BELLSOUTH TELECOMMUNICATIONS, INC.

REBUTTAL TESTIMONY OF GARY TENNYSON

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 030851-TP

JANUARY 7, 2004

Q. PLEASE STATE YOUR NAME, YOUR BUSINESS ADDRESS, AND YOUR POSITION WITH BELLSOUTH TELECOMMUNICATIONS, INC. ("BELLSOUTH").

A. My name is Gary Tennyson. My business address is 1884 Data Drive, Birmingham, AL 35244. My title is Principal Member – Technical Staff. I am employed by BellSouth Telecommunications.

Q. PLEASE SUMMARIZE YOUR BACKGROUND AND EXPERIENCE.

A. I have a Bachelor of Science degree in Electrical Engineering from Mississippi State University and a Masters of Science degree in Electrical Engineering from the University of Alabama at Birmingham.

I have been employed in the telecommunications industry for more than 27 years, all with BellSouth, and one of its predecessors, South Central Bell. From 1976 through 1984, I held line and staff positions in Outside Plant Engineering, where I was responsible for the planning and engineering of local loop facilities. From 1984 through 1987, I held a staff position in Marketing. Since 1987, I have been involved with representing BellSouth in various industry standards forums dealing with loop access and associated technical interfaces. During this time, I served a four-year term as the chair of T1E1.1, a Working Group of T1E1, an Industry Standards forum. This Working Group dealt with Analog Interfaces. Currently in BellSouth, I provide expertise on local loop transport issues, particularly in the area of Digital Subscriber Line ("DSL").

Q. HAVE YOU TESTIFIED PREVIOUSLY BEFORE ANY STATE PUBLIC SERVICE COMMISSION, AND IF SO, BRIEFLY DESCRIBE THE SUBJECT OF YOUR TESTIMONY?

A. No.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY BEING FILED TODAY?

A. I respond to portions of the direct testimonies of Mr. James D. Webber on behalf of MCI, and Mr. Mark David Van de Water on behalf of AT&T with regard to CLECs' proposal to mechanize the hot cut process.

Electronic Loop Provisioning

Q. AT&T ADVOCATES THE ELECTRONIC LOOP PROVISIONING ("ELP") PROCESS (VAN DE WATER, AT PAGE 70 OF HIS TESTIMONY). WHAT IS THIS PROCESS AND IS IT A VIABLE OPTION FOR THIS COMMISSION TO

CONSIDER?

A. In 2002, I participated in a meeting with AT&T Regulatory representatives at which the ELP concept was discussed in full. The ELP process is as follows: Where subscribers are served via copper loop facilities, i.e., no Digital Loop Carrier ("DLC") equipment is employed, ELP provides for the conversion of the analog voice grade signal to a digital format. When DLC is involved, the conversion is already done. After this conversion from analog to digital, the ELP concept provides for 'packetizing' the digital signal into Asynchronous Transfer Mode ("ATM") cells. (Note that despite AT&T's claims to the contrary, this packetization is not performed in any DLC systems used in BellSouth today). The ATM cells then transit an ATM switch. At the ATM switch, the ATM 'address' in the header of each cell is examined. Based on that destination address, the cell is then switched to the interface corresponding to the Incumbent Local Exchange Carrier ("ILEC") or Competitive Local Exchange Carrier ("CLEC") serving that subscriber. Finally, a 'de-packetizing' device is positioned between the ATM switch and each LEC's switching system, to convert the digital signal in the ATM cells back into the synchronous Time-Division-Multiplexed ("TDM") format necessary for interconnection to the switching system.

Since all carriers would be connected to the ATM switch, the manual hot cut process could be replaced with a set of commands, hence the term 'Electronic Loop Provisioning.' Note that this process would require that every loop be connected to an ATM switch, a switch that does not exist in BellSouth's network today.

Q. IS DEPLOYING ELP A REASONABLE OR JUSTIFIED PROPOSAL?

A. No. As I will explain throughout my testimony, AT&T's ELP process cannot be justified for either technical or economic reasons. First, as other BellSouth witnesses explain, the existing manual hot cut process is reliable. Second, ELP cannot be justified based on its cost. The hot cut costs incurred by the incumbent and passed onto the CLEC that would be avoided with ELP is only a one-time cost of $13 per loop transferred versus a recurring monthly charge of $6.66 on all lines. In other words, BellSouth would need to charge an additional $6.66 per loop per month forever to both its retail and wholesale customers. Moreover, it would cost BellSouth approximately $8 billion in capital expenditures to implement ELP in its network – a cost that would ultimately need to be borne by consumers through higher rates or special surcharges. Third, ELP is not the best architecture to enable DSL and would impede DSL innovation.

Q. HOW MUCH WOULD IT COST TO DEPLOY ELP?

A. The ELP cost estimate for copper loops is $339 per line; for DLC loops it is $299 per line. Based on the makeup of copper and DLC in BellSouth's region (roughly 60% of all loops are all-copper and 40% are on DLC), the melded cost per line is $323. To realize the stated goal of transferring the end user from the incumbents switch to a CLEC's switch via a 'software command', **all loops** must be modified to an ELP architecture. The estimated cost to implement ELP is approximately $8 billion region-wide. In addition, this strands about $1.6 billion in analog line equipment for BellSouth and provides no improvement in DSL availability.

Q. HOW LONG WOULD IT TAKE TO DEPLOY ELP IN BELLSOUTH'S REGION?

A. It would take at least several years, given the magnitude of such an undertaking given that each and every loop in BellSouth's region will need to be modified.

Q. DOES THE EQUIPMENT NECESSARY FOR ELP ALREADY RESIDE IN BELLSOUTH'S NETWORK AS THE CLECS' ALLEGE?

A. The CLECs' allegations are overly simplistic and therefore incorrect. BellSouth does not have any of the DLC equipment that ELP requires. Moreover, even though BellSouth has some limited ATM switching capability, BellSouth does not have the location, capacity, or quantity necessary to deploy ELP. Finally, BellSouth does not have the voice gateways necessary to connect ATM to voice in the right locations, capacity, or quantity.

Automated MDF

Q. ON PAGE 24 OF HIS TESTIMONY, MR. WEBBER OF MCI DISCUSSES THE "AUTOMATION" OF THE HOT CUT PROCESS AND REFERS TO "ELECTROMECHANICAL AND MICRO-RELAY TYPE MDFS." CAN YOU DESCRIBE THIS TECHNOLOGY?

A. Yes. What Mr. Webber wants is for BellSouth to replace the functionality of its Main Distributing Frames ("MDFs"). Some vendors are beginning to sell automated cross-connect devices that employ a physical, electrical connection.

It is important to distinguish these from the 'digital cross-connect' devices that are prevalent in the network today, and from the ATM switch employed in the AT&T ELP proposal. These new automated cross-connect devices provide for an electrical connection. They do not, therefore, require that the input signal conform to some defined format, e.g., DS-1, DS-3, etc, as do 'digital cross-connect' devices. They also do not require that the signal be in an ATM format, as does the ELP proposal. Importantly, BellSouth is not aware of any manufacturer that offers a device of sufficient scale to replace large MDFs. Thus, today this solution is not technically available.

Q. IS THE DETERRENT TO IMPLEMENTING THIS TECHNOLOGY TO PRECLUDE THE GROWTH OF UNE-L AS MR. WEBBER ALLEGES ON PAGE 25 OF HIS TESTIMONY?

A. No, the deterrent is scalability and feasibility. Let me explain. Consider a hypothetical situation involving a small Central Office ("CO") with only a thousand lines. If we assume that practically all of the loops would connect directly to the switch ports, then such an automated cross-connect may be economically feasible. In such an instance, the cross-connect device could be built with a thousand loop-side connections, a thousand switch-side connections, and could be built to be capable of cross-connecting any loop to any switch port. In fact, there are devices on the market today that have some limited capability in this regard, and BellSouth is looking at deploying such products in very small COs.

Problems arise when something other than a simple loop to switch port connection is required. For example, when it becomes necessary to connect a loop to something other than a switch, such as a Digital Subscriber Line Access Multiplexer ("DSLAM"), the 'switching matrix' becomes much more complex. In larger COs, the size and complexity of the 'switching matrix' makes such products financially impractical. BellSouth is not aware of any implementation offering more than sixteen thousand (16,000) terminations, combined loop-side and switch-side. Another constraint, of course, would be the requirement to accommodate a number of interfaces to the various CLECs offering service in a given central office. Given that each carrier (including both the incumbent and the CLECs) would need some capacity above and beyond that currently used, the capacity would be considerably less the eight thousand (8,000) lines as suggested above. In summary, the technology is simply not capable of operating at the scale needed to address the need.

GR-303

Q. PLEASE DISCUSS THE SPECIFIC ELECTRONIC UNBUNDLING METHODS FOR GR-303 COMPLIANT IDLC MR. WEBBER DISCUSSES ON PAGE 41-42 OF HIS TESTIMONY.

A. Mr. Webber talks about improving loop unbundling using GR-303-compliant equipment. This is impractical for several reasons.

First, only a small percentage of IDLC systems, in Florida and elsewhere in BellSouth, are Next Generation Digital Loop Carrier ("NGDLC") systems, capable of employing GR-303 Interface Groups. Second, wherever these systems do exist, there is a limit on the number of GR-303 Interface Groups that can be accommodated. BellSouth has deployed two (2) different types of NGDLC systems. In one type, the limit is one (1) Interface Group. For this type system, no CLEC could have its own dedicated Interface Group since only one (1) exists. In the other type, the limit is four (4) Interface Groups meaning that only three (3) CLECs could have their own dedicated Interface Group. Third, this option would require extensive Operation Support Systems ("OSS") development to manage each dedicated Interface Group.

To summarize, all of BellSouth's DLC (which comprises only about 40% of its network) is not NGDLC. Second, even where BellSouth has NGDLC, there are not sufficient facilities to serve all CLECs. Finally, even if BellSouth spent the money to replace its network with NGDLC, OSS would need to be developed.

IDLC

Q. DO THE UNBUNDLED LOOPS BELLSOUTH PROVIDES TO CLECS MEET APPROPRIATE TECHNICAL STANDARDS?

A. Yes. In an open industry forum, Technical Committee T1 has adopted certain minimum technical criteria for unbundled loops. This document is entitled T1 Technical Report # 60 "Unbundled Voicegrade Analog Loops." The loops BellSouth uses for its own retail service as well as the unbundled analog loops supplied to requesting CLECs conform to that Technical Report. BellSouth is not aware of any unbundled loop facility that, by design, fails to meet the criteria contained in that document. Furthermore, loops like this, i.e., either loaded copper loops, or loops provided via Universal Digital Loop Carrier ("UDLC"), are very commonly used to provide BellSouth's retail service.

Q. ON PAGE 48, MR. WEBBER CONTENDS THAT BY ADDING AN ADDITIONAL ANALOG TO DIGITAL CONVERSION ON THE LOOP AT THE CENTRAL OFFICE TERMINAL ("COT") IN THE CO, BELLSOUTH DOES NOT PROVIDE SERVICE "EQUIVALENT TO DS0 CAPACITY." PLEASE COMMENT.

A. I disagree with Mr. Webber's conclusion. The term 'equivalent to DS0 capacity' is not tightly defined in industry fora. In fact, even using an IDLC loop, a V.90 modem can connect at about 50 kbps or so. If we construe the 'equivalent to DS0 capacity' to require exactly 64 kbps through a dial-up data connection, then no loop meets that requirement. One could also interpret the phrase 'equivalent to a DS0 capacity' to require that the ILEC not employ, through transcoding technology, less than 64 kbps in the DLC backhaul. In this sense, UDLC meets the requirement. As referenced above, a better-defined set of requirements for unbundled loops can be found in T1 Technical Report #60.

Q. MR. WEBBER ALLEGES, ON PAGE 32 AND PAGE 37 OF HIS TESTIMONY, THAT WHEN IDLC LOOPS ARE UNBUNDLED, "[I]N MANY CIRCUMSTANCES, THE FACILITY TO WHICH THE CUSTOMER IS REASSIGNED IS TECHNOLOGICALLY INFERIOR TO THE EXISTING FACILITY OR MAY SIMPLY BE A FACILITY THAT HAS BEEN POORLY MAINTAINED." IS HE

CORRECT?

A. No. First, the allegation that a loop in BellSouth's network is "poorly maintained" is not correct. BellSouth maintains its network facilities to the applicable technical standards. It would make no sense for BellSouth to allow deployed plant to deteriorate in the ground especially considering that BellSouth uses those same facilities over which it provides service to its own retail customers.

Second, the "technologically inferior" condition of the new facility to which Mr. Webber refers is applicable only to the situation in which the end user is using a dial-up modem. It is not applicable to voice services. What Mr. Webber is really complaining about is a degradation in a service for which MCI has not paid. Specifically, while true that, in some instances, the unbundled loop to which the subscriber is transferred cannot support dial-up data at the data rate that might have been possible when the subscriber was on IDLC, at present there is no technology solution to that situation. Recently I participated in cooperation with one CLEC (DeltaCom) to determine whether a solution is available. I will discuss the technical trial in more detail later in this testimony.

Q. MR. WEBBER CLAIMS, ON PAGE 36 OF HIS TESTIMONY, THAT CLECS ARE UNABLE TO BENEFIT FROM IDLC TECHNOLOGY. IS HE CORRECT?

A. No. IDLC is a very efficient serving arrangement, when practically all of the lines served by the DLC system terminate on the local switching system into which the IDLC is integrated. CLECs could benefit from the use of IDLC technology, if the number of subscribers served at a DLC remote terminal site warrants an investment in a DLC system terminating in their switch.

Q. MR. WEBBER COMPLAINS ABOUT MODEM SPEED REDUCTION IN UNIVERSAL DLC ("UDLC") SYSTEMS. PLEASE COMMENT.

A. It is true that multiple A/D conversions — inherent to UDLC — make a dial-up data connection using the V.90 protocol impossible, and necessitates that the modems 'fall back' to a lower data rate. The key point here, however, is that CLECs are purchasing voice grade circuits from BellSouth and there is no degradation in the voice service.

Q. PLEASE BRIEFLY DESCRIBE THE GOALS OF THE IDLC TECHNICAL TRIAL THAT BELLSOUTH CONDUCTED WITH RESPECT TO REDUCED MODEM SPEEDS.

A. On January 13, 2003, I and others from BellSouth met with DeltaCom in Anniston, Alabama, to discuss the benefits and goals of BellSouth engaging in a technical trial of some technical alternatives that, if successful, might be useful in addressing DeltaCom's concerns regarding analog to digital conversions that are inherent when loops are provided over certain technology. Several other conference calls between BellSouth's and DeltaCom's technical experts ensued. In a spirit of cooperation, BellSouth agreed to shoulder the expense of this trial even though ordinarily a CLEC would detail the type loop it desired and, if that loop type is not currently offered, use the New Business Request process to have BellSouth analyze the feasibility of such a development. I was chosen to coordinate the trial and marshalled appropriate resources within BellSouth to conduct the technical trial and to document the findings of that trial.

Essentially, the trial was meant to determine if loops provided over IDLC could be provisioned without any additional analog to digital conversions (compared to the quantity of analog to digital conversions when the end user was a BellSouth retail customer) using functionality referred to as “side-door” or “hairpin” arrangements within the BellSouth switch and additional equipment referred to as Digital Cross-connect System (“DCS”) to aggregate unbundled loops for a given CLEC. For the trial, DeltaCom furnished a list of telephone numbers of ‘friendly customers’ who had BellSouth service. From this list, two (2) lines were selected. These customers were served via a Nortel DMS100 office in BellSouth's network, and DCS equipment was already installed in that building.

DMS100 switch peripheral (SMS) assignments were obtained for the loops in question. The availability of vacant DS1 terminations on the associated SMS was verified. DS1 terminations in the DCS were obtained, and BellSouth built circuits from the DCS to the SMS. The DS1 facilities between DeltaCom's collocation arrangement and the DCS were also built.

Q. WHAT WAS THE OUTCOME OF THE TECHNICAL TRIAL?

A. The trial was unsuccessful. Unfortunately, two (2) unforeseen issues arose. It turns out that the loops to be converted were working in Mode II, i.e., concentrated mode. Concentration, in this setting, is the sharing of transmission paths between the DLC Remote Terminal ("RT") and the switch. For example, two (2) end users might share a single path and this is referred to as 2:1 concentration. In the DMS100 switch, a Mode II channel must be in the four (4) right-most line card slots, i.e., channels 17-24, of the digital transmission facility in order to be 'hairpinned' in the switch.

BellSouth also learned during the trial that only one (1) customer may be assigned to the RT card (which normally accommodates two lines) serving the loop to be unbundled. This limitation arises due to the fact that the DMS100 'nails up' both channels on the line card. Because it's extremely unlikely that both end-users would be converting simultaneously to the same CLEC, this effectively means that the other channel must be vacant, resulting in stranded investment. To overcome these limitations, the end-users to be converted would have to be re-assigned to other DLC cards or other facilities. This would involve, among other things, a transfer at the crossbox.

When the unanticipated cost of the line rearrangements (necessary to 'hairpin' a mode II IDLC channel in a DMS100 office) became known, the process was viewed to be even less viable. No effort was made to transfer the end-users or continue the trial. Finally, when BellSouth better understood the effect of multiple links of robbed-bit signaling on V.90 modem performance, there was simply no point in continuing the work. BellSouth removed the temporary arrangements it had made and informed DeltaCom, in a conference call of both parties' technical subject matter experts participating, that the trial was unsuccessful.

Q. WHAT DOCUMENTATION OF THE TECHNICAL TRIAL DID BELLSOUTH PROVIDE TO DELTACOM?

A. The best description of the trial outcome is documented in the "white paper" that I produced at the end of the trial. A copy of that "white paper" was furnished to DeltaCom at the end of the trial and is attached to this testimony as Exhibit GT-1.

Q. HAS DELTACOM RESPONDED FORMALLY TO BELLSOUTH'S "WHITE PAPER" DISCUSSING THE OUTCOME OF THE TECHNICAL TRIAL?

A. No. I was on the conference call I mentioned earlier and I believe DeltaCom's representative appreciated the candor with which BellSouth explained its findings. From BellSouth's viewpoint, I believe the technical trial demonstrates that the technical solutions attempted are not technically feasible. At the conclusion of the conference call, BellSouth invited DeltaCom to suggest other technical solutions but so far, DeltaCom has made no such suggestion. To summarize, it is my belief that BellSouth and DeltaCom worked together in good faith to solve a technical problem for which at present there is no technically feasible solution.

Q. ON PAGE 33 OF HIS TESTIMONY, MR. WEBBER HYPOTHESIZES ABOUT THE DEVELOPMENT OF "TWO NETWORKS." IS HIS HYPOTHETICAL A LIKELY OUTCOME?

A. One can only guess that the two networks to which Mr. Webber alludes are 1)

Loops provided via IDLC, and 2) Loops provided via loaded copper and UDLC. As mentioned above, though, BellSouth uses the latter technologies extensively to provide its own retail offering. Given that it is in BellSouth's best interest to provide the best service possible, I do not agree that this hypothesis is a likely outcome.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.

Overview

This paper documents the lessons learned in a trial with ITC/DeltaCom. The trial attempted to unbundle a loop delivered via Integrated Digital Loop Carrier (IDLC) without incurring an additional Analog to Digital conversion. The trial was not successful.

Analog to Digital Conversions

Analog to Digital (A/D) conversions occur at analog interfaces to digital transport and digital switching. The latest dial-up modem protocol (as documented in ITU Recommendations V.90 and V.92) requires that there be only one A/D conversion, between the server modem pool (usually designated as a Remote Access Server) and the end-user. In the case of a digital switch serving metallic loops, with a digital trunk to a RAS, there is one A/D conversion in the line interface card in the digital switch. The V.90 protocol can be supported.

In the case of a digital switch serving Universal Digital Loop Carrier (UDLC), there is another A/D conversion in the channel unit at the DLC Remote Terminal (RT). The V.90 protocol cannot be accommodated, and the modems 'fall back' to the previous generation protocol, documented in ITU Recommendation V.34.

When IDLC to an ILEC switch is employed, there is no A/D conversion at the switch. The V.90 protocol can be supported.

Conversion to a UNE Loop

All three loop-types described above, i.e., metallic, UDLC, and IDLC, can be unbundled. Conversion of a metallic loop is straightforward. The A/D conversion point moves to the CLEC. Similarly, when a UDLC loop is unbundled, there are no additional A/D conversions. There were two A/D conversions when the end-user was served by the ILEC and there are two conversions when the end-user is served by the CLEC.

It is when the end-user is served via IDLC that the problem gets interesting. In different places, we have documented the various alternatives that are available when making such a conversion. They are as follows:

- Transfer the loop to copper feeder, if available
- Transfer the loop to a UDLC channel, if available
- Route the T1 lines serving the IDLC through a Digital Cross-Connect System. Subsequently, digitally cross-connect the channel to either a UDLC COT or a DS1 interface to the CLEC
- Use the switch-based 'hairpin' capability to route the channel back out of the switch, for connection to either a UDLC COT or a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC
- Convert the IDLC system to UDLC

If the IDLC system is an NGDLC system, it is — at least theoretically — possible to use the time-slot interchanger to connect the channel to either a UDLC COT, or a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC. We do not, however, have the OAM&P systems in place to utilize this capability.

Note that some of these alternatives add an A/D Conversion. Those alternatives that do not add an A/D conversion are as follows:

- Transfer the loop to copper feeder, if available
- Route the T1 lines serving the IDLC through a Digital Cross-Connect System. Subsequently, digitally cross-connect the channel to either a DS1 interface to the CLEC
- Use the switch-based 'hairpin' capability to route the channel back out of the switch, for connection to a Digital Cross-Connect System, for further grooming to a DS1 interface toward the CLEC

Multiple Robbed-Bit Signaling Links

The fact that the V.90 protocol cannot be supported across multiple A/D conversions is well known in the industry. It's less well known, though, that the presence of only 1 A/D conversion does not — in itself — guarantee that the V.90 protocol can be supported. Another limiting factor is multiple links of robbed-bit signaling.

DLC systems employ robbed-bit signaling, where the least-significant bit of the 8 bit encoded sample is overwritten with signaling information every 6th frame. The V.90 protocol is designed to recognize the robbed bit every 6th frame, so this isn't a problem with IDLC (into an ILEC switch).

When a DS0 with robbed-bit signaling traverses multiple DS1 links without intermediate conversions to analog, using a Digital Cross-Connect System (DCS) for instance, it's necessary that the signaling bits be written to multiple frames. This is necessary because the DS1's are not aligned on these six-frame groups (denoted superframes), or even frames, for that matter). The 6th frame in the first link, for instance, may be the 3rd frame in the next link. To overcome this problem, the product connecting the links (the DCS, to use the above example) must find the incoming superframe boundaries, detect the incoming signaling state, find the outgoing superframe boundaries, and repeat the signaling bits. It can be seen that 5/6 of the time, this will involve overwriting of a bit that was valid data.

As one might expect, multiple links of robbed-bit signaling impair the performance of V.90 modems. *This is a very important point that wasn't fully appreciated at the onset of the trial.* This problem is described in more detail in Annex A of ANSI T1.403.02a-2001, **Network and Customer Installation Interfaces — DS1 Robbed-bit Signaling State Definitions**. While the problem is well documented in the reference, the impact, i.e., that percentage of modems that can run V.90 across a specific number of robbed-bit links, isn't documented in the public domain. Discussions with vendors, though, indicate that most V.90 modems cannot employ the V.90 protocol when exposed to 3 such links. They 'fall back' to the V.34 protocol at 33.6 kbps or less.

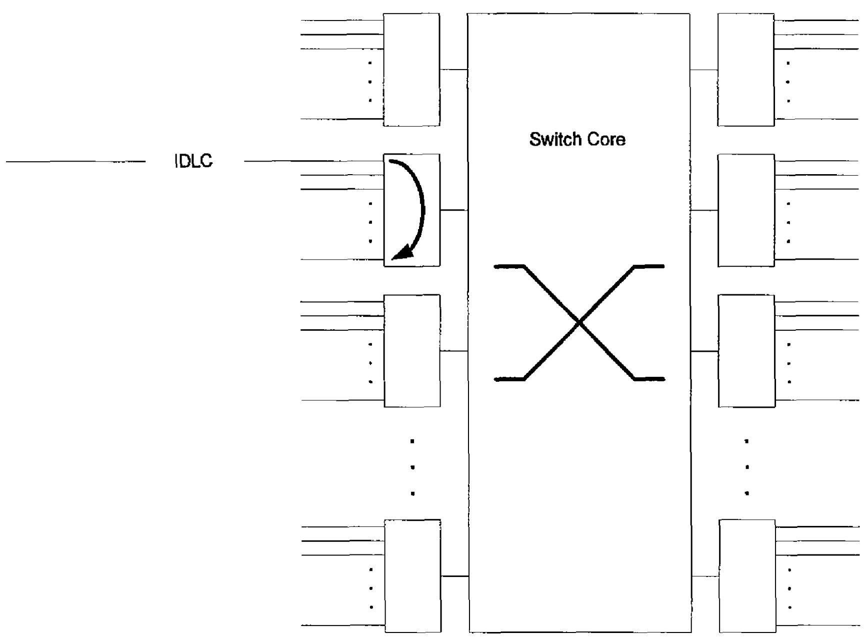
ITC/DeltaCom

ITC/DeltaCom initiated discussions with BellSouth regarding the unbundling of IDLC loops without incurring additional A/D conversions. After initial discussions, a decision was made to conduct a trial.

Although both parties recognized that the alternative of transferring a loop to copper feeder (if the copper is available) was a means of unbundling a loop without incurring an additional A/D conversion, such a conversion was not part of the trial. Early in the discussion, ITC/DeltaCom indicated that they has tried such conversions in the past, and had experienced various voicegrade transmission impairments. This avenue was not further pursued.

The second alternative, i.e., grooming of IDLC Channels in a Digital Cross-Connect System (DCS) was discussed. This alternative has a number of shortcomings. For one thing, a DCS not available in all CO's. For another, the DS1 circuits serving the DLC system must be routed through the DCS. This activity has a long lead time, and cannot be accommodated on a service-order basis. There is also a significant cost associated with the required DCS ports, and the associated maintenance activity. It should also be noted that any service outages during these rearrangements would affect all users served by the DLC system, not just those users converting to the CLEC. For these reasons, this alternative was not pursued.

The remaining alternative, i.e., using the switch-based 'hairpin' capability was the focus of the trial. We recognized at that time that, in a DMS100, the 'nail-up' could only be made within the switch peripheral, as illustrated in Figure 1, below:



DMS-100
Nail-Up only in Peripheral

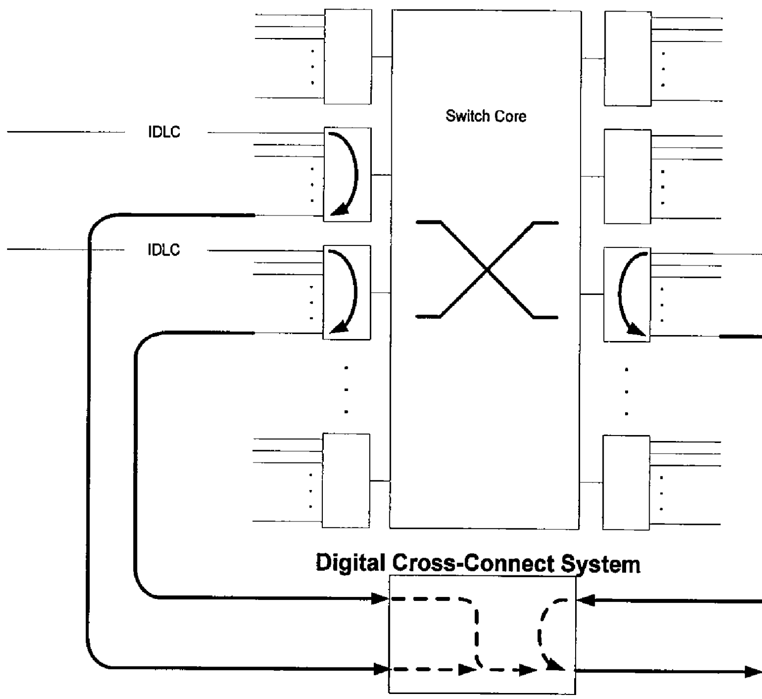
Figure 1

We also recognized that lines served via GR-303 IDLC and via Nortel DMS-1 Urban could not be 'nailed-up.'

We thought that the 5ESS and the EWSD did not suffer from the first limitation. The documentation on those switches suggested that they offered the ability to 'nail-up' a connection across an office, i.e., from one peripheral to another. Subsequent testing in the BellSouth technology Assessment Center proved that not to be the case. Only connections within the same switch peripheral can be 'nailed-up.'

The issue of multiple links of robbed-bit signaling (arising from chaining together these DS1's), and its effect on V.90 performance, was not discussed.

We recognized other limitations. We knew, for instance, that there are a limited number of ports per peripheral. We also recognized that this arrangement would have a very low DS1 fill unless a DCS were added, as illustrated in Figure 2, below.



Aggregation via DCS

Figure 2

For the trial, ITC/DeltaCom furnished a list of telephone numbers of 'friendly customers' who has BST service. From this list, two lines were selected. These customers were served via a DMS100 office, and a DCS was in the building.

DMS100 switch peripheral (SMS) assignments were obtained for the loops in question. The availability of vacant DS1 terminations on the associated SMS was verified. DS1 terminations in the DCS were obtained, and circuits were built from the DCS to the SMS's. The DS1 between DeltaCom's collocation and the DCS was also built.

Lessons Learned

Unfortunately, two unforeseen issues arose. It turns out that the loops to be converted were working in Mode II, i.e., concentrated mode. In the DMS100 switch, a Mode II channel must be in the four right-most slots, i.e., channels 17-24, of a digroup in order to be 'hairpinned' [1].

We also found that only one customer may be assigned to the RT card (which normally accommodates two lines) serving the loop to be unbundled. This limitation arises due to the fact that the DMS100 'nails up' both channels on the card. Because it's extremely unlikely that both end-users would be converting simultaneously to the same CLEC, this effectively means that the other channel must be vacant.

To overcome these limitations, the end-users to be converted would have to be re-assigned. This would involve, among other things, a transfer at the crossbox.

Conclusion

We recognized, going into this trial, that it would be expensive. Anticipated costs included the following:

- Determining the availability of spare switch peripheral ports,
- Determining the availability of a Digital Cross-Connect System and spare ports
- The provisioning of DS1 links between the switch peripherals and the Digital Cross-Connect ports
- The use of the Digital Cross-Connect system

When the unanticipated cost of the line rearrangements (necessary to 'hairpin' a mode II IDLC channel in a DMS100 office) became known, the process was viewed to be even less viable. No effort was made to transfer the end-users or continue the trial.

When we better understood the effect of concatenated links of robbed-bit signaling on V.90 modem performance, there was simply no point in continuing the work.

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[1] These slots were the only ones available for services requiring full-period assignment, i.e., coin and special services, in a SLC-96 system. A Series 5 system has no such slot restrictions, but it appears that the DMS100 retains the limitation even with the Series 5.