

9. Quality of Service

This section summarizes various kinds of service quality data filed by local exchange telephone companies in April 1999 covering the 1998 calendar year.¹ The Federal Communications Commission (FCC or Commission) does not impose service quality standards, *per se*, on communications common carriers. Rather, the Commission annually monitors carrier-submitted data and publishes this section in order to document customer-initiated trouble reports and company reactions. This section publicizes information about company performance and, specifically, statistics about company responsiveness to network failures and associated consumer complaints. We include, in the tables following the text of this section, company comparison data about various service parameters including installation, maintenance, switch downtime, and trunk blocking, along with associated customer perception data.

As with previous service quality reports, this section indicates areas where there is room for carrier improvement. Further, as expanding services and technology choices cause users to place ever greater demands on the network, it will be critically important to maintain our monitoring effort to help ensure high levels of network performance and reliability in the future.

Background

At the end of 1983, anticipating AT&T's imminent divestiture of its local operating companies, the Commission directed the Common Carrier Bureau to establish a monitoring program that would provide a basis for detecting adverse trends in network service quality. Throughout 1985, the Bureau modified the service quality reporting requirements to reduce unnecessary paperwork and to ensure that needed information would be provided in a more uniform format. The data were received semiannually, typically in March and August, and formed the basis for FCC summary reports published in June 1990 and July 1991.

With the implementation of price-cap regulation for certain local exchange carriers, the Commission made several major changes to the service quality monitoring program beginning with reports filed in 1991. First, the Commission expanded the class of companies filing reports to include non-Bell carriers subject to price-cap regulation.² Second, the Commission included service quality reports as part of the Automated Reporting Management Information System

¹ This section is a follow-up to a report released September 28, 1998 (mimeo number 85759), which covered data for 1995, 1996 and 1997.

² See *Policy and Rules Concerning Rates for Dominant Carriers*, Second Report and Order, 5 FCC Rcd 6786, 6827-31 (1990) (*LEC Price Cap Order*) (establishing the current service quality monitoring program and incorporating the service quality reports into the ARMIS program), Erratum, 5 FCC Rcd 7664 (Com. Car. Bur. 1990), *modified on recon.*, 6 FCC Rcd 2637 (1991); *aff'd sub nom.*, *Nat'l Rural Telecom Ass'n v. FCC*, 988 F.2d 174 (D.C.Cir. 1993).

(ARMIS).³ Third, the Commission ordered significant changes to the kinds of data reported.⁴ Following these developments, the Commission released service quality summary reports in February 1993, March 1994, March 1996, and September 1998. Pursuant to requirements in the Telecommunications Act of 1996⁵ the Commission reduced the frequency of the filed data from quarterly to annual submissions.⁶ In May 1997 relevant definitions were clarified further and these changes have been reflected starting with data covering the 1997 calendar year.⁷ This section represents an early view of data filed for 1998, which is subject to revision by the companies.

Data

The source data used in preparing this section can be extracted from an online database maintained on FCC website at fcc.gov/ccb/armis/db. The data are also available from ITS, Inc., at (202) 857-3800. Selected paper filings are available in the FCC Reference Information Center, Courtyard Level, 445 12th Street, S.W., Washington, D.C. 20554.

³ *LEC Price Cap Order*, 5 FCC Rcd 6786, 6827-30. The ARMIS database includes a variety of financial and infrastructure company mechanized reports in addition to the quality-of-service reports. Most data are available disaggregated to a study area or state level.

⁴ *LEC Price Cap Order*, 5 FCC Rcd 6786, 6827-30; *See Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 6 FCC Rcd 2974 (Com. Car. Bur. 1991) (*Service Quality Order*), *reconsideration* 6 FCC Rcd 7462 (Com. Car. Bur. 1991). Previously the Common Carrier Bureau had collected data on five basic service quality measurements from the Bell Operating Companies. These were customer satisfaction levels, dial tone delay, transmission quality, on time service orders, and percentage of call blocking due to equipment failure.

⁵ Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996 Act).

⁶ Orders implementing filing frequency and other reporting requirement changes associated with implementation of the Telecommunications Act of 1996 are as follows: *Implementation of the Telecommunications Act of 1996: Reform of Filing Requirements and Carrier Classifications*, Order and Notice of Proposed Rulemaking, 11 FCC Rcd 11716 (rel. Sep. 12, 1996); *Revision of ARMIS Quarterly Report (FCC Report 43-01) et al.*, Order, 11 FCC Rcd 22508 (Com. Car. Bur., rel. Dec. 17, 1996); *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115 (rel. May 30, 1997); *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, Order, 12 FCC Rcd 21831 (Com. Car. Bur., rel. Dec. 16, 1997).

⁷ *See Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115 (rel. May 30, 1997).

The data presented in this section summarize ARMIS 43-05 and 43-06 carrier filings for 1998 and represent an initial view of the data. The tables accompanying this section highlight many of the data elements now received. Tables include data from each major holding company: the regional Bell companies, GTE (including Contel), and Sprint.⁸

The data items summarized in the tables largely contain raw data measurements that are not scaled by company indexing processes. This removes a degree of procedural variation among companies. For example, companies file a fairly extensive amount of raw data about switching outages, including outage durations and number of lines affected.

The data summarized in this section contain sums, or weighted averages, of data reported by states or study areas and may be useful in assessing overall trends. Where information is reported in terms of percentages or average time intervals, data presented here are based on a composite of individual study area data that is calculated by weighting the percentage or time interval figures. For example, we weight the percent of commitments met by the corresponding number of orders provided in the filed data.⁹

The items contained in the tables cover data for 1998 and are summarized below. Installation, maintenance and customer complaint data are shown in Table 9.1 and switch downtime and trunk servicing data are shown in Table 9.2. Installation and maintenance data are presented separately for services provided to end users and for interexchange carrier access facilities. Outage data categorized by cause are shown in Table 9.3. Customer perception data are contained in Table 9.4 and the associated survey sample sizes are contained in Table 9.5.

⁸ In February 1992, United Telecommunications Inc. became Sprint Corporation [Local Division]; and in March 1993, Sprint Corporation acquired Centel Corporation. Although Bell Atlantic and NYNEX merged in August 1997, the tables continue to reflect the merged entities separately. Similarly, SBC and Pacific Telesis facilities are shown separately despite the merger of the two entities in April 1997.

⁹ Company composite data were typically recalculated on a consistent basis from study area data, as a number of company supplied composites could not be confirmed. Although the companies have prepared their own company rollups, we have discovered various inconsistencies or inaccuracies in some of these company-prepared composites. We have therefore weighted data involving percentages or time intervals in order to arrive at the more consistent composite data shown in the tables and expect that the companies will want to review their procedures for preparing composites. Parameters used for weighting in this section were appropriate for the composite being calculated and were based on the raw data filed by the carriers but are not necessarily shown in the tables. For example, we calculate composite installation interval data by summing the individual study area results multiplied by the number of installation orders reported for each study area and then dividing the result by the total number of orders.

This section has attempted to display data elements that have remained roughly comparable over the past few years. More detailed information on the raw data from which this section has been developed is contained on the Commission's website for the ARMIS database noted above. In addition, complete data descriptions are available in the Commission Orders referenced above.¹⁰ The row numbers and columns associated with the raw source data in the ARMIS 43-05 report are included in the descriptions below.¹¹

1. Percent of Installation Commitments Met

Percent of installations that were met by the date promised by the company to the customer. It is presented separately for residential and business customers' local service (row 132, columns f and i or af and ai, respectively) and access services provided to carriers (row 112, columns a and c or aa and ac).

2. Average Installation Interval (in days)

Average interval (in days) between the installation service order and completion of installation. It is shown separately for access services provided to carriers (row 114, column a and c or aa and ac) and for residential and business customers' local service (row 134, columns f and i or af and ai, respectively). Data on

¹⁰ See footnote 6, *supra*.

¹¹ For rows 110-121 in the raw machine readable data sets, column a or aa is the first column; for rows 130 to 151, column d or ad is the first column; for rows 180 to 190, column k or ak is the first column; for rows 200 to 214, column n or an is the first column; for rows 220 to 319 and 333-500, column t is the first column; and for rows 320 to 332, column aa or da is the first column. The companies also file printed copies of their submissions where rows 110-121 are designated as Table I, rows 130-170 are designated as Table II, rows 180-190 are designated as Table III, rows 200-214 are designated as Table IV, rows 220-319 and 333-500 are designated as Table IV-A, and rows 320-332 are designated as Table V. Note that some of the row numbers in the data such as rows 142, 143 and 160 do not appear in numerical order. In addition to definitional wording changes, most of which are minor, rows 111, 131, 160 and 170 (missed installations for customer reasons and subsequent trouble reports) have been added with the 1997 data; however, not all companies have populated the added rows. Many column designations have also been changed and most column labels are now preceded by the letter "a". The reader should note that there are variations in numbers of switches and access lines in the various ARMIS reports that may lead to inconsistencies when comparing data sources; however, these variations are not believed to be significant enough to alter the observations made in this section. Because the entire row and column descriptions and definitions for each year in question are too voluminous to reproduce here, the reader should refer to the relevant Commission Order referenced in a prior footnote describing requirements for the specific data year of interest.

intervals for missed installations (rows 113 and 133) were replaced by average interval described above.

3. Average Repair Interval

Average time (in hours) for the company to repair access lines and includes subcategories for switched access, high-speed special access, and all special access. Only data for switched and special access services provided to carriers are presented. (See row 121, column a and c or aa and ac.)

4. Initial Trouble Reports per Thousand Access Lines

Calculated as the total count of trouble reports reported as "initial trouble reports," divided by the number of access lines in thousands. (Note that multiple calls within a 30 day period associated with the same problem are counted once, and the number of access lines reported and used in the calculation is the total number of access lines divided by 1,000.) This item is subcategorized by Metropolitan Statistical Areas (MSA) (the sum of row 141, column d or ad and row 141, column g or ag divided by the sum of row 140, column d or ad and row 140, column g or ag); non-MSA (the sum of row 141, column e or ae and row 141, column h or ah divided by the sum of row 140, column e or ae and row 140, column h or ah); residence (row 141, column f or af divided by row 140, column f or af); and business (row 141, column i divided by row 140, column i or ai). Note that access lines for data filed in 1997 was requested in whole numbers, but was requested in thousands for prior years.

5. Found or Verified Troubles per Thousand Access Lines

Calculated as described in item 4, above. Represents the number of trouble reports in which the company identified a problem (row 141, column j or aj less row 143, column j or aj divided by row 140, column j or aj).

6. Repeat Troubles as a percent of Initial Trouble Reports

Calculated as the number of trouble reports that recur, or remain unresolved, within 30 days of the initial trouble report, divided by the number of initial trouble reports as described above (row 142, column j or aj divided by row 141, column j or aj). Provides a measure of the effectiveness of the company in resolving troubles at the outset. Subcategorized by MSA, non-MSA, residence, and business. (Also refer to the discussion of data qualifications that follows.)

7. Complaints per Million Access Lines

The number of residential and business customer complaints, per million access lines, reported to state or federal regulatory bodies during the reporting period. (Total residence complaints are calculated as the sum of row 331, column aa and row 332, column aa; total business complaints are calculated as the sum of row 321, column aa or da and row 322, column aa or da).

8. Number of Access Lines, Trunk Groups and Switches

The count of in-service access lines (row 140, column j or aj), trunk groups (row 180, column k or ak), and switches (the sum of row 200, column n or an and row 201, column n or an or the sum of row 210, column n or an through row 214, column n or an). Trunk groups only include common trunk groups between Local Exchange Carrier (LEC) access tandems and LEC end offices. Access lines were reported in thousands in pre 1997 data submissions. Starting with 1997 data submissions access line data was requested in whole numbers. Data for 1995 was annualized as the average of quarterly data.

9. Switches with Downtime

Number of network switches experiencing downtime and the percentage of the total number of company network switches experiencing downtime (row 210, column o or ao through row 214, column o or ao or the sum of row 200, column o or ao and row 201, column o or ao).

10. Average Switch Downtime in Seconds per Switch

Total switch downtime divided by the total number of company network switches indicates the average switch downtime in seconds per switch. Shown for all occurrences (the sum of row 200, column p or ap and row 201, column p or ap, multiplied by 60 and divided by the sum of row 200, column n or an and row 201, column n or an) and for unscheduled occurrences greater than 2 minutes (data derived from rows 220 through 319 and rows 333 through 500, columns t through z in the source data divided by the sum of rows 200 and 201, column n or an).

11. Unscheduled Downtime Over 2 Minutes per Occurrence

Number of occurrences of more than 2 minutes duration that were unscheduled, the number of occurrences per million access lines, the average number of minutes per occurrence, the average number of lines affected per occurrence, the average number of line-minutes per occurrence in thousands, and the outage line-minutes per access line. For each outage, the number of lines affected was multiplied by the duration of the outage to provide the line-minutes of outage. The resulting sum of these data represents total outage line-minutes. This number was divided by the total number of access lines to provide line-minutes-per-access-line, and,

by the number of occurrences, to provide the line-minutes-per-occurrence. This categorizes the normalized magnitude of the outage in two ways and provides a realistic means to compare the impact of such outages between companies. A separate table is provided for each company showing the number of outages and outage line-minutes by cause. (These items are derived from data in rows 220 through 319 and 333 through 500, columns t through z, in the source data).

12. Scheduled Downtime Over 2 Minutes per Occurrence

Determined as in item 11, above, except that it consists of scheduled occurrences. (These items are derived from data contained on rows 220 through 319, and rows 333 through 500, columns t through z, in the source data).

13. Percent of Trunk Groups Meeting Design Objectives

This data item provides the percentage of trunk groups exceeding an industry standard for blocking over the reporting interval (the sum of rows 189 and 190, column k, divided by row 180, column k for 1995 data and the sum of rows 189 and 190, column ak divided by row 180 column ak starting with 1996 data). The trunk groups measured and reported are interexchange access facilities. These represent only a small portion of the total trunk groups in service.

Qualifications

The data presented in this section is a first view of filed data and as such it may contain errors. Nonetheless the data may prove useful in focusing on potential problem areas and in gaining feedback. As in the past we have identified several pitfalls and general qualifications in using quality of service data that are presented below.

Overall, we caution readers to be aware of potential methodological shortcomings and inconsistencies associated with use of the service quality data presented in this section. First, carriers periodically revise submitted data as problems are discovered and data presented here may contain errors or may not reflect the latest updates. Second, although the data are subject to an initial screening by Commission staff and certain problems may have been corrected in carrier-submitted revised filings, there are still potential flaws in the data that will only become apparent when users subject the data to further analysis or compare it with data from other sources.¹²

¹² For example, small variations between GTE prepared composites and those that we calculated independently appear to have been caused by inclusion or exclusion of data from study areas such as Micronesia (GTMC) and Alaska (GTAK).

Third, Commission staff have recalculated holding company totals or data composites and these might not match company-filed totals or composites.¹³ This is primarily due to calculation variations regarding, *e.g.*, percentages or average intervals that require weighting in the calculations. Carriers have updated earlier filings numerous times. The data presented here typically reflect data updates filed with the Industry Analysis Division as of mid-June 1999. We therefore caution the reader that some of the problems that may be discovered in connection with the data presented here resulted from differences in aggregation methodologies, errors including data irregularities, or data revisions that either could not be used or were not available in time for use in this section.¹⁴

Fourth, outage measurements should be considered in context. For example, the average number of lines affected per event would tend to favor a company with a larger number of smaller or remote switches with lower line counts per switch, while the average outage duration might favor a company with larger switches. Thus, using the average number of lines per event measurement, one 25,000 line switch that is out of service for five minutes would appear to have a greater service impact than ten 2,500 line switches that are out of service for five minutes. That is why we present a grouping of outage measurements that include the outage line-minutes per event and per 1,000 access lines. We have also added the number of outages per switch as another metric for measuring a company's performance.

Notwithstanding these qualifications, we expect this section will promote company responsiveness and, thereby, assist in the elimination of errors that were not identified by earlier screenings or that can only be identified by the companies themselves. Therefore, except in the calculation of company composites, we have not, in most cases, deleted or adjusted data. It is expected that the process of data correction will continue as problems are further identified and corrected.

We also note the following specific caveat: responding to trouble reports is a process that can be affected by various externalities such as adverse weather conditions. Also, response times

¹³ Recent Commission orders have modified definitions in the data collection process in an attempt to remove perceived ambiguities. We note, however, that because this section contains many items whose composites are calculated as weighted sums or averages, we have recalculated company composites for this section to improve consistency and we have pointed out general cautions in using the data. We expect that this will be useful to the companies in their review of internal processes associated with calculation of composites and may enable us to use company calculated composites in the future.

¹⁴ We have noted in some cases that total access lines as reported in the last column of row 140 does not agree with the sum of the first column entry of rows 320 and 330. Variations in access line and switch counts may affect normalized outage data reported in the tables. In some instances irregularities inherent in the underlying data at the study area level may have resulted in other undetected errors in the calculated composites.

seem to be affected by such factors as company size and other company specific characteristics or factors.¹⁵ As a result, we advise the reader to remember that slower responsiveness to problems in service quality should not be confused with a lack of responsiveness.

This section presents data that reflect several different ways of measuring switch outages, including line-minutes-per-access line and line-minutes-per-event. Outage line-minutes is a measure that combines both duration and number of lines affected in a single parameter. We derived this parameter from the raw data by simply multiplying the number of lines involved in each outage by the duration of the outage, summing the resulting values and dividing the sum by the total number of access lines or events. Because outage measurements tend to exhibit more variability than other measurements, we have shown in the tables several ways of presenting the results. Improvements in responding to outages by some of the reporting companies may be associated with efforts to improve switch reliability, including working with manufacturers to replace poorly performing switches and to improve performance of existing ones.¹⁶

Because performance within any single data category may vary widely over time, evaluating a given company's performance by looking at a single measurement may be misleading, especially considering that long lead times might be needed to correct certain problems or that corrections might already be underway. On the other hand, problems that are observed in several service quality measurement categories could also reflect overall service deterioration. We believe that customer complaint and perception levels should be viewed in the context of other measures of performance. However, we have found that it is practically impossible to ascertain whether changes in aggregate customer complaint levels result from developments in a single problem area or reflect a perception of a wider ranging set of problems. For these reasons and because data is now filed annually rather than quarterly we recommend the use of both trend and pattern analysis of the data.

Finally, one of the measurements for which service quality data is collected is the number of service affecting troubles reported by customers. Because of the various classifications of

¹⁵ SBC, for example, had reported a high level of customer trouble reports for the fourth quarter of 1994 and attributed this to severe weather and flooding in Texas during the period. Similarly, Pacific Telesis attributed high first quarter 1995 trouble reports to weather-related problems. While the reduced frequency of data now filed reduces the number of data points available for trend analysis, it also smooths out the effects of seasonal and weather related problems.

¹⁶ GTE representatives met with the staff last year to express concerns about presentation of its outage data in this section, asserting that the raw number of outages taken out of context would result in GTE appearing worse than other companies due to the large number of small and remote switches in its territory. The use of a menu of data elements as a description of outage performance actually tends to portray performance more equitably for all companies and reduces reporting bias that would tend to result from a more limited description of the data.

trouble reports, the Commission's May 1997 Order addressed problems relating to subtleties in the definitions associated with the terms "initial" and "repeat" trouble reports.¹⁷ This and other issues were addressed in an October 1993 Order modifying filing requirements and were the subject of further clarification and expansion in subsequent orders leading to the reporting of a new category of recurring trouble reports.¹⁸

All of these reflections and observations essentially relate to the issue of maintaining the necessary continuity of data measurement. While an attempt has been made to preserve continuity up to this point, detection of errors and changes in reporting requirements that are deemed necessary to deal with price-cap and other requirements will introduce discontinuities into certain time series data or eliminate certain items of data entirely.

In addition, changes in technology have compelled changes in measurements required to adequately monitor service quality.¹⁹ Compounding this problem is the fact that the companies themselves periodically wish to change their internal measurement procedures from which regulatory data are drawn, adding difficulty to long-term measurement.²⁰ In some cases procedural changes in the data measurement and collection process may be subtle enough so that they are not immediately noticeable in the data. Significant changes in company procedures, however, usually result in noticeable and abrupt changes in data levels. It appears that at least

¹⁷ This issue was discussed in the last report on service quality and was addressed in recent Commission orders. See *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 12 FCC Rcd 8115, 8133 (rel. May 30, 1997); *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, Order, 12 FCC Rcd 21831, 21835 (Com. Car. Bur., rel. Dec. 16, 1997). See also Federal Communications Commission, Industry Analysis Division, *Quality-of-Service for the Local Operating Companies Aggregated to the Holding Company Level*, released March 22, 1996 (mimeo 60268) for further discussion.

¹⁸ See *Policy and Rules Concerning Rates for Dominant Carriers*, Memorandum Opinion and Order, 8 FCC Rcd 7474, ¶ 26 and attachments (1993). See also *Revision of ARMIS Annual Summary Report (FCC Report 43-01) et al.*, 12 FCC Rcd 21831 (introducing reporting of "subsequent" troubles).

¹⁹ For example there has been a lack of information on digital transmission characteristics particularly with respect to performance of high speed data modems used on analog lines. This lack of information and associated customer confusion may contribute to adverse customer perceptions. Furthermore, adequate public information on the performance of analog loops in terms of their performance when used with a data modem could provide a stimulus for the proliferation of digital and fiber subscriber loops.

²⁰ For those interested in trending customer perception data in this section with that available in prior Reports it should be noted that Bell Atlantic, for example, reported changes to its customer perception surveys that were reflected in its post-1990 data, and Pacific Telesis had noted changes effective in January 1992.

some of these changes are not reported to the Commission. These factors tend to limit the number of years of data available to track service quality trends and will affect the frequency and availability of summary reports that are prepared by the Commission. Although the Commission has made every effort to standardize and rationalize data reporting over the years, given the number of changes to the reporting regimes and predictable future changes, one should not assume exact comparability on all measurements for data sets as they are presented year by year.

It is our experience that service reliability data is, by its nature, subject to a greater volatility than other types of company data. As a general rule, one should be cautious about interpreting individual measurements until one develops a sense of what the data measurements disclose about company performance.

Table 9.1: Company Comparison -- Installation, Maintenance, & Customer Complaints -- 1998

Company	Ameritech	Bell Atlant.	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
ACCESS SERVICES PROVIDED TO CARRIERS -- SWITCHED ACCESS									
Percent Installation Commitments Met	38.4	85.6	98.3	96.1	69.6	73.2	82.4	95.3	81.8
Average Installation Interval (days)	53.5	32.0	24.6	36.5	33.9	30.8	38.8	26.7	24.0
Average Repair Interval (hours)	21.9	6.4	2.2	NA	9.5	3.2	10.7	14.8	7.0
ACCESS SERVICES PROVIDED TO CARRIERS -- SPECIAL ACCESS									
Percent Installation Commitments Met	93.9	87.0	85.1	98.2	89.3	97.4	88.7	91.1	78.9
Average Installation Interval (days)	14.6	17.4	14.7	22.0	20.1	0.0	22.3	14.8	13.9
Average Repair Interval (hours)	3.1	2.4	3.7	3.3	4.7	2.2	4.6	7.9	6.9
LOCAL SERVICES PROVIDED TO RESIDENTIAL AND BUSINESS CUSTOMERS									
Percent Installation Commitments Met	98.7	98.2	73.0	98.2	98.7	98.8	98.2	98.0	98.4
Residence	98.8	98.7	98.6	98.3	98.8	98.9	98.5	98.3	98.5
Business	97.8	95.0	96.8	97.4	97.9	98.1	96.4	95.7	97.6
Average Installation Interval (days)	2.3	2.4	0.6	1.2	2.4	0.7	1.6	3.0	4.1
Residence	2.2	2.2	0.7	1.1	2.2	0.7	1.3	2.8	3.9
Business	2.9	3.4	1.4	1.6	3.8	0.8	3.1	4.3	5.4
Initial Trouble Reports per Thousand Lines	216.9	154.6	286.5	190.7	155.7	223.9	196.0	201.7	240.7
Total MSA	213.2	155.0	262.5	190.6	NA	195.3	192.9	0.2	234.7
Total Non MSA	266.1	149.4	375.2	191.6	NA	375.4	207.3	0.2	253.2
Total Residence	277.5	195.2	325.5	232.1	NA	265.1	234.4	0.2	277.5
Total Business	108.5	84.4	173.9	114.6	NA	125.7	113.6	NA	NA
Troubles Found per Thousand Lines	151.5	104.3	145.0	135.6	109.2	157.2	132.3	201.4	209.0
Repeat Troubles as a Pct. of Trouble Rpts.	16.7%	20.4%	17.7%	19.2%	18.5%	15.2%	35.5%	0.0%	NA
Total Residence	16.9%	20.8%	18.2%	19.6%	19.1%	15.5%	34.9%	0.0%	NA
Total Business	16.0%	18.8%	15.5%	18.1%	16.3%	13.5%	38.1%	0.0%	NA
Res. Complaints per Mill. Res. Access Lines	182.5	158.4	144.3	245.3	51.1	53.2	722.4	0.1	125.1
Bus. Complaints per Mill. Bus. Access Lines	73.1	30.3	40.9	109.3	14.1	23.0	338.8	128.2	59.2

Please refer to text for notes and data qualifications

Table 9.2: Company Comparison -- Switch Downtime & Trunk Blocking -- 1998

Company	Ameritech	Bell Atlant.	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
Total Access Lines in Thousands	20,790	22,124	23,909	18,714	18,158	15,872	16,859	18,226	7,521
Total Trunk Groups	1,456	1,161	3,535	1,049	2,033	874	2,949	2,577	7,433
Total Switches	1,419	1,337	1,653	1,279	801	1,644	1,446	4,445	1,458
Switches with Downtime									
Number of Switches	529	140	148	122	110	261	941	341	127
As a percentage of Total Switches	37.3%	10.5%	9.0%	9.5%	13.7%	15.9%	65.1%	7.7%	8.7%
Average Switch Downtime in seconds per Switch									
For All Events	73.0	46.2	106.6	129.5	11.8	49.6	463.1	591.5	660.7
For Unscheduled Events Over 2 Minutes	64.4	39.2	95.1	121.0	1.6	27.1	320.7	590.0	371.8
For Unscheduled Downtime More than 2 Minutes									
Number of Occurrences or Events	27	22	79	32	2	28	156	246	83
Events per Hundred Switches	1.9	1.6	4.8	2.5	0.2	1.7	10.8	5.5	5.7
Events per Million Access Lines	1.30	0.99	3.30	1.71	0.11	1.76	9.25	13.50	11.04
Average Outage Duration in Minutes	56.4	39.7	33.2	80.6	10.5	26.6	49.5	177.7	108.9
Average Lines Affected per Event in Thousands	18.6	27.2	16.0	22.3	7.2	33.8	12.0	2.3	3.5
Outage Line-Minutes per Event in Thousands	324.8	1,000.4	371.5	2,089.1	75.8	1,106.2	1,071.6	218.2	231.3
Outage Line-Minutes per 1,000 Access Lines	421.8	994.8	1,227.6	3,572.2	8.3	1,951.4	9,915.6	2,945.4	2,553.1
For Scheduled Downtime More than 2 Minutes									
Number of Occurrences or Events	18	9	30	20	6	48	661	1	58
Events per Hundred Switches	1.3	0.7	1.8	1.6	0.7	2.9	45.7	0.0	4.0
Events per Million Access Lines	0.87	0.41	1.25	1.07	0.33	3.02	39.21	0.05	7.71
Average Outage Duration in Minutes	3.9	2.9	7.7	5.4	12.5	6.2	3.3	6.0	121.0
Avg. Lines Affected per Event in Thousands	15.6	29.2	18.8	58.3	32.0	27.1	12.5	4.9	6.7
Outage Line-Minutes per Event in Thousands	54.1	75.3	150.5	337.4	291.2	151.6	39.3	29.4	1,999.4
Outage Line-Minutes per 1,000 Access Lines	46.9	30.6	188.8	360.6	96.2	458.3	1,540.8	1.6	15,419.3
% Trunk Grps. Exceeding Blocking Objectives	1.85%	21.62%	2.09%	11.34%	4.43%	2.29%	16.41%	0.12%	0.55%

Please refer to text for notes and data qualifications

Table 9.3: Company Comparison -- Switch Downtime Causes -- 1998

Company	Ameritech	Bell Atlant.	BellSouth	NYNEX	Pacific	SBC	US West	GTE	Sprint
TOTAL NUMBER OF OUTAGES									
1. Scheduled	18	9	30	20	6	48	661	1	58
2. Proced. Errors -- Telco. (Inst./Maint.)	1	0	0	7	0	3	0	9	10
3. Proced. Errors -- Telco. (Other)	5	2	12	0	1	4	21	13	2
4. Procedural Errors -- System Vendors	3	2	9	2	0	4	1	5	4
5. Procedural Errors -- Other Vendors	0	1	3	1	0	1	3	7	0
6. Software Design	4	4	23	1	0	4	24	25	7
7. Hardware design	0	1	3	0	0	1	9	0	1
8. Hardware Failure	11	10	22	10	0	10	69	110	19
9. Natural Causes	3	0	1	2	0	0	9	51	6
10. Traffic Overload	0	0	0	0	0	0	0	0	0
11. Environmental	0	0	0	0	0	1	0	2	3
12. External Power Failure	0	1	3	2	0	0	14	18	7
13. Massive Line Outage	0	0	0	0	0	0	0	6	9
14. Remote	0	0	3	0	0	0	2	0	0
15. Other/Unknown	0	1	0	7	1	0	4	0	15
TOTAL OUTAGE LINE-MINUTES PER THOUSAND ACCESS LINES									
1. Scheduled	46.9	30.6	188.8	360.6	96.2	458.3	1540.8	1.6	15419.3
2. Proced. Errors -- Telco. (Inst./Maint.)	67.5	0.0	0.0	1860.1	0.0	525.0	0.0	76.6	555.7
3. Proced. Errors -- Telco. (Other)	75.9	26.7	338.6	0.0	2.8	100.4	42.0	102.2	19.8
4. Procedural Errors -- System Vendors	2.7	10.0	89.1	5.0	0.0	427.8	15.6	14.5	27.5
5. Procedural Errors -- Other Vendors	0.0	16.8	31.7	5.6	0.0	0.9	63.3	167.7	0.0
6. Software Design	48.8	624.4	154.4	8.4	0.0	31.8	152.0	379.9	68.3
7. Hardware design	0.0	73.7	37.7	0.0	0.0	5.0	32.0	0.0	0.3
8. Hardware Failure	168.7	100.1	224.7	49.4	0.0	803.5	6922.0	873.4	759.6
9. Natural Causes	58.2	0.0	1.6	589.1	0.0	0.0	1144.8	1221.4	561.7
10. Traffic Overload	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11. Environmental	0.0	0.0	0.0	0.0	0.0	57.0	0.0	38.1	78.6
12. External Power Failure	0.0	141.2	330.2	134.8	0.0	0.0	1151.0	59.2	111.0
13. Massive Line Outage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.3	234.8
14. Remote	0.0	0.0	19.6	0.0	0.0	0.0	4.2	0.0	0.0
15. Other/Unknown	0.0	1.8	0.0	919.8	5.6	0.0	388.7	0.0	135.9

Please refer to text for notes and data qualifications

Table 9.4: Company Comparison -- 1998 Customer Perception Surveys

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE
Percentage of Customers Dissatisfied								
Installations:								
Residential	7.71	3.86	6.84	4.42	7.15	4.98	4.77	7.39
Small Business	10.83	7.05	7.18	8.13	9.86	6.43	11.97	13.14
Large Business	10.77	11.04	3.88	7.88	8.33	6.28	NA	4.06
Repairs:								
Residential	12.39	12.28	10.19	12.69	15.57	7.59	7.65	11.00
Small Business	11.71	10.46	8.30	11.43	9.72	5.95	8.54	12.52
Large Business	12.60	14.58	5.38	13.25	9.57	8.03	NA	2.49
Business Office:								
Residential	8.91	5.35	7.60	6.76	6.76	6.32	2.14	2.13
Small Business	9.61	9.52	7.99	8.11	9.36	5.80	5.02	4.76
Large Business	9.27	11.61	4.28	8.17	7.68	5.34	NA	1.47

Please refer to text for notes and data qualifications

Table 9.5: Company Comparison -- 1998 Customer Perception Surveys

Company	Ameritech	Bell Atlantic	BellSouth	NYNEX	Pacific	SBC	US West	GTE
Sample Sizes -- Customer Perception Surveys								
Installations:								
Residential	28,568	12,767	49,182	17,865	18,905	13,426	2,361	27,277
Small Business	27,746	12,627	26,156	17,465	18,223	16,197	2,584	27,328
Large Business	1,421	2,304	NA	2,518	3,625	6,222	NA	926
Repairs:								
Residential	28,637	12,747	49,579	17,877	18,480	18,927	2,414	27,362
Small Business	27,749	12,609	22,316	17,825	17,106	16,255	1,921	27,291
Large Business	992	2,051	NA	2,359	3,680	5,067	NA	843
Business Office:								
Residential	38,889	25,838	31,840	20,559	19,893	24,745	2,358	27,054
Small Business	13,136	9,269	20,837	7,887	17,412	24,612	2,583	18,678
Large Business	884	1,505	1,097	1,519	4,857	1,648	NA	919

Please refer to text for notes and data qualifications