ORIGINAL

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November 13, 1997

Mrs. Blanca S. Bayo
Director, Division of Records and Reporting
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399

Re: Docket Nos. 960833-TP, 960846-TP, 960757-TP
960916-TP and 971140-TP

Dear Mrs. Bayo:

Enclosed is an original and fifteen copies of Direct Testimony of David Garfield, Walter S. Reid, Alphonso J. Varner, Ellis E. Smith, Daniel M. Baeza, Eno Landry and the Panel Testimony of William P. Zarakas and Daonne Caldwell. Please file these documents in the captioned docket.

A copy of this letter is enclosed. Please mark it to indicate that the original was filed and return the copy to me. Copies have been served on the parties shown on the attached Certificate of Service.

Sincerely,

Bennett L. Ross

Bennett L. Ross

Enclosures

cc: All Parties of Record
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W. J. Ellenberg

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CERTIFICATE OF SERVICE
DOCKET NOS. 960833-TP/960846-TP/960757-TP/960916-TP/971140-TP

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BELL COMMUNICATIONS RESEARCH, INC.

DIRECT TESTIMONY OF DAVID GARFIELD

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NOS. 960833-TP, 960846-TP, 960757-TP, AND 971140-TP, 960916-TP

NOVEMBER 13, 1997

Q. PLEASE STATE YOUR NAME, ADDRESS AND OCCUPATION.

A. My name is David Garfield. My business address is 3 Corporate Place, Piscataway, New Jersey. I am an engineer in the Business Consulting Services Business Unit of Bell Communications Research, Inc. (hereinafter referred to as "Bellcore"). My area of responsibility relates to the analysis of telecommunications switching equipment for the purposes of determining cost of service.

Although I am an employee of Bellcore, I am filing this testimony at the request of BellSouth Telecommunications.

Q. PLEASE GIVE A BRIEF DESCRIPTION OF YOUR EDUCATIONAL BACKGROUND AND WORK EXPERIENCE.

A. I attended the University of Delaware, graduating with a Bachelor's of Science Degree in Mathematics in 1976 and Rutgers University, graduating with a Master of Science Degree in Applied Mathematics in 1978. I have attended numerous Bellcore and switch vendor courses relating to switching system provisioning and engineering. I have also attended courses related to service cost studies and economic principles.

My initial employment was with Bell Laboratories in 1978 in Holmdel, New Jersey, in the Local Switching Systems Engineering Department. My initial responsibilities included area planning for remote switching and methodology development for switch replacement studies. I came to Bellcore upon divestiture in 1984, continuing work on switch replacement studies with digital switching systems until 1986, where I briefly worked on DMS-100F model development. Upon conclusion of this work effort, I became involved in CLASS (custom local area signaling services) requirements through 1989, when I transferred to the Business Decision Support organization to work on SCIS. My current responsibilities include model office development for the 5ESS and Fetex-150 switching systems and training.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to provide an overview of Bellcore's Switching Cost Information System (hereinafter referred to as "SCIS"). This overview will include a description of what SCIS does, who uses it and how it is developed..

Q. WHAT IS SCIS?

A. SCIS is a PC-based software application that determines the central office switching investment required to provide telephone subscribers with services and features. It is competitively neutral in that it apportions costs to all users of the switch on the same basis for BellSouth users and Competitive Local Exchange Companies (CLECs). SCIS has been continuously updated to meet the changing needs of its users for over 18 years.

Q. IS SCIS APPLICABLE ONLY FOR RETAIL BUSINESS PRICING?

A. No. The versatility and flexibility of SCIS is demonstrated by the fact that SCIS has been approved for use in applications other than retail business pricing. In particular, the use of SCIS has been accepted in two Unbundled Network Element proceedings within Bell Atlantic. The proceedings consist of docket number 96-234, order dated July 9, 1997 in the state of Delaware and docket number A-310203-F0002, order dated August 8, 1997 in the state of Pennsylvania.

In the state of Connecticut, SCIS has been accepted in an Unbundled Network Element proceeding, docket number 95-06-17, Part A (order dated December 20, 1995), Part B (order dated June 5, 1996), and Part C (order dated March 25, 1997). Modifications of Unbundled Network Element rates are pending in docket number 97-04-10.

Finally, on behalf of the FCC, Arthur Anderson made an extensive review of SCIS in 1992 in the context of ONA filings made by several RBOCs. Based on this review, SCIS was "found reasonable" by the FCC for use in determining switching costs. [1]

Q. HOW DOES SCIS DETERMINE SWITCHING INVESTMENT?

A. Engineering and pricing information obtained from switch manufacturers is combined with a network provider's configuration and demand characteristics to attribute the cost of deploying switching equipment to basic switching functions and features based on the application of generally accepted economic theory.

Q. WHO USES SCIS?

[1] In the Matter of Open Network Architecture Tariffs of BOCs, CC Docket 92-91. Order by the Commission, released December 15, 1993, at para. 79 - 83 (FCC 93-532).

A. SCIS is used by all of the Regional Bell Operating Companies except for U.S. West, many independent U.S. Local Exchange Carriers, and several telephone companies outside of the United States.

Q. WHY WAS SCIS DEVELOPED?

A. The provisioning of telecommunications services became increasingly complex in the early 1970's. The complexity arose from the proliferation of new technological developments which, in turn, permit the introduction of sophisticated new features and services. Developments in switching technology greatly contributed to this phenomenon. Concurrently, it became increasingly important to obtain a high degree of accuracy in the costing of these sophisticated capabilities for both business decision and tariff purposes.

Prior to the 1970's, switching was mostly mechanical in nature and was used, primarily, to set up POTS (Plain Old Telephone Service) telephone calls. However, the introduction of computerized electronic switching systems raised questions regarding the costing and pricing for the new vertical services these switches could provide. Indeed, since the new services shared the same switching resources within the switch that provided POTS, it became increasingly important for the telephone companies to have a process whereby they could address the shared equipment phenomenon while accurately identifying the individual cost of these new services. Accurate determination of service costs was essential to the development of just and reasonable rates based on the principle of cost causation and for making informed business decisions.

In analyzing the intricacies of how such a problem could be solved, it became evident that the solution would be both time consuming and costly. Indeed, the new switches were among the most sophisticated computers ever built with a multiplicity of components that were shared by thousands of users and hundreds of services. Nonetheless, the cost analysis solution evolved as a mathematical model and is called the Switching Cost Information System ("SCIS").

The underlying mandate of the model was the need to determine the switching costs required to provide *specific* central office feature functionality. For that reason, the model had to be capable of assigning the investment in shared switching resources to various basic switching functions as well as individual features.

The model not only had to conform to the requirements of that period, but it had to evolve to meet the evolving, and diverse, needs of the user community. SCIS has successfully done so for over 18 years.

Q. WHAT ARE THE KEY PRINCIPLES THAT GOVERNED THE DEVELOPMENT AND EVOLUTION OF SCIS?

A. The first principle is that SCIS is objective. That is, a "bottom-up" approach is incorporated into the development of SCIS. This means that, in the development of the models, the individual components of a switch are examined in order to determine what switching functionality causes them to be provisioned. Total switch investment is built up by aggregating individual components based on the demand for the various basic switching functions.

A top-down approach -- where the total switch investment is considered first and an attempt is made to allocate investment to the various functions -- does not effectively address the shared equipment phenomenon and lacks the certainty of attribution of the basis of causation that is possible with the rigorous analysis needed to implement the bottom-up approach. The bottom-up methodology provides the necessary level of detail to distinguish the use of the switch resources by functionality. Such detail is considered a prerequisite if shared equipment is to be properly assigned to individual services. Thus, one of the underlying principles of SCIS is the development of a set of basic unit resource investments that describe switch provisioning so that the cost of *any* feature, service or switching element can be easily built up from this set.

The second principle is that the system be forward-looking. The model is based on the latest technology, along with up-to-date vendor pricing and engineering information.

The third principle is that the system has a long term perspective. This perspective has the desired effect of reducing cost fluctuations resulting from "lumpy" investments and the sequencing of customers and services. For example, the equipment used to connect an individual subscriber with the rest of a switch is typically provisioned in modules that serve many subscribers. The cost of such a module is not attributed entirely to the one customer who happens along just at the point when existing equipment is fully utilized (with subsequent customers having zero cost until the next module is needed). Instead, a pro-rata share of the module is attributable to each new subscriber. This means that services or customers do not artificially benefit, nor are artificially disadvantaged, from the nature of switching equipment and the order of appearance of customers and services.

The fourth principle is that cost results are based on usage and are competitively neutral. That is, the system expresses the cost of shared equipment as a function of the capacity consumed to perform service specific activities without regard to who is the user of switch capacity. From an objective standpoint, implementation of this principle achieves, among other things, cost causative results and fairness.

Q. PLEASE ELABORATE ON THE TREATMENT OF GETTING STARTED INVESTMENT IN SCIS.

A. SCIS determines a getting started investment for each switching system. This investment models the investment for processor related equipment and other equipment independent of switch size and traffic. The limiting resource of the processor complex is realtime (i. e., milliseconds). SCIS apportions the getting started investment based on realtime. Bellcore obtains precise realtime consumption data from the switch vendors for different types of calls and features and incorporates this information into SCIS. As a result, SCIS provides a mechanism to apportion the getting started investment to individual calls and features based on the realtime actually consumed by such calls and features.

This methodology is supported by the reality of constantly-evolving switch capacity. Switch vendors, such as Lucent and Nortel, have constantly evolved the processor complex of their respective digital switching systems in order to stay one step ahead of realtime demand. This evolution has enabled Lucent and Nortel to achieve advertised processor capacities and avoid processor exhaust situations or near exhaust scenarios that result in service degradation. In today's environment of sophisticated subscribers and services, it is improper and unrealistic to assume that even today's processors would not exhaust throughout their life if not upgraded or retrofitted in the future. Assignment of getting started investment to traffic sensitive switching elements properly accommodates such processor growth and evolution, in a manner that tracks its cause: usage.

Consider Nortel's DMS-100F switching system as an illustration of such switch processor evolution. If a new DMS-100 was purchased in the early 1980's, Nortel supplied their current state of the art processor called NT40. If a new DMS-100 is purchased today, Nortel supplies one of their current state of the art processors, SuperNode 60 or SuperNode 70. The original NT40 processor is no longer available for purchase and can not handle today's realtime demand from subscribers. The SuperNode 60 processor is approximately 6.6 times faster than the original NT40 processor. The SuperNode 70 processor is approximately 11 times faster than the original NT40 processor. Nortel is already developing their processor complex beyond SuperNode 70, providing further evidence that even today's processors are not expected to handle the realtime load throughout the life of the switching system.

As such, BellSouth, using SCIS, apportions the getting started investment on a basis that tracks cost causation, namely, realtime consumption of different call types (line-to-line, line-to-trunk, etc.) and features. There is a strong linkage between processor realtime as a cost recovery mechanism and the getting started investment. This linkage is suppported by the precise realtime consumption data obtained by Bellcore from the switch vendors for different types of calls and features. The getting started investment is apportioned to each call type and feature based on actual realtime consumption.

Q. WHAT SWITCHING SYSTEMS ARE MODELED IN SCIS?

A. BellSouth uses the SCIS models for Lucent Technologies' 5ESS and Northern Telecom's DMS-100F switches.

Note, however that there are a total of seven switching systems, referred to as technologies, currently modeled in the U.S. version of SCIS: Ericsson Network Systems' AXE-10; Lucent Technologies' 1AESS, 4ESS, and 5ESS; Northern Telecom's DMS-100F and DMS-10; and Siemens Stromberg-Carlson's EWSD. An additional three technologies - Alcaltel's System 12; Fujitsu's FETEX-150 and NEC's NEAX-61E -- are modeled, along with international versions of some of the above systems, for licensees outside of the U.S. The inclusion of these various switching systems in SCIS, using a consistent application of the key principles that comprise the SCIS approach to modeling, demonstrates both the flexibility and soundness of the methodologies employed. In addition, the analysis of these various technologies has provided Bellcore with a comprehensive knowledge of switching equipment and its provisioning.

Q. HOW IS SCIS IMPLEMENTED?

A. SCIS is implemented as two distinct, but interrelated, Windows™ applications; SCIS Model Office (SCIS/MO) and SCIS Intelligent Network (SCIS/IN).

SCIS/MO determines unit resource investment, and corresponding total investment, for the various basic switching functions. SCIS/IN utilizes the results from SCIS/MO, combining them with the feature - or service-specific demand for basic switching resources (determined by vendor specific switching requirements and customer usage characteristics) to calculate the investment required to provide a given feature or service.

Q. PLEASE ELABORATE ON SCIS/MO.

A. SCIS/MO analyzes all switching components for purposes of identifying equipment costs associated with the fundamental switching functions and resources. The investment needed to provide a basic switching function is calculated so that the investment behind any feature or service can be determined by the appropriate aggregation of these SCIS/MO results. Examples of SCIS/MO results, referred to as "basic unit resource investments" are the investment of a central processor millisecond; the non-usage sensitive investment per line termination; the investment per originating + terminating (O+T) CCS; the investment per outgoing + incoming (O+I) CCS; and the investment per a call set-up function (e.g. a terminating call function that reflects the hardware -- provisioned as a function of terminating calls -- needed to provide ringing). The basic unit resource investments that apply to each switching system depend on the switching system architecture and vendor specified engineering rules.

The SCIS/MO analysis may involve a single office, or multiple offices. If multiple offices are considered in a user's study, the model analyzes each office individually and provides a weighted average output for each basic unit resource investment by switching system. For all offices included in a study that serve as hosts for remote switching entities, investments of the associated remotes are also determined and weighted in with those of the host.

This weighting process is the basis for the Model Office. In other words, the results of a given SCIS/MO study reflect a "model" office that is representative of entities considered. This approach produces a cost of a particular investment driver (ultimately, a portion of a feature, service or network element) which is the same regardless of the specific switch entity serving the customer, or the particular technology used to provide the switching functionality (e.g. analog vs. integrated digital loop carrier line termination).

Q. PLEASE ELABORATE ON SCIS/IN.

A. As mentioned earlier, SCIS/IN aggregates basic unit resource investments quantified by SCIS/MO based on customer usage characteristics and the vendor specified resources required (e.g., processor real time, CCS, signaling packets) to implement a specific feature in the switch. The output of each feature costing algorithm may be expressed on a per call basis, per line, per customer, per group, or other basis, depending on the structures of the tariffs, nature of the feature or service, or purposes of the study. Each feature cost output exhibit includes results categorized by basic unit resource investment. SCIS/IN provides investments for individual features by switch technology. Optionally, these results can be combined together to produce a weighted average result across all considered switching systems.

Q. HOW IS SCIS/MO DEVELOPED?

A. The output reports generated by SCIS contain a complex body of analytical work. The primary effort in that work is the establishment of the switching system-specific model used in SCIS/MO. The SCIS/MO model developer creates and maintains this model based on the principles described earlier and a standard methodology that is not dependent on the switch technology. Here is a step-by-step description of the SCIS/MO model development process:

STEP 1. Detailed methods-of-operation, engineering rules and other technical documents, along with component list prices, are obtained from the switch vendor. This information is studied to determine the overall switch architecture and the functional characteristics of each of the major sub-systems. At the model developer's discretion, sample offices are run through the vendor's pricing and provisioning tool to clarify engineering rules and gain further general knowledge.

STEP 2. An understanding of the switch architecture and the functionality of the major sub-systems enables the model developer to establish various basic unit resource investments that express the switch equipment costs by function. The cost drivers for these categories are also identified. For example, consider the capability to terminate a line. This functionality is represented by the Line Termination Investment category, into which all equipment used to terminate a line is grouped. The cost drivers of this category include the quantity of lines in the office and the Busy Hour CCS per line. Another example is the Getting Started Investment. This category includes the central processor along with other equipment, that, while not associated with any particular basic switching function, has central processor real time as an investment driver, since (the exhaust of) the real time resource drives the purchase of a new switch.

STEP 3. Algorithms and formulas are generated that will be translated into the software code that combines various modeling elements -- investment category values, equipment capacities and demand parameters -- based on the office configuration inputs.

STEP 4. Switch components are analyzed to determine functionality and are "assigned" to the appropriate investment categories. This assignment may be made in multiple or fractional quantities based on the engineering rules. This bottom-up analysis is referred to as the "partitioning process." The results of the partitioning process are the Investment Table entries.

STEP 5. Sample central offices representing a wide range of traffic volumes and line and trunk quantities are selected for purposes of verification of the resulting model. Each office in this verification set is run through the vendor's pricing and provisioning tool. The total investment reported by the vendor tool is compared against the Total Investment result generated by SCIS/MO. If the difference between the vendor's total and the SCIS total is less than or equal to 2%, over the entire set, then the model is released. If the comparison diverges greater than 2%, analysis is done to determine where the greatest material differences are so that appropriate refinements can be made.

Q. WHAT IS THE VALUE OF THE SCIS/MO VERIFICATION PROCESS?

A. The SCIS/MO verification process demonstrates that SCIS/MO correctly models switch engineering rules. Total switch investment is dependent upon quantities of switch equipment which, in turn, are determined by switch engineering rules. The real value of the verification process is its demonstration that SCIS/MO accurately models the switch engineering rules that determine switch component quantities and resulting total investment.

Q. HOW IS SCIS/IN DEVELOPED?

A. The steps required to develop feature costing algorithms are outlined below. Note that the model developer need not perform the following steps in the exact sequence depicted. However, each step must be performed.

STEP 1. The model developer is informed of new features/services from the vendor and/or users request that an existing feature or service not previously considered by SCIS/IN be modeled.

STEP 2. The operation of the feature is researched from both the subscriber's viewpoint and the switch resource perspective.

STEP 3. The types of switch resources being utilized by the feature are identified, including any special hardware required only for vertical services, and the feature activities that consume switch resources are determined (e.g. activation, holding time, etc.). Equations are developed that replicate the use of any special hardware in terms of their respective investment driver (e.g. CCS for a 3-port conference circuit).

STEP 4. Feature specific switch resources measurements for processor(s) real time (milliseconds), CCS, packet utilization and other basic switching functionality are obtained from the vendor. A determination is also made as to whether or not the switch measures feature usage (e.g. number of activations).

STEP 5. Possible tariff structures are identified. In order to determine the costs of the feature, it is necessary to identify if any part of the feature is already recovered by existing tariff structures (e.g., the forwarded leg of a call is addressed by the normal POTS tariffs on the forwarding station). These tariffs could be local, toll or long-distance. In the above example of call forwarding, if a station forwards its calls from Washington to California, the access and long-distance tariffs would charge for that forwarded leg of the call.

STEP 6. Create the actual feature costing algorithms using SCIS/MO basic unit resource investments, user-entered inputs and vendor supplied switch resource measurements (and, if applicable, feature-only hardware). Additional algorithms may be needed to generate the feature investment output in the same format as the possible tariff structures (e.g., Multiline Hunt Groups may be tariffed per line or per group).

STEP 7. For intelligent network services, it is necessary to identify the SS7 signaling resources utilized. Once identified, separate algorithms are constructed to define these investments using methodology similar to the above.

Q. HOW DOES THE SCIS/MO VERIFICATION PROCESS SUPPORT THE VALIDITY OF SCIS/IN?

A. There are three components to total switch investment related to features.

1. Basic switching components,
2. Feature related hardware, and
3. Right-to-use (RTU) fees.

The SCIS/MO verification process supports the validity of SCIS/IN regarding basic switching components and feature related hardware.

Some features require a path through the switch to access an announcement system or some other special hardware. The engineering rules related to such a path are identical to those modeled in SCIS/MO. That is, engineering rules related to a switching system path are the same for POTS traffic and feature traffic. Both types of traffic require a path through specific switch components (such as a line interface) and quantities for such components are determined by a single set of engineering rules. Therefore, SCIS/MO basic unit resource investments, such as investment per line CCS, are used to model such investment in the feature algorithms of SCIS/IN. The SCIS/MO verification process demonstrates the accuracy of how these engineering rules are modeled.

The resulting basic unit resource investments determined by SCIS/MO are valid for both POTS demand in SCIS/MO and feature demand in SCIS/IN.

Capacity cost techniques similar to those used in SCIS/MO are used to model feature related hardware, such as special announcements or conference circuits, in SCIS/IN. The SCIS/MO verification process demonstrates the validity of these modeling techniques in SCIS/MO. As such, these proven techniques are used in SCIS/IN as well.

RTU fees for features are beyond the scope of SCIS/MO and SCIS/IN and are modeled outside of both applications.

Q. WHAT TYPE OF INFORMATION IS NEEDED FROM THE SWITCH MANUFACTURERS TO DEVELOP SCIS?

A. In order for Bellcore to perform the analyses needed to develop SCIS, certain technical information must be obtained from the vendor of each switching system modeled. This information includes:

- long range product development plans and delivery schedules;
- detailed technical descriptions of the switch architecture;
- current hardware engineering rules and engineered capacities;

- current unit level prices of individual switching components;
- universal discounting schemes;
- automated engineering and pricing tools, for purposes of model verification;
- detailed service descriptions, including how the switch implements the service;
- basic switching resource consumption on a per feature or function basis, as needed; and
- documentation that describes where feature traffic measurements may be obtained (e.g. usage, activations, or deactivations, etc.).

Some of this information -- in addition to being needed for analysis purposes -- is stored directly in the SCIS databases (e.g., real times, memory, signaling packets for ISDN services, equipment capacities, etc.) for use by the model algorithms.

Q. WHAT INFORMATION MUST THE USER PROVIDE?

A. User inputs can be organized into three categories as follows:

The first category contains system-level or “Setup” parameters. System-level parameters include both system configuration settings (e.g. default report formats) and values to be used across all offices or features (e.g. discounts). Note that SCIS/MO and SCIS/IN have separate system-level input sets.

The second category includes the office parameters. These inputs provide hardware configuration information and subscriber demand characteristics on a switch-by-switch basis (hosts, standalones and remotes). Examples of office parameters are line and trunk quantities, line concentration ratios (if known), traffic demand and processor utilization data (hosts only). Office-level inputs are entered into SCIS/MO.

The third category of input is associated with feature and service costing. Each vertical service requires incorporation of a unique data set that is relevant to the feature. Typical SCIS/IN inputs include Busy Hour attempts and holding times. Separate algorithms for each feature combine these inputs with SCIS/MO calculated resource costs to develop feature specific costs.

Q. WHY IS SCIS CONSIDERED PROPRIETARY?

A. SCIS is a trade secret of Bellcore and constitutes valuable intellectual property. It is marketed worldwide and provides commercial value to Bellcore. Public disclosure of such information could adversely impact SCIS's position in the competitive marketplace. SCIS contains the confidential information of various switch vendors, provided to Bellcore pursuant to nondisclosure agreements which preclude Bellcore (and its clients) from disclosing the information to any party absent written consent of the switch vendor. Public disclosure of the switch vendor's competitively sensitive information could adversely impact their position in the switch manufacturing marketplace.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.