digital)	8-11(Analog) 11-13(Digital)	6-9(Analog) 8-9(Digital)
Digital Switch	NA	9.7	16-18	9-11
Non-Metallic Cable (Fiber)	See Distrib. Facilities	20	25-30	15-20
Vehicles	3-7	6.6	7.5-9.5	NA
Furniture & Office Eqpt	9-11	5.6(Furniture) 9.3(Ofc Eqpt)	15-20(Furn) 10-15(Ofc Eq)	NA

1. **Cable TV Asset Lives** - This column shows the ranges of asset lives the FCC has established for use by cable providers pursuant to the Cable Act of 1992 and the FCC's Order in MM Docket No. 93-215 and CS Docket No. 94-28, released January 26, 1996.

2. **AT&T Asset Lives** - This column lists the lives ordered in CC Docket No. 95-32, AT&T's depreciation prescription as of January 1, 1994.

3. **LEC Asset Lives** - These life range are currently used by the FCC to prescribe depreciation rates for LECs under the procedures adopted in CC Docket No. 92-296.

4. **TFI Recommended Asset Lives** - These lives result from TFI's most recent studies for LEC assets as described in Table 1.

Despite the fact that the facilities of the non-LEC companies are relatively new compared to the ages of LEC assets, these non-LEC companies are depreciating their assets at much faster rates than the LECs. Even with the relatively young age of their plant, the depreciation reserves of these soon-to-be (if not already) local network competitors are often significantly higher than the LECs' regulatory reserve levels.

Table 4 compares average depreciation rates and derived remaining lives of firms in the converging industries of telecommunications, computers and entertainment.

It is easy to see from this data why existing regulated depreciation practices disadvantage LECs vis-a-vis their competitors. Cable television companies, which are rapidly deploying fiber optics and digital transmission capabilities throughout their networks, are depreciating their facilities over a remaining life of 3.6 years. IXCs/CAPs, which have almost no copper facilities and nearly all digital networks, are depreciating their assets over a remaining life of 5.7 years. In contrast, LECs are required to use remaining lives of 12 years or more for their outdated copper plant, and are depreciating their total network assets over a remaining life of 8.1 years, more than 100% longer than cable TV companies and 40% longer than the IXCs/CAPs. TFI's independent analysis confirms that the cable, IXC and CAP lives would be more realistic for the LECs' assets than the lives which the FCC currently prescribes.

Table 4

CONVERGING INDUSTRIES DEPRECIATION COMPARISON

Company	% 1995 Depr Rate	Depr Resv % (12/31/94)	Derived Remaining Life(yrs)[4]
Cable/Entertainment			
Time Warner	32.6		
Comcast	24.7		
Viacom	24.2		
Cablevision	21.2		
Walt Disney	20.2		
Jones Cable	14.8		
TCI	12.6		
Cox	11.0		
AVERAGE	**18.5**	33	3.6
High Tech Mfgrs			
Dell	18.3		
IBM	13.6		
Hewlett Packard	13.0		
Motorola	12.4		
Apple	11.7		
Compaq	11.1		
AVERAGE	**13.2**	57	3.3
IXC/CAPS			
MFS	13.0		
AT&T	9.3		
MCI	8.9		
AVERAGE	**9.3**	47	5.7
LECs			
SNET	7.9		
Sprint	7.9		
Rochester	7.8		
Bell Atlantic	7.5		
GTE	7.4		
BellSouth	7.3		
Southwestern Bell	7.2		
US West	7.2		
Ameritech	7.1		
NYNEX	7.1		
Pacific Telesis	7.0		
AVERAGE	**7.3**	41	8.1

[4] The derived Remaining Life is calculated by (100% - Depreciation Reserve %) / Depreciation Rate. The Net Salvage is assumed to be zero.

3. ERRORS IN MICRA'S ANALYSIS

There are several reasons why the MiCRA conclusions are incorrect. Simply put, MiCRA has made fundamental errors by not reflecting TFI's comprehensive studies on technology substitution, LEC discontinuance of FAS 71, and the depreciation practices of other telecommunications providers, in its analysis.

a. Use of Regulated Lives and Reserves

MiCRA's conclusions are not based on any specific analyses of changing technology, competition, new services or asset lives. Instead, MiCRA accepts the FCC's regulatory represcriptions, which are often influenced by political factors and compromise, as proper for LEC asset lives without any attempt to reflect the rapidly changing environment in which the LECs operate. The theoretical reserve calculations used by MiCRA are actually based upon the FCC's prescribed depreciation parameters. Thus, MiCRA's reasoning that their theoretical reserve calculations validate the accuracy of the FCC's prescribed lives is circular and totally wrong.

Another problem with MiCRA's study relates to its improper and confusing use of the various types of lives used by depreciation analysts in Tables 16-20. MiCRA appears to mix projection lives with average service lives, which are not synonymous. A more proper comparison would be to use the projection lives underlying the average service lives.

Also, MiCRA has limited its analysis to LEC represcriptions in the 1992-1994 time frame. In doing so, it incorrectly ignores the extensive body of evidence which has become available since that period. For instance, as noted in MiCRA's report,[4] LEC regulatory studies in 1995 resulted in a significant increase in the theoretical reserve deficiency to over $6 billion. This increase reflects only those LECs whose depreciation rates were prescribed by the FCC in 1995. Extrapolation of this deficiency to the remaining two-thirds of the companies not subject to represcription in 1995 produces a reserve deficiency for the LEC industry which proves that the $3-5 billion cited by MiCRA is drastically understated.

The LECs' most recent studies have reflected the further and significant changes occurring in the telecommunications industry, such as new MiCRA neither recognizes these implications nor adds insight that might help determine appropriate depreciation lives today.

b. Copper Distribution and Subsidies

MiCRA asserts that the acceleration of copper cable replacement will result in present subscribers being required to subsidize new technology which will be used for other than traditional telephony services. MiCRA's argument is misplaced. The telecommunications industry has experienced technology evolution since the invention of the telephone. For cable plant, these changes have included open wire evolving to copper

[4] MiCRA, Depreciation Policy in the Telecommunications Industry: Implications for Cost Recovery by the Local Exchange Carriers, Table 8.

cable, and continuing changes in the types of insulation and sheathing. Also, aerial facilities have migrated to buried, and loadings and other electrical encumberments have been substantially eliminated in local exchange cable routes. The nature of telephone service has also changed dramatically over the years. Initially, party-line service was totally acceptable to most subscribers. Today, with facsimile and data services, many homes and virtually all businesses have multiple single party lines.

As technology and services have evolved, each generation of customers has paid for the on-going cost of network improvements that have increased quality and decreased prices. The transition to fiber-optics is the natural progression of a series of technology changes which have enabled the provision of less costly, improved, and enhanced telephony services. This transition is inevitable as a result of the ever-improving economics of fiber. In this transition, today's subscribers are paying for services provided, not for the early replacement of a still vibrant technology. The LECs' copper cable facilities are increasingly costly to maintain, and do not provide the capabilities and services already being demanded by today's customers. In short, economic reality and market demand, not some scheme on the part of the LECs, are driving copper cable from service. MiCRA is wrong that the LECs or any group of competitors should be forced to rely on dying copper technology.

4. CONCLUSION

Accelerating technology change and competition subject the LECs' $300 billion investment base to a substantial risk. TFI estimated in Table 1 that the ARLs of existing

LEC assets are considerably below current regulatory life prescriptions and, indeed, are very close to the lives being used by the LECs' competitors to depreciate more modern assets.

MiCRA's arguments must be dismissed because they are based on a cursory review of high level regulatory depreciation data, and they do not reflect detailed analyses of technology, new services or competition. Further, MiCRA ignores the implications of legislative and regulatory changes for LECs in the current environment. It also completely ignores the evidence provided by the LECs' discontinuance of FAS 71 accounting. The LECs' determinations that regulatory depreciation accounting is not valid for external financial reporting was based on objective and forward looking evaluations of LEC assets. These determinations were reviewed and validated by the LECs' external auditors.

MiCRA infers that the only good investment decision is one with a long asset life. If that were true, LECs would have few depreciation-related problems, and LEC competitors would be quick to increase their profitability by lengthening their asset lives. As we approach the 21st century, regulators must accept the implications of their depreciation decisions, and act now to reduce asset lives consistent with economic reality. This will enable LECs to fully and rigorously participate in newly competitive telecommunications markets. Failure of regulators to act will further disadvantage the LECs' already difficult economic situation with respect to their large and under-recovered networks.

It is clear that the LECs' regulated reserves and depreciation lives are not adequate. They are based on faulty estimates of useful asset lives. MiCRA's reliance on these estimates is a fatal flaw in its analysis. Accordingly, MiCRA's conclusion that "all is well" with LEC depreciation must be rejected.

APPENDIX A

Technology Futures Telecommunications Studies

1985 Technology's Impact on Lives of Telecommunications Equipment at New York Telephone

1986 Comparisons of Technology Substitutions in Telecommunications and Other Industries

1987 The Effects of Various Levels of Aggregations in Technology Substitutions

1988 Technological Substitution in Transmission Facilities for Local Telecommunications

A Critical Examination of the Future Utilization and Application of Cellular Technology in Telecommunications

1989 Technological Substitution in Switching Equipment for Local Telecommunications

Technological Substitution in Circuit Equipment for Local Telecommunications

Future Technology in the Local Telecommunications Network: An Expert Opinion Survey

1991 Wireless Telephony Market Update: A Quantitative Projection of U.S. Markets

1991-93 NEW TELECOM SERVICES SERIES

Computer Based Imaging and Telecommunications: Forecasts of Markets and Technologies

A Facsimile of the Future: Forecasts of Fax Markets and Technologies

Interactive Multimedia and Telecommunications: Forecasts of Markets and Technologies

Local Area Network Interconnection: Forecasts of Markets and Technologies

Video Communications: Forecasts of Markets and Technologies

Telecommunications for Television/Advanced Television: Forecasts of Markets and Technologies

New Telecommunications Services and the Public Telephone Network

1993 Personal Communications: Perspectives, Forecasts, and Impacts

1994 Transforming the Local Telephone Network: Analyses and Forecasts of Technology Change

1995 Wireless and Cable Voice Services: Forecasts and Competitive Impacts

Depreciation Lives for Telecommunications Equipment

1996 Advanced Video Services: Analysis of Forecasts for Terrestrial Service Providers

APPENDIX B

Depreciation Lives for Telecommunications Equipment:

Review & Update

Local exchange carriers (LECs) have over $250 billion invested in their networks. Over 80% of this investment falls into three categories—outside plant, circuit, and switching. In each category, tremendous changes are underway which are obsoleting the bulk of existing investment and making necessary large amounts of new investment. Since telephone equipment has traditionally been assigned long depreciation lives, these changes mean that existing equipment will be obsolete, and likely out of service, well before existing investment has been recovered under current regulatory depreciation schedules. This report reviews our assessment of the situation and our recommendations for LEC depreciation lives.

Drivers for Change

There are three highly-interrelated drivers that are driving change in telecommunications: technology, competition, and new services. None of these are fully accounted for in the traditional approach to regulatory depreciation. This section briefly reviews these drivers and how they reinforce each other.

Technology Advance

Advances in technology are providing more efficient and functional ways of offering traditional telephone services, as well as wireless services, video services, and new digital communications. Four of the key technologies are:

- Fiber in the loop (FITL), including any architecture that extends fiber into the distribution portion of the local loop. The last link to the customer may be on fiber, copper pairs, coaxial cable, or wireless.

There are a number of architectures that are under consideration or are being planned. A true consensus has yet to emerge on a single FITL architecture. Continuing changes in technology costs, regulation, business relationships, market forecasts, and market share assumptions probably mean that consensus will be arrived at only gradually. Whatever architecture is chosen, it will displace the vast majority of copper investment.

- Advanced digital switching, especially Asynchronous Transfer Mode (ATM) switching.

The next major switching generation, ATM switching, is optimized to handle all types of traffic on the network efficiently and quickly. Today's digital switches use time division multiplexing to connect continuous streams of digitized voice or data at 64 Kb/s for the duration of a call. This is efficient for low-speed, circuit-switched applications such as voice, but it is unusable or inefficient for high-speed digital applications, especially those with bursty (non-continuous) traffic characteristics. ATM switches, on the other hand, use small fixed-length packets called cells. Unlike conventional packet switches, ATM switches do not introduce significant signal delay (because of the simple cell structure) which means they can be used for continuous, real-time applications such as voice and videoconferencing. However, since ATM uses packet switching, it is also good for bursty data traffic. The ability to handle all types of traffic, at all variable data rates, not only makes ATM an efficient switch, but it is also ideal for networked multimedia applications that use all types of communications.

- Synchronous Optical Network (SONET) transmission on fiber optic systems, including Next Generation Digital Loop Carrier (NGDLC) systems incorporating SONET.

SONET is a new format for organizing information on a fiber optics channel that recognizes the need for integrating different types of traffic on the same pair of fibers. Among its many advantages are standardized optical and electrical interfaces to which all suppliers must adhere. Another is that an individual information stream on a fiber channel can be efficiently separated from the rest of the information on the channel. With a SONET add-drop multiplexer, any signal can be extracted with a single piece of equipment without breaking down the whole signal. SONET add-drop multiplexers are already cost-competitive with asynchronous equipment, and soon will be commodity items that are integrated into almost every piece of circuit (and switching) equipment. This will render redundant much existing circuit equipment, including digital crossconnects and multiplexers.

Further, with SONET, carriers can mix-and-match circuit equipment so that they can use different manufacturers' equipment. This, of course, provides operational and equipment savings, as well as more competition between manufacturers. Later on, SONET interfaces will be built directly into switches, leading to even more equipment savings. NGDLC systems will directly link to switches through SONET interfaces. From the same unit, some channels may be connected to other switches or facilities using a built-in SONET add-drop multiplexer. Circuits could be transferred from one switch to another instantaneously. This will give carriers much more flexibility when it comes to dealing with switch manufacturers. SONET will benefit customers as well as carriers. In addition to the inherent economic benefits of a more efficient network, SONET will provide greater reliability through its support of fiber ring architectures and enhanced response time and flexibility in provisioning new channels.

- High-capacity digital wireless technologies such as Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA).

These digital wireless technologies can multiply the capacity of existing cellular systems by a factor of from three to 10 and will also be utilized with the new personal communications systems. One implication of the increased capacity is the ability to compete more directly with wireline service.

In a nutshell, the benefits of these technologies are reduced operating costs, reduced capital costs, better service, or, in some cases, new services. The technologies are all well-understood and do not require scientific, engineering, or economic breakthroughs to be deployed. There is widespread agreement about their benefits and cost targets. While there is some controversy about the details and timing, there is consensus that the future of telecommunications is built around these technologies.

Competition

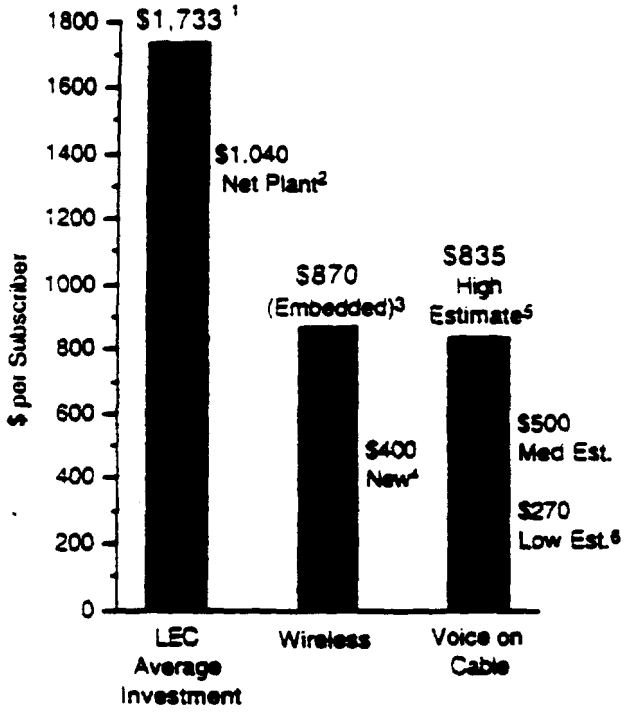
Competition has entered the local exchange business, and it will increase dramatically over the next few years. So far, most local exchange competition has centered on the large business customer. Competitive access providers (CAPs) are already serving large businesses in concentrated areas, and cable television companies are providing alternative access for high-bandwidth services. CAPs are installing the latest, most efficient technology—fiber optics, SONET, and, in cities/locations where they provide switched services, modern digital switching.

The next competitive arena will be the mass market for voice services. Such competition has already begun in public phones and, in some states, in intra-LATA long distance. Two additional, more pervasive sources of competition are cable television networks and wireless networks, specifically cellular and personal communications services (PCS). Technologies are emerging that will allow voice to be added to state-of-the-art cable systems at a cost that is less than on copper pairs. On a per-subscriber basis, cellular technologies are already less costly than wireline. With the new high-capacity digital wireless technologies, such as TDMA and especially CDMA, wireless technologies will also be less costly on a per-minute of use basis. Exhibit 1 illustrates some of these cost comparisons.

Because they are more efficient, the new technologies offer very substantial cost advantages to new entrants in local telecommunications. These new entrants can invest in the most efficient modern equipment without regard to an embedded infrastructure such as the LECs have. This, in turn, will pressure LECs to adopt new technology quickly in order to stay competitive. Thus, competition reinforces the technology drivers and magnifies the obsolescence of the old technology.

Exhibit 1

Investment Per Subscriber



Source: USTA Engineering Subcommittee on Depreciation

[1] Industry investment of $260 billion and 150 million access lines at year-end 1993.
[2] Net plant assumes 40% depreciation reserve (industry average at year-end 1993).
[3] Total wireless industry investment divided by number of customers (source: CTIA, year-end 1993).
[4] Annual wireless industry investment increase divided by customers gained (source: CTIA, year-end 1993).
[5] Estimate by Hatfield Associates, Inc. in a 1994 study for MCI, Alternative Distribution and Access Technologies. Includes land and buildings, switch, network interface unit, backhaul, and customer connection (similar to fee paid by cellular to sales agent, $320).
[6] Estimate by David P. Reed in "The Prospects for Competition in the Subscriber Loop: The Fiber-to-the-Neighborhood Approach," presented at the 21st Annual Telecommunications Research Policy Conference (September 1993). It represents costs allocated to telephony for upgrading a cable system for interactive TV and telephony.