ATTACHMENT C

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RL: 01-12-002BT

BELLSOUTH®

file code: 204.000

subject: ADSL Planning Directives

type: Information Letter

date:

replaces: RL: 00-01-012BT

related: Reference List

to: Attached Distribution List

entities: BellSouth Telecommunications, Inc.

from: Peter Hill, NVP-Technology Planning and Deployment, Science and Technology

description: Planning recommendations for the deployment of ADSL, remote DSL access multiplexers and remote access multiplexers.

* * *

This letter transmits our recommendations for the planning and deployment of ADSL technologies. While many of the long range planning decisions for ADSL are being driven by headquarters organizations, there are many current planning and deployment decisions that field planners and capacity managers will need to resolve. ADSL capabilities will need to be deployed in the near term at thousands of digital loop carrier sites. The rapid ADSL deployment that will be required over the next few years to meet high speed data demand and competition is a very important step for our company. The use of these directives will permit you to optimize the design of our high-speed network.

Questions from your organization may be directed to Jim Jackson at (205) 977-5032 or to John Jackson at (205) 977-5043.

Peter Hill
NVP-Technology Planning and Deployment, Science and Technology

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Executive Summary

The pace of ADSL deployments for the next few years will need to continue at a rapid pace to provide high speed data services to a broad cross section of Bellsouth customers. ADSL capabilities will need to be deployed in the near term at thousands of digital loop carrier sites. Initial ADSL deployments will use digital subscriber line access multiplexers (DSLAMs) or remote access multiplexers (RAMs). Channel units that combine voice and ADSL in a combination channel unit also known as integrated ADSL will play a major role in ADSL deployments in 2002 and beyond for NGDLC and SLC Series 5. ADSL capabilities on FITL platforms will also be ready for deployment in 2002. These new capabilities are an important factor in your ADSL design decisions

The rapid ADSL deployment that will be required over the next few years to meet high speed data demand and competition will provide many opportunities to maximize value and minimize investments if carefully planned and deployed. Failure to carefully plan and deploy ADSL equipment will result in higher costs, increased labor requirements, and a lower quality of service for customers.

Summary of the planning considerations included in this directive:

1. Loops that support ADSL
    A. Non-loaded copper, generally less than 18kft
    B. Any Carrier Serving Area design copper
    C. Not on same pair with ISDN, P-phone, DDS/SynchroNet, program audio, DAML
2. DSLAM functionality must be provided at DLC RT site to provide ADSL on DLC loops
    A. When activating Remote DSLAM, all copper ADSL lines in the affected FDIs must be cut-over to the Remote DSLAM – or
    B. If copper ADSL capacity in FDIs is greater than the 1-2 year forecasted ADSL demand, all lines requesting ADSL should be moved from DLC to copper feeder to provide ADSL rather than installing Remote DSLAM
    C. Terminate Remote DSLAM pairs in FDI where practical to provide maximum flexibility whether using existing FDI capacity or a new tandem FDI is required
    D. Use protector jumper to wire in remote DSLAM where less than 216 ADSL connections will be made in an enclosure
    E. Splice Remote DSLAM to DLC derived pairs where not practical to terminate pairs in FDI.
        - Splice to vacant capacity to minimize moving lines
        - When cut-through card is replaced with splitter to activate the 1st ADSL line on that slot, all services on that card that use spectrum above 4kHz must be moved to non-ADSL DLC capacity.

3. SLC Series 5 and NGDLC voice and ADSL combination channel units will reduce wire work associated with ADSL remote facility provisioning and ADSL service activation
    A. Catena Networks CNX-5 products provide the capability for ADSL services from SLC Series 5 dual channel banks and will be ready for deployment in April 2002
    B. Marconi DISC*S channel units that provide both voice and ADSL will be ready for deployment in the second half of 2002
    C. Alcatel Litespan channel units that provide both voice and ADSL will be ready for deployment in the second half of 2002
4. ADSL capabilities for Marconi fiber distribution platforms will be deployed in 2002
    A. ADSL upgrades for the Marconi FITL-A systems are ready for deployment now. Broadband and Internet Services is prioritizing deployment plans to maximize revenues achieved by the upgrades.
    B. Marconi MX ADSL capabilities will be ready for deployment the second half of 2002

1.0 Introduction

This document is provided to highlight ADSL planning and deployment issues that can impact costs, customer service perception, and workforce requirements.

While many long range planning decisions for ADSL are currently being driven by headquarters organizations, there are a number of current planning issues and deployment options that need to be considered by field planners and capacity managers. Additionally, it is expected that more of the longer range planning process will transition from headquarters to field organizations over time. This document will provide a brief overview of the ADSL architecture alternatives and will identify issues and their impacts.

2.0 ADSL Services

BellSouth ADSL service is intended as an industrial offering that is made available to Network Service Providers for provision of high-speed data service to their customers. The service establishes a point-to-point virtual circuit between two customer-designated locations. The actual data throughput that the end user achieves depends on the transmission characteristics of the loop and the inside wire that serves his/her location. The DSLAM limits the maximum data throughput in both directions.

Two basic service classes are currently offered. These two service classes are industrial, which provides best effort residential service at one specified peak rate, and business, which provides multiple service category options with differing bit rates and Quality of Service (QoS) options. The table below summarizes the service offerings available and the provisioning parameters.

Advertised	Service	Downstream		Upstream	
Rate	Class	Minimum	Maximum	Minimum	Maximum
1.5Mbps X 256kbps	Industrial	256kbps	1.5 Mbps	128kbps	256kbps
192kbps X 192kbps	Business	192kbps	1024kbps	192kbps	768kbps
384kbps X 384kbps	Business	384 kbps	384 kbps	384 kbps	384 kbps
768kbps X512kbps	Business	768 kbps	1024kbps	512 kbps	768 kbps
1.5Mbps X 512kbps	Business	1.5 Mbps	1.8 Mbps	512 kbps	768 kbps
2-4Mbps X 640kbps	Business	2.0 Mbps	4.0Mbps	640 kbps	896 kbps
4-6Mbps X 640kbps	Business	4.0Mbps	6.0 Mbps	640 kbps	896 kbps

Since all of the business class services involve guaranteed ADSL modem data rates, service inquiries and circuit design processes are used for these services.

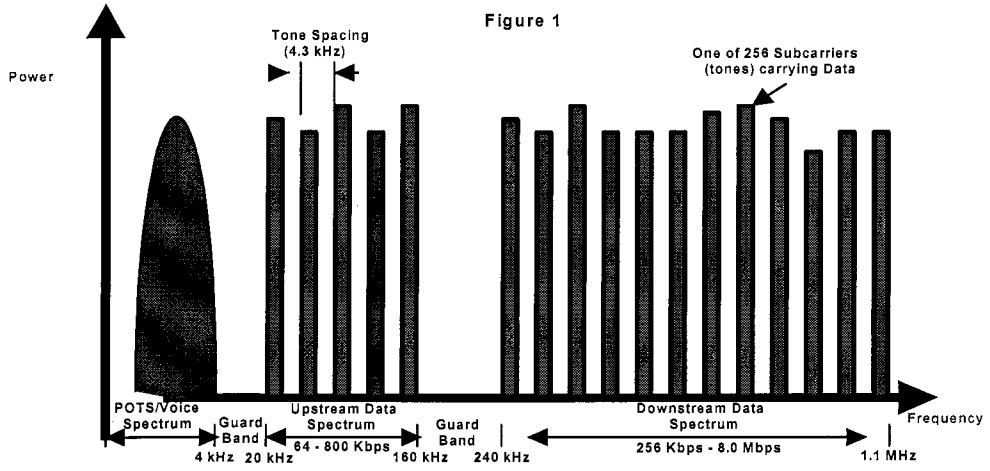
3.0 ADSL Architectures

Asymmetrical Digital Subscriber Line (ADSL) is a data-over-voice transmission system that operates over a copper cable pair. US and international standards are in place for ADSL. ADSL equipment is available in two versions. Full rate ADSL, described by the standard document T1.413 and ITU recommendation G.dmt, provides for up to 8 Mb/s transmission rates from the network toward the subscriber and up to 800 kb/s from the subscriber toward the network. Universal ADSL, ITU recommendation G.lite provides for up to 1.544Mb/s

transmission rates from the network toward the subscriber and up to 500 kb/s from the subscriber toward the network.

Both of these systems use frequency division multiplexing (FDM) to provide separate channels for voice, downstream data, and upstream data. Within the frequency spectrum allocated to data, up to 256 discrete tones are used as subcarriers for data at up to 32kb/s each. Tones are selected for use and symbols per tone are assigned based on the transmission impairments present on the cable pair when the system starts up. Additionally, symbols per tone adjustments are made during operation if line conditions change. This method of operation allows the system to operate at the maximum rate possible based on the loop conditions that it encounters. This means that ADSL data rates will be different for different loop lengths and for different noise conditions. The noise sources with the largest impact on ADSL operation are crosstalk from T1 and HDSL in the same binder group and AM radio interference. Figure 1 illustrates the frequency allocations for voice and both directions of transmission for data.

Figure 1



The ADSL system illustrated in Figure 1 is the full rate system. Universal ADSL, G.lite, is the same type of transmission system, but uses only 128 tones instead of the full rate system's 256. Universal ADSL also transmits at a lower power level.

ADSL will generally work at some data rate within our service offering on any non-loaded loop meeting 1300 Ohm resistance design or carrier serving area design rules. Since ADSL uses spectrum well above the voice spectrum, it can not be used on loaded cable because the loading inductance has the effect of making the bandpass of the cable DC to 3kHz. Furthermore, ADSL cannot work on loops with ISDN, P-Phone, DDS/SynchroNet, program audio, and any service provided via DAML since they all use spectrum above 4kHz.

3.1 Copper Loop ADSL Deployment

The network architecture for ADSL deployed on loops that are copper from the CO to the end user is illustrated in Figure 2.

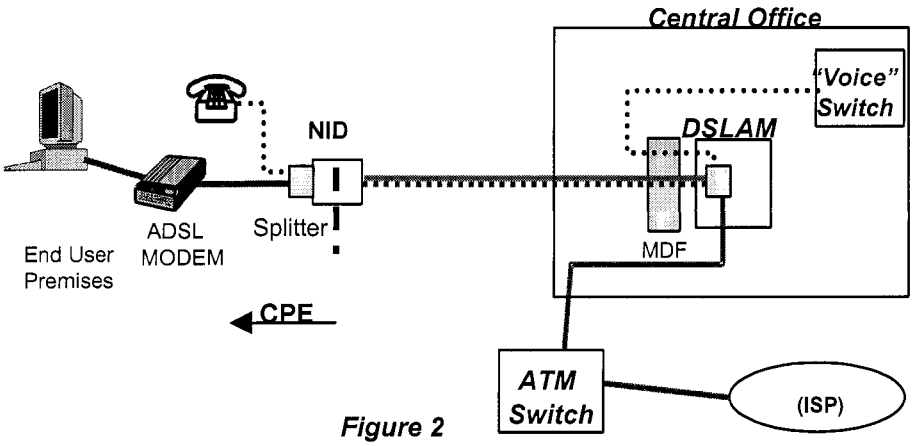


Figure 2
ADSL on copper loop from the Central Office

The digital subscriber line access multiplexer (DSLAM) in the CO is the equipment shelf that houses the splitter, the ADSL modem, and ATM multiplexer function. Information about DSLAM equipment configurations and design can be found in "Non-Aggregated DSL Architecture Technical Service Description" available at http://technology.snt.bst.bls.com/. The splitter provides a low pass filtering function so that only signals in the DC to 4kHz band are sent to the circuit switch providing the customer's telephone service. The ADSL modem terminates the DMT transmission system and provides the input and output interfaces to the high-speed data buses. The data buses are where the ATM cells for all of the customers on the DSLAM are statistically multiplexed onto a DS3 or OC3 interface for connection to the ATM switching network.

Between the DSLAM and the end user premises, the voice and data signals are multiplexed as illustrated in Figure 1.

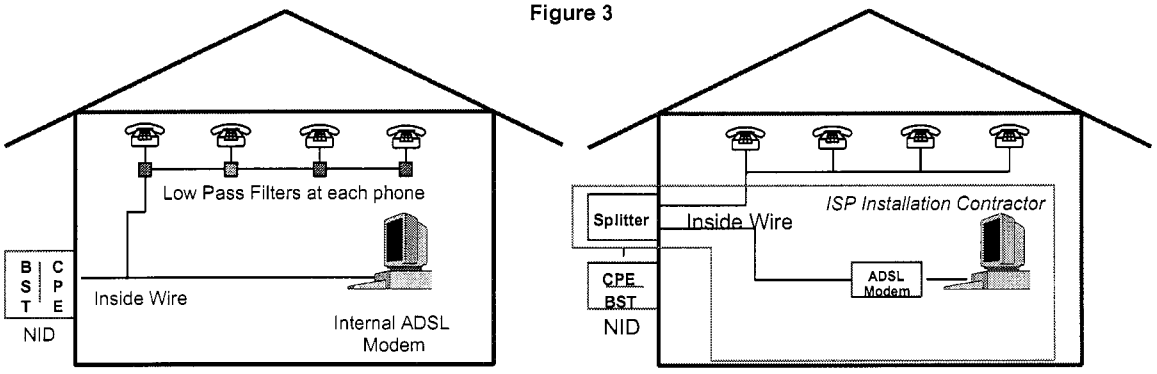
At the end user premises there is a splitter on the customer side of the network interface device. That splitter provides a low pass filtering function so that only signals in the DC to 4kHz band are sent to the customer's telephone sets. Separate inside wire pairs or separate inside wiring runs are required for voice services and ADSL between the splitter and the ADSL modem when using the full rate ADSL equipment currently being deployed. When the universal ADSL equipment becomes available later this year, the splitter at the NID will no longer be required and there will be no need to have separate inside wire pairs for voice and data. For universal ADSL both voice and data signals will be delivered to all of the RJ11s on the inside wire. However, each telephone or other voice band device will need to have a small low pass filter inserted in series at the jack. The ADSL modem at the end user premises terminates the DMT transmission system and provides the input and output interfaces to the user's computer or other data appliance. BellSouth also offers splitterless operation of full rate ADSL service.

There is no difference in service order process for splitterless ADSL compared to ADSL with a splitter located at the NID and therefore no impact to service order processing. This is a self-install done by the customer that saves the "Truck Roll" and is done at the customer's convenience without having to wait on a Service Technician to visit the home.

NSPs are notified that, if there is a burglar alarm on the line, this splitterless self-install operation may not be possible due to the fact that it may cause the alarm to malfunction if there is not a way to insert a low pass filter in the burglar alarm transmission path.

The differences in end-user wiring arrangements are illustrated in Figure 3.

Figure 3



Inside Wiring Arrangement for Splitterless ADSL

Inside Wiring Arrangement for ADSL with Splitter

One of the reasons for the development of the Universal ADSL standard was the desire for an alternative that would not require re-configuration of the end user's inside wire. That is the reason that universal ADSL is sometimes referred to as "splitterless ADSL". This was in an attempt to make it possible for ADSL installation not to require a field visit by the ISP's installation contractor. As illustrated in the universal ADSL portion of Figure 3, this may be possible if the user can install the filters at each telephone. The filters are available with modular jack connections for most applications. Users may need assistance for connections to their inside wiring that are not made in modular jacks. These might include wiring in older homes or connections of intrusion/fire alarm equipment. This assistance is the responsibility of the end user and the ISP or ISP installation contractor.

3.2 Digital Loop Carrier Architectures for ADSL

Functionally, the network architecture for providing ADSL services over loops utilizing digital loop carrier changes primarily by moving the DSLAM functionality from the CO to the DLC remote terminal site. This is accomplished either by placing DSLAM shelves at RT sites as Remote DSLAMS or by placing smaller remote access multiplexers (RAMs or Mini-RAMs) at the RT and hubbing these back to the CO DSLAM. This allows the ADSL modem to be connected to the copper loop beyond the DLC. Figure 4 illustrates this configuration.

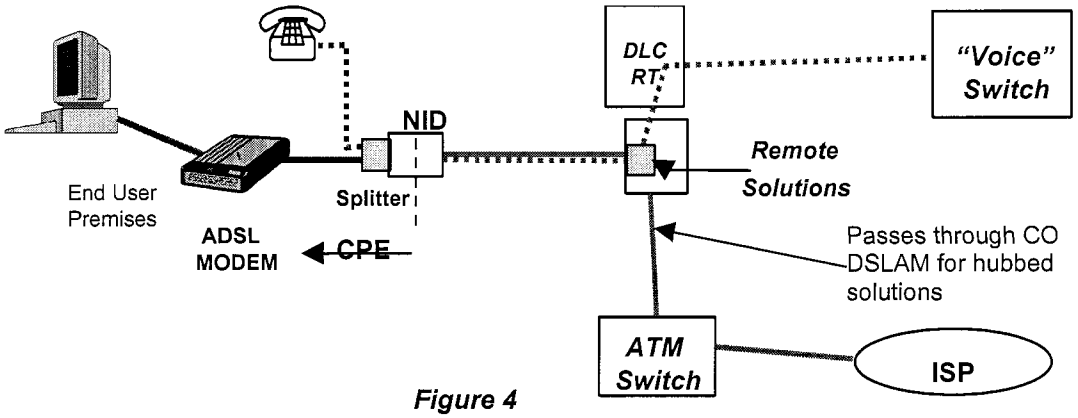


Figure 4
ADSL on DLC feeder loop

Technical Service Descriptions and Network Service Descriptions for equipment configurations used to provide ADSL services may be found at: http://technology.snt.bst.bls.com/ under the documents page of the broadband access section.

4.0 ADSL Remote Solutions CAUTION!

For all remote solution alternatives it is required that ***all copper served ADSL lines*** in the FDIs served by the DLC site where the remote solution is being added ***must be cutover to the remote solution***. If this is not done before new ADSL lines are added from the remote solution, the copper ADSL lines in the same sheath/binder group with the new ADSL line anywhere in the distribution plant will go out of service or at least there will be a dramatic reduction in the data rate that can be achieved. The already attenuated signal on the copper served ADSL line will be overpowered by the near end crosstalk from the ADSL modem in the remote solution. More complete discussion of the spectrum management issues and alternatives concerning mixing various ADSL and other copper transmission systems in the loop plant can be found in RL: 01-05-027BT, "Overview of Spectrum Management Requirements" at the Technology Directives website: http://technology.snt.bst.bls.com/techdirect/Loop.html

If ADSL capable copper feeder facilities sufficient to meet 2 years demand is available at an FDI that is also fed by DLC, the copper facilities should be used to support ADSL and the remote solution deferred for that FDI. Operations systems have been updated to accommodate this alternative.

Numerous remote solutions have been developed to provide the flexibility to economically meet ADSL demands for areas served by digital loop carrier. The table below provides a listing of remote solutions. Standard density DSLAM shelf solutions have generally been discontinued, although some limited supplies will be available for 2002 deployments in ADJ96 and STR48C configurations. See OSP Engineering M&Ps for availability of the various alternatives at intranet site http://npps.bst.bls.com/users/ospes/ADSL/index.html

Current Copper Remote Solutions

Remote Solution	Housing Type	Backbone Feed	ADSL Ports	Shelves
MR-1400	MicroRAM mini-RAM	1-4 DS1's IMA	16	N/A
ADJ96	Avaya 52B Cabinet	4 DS1's IMA Per Shelf	96	2 Standard Density Shelves
ADJ108	Avaya 52B Cabinet	8 DS1s IMA	108	Low profile High Density Shelf
STR108C	Existing Cabinet	8 DS1s IMA	108	Low profile High Density Shelf
ADJ144	Avaya 52B Cabinet	DS3	144	Low profile High Density Shelf
STR48 & STR48C	Existing Structure	4 DS1's IMA	48	1 Standard Density Shelf
RD216	MESA2 Cabinet	DS3	216	1 High Density Shelf
STR216	Existing Structure	DS3	216	1 High Density Shelf
ADJ216	Avaya 52B Cabinet	DS3	216	1 High Density Shelf
STR432	Existing Structure	DS3	432	2 High Density Shelves
STR648	Existing Structure	DS3	648	3 High Density Shelves
STR864	Existing Structure	DS3	864	4 High Density Shelves
RD432	MESA4 Cabinet	DS3	432	2 High Density Shelves (optional Mux)
RD864	MESA4 Cabinet	DS3	864	4 High Density Shelves (Optional Mux)
RD648	MESA4 Cabinet	DS3	648	3 High Density Shelves (Optional Mux)
CNX-5 DS1 Systems	Existing Cabinet or Structure	4 DS1's IMA	48 per DCB	Equipped per SLC5 DCB
CNX-5 DS3 Systems	Existing Cabinet or Structure	1, DS3 for up to 9 SLC5 DBC	116 per DCB	Equipped per SLC5 DCB
DISC*S Integrated ADSL on copper	Existing Cabinet or Structure	1-4 DS1s IMA per channel shelf	48 per channel shelf	Equipped per channel shelf
Litespan integrated ADSL on copper	Existing Cabinet or Structure	OC3	224 per cabinet	Equipped per cabinet

For those solutions using multiple DS1s, ATM Inverse Multiplexing (IMA) is employed at the DSLAM and remote solution to create a single virtual pipe to maximize utilization of the available bandwidth. This is done in the DSLAM and remote equipment and does not require any special equipment separate from those units.

Discontinued Copper Remote Solutions

Remote Solution	Housing Type	Backbone Feed	ADSL Ports	Shelves
AMR8	Alcatel mini-RAM	1-4 DS1's IMA	8	N/A
RD144	MESA2 Cabinet	DS3	144	3 Standard Density Shelves W/ MUX
RD192	MESA2 Cabinet	DS3	192	4 Standard Density Shelves
STR96	Existing Structure	DS3	96	2 Standard Density Shelves
STR144	Existing Structure	DS3	144	3 Standard Density Shelves
RD576	MESA4 Cabinet	2 DS3's	576	2 Standard & 2 High Density Shelves

5.0 ADSL Wiring Arrangements at RT Sites

All of the remote solutions for ADSL that do not integrate ADSL and voice service on the same channel units at the RT present a challenge as to how to insert the ADSL equipment is series with the existing voice service configurations. Three methods are available to accomplish this wiring challenge. Practice 915-800-022PR contains outside plant engineering methods and procedures for these configurations.

5.1 Terminated Method

The recommended method to interconnect a remote solution with a POTS line is by means of the terminated method in a feeder-distribution interface (FDI). This configuration allows any DLC derived feeder facility to be wired through the Remote DSLAM cabinet so that the ADSL signal can be added to the facility already providing the end user's voice service. This will usually require the installation of a new tandem FDI. The tandem FDI should be sized to terminate the ultimate number of PG derived pairs plus the ultimate number of ADSL ports for the site. The total number of binding posts in the FDI needs to be at least twice the sum of the PG plus ADSL pairs since these are "in" and "out" terminations. Remote DSLAM and other "special" capabilities such as universal DLC, Mode I vs Mode II, etc., can be provided only to the tandem FDI. The out count from that cross connect can be used as the feeder to all of the FDIs served by the DLC site where the Remote DSLAM is located. While this alternative can be expensive to initially implement, it can reduce monitoring and provisioning expense by reducing the need to monitor multiple FDIs for these "special" facility types.

5.2 Protector Jumper Method

The next method to interconnect ADSL with POTS is the protector-jumper method. The protector-jumper method can be utilized when the ADSL capacity can be spread among several DLE cabinets. No more than 216 interconnections should be attempted within a cabinet. This limit is due to the congestion caused by so many jumpers within the protector panels that can lead to an increase in trouble reports.

There are no suggested limits on the number of protector-jumper interconnections in a larger structure such as a CEV or Hut. However, when more than 216 protector-jumpers are being proposed, the Loop Capacity Manager (LCM) should obtain the concurrence of the

Construction and I&M groups for the jumper routing and agree on an appropriate wire management plan.

5.3 Direct Splice Method

Another alternative for connecting the Remote DSLAM to the existing cable is to splice the DSLAM cable in series with some or all of the channel bank capacity available in that DLC remote terminal enclosure. Unless all DLC capacity can be spliced to the Remote DSLAM, existing lines requesting ADSL service must be moved to the portion of the DLC capacity that is "ADSL capable", at the time of the ADSL service request. It is recommended that the Remote DSLAM be spliced to vacant DLC capacity if available to avoid moving two lines on each service request (one to vacate an "ADSL capable" channel and another to move the line requesting ADSL service to the "ADSL capable" channel). Where growth will require future channel bank placements, consideration should be given to advancing the addition of channel bank capacity so that vacant capacity is available to be spliced to the Remote DSLAM equipment. The trade-off to be considered here is 2 LST per ADSL order versus one. Therefore, the cost trade-off is the cost of an LST per ADSL order compared to the cost of advancing a channel bank. However, it is not technically necessary to splice the Remote DSLAM to only vacant DLC capacity.

When the Remote DSLAM is spliced to working DLC channels a "cut-through card" in the Remote DSLAM provides continuity so that existing services will continue to work properly. When the cut-through card is replaced with a splitter card to activate an ADSL customer, all four lines associated with the Remote DSLAM slot where that splitter is placed will be routed through the splitter and ADSL circuits. This will not affect basic telephone service because the splitter will provide continuity and the startup protocol for the ADSL equipment calls for the ADSL electronics to remain silent until an ADSL user modem sends a startup signal. However, services that use frequencies above 4 kHz must be moved to non-ADSL channels at the time that the cut-through card is replaced with a splitter since the splitter low pass filter will not pass frequencies above 4kHz. This would include ISDN, P-Phone, DDS/SynchroNet, program audio, and any service provided via DAML.

6.0 NGDLC ADSL Capabilities

Both Alcatel Litespan® and Marconi DISC*S® NGDLC systems have channel units with voice and ADSL. These capabilities upgrade the NGDLC system to provide ADSL services without deployment of standalone remote DSLAMs. Since both voice and ADSL are provided from the same channel unit, the complex wiring to insert the ADSL electronics in series with existing voice services is eliminated.

6.1 DISC*S ADSL Implementation

The DISC*S ADSL implementation requires a Data Aggregation Unit (DAU) for each channel shelf equipped for ADSL. The DAU can be placed in any channel slot on the channel shelf, but it does reduce the total capacity of the shelf by one slot to 94 lines. When a customer requests ADSL service, the channel unit serving that customer must be replaced with an ADSL channel unit. The DCU207 will provide voice and ADSL to subscriber lines. Wiring rearrangements may be required at the RT or at the FDI if Line & Station transfers (LSTs) are required to vacate a channel slot for the DAU, to move a customer to a shelf equipped for ADSL, or to move a customer to a channel unit with spare

ADSL capacity. DS1s from the DAUs will be transported back to the CO over the SONET system and terminated on an access multiplexer shelf.

6.2 Litespan ADSL Implementation

The Litespan ADSL implementation requires that the bank controller unit (BCU) be replaced with an ATM bank controller unit (ABCU) in each channel bank assembly equipped for ADSL. The Litespan ADSL channel units can support 4 lines of both ADSL & POTS. When an existing POTS customer requests ADSL, the existing quad POTS channel unit must be changed out to an ADSL channel unit for those customers in a CBA that has been upgraded to be ADSL capable. If the customer requesting ADSL service is not in a CBA that has been upgraded, an LST will be required to move the customer to the upgraded CBA. Heat dissipation and power consumption will generally allow only one CBA per cabinet to be equipped for ADSL. For huts and CEVs heat dissipation limitations on ADSL capacity must be engineered on a case-by-case basis. James Viator at (404)529-3994 will assist with capacity limitation calculation based on enclosure capacities plus existing and planned equipment. In huts and CEVs where multiple CBA are upgraded for ADSL, ABCUs can be daisy-chained together so that only one ATM transport link is required from the RT to the CO.

7.0 Catena Networks CNX-5

This ADSL platform provides a way to deliver ADSL utilizing the existing SLC Series 5 Dual Channel Bank (DCB) that is widely deployed throughout the BellSouth network. The upgrade required to perform this functionality is relatively simple and therefore provides initial labor savings as well as increased speed to market for faster coverage. There are two versions of the CNX-5, which are described below.

7.1 CNX-5 DS1

With the DS1 version, 1 to 4 DS1's IMA group is used to transport the aggregated ATM traffic from each SLC Series 5 DCB to a Central Office DSLAM. This will be deployed in a hubbed architecture from either SD or HD DS1 LT cards in the Central Office DSLAM. There are two cards required to deliver ADSL via this architecture as described below.

7.11ECTU - DS1 IMA Enhanced Channel Test Unit

This card replaces the existing Channel Test Unit located in the SLC Series 5 DCB and provides:

1) The ATM switching fabric.
2) Traffic management.
3) The physical ATM DS1 network interface.
4) Preserves the legacy Channel Test Unit functionality and loop functionality.
5) Shaping and policing functions.

7.12 ECU – Enhanced Channel Unit

This card replaces the existing Channel Unit located in the SLC Series 5 DCB and provides:

1) Integrated dual POTS with dual ADSL.
2) Integrated splitter functionality.

7.2 CNX-5 DS3

With the DS3 version, a DS3 is used to transport the aggregated ATM traffic from 1 to 15, SLC Series 5 DCB's to the Central Office for connection to the ATM core network. While the technical limit is 15 DCBs supported by one DS3, bandwidth requirements limit the maximum to 9 DCBs supported by a DS3. There will be future interoperability testing with the HD DSLAM DS3 LT card when it becomes available but initially this will not be deployed in a hubbed architecture. There are three cards required to deliver ADSL via this architecture as described below.

7.21 DS3 WAN Card – Wide Area Network Card
This card is placed in the unused AIU slot of the SLC Series 5 DCB and provides:

1) The ATM switching fabric.
2) A proprietary OC3 rate with optional ring protection.
3) The physical connectivity between daisy chained or ringed fiber ECTU's.
4) The physical ATM DS3 network interface.
5) Shaping and policing functions.

7.22 Fiber ECTU - Fiber Enhanced Channel Test Unit
This card replaces the existing Channel Test Unit located in the SLC Series 5 DCB and provides:

1) The fiber subtending capabilities for multiple CNX-5 systems or DCB's.
2) The short reach high-speed optics that can operate in either a daisy chained or protected ring architecture.
3) Preserves the legacy Channel Test Unit functionality and loop functionality.

7.23 ECU – Enhanced Channel Unit
This card replaces the existing Channel Unit located in the SLC Series 5 DCB and provides:

1) Integrated dual POTS with dual ADSL.
2) Integrated splitter functionality.

Note: This is the only card that is the same for both the CNX-5 DS1 and CNX-5 DS3 architectures.

8.0 Sizing and Relief Steps for Remote Solutions

8.1 For a Cabinet site that serves primarily residential customers (greater than 60% residential)- Integrated ADSL technology is first choice.

The steps outlined below provide the directives for selecting ADSL remote solutions for sites where at least one of the types of DLC installed is capable of integrated ADSL.

1. Screen sites to be activated in committed timeframe to see if the availability dates for the integrated capability will allow schedules to be met. If not, meet schedules using overlay remote DSLAM sized to meet two-year demand.

    a. Integrated ADSL on SLC Series 5 using Catena Networks 4,DS1 IMA solution with a capacity of 48 lines per dual channel bank will be available for deployment in April 2002. For sites utilizing this alternative a maximum of 3 dual channel

banks should be planned. If more than 3 DCBs are required to meet demand the DS3 solution in b. below should be used.

b. Integrated ADSL on SLC Series 5 using Catena Networks DS3 solution with a capacity of 116 lines per dual channel bank with up to 4 dual channel banks served by one DS3 will be available for deployment in June 2002. A new software release from Catena Networks to be available in 4Q2002 will increase to 9 the number of dual channel banks for a total of 1044 lines, at the same site, which can be served from one DS3.

c. Integrated ADSL on DISC*S copper distribution with up to 50 percent of lines capable of ADSL will be available for deployment in second half of 2002.

d. Integrated ADSL on Litespan copper distribution with a single channel bank assembly (224 ADSL lines per cabinet) will be available for deployment in second half of 2002.

2. If integrated ADSL capability available or planned at a site will meet the five-year ADSL demand for the site, activate integrated ADSL capability sized to meet the ***two year*** demand.

3. If integrated ADSL capability available or planned at a site will meet the two-year ADSL demand for the site, activate integrated ADSL capability and develop a plan to add an overlay remote DSLAM at the site on exhaust of integrated ADSL capability. *This plan should include acquisition of additional easements if required.*

4. If integrated ADSL capability available or planned at a site will not meet two-year demand, deploy an overlay remote DSLAM solution sized to meet five-year demand.

General: When deciding whether integrated ADSL capacity at an RT site can meet forecasted demand, consideration must be given to the difficulty/cost involved with making sufficient derived pairs from the integrated ADSL systems available to all FDIs served from the RT site. Those costs must be balanced against the wirework involved with the overlay remote DSLAM solution in reaching the final solution decision.

8.2 For a hut, CEV or customer premises site that contains adequate bay space to meet long-term POTS demand and the 2-year ADSL demand, high density overlay is first choice for ADSL capacity installation even if DLC/NGDLC capable of integrated ADSL is available at the site.

The remote DSLAM solution should be sized to meet the 2-year demand. Additional demand beyond two years should be planned on an integrated platform if there is SLC Series 5, DISCS, or Litespan existing or planned at the site. This will allow the integrated platforms to develop and provide a full functionality feature set that will meet the demands of the "Business Class" market.

Lower capital cost of the overlay structure solution set in an existing structure drives this product selection over early integrated solutions where equipment space can be made available for the additional equipment.

Structures that do not have bay space that can meet long-term POTS demand and an overlay ADSL solution should use integrated ADSL capability to meet ADSL demand.

8.3 For any site where 40% or more of the services are business services, high density overlay is first choice for initial ADSL capacity installation even if DLC/NGDLC capable of integrated ADSL is available at the site.

The remote DSLAM solution should be sized to meet the 2-year demand. Additional demand beyond two years should be planned on an integrated platform if there is SLC Series 5, DISCS, or Litespan existing or planned at the site. This will provide a technology to meet the immediate needs of business customers as well as allow the integrated platforms to develop and provide a full functionality feature set that will meet the demands of the "Business Class" market.

The inability of the integrated solutions to support the G.shdsl business services is the primary driver for the selection of the remote DSLAM solution.

For sites where bay space or easement can not be made available for ADSL overlay solution, integrated ADSL capability should be used to meet ADSL demand.

9.0 Other Remote Solutions Planning Considerations

Carrier Serving Areas (CSAs) where available space for ADSL remote solutions has been exhausted, but narrowband demand can still be served for 1–2 years from the existing DLC enclosure require other factors to be considered. The long range plan for the CSA should be consulted to determine how future narrowband demand will be served when selecting ADSL alternatives. If the alternative selected to serve ADSL demand is to add an ADSL remote solution at another location in the CSA, that site should be selected and adequate easement acquired to allow future narrowband demand relief from that site. The housing placed should be sized to serve the long-term demand of the 3-5 year development for narrowband services demand, to cutover existing ADSL services in the FDIs to be served from that site and to serve two year ADSL demand. If this situation arises after ADSL is available on NGDLC, placing a new NGDLC enclosure at the new site to serve ADSL demand and provide narrowband services relief would generally be the most cost effective solution. If an additional ADSL remote solutions site is established in this fashion, transmission issues will dictate cutover of all ADSL lines in FDIs to be served from the new site that are served from the original ADSL remote site for this CSA to the new ADSL remote. This is because the different level ADSL signals from remotes at different locations will generate more near end crosstalk than can be tolerated.

ADSL capability to an FDI can be provided from only one RT site even though multiple RT sites might serve a common FDI.

Derived pairs (forward feeding or back feeding) from multiple ADSL capable RT sites can not share a common cable sheath for more 50 feet, even if the RT sites do not serve a common FDI.

10.0 Fiber Distribution and ADSL

High-speed data capability using an ADSL user-network interface is a capability of Marconi fiber distribution systems. The capability to upgrade Marconi's existing FITL-A product to provide ADSL service is ready for deployment. Two DS1s per Optical Channel Shelf (OCS) will be required between the CO and the RT to connect the OCSs to the ATM network. Engineering M&Ps for upgrading FITL-A are available in BellSouth Practice 915-810-001BT. 2002 ADSL deployment plans currently include 140 FITL-A site upgrades. FITL-A site upgrades will be increased for 2002, but the extent of the increase is still being studied. ADSL capability on Marconi's MX fiber distribution system is expected to be ready for deployment in the second half of 2002. Traffic and logical capacities will allow up to five MDSs to be daisy chained on a DS3. Engineering M&Ps for Marconi MX in BellSouth Practice 915-710-127BT will be updated to include ADSL requirements.

11.0 Network Rearrangement Impacts on ADSL

Network rearrangements impact for ADSL are similar to those experienced for ISDN. If rearrangements are being planned that would move customers from ADSL capable facilities, careful consideration should be given to the alternatives available for dealing with those situations.

1. If the facility rearrangement is discretionary, enough ADSL capable facilities should be left in place to serve existing plus forecasted 2-year ADSL demand.
2. If the facility rearrangement is non discretionary, like a road move or damaged cable, and another ADSL capable facility, such as pairs from another ADSL qualified copper cable, can be made available, provide sufficient ADSL capable facilities to serve existing plus forecasted 2 year ADSL demand.
3. If the facility rearrangement is non discretionary, like a road move or damaged cable, and no other ADSL capable facility is available, contact the ADSL Deployment Team in Broadband Operations to acquire approval and funding for ADSL remote capacity sized per the recommendations provided earlier in this document.

12.0 FCC Line Sharing Order

On November 18, 1999, the FCC issued an order that established "line sharing" principles that require BellSouth and other incumbent local exchange carriers (ILECs) to share the spectrum of the facilities with other services. In particular, the order requires that BellSouth allow another service provider to provide xDSL based services on the cable facility that BellSouth is using to provide telephony. RL:00-05-021BT, OSPE Methods and Procedures for Collocation at Remote Terminal Sites, provides guidance for design and provisioning of line sharing at remote terminal sites. OSPE M&P for Provisioning Unbundled Network Elements, provides guidance for design and provisioning of line sharing at the central office.

13.0 ADSL Capacity Management

The three categories of ADSL resource for which capacity management is required are:

- Equipment ports

- Logical resources
- Bandwidth

Network Management System (NMS) monitors many of these resources and provides alerts a preset alarm levels so that additional capacity can be provisioned to meet any expected additional demand. The Broadband Capacity Tracking System (BCTS) also provides a means for monitoring these resources. The Loop Capacity Manager Support site at http://user2.home.bst.bls.com/~lcm/ contains the latest information on ADSL capacity management and links to other ADSL related sites.

13.1 Equipment Ports

The Central Office DSLAM hardware monitoring of the ADSL ports will be done by Circuit Capacity Management (CCM). The Loop Capacity Managers (LCMs) in the District will do capacity management and hardware monitoring of the DS1 ports. The District will be responsible for notifying circuit capacity management when more DS1 hub shelf capacity is required.

13.2 Logical resources

CO and remote solutions have been designed for BellSouth deployment so that current ADSL services are not expected to be limited by virtual circuit (VC) resource limitations. However, NMS alarm levels for logical resources have been set to warn of any unanticipated capacity issues. Circuit Capacity Management and S&T TP&D ATM planners will monitor these resources initiate relief when required.

13.3 Bandwidth

Circuit Capacity Management and ATM planners in the S&T TP&D will be responsible for monitoring bandwidth utilization and initiating relief steps.

General bandwidth requirement calculation:

- The maximum Burst Bit Rate (BBR) of any user on a DSLAM, MiniRAM, or single shelf DSLAM cannot exceed the available bandwidth in the feeder
- The sum of all the individual Engineered Bit Rates (EBRs) on either a DSLAM, MiniRAM, or remote DSLAM cannot exceed the total bandwidth of the feeder

These calculations will be performed by NMS at ADSL service activation to assure that alarm thresholds have not been exceeded.

The following table provides BBR and ERB for current services.

Service Class	Advertised Rates (kbps)	RT and CO DSLAM EBR (kbps)	Mini-RAM EBR (kbps)	BBR (kbps)
Consumer	1500 x 256	30.92	90.29	1472
Business	192 x 192	33.13	96.74	1024
Business	384 x 384	448	448	512
Business	768 x 512	44.18	129	1024
Business	1500 x 512	258.85	755.84	1800
Business	2000-4000 x 640	347.89	1015.84	4000
Business	4000-6000 x 640	690.26	2015.56	6016

The relief alternatives for remote solutions when bandwidth utilization reaches exhaust will be as follows:

Remote Solution	Initial ATM Feed	Recommended Relief ATM Feed
AMR8	1 DS1 IMA	4-DS1's IMA
MR-1400	2 DS1's IMA	4-DS1's IMA
ADJ96	4 DS1's IMA Per Shelf	1-DS3 for both shelves
ADJ108	8 DS1's IMA	DS3
ADJ144	DS3	OC3
RD144	DS3	OC3
RD192	DS3	OC3
STR48 & STR48C	4 DS1's IMA	1-DS3 per shelf
STR96	DS3	OC3
STR144	DS3	OC3
ADJ216	DS3	OC3
STR216	DS3	OC3
STR432	DS3	OC3
STR648	DS3	OC3
STR864	DS3	OC3
RD576	2 DS3's	OC3 for the exhausted DS3
RD432 & RD432M	DS3	OC3
RD648 & RD648M	DS3	OC3
RD864 & RD864M	DS3	OC3
CNX-5	4 DS1s IMA per SLC DCB	DS3
CNX-5	1 DS3 for up to 9 SLC DCB's	Reduce # of SLC DCB's per DS3
DISC*S Integrated ADSL on copper	2 DS1s IMA Per Shelf	4 DS1s IMA Per Shelf
Marconi ADSL on FITL-A	2 DS1s IMA Per Shelf	4 DS1s IMA Per Shelf
Marconi ADSL on MX	1 DS3 for up to 6 MDSs	Reduce # of MDS per DS3

With the usage currently being experienced with the consumer class of service, none of the remote solutions will have enough traffic to exhaust a DS3 feed, and therefore require a DS3 to OC3 upgrade. Dramatic increases in customer usage or dramatic increases in business class services may exhaust these DS3 feeds in the future.

Reference List

OSPE Methods and Procedures for the Alcatel High-Density DSLAM, BSP 915-800-022PR

Outside Plant Engineering Methods and Procedures for BellSouth ADSL Service, 915-800-019PR
OSPE M & Ps for Administering ADSL over Marconi DISC*FITL-A, 915-810-001BT
ADSL Network Architecture Service Description, Rev 10.0 – November 9, 2001
Non-Aggregated DSL TSD, Issue 12 – September 7, 2001
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2001 Issue of the Loop Technology Deployment Directives, RL:01-03-001BT
Overview of Spectrum Management Requirements, RL: 01-05-027BT