Exhibit No:
Issues: Network Issues
Witness: Richard T. Scharfenberg
Type of Exhibit: Direct Testimony
Sponsoring Party: Southwestern Bell Telephone Company
Case No: TO-99-593

IN THE MATTER OF THE INVESTIGATION
INTO SIGNALING PROTOCOLS, CALL RECORDS,
TRUNKING ARRANGEMENTS, AND TRAFFIC MEASUREMENT

CASE NO. TO-99-593



# DIRECT TESTIMONY
# OF
# RICHARD T. SCHARFENBERG

ON BEHALF OF
SOUTHWESTERN BELL TELEPHONE

Little Rock, Arkansas
November 2000

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

| | | |
|---|---|---|
| In the Matter of the Investigation into Signaling Protocols, Call Records, Trunking Arrangements, and Traffic Measurement | ) ) ) ) | Case No. TO-99-593 |

AFFIDAVIT OF RICHARD T. SCHARFENBERG

STATE OF ARKANSAS )
) SS
COUNTY OF PULASKI )

I, Richard T. Scharfenberg, of lawful age, being duly sworn, depose and state:

1. My name is Richard T. Scharfenberg. I am presently Vice President of R & A Consulting, Inc.
2. Attached hereto and made part hereof for all purposes is my direct testimony.
3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct to the best of my knowledge and belief.

Richard T. Scharfenberg

Subscribed and sworn to before this 27 day of November, 2000.

Luci G. Stephens
Notary Public

My Commission Expires: 7/25/06

**DIRECT TESTIMONY OF RICHARD T. SCHARFENBERG**

**ON BEHALF OF**

**SOUTHWESTERN BELL TELEPHONE COMPANY**

**CASE NO. TO-99-593**

## I. INTRODUCTION AND QUALIFICATIONS

**Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

A. I am Richard T. Scharfenberg. My business address is 2805 Timber Creek Court, North Little Rock, Arkansas.

**Q. BY WHOM ARE YOU EMPLOYED AND WHAT IS YOUR POSITION?**

A. I am an independent engineering consultant hired by Southwestern Bell Telephone Company for the purpose of providing testimony in this case.

**Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?**

A. I attended the University of Central Arkansas in Conway, Arkansas, where I received a Bachelor of Science, with honors in Mathematics, in June 1964. I have completed numerous training courses and seminars conducted by the Bell System, Southwestern Bell Telephone Company (SWBT), American Telephone & Telegraph (AT&T), Nortel, Bellcore, and other vendors, suppliers and consultants on a variety of subjects including digital switching systems, fiber optic transmission systems, computer operations, data communications, and network distribution systems.

**Q. WHO WERE YOU EMPLOYED BY BEFORE YOU BECAME AN INDEPENDENT CONSULTANT?**

A. I worked for Southwestern Bell Telephone Company as a network engineer for over 34 years until my retirement in December 1998.

**Q. PLEASE DESCRIBE YOUR WORK EXPERIENCE WITH SOUTHWESTERN BELL TELEPHONE.**

A. RTS Exhibit 1 is a summary of my work experience with Southwestern Bell Telephone Company.

**Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION BEFORE?**

A. Yes. I testified before this Commission in Case No. TO-97-217. RTS Exhibit 2 contains a complete listing of my testimony before the Arkansas Public Service Commission, the Kansas Corporation Commission, the Missouri Public Service Commission and the Oklahoma Corporation Commission.

## II. PURPOSE OF TESTIMONY

**Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

A. The purpose of my testimony is to address the issues the Missouri Public Service Commission directed be investigated in its Report and Order issued on June 10, 1999, in Case No. TO-99-254, et al.

**Q. WHAT WERE THE ISSUES THAT THE COMMISSION ORDERED TO BE INVESTIGATED IN THIS CASE?**

A. The Commission ordered the following issues to be investigated:

- Signaling Protocols
- Call Records
- Trunking Arrangements
- Traffic Measurements

## III. BACKGROUND

**Q. WHAT IS THE HISTORY OF THE SIGNALING FORMATS USED BEFORE THE DEVELOPMENT OF THE FEATURE GROUPS USED IN THE CURRENT NETWORK?**

A. Before divestiture of the Bell System in 1984, a common signaling protocol was used by the local exchange carriers (Bell and Independent Companies) and American Telephone & Telegraph (AT&T). This protocol did not have an official feature group name at the time. This signaling protocol was used by all switching systems (Step-by-Step, Cross-Bar, Analog Electronic Switching, etc.). This signaling protocol was used by all Local Exchange Carriers (LEC) customers to place 1+ dialed toll calls. Prior to the introduction of long distance competition, these toll calls were either sent to AT&T to be completed to an interstate destination or were completed by the LEC to one of the Bell or independent company customers within the state.

When Interexchange Carriers (IXCs) other than AT&T were permitted to offer toll service, their customers could only access them using either a line-side connection (dialing a seven-digit telephone number) or a trunk-side connection using a 7-digit access code (950-XXXX). The IXCs saw this as discriminatory

since only AT&T could use the traditional signaling protocol which provided the 1+ and 0+ dialing pattern. At divestiture, Feature Group D (FGD) was developed to allow competing IXCs to provide interLATA toll service on a 1+ or 0+ basis. All IXCs, including AT&T, were to use the new FGD signaling protocol for interLATA service and the LECs continued to use traditional signaling for intraLATA toll service. This traditional signaling protocol became known as Feature Group C (FGC).

**Q. WOULD YOU PLEASE EXPLAIN THE DIFFERENT FEATURE GROUPS AVAILABLE FOR INTERCONNECTION TO TOLL PROVIDERS?**

A. Yes. Several forms of access were defined at the time the Modification of Final Judgment (MFJ) was implemented. These forms of access were designated as "Feature Groups" (FGs).

Following is a summary of the FGs being considered in this case[1]:

- Feature Group C (FGC) – FGC is the method for trunking and routing long distance calls without the use of an Interexchange Carrier (IXC) (i.e., Local Exchange Carrier to Local Exchange Carrier, "LEC-to-LEC"). FGC is a trunk-side access service where a customer dials a one-digit access code plus the called telephone number (1+10 Digits). Prior to divestiture, most toll calls were originated and completed using this Feature Group. After divestiture, the Regional Bell Operating Companies (RBOCs) implemented a new type of

[1] Additional feature groups available are as follows:
- Feature Group A (FGA) – FGA is a line-side access service where a customer dials an assigned telephone (POTS) number that connects to a specific IXC.
- Feature Group B (FGB) – FGB is a trunk-side access service where a customer dials a 950-XXXX access code to reach the IXC.

access service (i.e., FGD) for interLATA toll service. FGC was retained as the standard for use by Local Exchange Carriers (LECs), both RBOC and Independent Incumbent Local Exchange Carrier (Independent ILEC), for completing intraLATA toll calls without the use of an IXC. FGC service is fully supported by switching vendors, and I know of no plans to discontinue the availability of this Feature Group.

- Feature Group D (FGD) – FGD was developed as a method of providing equal access to IXC networks. FGD access is provided through the end office serving the originating telephone customer. FGD is a trunk-side access service where a customer dials either a one-digit access code (1) for access to a presubscribed IXC or a seven-digit access code (101-XXXX) for dial-around use to access an IXC other than his presubscribed carrier. The call is routed either directly to the IXC or via an Access Tandem equipped to handle FGD calls. This Feature Group is designed to allow the serving end office to route a toll call to the IXC chosen by the customer to handle the call. It was not intended to provide interconnection between LECs.

**Q. WHAT DO YOU MEAN BY A PRESUBCRIBED CUSTOMER?**

A. As part of the implementation of equal access , a customer is allowed to choose an IXC on a presubscribed basis. This allows the customer to dial interLATA calls using a "1+" access code. Since the customer has "presubscribed," the originating end office knows which IXC is to be used to transport the call. The term "PIC" is used to refer to the Presubscribed Interexchange Carrier. With the introduction of presubscription for intraLATA calling, FGD is also used when a

customer elected to use an IXC to handle their intraLATA calls. FGC continued to be used when the customer elected to use the LEC for intraLATA calling.

**Q. WHAT IS MEANT BY THE EXPRESSION "2PIC"?**

A. The end offices are equipped with software that reflects the customer's choice of an IXC provider for interLATA and, optionally, intraLATA service (i.e., "2PIC"). The customer can choose the same carrier or different carriers for their toll calls or the customer can continue to use the LEC for intraLATA toll. When a customer chooses an IXC as the carrier of choice for their toll calls (interLATA and/or intraLATA), the customer's line will be set in the end office with that carrier's Carrier Identification Code (CIC) and 1+ toll calls will route to that carrier using the FGD signaling protocol. If the customer chooses SWBT to complete their intraLATA toll calls, the software will route those call to the existing network using the FGC signaling protocol.

**Q. DOES THE RETENTION OF FGC FOR LEC-TO-LEC INTRALATA CALLING ALLOW THE USE OF 101-XXXX DIAL AROUND (CASUAL DIALING) FOR INTRALATA CALLS?**

A. Yes. The use of the 101-XXXX (10-XXX was used prior to 7/1/98) dial around method for completing intraLATA calling is used today by many IXCs.

**Q. WOULD YOU SUMMARIZE THE DIALING STANDARDS USED FOR FGC AND FGD CALLS?**

A. Yes. The following table is a summary of the dialing standards used for FGC and FGD calls, after the introduction of intraLATA presubscription:

| Feature Group | Type Traffic | Service Provider | Dialing Standard | Dial Around Method |
|---|---|---|---|---|
| FGC | LEC-to-LEC | LEC | 1+10 Digits | 101-XXXX+ |
| FGD | LEC-to-IXC (intraLATA) | IXC | 1+10 Digits | 101-XXXX+ |
| FGD | LEC-to-IXC (interLATA) | IXC | 1+10 Digits | 101-XXXX+ |

Table 1

As reflected in Table 1, dialing parity is achieved by these standards, since access to all toll providers are available and the number of digits dialed are the same for each call type.

**Q. HAVE YOU PREPARED A NETWORK DIAGRAM THAT ILLUSTRATES THE USE OF THESE FEATURE GROUPS IN THE NETWORK USED BY THE LECS?**

A. Yes, RTS Exhibit 3 contains a diagram that illustrates the current network. This diagram may also be helpful in understanding the technical discussion contained in the remainder of my testimony.

## IV. SIGNALING PROTOCOLS

**Q. WOULD YOU EXPLAIN WHAT IS MEANT WHEN REFERRING TO MULTIFREQUENCY (MF) SIGNALING AND SIGNALING SYSTEM 7 (SS7) SIGNALING?**

A. Yes. These signaling methods refer to the physical methods used to transfer information between switching systems. The MF signaling method uses AC-

tones to transmit the control messages, as defined by the signaling protocol, between switching systems. These signals are made over the voice-channel that is also used for voice conversations.

Common Channel Signaling (CCS) is a signaling method in which the control messages are no longer carried over the voice-channel. Instead, a separate shared (common) channel (signaling link) is used to convey the control messages, as specified by the appropriate signaling protocol (i.e., FGC or FGD). The CCS signaling method uses a special-purpose data communications network to convey control messages between switching systems. Signaling System 7 (SS7) is the latest version of this signaling method as covered in Bellcore's Generic Requirement GR-246-CORE.

**Q. WOULD YOU EXPLAIN WHAT IS MEANT WHEN REFERRING TO THE TERM "SIGNALING PROTOCOL."**

A. Yes. "Signaling Protocol" refers to a standard set of rules that have been developed by the industry on a national basis to define call control messages used between switching systems. These protocols are used by switch vendors to develop the software and hardware needed to integrate their switching systems into the telecommunication network. For example, Bellcore's Generic Requirement GR-317-CORE defines the signaling protocol to be used for Feature Group C calls and GR-394-CORE defines the signaling protocol for Feature Group D calls.

**Q. HOW IS THE SIGNALING PROTOCOL USED BY THE SWITCH VENDORS IN THE DEVELOPMENT OF SOFTWARE FOR THEIR SWITCHING PRODUCTS?**

A. Once the switch vendors know the number and size of the data fields of the signaling protocol, they develop software that recognizes the type of call that is being handled (e.g., originating toll LEC-to-LEC or terminating toll IXC-to-LEC) and define in software the data fields that must be populated in order to complete that call type. For example, in the Nortel switching systems the trunk group type of "IT" is used to fulfill the signaling requirements of a FGC type call and the trunk group type "ATC" is used to fulfill the signaling requirements of a FGD type call. Also, since originating and terminating calls are handled differently by the switching system, different data fields are populated depending on the direction of the call.

**Q. WOULD YOU SUMMARIZE THE SIGNALING STANDARDS USED FOR FGC AND FGD CALLS?**

A. Yes. The following table is a summary of the signaling standards used for FGC and FGD calls:

| Feature Group | Type Traffic | Service Provider | Signaling Standard | Nortel Switch Trunk Group |
|---|---|---|---|---|
| FGC | LEC-to-LEC | LEC | GR-317 | IT |
| FGD | LEC-to-IXC (intraLATA) | IXC | GR-349 | ATC |
| FGD | LEC-to-IXC (interLATA) | IXC | GR-349 | ATC |

Table 2

**Q. HAVE FGC AND FGD BEEN DEPLOYED IN SWBT END OFFICES IN MISSOURI?**

A. Yes. SWBT end offices have the capability to establish network connections using either traditional FGC signaling or FGD signaling. FGC has been used for those calls not requiring an IXC (i.e., LEC-to-LEC calls). FGD is used when an IXC is selected by the end user for transport of toll calls.

**Q. HAVE FGC AND FGD BEEN DEPLOYED IN SWBT TANDEM OFFICES IN MISSOURI?**

A. Yes. SWBT tandem offices recognize the called number in the traditional FGC signaling received from the originating end office and route those calls to the tandem or end office serving the called customer. The SWBT access tandems also recognize the Carrier Access Code (CAC) in the FGD signaling received from the originating end office and route those calls to the selected IXC as represented by the Carrier Identification Code (CIC). The existing originating access tandems route the FGD call to an IXC based on the CIC. These tandems do not have the capability (i.e., IXC software) to route an originating FGD call on a called-number basis. The following table is a summary of the tandems used in Missouri and the capability of each type switch:

| Tandem Type | Number | FGC | FGD | IXC Capability |
|---|---|---|---|---|
| DMS 100/200 | 5 | Yes | Yes | No |
| DMS 100/200 | 1 | Yes | No | No |
| DMS 200 | 1 | Yes | Yes | No |
| 5ESS | 3 | Yes | Yes | No |
| 5ESS | 1 | Yes | No | No |
| AXT | 1 | Yes | No | No |

Table 3

**Q. IS FGD SIGNALING PROTOCOL SOMEHOW SUPERIOR TO TRADITIONAL FGC SIGNALING?**

A. No. They are simply different standardized methods used for the trunking and routing of an end user's long distance calls. FGC routes calls directly to a specific telephone number using the NPA-NXX (the area code and the first three digits of the seven digit telephone number). FGC shares many network elements with the FGD and is not considered by the industry as a separate network. FGD simply routes calls to an IXC based on the Carrier Identification Code (CIC).

**Q. FROM A TECHNICAL STANDPOINT, WHAT ARE THE SIMILARITIES OF FGC AND FGD SIGNALING?**

A. FGC and FGD signaling networks are in place to handle different call functions. Although separate trunk groups may be used in some parts of the network, the technology used to complete these calls is the same for both FGC and FGD, as discussed below:

- Both use trunk side connections at the end office and/or the tandem switches and in many cases share a common trunk group.
- Both use SS7 or MF signaling between switching systems.
- Both use Stored Program Control (SPC) switching systems (e.g., Digital or Analog ESS Switching).
- Both utilize 1+10-digit dialing.
- Both utilize the same transmission facilities (e.g., Digital Carrier and/or Fiber Optic Systems).
- Both utilize tandem switching as needed.
- On average, both have approximately the same call set-up time.
- On average, both have approximately the same call blocking results.

These signaling protocols were designed to fulfill different functions but, from a technical standpoint, are equal when used for their designed purpose. There is no difference in quality of service as far as the end user is concerned.

Q. **WHAT ACTIVITY WOULD BE REQUIRED FOR SWBT TO CONVERT ITS NETWORK FROM FGC SIGNALING TO FGD SIGNALING?**

A. A major reconfiguration of the Southwestern Bell Telephone network would be required to convert from FGC to FGD signaling protocol. These changes are discussed below.

- Software capable of switching IXC type calls would have to be deployed in the Missouri network. The IXC software that would be used by Southwestern Bell Telephone is the DMS-250 software provided by

Nortel. A new DMS-250 switching systems would be required in each LATA in Missouri.

- If new switching systems are deployed, building modifications would be required which would include such items as asbestos abatement, building construction and additions and/or rearrangement to power and HVAC systems.
- Re-homing of trunks from switching systems without IXC software to switching systems that have the IXC capability would be required.
- These re-homings could exhaust existing interoffice facilities and necessitate the installation of new fiber optic systems and associated fiber regeneration stations. This could result in stranded investment in switching and interoffice facilities.
- A full set of translations would be required for the new DMS-250 switching systems that would be deployed.
- Circuit layout and design records would have to be made for all trunk groups that are added and or re-homed to new switching systems and/or fiber optic interoffice facilities.
- In each end office, a four digit Carrier Identification Code (CIC) and Carrier Common Block would be required to route the originating calls using FGD signaling. The existing trunk groups and trunk group members in translations of the 1AESS, 5ESS, and DMS switching technologies would have to be deleted and re-established as a FGD trunk

group type. The existing trunk group translations in the Ericsson switch could be changed without disconnection of the trunk group in translations.

**Q. WOULD YOU EXPLAIN THE DIFFERENCE IN THE NORTEL DMS SOFTWARE USED BY SOUTHWESTERN BELL TELEPHONE?**

A. Yes. Nortel uses a numbering system to designate the difference in DMS switching products. The following table lists the most commonly used DMS switch designations.

| Designation | Type of System |
|---|---|
| DMS 10 | Small Local Switching System |
| DMS 100 | Large Local Switching System |
| DMS 200 | Access Tandem Switching System |
| DMS 250 | Interexchange Carrier Switching System |
| DMS 300 | International Switching System |
| DMS 500 | Combined DMS100/200/250 |

Table 4

**Q. WHAT CHANGES WOULD BE REQUIRED TO THE TANDEM SWITCHING NETWORK IN MISSOURI TO CHANGE FROM FGC TO FGD SIGNALING?**

A. The following changes to the tandem switching network would be required to change the intraLATA network from FGC to FGD:

- Three new DMS 250 switching systems would have to be deployed.
- Three 5ESS switching system would have to route their intraLATA traffic to the new DMS 250 in St. Louis.
- One 5ESS switching system would have to route its intraLATA traffic to the new DMS 250 in Kansas City.
- Four DMS-100/200 switching systems would have to route their intraLATA traffic to the new DMS 250 in Kansas City.

- Two DMS-100/200 switching systems would have to route their intraLATA traffic to the new DMS-250 in St. Louis.
- One DMS-200 switching system would have to route its intraLATA traffic to the new DMS-250 in Springfield.
- One Ericsson switching system would have to re-home its intraLATA traffic to the new DMS-250 in St. Louis.

The following table summarizes these changes:

| LATA | LOCATION | TYPE | FGB | FGC | FGD | IXC |
|---|---|---|---|---|---|---|
| 520 | FLAT RIVER | 5ESS | | @ | | |
| 520 | HANNIBAL | DMS100/200 | | @ | | |
| 520 | MEXICO | AXT | | @ | | |
| 520 | SIKESTON | DMS100/200 | X | @ | X | |
| 520 | ST.LOUIS | 5ESS | X | @ | X | |
| 520 | ST.LOUIS | 5ESS | X | @ | X | |
| 520 | ST.LOUIS | DMS250 (New Switch) | | | | # |
| | | | | | | |
| 522 | SPRINGFIELD | DMS200 | X | @ | X | |
| 522 | SPRINGFIELD | DMS250 (New Switch) | | | | # |
| | | | | | | |
| 524 | CHILLICOTHE | DMS100/200 | X | @ | X | |
| 524 | KANSAS CITY | DMS100/200 | X | @ | X | |
| 524 | KIRKSVILLE | DMS100/200 | X | @ | X | |
| 524 | MOBERLY | 5ESS | X | @ | X | |
| 524 | ST.JOSEPH | DMS100/200 | X | @ | X | |
| 524 | KANSAS CITY | DMS250 (New Switch) | | | | # |

Table 5

X = Current
# = Additions
@ = Discontinue

**Q. WHAT WOULD IT COST SWBT TO CHANGE THE FGC LEC-TO-LEC NETWORK TO FGD?**

A. The deployment of an IXC-type switch in St. Louis, Springfield and Kansas City, and the re-home of intraLATA traffic would involve a capital expenditures of

more than $18,600,000. This estimate does not include any building, translations, trunk and facility rearrangement cost or any new interoffice fiber optic systems that may be required to change from FGC to FGD.

**Q. WHAT WOULD BE NEEDED TO IMPLEMENT FGC FOR INTRALATA CALLING?**

A. Since FGC is currently deployed in the LEC Network, no changes in the network or additional cost would be required to continue the FGC signaling protocol.

**Q. WHAT SIGNALING PROTOCOL (FGC OR FGD) SHOULD BE USED FOR SIGNALING LEC-TO-LEC INTRALATA CALLING?**

A. If the incumbent local exchange company carries a customer's intraLATA calls, then the current standard signaling protocol (FGC) should continue to be used until another standard is developed and made available by the switch manufacturers. Currently, the standardized method to route an intraLATA call directly to another LEC without using an IXC is the FGC signaling protocol.

## V. CALL RECORDING

**Q. DO INDUSTRY STANDARDS EXIST FOR THE RECORDING OF CALLS?**

A. Yes. Recording and billing issues and requirements are covered by a separate set of industry standards. For example, Bellcore's GR-1100-CORE defines the Bellcore Automatic Message Accounting (AMA) Format requirements used by the industry. Again, these standards are used by the switching vendors to develop the software needed by the switch to provide a uniform message record.

These standards are also used by billing vendors to develop the required programs to interface with billing systems used by the industry.

**Q. WOULD YOU SUMMARIZE THE AMA RECORDING STANDARDS USED IN THE LEC NETWORK?**

A. Yes. The following table is a summary of the signaling and associated AMA recording standards:

| Type Traffic | Feature Group | Signaling Standard | Recording Standard |
|---|---|---|---|
| Originating to LEC Network | FGC | GR-317 | Call Code 006 |
| Originating to IXC Network | FGD | GR-394 | Call Code 110 |
| Terminating from LEC Network | FGC | GR-317 | N/A |
| Terminating from IXC Network | FGD | GR-394 | Call Code 119 |

Table 6

**Q. IS THE ORIGINATING CARRIER IDENTIFICATION CODE (CIC) USED ON THE TERMINATING SIDE OF A CALL?**

A. No. The CIC is not required for call completion on the terminating side of a call. The termination of a call received by the LEC from an IXC is made using the called number. This is similar to the way a call received on the LEC network is terminated. The originating CIC is not used for call completion. Since CIC is not used. the IXCs do not normally provide this information to the LECs.

**Q. WILL FGD SIGNALING PROTOCOL GIVE THE TERMINATING END OFFICE THE ABILITY TO IDENTIFY THE RESPONSIBLE ORIGINATING SERVICE PROVIDER?**

A. No. The CIC is not required in the terminating network, even when using FGD signaling protocol. The CIC is used to route FGD calls in the originating network to the IXC selected by the end user to carry the call. Once the call is routed to the appropriate IXC, the CIC is no longer required for call processing. Rather, the IXC switch performs a translation to identify the terminating end user and sends the call to the appropriate LEC network for termination. All further call processing is done using the called number (i.e., NPA-NXX). Since the CIC is not required to complete the call in the terminating network, it is often not included in the information received by the LEC from the IXC.

**Q. DOES THE USE OF SS7 SIGNALING GIVE THE TERMINATING END OFFICE THE ABILITY TO IDENTIFY THE ORIGINATING CUSTOMER?**

A. No. As covered in my response to the previous question, the CIC is not always available in the terminating network, even when using SS7 signaling. The present industry standards do not require the passing of a CIC code through the network to an end office for a terminating call.

**Q. IF THE CIC IS NOT PROVIDED TO THE LEC, HOW IS A TERMINATING ACCESS BILLING RECORD MADE?**

A. An access billing record is made at the first point of entry within the LEC terminating network. This record (Call Code 119) uses a trunk group identifier to determine the IXC responsible for access charges.

**Q. WHERE SHOULD FGC, LEC-TO-LEC INTRALATA CALLS BE RECORDED?**

A. The commonly accepted industry practices and procedures provide for the recording of FGC LEC-to-LEC intraLATA calls in the originating end office or at

the originating tandem office, if the originating end office cannot make the recording. This method of recording is used by the industry throughout the country and is supported by switch vendors and standards organizations that address billing issues on a national basis.

**Q. CAN FGC CALL RECORDING BE DONE AT THE TERMINATING END OFFICE?**

A. The capability to record calls in the terminating end office may be possible in some switch types but has limitations and is not considered standard by the industry. The absence of CIC information on some calls would make the use of terminating call records unreliable for the purposes of billing. The use of terminating recordings does not allow the identification of the responsible service provider for the call thus resulting in incorrect billing. Until terminating recording of FGC calls is standardized by the industry and switch manufacturers, it should not be adopted for use in Missouri.

## V. TRUNKING ARRANGEMENTS

**Q. DO YOU RECOMMEND THE IMPLEMENTATION OF SEPARATE TRUNK GROUPS FOR MCA OR OTHER TYPES OF TRAFFIC?**

A. No. Currently, traffic terminating into many small end offices is handled on a single common trunk group. These large trunk groups are more efficient than several small trunk groups carrying the same load. For example, an end office served with a common group of 100 trunks would have the capacity to handle a load of 3,029 hundred call seconds (CCS) of traffic, according to the Neal-

Wilkinson B.01 Trunk Capacity Table. If this trunk group is split into ten (10) separate trunk groups, it would take 160 trunks to handle the same load. In this example, the trunk requirement would increase by 60 percent. If this trunk group is split into four (4) separate trunk groups, it would take 124 trunks, resulting in a 24 percent increase in trunk requirements. The implementation of separate trunk groups would be extremely inefficient and costly to implement. A 60 percent increase in trunk requirements could exhaust some existing switching systems and transmission facilities and have a negative impact on customer service.

**Q. HOW WOULD THE IMPLEMENTATION OF SEPARATE TRUNK GROUPS HAVE AN IMPACT ON CUSTOMER SERVICE?**

A. With smaller trunk groups, the quality of service can be impacted by trunk outages and calling peaks. For example, if a single trunk experiences a maintenance problem in a group of 100 trunks, the lost call carrying capacity (the capacity of the last member in the group) would be approximately one (1) percent of its capacity. If a single trunk experiences a maintenance problem in a group of 10 trunks, the lost call carrying capacity would be approximately 15 percent. This potential loss in capacity would have a negative impact on customer service during periods of high calling (Busy Hour and Peak Calling). Because of the possible impact on customer service, the unnecessary implementation of inefficient trunk groups should be avoided.

**Q. WHAT SHOULD BE DONE ABOUT THE USE OF COMBINED TRUNK GROUPS THAT CURRENTLY CARRY INTERLATA, INTRALATA, CLEC AND WIRELESS TRAFFIC?**

A. As discussed above, because of the efficiency of large trunk groups and the possible impact on customer service, the Commission should allow the continued use of the current combined trunk groups for interLATA, intraLATA, CLEC and Wireless traffic.

**Q. WHAT, IF ANY, CHANGES IN TRUNKING ARRANGEMENTS WOULD YOU RECOMMEND TO THIS COMMISSION?**

A. No changes in trunking arrangements for should be made in Missouri.

## VI. TRAFFIC MEASUREMENTS

**Q. WHAT TRAFFIC MEASUREMENTS ARE USED IN THE TELECOMMUNICATIONS NETWORK FOR BILLING, NETWORK MONITORING AND CUSTOMER CONTROL?**

A. Traffic measurements used in the telecommunications network can be grouped into four broad categories as follows:

- Call Recording (Automatic Message Accounting)
- Network Monitoring
- Customer Network Monitoring
- Customer Management Services

**Q. WHAT IS THE PRIMARY USE OF THE AUTOMATIC MESSAGE ACCOUNTING (AMA) SYSTEM?**

A. The AMA system is designed to be used to provide billing usage data. This data is needed to permit charging the customer for use of network services or to permit charging of other carriers for assistance in placing call connections. This system must be highly reliable and available at all times because of the accuracy required for customer and carrier billing.

Because of the tremendous volume of AMA data that must be processed each day and the requirement for a very high integrity billing process, it is necessary that a universal AMA data format be used by all network providers. The format presently used is the Bellcore AMA Format (BAF). The generic requirements of BAF are set forth in GR-1100 CORE, Bellcore Automatic Message Accounting Format (BAF) Requirements.

The data commonly required for customer billing includes the calling number, the called number, call duration, the day of the week, the date, and the time of day. The elapsed time from answer time to disconnect is used for billing the customer for the call. When an IXC is involved in the call, the carrier-connect time is required, along with the carrier's identification. The elapsed time from carrier-connect to disconnect is used for billing the IXC for access.

**Q. WHAT IS THE PRIMARY USE OF NETWORK MONITORING TRAFFIC MEASUREMENTS?**

A. The Network Monitoring traffic measurements provide statistical indicators that can be used to evaluate the quality of the telecommunications network under all types of service conditions. Evaluation consists of monitoring selected call attempts to determine the disposition of the call (i.e., completed, busy, no

answer, equipment blockages, and failures). Network monitoring data is used to provide quality assessment of network performance delivered to the customer. Network Monitoring will use random samples of telephone network performance. The data commonly used consist of peg counts of events, overflow counts and CCS (Hundred Call Seconds) usage data for groupings of network components. The data collected is not as reliable as AMA data since it is not designed to be used for billing.

**Q. WHAT IS THE PRIMARY USE OF THE CUSTOMER NETWORK MONITORING TRAFFIC MEASUREMENTS?**

A. Customer Network Monitoring provides data to customers concerning the customer's use of the LEC facilities and services. This data may be used by the customer for such purposes as cost allocation and private network management. These services are commonly used by large business and government customers.

Customer Network Monitoring provides for the recording of usage information for features such as account or authorization codes, queuing, automatic route selection, facility restriction, private facility access, etc.

**Q. WHAT IS THE PRIMARY USE OF CUSTOMER MANAGEMENT SERVICE TRAFFIC MEASUREMENTS?**

A. Customer Management Service offers a variety of services to a customer that provides for access to and control over the facilities and services that they obtain from a LEC. Large businesses and government customers are typical

users of these services. Some of these services are configuration management. performance management. fault and security management.

**Q. WHICH OF THE TRAFFIC MEASUREMENTS DESCRIBED ABOVE SHOULD BE USED FOR BILLING?**

A. The AMA system is the method that is designed for and reliable enough to be used for customer and carrier billing. It is also the standard used by all network service providers

**Q. HAS ANY OTHER TRAFFIC MEASUREMENT SYSTEM BEEN DEVELOPED THAT WOULD ENABLE THE LEC'S TO MONITOR NETWORK USAGE?**

A. Yes. Several vendors have developed network monitoring systems. Hewlett Packard/Agilent has developed a system called AcceSS7 Business Intelligence. It uses Signaling System 7 (SS7) derived call records as the primary data source. As calls are routed over trunks using SS7, the signaling links are monitored at the Signal Transfer Point (STP) locations using Call Detail Records (CDR) collection hardware and software in the AcceSS7 System. This system is designed to allow a company to acquire call records that would include the following:

- Originating switch point code
- Destination switch point code
- Calling Number (when available)
- Called Number
- Timestamp of the call
- Elapsed time
- Carrier ID Code (when available)
- Trunk ID Code

**Q. HOW COULD THE ACCESSS7 SYSTEM BE USED IN MISSOURI?**

A. This system could be used to make periodic studies of the data contained in the SS7 signaling system as compared to the AMA data during the same period of time. This study capability would allow the LECs in Missouri to determine if calls being terminated to an end office are also flowing through the billing and compensation systems. If calls are not represented in the billing data, the SS7 data could be used to determine the source of the missing billing data and the appropriate action could be taken to correct any problems with the creation or exchange of AMA data.

**Q. COULD THE ACCESS7 BUSINESS INTELLIGENCE SYSTEM BE USED FOR BILLING?**

A. The system, as deployed by SWBT, is designed to be a Network Monitoring and Administrative tool. But working in conjunction with the AMA system, the AcceSS7 system can provide records in instances where the AMA system does not and those records can be used for billing. SWBT expects this system to augment its AMA based system and procedures, not replace them.

## VII. CONCLUSION

**Q. SHOULD THE LECS BE REQUIRED TO DEPLOY FGD SIGNALING PROTOCOL FOR COMPLETION OF INTRALATA CALLS?**

A. No. The currently deployed FGC signaling in the LEC-to-LEC network should continue to be used for intraLATA calling in Missouri. It is not necessary or appropriate to require the LECs to shift from FGC to FGD signaling protocol.

This change would be very expensive and require significant network expenditures and rearrangements. As stated above, the cost to change the tandem switching network for SWBT alone would be over $ 18.6 Million. Such major network deployments and rearrangements, if made, would still not provide the capability to determine the originating telephone number and/or responsible carrier so that terminating access could be accurately billed to the appropriate carrier.

**Q. HOW AND WHERE SHOULD TERMINATING INTRALATA TRAFFIC BE RECORDED?**

A. Commonly accepted industry practices and procedures provide for the recording of FGC LEC-to-LEC intraLATA calls at the originating end office (or the originating tandem office, if the originating end office cannot make the recording) using Call Code 006. This method of recording is used by the industry throughout the country and is supported by switch vendors and standards organizations that address billing issues on a national basis. This method has been used in Missouri for many years and is the basis for end user billing. The change to a non-standard terminating recording would be unreliable and would not provide the capability to determine the originating telephone number and carrier so that terminating access could be accurately billed to the appropriate carrier.

**Q. SHOULD THE LECS BE REQUIRED TO PROVISION SEPARATE TRUNK GROUPS FOR MCA OR OTHER TYPES OF TRAFFIC?**

A. No. The requirement to provision separate trunk groups for MCA or other types of traffic would be extremely inefficient, costly to implement and could have a negative impact on customer service. As discussed above, the establishment of several small trunk groups carrying the same load as one larger trunk group could result in an increase in trunk requirements ranging from 24 to 60 percent. With smaller trunk groups, if a single trunk experiences a maintenance problem, the lost call carrying capacity could be 15 percent or greater, resulting in a negative impact on customer service during periods of peak usage. Any unnecessary trunk additions could exhaust some transmission facilities and cause equipment additions in the associated tandem offices. These unnecessary trunk additions would still not provide the capability to determine the originating telephone number and carrier so that terminating access could be accurately billed to the appropriate carrier.

**Q. WHAT TRAFFIC MEASUREMENT SHOULD BE USED FOR CUSTOMER CALL RECORDING IN MISSOURI?**

A As stated above, the national standard AMA call recording system should be used for customer call recording in Missouri. FGC LEC-to LEC intraLATA calls should be recorded in the originating end office using the current national standard Call Code 006 record. Access billing on IXC calls should be recorded at the first point of entry within the LEC terminating network using the current national standard Call Code 119 record.

**Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

A. Yes.

## SOUTHWESTERN BELL WORK EXPERIENCE

I was employed by SWBT in 1964 in Little Rock, Arkansas. During the next six years. I held various management positions in Arkansas and Missouri before being appointed in 1970 to the position of District Traffic Superintendent in Fort Smith, Arkansas.

In 1973, I was appointed Traffic Manager-Network Design Planning in Little Rock. Arkansas. I was appointed in 1979 to the position of District Manager-Network Planning with the responsibility for planning all Southwestern Bell Telephone switching, interoffice and outside plant facilities for the State of Arkansas.

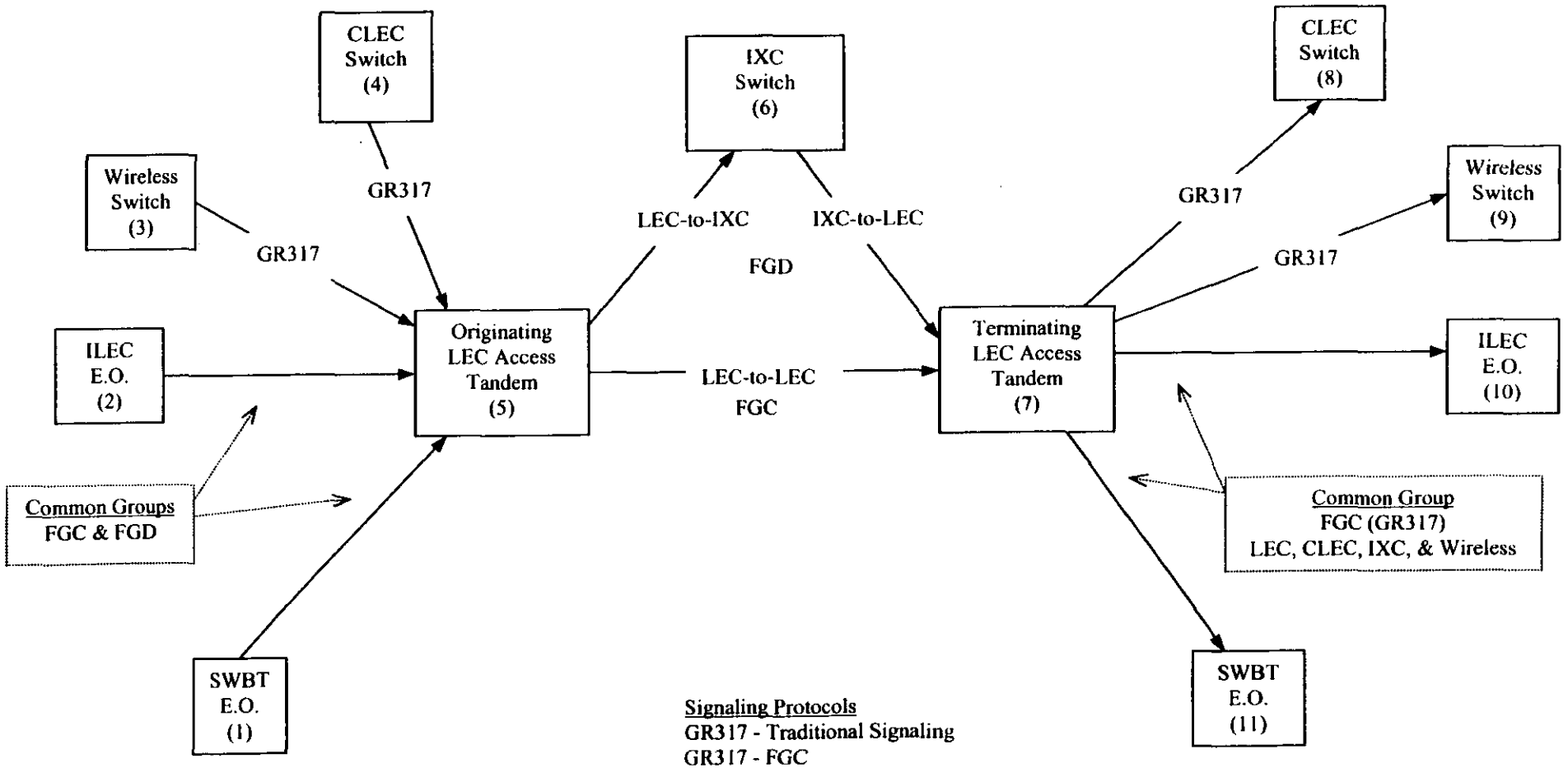
On November 1, 1993, I was appointed to Director–Planning and Engineering and participated in the development, planning, and engineering of SWBT's telephone network in the States of Arkansas, Kansas, Missouri and Oklahoma and was the network regulatory and legislative liaison in those states. My responsibilities included the presentation, explanation and justification of the company's network plans before regulatory and legislative bodies. This included the preparation and filing of Network testimony with the state regulatory commissions. I also provided technical support to the Southwestern Bell Telephone Legal and External Affairs departments.

I retired from Southwestern Bell Telephone on December 30, 1998, after more than 34 years of service.

# REGULATORY TESTIMONY

| Jurisdiction | Docket | Subject |
|---|---|---|
| Oklahoma | PUD 980000263 | In the Matter of the Application of Atlas Telephone Company, et. al., for the approval of Tariffs |
| Oklahoma | PUD 970000171 | Application of the Oklahoma Central Office Code Administrator and Numbering Plan Area (NPA) Relief Coordinator Seeking Approval and Assistance with a 405 NPA Relief Plan |
| Missouri | TO-97-217 | In the Matter of an Investigation Concerning the Continuation or Modification of the Primary Toll Carrier Plan When IntraLATA Presubscription is Implemented in Missouri |
| Kansas | 190,492-U | In the Matter of a General Investigation into Competition within the Telecommunications Industry in the State of Kansas |
| Arkansas | 96-301-U | In the Matter of a Request by the NPA Relief Coordinator to Select an Area Code Relief Plan for Arkansas |
| Arkansas | 93-125-U | In the Matter of the Consolidation of Expanded Calling Scopes and the Appropriate NTS Allocation and Return on Investment for the Arkansas Carrier Common Line Pool |
| Arkansas | 92-260-U | In the Matter of an Earnings Review of Southwestern Bell Telephone Company (Annual Review) |
| Arkansas | 92-260-U | In the Matter of an Earnings Review of Southwestern Bell Telephone Company |

# LEC Network Diagram




Signaling Protocols
GR317 - Traditional Signaling
GR317 - FGC
GR349 - FGD

Originating AMA
FGC – Call Code 006
FGD Call Code 110
Wireless – Call Code 066

Terminating AMA
FGC – None
FGD - Call Code 119
Wireless – Call Code 064