East Carolina University
Voice Services Business Plan

Office of the CIO
March 2003

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Executive Summary

Introduction
Under direction of the CIO, the IT staff has undertaken a comprehensive review of East Carolina University's (ECU) telecommunications system from the following perspectives: (1) UNC mandated business continuity and disaster recovery planning; (2) University competitiveness in services and support to students and faculty; (3) cost containment while providing for enrollment growth, expansion of services and service area, and coordination of cross-campus operation.

Problem
As a result of the review, significant risk factors emerged in two areas: Operational risk and Institutional risk. The operational risk is the potential failure of a large portion of the voice infrastructure that serves students and faculty. This risk has developed over time as key hardware elements have become obsolete and are no longer supported by the manufacturer. Due to the extremely high cost of services and support contracts, the transport nodes (fiber optic ring) have not been maintained and the staff has not been trained to perform necessary tasks. The voice transport system is not balanced in terms of load carrying and the software that runs the main switch (DMS 100) is five versions behind. Nortel, the switch manufacturer, indicates that support is minimized when the switch software is more than three revisions behind.

There is no executable communications disaster recovery plan for risks from acts of God or other equipment related outages, as happened in 1999, which could leave large portions of campus without communications for an extended time. Finally, the single block of phone numbers 252-328-xxxx is almost exhausted, limiting growth

The Institutional risk reflects the numbering plan issues as well as publicity and liability exposure from potential long-term outages. In addition, services to students are lagging relative to competitive institutions while revenues from traditional services provided to students such as long distance phone service are rapidly declining. Finally, opportunities for reducing operating and capital expenditures are limited by the existing services platform and would be drastically impacted by the high cost of responding to an emergency caused by a catastrophic failure.

Alternatives
Doing nothing leaves the unacceptable risks in place. Continued spending solely on a legacy telephony infrastructure will not provide a return, solve underlying service problems, or give real guarantees of reliable service. At a minimum, a formal disaster recovery and business continuity plan should be completed, then communicated to manage expectations in terms of length of potential outage and costs of repair and recovery.

Outsourcing management of the current system is not realistic due to the obsolescence of the existing equipment. Outsourcing with a traditional style Centrex service would entail an estimated annual operations expenditure of $1.9 million. While this would eliminate the need for a major capital expenditure and provide higher reliability than the current system, it would not support the delivery of new service applications. Replacing the current system with conventional PBX technology would be comparatively expensive (approximately $11.3 million), would not provide longer-term upgrade paths, and would be costly in terms on training, ongoing maintenance, and the recruitment of skilled staff.

Recommendation
The best long-term choice is a migration to Internet Protocol (IP) Communications, technology that uses the same network as the computer systems and is flexible and upgradeable, similar to computer software, with attendant costs. This migration would require estimated expenditures of: $1.46 million implementation costs, $.033 million annual maintenance cost for year 1, $1.98 million implementation costs, $.144 million annual maintenance cost for year 2, and $1.98 million implementation costs, $.280 million annual maintenance cost for year 3. The total cost for this implementation is $5.89 million. This investment would also provide the foundation for intangible savings from relatively inexpensive and virtually unlimited applications (homegrown or bought) delivered through the handsets themselves as Extensible Markup Language (XML) programs linked into ECU services.

We have already implemented IP Communications as the voice platform for the Daily Reflector site and proposed IP Communications for the Science and Technology building due to the significant cost advantage, ease of maintenance and service, and flexibility of features and on-screen applications. We have also tested the technology extensively and found that it meets ECU needs. As a result, we are ready to take the next steps in scaling up the IP Communications infrastructure to position us to deploy this technology campus-wide.

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1. Project Description

1.1 Purpose - ECU's vision is to phase in IP Communications as a replacement for legacy based voice services. The critical success factors influencing the speed of this migration are:

- making technology in-source/out-source deployment decisions
- committing to technical excellence
- determining a tolerance for current risk

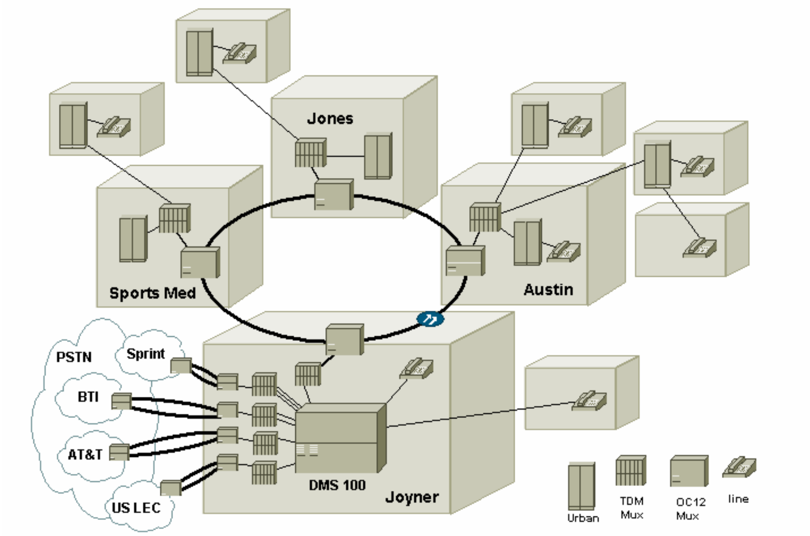

Figure 1.1. ECU current voice network

1.2 Features and benefits - The business benefits of this strategy are tangible.

- A common infrastructure eliminates the need for maintaining a separate voice network.
- By nature of the technology, IP Communications avoids a single point of failure.
- One disaster recovery plan can be implemented to cover a converged voice/data network.
- The IT staff will develop skills that are cross-functional, not just focused on voice or data.
- IP Communications provides an open platform to support new revenue generating services.
- IP Communications will give ECU a more affordable platform for voice than the DMS 100.

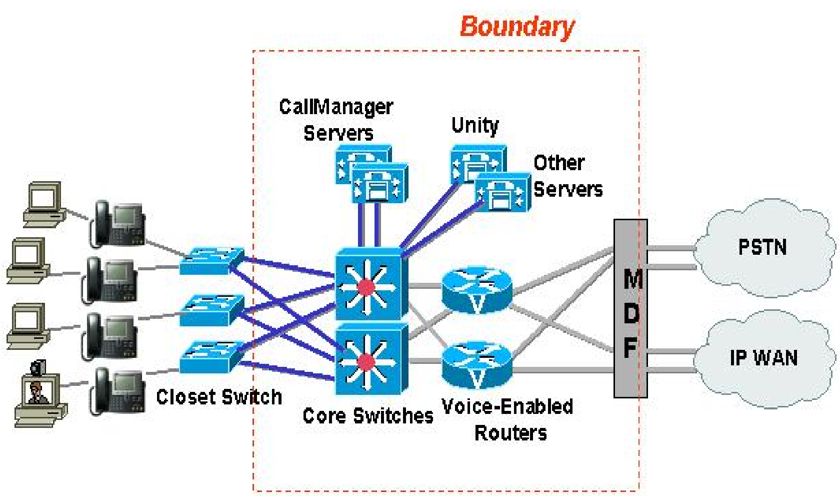

Figure 1.2. IP Communications use a distributed architecture for reliability

1.3 Value - The true value of IP Communications is more than cost effectiveness, it is the applications it can enable. By leveraging open industry standards:

- multiple user directories can be consolidated into a single, enterprise wide repository
- legacy applications become simpler and more cost effective to implement, for example:
  - Interactive Voice Response (IVR)
  - Automatic Call Distribution (ACD)
  - contact centers
  - voicemail

- new applications can empower simple voice calls through software based features such as:
  - Unified Messaging
  - Personal Assistance
  - collaboration
  - speech recognition
  - XML

By replacing proprietary hardware with the power of Internet Protocol and World Wide Web software, voice call routing for any enhanced services application becomes possible.

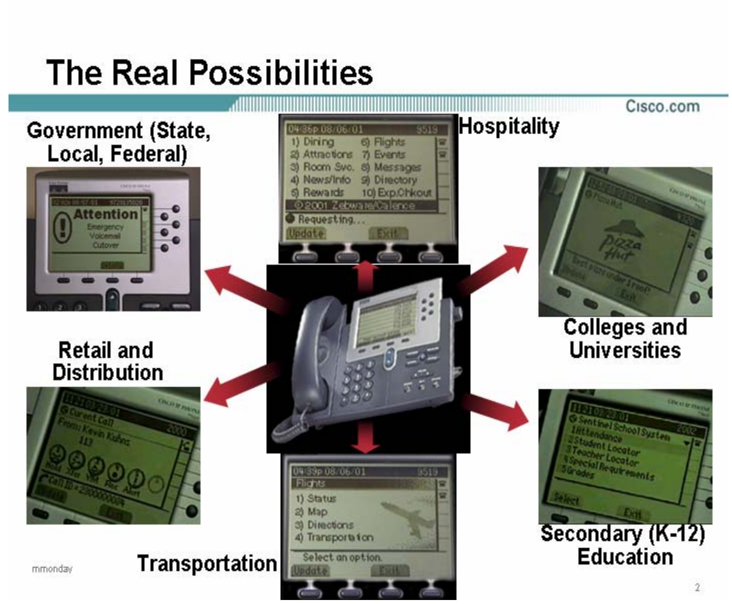

Figure 1.3. A new generation of applications are possible using IP

1.4 Costs - IP Communications costs vary based on implementation, but equipment cost can be understood by breaking the voice system into four components:

1.4.1 Voice endpoints (phones) - IP telephones are less costly. Of the phones served by ECU's DMS100, 90% are analog and 10% digital.

Cisco's IP Communications costs ECU $160 for an analog port, $220 for a single line 7905 IP phone, $348 for a two-line 7940 IP phone, and $412 for a six-line 7960 IP phone. Included in each phone cost is a $150 software license fee.

1.4.2 Network - IP Communications does not require a separate network. IP Communications will use ECU's existing data network for connectivity. All access switches now purchased for the data network support Quality of Service (QOS) and can deliver -48V DC power to an IP phone. Based on impact and probability, Uninterruptible Power Supplies (UPSs) may be required for critical data closets to maintain service in the event of a power outage.

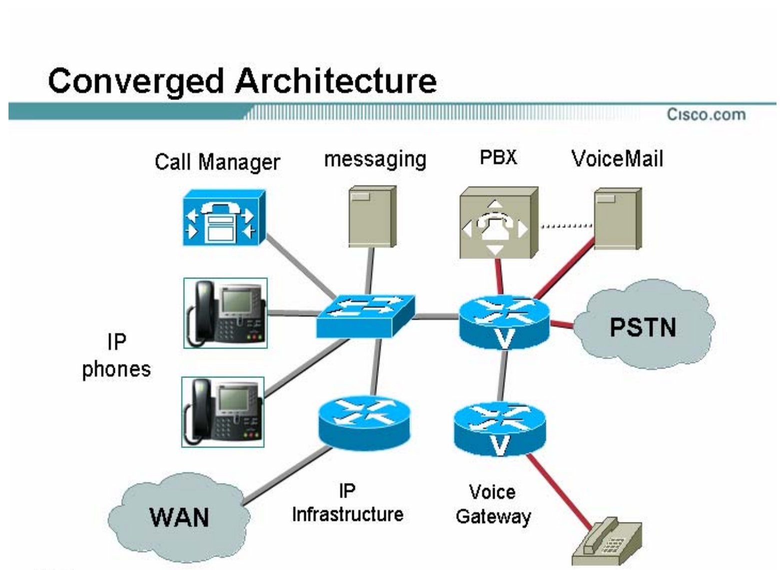

Figure 1.4. Elements of a converged architecture.

1.4.3 Switching - Software and hardware for IP Communications voice "switching" is less costly. ECU will either outsource or insource the function of routing voice calls. If insourced, ECU's cost for CallManager software is $10,300 per server. Each standards-based server will cost ECU an additional $15,100. For approximately $25,400, an IP Communications server can support over (2,500) IP phones and through clustering scale to support over 100,000 users.

As an alternative, if voice routing is outsourced to a Local Exchange Carrier (such as Sprint) or to a competitive LEC, ECU can generate revenue by extending it's "service offering" to businesses or individual consumers not directly located on East or West campus.

1.4.4 PSTN/off-net access - PSTN/Off-net access is less costly and more flexible. ECU's current DMS100 is connected to the Public Switched Telephone Network (PSTN) by 19 T1-CAS trunk lines. A variety of carriers (Sprint, AT&T, BTI, and USLEC) provide service based on the type of call made (e.g. local access, in/out-of-state long distance, international, and inbound 800). Based on the most recent traffic study, 2/3 of the calls originating on main campus are routed off-net to the PSTN. IP Communications uses gateways to connect IP phones to the PSTN. ECU's cost for a T1 IP Communications gateway is $1,600 per T1 trunk. Since these gateways support ISDN, older T1-CAS trunks can be migrated to newer T1-PRI trunks. This will require less total lines to carriers and can improve service reliability. [See Appendix C for photos & description.]

Additionally, IP Communications has two attractive off-net options:

- IP gateways can be outsourced to a service provider
- IP calls can be routed over North Carolina's NCREN IP based Intranet

These options can allow ECU to build a "packet only" voice network that is not dependent on legacy time division multiplexing (TDM) voice technology.

2. Problem: Risk

2.1 Risk analysis methodology - This section applies a risk analysis approach to understanding ECU's current voice network. Risk analysis is an eight step-structured methodology:

1. **Assess the risk** (**sections 2.1-2.6**)
   a) Identify the elements
   b) State the assumptions
   c) Assign each element an event probability based on the assumptions:
      - simple classification (high, medium, low)
      - sophisticated classification (severity, probability, timing, most likely consequences)
2. **Identify the consequences of an action (section 2.7)**
   a) Can immediate & decisive action contain or mitigate the risk?
   b) How can severity or impact be reduced?
   c) Can the risk be deferred to another time frame?
   d) Is it possible to replace the risk with one of a lesser impact?
   e) Can the risk be replaced with some other, less-negative consequence?
3. **Identify risk vs. reward (section 2.8)**
   a) What are the alternatives?
   b) All decisions involve risk
   c) Practicality, not precision, is the goal.
   d) Do the rewards outweigh the risk?
4. **Mitigate negative effect (section 2.8)**
   a) Identify how to reduce negative effect of complete or partial failure
      - In finance this is called hedging.
5. **Raise the odds of success (section 2.8)**
   a) Use resource application (weigh resource cost against full/partial failure).
6. **Predict the results (section 2.8)**
   a) Critically assess the decisions, were steps skipped?
   b) Is the risk adequately understood?
   c) Is the risk-versus-reward ratio realistic?
7. **Take action (section 2.8)**
   a) Doing nothing can be more destructive than doing the wrong thing.
   b) Create a project plan with milestones and timelines
   c) Formulate Assessment Record Book (ARB) objectives for the project
8. **Measure the results (section 2.8)**
   a) Was the outcome effective?
   b) Submit the completed ARB's as part if our SACS institutional assessment

2.2 Description of current ECU voice network - ECU has two campuses – East and West – located about 1-2 miles apart, with a total population of 20,624 students and more than 4,000 faculty and staff. ECU's annual growth rate is 6.2%.

East campus is the main campus. It covers 390 acres, contains 80 buildings, supports the majority of faculty/staff, and houses 5,500 students in 2,600 rooms of 15 residence halls. West campus is the School of Medicine. It is co-located with Pitt County Memorial Hospital (PCMH) and contained in 27 buildings covering 46 acres. The School of Medicine is home for 1,500 ECU staff & students. PCMH employs more than 3,000 employees and treats 200,000+ patients per year. Seventy percent of ECU students live off campus. Of these 12,500 off-campus students, it is estimated that a minimum of 10% live within 1-2 miles of main campus.

With the exception a few small key systems*, most voice switching for the 5,500 students and 3,500 faculty/staff on main campus is provided by a Nortel DMS100 class 5 switch* located in the Joyner Telecom room (provided with DC power* and generator backup*). On the line side, an OC-12 SONET fiber ring deploys voice calls using four Nortel Transport nodes* (Subscriber Modular Units a.k.a. SMUs) located in the Jones, Joyner, Austin*, and Sports Medicine buildings. Telephones (7,500 total) are connected back to the DMS via direct Line Concentrator Modules (LCMs)* or remotely using the four SMUs (Transport Nodes) and 22 Nortel Urban service nodes* (Remote Concentrator Units a.k.a RCUs). RCUs can support a maximum of 528 analog lines each. On the trunk side, the DMS has a total of 19 T1-CAS trunks (ECU has not licensed ISDN PRI software) connecting it to the PSTN. Local access trunks (11 T1s) connect to a Lucent 5ESS switch in Sprint's GNVLNCXA75F exchange on 5th Street. Long distance access for students is provided by two T1s to BTI, long distance for faculty/staff is provided by four T1s to AT&T's DAIN network. Two (2) trunks are provided to USLEC for 800 service. Voicemail (72 ports with 4,500+ mailboxes) is provided by a Nortel Meridian Mail system attached to the DMS. [1]

Voice services for the School Medicine on West campus and PCMH are handled by two new Nortel 81C PBXs.

2.3 Discussion of current ECU voice network - When installed in 1995, the DMS, Transport nodes, and Urbans were adequate for deploying basic voice service. The installation was carrier class quality and funded by a bond offering. Seven years later, however, ECU faces an increasing level of risk associated with the system. This assumed risk is the direct result of avoided or deferred expenditures for capital & operating expense. In short, the current voice platform may be too costly for ECU to properly support.

2.3.1 Assumed risk - As a comparison, a carrier using the same equipment to provide local dial-tone services from a central office can expect an average annual operating expense (OpEx) of $150-200/line. For a typical 10,000 line DMS installation, this equates to OPEX in the range of $1.5 to $2.0 million/year. Assuming that this level of OPEX (excluding overhead required to operate as a regulated carrier) represents a reasonable cost of service, comparing ECU's OPEX (mostly unbudgeted) for the switch yields a significant delta. This delta represents risk that ECU has accepted as a trade-off for minimizing, deferring, or avoiding OPEX costs.

2.3.2 Lack of features - The DMS was procured to eventually sell commercial voice services. Unfortunately, this never happened. In addition, a central office CLASS 5 switch like the DMS-100 is not as feature rich as PBX systems (such as a Nortel Option 81). While many features (such as ISDN) have since been added to CLASS 5 switches, ECU has not found them affordable to implement. To circumvent this cost, yet offer internal customers voice services they have requested, ECU has deployed some key systems. This solution supplements some features missing in the DMS, but does so with a potential for increasing the overall complexity of the voice system.

2.3.3 Invisible risk - As a result of avoided OPEX, risk has been assumed. Risk assumption is valid as long as the risk is understood and accepted. Understanding true risk can be clouded by perception, especially when it comes to understanding voice services. Culturally we have grown up perceiving every time the handset of a traditional telephone system is picked up, we can expect dial-tone with five nine's of service.

While industry specifications have been defined to measure this availability (like BellCore GR-512), ECU does not have a realistic assessment of the probability or impact of a major voice services outage. In short, associating the perception of "99.999% uptime/carrier class quality" with ECU's current voice system is an improperly set expectation. Properly designed & implemented, an IP Communications system can meet or exceed the "Five Nines" service reliability.

[1] See Appendix B for diagrams and photos.

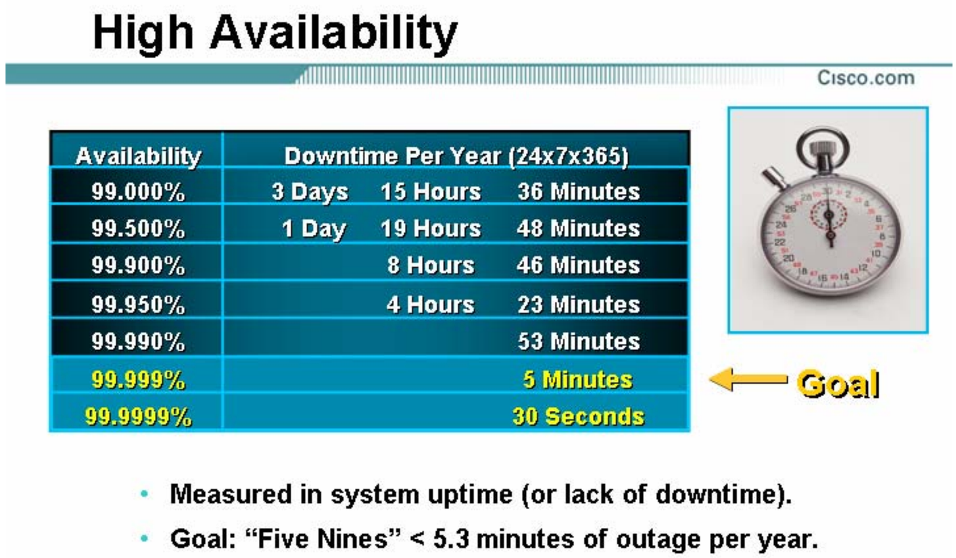

Figure 2.3.3. "Five Nines" availability.

2.4 Risk elements and impact - A simple classification scheme (H-high, M-Medium, L-low) was used to prioritize the identified risk elements associated with the current legacy voice system.

High

- Disaster recovery/avoidance - no formal plan exists for voice services
- Urban service nodes - obsolete, no support from Nortel
- Transport nodes - no regular maintenance schedule
- Transport nodes - a majority of student dorms are on the Jones Transport node
- DMS software - high upgrade cost, capitalized, no annual budget
- DMS hardware - high upgrade cost, capitalized, no annual budget, no support contract
- Growth - high cost for incremental DMS capacity increases
- Declining revenue - commissions from student long distance are decreasing
- E.164 addresses - current 252-328-xxxx NPA-NXX is inadequate to meet growth

Medium

- Transport nodes - no ECU staff trained for on-site technical support
- Staff - difficult to hire/maintain support staff
- MACs - significant personnel cost for Moves, Adds, and Changes of telephone handsets
- Disaster recovery/avoidance - no metric for estimating service disruption cost
- Growth - no annual capacity management analysis
- E.164 addresses - ECU has no ownership of 252-328-xxxx NPA-NXX numbers
- DMS hardware - 50% remains of an estimated 15-year useful life cycle
- Voicemail - significant personnel cost for mailbox management

Low

- PSTN LEC access - single carrier (ILEC Sprint) for local access
- Technology - difficult to integrate DMS call control with data applications
- Technology - obsolete switching & transmission technology
- SLA - no system for service level tracking, auditing, performance tracking
- OAMP - no formal system for Operations, Administration, Management, & Provisioning
- DMS PRI trunk support - no software support for ISDN
- Voice hardware - low secondary market resale value

2.5 Event scenarios - There are a number of potential scenarios which can impact the identified risks. The probability rating for these event scenarios is very subjective, but a general qualification could be as follows:

High

- Monetary impact - budget cuts, cost increases, declining revenue
- Growth - deletion of assigned 252-328-xxxx address ranges
- Mechanical failure - switch, transport system
- Natural disaster - flood, hurricane, lightening

Medium

- Physical accidents - fiber cuts, physical impact with equipment
- Environmental disaster - HVAC failure, power failure, building destruction, fire
- Configuration error - load balancing, PSTN trunks, line disconnects, switch software

Low

- Student attendance - declining attendance
- Staffing - departures, new hires, voluntary separations, work stoppages
- Processing outage - capacity overload
- Intentional sabotage - acts of terror, vandalism, or reprisal
- Carrier impact - trunk outages, transmission system outages, routing errors

2.6 Assumptions - Many things affect how aggressively ECU can migrate to IP Communications. From interviews with IT staff, the following assumptions were gathered:

2.6.1 Growth

- 6.2% annual student enrollment increase
- potential addition of a College of Engineering
- Addition of one new building every year, continuous renovation

2.6.2 Budget

- Flat budget for telecommunications
- Upgrades and replacements budgeted through campus reallocation
- No major new capital programs
- Emphasis on cost control and expense reduction
- ITCS will continue the 16% surcharge for all departmental phones.
- Operating capital/expense will continue to not be budgeted, delayed as long as possible

2.6.3 Operating costs

- Gross annual cost for ECU voice services is difficult to quantify
- Switch maintenance is time & material @ average labor rate of $440/hr ($30k for FY2001) with software version upgrades averaging $250,000
- Urban replacement cost (3rd party) is $75k *
- Switch annual software maintenance (not upgrade) can average $50-75k/yr *
- System expansion (no phones) can run $500-750/line *
- Phone costs range from $156 (analog) to $567 (digital)
- Urban line card costs are included in phone costs
- AT&T DAIN costs for staff/faculty long distance average $160k/yr (+/-)
- 16% uplift to departments on phone purchase (recovery for IT administrative)
- 16-25% uplift to departments for monthly LD (recovery for IT administrative)
  * note: averaged costs, sampled from Nortel quotes 1999-2001

2.6.4 Revenues

- $0.029/minute student LD commissions from BTI, minutes continue to decrease
- $500k/yr. internal transfer from Student Life to IT will continue to retire bond debt
- $10k/yr. from ECU phone book advertising
- No commissions from USLEC, Sprint, or AT&T carriers
- Incremental student revenue could be collected for “enhanced” services
- Potential for selling services to off-campus customers

2.6.5 Technology

- DMS100 switch has a useful life of 15 years, 50% expended now
- OC-12 Transport node system has a useful life of 10 years, 80% expended now

- Voice Over IP and TDM are both legitimate voice technologies
- NCREN IP network can be used for some intra-state toll-bypass calls
- PSTN access - Sprint will continue to be the provider for local access service

2.6.6 Administrative

- Staffing – additional requirements

Systems Prog. II	$53,315 (SMR)
Social Security	4,078 (7.65%)
Retirement	1,615 (3.03%)
Insurance	<u>2,933</u>
Total	$61,941/yr. x 5 yrs. = $309,705

Comp. Netw. Coord.	$46,261 (SMR)
Social Security	3,539 (7.65%)
Retirement	1,402 (3.03%)
Insurance	<u>2,933</u>
Total	$54,135/yr. x 5 yrs. = $270,675 x 2 positions = $541,350

For five years it would cost approximately $851,055 to fund these three positions, if there are no changes in the benefits.

- Cross department - increased cross utilization of resources on East & West campus
- Legal - loss of voice service for student dorms can have legal implications

2.7 Consequences of a risk event - Accepting risk implies that the risk, probability and impact is understood.

2.7.1 Most significant risks - Reflecting on the risk elements identified in section 2.4, and assessing the vulnerability of the current voice infrastructure to a risk event, the most significant risks appear to be:

2.7.1.1 Obsolete Urbans - Nortel has discontinued service and support
2.7.1.2 Unmanaged Transport nodes - no regular maintenance performed, staff not trained
2.7.1.3 Unbalanced Transport nodes - high percentage of residence students rely on one node
2.7.1.4 DMS software - DMS averages three to five versions behind the recommended software release
2.7.1.5 Disaster recovery/avoidance plan - no formal plan exists
2.7.1.6 Numbering - single block of 252-328-xxxx numbers is inadequate to meet growth

2.7.2 Highest event probability - Reflecting from section 2.5, the highest probable risk events are:

2.7.2.1 Monetary impact - budget cuts, cost increases, declining revenue
2.7.2.1 Growth - deletion of assigned 252-328-xxxx E.164 addresses
2.7.2.1 Mechanical failure - switch, transport system
2.7.2.1 Natural disaster - flood, hurricane, lightening

2.7.3 Three event scenarios - Combining these prioritized lists could yield the following scenarios:

2.7.3.1 A Transport node fails (possibly the primary residence hall node)
2.7.3.2 A natural disaster (such as a flood) impacts campus
2.7.3.3 Campus growth becomes limited by the current voice system

2.7.4 Consequences - A true scenario model would elaborate on each of these possibilities in detail. However, for the purpose of this brief discussion, the following consequences might happen:

2.7.4.1 An embarrassment or litigation occurs as the result of an outage (intangible costs?)
2.7.4.2 A business financial loss occurs as the result of an outage
2.7.4.3 A financial loss occurs as the result of inadequate response to a natural disaster
2.7.4.4 University growth or image suffers by not meeting business demands
2.7.4.5 Excessive cost is incurred to bring the DMS & voice system up to carrier class standards

2.8 Alternatives and mitigation options:

2.8.1 Do nothing - An unacceptable alternative. Based on the assumptions and the probable events (2/3 of which have already occurred), some action must be taken. At a minimum, a formal business continuity plan needs to be developed in the event of another natural disaster.

2.8.2 Invest in the current voice infrastructure to reduce risk - Costly with a poor ROI. The current equipment is already at 50% (minimum) of its expected useful life. The cost necessary to bring the equipment up to carrier class operational levels (relative to the initial investment) would be significant. In addition, an ongoing operational budget would be needed. This is a commitment ECU has been reluctant to address for the past seven years. At a minimum, a formal estimate of maintenance and replacement costs needs to be budgeted for the remaining in-service years for the DMS.

2.8.3 Outsource operation and ownership of the current voice infrastructure - Possible, but not likely nor cost effective. Faced with a situation similar to ECU, another major university in North Carolina explored this alternative. The result was that, while companies may offer to take over operation of the voice service infrastructure, no companies have offered to purchase it. As a result, the capital investment in the infrastructure becomes a stranded cost. Also to expect a company to operate the switch with a lower level of risk implies that some investment will be made. If this is done by the operations company, it will probably be passed back to ECU in the form of higher operational costs. At a minimum, an outsourcing contract could be explored.

2.8.4 Replace the DMS, Transport nodes, and Urbans with a LEC based Centrex service – Expensive and leaves few long-term strategic options available. For a carrier to offer this service, a significant portion of the current voice infrastructure would need to be replaced. Since ECU deployed a fiber based voice transport system (with a small percentage of voice lines directly attached via copper wiring), any carrier replacing this service would need to implement a similar infrastructure. As a result, if bid at a fixed price, ECU would be expected to make a long-term contractual commitment. In addition, this alternative does nothing to address positioning ECU to take advantage of new software based telephony features and voice applications.

2.8.5 Replace the DMS, Transport nodes, and Urbans with a distributed PBX model - Technically possible, poor ROI, limited long term value. As with previous alternatives, the current voice transport infrastructure would need to be replaced in addition to the DMS. If replaced completely, it will require significant project management and still result in an inability to take advantage of new open standards, software based telephony features and voice applications. If replaced partially, the resulting complexity of the infrastructure will increase (i.e. some calls are switched thru the DMS, some thru the PBX, which trunks feed where, etc.). As was observed by another university in North Carolina who supplemented a CLASS 5 switch with a PBX, this results in a very complex network. Adding services (such as enterprise wide voicemail) to this hybrid network requires significant effort.

2.8.6 Migrate to IP Communications in six-month phases - Technically reasonable, affordable, good ROI, good long-term value, but requires a significant commitment to the migration project. As section 3.0 of this discussion outlines, IP Communications represents the best alternative for ECU. The technology addresses all of the high-risk elements and events, and makes sense in planning for each of the three probability scenarios. However, the success of a migration to IP Communications for ECU requires:

- Some fundamental business decisions are addressed
- A commitment to technical excellence
- A tolerance is determined for accepting the current level of risk.

These three critical success factors are discussed in more detail in section 2.9.

2.9 Risk and Cost vs. Benefit Summary

	Risks (-) vs. Benefits (+)	
Area of Impact	**Legacy voice**	**IP Communications**
Transport Infrastructure	- Obsolete (Urbans, SMUs) - Voice only - Inadequate local support	+ Current (switches, routers) + Voice, Video, Data + Locally supportable
Voice switching (Hardware, software)	- Mid useful life - Single point of failure + Mature software - Closed architecture	+ P4 Ghz servers + Distributed architecture + > 1M production IP phones + Open architecture
Access (PSTN, NCREN)	- No ISDN support - PSTN access only - Poor disaster recovery	+ ISDN++ support + IP access to PSTN/NCREN + Managed IP gateways

Operations	- Staff w/CLEC skills - No asset management - No Disaster recovery	+ Data networking engineer + Current asset/mgmt tools + Flexible, quick deployments
Growth	- Limited trunk capacity - Limited line capacity - CLEC costs	+ Scales virtually (IP packets) + Scales virtually (IP packets) + Enterprise costs

	Cost (-) vs. Benefit (+)	
Area of Impact	**Legacy voice**	**IP Communications**
Transport Infrastructure	- High cost to evolve - Service cost ($/voice) - Contract support	+ Included in data network budget + Service cost ($/voice,video,data) + Locally supportable
Voice switching (Hardware, software)	- Expensive hardware - Costly to "expand" - Costly software upgrades - Costly maintenance	+ Commodity hardware + Economical to "grow" + Affordable software upgrades + Affordable maintenance
Access (PSTN, NCREN)	- Expensive to add ISDN support - Difficult to change LECs - PSTN charges to UNC schools	+ ISDN++ support included + Managed IP gateway alternatives + Use NCREN to avoid toll charges
Operations	- Staff w/CLEC skills - Difficult to know operational cost - Disaster recovery is difficult	+ Data networking engineer + Current asset/mgmt tools + Flexible, quick deployments
Growth	- Expensive to add ISDN support - Costly to support new buildings - CLEC costs	+ ISDN++ support included + Economical to "grow" + Enterprise costs

2.10 Suggested actions - The suggested action steps in this section articulate strategic, business, and tactical issues that need to be addressed. Making fundamental business decisions about ECU's approach to IP Communications will greatly impact the technology architecture. Making the strategic decisions will greatly impact the migration strategy. For a successful commitment to IP Communications, S.M.A.R.T. (Specific, Measurable, Achievable, Realistic, and Time bound) goals need to be set.

As discussed in the best practices of Cisco's own IP Communications migration, a successful project starts with visible executive commitment and sponsorship. To be successful, ECU will need to obtain the same level of executive commitment. This commitment will set the foundation for how quickly ECU can migrate off the DMS. Cisco successfully migrated (20,000) employees on a single campus in (12) months. If ECU chooses the most aggressive migration strategy, it will still be 50% of the people in 200% of the time as compared to Cisco's migration. Given executive commitment and the necessary resources, it is very realistic for ECU to meet the dates in section 4.0 for an IP Communications migration.

2.10.1 Immediate action

- Formalize a short-term plan for voice services disaster recovery by July 1, 2003.
- Re-distribute some of the student lines on the Jones Transport node by July 1, 2003.
- Publicly state a goal of "turning off" the DMS100 by Jan. 1, 2007.
- Use IP Communications in all new and renovated building projects beginning Jan. 1, 2003.
- Identify and replace 3 of the 22 Urbans by Jan. 1, 2004.

2.10.2 Strategic initiatives

- Become familiar with best practices for IP Communications rollout.
- Define ECU's IP Communications architecture (services and off-net IP calls).
- Pilot outsourced managed IP voice (PSTN gateway, IP Centrex) services with Sprint.
- Pilot IP phones in the dormitories, work with Student Life to develop new services.
- Study offering common IP Communications services to both East & West campus.

2.10.3 Business initiatives

- Decide ECU's operating model for voice services: cost recovery or revenue generation.

- Decide ECU's commitment to offering IP Communications services for the UNC system.
- Decide ECU's commitment to offering IP Communications services for other universities.
- Decide ECU's commitment as a clearinghouse for XML & IP Communications applications.
- Decide ECU's commitment to curriculum development involving IP Communications.

2.10.4 Tactical initiatives

- Implement a series of "quick strike" initiatives.
- Implement a non production IP Communications test system.
- Migrate the current IP Communications system to a redundant cluster. *(complete)*
- Move the IT staff to IP Communications. *(complete)*
- Assess staff support skills for IP Communications, provide additional training.

3. Strategy: Mitigate Risk by Migrating to IP Communications

3.1 Objectives – ECU's strategy to eliminate the risk described in section 2 of this discussion is to implement IP Communications. The objectives of this strategy are to eliminate the unacceptable level of risk associated with the current voice infrastructure. The objectives are to:

- manage the risks in providing voice services
- manage and contain operational and capital costs
- provide and extensible platform to cost effectively extend voice services in the future and create a reliable telephone service.

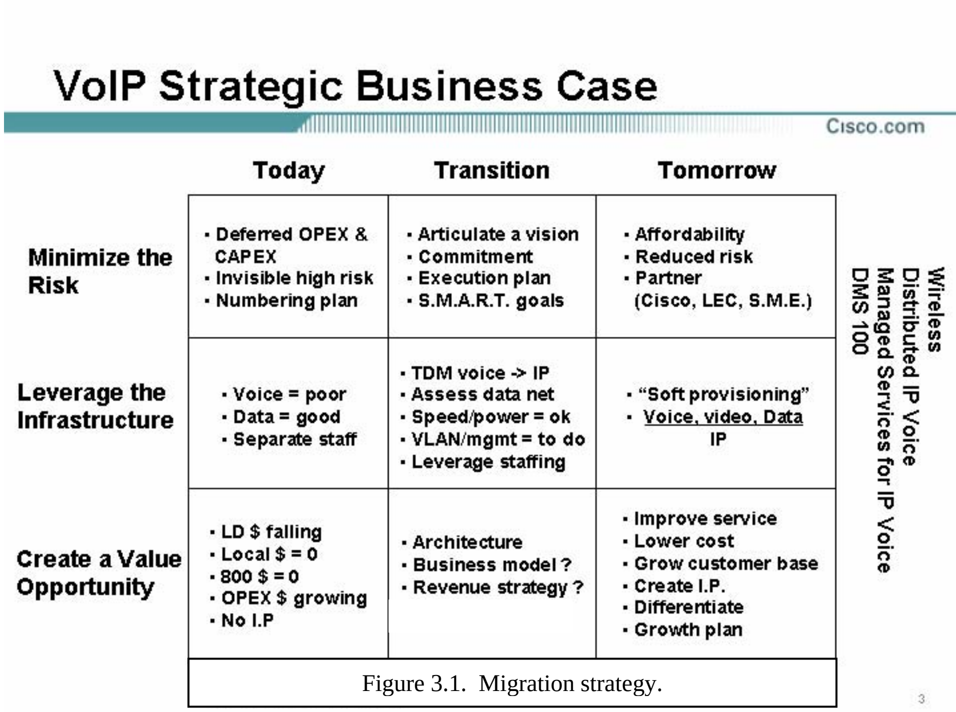

Figure 3.1. Migration strategy. [2]

3.2 Discussion - Implicit in the strategy is to mitigate and contain the understood current risk as quickly as possible. At best, the current risk can be eliminated and replaced with a manageable risk. All decisions and actions have risk, however well managed risk is the ultimate goal. As discussed in section two, to manage risk means it must be understood. As also mentioned in section two, the objectives of this strategy are influenced by critical success factors, namely:

- making technology in-source/out-source deployment decisions
- committing to technical excellence
- determining a tolerance for current risk.

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[2] OPEX – Operating Expenses
CAPEX – Capital Expenses
TDM – Time Division Multiplexing
LD – Long Distance

While the following four objectives of this strategy outline a plan to address current risk, they do not preclude introducing new risk with the new solution, risk that also becomes unmanageable. To reduce the chance of this happening, some strategic and tactical initiatives are necessary (discussed in sections 3.3 & 3.4 below) to support the following objectives:

Contain deferred operational and capital costs - Rather than committing to the potentially large cost of upgrading (or replacing) the DMS, Transport nodes, and Urbans, a cost containment strategy makes sense. This strategy would mandate that all new & renovated buildings deliver voice services using IP Communications. Taking a "shrink-and-grow" approach does require careful planning. For instance, calls will still need to be trunked from the new IP Communications system into the DMS, so costs associated with interim trunking arrangements would need to be carefully managed (perhaps a managed gateway service can be explored with Sprint). The more aggressive the timeframe is for the migration, the better the chance is to avoid DMS capital expenditures. The longer the migration, the higher the risk will grow and the greater the probability that capital expenditures will not be able to be deferred.

Implement an affordable platform for voice services - Since the real annual operating cost of the current voice infrastructure is difficult to quantify, it may also be difficult to define what an affordable cost is. At best, affordable could be described as incremental growth and maintenance costs that are an order of magnitude less than the DMS. It could also be qualified as offering the ability to "not be surprised" by unbudgeted incremental expenditures. An affordable platform also implies that people resources are knowledgeable on the technology, deployable, and available. Implementing an IP Communications based voice services platform leverages data networking skills and is a step in this direction. If the decision is made to out-source IP call-control to a LEC (such as IP Centrex from Sprint), then costs can be negotiated and controlled up-front. If IP call-control is in-sourced (such as a cluster of CallManagers on ECU's campus), then these budget amounts can be calculated and tracked up-front as well. In either case, IT will be held responsible for demonstrating that the new voice platform is more "affordable" (by quantifying both tangible and intangible benefits). Therefore, to not repeat the mistakes made with the DMS, migration as well as on-going OPEX costs need to be articulated and budgeted before the migration begins. Doing this depends on first answering the business decisions in section two; these decisions greatly affect the architecture and implementation of IP Communications for ECU.

Leverage a common infrastructure for voice/video/data - As highlighted in this short document on Cisco's website, a common infrastructure offers many benefits, but also has many requirements. To better understand these requirements, the following documents should be understood:

- http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/network/index.htm
- http://www.cisco.com/univercd/cc/td/doc/product/voice/ip_tele/avvidqos/index.htm

Together, these three documents will help ECU evolve a strategy for the IP Communications migration, regardless whether an IP Centrex or IP PBX approach is taken.

Create a value opportunity for offering university convergence (voice, video, and data) services - Again, this objective takes on different meaning based on these business decisions:

- Decide ECU's operating model for voice services: cost recovery or revenue generation.
- Decide ECU's commitment to offering IP Communications services for other universities.
- Decide ECU's commitment as a clearinghouse for XML & IP Communications applications.
- Decide ECU's commitment to curriculum development involving IP Communications.

Regardless of these decisions, as long as ECU continues to deliver voice services with it's current TDM based infrastructure, there is no value opportunity. Few, if any, new sources for additional revenue exist. As an information appliance, a regular phone (desktop or cellular) has little value. IP based devices are not just portals to display web based information via XML, they are method to unlock the power of content and intellectual property.

Once these business decisions are made, ECU should focus to create a measurable value opportunity. Depending on the number and magnitude of the business decisions, ECU should consider partnering with other universities, companies, or service providers (such as Sprint). The idea behind creating value is to concentrate on intellectual property (content, services, or products that are in demand by a consumer group) and not on unnecessary operational issues. Partnering allows this focus to happen, and creates the opportunity for an ecosystem (such as Cisco has done with its AVVID strategy) to evolve.

3.3 Initiatives: strategic - IP Communications is a method to deliver voice services and its implementation can take many forms. If implemented with out-sourced IP call-control, the network architecture will be defined one way. If implemented with out-sourced PSTN gateways, it will have a different look. If implemented with in-sourced IP call-control, the architecture will take yet another slight variation. All of these are perfectly acceptable, yet each style of deployment will have different implications for what protocols are used and how additional voice services are eventually rolled out. Once the business decisions have been made, then some strategic initiatives make sense to address:

3.3.1 Become familiar with best practices for IP Communications rollout
3.3.2 Define ECU's IP Communications architecture (services and off-net IP calls)
3.3.3 Pilot outsourced managed IP voice (PSTN gateway, IP Centrex) services with Sprint
3.3.4 Pilot IP phones in the dormitories, work with Student Life to develop new services
3.3.5 Study offering common IP Communications services to both East & West campus

These are a combination of both making fundamental architecture decisions and considerations for how to begin the project management of an implementation. The suggestion is made for ECU to consider some pilots of managed services while defining the architecture. An architecture (even if it has a couple of variations) always gives a solid point of reference to come back to when making decisions during the rollout. Possibly a set of architectural principles could be defined that would help guide later design decisions. Armed with another implementer's experience (Cisco's white paper), an architecture, and some evaluation pilots, ECU will be able to consider extending the migration to IP Communications to include offering common services on both East and West campus. Again, there are different business drivers for each campus, but the potential ROI for a common University wide architecture is well worth considering.

3.4 Initiatives: tactical and immediate - Regardless of architecture, implementation, or business decisions, there are some tactical and immediate initiatives that can give immediate benefits. This discussion recommends that ECU:

3.4.1 Implement a series of "quick strike" initiatives
3.4.2 Implement a non production IP Communications test system
3.4.3 Migrate the current IP Communications system to a redundant cluster *(complete)*
3.4.4 Move the IT staff to IP Communications *(complete)*
3.4.5 Assess staff support skills for IP Communications, provide additional training

These steps can yield some quick returns. They will give the IT staff both a production and a test environment which is essential before considering a full production rollout. By moving the IT staff to where they are totally dependent on a production IP Communications environment, they will demonstrate to the user community that they are subject to the same service levels, nothing special, as everyone else. This has in-fact already happened with the recent move of the IT department into the Cotanche building.

The last item in this list cannot be underestimated. A commitment to a successful migration, and a commitment to excellence both require adequate resourcing and staff training. It is strongly recommended that ECU adopt the same Tiger Team approach as Cisco did when they migrated from PBXs to IP Communications. This matrix approach leverages team member's skills as well as gives the opportunity for staff to "fill in the gaps" through cross interaction and formal training.

4. Implementation

Complete migration to IP Communications in six phases. The question of how quickly to address the conversion issue is an administrative decision; however for the purposes of this business plan, a six phased conversion approach was viewed as reasonable and responsible with respect to minimizing the ECU risk factors noted in section 2.4 above.

4.1 Migration plan

4.1.1 **Partners**: Cisco (hardware/software equipment provider), Dimension Data (Cisco equipment reseller and system integrator), and Sprint (public switched telephone network provider)

4.1.2 Assumptions

4.1.2.1 IP Telephony for new construction & remodeling must be capitalized within the project budget.
4.1.2.2 Migration is for ECU East campus only. ECU's Brody School of Medicine campus is excluded from this migration plan due to recent acquisition of a new OPBX phone switch.
4.1.2.3 Computer Telephone Integration (CTI) and Extended Markup Language (XML) applications are no cost value-adds associated with VoIP technology that will enable new and improved ECU telephone services. However, inclusion of this technology is beyond the scope of this report.

4.1.2.4 Wireless IP phones and Interactive Voice Response (IVR) applications are a value-added service associated with VoIP technology that will enable new and improved ECU telephone services. However, while an expense, inclusion of this technology is beyond the scope of this report.

4.1.2.5 The required number of IP phones for staff/faculty use is anticipated to be: Cisco 7960 telephone set (20%) and Cisco 7940 telephone set (80%).

4.1.2.6 The required number of IP phones for student use is anticipated to be: IP phones (20%) and analog phones (80%).

4.1.2.7 The current migration plan is based upon a current ECU telephone infrastructure comprised of 4 SONET transport nodes, 22 Nortel Urbans, and 8,241 telephone lines.

4.1.2.8 All students, faculty, and staff will have voice mail, "Unified Messaging"

4.1.2.9 The number of required telephone lines needed to meet the growing needs of students, faculty, and staff is variable but expected to grow by 6% annual growth over the next three years.

4.1.3 Architecture

ECU's IP Communications infrastructure will consist of Cisco's "Call Managers", "Unity Servers", routers, IP Phones, and IP/TDM gateways. Assumptions include:

4.1.3.1 IP based components - ECU's architectural vision is to create an all IP voice infrastructure and avoid legacy TDM components as much as possible. ECU will build a single common infrastructure: IP phones & voice servers will be uniformly supported, similar to how PCs and data servers are supported now. Network design and QOS provisioning will be in concurrence with Cisco's published Solution Reference Network Design (SRND) guides. The decision of whether to use analog phone adapters versus IP phones for students will be evaluated during the migration.

4.1.3.2 Public Switched Telephone Switch (PSTN) PSTN trunking (outsourced managed gateways vs. CPE) – If in-sourced, ECU will provide access to the PSTN by multiple ISDN Primary Rate Interface (PRI) IP/TDM gateways. However, in an effort to strive for an all IP voice infrastructure, an option will be explored with Sprint to provide a managed gateway service. With this service, it is envisioned that the IP/TDM gateways would not be owned by ECU, but be part of a managed service offering provided by Sprint. The LEC would provide dual, redundant GigE connections to the local CO, where Sprint owned gateways would convert the IP voice packets to TDM call legs. This would allow ECU to fluctuate PSTN trunking capacity during migration and avoid having excess gateway capacity at the end of the migration.

4.1.3.3 IP services - IP services such as enhanced conferencing, fax transport, fax to Unified Messaging System, Auto Attendant, Automatic Call Distribution (ACD), and Emergency 911 services will be provided. The majority of these services will be implemented during the first phase of the migration in preparation for system wide deployment in phases 2-5.

4.1.4 Description of four-year plan: six-month phases

4.1.4.1	Phase 1 - Day 0 services	
4.1.4.2	Phase 2 - Migrate Sports Med segment	(3 Urbans, 591 lines)
4.1.4.3	Phase 3 - Migrate Austin segment	(8 Urbans, 2,361 lines)
4.1.4.4	Phase 4 - Migrate Jones segment	(5 Urbans, 1,417 lines
4.1.4.5	Phase 5 - Migrate Joyner segment	(7 Urbans, 3,872 lines)
4.1.4.6	Phase 6 - Decommission current DMS100 telephone switch	

Implementation of this VoIP business plan will take place over a four year time frame with significant milestones being achieved in six month phases. A specific start date for phase one is not identified in this report due to uncertainty as to when the funding required for project completion will be available.

4.2 Phase 1: Day 0 services

4.2.1 Objective - The phase one objective is to initiate the replacement of ECU's current telephone infrastructure with state of the art IP based telephone services. This includes addressing QOS issues and related network infrastructure improvements in addition to decommissioning two urbans in the Sports Medicine and Allied Health buildings.

4.2.2 Goals - Phase one goals include: a) create an outsource contract for implementation services, b) development of a comprehensive training program for faculty and staff, c) upgrade the data/network switches to accommodate the VoIP migration, d) create and outsource contract for telephone billing services, e) create a test environment, and f) deploy infrastructure for auxiliary voice services.

4.2.3 Milestones - Approximately 3 months will be required to generate an outsource contract with a service integrator, contract for telephone billing services, and to upgrade data/network switches to accommodate new VoIP equipment. The last 3 months would be spent developing a VoIP telephone training plan that could be rolled out to faculty and staff. This phase would also include coordination with ITCS Help Desk support staff to address service issues associated with the use of VoIP equipment among faculty and staff users.

4.2.4 Roadblocks - Roadblocks include the lack of adequate support staff, i.e. trained integration service personnel (outsourced contract).

4.2.5 Solution – the benefits of this phase are that all preliminary services and components will be ready for a complete migration to IP voice systems.

4.2.6 Support Requirements - must include staffing needs and training, equipment test lab, help desk support services, and an outsourced billing solution.

4.2.7 Assumptions – these base level services need to be tested and ready to go before the migration can be started for the remainder of the campus.

4.2.8 Components - The following hardware components must be in place prior to the rollout of any campus based VoIP services. Components and the associated one-time budgeted expenses are as follows:

- 4.2.8.1 Test system & evaluation phones ($80K)
- 4.2.8.2 Auto Attendant servers, conference servers, IP conference MCUs ($200K)
- 4.2.8.3 Fax (legacy transport, UMS migration), ACD (IPCC or ICD) ($100K)
- 4.2.8.4 E911 servers ($25K)
- 4.2.8.5 Billing services ($20K)
- 4.2.8.6 Monitoring/troubleshooting ($75)
- 4.2.8.7 Training & implementation services ($100K)
- 4.2.8.8 West campus remote shelf ($100)

4.3 Phase 2: Migrate Sports Med segment

4.3.1 Objective - the objective is to replace three urbans, identified in section 4.3.7. A margin of error of ten percent has been included to accommodate unanticipated growth in the number of required telephone lines.

4.3.2 Goals - the goal of this phase is to begin implementation by focusing primarily on replacing faculty and staff traditional telephone sets with VoIP technology.

4.3.3 Milestones – every two months, one building will be migrated.

4.3.4 Roadblocks – learning curve as associated with the first time elimination of urbans

4.3.5 Solution - The features and benefits of this phase include the provision of enhanced voice services to approximately 8% of the university community.

4.3.6 Support requirements - must include staffing needs and training, equipment test lab, and desk support services.

4.3.7 Assumptions

- 4.3.7.1 0% students, 100% staff-faculty
- 4.3.7.2 Lines & Urbans:

Sports Med	163
Minges	164
Belk Allied	210
	--------
(3) Urbans	537
10%	54

Total	591

4.3.8 Components and budgetary pricing
- 4.3.8.1 Capital cost ($669K)
- 4.3.8.2 Infrastructure upgrade ($45K)
- 4.3.8.3 Annual maintenance ($33K)

4.4 Phase 3: Migrate Austin segment

4.4.1 Objective - The objective is to replace eight urbans, identified in section 4.4.7. A margin of error of ten percent has been included to accommodate unanticipated growth in the number of required telephone lines.

4.4.2 Goals - this phase is to continue implementation by focusing primarily on replacing faculty and staff traditional telephone sets with VoIP technology. A secondary goal is to begin the student migration to VoIP technology by migrating Slay and Umstead dorms.

4.4.3 Milestones - Milestones include allowing a 2 week migration period per building, a one week migration period for both Slay and Umstead dorms, and holding one week in reserve for unanticipated problems encountered during this phase of the migration.

4.4.4 Roadblocks - Roadblocks include the lack of adequate support staff, i.e. trained integration service personnel (outsourced contract).

4.4.5 Solution - The features and benefits of this phase include the provision of enhanced voice services to approximately 30% of the university community.

4.4.6 Support requirements - must include staffing needs and training, equipment test lab, and desk support services.

4.4.7 Assumptions - The total number of faculty, staff, and students identified in section 4.4.6.2 is approximately 10% students, 90% staff-faculty.

Lines & Urbans:

Austin	336
Rawl	166
Rivers	278
Whichard	327
Bates	317
AJ Fletcher	296
Flanagan	194
Slay & Umstead	232
	--------
(8) Urbans	2,146
10%	215

Total	2,361

4.4.7 Components & budgetary pricing
- 4.4.7.1 Capital cost ($1,008K)
- 4.4.7.2 Infrastructure upgrade ($140K)
- 4.4.7.3 Annual maintenance ($43K)

4.5 Phase 4: Migrate Jones segment

4.5.1 Objective - The objective is to replace five urbans, identified in section 4.5.7. A margin of error of ten percent has been included to accommodate unanticipated growth in the number of required telephone lines.

4.5.2 Goals - this phase is to continue implementation by focusing primarily on replacing student traditional telephone sets with VoIP technology. A secondary goal is to begin the student migration to VoIP technology by converting the dorms identified in section 4.5.7.2.

4.5.3 Milestones - Milestones include allowing a 8 weeks migration period per building and holding one week in reserve for unanticipated problems encountered during this phase of the migration.

4.5.4 Roadblocks - Roadblocks include the lack of adequate support staff, i.e. trained integration service personnel (outsourced contract).

4.5.5 Solution - The features and benefits of this phase include the provision of enhanced voice services to approximately 30% of the university community.

4.5.6 Support requirements - must include staffing needs and training, equipment test lab, and desk support services.

4.5.7 Assumptions -
- 4.5.7.1 90% students, 10% staff-faculty
- 4.5.7.2 Lines & Urbans:

Jones	234
Tyler	262
Scott	261
Aycock	270
Belk	261
	--------
(5) Urbans	1,288
10%	129

Total	1,417

4.5.8 Components & budgetary pricing -

4.5.7.1 Capital cost ($624K)

4.5.7.2 Infrastructure upgrade ($35K)

4.5.7.3 Annual maintenance ($68K)

4.6 Phase 5: Migrate Joyner segment

4.6.1 Objective - The objective is to replace seven urbans, identified in section 4.6.7. A margin of error of ten percent has been included to accommodate unanticipated growth in the number of required telephone lines.

4.6.2 Goals - this phase is to continue implementation by focusing primarily on replacing the remaining faculty, staff, and student traditional telephone sets with VoIP technology. A secondary goal is to begin the student migration to VoIP technology by converting the dorms identified in section 4.6.6.2.

4.6.3 Milestones - Milestones include allowing an 3 weeks migration period per building and holding one week in reserve for unanticipated problems encountered during this phase of the migration.

4.6.4 Roadblocks - Roadblocks include the lack of adequate support staff, i.e. trained integration service personnel (outsourced contract).

4.6.5 Solution - The features and benefits of this phase include the provision of enhanced voice services to approximately 30% of the university community.

4.6.6 Support requirements - must include staffing needs and training, equipment test lab, and desk support services.

4.6.7 Assumptions

4.6.6.1 40% students, 60% staff-faculty

4.6.6.2 Lines & Urbans:

White	410
Jenkins	96
Fletcher	382
Mendenhall	301
Spilman 266	
Greene	216
Cotton	133
	--------
(7) Urbans	1,864
LCM connect	1,656
10%	352

Total	3,872

4.6.8 Components & budgetary pricing

4.6.8.1 Capital cost ($1,656K)

4.6.8.2 Infrastructure upgrade ($78K)

4.6.8.3 Annual maintenance ($136K)

4.7 Phase 6: Decommission & remove DMS

4.7.1 Objective - to decommission and remove DMS 100 switch

4.7.2 Goals – determine how the decommissioned assets will be disposed of, i.e sold, traded, or surplused.

4.7.3 Milestones - allow 2 months to power DMS 100 down and disconnect unit. Allow 2 months to cancel software contracts and cleanup existing telephone records. Allow 2 months to physically remove the hardware from Joyner Library.

4.7.4 Roadblocks - Roadblocks include the lack of adequate support staff, i.e. trained integration service personnel (outsourced contract).

4.7.5 Solution – The benefit of project completion is that the Joyner Library space can be reclaimed by the university and re-designated for other purposes.

4.7.6 Support requirements - must include staffing needs and training, equipment test lab, and desk support services.

4.7.7 Assumptions - none

4.7.8 Components & budgetary pricing

4.7.7.1 Capital cost - none

4.7.7.2 Contract labor – ($75K)

5.0 Estimated Project Cost

The following sections depict cost summaries for Three-year implementation plans and Four-year implementation plans. The spreadsheets are cost estimates for phased implementation of of Voice over IP. Section 5.3 depicts all possible alternatives for voice communications for East Carolina University.

5.1 Three-year Implementation Plan

Estimated Project Cost: 3 Year Implementation Plan

Preferred Alternatives	Y1	Y2	Y3	Project Total
Yearly Totals	$1,509,000.00	$2,123,000.00	$2,261,000.00	
Capital Costs				
Project Initiation Costs				
Initial Startup Costs	$ 500,000.00			
Training and Implementation	$ 100,000.00			
ACD, Help Desk Solutions	$ 100,000.00			
Sports Medicine				
Initial Capital Costs	$ 669,000.00			
Req'd Infrastructure Upgrades	$ 45,000.00			
Austin				
Initial Capital Costs		$1,008,000.00		
Req'd Infrastructure Upgrades		$ 140,000.00		
Jones				
Initial Capital Costs		$ 624,000.00		
Req'd Infrastructure Upgrades		$ 35,000.00		
Joyner				
Initial Capital Costs			$1,656,000.00	
Req'd Infrastructure Upgrades			$ 78,000.00	
Decommision DMS			$ 75,000.00	
Maintenance				
Sports Medicine	$ 33,000.00	$ 33,000.00	$ 33,000.00	

Austin		$ 43,000.00	$ 43,000.00	
Jones		$ 68,000.00	$ 68,000.00	
Joyner			$ 136,000.00	
Personnel				
Systems Programmer II	$ 62,000.00	$ 62,000.00	$ 62,000.00	
Computer Network Coordinator		$ 55,000.00	$ 55,000.00	
Computer Network Coordinator		$ 55,000.00	$ 55,000.00	
				$ 5,893,000.00

Notes:

1) ACD - Automatic Call Distribution
2) Figures above do not include costs for anticipated growth in students, staff, or faculty.
3) For each 1,000 additional handsets added, capital cost will increase $450,000 (Includes call managers & gateways) & maintenance costs will increase $18,000
4) Stand-alone handsets cost $350,000 per 1,000

5.2 Four-year Implementation Plan

<u>Estimated Project Cost:</u> 4 Year Implementation Plan

Preferred Alternatives	Y1	Y2	Y3	Y4	Project Total
Yearly Totals	$ 1,509,000.00	$ 1,396,000.00	$ 975,000.00	$ 2,261,000.00	
Capital Costs					
Project Initiation Costs					
Initial Startup Costs	$ 500,000.00				
Training and Implementation	$ 100,000.00				
ACD, Help Desk Solutions	$ 100,000.00				
Sports Medicine					
Initial Capital Costs	$ 669,000.00				
Req'd Infrastructure Upgrades	$ 45,000.00				
Austin					
Initial Capital Costs		$ 1,008,000.00			
Req'd Infrastructure Upgrades		$ 140,000.00			
Jones					
Initial Capital Costs			$ 624,000.00		
Req'd Infrastructure Upgrades			$ 35,000.00		
Joyner					
Initial Capital Costs				$ 1,656,000.00	
Req'd Infrastructure Upgrades				$ 78,000.00	
Decommision DMS				$ 75,000.00	
Maintenance					
Sports Medicine	$ 33,000.00	$ 33,000.00	$ 33,000.00	$ 33,000.00	

Austin		$ 43,000.00	$ 43,000.00	$ 43,000.00	
Jones			$ 68,000.00	$ 68,000.00	
Joyner				$ 136,000.00	
Personnel					
Systems Programmer II	$ 62,000.00	$ 62,000.00	$ 62,000.00	$ 62,000.00	
Computer Network Coordinator		$ 55,000.00	$ 55,000.00	$ 55,000.00	
Computer Network Coordinator		$ 55,000.00	$ 55,000.00	$ 55,000.00	
					$ 6,141,000.00

Notes:

1) ACD - Automatic Call Distribution
2) Figures above do not include costs for anticipated growth in students, staff, or faculty.
3) For each 1,000 additional handsets added, capital cost will increase $450,000 (Includes call managers & gateways) & maintenance costs will increase $18,000
4) Stand-alone handsets cost $350,000 per 1,000

5.3 Implementation Plan Summary

<u>Estimated Project Cost:</u> Implementation Plan Summary

			Implementation Cost		Annual Maintenance	
1	Implement Voice over IP - 3 Year Plan	$	5,436,000.00	$	457,000.00	
2	Implement Voice over IP- 4 Year Plan	$	5,608,000.00	$	533,000.00	
3	Upgrade current DMS 100 to recent levels	$	9,337,511.00	$	1,500,000.00	Approx. cost for DMS upgrade and annual maintenance
4	Replace current DMS with Centrex Services	$	-	$	1,944,000.00	Primary cost is $18 per line per month for each of 9,000 lines. Adds, moves, and changes are additional costs as they occur
5	Replace current DMS with distributed PBX	$	11,300,000.00	$	900,000.00	Capital Cost is highly front-end loaded
6	Do nothing	$	-	$	-	System will degrade to the point of inoperability within 2 or 3 years.

6. Appendix

6.1 Abbreviations and Definitions

ACD	Automatic Call Distributor - A device that distributes incoming calls to a specific group of terminals.
AVVID	Architecture for Voice, Video and Integrated Data - Cisco AVVID provides the baseline infrastructure that enables enterprises to design networks that scale to meet Internet business demands. Cisco AVVID delivers the e-business infrastructure and intelligent network services that are essential for rapid deployment of emerging technologies and new Internet business solutions.
CLEC	Competitive Local Exchange Carrier - Alternative Local Exchange Carrier.
CTI	Computer Telephone Integration - The ability of a computing application to take control of a telephone system.
DAIN	The state's long distance network.
DMS	Digital Multiplex System - Northern Telecom's line of usually huge, and central office-oriented, voice and high-speed data switches. A DMS switch typically provides telephone service for 10,000 or more customers.
IP	Internet Protocol - The method or protocol by which data is sent from one computer to another on the Internet..
ISDN	Integrated Services Digital Network - An international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires.
IVR	Interactive Voice Response - A telephony technology in which someone uses a touch-tone telephone to interact with a database to acquire information from or enter data into the database.
LCM	Line Concentrator Module
LEC	Local (Telephone) Exchange Carrier - A public telephone company in the U.S. that provides local service.
MCU	Multipoint Control Unit - a device in videoconferencing that connects two or more audiovisual terminals together into one single videoconference call.
NCREN	North Carolina Research and Development Network – A private telecommunications network to interconnect universities, research institutions, and medical and graduate center in North Carolina.
PBX	Private Branch (Telephone) Network - A private telephone network used within an enterprise..
PRI	Primary Rate Interface (for digital network service) - A type of ISDN service designed for larger organizations.
PSTN	Public Switched Telephone Network - Refers to the international telephone system based on copper wires carrying analog voice data.
QOS	Quality of Service - a networking term that specifies a guaranteed throughput level.
SONET	Synchronous Optical NETwork - a standard for connecting fiber-optic transmission systems.
SMU	Subscriber Modular Unit.

TDM	Time Division Multiplexing - A type of multiplexing that combines data streams by assigning each stream a different time slot in a set.
T1	A dedicated connection supporting data rates of 1.544Mbits per second.
T1 CAS	A dedicated connection supporting up to twenty-four voice channels.
T1 IP	A dedicated connection supporting twenty-three voice channels and one data channel.
UPS	Uninterruptible Power Supply (emergency power supply) - a power supply that includes a battery to maintain power in the event of a power outage.
VoIP	Voice Over Internet Protocol - Voice delivered using the Internet Protocol via a data network.
WAN	Wide Area Network - A computer network that spans a relatively large geographical area
XML	eXtensible Markup Language - New standard developed by the World Wide Web Consortium (W3C). A flexible way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere.