Research Report

THE STATE OF COMPETITION IN U.S. TELECOMMUNICATIONS

by

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1.0 Introduction

Not surprisingly, there are many opinions regarding the state of competition in the telecom industry. There are many submarkets to consider, each with a very different potential for the manifestation of competition as commonly defined in economics. Competition, of course, is a matter of degree and there is a great deal of confusion regarding the criteria to determine the level of competition in any given market at any given time. For this reason we focus on empirical observations using the available data to evaluate competition since divestiture.

One of our main purposes is to make the same data available to others for their own interpretation. Due to the limitations of space we do not attempt to examine causality in any detailed quantitative fashion. This is appropriate considering the limitations of reported data and the short history since divestiture. Moreover, economic causality is difficult to evaluate, and the divestiture itself may not even be a major factor as a host of post-divestiture exogenous and entirely random factors such as tax reform, low inflation, high growth, technical change, and numerous judicial and regulatory decisions are in large part responsible for what we observe.

Of critical importance to most economists in evaluating competition are the actual and potential number of market suppliers and buyers, and the ease with which suppliers may enter the market. There are many possible measurements, including the

counting of suppliers, and evaluating entry barriers and the ready capacity of alternative suppliers. A traditional structural approach looks at market share at a point in time and over time to evaluate competition. Strict market share calculations are not total indicators of the state of competition in any market. Price movements are also important indicators of competitive conditions, and we have made an attempt to examine these as well. Financial performance and profitability are also relevant.

Beyond the usual indicators, there are other behavioral considerations such as the presence or absence of joint ventures and other partnerships among firms or groups of firms, productivity, product/service introduction and innovation, progress in technology adoption. Even were data available on all such factors, which they are not, an analysis of competition is complicated by transition dynamics and institutional, regulatory and other exogenous factors for which there is often no data at all.

The post-divestiture telecom marketplace features a wide range of submarkets, only some of which are closely related. Various categories of telecom products and services can be substitutes or complements depending on income levels or other characteristics of users. Various network services are often used in combination by certain residence and business customers, while many others consider them as substitutes and choose one or another. For example, some businesses use switched and dedicated

lines in relatively fixed proportions, while others view them as close substitutes based on price. We proceed to look at data on each category separately, recognizing that only net effects are revealed among a host of complex cross-elastic relationships. The market categories examined are: toll network services, including switched and non-switched network services; local network services including access lines and usage; access services for toll calling; customer premises equipment; network switching and transmission equipment; cellular mobile telecommunications; public or pay telephone equipment and services including alternative operator services; local and metropolitan area networks (LANS/MANS); and information services.

Since divestiture, the telecommunications industry has become one of the fastest growing markets in the economy. However, there are large variations in the growth rates of different submarkets. There also appears to be a strong correlation between growth rates and competitive conditions, i.e. the highest rates of growth appear in sectors with the most competition.[1] This correlation exists for several reasons. First, the pressures for entry usually occur in segments with high growth prospects. Second, competition drives down price and this increases demand. Third, it is easier to support new entrants in very high growth industries. Correlation, however, is not causation, thus it is necessary to consider whether entry

[1] This is not true for cellular radio as discussed below, where demand growth is exceptional but only two basic service providers exist in any regional market.

constitutes a perhaps short-lived competitive fringe, or genuine long-run price/quality rivalry. Industry "shakeouts" typically follow boom periods and such situations should be monitored closely.

The top half of Table 1.0 presents data on growth rates in local, toll and access volumes for the 1984 to 1988 period. These growth rates are significantly affected by federal and state rate changes mandating local price increases and toll and access service price decreases. The history of these price changes is given in Table 1.1. The increase in the price of local and the fall in the price of interstate toll access reflect the rebalancing of rates that has taken place. Obviously, the aggregate demand response to such large rate and rate structure changes represents a significant part of observed growth in toll and access service since 1984 and not just inherent structural differences in long-run growth rates. Within the overall industry, growth in local telephone service since divestiture, especially for voice lines and usage is quite sluggish, with the growth in voice toll and access services being two to four times greater. Such slow growth in the presence of unprecedented post-war economic expansion could indicate that local service is a very mature and largely saturated market whose future is likely closely related to population growth more than anything else.

Table 1.0

INDUSTRY DATA

Network Market Segment Growth (%)
(year over year)

	1984	1985	1986	1987	1988
Access Lines[1]	-	2.6	2.6	3.4	3.2
Local usage[2]	-	2.1	0.5	0.8	0.5
Toll usage[3]	-	8.0	6.3	8.3	9.4
Access Usage[4]	-	10.5	8.3	15.2	13.0

Note: Comparisons of switched toll and access are difficult to make partly due to difference in measurement and reporting and bypass.

Industry Revenues ($B)

	1984	1985	1986	1987	1988
Total[5]	113.7	124.6	131.2	134.2	142.0
Local[6]	75.3	82.6	87.7	91.5	96.7
Toll[7]	38.4	42.6	43.5	42.7	45.3
Access[8]	25	27	23	22	25.2

1 RBOCs plus the 18 largest independents (Source: Annual Reports/ FCC Statistics).
2 Subscriber line usage data (Source: FCC Tier 1 companies, Joint Board Monitoring Report, CC. Docket No. 80-286, p.198, 12/88).
3 Based on AT&T data, for switched service only. Non-reporting carriers are usually higher growth and private and bypass usage is excluded, causing the estimates shown to be lower than actual.
4 Interstate (Source: FCC reports on Interstate Switched Market, March, 1989).
5 Based on data for approximately 90% of the market (Source: Annual Reports/ FCC).
6 RBOCs plus the 18 largest independent companies, includes local service, intraLATA toll, access (Source: Annual Reports/ FCC).
7 Includes top 5 carriers or about 95% of market (AT&T, MCI, Sprint, NTN, Allnet.)
8 Author estimate.

Table 1.1

TELEPHONE PRICES
(Annual Rate of Change)

	Local	Intrastate Toll	Interstate Toll	Access*
1984	+17.2	+3.6	-4.3	--
1985	+8.9	+0.6	-3.7	-8.1
1986	+7.1	+0.3	-9.5	-14.3
1987	+3.3	-3.0	-12.4	-21.7
1988	+4.5	-4.2	-4.2	-8.5
Total	+41.0	-2.7	-34.1	-52.6

* Interstate only
Source: FCC price index study 1989

The same is true of voice toll and toll-access services, but large rate reductions make them appear to be very high-growth markets. Data telecom services on the other hand, even local service, show very high growth rates (see Figure 1). This is not due to divestiture or changes in regulation but simply reflects shifting demand.

The bottom half of Table 1.0 provides information on the levels of 'industry' revenues (some 90% to 95% of the market, see Table notes). Total revenues, so measured, have risen by 25% in the five year period with "local" (LEC) revenues increasing 28% and toll revenues (interstate) increasing 18%. Significant repricing must be taken into account when evaluating this data. The overall financial health of the industry since divestiture is indicated in Tables 1.2 - 1.4. Table 1.2 shows the market/book values of the publicly traded shares of major firms for the 1984

to 1988 period as well as for the S&P 400; Table 1.3 provides key financial data for the industry, as well as for the LECs and interexchange segments. Table 1.4 shows the industry growth in telecom plant in service and also provides data on capital turnover rates. Several important observations may be made from these data. The first is that operating cash flow and net income (total industry) expanded significantly between 1984 and 1988 (28% and 22% respectively). Operating cash flow grew for both LECs and IXC firms. Net income was significantly down for IXC firms in 1985, 1986 and 1987, reflecting problems for MCI and particularly for US Sprint, but has recovered nicely in 1988. Capital expenditures have risen appreciably since pre-divestiture days. Much of the capital spending in earlier years (1984-86) was to pay for equal access required by the MFJ and remains high due to aggressive network modernization programs.

Table 1.2

Market/Book Ratios for Telephone Company Equities

Market/Book Value

	AT&T	GTE	United	S&P 400	RBOC's
1984	1.43	.96	1.17	1.51	.94
1985	1.78	1.24	1.32	1.86	1.16
1986	1.98	1.47	1.45	2.16	1.41
1987	2.00	1.28	1.61	2.13	1.46
1988	2.69	1.55	2.53	N/A	1.50

$$\text{Market/Book} = \frac{\text{(Stock Price) x (Shares Outstanding)}}{\text{Shareholder's Equity}}$$

All data from Annual Reports (except S&P 400)

Table 1.3

TELCO FINANCIAL DATA ($M)

Industry Total

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	113732.0	25744.5	9332.6	13406.7	9130.2	21459.3	35.5	7.49
1985	124584.9	29444.8	10180.8	15791.7	8775.4	24202.5	35.1	6.77
1986	131237.3	30670.4	10120.1	17946.6	10068.9	26275.2	33.8	7.81
1987	134247.0	30550.0	10464.7	20633.0	10480.2	24913.3	34.2	7.70
1988	142004.9	32669.0	11987.6	21945.8	10914.3	25570.9	34.0	8.22

LEC Subtotal

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	75324.0	23085.5	8550.8	11906.5	6691.2	18206.6	43.18	7.40
1985	82624.7	25789.3	9605.4	13672.5	5984.3	20386.1	42.19	6.80
1986	87719.3	26980.8	10071.6	15396.0	6484.0	21035.1	41.43	8.03
1987	91532.2	26920.0	10085.5	17806.3	6958.2	20311.7	41.73	7.79
1988	96668.4	28039.3	10449.6	18767.4	7153.1	20806.3	41.00	8.00

Interexchange Subtotal

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio* (%)	Rate of Return (%)
1984	38408.0	2659.0	781.8	1500.2	2073.0	3252.8	39.0	5.2
1985	41960.2	3655.5	575.4	2119.2	2791.0	3816.5	35.1	7.4
1986	43517.9	3689.6	48.5	2550.6	3584.8	5240.1	38.8	7.7
1987	42714.8	3630.0	379.3	2826.6	3522.0	4601.6	38.4	8.6
1988	45336.5	4629.7	1538.0	3178.4	3761.2	4764.6	38.4	11.0

KEY: Debt Ratio - Long term debt/invested capital
Rate of Return - Net Income/invested capital

* AT&T and MCI

Source: Company Reports for 5 largest IXCs, 25 largest LECs (about 95% of market)

Table 1.4

TELCO INVESTMENT ($M)

Industry Total

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	207212.0	158681.6	23.42	6.47	7245.4	21459.3
1985	224624.1	167656.8	25.36	7.03	7824.9	24202.5
1986	242447.0	174878.6	27.87	7.40	8746.7	26275.2
1987	253500.8	179998.4	28.99	8.14	9862.7	24913.3
1988	266889.1	183218.1	31.35	8.22	9961.7	25570.9

LEC Subtotal

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	185301.1	143154.8	22.74	6.43	6756.1	18206.6
1985	200091.4	150725.7	24.67	6.83	7179.1	20386.1
1986	213206.0	155658.6	26.99	7.22	7659.2	21035.1
1987	222402.3	159812.3	28.14	8.01	8538.7	20311.7
1988	232604.7	161197.4	30.70	8.07	8559.7	20806.3

RBOC Subtotal

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	144453.0	112589.3	22.06	5.94	4753.7	12377.5
1985	154817.4	117501.9	24.10	6.48	4880.0	14507.4
1986	163933.1	120223.7	26.66	6.81	5257.5	14109.2
1987	172777.2	121222.6	29.87	7.53	5799.7	13841.0
1988	180036.8	122155.5	32.15	7.43	5808.9	13666.8

Interexchange Subtotal

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	21910.9	15526.8	29.14	6.85	489.2	3252.8
1985	24532.7	16931.1	30.99	8.64	645.8	3816.5
1986	29241.0	19220.0	34.27	8.72	1087.9	5240.1
1987	31098.5	20186.1	35.09	9.09	1324.0	4601.6
1988	34284.4	22020.7	35.77	9.27	1402.0	4764.6

GPIS: Gross Plant in Service
NPIS: Net Plant in Service
DR: Depreciation Reserve/GPIS
DE: Depreciation Expense/GPIS
RETS: Plant Retirements
ADDS: Plant Additions

Source: Company reports

Note that the ratio of long-term debt to invested capital has decreased, and that depreciation rates have increased 50%. These facts, combined with relatively low inflation and taxes, have allowed the industry to rapidly replace and modernize plant without sacrificing profits or dividends. Dividends fell somewhat for LECs in 1985 but otherwise have grown steadily for both LECs and IXCs.

Currently almost two-thirds of industry cash flow is from depreciation. The very important financial effect of recent increases in allowed depreciation rates is a result of both divestiture and competition. It is hard to accept that such rapid increases in depreciation would have been allowed by regulators if AT&T still owned the majority of local distribution and manufacturing facilities as a vertically integrated entity. Of course, the simultaneous effects of positive exogenous economic factors which reduced pressure on regulated rate levels certainly is also responsible for the favorable financial picture.

We now turn to a discussion of the various subcomponents of the 'industry' and broad aggregates such as LECs to determine whether the same trends are evident below the surface. This section provides a descriptive analysis of economic conditions for various telecom submarkets using the available data. Most financial information is from public accounting data and may not provide a particularly accurate economic evaluation. However, the data is likely reasonably consistent across firms allowing for comparison of nominal financial results. As long as such

comparisons are made among firms within a given narrow industry segment, the actual economic conditions underlying the data are likely to be similar for all of them. Of course, the institutional environment may favor certain firms over others, however, only the most obvious cases will be mentioned. The data presented for each industry segment that will yield insights into indicators of competitive activity include market structure, growth, capacity, prices, new products and services, productivity, and technology adoption.

2.0 Toll Service

Table 2.0 shows the key financial results for the three major interexchange carriers for the period since 1984. On average, total toll revenues have grown by about 4% per year even with the substantial price reductions that were detailed in Table 1.1. Cash flow, net income, capital turnover and capacity additions have all risen rapidly since divestiture but are beginning to slow down. Construction spending has peaked and is on the decline as significant capacity expansion particularly in fiber-optics plant has occurred. Depending on one's definition of usable toll capacity in place, there is now 2 to 5 times the intercity capacity as there was at divestiture. Due to competitive entry, these capacity additions may have taken place without divestiture. Significant cuts in construction budgets in 1988 and 1989 are indicated for all major carriers. Investment data for the largest individual firms are also given separately

Table 2.0

IXC FINANCIAL DATA ($M)

AT&T

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	34935.00	2255.50	607.06	1148.44	0.00	1148.00	34.80	5.2
1985	37578.00	3180.00	975.09	1661.10	836.00	1791.08	30.00	8.8
1986	36781.00	3701.00	1307.30	1790.04	1520.00	2483.83	28.40	12.0
1987	35129.00	3964.00	1472.80	2028.57	1248.00	2526.00	26.00	13.0
1988	35400.00	3831.00	1689.00	2266.00	2338.00	3033.00	31.40	13.3

MCI

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	1959.29	377.84	59.20	264.57	0.00	1157.12	60.30	1.90
1985	2542.27	643.00	113.30	347.15	0.00	1000.10	56.27	3.76
1986	3592.00	398.00	-448.00	451.00	0.00	1074.00	67.95	-11.38
1987	3939.00	523.00	88.00	471.00	0.00	619.00	66.31	2.19
1988	5137.00	929.00	346.00	549.00	0.00	896.00	66.33	7.93

US Sprint*

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	1245.00	-68.00	114.60	80.00	NA	925.00	NA	NA
1985	1345.00	-253.00	-490.00	99.00	NA	1000.00	NA	NA
1986	2345.20	-418.20	-700.00	281.80	NA	1101.00	NA	NA
1987	2672.20	-846.50	-1154.90	308.40	NA	996.00	NA	NA
1988	3405.40	-122.50	-467.10	344.60	NA	728.20	NA	NA

KEY: Debt Ratio - long term debt/invested capital
Rate of Return - Net Income/invested capital

* Data for 1984-86 represents predessor companies.

Source: Company Reports

in Table 2.1.

AT&T's total revenues are now (1988) only about 2% above 1984 levels, and in fact are lower than 1985 and 1986 (remember the price decreases). AT&T's depreciation has nearly doubled, net income has risen and the ratio of debt to invested capital has decreased.[2] MCI's 1988 revenues were 162% above 1984 levels, and Sprint's 1988 revenues were nearly three times the 1984 level. US Sprint, even in 1988, had negative cash flows and net income, however they may have reached a turning point since early 1989 results look better and industry analysts predict a net profit for the first time.

Figure 1 shows the growth in various toll market segments since divestiture: residence, business, WATS, 800 service and data, and indicates the strong relative growth of business toll services, especially WATS and data. Again remember how prices have fallen. Table 2.2 gives estimates of fiber optic installations in the toll market since divestiture for major IXCs. Fiber-miles in service have increased from 455 thousand in 1985 to 1.88 million in 1988. Advances in electronics will lead to even greater capacity without new lines. This growth is remarkable.[3]

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[2] AT&T's data reflects only regulated operations and accounting rules are different. The recent AT&T write-down of communications plant increases its book debt ratio but is not recognized on the regulated books.

[3] According to FCC estimates, if state-of-the-art electronic and photonic devices were used on the 1988 installed base of fiber, the network capacity would be 10 times that of AT&T's pre-divestiture network. With current devices and components for transmission systems and the amount of "lit" (active) fiber transmission lines, capacity is at least doubled.

Table 2.1

INTEREXCHANGE CARRIERS INVESTMENT DATA

($M)

AT&T Communications

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	17481	12062	31.0	6.57	553	1514
1985	18684	12630	32.4	8.89	589	1791
1986	20338	13219	35.0	8.80	829	2484
1987	21758	13490	38.0	9.32	1078	2498
1988	23820	14263	40.1	8.52	1000	2800

MCI

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	3270	2614	20.1	8.09	42	1157
1985	4164	3045	26.9	8.34	51	1000
1986	5284	3710	29.8	8.54	100	1074
1987	5685	3854	32.2	8.28	218	619
1988	6577	4363	33.7	8.35	153	896

US Sprint*

	GPIS	NPIS	DR(%)	DE(%)	RETS	ADDS
1984	1100	800	27.3	7.27	NA	925
1985	1600	1200	25.0	6.19	NA	1000
1986	3500	2203	37.1	8.05	NA	1101
1987	3536	2763	21.9	8.72	NA	996
1988	3583	2938	18.0	9.62	NA	728

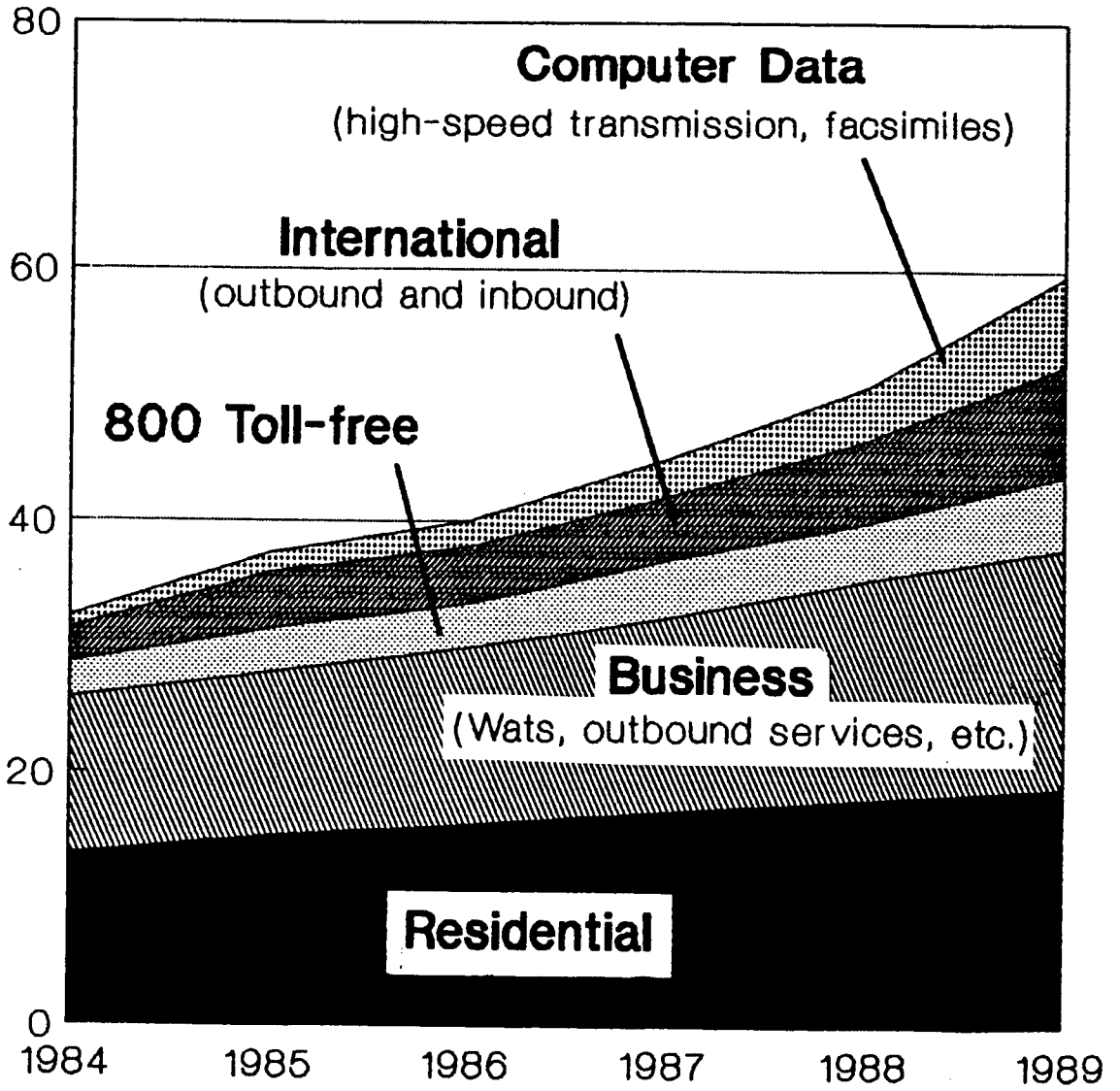
Key: GPIS - gross telephone plant in service
NPIS - net telephone plant in service
DR - depreciation reserve/ GPIS
DE - depreciation expense/ GPIS
RETS - plant retirements
ADDS - plant additions

* Data for 1984-86 represents predecessor companies

Source: Company Reports

Figure 1

Long-Distance Market Data
($B)



Source: New York Times, May 22, 1989 (Paine Webber).

Table 2.2

IXC FIBER OPTIC DEPLOYMENT

	Approx. Current Invest. (millions $)	Route-Miles 1985	1986	1987	1988	Fiber-Miles 1985	1986	1987	1988
NTN Partners:									
Consolidated Network		310	292	352	352	3504	3504	3864	3864
Litel		881	950	1210	1210	13720	17274	22280	22280
Microtel (see note 2)		800	950	967	1127	8000	9500	9670	17158
SouthernNet		188	895	895	-	1880	8950	8950	-
Southland Fibernet		277	277	277	-	2770	2770	2770	-
Southern & Southland *		-	-	1172	1172	-	-	11720	11720
LDX Net		670	1379	-	-	16080	33096	-	-
WilTel		214	2899	-	-	2140	58077	-	-
LDX & Wiltel *		-	-	4244	5177	-	-	104923	131865
NTN Subtotal:	**584**	**3340**	**7642**	**7945**	**9038**	**48094**	**133171**	**152457**	**186887**
AT&T	1758	5677	10893	18000	23324	136248	261432	432000	704731
MCI	823	2560	5580	8775	10975	79200	167400	245700	264680
GTE-Sprint	-	1200	-	-	-	24000	-	-	-
US Telecom	-	4100	-	-	-	98400	-	-	-
US Sprint	1670	-	10000	18195	22090	-	190000	497224	575562
Electra *	50	493	493	493	493	10194	10194	10194	10194
Lightnet	280	2200	5000	5300	5300	52800	120000	127200	127200
Mutual Signal Corp.	32	0	0	420	420	0	0	4200	4200
Norlight	50	0	0	670	670	0	0	8040	8040
**RCI ** **	7	580	580	796	413	6960	6960	7202	2618
Teleconnect	30	0	0	320	400	0	0	1920	2400
Totals	5285	20150	40183	70031	73123	455896	889157	1497857	1886512

Source: FCC Fiber Report, February 17, 1989

Table 2.3 estimates the market share for interexchange (state and interstate) toll revenues since divestiture. The interstate market remains even more competitive (deregulated) relative to intrastate markets and this is indicated in the lower market share for AT&T, as can be seen in Table 2.4.

Table 2.3

Interexchange Carriers Market Shares*

(% Revenue)

	1984	1985	1986	1987	1988
AT&T	90.96	89.35	84.42	82.28	78.09
MCI	5.10	6.18	8.31	9.20	11.33
US Sprint	3.24	3.27	5.42	6.24	7.51
NTN	0.00	0.36	0.81	1.35	2.21
Allnet	0.70	0.84	1.04	0.92	0.87

* Top 5 firms estimated to be 95% of total interexchange market revenues

Source: Annual Reports, Company Data

Table 2.3 shows a steady decline in ATT's share of the interstate market from 91% in 1984 to 78% in 1988. This has no doubt been partly a result of progress in conversion of the public network to equal access. The effects of equal access are indicated in Table 2.5 and show that AT&T's share of premium and all minutes of interstate toll use are nearly equal in 1988.

Table 2.4

Share of Interstate Switched Access Minutes (%)

	AT&T	Other Carriers
1984	80	20
1985	77	23
1986	73	27
1987	70	30
1988	67	33

Source: FCC report on Interstate Switched Access, March, 1989.

Table 2.5

AT&T Share of The Interstate Market (%)

(End of Year)

	Premium Minutes	All Minutes
1984	94	80
1985	88	77
1986	79	73
1987	74	70
1988	69	67

Source: FCC report on Interstate Switched Access, March, 1989.

Since 1984, the number of IXCs has expanded rapidly (see Table 2.6). Even though most are resellers, there have been a large number of facilities-based entrants. Along with many new firms came a proliferation of new toll service offerings including many from AT&T as a competitive response.

Table 2.6

Number of IXC's

(End of Year)

1984 - 123
1985 - 217
1986 - 334
1987 - 451
1988 - 493

Source: FCC report on IXC, Carrier Identification Codes, April, 1989.

Data on market shares or investment do not capture the full flavor of the degree of competition (or lack of it) in any market. Market share is but one descriptive statistic of the nature of competition. One cannot be unimpressed, however, by the sharp fall in AT&T's share of the IX market, by the competitive service offerings in terms of quality (fiber-optics), the range of services and price (although here AT&T is greatly constrained). The obvious response is to say that the market is competitive. Yet the "market" is an aggregate and the toll market is geographically specific. One study by Multinational Business Systems Inc. (MBS) in November 1987 examined competition in IX markets. MBS found that in 1987 AT&T had only a 60% share of the high-volume business and residential markets. In the most profitable business markets, AT&T's share was only 59%. MBS concludes "AT&T retains a 'dominant' market share only in lower profit markets where competition is not vigorous. These markets include rural, low volume and short-haul private line long distance services." It is important to note that in these markets where AT&T is dominant, AT&T serves "nearly all rural customers, 75% of all residential customers and 85% of all business customers."[4]

In its recent order (FCC 89-9137691) implementing price-cap regulation for AT&T, the FCC does not discuss the state of competition explicitly. Instead by referring to "Dominant Carrier

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[4] Multinational Business Systems, Inc. Nov. 1987, p. 6 and 15.

Regulation" for AT&T but none for competing carriers the Commission is implicitly suggesting that ATT-C has market power over its rivals. Judge Greene's report re-examining the Divestiture Order spends half-a-page on IX competition, implicitly dismissing the arguments that IX is 'competitive.' Here we return to the notions raised in the introduction. Few markets and certainly not those with sunk investments such as in fiber-optics can be "perfectly" competitive. In the industrialized world we recognize this fact generally in utilizing antitrust laws, not regulation to police competition. Antitrust is an ex-post system of compensation for harm and fining perpetrators. Regulation is an ex-ante constraint on firm behavior and entry.

The case is not whether the IX market fits some textbook version of competition but whether it fits into those sectors we deem competitive enough for ex-post evaluations of firm strategies or into the ex-ante regulatory box we view as irredeemably not competitive. We believe the IX market is generally in the ex-post category, i.e. sufficiently competitive that with few rules (far fewer than in the FCC price-caps order which is really closer to rate-of-return regulation than price-caps) one can allow real competition.[5] The lack of competition in some IX markets does require some oversight, but we are

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[5] See L. Waverman "U.S. Interexchange Competition", in Changing the Rules: Technological Change, International Competition and Regulation in Communication, Crandall and Flamm eds., 1989, Brookings Institution.

convinced that the judicious use of price-cap regulation can protect captive customers, encourage competition and still not unduly hamper the actions of AT&T.

3.0 Local Service

There are about 1400 local telephone companies of which the Bell Operating Companies and GTE represent about 85% of the total market. Table 3.0 gives key financial data on the seven Regional Bell Operating Companies and 18 of the major independent companies which collectively serve about 90% of the total number of local service subscribers in the U.S. The revenue and cash flow data include charges for local service (access lines and usage) and intraLATA toll charges as well as interLATA access charges. Not evident from this Table is the fact seen earlier that growth in local service revenues alone is quite slow or even flat while toll revenues exhibit healthy (but only single digit) growth rates. Table 1.0 shows the growth rates for access lines and local usage. The RBOCs have had increased cash flow (24%) over the last five years and have maintained dividends near 1984 levels (Table 3.0). If 1984, the year of financial transition, is excluded, dividends have increased steadily since 1985. Net income has risen 30% (1988 over 1984) and depreciation expense increased over 50% (again 1988 and 1984 comparisons). Data for the 18 independent LECs aggregated on the bottom half of Table 3.0 show steady cash flow, declining net income and increased dividends.

Table 3.0

LEC FINANCIAL DATA ($M)

RBOCs

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Deferred Tax	Other	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	57762.6	17936.4	6805.9	8796.4	2018.9	315.2	6732.9	13872.7	41.17	7.63
1985	63365.5	20148.9	7534.0	10211.7	2024.3	378.9	6008.3	15458.8	39.76	8.14
1986	67390.1	21290.4	8135.9	11545.7	1814.0	-205.2	6189.2	15750.7	38.25	8.52
1987	70187.3	21166.2	8372.4	13627.6	343.2	-1177.0	6440.8	14735.0	39.29	8.46
1988	74197.4	22235.7	8914.5	14397.6	88.9	-1165.3	7034.8	15315.7	40.00	8.50

Independent LECs

	Annual Revenues	Operating Cash Flow	Net Income	Deprec. Expense	Deferred Tax	Other	Dividends	Capital Expends.	Debt Ratio (%)	Rate of Return (%)
1984	17540.5	5271.0	1781.7	3130.8	182.0	-79.6	1177.6	4351.9	49.18	6.70
1985	19066.8	5789.3	2111.3	3435.9	248.0	-242.4	1397.0	4942.4	49.77	6.64
1986	20187.9	5999.0	1968.9	3873.1	193.0	-243.3	1392.1	5297.2	50.86	6.56
1987	21195.3	6135.1	1740.6	4176.4	84.5	-212.2	1525.2	5590.7	51.76	5.82
1988	21931.1	5941.1	1454.1	4254.7	78.7	-235.7	1547.6	5405.9	52.00	6.00

Key: Operating Cash Flow - Net Income + Depreciation + Deferred Tax + Other
Debt Ratio - Long Term Debt/Invested Capital
Rate of Return - Net Income/Invested Capital

Note: Some data represent non-telco operations due to consolidated reporting (non-telco activities estimated in 1988 to be no more than 10% of revenues). Data for GTE and United is net of Sprint and US Telecom, respectively.

Source: Annual reports/company reports for RBOCs and 18 largest independents (about 90% of market).

LEC rates for basic service have undergone significant rate and rate structure changes since divestiture. The federally mandated subscriber line charges since divestiture appear in Table 3.1. Table 3.2 gives an analysis of an average residential monthly bill for local service since divestiture, and shows the lowest average rate for basic service. Also shown is the minimum "hook-up" or connection charge. The average local flat rate for residential service is about $12.50, with subscriber line charges and taxes it is about $16.60.

Currently, the average residential customer monthly bill is about $45.00, half of which is for toll service, and the balance for basic local service ($16.60) and non-basic services. However, the LEC only gets about $30.00 after toll revenues for AT&T or other carriers is subtracted out. With business service added in, the average LEC revenue per subscriber line is about $60 per month, and growth in average revenue appears to be flat.

Table 3.3 shows the number of access lines since divestiture for major LECs, and Table 3.4 gives total revenue per line for major LECs and RBOCs. Table 3.5 summarizes year-to-year changes in LEC revenues per line. Total revenues per line vary widely among carriers (Table 3.4). Since 1985, it has been relatively stable for 11 of the 21 firms shown in the table. Many firms even show declines in some years. The aggregate changes shown in Table 3.5 are surprising, given the sharp price

Table 3.1

Interstate Subscriber Line Charges

(by local Telephone Companies to End Users)
(In Dollars per Month per Line)

	Residential and Single Line Business	Multi-line Business	Centrex
5/26/84 to 5/31/85	$0.00	$4.99	$2.00
6/1/85 to 9/30/85	1.00	4.99	2.00
10/1/85 to 5/31/86	1.00	4.97	2.00
6/1/86 to 12/31/86	2.00	4.97	3.00
1/1/87 to 6/30/87	2.00	5.12	3.00
7/1/87 to 11/30/88	2.60	5.12	4.00
12/1/88 to Present	3.20	5.12	5.00

Source: FCC

Table 3.2

Average Monthly Residential Telephone Rates*

(In October of Each Year)

	1983	1984	1985	1986	1987	1988
Unlimited Local Calling	$10.50	$12.10	$12.17	$12.58	$12.44	$12.33
Subscriber Line Charges**	.00	.00	1.01	2.04	2.66	2.67
Taxes	1.08	1.25	1.36	1.51	1.56	1.59
Total	11.58	13.35	14.54	16.13	16.66	16.59
Lowest Generally Available Monthly Rate	$5.37	$5.62	$5.75	$5.96	$5.81	$5.62
Subscriber Line Charges**	.00	.00	1.01	2.04	2.66	2.67
Taxes	.56	.58	.70	.84	.94	.91
Total	5.93	6.20	7.46	8.84	9.41	9.20
Minimum Connection Charge	$35.01	$43.71	$44.32	$45.63	$44.04	$42.98
Taxes	1.75	2.19	2.22	2.28	2.20	2.11
Total	36.76	45.90	46.54	47.91	46.24	45.09

* Monthly rates and connection charges do not include lifeline rates.
** Includes both interstate and intrastate charges.

Source: FCC

Table 3.3

Access Lines
(in 000s)

	1984	1985	1986	1987	1988
Ameritech	14,337	14,555	14,755	15,094	15,469
BellSouth	14,000	14,500	15,000	15,700	16,400
Bell Atlantic	14,667	15,090	15,509	16,056	16,541
NYNEX	13,225	13,624	13,926	14,415	14,851
Pacific Telesis	11,307	11,630	12,063	12,525	13,093
Southwestern Bell	10,650	10,898	11,083	11,105	11,340
US West	10,871	11,167	11,332	11,613	11,876
GTE	12,304	12,681	13,087	13,635	14,373
United	3,140	3,256	3,376	3,516	3,685
Contel	2,160	2,230	2,280	2,380	2,470
SNET	1,617	1,674	1,712	1,779	1,839
Centel	1,267	1,295	1,354	1,422	1,503
Alltel	950	985	1,014	1,045	1,084
Cincinnati	700	714	727	748	763
Puerto Rico Tel	550	593	640	696	750
Rochester	486	499	511	526	559
Century	200	223	227	231	239
TDS	173	190	206	221	223
Lincoln	200	200	202	206	212
Pacific Telecom	164	221	225	230	240
CP National	56	56	57	60	62
Total	113,024	116,284	119,305	123,203	127,572

Companies listed are estimated to be 90% of the market

Source: FCC and Annual Reports

Table 3.4

Telephone Revenues per Line ($)

	1984	1985	1986	1987	1988
Ameritech	582	620	635	663	640
BellSouth	680	735	763	779	829
Bell Atlantic	552	605	648	669	658
NYNEX	719	757	814	838	853
Pacific Telesis	692	731	744	729	724
Southwestern Bell	675	727	713	721	745
US West	670	700	733	727	776
GTE	750	793	821	818	813
United	685	707	685	679	681
Contel*	1074	1146	1348	1221	1200
SNET	824	825	837	826	861
Centel*	1085	1024	1012	843	728
Alltel	114	123	143	158	158
Cincinnati	682	654	678	847	968
Puerto Rico Tel	640	640	610	613	613
Rochester	737	811	784	835	856
Century	802	871	910	947	770
TDS	574	627	752	790	807
Lincoln	724	718	785	824	861
Pacific Telecom*	2433	2079	2195	2289	2300
CP National*	1345	1373	1504	1588	1515

* May include significant non-telephone revenues due to consolidated reporting.

Companies listed are estimated to be 90% of the market

Source: FCC and Annual Reports

Table 3.5

Percent Change in Revenue/Line*
(year over year)

	Independent LECs	RBOCs	Total LECs
1984	-	-	-
1985	4.95	6.74	6.33
1986	4.04	3.72	3.82
1987	-1.91	0.64	0.04
1988	-2.83	2.33	1.12

* Includes local service, intraLATA toll and access service.

increases for local services noted earlier in Table 1.1.[6] It is possible that new service and tariff options are responsible, which allows consumers to substitute 'cheaper' for 'more expensive' telephone services.

Even though LEC revenue and subscriber lines grow very slowly and revenue per line is basically flat (Table 3.5), the data in Table 3.0 show that cash flow, net income and construction spending remain quite high and were growing relatively rapidly since divestiture. The primary reason is higher local rates and very high depreciation, along with lesser but related effects of lower inflation and taxes. In fact, depreciation alone as a source of operating cash flow provided

[6] The revenue per line data in Table 3.4 are for telephone operations only (except for a few smaller companies). Revenues from new and otherwise unregulated products and services are estimated to be about 3% of total industry revenues in 1984 and 10% in 1988 and are included in the data in Table 1.3.

about 90% of all funds used for new construction in 1988 and to a significant extent, albeit a lesser percentage, in 1984-1987. It should be pointed out however that much of the earlier years' construction spending was 'abnormal' due to increased requirements for mandated equal access conversion schedules. If the "bubble" in construction spending caused by equal access is removed, construction spending would have risen steadily with depreciation and cash flow.

Table 3.6 provides data on LEC investment, rate base, depreciation, and construction spending. The data indicate that the high embedded base of LEC investment is providing an umbrella for sustained capital additions as the Gross Plant in Service (GPIS) and the rate base (Net Plant in Service - NPIS) continue to grow at about 5% and 2% respectively. Normally, high depreciation rates serve to reduce the rate base, but due to aggressive modernization this is not happening yet. It must

Table 3.6

LEC Data ($B)

	GPIS	NPIS	DEP.	ADDS
1984	186.0	143.6	11.9	18.2
1985	200.8	151.2	13.6	20.4
1986	213.9	156.2	15.4	21.0
1987	222.4	159.9	17.8	20.3
1988	231.2	160.2	18.7	20.7

happen eventually, however, since the useful service life of relatively new plant is at some point higher than the remaining service life of old plant.[7] Table 3.7 shows the rapid increase in depreciation rates since 1980 for major LECs as well as for AT&T and MCI post divestiture.

Table 3.7

Annual Depreciation Rates (%)

	AT&T	MCI	RBOCs	GTE	Other LECs
1980	5.32	5.22	NA	5.65	5.47
1981	5.39	7.28	NA	5.75	6.04
1982	5.53	6.64	5.60	6.42	6.11
1983	5.90	7.51	5.90	7.54	6.53
1984	6.57	8.09	6.05	8.62	7.72
1985	8.89	8.34	6.54	8.88	7.70
1986	8.80	8.54	6.92	9.69	8.23
1987	9.32	8.28	7.88	9.94	8.43
1988	8.52	8.35	7.96	9.67	8.46

Def: Annual DE/GPIS

Table 3.8 provides market share data for major LECs since 1984. Based on this and the other LEC data, there is no indication of serious competition for the basic local service market and little for intraLATA toll and other local services as well. This is the implication of stable market shares of incumbent firms, which only seem to be sensitive so far to exogenous regional growth differences. Furthermore, as noted,

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[7] For a detailed account of the recent telco investment activity and the role of depreciation see Egan and Taylor, "Capital Budgeting and Technology Adoption in Telecommunications: The Case of Fiber," Center for Telecommunications and Information Studies Research Working Paper #349, Columbia University, Sept. 1989.

Table 3.8

Market Share: Local Exchange Carriers
(% Revenue)

	1984	1985	1986	1987	1988
Ameritech	11.08	10.94	10.96	10.45	10.30
Bell Atlantic	10.75	11.08	11.48	11.76	11.32
BellSouth	12.64	12.94	13.07	13.38	14.14
NYNEX	12.62	12.51	12.95	13.22	13.17
Pacific Telesis	10.39	10.31	10.25	9.02	9.49
Southwestern Bell	9.55	9.61	9.02	8.76	8.79
US West	9.67	9.48	9.49	9.24	9.59
GTE	12.26	12.20	12.27	12.21	12.16
United	2.86	2.79	2.64	2.61	2.61
Contel	2.19	2.09	2.09	2.18	2.22
SNET	1.77	1.68	1.64	1.61	1.65
Centel	1.05	1.00	0.94	0.94	0.94
Alltel	0.65	0.63	0.73	0.74	0.77
Cincinnati	0.63	0.57	0.56	0.69	0.77
Puerto Rico Tel	0.46	0.46	0.45	0.47	0.47
Rochester	0.48	0.49	0.46	0.48	0.50
Century	0.21	0.24	0.24	0.24	0.19
TDS	0.13	0.14	0.18	0.19	0.19
Lincoln	0.19	0.17	0.18	0.19	0.19
Pacific Telecom	0.53	0.56	0.56	0.58	0.57
C-TEC	0.11	0.10	0.10	0.11	0.11
Other	0.23	0.35	0.34	0.33	0.33

the RBOCs and many LEC's market value, net income, cash flow and profits have increased since 1984 and remain high, all in the face of relatively low growth in the quantity of services sold. The data in Table 3.8 indicate that no major new local service companies have entered the market, at least not sufficiently to substantially lower market share even though there is no MFJ prohibition against IXCs or other LECs from providing local service in competition with the incumbent dominant LEC. Further

evidence of LEC market power is that although rates for basic local service have risen over 40% since divestiture market penetration still grows.

The lack of competition at the state and local level is due to many factors, the primary one being regulatory policies which do not encourage entry. The incumbent LEC enjoys the relative comfort of rate-base regulation. While most states do not grant exclusive certificates of necessity and convenience to the incumbent LEC, regulatory barriers exacerbate entry barriers in terms of up-front sunk costs since assets are fixed and immobile, meaning very high business risk for new entrants with no rate-base, customer base, or cash flow. It is not clear if local competition would flourish in the absence of regulation, but we would expect to see more entry if regulatory protection were removed. The only true test of course is to see what would happen without regulation. Where niche local exchange competition has emerged, a host of regulatory, legal and technical roadblocks continue to face the new entrant.

Arguably there are some large new niche competitors in the business local service market. Two of the most prominent are Metropolitan Fiber Systems, Inc. and New York's Teleport. The track record of such firms is still in the start-up phase, however for now at least they are primarily bypass suppliers. Recently these two suppliers announced plans to expand to a number of cities, including New York, Chicago, San Francisco, Los

Angeles, Boston, and Houston.[8] Most interesting, however, are these two firms' plans to compete against each other, as well as against the LECs. In time, of course, this situation will gradually change. We emphasize that the true nature of feasible competition will only be known when local service and access are correctly priced in relation to cost and regulatory barriers removed.

Another interesting case of potentially important post-divestiture competition are the so-called Shared Tenant Service (STS) providers. These were firms that chose natural aggregates of local subscribers in large buildings or campus complexes and basically resold LEC service usually through the use of private remote switching and/or multiplexing equipment. Accurate data on such private arrangements is not generally available. Such activity grew rapidly in 1984 through about 1986, but recently it has fallen off and even declined to the point where it is not even discussed much in the trade press anymore. At first glance, this appears curious. The likely explanation is that while this new market was initially perceived as substantial, as often is the case with new and untested markets, in fact there was little potential given the environment. It proved to be difficult for a STS provider, even in partnership with a building owner/contractor, to contract for a break-even penetration rate among tenants. Furthermore in some states, litigation brought by

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[8] See Communications Week, June 26, 1989, p. 15.

LECs and regulators or other groups against the STS industry resulted in delays and even some orders to terminate operations for fear of cream-skimming the LECs.[9]

4.0 Access Service

Access services represent a huge market that was strictly a product of regulatory decisions of the early 1980s. Prior to divestiture, access charges were an implicit part of retail toll prices except in the case of a few fledgling toll carriers. After divestiture, AT&T and other IXCs had to pay large per-minute fees to LECs whenever a toll call was placed using LEC local connections. Table 1.0 provides data on LEC access revenues since divestiture. Table 4.0 summarizes the federally mandated access tariff rate levels, which have gone from 17.3 cents per minute of toll use in 1984 to 9.8 cents today, the decrease being primarily due to concomitant increases in local Subscriber Line Charges which appear on the monthly bill for local service. Intrastate access rates are also available but are far too many to display, however, they are similar to interstate rates both in level and structure. Access charges represent almost a third of LEC revenues and almost half of AT&T annual operating expenses. Average switched toll rates nationwide are about 30 cents per minute.

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[9] Much of the early market for STS providers was the huge profit opportunity from reselling long distance and with the substantial toll price cuts their margins were squeezed. Many states since 1986 have chosen to regulate or prohibit STS operations and the FCC recently declined to pre-empt such regulation.

Table 4.0

Interstate Charges By Local Telephone Companies To Long Distance Carriers

(National Average for "Premium" Service in Cents per Minute)

	Carrier Common Line Charges Per Originating Access Minute	Carrier Common Line Charges Per Terminating Access Minute	Total Traffic Sensitive Charges Per Access Minute	Total Charges Per Conversation Minute
5/26/84 to 12/31/84	5.24	5.24	3.1	17.3
1/1/85 to 5/31/85	5.43	5.43	3.1	17.7
6/1/85 to 9/30/85	4.71	4.71	3.1	16.2
10/1/85 to 5/31/86	4.33	4.33	3.1	15.4
6/1/86 to 12/31/86	3.04	4.33	3.1	14.0
1/1/87 to 6/30/87	1.55	4.33	3.1	12.4
7/1/87 to 12/31/87	0.69	4.33	3.1	11.5
1/1/88 to 11/30/88	0.00	4.14	3.1	10.6
12/1/88 to present	0.00	3.39	3.1	9.8

Source: FCC

The main reason for analyzing "access" separate from other LEC markets is that it is uniquely competitive for large users and many bypass substitutes exist and their numbers are growing rapidly. As is the case with toll service, smaller users in many geographic markets still have no ready alternative to LEC switched access services. In recognition of potential bypass competition, the FCC has significantly reduced interstate access charges on originating switched toll traffic. Some evidence of relative price elasticity in LEC access services is the fact that access service revenues remain steady despite large annual rate

declines.

It is difficult to evaluate real growth rates for LEC access services since substantial rate reductions have occurred annually since divestiture. Before divestiture, LEC access charges were implicitly part of retail toll prices which made it more difficult, even for large users, to avoid paying them for switched services. The post-divestiture environment provides large customers with a number of alternatives for obtaining cheaper access services, including WATS, 800 Service, private bypass and interconnect services. As new IXC toll service options grow, even moderate and small customers will begin to have alternatives to full-priced LEC switched access service. AT&T's new small-customer 800 Readyline Service is an early example.

No solid data source on private bypass of LEC switched access charges exists and thus it is difficult to estimate market share declines, especially in the face of fairly rapid overall toll service growth partially caused by dramatic rate declines. One method for estimating LEC bypass is available from the FCC Bypass Monitoring Report in CC Docket 87-339 (Dec. 1988) and puts it at $3.7 billion annually for the RBOCs and GTE. A recent NTIA report, Telecom 2000 (1988: p.343) estimates compound annual growth rates for bypass networks at 20% for the period 1985-1990. Table 4.1 provides some data on the growth of microwave radio and satellite systems. Currently, about 16,000 domestic common carrier point-to-point microwave systems are in operation,

Table 4.1

FCC Microwave Facilities Applications

1986	1987	1988	1989	1990
8,593	7,928	6,400	*7,000	*13,000

* estimates

source: FCC Radio Facilities Division (Common carrier point-to-point service.)

Very Small Aperture Terminal Market ($M)

1984	1985	1986	1987	1988
59.7	73.5	62.6	92	151.4

Source: Dataquest

licensed to almost 1,325 carriers, and the annual growth in facilities is substantial. Private (non common carrier) systems have also proliferated. As of July 1989, there were about 18,000 domestic satellite earth stations authorized by the FCC and since 1984 over 12,000 applications for new earth stations were filed and about 1,500 for modification of existing ones. The U.S. Department of Commerce estimates the current annual market for satellite ground stations at $600 million (1988) and forecasts sales to reach $900 million by 1991 (includes VSAT, DBS, TVRO, and mobile stations). Private satellite, radio, copper and fiber telecom systems vendors have grown rapidly, well into double digit growth since divestiture, and have by definition reduced

LEC market share. Recent FCC pricing rules have allowed LECs to rapidly lower originating access rates to try to stem the competitive tide, but high rates obviously persist at about 10 cents per minute. This trend will continue and therefore LEC access services, at least for interstate service -- which is 75% of the market -- is effectively competitive. In many state jurisdictions however, the market structure for toll and access more closely resembles the monopoly model.

5.0 Customer Premise Equipment (CPE)

The CPE market was already quite competitive by 1984 due to some important regulatory decisions, especially Carterfone (1968) and Computer Inquiry II which detariffed CPE, and forced structural separation of AT&T from its CPE division, known at the time as American Bell. Today, there are numerous buyers and sellers, none of which currently exercises market power. Even the industry giant AT&T is only an average supplier as evidenced by the number of competitive-bid contracts it wins. Foreign imports of CPE dominate the market and foreign production capacity is so large as to prevent the U.S. from ever again dominating the market to the extent that market prices would be forced higher. Table 5.0 shows sales and shipments of CPE since 1984.

We cannot estimate market share by supplier for 'POTS' telephones, there are simply too many of them; that market is competitive. Table 5.1 provides some market share data for all

Table 5.0

U.S. Factory Shipments Of Telephone and Telegraph Equipment ($M)

	1984	1985	1986	1987	1988
Private Branch Exchange Equipment	1,603.7	1,720.8	855.9	1,222.0	1,300.0
Other Switching and Switchboard Equipment	1,410.6	1,660.7	1,851.9	1,816.1	1,850.0
Carrier Line Equipment	1,917.3	2,329.5	2,833.0	2,737.0	2,745.0
Telephone Sets	846.7	1,218.6	783.7	875	NA
Teleprinters	294.1	270.8	361.2	NA	NA
Modems	848.3	829.5	1,228.2	1,078.1	1,155.0
Voice Frequency Equipment	301.7	328.3	243.0	196.2	175.0
Other Telephone and Telegraph Equipment	4,161.4	3,371.5	2,857.5	3,027.8	3,000.0

CPE Shipments And Sales

	1984		1985		1986		1987		1988	
	Units (000s)	$ (M)	Units (000s)	$ (M)	Units (000s)	$ (M)	Units (000s)	$ (M)	Units (000s)	$ (M)
Home Computers	5,100	2,250	4,100	2,050	3,800	2,890	4,000	2,920	4,500	3,150
Home Computer Software	40,000	640	50,000	750	NA	1,000	NA	1,600	NA	2,000
Satellite Earth Station Systems	NA	NA	600	900	375	750	250	625	275	855
Cordless Telephones	6,300	460	4,000	280	4,400	315	5,200	355	6,300	440
Corded Telephones	24,000	790	21,000	630	21,000	650	21,000	600	20,000	600
Cellular Telephones	25	50	75	115	280	265	300	265	350	300
Answering Devices	3,000	230	4,220	325	5,540	400	7,200	500	8,000	545
Telephone Accessories	NA	NA	NA	200	NA	250	NA	290		330

Source: Estimated by EIA Marketing Service Department

Table 5.1

CPE Market Share Data

World's Market Top Ten Telecommunications Equipment Manufacturers

Rank	Company	Headquarters	1986 Sales ($B)
1	AT&T Technologies	USA	10.20
2	Alcatel NC	Belgium	8.00
3	Siemens	W. Germany	5.40
4	NEC	Japan	4.50
5	Nothern Telecom	Canada	4.40
6	IBM	USA	3.30
7	Motorola	USA	3.10
8	Ericsson	Sweden	3.10
9	Fujitsu	Japan	2.10
10	Philips	Netherlands	2.00

Full Product Line Equipment Manufacturers 1987 U.S. Market = $103B

AT&T	12.0%
Alcatel	10.0
Siemens	8.0
Northern Tel.	6.0
Ericsson	5.0
NEC	3.0
Philips	--
Fujitsu	--
Italtel	--
Other	55.0

U.S. PBX Voice and Data Line Shipments

AT&T	21.40%
Northern Tel.	19.60
Rolm	15.40
Mitel	9.60
NEC	9.50
Other	24.70

PBX Market Shares

	1984	1985	1986	1987	E1992
AT&T	19.00%	26.00%	22.00%	21.00%	22.00%
Northern Telecom	21.00	22.00	21.00	20.00	20.00
IBM	18.00	15.00	18.00	17.00	20.00
Mitel	9.00	8.00	9.00	10.00	9.00
NEC	7.00	7.00	8.00	9.00	9.00
GEC/Fujitsu	NA	NA	NA	8.00	7.00
Other	26.00	22.00	22.00	15.00	13.00
Total Revenues($B)	3.5	3.67	3.42	3.39	NA

Source: NTIA Telecom 2000, Gartner Group Reports

telecommunications equipment including the equipment used by telcos. The data do not pertain only to the CPE market, but they do show low concentration on a world or U.S. basis. Of greater relevance to our analysis of competition in the CPE market are the data in Table 5.1 showing market shares in the PBX market. PBXs are much more sophisticated than 'POTS' telephones and as such, less vendors will exist. Here, in 1987, the four-firm concentration ratio was 68%. The market shares of the top four PBX vendors exhibit stability over the 1984 to 1987 period. Yet, industry experts know the ferocious competition that has existed in this market even with its high start-up costs and exit barriers (the software for an unsuccessful PBX has zero salvage value). If PBX's are a competitive market (and they are), other CPE equipment is clearly a competitive market now.

Two issues remain. First, the BOCs are not allowed to manufacture equipment. Second, ISDN and other developments require more sophisticated CPE. We would be inclined to allow RBOCs to manufacture; given intense competition already,they can only add to it, however some regulatory rules may be acceptable to prevent favoritism of one's own manufacturing division.[10] As CPE becomes more sophisticated, entry costs rise. Yet, the market is huge and the number of potential producers is large and we see no serious problems for competition. The present

[10] A safeguard against subsidies might be to not allow BOCs to sell equipment to themselves, which may already apply in today's situation where they have an equipment sales division selling to the telephone company for internal use.

Congressional hearings into safeguards, such as cost allocation or separate subsidies for BOC permission to manufacture equipment, really ignore the enormous competition in CPE and the inability of any vendor to predate against other suppliers so as to wield long-run market power. Submissions to the House Committee argue that the BOCs could subsidize the R&D and software costs for new equipment and thus dominate the equipment market. There is little ground to believe that "deep pockets," wherever financed, will ensure success in the CPE market.

Whatever the failures of domestic regulatory policy in fostering competition in other areas, in the case of CPE they have been a very significant stimulus. To some, deregulation of CPE coupled with BOC line of business restrictions have gone too far by leaving the U.S. in a poor competitive position in the international arena. The U.S. share of the current world CPE market is only about 20-25% and most of the rest is from the Far East, and prices have plummeted as a result. Residence customer CPE comes almost entirely from overseas manufacturing facilities, and even for large scale business systems domestic production is estimated to be less than 25% of the U.S. market.

For a long time before divestiture, LECs depended on Centrex service, a central-office-based business system, to compete with on-premises PBX systems. The displacement of LEC Centrex by competitive PBX systems since divestiture has been substantial, indicating that even when the LEC enjoys a significant physical advantage of being the sole supplier of Centrex (they own all the

central office switching machines), there are ready market substitutes. Recently however, Centrex is making a comeback as a way for business customers to obtain digital service and ISDN and this could develop into a market advantage for LECs. Nonetheless, recent Open Network Architecture regulations which promise to unbundle LEC interconnection arrangements will likely allow for a competitive alternative.

It is hard to envision a freely operating CPE market returning to a monopolistic structure and therefore we feel that any residual regulation is probably unnecessary.

6.0 Network Equipment

The next category to examine is large-scale network switching and transmission systems. The embedded base represents a huge investment of over $230 billion, and includes some 22,400 network switch locations and several billion circuit miles of transmission capacity. Estimates of sales and shipments since 1984 for network equipment are given in Table 6.0. Currently in the U.S., shipments are about $15 billion, of which about a third is switching equipment, and the rest is electronic devices and components (about $2 billion) and transmission systems. Table 6.1 gives market share data for transmission and switching equipment and fiber optics for major firms, which represent the areas of highest growth as telcos upgrade their networks. Other growth areas include digital microwave and satellite networks and some data on these were provided in Table 4.1. The data in Table 6.1

Table 6.0

U.S. Shipments of Network Communications Equipment ($M)

	1984	1985	1986	1987	1988
Telephone switching and switchboard equip.[1]	5,871.2	7,714.3	7,180.0	7,480.5	NA
Carrier line equip. and modems[2]	8,369.5	8,348.1	4,062.2	3,815.1	NA
Other telephone and telegraph equip.[3]			3,891.1	4,227.2	NA
Comm. systems and equip. (excl. broadcast)[4]	9,258.5	10,708.0	11,216.5	11,363.2	NA
Central office equipment[5]	2,856.9	4,332.8	4,525.0	4,442.5	4,500

[1] SIC Code 36611
[2] SIC Code 36613
[3] SIC Code 36614
[4] SIC Code 36631
[5] Estimate

Source: U.S. Dept. of Commerce, Bureau of Census.

show that the U.S. market for switching and fiber optics is highly concentrated, featuring two major suppliers in each segment. It is difficult to measure the impacts of divestiture on sales and purchases of network equipment. Clearly, sales of Northern Telecom increased sharply after 1983, and inroads have been made in the device and components sector, as well as in microwave and satellite technology, since there are many suppliers and some significant new firms.

Table 6.1

Market Share Data
Network Equipment

WORLDWIDE TELECOMMUNICATIONS EQUIPMENT MARKET (1985)

(Switching, Transmission, PBX, Telephone, Cable, Fiber, Outside Plant)

AT&T	24.80%
ITT & Alcatel	14.60
Siemens	10.00
Northern Telecom	9.00
Ericsson	9.00
NEC	5.40
GTE	4.60
Other	19.30

Source: Gartner Group

U.S. SWITCH MARKET (1989)

AT&T	53.00%
Northern Telecom	40.00
GPT-Stromberg	3.00
Siemens	2.00
Ericsson	1.00
NEC	0.50
Fujistu	-

Source: Business Week, May 2, 1989

U.S. FIBER OPTICS CABLE MARKET SHARE

1985		1988	
AT&T	37%	AT&T	52%
Siecor	32	Siecor	30
ITT	13	Alcatel	8
Ericsson	9	Pirelli	4
Northern Telecom	4	Northern Telecom	2
Others	5	Others	4

Source: ElectroniCast Corporation

The nature of the production in the market for large-scale switching and transmission systems features very high start-up costs and substantial scale requirements both static and dynamic.[11] Competition is still evident, however, even with only two major firms since the products of each remain very close substitutes. Moreover, the "competitive fringe" includes a substantial number of large foreign firms licensed to serve the U.S. market. As a result of technical progress and competition, unit prices for transmission and switching capacity are falling, and market power, if it exists, is not evident from current behavior and performance of major firms. What is more, we expect the dominant firms' share of the domestic switching and transmission equipment market to begin to fall as foreign competitors continue to enter and as technology evolves. Competition is really at a global level and on a world basis, four-firm concentration ratios (albeit not measured for the markets in which they can today sell) are lower. We therefore feel that the market for CO switching equipment appears very competitive. Barring future trade barriers or collusion in LEC procurement practices this market should continue to feature competitive characteristics.

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[11] For any telco, once it has selected one or two vendors for certain kinds of equipment -- e.g. central office switches -- costs of conversion to other vendors may make it unlikely that new suppliers will win contracts.

7.0 Cellular Service

The growth rate in cellular communications service is the highest of any major new telecommunications market since 1984, but this is not a result of divestiture. In 1984, there were only 50,000 cellular subscribers and by 1988 there were about 2,000,000. Table 7.0 and Figure 2 provide data on market share, sales, and shipments since 1984 for both cellular service and equipment. Price competition for cellular customer equipment is fierce by any measure and today's average unit price is a small fraction of what it was in 1984. Prices for service have fallen too, but not substantially. Some have argued that those service price declines are insufficient. One possible reason for less competition on the service side is that only two competitors were designated by the FCC to operate in any given locale. Another problem is that cellular is provided over scarce radio spectrum and as usual ownership or control over spectrum use bestows certain market power advantages. Like other markets using scarce radio spectrum, some sort of regulation is necessary since auction markets are not used, and early mistakes were made in the process of regulating this new market.

Service price competition is possible with two suppliers; we see it in the provision of central office equipment, but here many real and potential entrants exist. The same is not true for cellular service. Service prices vary widely city by city. Presumably the cost structures are similar, (at least for cities of similar size); therefore the ability to regionally segment

Table 7.0

U.S. Cellular Switching Systems Market

(% share of system contracts)

	1985*	1986*	1987*	1988+	1989+
Motorola	50.0%	40.1%	36.9%	33.1%	31.1%
AT&T	33.0	32.4	32.8	26.2	25.6
NTI/GE	8.4	12.7	12.3	12.0	15.6
Ericsson	2.8	9.5	9.7	10.5	14.4
Harris	2.8	--	--	--	--
NEC	2.8	2.5	3.0	2.8	2.3
Astronet	--	1.9	4.1	8.8	5.6
CTI/EF Johnson	--	.6	0.05	--	--
NovAtel	--	--	0.05	5.1	4.6
Plexsys	--	--	--	1.1	0.5

+ based on top 306 markets
* based on top 90 markets

Source: Cellular Business Magazine

U.S. Installed Base Cellular Subscribers

(000's)

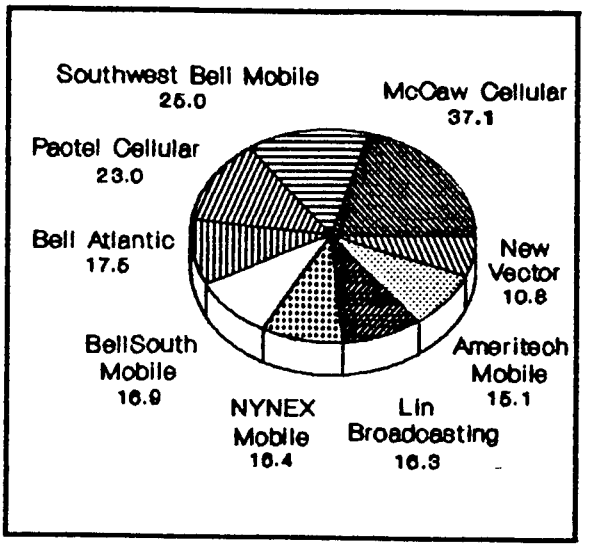
1984 (Nov.)	1985 (Nov.)	1986 (Apr.)	1987 (Dec.)	1988 (Apr.)	1989 (Apr.)
50	300	600	1,197	1,428	2,193

Source: Cellular Business Magazine

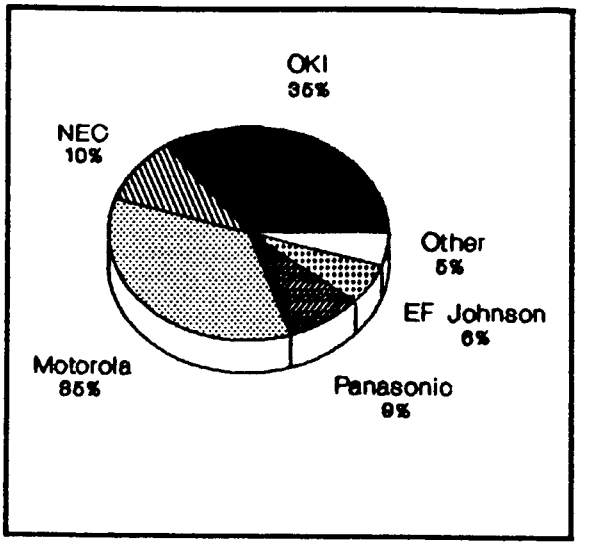
Figure 2

U.S. Cellular Market Data

Service Market Share* (1987)

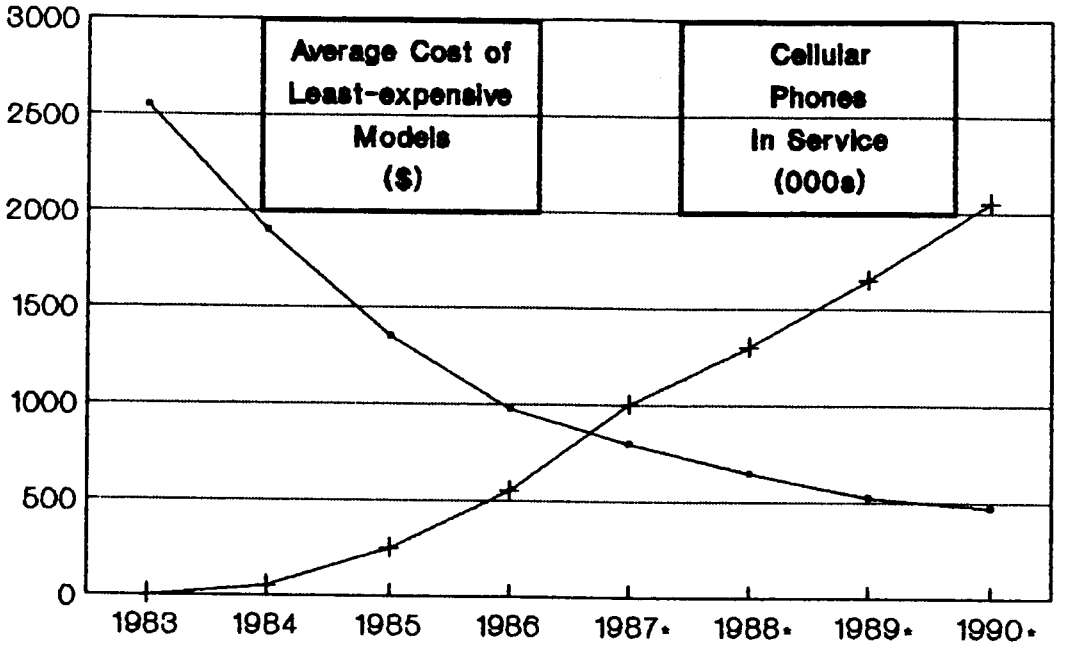


Equipment Market Share (1985)



* millions of potential subscribers

Equipment Market Data



* estimates

Estimated data - Herschel Shosteck Associates, Ltd.
Source: Cellular Business Magazine

this market will allow for the potential of monopoly abuse and it is imperative that the two major service suppliers in a given area not be able to coordinate pricing policy.[12] U.S. market share data on cellular service is not particularly meaningful for two reasons -- it is a young market in transition and entry is restricted. There has also been a trend of holding company's buying up cellular franchises, and the high prices paid are indicative either of monopoly rents which accrue to the owner of the cellular licenses or of forecast growth (and growth as stated is high). Some believe this could potentially result in coordination of pricing and innovation and perhaps less service options, but this remains to be seen as it has not seemed to dramatically effect the radio paging business or cable TV, both of which also have similar local monopoly possibilities. In the case of cable TV however, the local area franchise does bestow market power and may be more valuable than the license for local radio spectrum use for paging and cellular service.

8.0 Public Telephone Service

Public telephone service has also been a very high growth market since divestiture and almost anyone that travels has experienced the effects of stiff competition in public telephone sets and services which proliferated. To some, the competition is an annoyance as information on prices and service is confusing

[12] See Proceeding 1.88-11-040 before the California PUC on the state of competition in cellular.

or nonexistent. We feel that such problems will likely work themselves out eventually, but for now the reduced regulation and lack of good consumer information has in fact resulted in higher market prices in many cases. It does not necessarily mean monopoly profits however as cost structures are not known, and the present market may be stating that old prices were set too low. On the other hand, it could be an indication that deregulation has allowed the owner of the premises where such phones are located to garner local monopoly rents where demand is very price inelastic.

Table 8.0 provides estimates of sales and market share data for customer owned coin operated telephones (COCOTs) and public telephone services since 1984. This COCOT part of the market is

Table 8.0

Public Pay Phone Vendors Market Data (1988)

Pay Phone Vendors	Market Share Estimates (Units)
Segments	Approx. % Share (Units)
BOCs	80%
Independent Telcos	10
Private	9
	(Range is 5 to 15%, depending on Region)
AT&T	1

Total Number of Units: Approx. 2 million

Source: Telecom Services, Inc.

very competitive since the only real monopoly power lies with the owners of the locations that the COCOT vendor desires to use. Ofcourse, there is no data on these monopoly rents. So far as we know there is no good regulatory solution to this, and recent calls for broad reregulation should be viewed with caution. Recently the FCC has proposed requiring COCOT vendors to inform customers of rates and charges for COCOT services, and we believe such minor regulations may be acceptable.

A very important market segment is Alternative Operator Services (AOS), which for the first time competes with telco operators. Table 8.1 provides some data on the AOS market. Currently AOS sales are $800 million or almost 9% of the total market for operator services. This also appears to be a very competitive influence and as it develops will provide a ready

Table 8.1

Operator Services Market Data (1988)

Estimated Market Shares

Segment	Approx. % Share	Calls Completed (approx. million)
Bell Operating Companies	42.5%	1200-1700
Independent Telcos	2.5	75-90
Interexchange Carrier	50.0	1500-2000
New Entrants (Private cos.)	5.0	150-200
Totals	100.0%	3000-4000

Source: Telecom Services, Inc.

alternative and some discipline to the AT&T and LEC operator services markets.

We realize that the partially deregulated COCOT and AOS markets, while competitive in many aspects, will not be able to be completely deregulated for reasons of emergency service and potential for local monopoly abuse. However we know of no existing proposals for reregulation that are worth implementing and prefer the current situation of minimum residual regulation.

9.0 Local/Metropolitan Area Networks (LANS/MANS)

LANs and MANs provide an alternative for local telephone services in one or many buildings (LANs) or an entire metropolitan area (MANs). As such they may not constitute a market per se, however we classify them as one since even though they displace LEC local service (in building or campus settings), LECs generally are barred from effectively competeing with them, and consequently have no significant market share. Table 9.0 provides estimates of the revenues and shipments of the U.S. LAN market since divestiture and provides some forecasts to 1993. Data on fiber MANs is provided in Table 9.1 however, the market is very young and many systems are still on the drawing board. The market for LANs is competitive and exhibits very high-growth, allowing many businesses to save money by bypassing the LEC for intracompany communications. There are numerous vendors of LAN equipment, however the market for LAN installations and operations is currently dominated by several suppliers which are

Table 9.0

LAN Market Data

Projections of Total PC LAN Revenues
1983-1993

Year	Revenues	Growth Rate (%)
1984	263.4	63
1985	331.8	18
1986	358.1	15
1987	440.0	23
1988	658.5	50
1989	929.5	41
1990	1274.4	47
1991	1659.1	30
1992	2000.7	21
1993	2228.9	11

Source: Market Intelligence Research Company

1987 LAN Market Data
(Total = $1800 million)

Company	Percent
DEC	27%
3Com/Bridge	16
U-B	10
Novell	9
Sytek	7
IBM	4
Other	27

Source: Gartner Group

LAN PC Connections Market Segment

	1984	1985	1986	1987	1988
Annual Shipments (000s)	340	690	1160	2100	3453
Avg. Selling Price($)	959	859	787	776	747
Revenue ($M)	326	593	913	1630	2580
Retirement from installed base (000s)	2	6	15	60	85
Installed Base (000s)	671	1355	2500	4550	7908

Source: Dataquest, Inc.

Table 9.1

METROPOLITAN FIBER SYSTEMS

	Route Miles		Fiber Miles		Percent Lines	
	1987	1988	1987	1988	1987	1988
ICC	88.5	108.4	3059	5462	*	40%
Indiana Digital Access		7.0		238	*	12%
Inter-Media Communications		5.9		211	*	8%
Metropolitan Fiber System, Inc.	*	4.8	*	344	*	*
NY Teleport	44.5	57.7	4771	5433	38%	39%
Philadelphia Fiber Optic		7.0		506	*	42%
Total of Reported Amounts	133.0	190.8	7770	12194		

Notes:

1. Philadelphia Fiber Optic is a partially owned subsidiary of Fiber Optic Company of the U.S. or "FOCUS" which is expected to deploy fiber in Chicago and other cities. Metropolitan Fiber System, Inc. is a Chicago based company which will be deploying fiber in a number of cities.
2. * Data not available.
3. Blank entries denote no known fiber deployed.

Source: FCC Fiber Report, February, 1989.

given in Table 9.0. While the 4 firm concentration ratio is 62, the products of all suppliers are highly substitutable and price competition results.

The health of the LAN/MAN market is important for the future of competition and eventual deregulation of local telecommunications markets. Before the development of LAN technology, LECs directly or indirectly provided much of corporate communications. As MAN technology develops as an alternative to LEC local service, it has the potential to add

some market discipline to LEC pricing practices. To the extent that ONA allows easy MAN interconnection with LEC networks, the competitive influence is greatly enhanced. Policymakers should assure this will be the case.

10.0 Information Services

The market for information services broadly defined includes such services as facsimile, E-mail, paging, audiotext, videotext, computing, electronic publishing, database, transaction services and the like. By all accounts information services growth potential is enormous and regulatory initiatives such as ONA and the recent MFJ Court ruling allowing BOCs to provide gateways for other vendors will significantly stimulate demand. The 'market' and its subcomponents is quite competitive, usually featuring many suppliers and price competition. What remains limited is ubiquitous distribution networks and this is where the LECs can help. Table 10.0 gives some data on various existing services. Substitutes for such services generally abound and rapid firm entry and exit is evidence of relatively low entry barriers in the software and database portion of the business. The key to success (besides a good product competitively priced) is easy distribution to end users. Open interconnection with LECs will help the ability of such entrants to reach enough volume to break-even and new services will abound. For now, BOCs are not allowed to directly provide information services as they enjoy a competitive advantage owing to their ubiquitous distribution

network. This restriction should eventually be lifted when alternative distribution networks develop and LEC interconnection becomes easy and open under the new ONA guidelines.

Table 10.0

Information Services Market Data

Year	Databases	Database Producers	Online Services	Gateways
79/80	400	221	59	
80/81	600	340	93	
81/82	965	512	170	
82/83	1350	718	213	
83/84	1878	927	272	
84/85	2453	1189	362	
1986	2901	1379	454	35
1987	3369	1568	528	44
1988	3699	1685	555	59

Source: Cuadra/Elsevier Directory of Online Databases, NTIA Information Services Report, 1988.

Those readers looking for a strict conviction that any given market is "competitive" or not, may be unhappy at this point. We have presented too much data, provided too few analyses and often not made a definitive statement. Such is the nature of competition. In the interim before Nirvana, there are certain principles for "good" residual regulation including non-discriminatory access, unbundling of services and non-discriminatory pricing rules. Wherever non-competitive elements

remain in telecom markets, they are either because of bottleneck facilities or because of regulation. Those competitors who lease facilities from the bottleneck providers (be these thin IX markets or thick local markets) require non-discriminatory unbundling so that competition can become effective. Of course non-discriminatory and easy interconnection is ultimately a two-way street. Eventually as competition increases to the point where alternatives for LEC facilities become available, market forces should increasingly be relied on and asymmetric rules favoring new competitors should be relaxed.