

North Carolina [Company] WAN Expansion

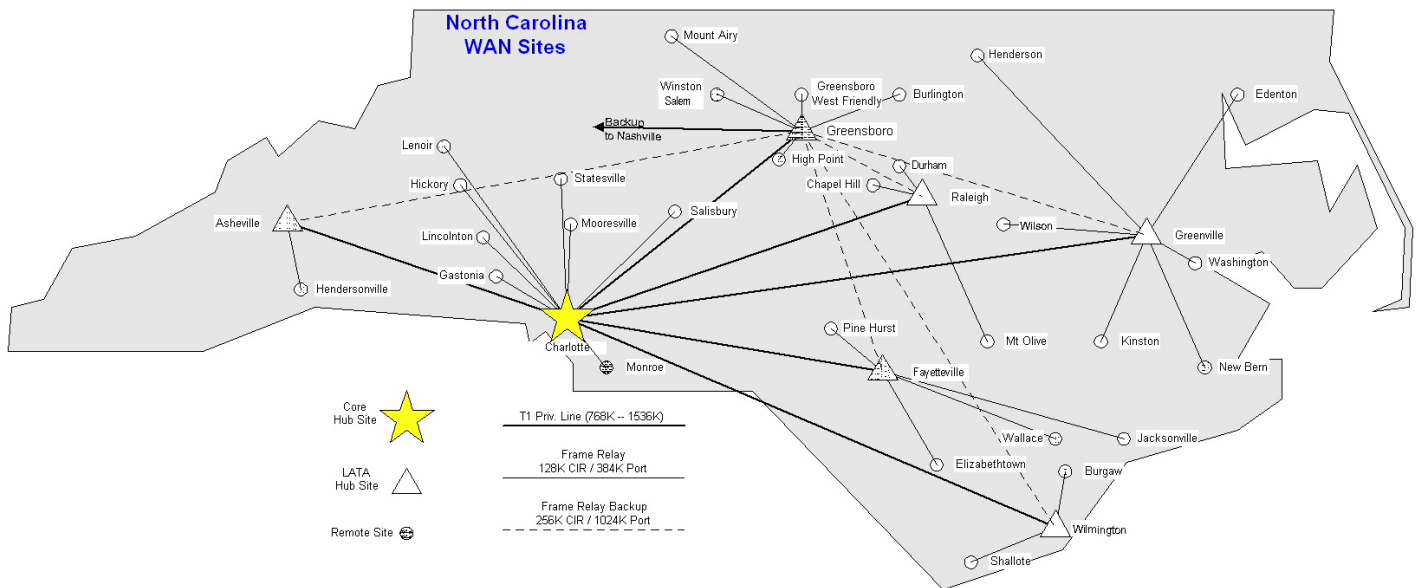


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Project Plan

1. Project Overview

The [Company] Project has requested a design and costs to expand the WAN to 19 new remote sites in North Carolina. The new sites will support two to five users with no local file server. Currently, in North Carolina, the Enterprise WAN (EWAN) supports 18 sites outside of the Charlotte Campus. Twelve of these sites are connected directly to Charlotte via Bell South / ICI Frame Relay. One site (Fairview Road) is in Charlotte on a dedicated T1. Another site, Rock Hill is also supported on a dedicated 64K leased line to Charlotte. The Fairview Road and Rock Hill sites are not addressed in this project. The remaining sites connect to the Greensboro facility. Most Frame Relay sites are currently served by 64K circuits (32K CIR / 64K PIR). Exceptions to this are Raleigh (256K CIR), Asheville (128K CIR), and Greenville (128KCIR).

For the new [Company] sites, users will log into an existing server at the Distribution site (LATA Hub site). The design presented in this proposal is modeled after the [Branch Network] design that will be implemented in North Carolina in 1999. The design and costs have been prepared in two major phases. Phase 1 addresses the [Company] project requirements including certain infrastructure upgrades necessary to support those requirements. Phase 2 provides upgrades to remaining legacy sites. It is important to note that all of the NC remote WAN sites currently use Bay Networks routers. These routers are at the end of life and end of lease - Bay Networks does not plan to support them after 1999. Phase 1 of this project provides the initiative and most of the funding to prepare for and replace some of these routers. Phase 2 provides replacement for the remaining routers.

In general this proposal will establish a WAN hub in each of the seven LATAs in North Carolina. Each Hub site will collect service (circuits) from the remote sites within that LATA and aggregate WAN traffic back to Charlotte. Aggregating connectivity within a LATA saves considerable inter-LATA circuit costs. This is similar to the [Branch Office] network plan. Connectivity from Charlotte to each LATA hub city is already available, however, each will require some level of service upgrade locally and in Charlotte. File servers are already available in each of these cities and will be used as the "home" server for serverless remote sites in that LATA.

Backup service has been designed to reroute around failures in local circuits, LATA Hubs, and outages in Charlotte.

The following sections detail the design, equipment and circuit specifications, costs, and high level implementation plan. Attachments include the current NC WAN connectivity, proposed connectivity, site information and cost matrix, and vendor quotes.

2. Design Summary

2.1. Current NC WAN Remote Site Connectivity

The Enterprise WAN Currently supports 18 sites in North Carolina - outside of the Charlotte Campus. These sites were described in the Overview. The Greensboro facility is connected to Charlotte via a 1024Kb Frame Relay circuit. In the Greensboro area, the West Friendly and Winston-Salem sites are connected to Greensboro via fractional T1 (512Kb minimum) on a Bell South "Flex Serv." Ring. The High Point site also connects to Greensboro via a 64K dedicated circuit.

The attached diagram - **NCLANWAN.VSD** - details the new network connectivity.

All existing NC WAN sites use LN routers (Greensboro Facility has a CN). Each has at least two sync ports with one in use for connectivity back to either Charlotte or Greensboro. One Token Ring port is in use at each of these sites for LAN connectivity. Typically a 2715 hub provides the token ring connectivity. Raleigh is a larger site using a combination of Bay 3000 and 2715 hubs. The Greensboro, Facility supports nine Netware file servers and more than 1000 users on 18 token ring segments.

The original backup service plan to the remote sites was limited in affect and not practical. In practice, service for all North Carolina sites is currently dependent on service through Charlotte to access the rest of the WAN.

2.2. Proposed NC WAN Remote Site Connectivity

The new design will establish a Distribution Router in each of the seven LATAs in North Carolina. These distribution cities will be:

- Asheville
- Charlotte
- Fayetteville
- Greensboro
- Greenville
- Raleigh
- Wilmington

These sites were chosen for two reasons - 1) they are currently on the WAN and easily upgraded; and 2) they are Frame Relay switch sites for Bell South (and ICI where applicable).

The Charlotte and Greensboro Distribution routers will function as concentration points for circuits from the other LATA, Distribution routers. This double use will provide maximum benefit from the equipment purchased for this project with minimal impact to performance. If the Branch network opts to use this same hardware in the LATAs (including Charlotte and Greensboro), the design will need to be modified somewhat to avoid interconnecting Distribution routers. When the time comes, this should be a simple migration effort. Primary connectivity from Charlotte to the LATA hub sites will be on dedicated T1 circuits with initial bandwidth set to 768Kbps service. As needed these circuits can grow to full T1 or provide up to 768Kbps to other projects at no additional cost. Charlotte and Greensboro are already connected to the WAN and do not require circuit upgrades, however, new circuits will be used to ease the migration to the 10.x network. Existing circuits will be terminated at a later date. LATA Hub site routers are currently Bay Networks LN routers. Although these routers could work, they are at the end of their technical life, the end of their support life, as well as the end of their lease. In addition to these issues, the new network design is based on the 10.x IP network plan and the Cisco proprietary EIGRP routing protocol. It is the strong recommendation of this proposal to upgrade these routers to support this initiative as well as possible support for the [Branch Network] (scheduled for North Carolina in 1999). Cisco model 7206 routers have been specified, each with one quad sync and one quad token ring port adapter to accommodate the future processing and aggregation requirements at these locations.

In Charlotte, this design will use a new router for sync data service from the LATA hubs. This new distribution router will be on the 10.32.2.0 backbones. One Cisco 7513 router with the following port adapters has been specified:

- 2 Fast Eth.
- 2 Quad Sync
- 1 Dual Channelized T1/PRI

This router will be used for future Sync Enterprise WAN connectivity as well as available for Branch Network connectivity. It also serves as a 10.x network backup to the Charlotte Policy Router by providing an alternate route from Charlotte to Nashville via Greensboro.

At each LATA hub site, two physical circuits will be used. The first (from MCI) will provide connectivity to Charlotte. The second circuit (LATA Frame Relay) will carry PVCs from remote sites (128K CIR / 384K PIR) and a backup PVC (256KCIR) to the Greensboro Facility. All backup PVCs from the five LATAs (outside of Charlotte and Greensboro) will terminate on two T1 Frame Relay ports in Greensboro.

In Greensboro, a new distribution router - Cisco model 7513 - has been specified. This will eventually replace the existing CN router and has been specified with the following port adapters:

- 1 Quad Token
- 2 Quad Sync
- 1 Dual Channelized T1/PRI

It will ultimately be used for all Sync and LAN circuits in that building. It provides a platform to migrate existing token ring segments from the CN router to the 7513. In order to fully migrate off of the CN router, four additional Quad Token port adapters and two VIP cards will be required. These cards are proposed in Phase 2 of this project. In addition to the backup service from the five LATA hub sites, a new T1 circuit from Greensboro to Nashville will be requested. This connection will be used to route around major outages that may occur in Charlotte. To fully protect Greensboro from router failures, redundant routers should be used, however, that level of redundancy is not included in this proposal.

At each of the new remote sites, a Cisco model 3620 router has been specified and a single circuit (128K CIR / 384K PIR) will be used to connect to the LATA hub site. Where available, ISDN backup has been requested. ISDN PRI circuits have been requested for Charlotte and Greensboro for the remote sites to "dial". The following specifications have been ordered on the 3620 routers:

- 1 Ethernet port
- 1 Token Ring port
- 1 Internal T1 CSU/DSU WAN port
- 1 ISDN BRI w/internal NT-1

Users at remote sites that do not have a local file server will be assigned to a server at their local LATA hub.

The attached diagram - **NC_WAN.VSD** shows all connectivity described in this section.

The attached spreadsheet - **NC_WAN.XLS** details connectivity, addressing, Phase1 and Phase 2 sites, and circuit information.

2.3. Backup Service Plan

Backup service has been designed to reroute around failures in local circuits, LATA Hubs, and major outages in Charlotte. In general, a service outage at any site is limited to the site of the router failure. From each remote site ISDN BRI service will be used to dial PRI circuits available in Charlotte and Greensboro. LATA hub sites do not have ISDN backup, but will use two physical circuits - one circuit with a T1 to Charlotte; the second with a PVC to each remote site in that LATA plus a backup PVC to Greensboro. In the event of a failure on the Charlotte circuit or Charlotte Distribution router, traffic from the affected LATA(s) will automatically reroute through Greensboro. A backup WAN connection between Greensboro and Nashville will provide alternate access to the WAN. If required, traffic from Greensboro can reroute through Nashville back to Charlotte or to the rest of the WAN.

Implementation Plan

This plan is intended to provide a chronology of major tasks to implement this project. A detailed implementation Project Plan and configuration plan will be developed as required in separate documents - after project approval.

1. Overall Project Plan Development

1.1. Network Design (Complete)

1.2. Equipment Specifications & Quotes (Complete)

2. Order circuits

Circuit orders will be staged regionally starting with Charlotte and Greensboro, then Asheville, Raleigh and Wilmington, Fayetteville and Greenville. This sequence will provide a geographic "sweep" and adequate time to migrate existing circuits and sites as needed.

2.1. LEC Frame Relay circuits (Complete).

All Frame Relay connections from remote sites to the LATA hubs and the backup PVCs to Greensboro will be provided through BellSouth. ICI will provide the IXC and independent LEC portion of these circuits.

All BellSouth & ICI circuit orders have been placed. Month-to-month service is required initially until year 2000 compliance/contractual issues can be negotiated/resolved.

2.2. Primary circuits from each LATA hub to Charlotte (Complete).

The primary circuit from each LATA will be Private Line T1 service ordered through MCI. This service is the most cost effective at this time.

2.3. Greensboro to Nashville Backup (Pending configuration in Nashville)

The contingency circuit from Greensboro to Nashville will be provisioned with a private line T1 from Sprint. This is more cost effective than Frame Relay and provides maximum bandwidth availability for contingency.

2.4. Remote site PVCs to the LATA hub (Complete):

2.4.1. Charlotte -

- 2.4.1.1. Order five MCI Private Line circuits (4/27/98)
- 2.4.1.2. Order Charlotte LATA sites (Boone, Lenoir, Lincolnton, Monroe, Mooresville, Salisbury) (4/27/98)
- 2.4.1.3. Order ISDN PRI backup circuits for Charlotte (5/12/98).
- 2.4.1.4. ISDN BRI Backup circuits at remote sites (5/12/98).

2.5. Asheville - Bell South

- 2.5.1. Order Asheville LATA sites (Hendersonville, GSB(8) backup).
 - 2.5.1.1. ISDN BRI backup circuits.

2.6. Greensboro - Bell South

- 2.6.1. Order Greensboro LATA sites (Mount Airy).
- 2.6.2. Order new Primary Ckt from CLT(9)—GSB(1) (512K/1024K)
- 2.6.3. Order Backup to Nashville, Ops. (Sprint).
- 2.6.4. Order Greensboro ISDN PRI backup circuit.

2.7. Raleigh - Bell South

- 2.7.1. Order Raleigh LATA sites (Mt. Olive, GSB(8) backup).
- 2.7.2. ISDN BRI backup circuits.

2.8. Wilmington - Bell South

- 2.8.1. Order Wilmington LATA sites (Burgaw, Shallotte, GSB(8) backup).
- 2.8.2. ISDN BRI backup circuits.

2.9. Greenville - ICI

- 2.9.1. Order Greenville LATA sites (Edenton, Henderson, Kinston, New Bern, Washington, Wilson, GSB(9) backup).
- 2.9.2. ISDN BRI backup circuits.

2.10. Fayetteville - ICI

- 2.10.1. Order Fayetteville LATA sites (Pinehurst, Wallace, GSB(9) backup).
- 2.10.2. ISDN BRI backup circuits.

3. Register Sites

3.1. IP Registrations (Complete)

Router, Server, Hub, DLCI, & DHCP Registrations submitted 5/14/98.

3.2. DLCI Assignments (Complete)

4. Order routers & hubs (4/27/98)

4.1. Order router & hub equipment; ship to Charlotte for distribution.

- 4.1.1.1. CER signatures (complete)
- 4.1.1.2. Forward CER to Platform for ordering (complete)
- 4.1.1.3. Order Equipment (Platform Support) (complete)
- 4.1.1.4. Receive Equipment (complete)

4.2. Software configuration (3620 complete; 7206, 7513 Complete)

Copies of configurations attached in file newwancfg.zip

5. Order DSUs

5.1. Order 3160 DSUs (2 port model) - Complete

Determine quantity from spreadsheet (ship to Charlotte for distribution).

5.2. Configure DSUs

- 5.2.1. Set up as specified in design documents.
- 5.2.2. Send DSUs to Telecom for installation/delivery with router.

6. Site surveys

6.1. Survey for space, power, environmental, security access, photos, site contact.

- 6.1.1. Asheville - Complete
- 6.1.2. Charlotte - Complete
- 6.1.3. Greensboro - Complete
- 6.1.4. Raleigh - Complete
- 6.1.5. Wilmington - Complete
- 6.1.6. Fayetteville - Complete
- 6.1.7. Greenville - Complete

7. Site preparation

7.1. Individual sites as required per survey data.

- 7.1.1. Asheville - Complete
- 7.1.2. Charlotte - Complete
- 7.1.3. Greensboro - Complete
- 7.1.4. Raleigh - Complete
- 7.1.5. Wilmington - Complete
- 7.1.6. Fayetteville - Complete
- 7.1.7. Greenville - Complete

8. Order racks, other miscellaneous equipment

8.1. Individual sites as required per survey data.

- 8.1.1. Asheville - Complete
- 8.1.2. Charlotte - Complete
- 8.1.3. Greensboro - Complete
- 8.1.4. Raleigh - Complete
- 8.1.5. Wilmington - Complete
- 8.1.6. Fayetteville - Complete
- 8.1.7. Greenville - Complete

9. Phase 1 Installation Schedule

9.1. Install new Distribution router in Charlotte - Complete

- 9.1.1. Install router
- 9.1.2. Connect to 10.32.2.0 backbone
- 9.1.3. Connect new circuits in Charlotte

9.2. Install new Distribution router and circuits in Greensboro – 95%

- 9.2.1. Install router - Complete
- 9.2.2. Connect to Legacy TR BB – Phase 2
- 9.2.3. Connect to CLT Primary Ckt - Complete
- 9.2.4. Connect to NSH backup - PENDING
- 9.2.5. Connect ISDN PRI Backup circuit - PENDING
- 9.2.6. Connect GSB(8) backup ckt - Complete
- 9.2.7. Connect GSB(9) backup circuit - Complete

9.3. Asheville LATA hub Installation

- 9.3.1. Install LATA Hub Router
- 9.3.2. Connect Phase 1 remote circuits to LATA hub routers
- 9.3.3. Connect new LATA hub routers to legacy Token Ring
- 9.3.4. Migrate LATA hub users and servers to 10.x network
- 9.3.5. Install / connect new remote routers (Phase 1 sites)
- 9.3.6. Install hubs at remote sites (connect router)
- 9.3.7. Test connectivity (local and to WAN)
 - 9.3.7.1. Local access
 - 9.3.7.2. DHCP
 - 9.3.7.3. WAN Access
- 9.3.8. Connect users at remote sites

9.4. Charlotte LATA hub Installation

- 9.4.1. Connect Phase 1 remote circuits to LATA hub routers
- 9.4.2. Install / connect new remote routers (Phase 1 sites)
- 9.4.3. Install hubs at remote sites (connect router)
- 9.4.4. Test connectivity (local and to WAN)
 - 9.4.4.1. Local access
 - 9.4.4.2. DHCP
 - 9.4.4.3. WAN Access
- 9.4.5. Connect users at remote sites

9.5. Greensboro LATA hub Installation

- 9.5.1. Connect Phase 1 remote circuits to LATA hub routers
- 9.5.2. Install / connect new remote routers (Phase 1 sites)
- 9.5.3. Install hubs at remote sites (connect router)
- 9.5.4. Test connectivity (local and to WAN)
 - 9.5.4.1. Local access
 - 9.5.4.2. DHCP
 - 9.5.4.3. WAN Access
- 9.5.5. Connect users at remote sites

9.6. Raleigh LATA hub Installation

- 9.6.1. Install LATA Hub Router
- 9.6.2. Connect Phase 1 remote circuits to LATA hub routers
- 9.6.3. Connect new LATA hub routers to legacy Token Ring
- 9.6.4. Migrate LATA hub users and servers to 10.x network
- 9.6.5. Install / connect new remote routers (Phase 1 sites)
- 9.6.6. Install hubs at remote sites (connect router)
- 9.6.7. Test connectivity (local and to WAN)
 - 9.6.7.1. Local access
 - 9.6.7.2. DHCP
 - 9.6.7.3. WAN Access
- 9.6.8. Connect users at remote sites

9.7. Wilmington LATA hub Installation

- 9.7.1. Install LATA Hub Router
- 9.7.2. Connect Phase 1 remote circuits to LATA hub routers
- 9.7.3. Connect new LATA hub routers to legacy Token Ring
- 9.7.4. Migrate LATA hub users and servers to 10.x network
- 9.7.5. Install / connect new remote routers (Phase 1 sites)
- 9.7.6. Install hubs at remote sites (connect router)
- 9.7.7. Test connectivity (local and to WAN)
 - 9.7.7.1. Local access
 - 9.7.7.2. DHCP
 - 9.7.7.3. WAN Access
- 9.7.8. Connect users at remote sites

9.8. Fayetteville LATA hub Installation

- 9.8.1. Install LATA Hub Router
- 9.8.2. Connect Phase 1 remote circuits to LATA hub routers
- 9.8.3. Connect new LATA hub routers to legacy Token Ring
- 9.8.4. Migrate LATA hub users and servers to 10.x network
- 9.8.5. Install / connect new remote routers (Phase 1 sites)
- 9.8.6. Install hubs at remote sites (connect router)
- 9.8.7. Test connectivity (local and to WAN)
 - 9.8.7.1. Local access
 - 9.8.7.2. DHCP
 - 9.8.7.3. WAN Access
- 9.8.8. Connect users at remote sites

9.9. Greenville LATA hub Installation

- 9.9.1. Install LATA Hub Router
- 9.9.2. Connect Phase 1 remote circuits to LATA hub routers
- 9.9.3. Connect new LATA hub routers to legacy Token Ring
- 9.9.4. Migrate LATA hub users and servers to 10.x network
- 9.9.5. Install / connect new remote routers (Phase 1 sites)
- 9.9.6. Install hubs at remote sites (connect router)
- 9.9.7. Test connectivity (local and to WAN)
 - 9.9.7.1. Local access
 - 9.9.7.2. DHCP
 - 9.9.7.3. WAN Access
- 9.9.8. Connect users at remote sites

10. Phase 2 Installation Schedule

10.1. Define Phase 2 remote PVCs to LATA hub routers

10.2. Install Phase 2 remote site circuits

10.3. Install / connect new remote routers (Phase 1 sites)

10.4. Connect Phase 2 routers to legacy Token Ring

10.5. Migrate users and servers to 10.x network

11. Remove old equipment

12. Return leased legacy equipment to leasing company

13. Cancel legacy circuits that are no longer needed.

Support Procedures

LAN/WAN Support

Normal LAN/WAN Support will be provided in the same manner as other sites on the Enterprise WAN. Platform Support will provide configuration management on the routers and hubs. They can be reached via 24 hr. pager at 1-800-.....

Local installation and troubleshooting will be provided by Regional Telecom. They can be reached

The NC Hardware Center coordinated circuit orders, installation and support of circuits and CSU/DSUs. They can be reached via....

Network Engineering is also available for third level support as needed by....

Network Connectivity Detail

The following pages contain excerpts from these files:

Proposed NC WAN Connectivity Diagram

NC_WAN.VSD

Network Connectivity and Circuit Information Worksheet

NC_WAN.XLS

(Site Info)

(Network Detail)

(Circuit Info)

Router Configuration Files

NCWANCFG.ZIP

Network Connectivity and Circuit Information Worksheet

NC_WAN.XLS

(Site Info)

(Network Detail)

(Circuit Info)