ISUnet UWP (Universal Wiring Plan)
July 1995 Revision

I. Introduction

This document is a revision of the original ISUnet UWP (Universal Wiring Plan) which was adopted when ISUnet was first designed. With the passage of time, the original UWP has only been altered superficially. This revised plan significantly alters the original UWP and provides a much more flexible, scaleable, and higher performance design. As a result, the revised UWP offers much more upgradeability into future technologies with minimal investment. This revision also more closely conforms to the EIA/TIA specifications for data grade service.

Although the infrastructure for telecommunications is included in the original UWP, there will be little mentioned about it in this revision. There are no changes in the telecommunications cabling system in this plan. There are changes in the faceplates where both data and telephone service are present.

It is intended that this revision take effect immediately. Even if a given project is already been initiated, this plan should be evaluated and employed if the project is in a stage where it can be altered. Locations where STP cabling exists as described by the original UWP will not initially be effected by this revision. Each location on ISUnet will need to be reviewed to see what portions of this revision apply.

II. Standards

All work pertaining to ISUnet cabling must conform to a specific set of University and industry standards. These specifications help to guarantee that work described by these standards is performed at a consistent level of quality all across campus. Materials used and work performed should be in strict accordance with the latest requirements of the following standards bodies:

1) UL (Underwriters Laboratories)
2) NEC (National Electric Code)
3) NFPA (National Fire Protection Association)
4) EIA/TIA (Electronics Industry Association)/(Telecommunications Industry Association)
    a) 568 Telecommunications Wiring Standard
    b) TSB 36 (additional specifications for UTP cabling)
    c) TSB 40 (additional specifications for UTP connecting hardware)
    d) 569 Telecommunications Pathways and Spaces Standard
    e) 607 Grounding and Bonding Requirements (equalized potential)
5) ANSI (American National Standards Institute)
6) ISO (International Standards Organization)
7) IEEE (Institute of Electrical and Electronic Engineers)
    a) 802.5 (specifications for token ring and physical layer requirements)
    b) 802.3 (specifications for CSMA/CD and physical layer requirements)
8) OSHA (Occupational Safety and Health Act)
9) NEMA
10) ASA
11) ISUnet Revised UWP (Universal Wiring Plan)

III. The Original ISUnet UWP (Universal Wiring Plan) for Intrabuilding Networking

When ISUnet was first designed, token ring was selected as the primary campus network architecture. Since the focus of developing this new campus network was to replace our existing SNA network (COAX based) with a shared media network, support had to be available in our 3174 terminal controllers. This would provide workstations running 3270 emulation mainframe connectivety. At this time, only token ring was supported in our 3174 controllers. Since SNA was our primary reason for developing ISUnet in the beginning, token ring was the only real solution available at the time.

Once the architecture had been determined, we needed to select a cabling type. It had to be standards based (to provide consistency) and easy to work with (to allow us to deploy it in a timely manner). At the time, the only cabling system that was available that met this criteria was STP (Shielded Twisted Pair). UTP (Unshielded Twisted Pair) was also available, but no true cabling standard existed for data grade service (only analog and digital telephone cabling was available). As a result, UTP was not a valid media specification for token ring. Token ring on UTP cabling was not supported until category 4 was developed.

The IBM UDC (Universal Data Connector) was used as the standard data connector between patch cables and STP based equipment. This connector rates out around 30Mhz which fully satisfied the requirements for 16Mb/s token ring.

After token ring using STP cabling was selected, a cabling plant design was needed to provide uniformity between multiple locations on the new network. Since STP cabling has a large conduit requirement in bundles, the decision was made to use a distributed hub model. This would allow us to have minimal cables between floors and reduce the overall cable length to end stations. In this model, a token ring hub was placed in a closet on each floor in a given building. All station cable that came into the closet was connected directly to the hub (using IBM data connectors). A pair of cables was then provided between floors to interconnect the hubs. In an effort to keep these cables at the same length (to reduce the possibility of distance issues), the cables were only connected to a downstream hub port at every other floor when possible.

The original token ring hub used was the IBM 8228 MAU (Multistation Access Unit). This hub is non-intelligent and has 8 data ports. Our original specification allowed up to 200 devices on a single ring. With this configuration, up to 24 MAUs could be chained together on a single network.

Once the system was designed, we needed to address the issue of how to get end station cabling to a jack for our users. In response, it was decided to offer an STP jack wherever there was telephone service. When the Telecommunications Office replaced their existing analog phone system with a digital service, the existing telephone cabling was replaced with level 2-3 UTP cable (for the digital telephone service) and STP cable (for data) was pulled with it. The end result was that where there was a digital phone, there was a token ring jack. All future adds for telephone and data service was arranged by contract with Ericsson.

When the cabling was pulled, it was brought the nearest cable tray system (when available) on the same floor. This system delivered the cables to the appropriate riser closet on the same floor. In between the riser closets, a 2” conduit (or sleeved hole) was needed to provide an avenue for patch cabling between hubs. In the beginning, this cabling was STP but eventually evolved into 12 strand MMF riser rated cabling.

As each MAU was placed in a closet, a system was needed to standardize the interconnections between floor closets. Basically, there are two types of floor closet systems in the original UWP. The first type is the vertical riser system. In this environment, a pair of STP cabling was pulled to every floor. In the base riser closet, the cable ends were terminated with IBM data connectors. One riser cable plugged into the RI (ring in) of the first MAU in the rack. The other riser cable plugged into the RO (ring out) of the last MAU in the same rack. STP patch cable was used to interconnect MAUs in the same closet by chaining from the RO on the first MAU to the following RI on the next MAU. The riser cable originating from the RI on the first MAU would terminate in the closet two floors above the base riser system (if there are 3 or more floors other it would terminate on the second floor). This terminated cable will then plug into the RO on the last MAU in the rack. The second type of cable system was the horizontal system. In this environment, cable was pulled in pairs between closets on the same floor. The important notion was that the cabling distance needed to be minimized as much as possible.

As each token ring was created, a connectivety solution was needed. This product would allow us to interconnect token ring networks so that we could scale ISUnet. At the time, SRB (Source Route Bridges) were the only technology available for interconnecting token ring networks. In an effort to address cost concerns, we deployed SRB using 286 based (or higher) PCs running bridging software.

As time passed, MMF (Multi-Mode Fiber) was passed between floors in the same manner as the original STP patch cables. This allowed us to transcend distance and other issues typically synonymous with copper cabling. IBM 8220 Fiber Optic Repeaters were used at either end of each fiber pair. Although SMF (Single Mode Fiber) was available, it was economically unfeasible (in some cases costing an order in magnitude more than MMF). The same basic rules applied for pulling MMF between floors as did with STP cabling.

In an effort to reduce the impact of wire faults and add auto recovery, we introduced intelligent token ring hubs in strategic parts of ISUnet. The intelligent hub used was the IBM 8230 CAU (Controlled Access Unit) which featured ring recovery, fault isolation, and connection information. The CAU has also helped us with our physical address management. Twenty data ports were provided by the LAM (Lobe Attachment Module). Each CAU could support up to four LAMs.

Where fiber was used between closets, a pair of fiber optic converters could be plugged directly into a CAU replacing the copper attachment modules. In this configuration, the IBM 8220 Fiber Optic Repeaters were no longer needed. The only issue of this design was that fiber optic converters and fiber optic repeaters are incompatible on the same cable. IBM fiber optic repeaters use a proprietary signaling method with a 5 volt phantom signal. The IBM 8230 fiber optic converter modules follow the specifications outlined in the IEEE 802.5c pseudo standard for token ring over fiber.

In review, the following equipment is used in every closet:

1) 19” Harris Dracon equipment rack
   - a) EIA spec threaded hole drill pattern
   - b) IBM grounding kit, (P/N 4716804)
   - c) 6 outlet AC power strip with 6’ cord
   - d) rack shelf (for bridge), IBM (P/N 62173036)

2) fiber optics
   - a) Siecor 12 strand, 62.5 (FDDI spec MMF) riser rated (NEC Section 770, OFNR rating) fiber optic cabling (P/N 12K81-31141-00)
   - b) 2 fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to mini BNC connectors
   - c) Siecor 24 port patch panel, rack mountable (P/N C-MIC-024)
   - d) Siecor connector panel (P/N FDC-CROP)
   - e) Siecor interconnect sleeves (P/N TER-067)
   - f) terminating connectors for MIC-012 cable, industry standard ST connector

1) IBM 8230
   - a) CAU (Controlled Access Unit) Model 1, 80 stations
   - b) copper patch between CAUs in same closet; fiber between closets
   - c) LAM (Lobe Attachment Module) STP (using IBM UDC)
   - d) 20 data ports for each LAM
   - e) up to 4 LAMs/CAU
   - f) 2 IBM wiring harnesses for each LAM

4) IBM Fiber Optic Converter Module (P/N 55F5503)
   - a) 2 for each closet

5) STP-A cabling (type 1, plennum)
   - a) Belden
   - b) IBM UDC connectors

Each building ring was bridged into a campus fiber ring located in a closet in the base riser system which was traditionally in the basement or first floor of a building. Building bridges connect the building network to one of seven campus fiber networks. In the same closet, a pair of IBM 8220 Fiber Optic Repeaters are used to connect to an IBM 8228 MAU. The bridge primary adapter (in slot 1) plugs into the first port on the MAU connected to the fiber repeaters. The alternate adapter (in slot 2) plugs into the first port of the MAU (or LAM) on the building ring. Before the bridge can be brought on-line, it must be configured by someone from Networking Systems.

The following equipment is used in addition to the equipment listed above in the closet where the campus trunk ring connects to the building network:

1) fiber optics
   - a) two IBM 8220 Fiber Optic Repeaters (P/N 96X5810)
   - b) IBM Rack Mounting Assembly (P/N 6339139)
   - c) yellow crossover STP cable, IBM (P/N 6339137)
   - d) black patch STP cable, IBM (P/N 8642551)

2) PC based bridge
   - a) 386 based PC, ISA
   - b) two ISA IBM Token-Ring Network 16/4 Network Interface Card Adapter, f/n 0149
   - c) two IBM Token-Ring PC Adapter Card Cable (P/N 6339098)

d) IBM Token-Ring Bridge Program
e) IBM PC DOS V5

3) IBM 8228 MAU (Multistation Access Unit)
   a) 8 data ports
   b) connects to fiber optic repeaters
   c) bridge interconnects between the first port on a MAU and the first port on the first LAM

With the infrastructure complete, the jack had to be standardized. With both data and telecommunications needs provided, our standardized jack became the Epitome single gang system. In this configuration, the IBM UDC (Universal Data Connector) was placed on the top of the faceplate and a dual RJ11 was placed on the bottom. The IBM UDC was provided for data grade service (ISUnet) and the dual RJ11 was provided for both phone (left jack) and low grade data service (right jack). The low grade data service included localtalk and ethernet. In the dual jack, all eight conductors of the 4 pair circuit were split. Thus, each jack had 2 pair for use.

The following components were used in the ISUnet faceplate:

1) faceplate
   a) Thomas & Betts, Epitome
   b) single gang, dual interface
2) data
   a) UDC (Universal Data Connector) aka IBM data connector
   b) locking clip
   c) top position in faceplate
3) telephony
   a) dual RJ11 module, 8 conductor
   b) bottom position in faceplate

This system has grown into what is known as the ISUnet UWP (Universal Wiring Plan). Although it has been altered over the years (as demonstrated in this section), it has not significantly changed since its original development..

As ISUnet grew, issues pertaining to scaleability began to emerge. SRB only provided scaling to a certain degree. Due to this concern and other technical issues with network layer protocols, we began introducing multiprotocol routers. When strategically placed, these routers have allowed us to reduce unneeded traffic levels, respond to specific technical problems, and scale out ISUnet. At the same time, we have and will continue to enhance or replace our existing bridges and introduce intermediate technologies such as packet switches. These changes are not included in the original UWP.

IV. Reasons for Revising the Original UWP

Much time has passed since the development of the original ISUnet cabling design plan known as the UWP (Universal Wiring Plan). Since no major changes have taken place in this plan but many changes have occurred in the industry, we feel that the original UWP no longer meets the needs of our campus environment. Nor does this standard appropriately posture ourselves for future emerging technologies. Today, we work with not only token ring (using STP), but also ethernet (using COAX and UTP) and localtalk (using UTP) of various types and configurations. We are also trying to prepare ourselves for future technologies such as fast ethernet, 100BaseVG, and ATM (Asynchronous Transfer Mode). With the adoption of 25Mb/s ATM by the ATM Forum back in March of this year, we feel that STP has seen the end of its useful life. We have heard of the development of a 51Mb/s ATM using STP but this is still speculation.

ATM is a newly evolving high performance networking architecture that combines data, telephony, and video services over a single cabling system. The QOS (Quality of Service) is determined by the application. For example; telephony or video applications need isochronous transmission rates while data is more bursty and less susceptible to delays. ATM is also the first architecture that is scaleable from 25Mb/s, 100Mb/s, to 155Mb/s (OC3). Future applications will use 622Mb/s (OC12) and 2.48Gb/s (OC48).

In the end, STP cabling doesn’t appear to have evolved with these new high performance architectures. The original STP and the accompanying data connectors did not initially rate beyond 30Mhz. Most high performance networks require 100Mhz and beyond. This is an issue to be concerned about since the development of networked multimedia applications have greater bandwidth requirements than traditional environments deliver. Today, existing Belden STP has been reclassified as STP-A which performs up to 300Mhz for data applications and 550Mhz for video applications. This development appears to give STP cabling performance requirements that are needed for newer technologies, but other components such as connectors, patch panels, and electronics have not emerged to support these higher performing characteristics.

Although STP has evolved into a higher performing cabling system (STP-A), the existing STP data connector still does not satisfy these performance requirements. A new data connector has evolved for STP that does meet the 100Mhz specification. The EDC (Enhanced Data Connector) has enhanced shielding than the UDC allowing higher performing architectures on the original STP cabling system. However, the EDC has not yet been used on campus. This topic will be addressed in the section entitled ***Maintaining STP Installations*** covered later in this revision.

Despite these issues, STP still has technical advantages over UTP cabling. STP offers superior electrical characteristics due to the type and level of shielding used between cable pairs. With STP, we have never experienced problems as the result of EMI (Electromagnetic Interference) between pairs or with other devices. This is not necessarily the case with UTP cabling. Greater care has to be taken when designing cabling systems with UTP since it is more susceptible to EMI and RFI. This dilemma has kept us from making this specification change until now. However, this feature alone cannot make up for the lack of development with STP in emerging technologies.

In the interim since we've introduced STP cabling on campus, 4 pair category 5 UTP cabling has become the new industry cabling standard as improvements in line quality and performance have been made repeatedly. This is due to the fact that UTP has been widely adopted in ethernet (which comprises about 70 percent of the total networking market). As a result, all of the new evolving high performance architectures have support for UTP (category 5) cabling. In response to this concern, we have been using UTP cabling in our residence hall project. This cable is rated at 350Mhz and is completely supported in the newly evolving high performance standards. This system is higher performing from the electronics to the jack than the STP-A cabling system could ever be.

Electronics that are being developed today are specifically geared towards environments where UTP and MMF (Multi-Mode Fiber) are used. No vendor is developing products that include STP cabling systems as part of their new networking product lines. Today, vendors are telling us that 155Mbs ATM on UTP cabling is a product that will be available soon (100Mb/s ATM on UTP is already here). There is no development at all with ATM (or other high performance network architectures) using STP cabling.

About a year ago, IBM developed a proprietary system known as SDDI (STP Distributed Data Interface) for STP-A cabling systems. This system rated at 125Mhz (100Mb/s FDDI on STP). However, components necessary for using SDDI were expensive and difficult to obtain. As a result, SDDI never really emerged as a real high performance architecture on STP. Even IBM admits that the evolution from token ring should be ATM.

Although it is possible to mix UTP and STP, a major characteristic of these cabling systems must be addressed. The impedance of UTP cabling is 100ohms while the impedance of STP cabling is 150ohms. To interconnect these cabling systems, an impedance matching device is needed. This can either be done at the electronics or with a special interface adapter. These factors increase the cost of delivering these services.

STP cabling is a 2 pair standard while category 5 UTP cabling systems are traditionally 4 pair. Although not all 4 pairs are used at the same time, special application specific pinout assemblies would be needed to interface between the two systems. A four pair system would be application independent. The following table depicts cabling pin assignments by architecture on a 4 pair UTP cabling plant:

Architecture	***Pin 1***	***Pin 2***	***Pin 3***	***Pin 4***	***Pin 5***	***Pin 6***	***Pin 7***	***Pin 8***
token ring			X	X	X	X		
ethernet	X	X	X			X		
ATM	X	X					X	X

Regardless of what application is used, the cabling system would not be altered because all 4 pair are punched throughout the cabling system. In an STP environment, special cables with application specific pinouts would need to be used.

If the current trend continues, then it would seem inappropriate to continue to deploy STP cabling in new construction or renovations when UTP cabling would be more flexible and better serve our future requirements. It is for this reason that UTP cabling was chosen in the cabling design for the new residence hall networks. This cabling plant has worked well and given us a migration path into high performance technologies with minimal future investment (in the cabling, jacks, or connectors).

Other less technical reasons exist for changing our existing cabling standard. Conduit requirements are much greater for STP plants compared to 4 pair UTP plants. Two pair STP cabling is about 4 times larger than 4 pair UTP cabling. This issue has been a major influence from keeping the market away from STP.

We also need to move towards being more flexible in the use of deploying multiple simultaneous network architectures. Together with the electronics we have selected, we can selectively support multiple network applications over a common cabling specification in the same chassis. Today, this includes token ring and ethernet. In the near future, this will include fast ethernet, 100BaseVG, and ATM (25Mb/s, 100Mb/s, and 155Mb/s). In these configurations, a bridge, router, or switch would be needed to interconnect these networks. This makes the new specification described in this revision as *future proof* as technically possible.

Although we can offer more than just token ring with this new cabling plan, we have not adjusted our position on the importance and continued focus on token ring on ISUnet. Token ring will continue to be our primary campus network architecture until a superior application evolves and can be implemented in a cost effective manner. This future technology will most likely be ATM.

In addition to addressing concerns with intrabuilding networking, we need to deal with migration to future technologies for our campus backbones. With the original UWP, we delivered 6 or 12 strand MMF between buildings on a given fiber backbone. This was fine for token ring, ethernet, or FDDI (Fiber Distributed Data Interface). Today with the evolving standards of newer higher performing architectures such as ATM (Asynchronous Transfer Mode), MMF is not a solution for building an ATM backbone. Only SMF is being developed as a means for delivering ATM as a campus backbone infrastructure. As a result, SMF needs to be included in our standard for interbuilding networking.

V. The Revised ISUnet UWP (Universal Wiring Plan) for Intrabuilding Networking

To use UTP in new construction and renovations, a new standard for cabling and associated components must be developed. This new plan would need to be much more flexible than the original UWP but be cost effective. Most importantly, the revised UWP must offer a system plan that provides an environment for existing systems (such as token ring and ethernet) and future applications such as 100Mb/s ethernet, 100BaseVG, and ATM.

For station cabling, using UTP would give us the opportunity to develop a new system design philosophy compared to the specifications of STP in the original UWP. STP cabling has a large cable diameter. As a result, the only practical model for designing cabling plants was the distributed cabling system. Since UTP has a much smaller cable diameter than STP cabling, it is possible for us to consider a cabling home run system or some type of hybrid with the distributed model. In this design, cabling from a given set of floors in a riser system would connect to a concentrator in an assigned closet. Since the distance between floors in a stacked riser system is only about 12 feet for each floor (on the average), we feel that home running does not significantly impact the total cable distance. The advantage of this design is to allow us to centralize our electronics. Typically, a high density concentrator has more intelligence and greater expandability than a set of distributed hubs. This allows us to offer more features and have greater control for an equal or smaller amount of money than a distributed hub design. With higher density riser systems (discussed later), multiple closets would contain electronics.

At the same time, we need to address the requirements of applications over fiber. The contruction of a fiber distribution system should be a major component of the UWP revision. This system must provide an infrastructure for multiple applications such as high speed datacommunications and video.

With cabling systems, there are two potential distribution models. With a vertical riser system using home run cabling with UTP, drops would be pulled from the jack horizontally to the nearest riser closet on the same floor (a given building may have multiple riser systems) through a cable tray system. With a horizontal system with UTP, cabling would be ran to the nearest closet through a cable tray system. On ISUnet, the vertical riser system is more prominent and preferrable.

With station cabling, Belden systems have long since been one of the highest performance cabling products on the market (if not the highest). This is true for both STP and UTP. As a result of our research and previous experience, we have selected the DT350 (DataTwist 350) cabling system from Belden for the revised UWP. This product obtained the name DT because each of the 4 pairs in the sheath are bonded together. This helps to prevent improper installations by having the pairs untwisted too far on the termination block. The 350 indicates that this cabling is rated at 350Mhz for data applications (although Belden has unofficially told us that the cabling actually rates much higher). To satisfy the requirements of UL and NEC standards, plennum rated cabling is used throughout the system (with the exception of the patch cordage in the electronics closets). All cabling is red to distinguish it from other systems.

This system should conform to the specifications described in the EIA/TIA 569 standard. All requirements must be met including the 25 foot-pound limit and the bend radius specification for category 5 UTP. Cabling should be kept at least 12" from any potential EMI (Electromagnetic Interference) or RFI (Radio Frequency Interference) throughout the system. To conform to the EIA/TIA 568 specifications, the cable distance from the jack to the media module in the concentrator must not exceed 90 meters

A cable tray system would need to accommodate the horizontal UTP cabling as it was pulled to the terminating closet. These closets are known as the DIDF (Data Intermediate Distribution Frame). The DIDF contains the components for a fiber patch panel and UTP termination assembly. A 19" rack would be placed in this closet for mounting a high density rack mounted termination system. The size of the system would vary depending upon the density required in the closet.

In the revised UWP, we would move toward high performance terminating blocks. The specific product we intend on using is the Krone highband termination system. This is the only product in the market that specifically spells out in writing that it will support requirements for high performance networking such as 100Mb/s ethernet and 155Mb/s ATM over a qualified 4 pair, category 5 UTP cabling system. Krone and Belden have officially certified each others products for these performance standards.

The terminating block system is composed of a 19" rack mount kit, three 20 position mounting brackets, and sixty highband terminating block modules. The capacity for this system is 120 stations (punching all 4 pair) for every rack mount kit. Since this system is rack mounted (as opposed to wall mounted), it can be placed on both sides of the 19" rack providing a capacity for up to 240 stations. To offer this density, the 19" rack must be oriented in the closet as to provide access to both front and back of the rack. The termination block system will be placed in the middle third of the rack to leave room for the deployment of future electronics.

The terminating block modules snap on to an used row of the 20 position brackets. Cabling originating from the jack we come into the back of the mounting bracket assembly and terminate on top of the block by pair. Starting at the top of the system, each cable coming from a cable tray or similar system would terminate in order by room number onto the block. No more than half of an inch of each pair should be untwisted when punching on the block. The sheath should not expose any of the pairs beyond 1". All four pair are to be terminated using EIA/TIA 568B pinout assignments. We require at least 2' of slack for each cable terminating into the termination block so there is enough cable for movement within the system.

A separate (identical) cable would then be punched on the block on top of the horizontal cabling. This cable would drop down or rise through a vertical riser conduit or a bundle with a floor sleeve without interruption until it came into the primary closet for that riser system which is typically located in the basement or first floor of a building. Riser cables originating from floors above would not be punched in the termination block. Instead, these riser cables would continue down the riser system until it reached the closet where the assigned electronics were located.

Terminating the horizontal UTP cabling in the riser closet and then terminating a new cable that continues to the closet containing the electronics would give us a great deal of flexibility. If the cabling was damaged or needed to be replaced, only a portion of the drop would need to be repulled. If we needed to tap into a drop in the riser closet, we could do it directly in the existing termination block in the rack with the least amount of work. An additional 5' loop of the riser cable will be left in the floor closet for easy termination on multiple floors for future requirements. Although this does not directly conform to the EIA/TIA 569 specification, we have been assured this configuration does not alter the quality of the installation. Since we don't use patching blocks which potentially introduce more points of failure or reduce installation quality as described in EIA/TIA 569, we feel that this is an acceptable alternative.

Cables should be properly secured to the rack and wire management system. Tie wraps should only be used sparingly (at most once every 2'). Staples or similar products should ***NEVER*** be used.

The closet containing the electronics are assigned based upon physical requirements within the riser and the station density. These closets are known as the EIDF (Electronics Intermediate Distribution Frame). An EIDF contains the same components as a DIDF with the addition of electronics such as concentrators, bridges, routers, or switches. The advantage of the DIDF-EIDF system is that any DIDF can easily be transformed into an EIDF as needs dictate.

With a horizontal cabling system, multiple EIDF closets could be placed on select floors. Usually, when we have reached 200 to 250 station cables in a given riser system, there needs to be an even distribution of EIDF closets. Each of these electronic closets are treated as distinct networks. There may also be multiple vertical riser systems within a building. In this environment, each EIDF closet would create a separate and distinct network. Every EIDF must have 6 four pair, category 5 UTP cables terminating in the closet where the campus fiber trunk enters the building. When possible, an indoor 12-12 fiber hybrid system (12 strand MMF and 12 strand SMF) should also be pulled with all 24 strands terminated in a junction box at either end.

In the EIDF closet, each riser cable would terminate onto another termination block with the same specifications as described for use in the DIDF closets. Again, the rack must be oriented in the closet so that the termination blocks are easily accessible from both the front and back for easy maintenance. The termination block system would be placed in the middle third of the 19" rack located in the closet. Above the system, there should be room at the top for a 24 port fiber junction box, a 2500 series CISCO router, and a concentrator. Initially, there may be no fiber terminating in these junction boxes.

To give ourselves flexibility, we need to define the specifications for a DIDF and EIDF wiring closet. Within the closet, we would require an minimal amount of space (4' by 4') with some type of physical security where we would place a 19" rack. No wall space is needed. This closet must satisfy the environmental requirements of the electronics used (i.e.: no harsh temperature or humidity conditions).

If the closet is collocated with other systems, there must be a reasonable level of protection provided. Even though in most closest there may be no electronics, in the short term future we may deploy equipment in these areas as the need arises. There should also be one 2" conduit for future fiber pulls and one 4" conduit for every 100 station cables between all floors (EIA/TIA describes a maximum 40% conduit fill). An additional 4" conduit should be placed in this riser system for future unforeseen applications in all new construction. These risers are dedicated for the sole purpose of data oriented applications (such as token ring, ethernet, ATM, etc.). Telephone, video, and power service should all be ran through other dedicated conduit.

Labeling would be crucial in maintaining this system. A label would need to be placed at the end of the cable where it terminates on the port on the terminating block in the EIDF. A label would also need to be placed on the jack. In the original UWP, there is no consistent system for labeling data grade cabling. With the revised UWP, a very simple model using a building number, room number, and jack number could be used for uniquely identifying each jack that all departments on campus could use for identification.

In addition to the UTP cabling distribution system, we would also deploy a fiber distribution system. In the revised UWP, we'll continue to use fiber in the campus trunk as was described in the original UWP. In addition, we'll begin using a fiber hybrid cabling system for intrabuilding networking. The DBDF (Data Building Distribution Frame) or EBDF (Electronics Building Distribution Frame) is the closet where the campus fiber trunks interconnect with the building network (aka the campus backbone closet).

At the top of the each rack in the riser system, we would place a 24 port fiber distribution cabinet with 2 slots for splicing trays. This system would house our indoor (tight buffer) 12-12 fiber hybird (12 strand MMF and 12 strand SMF). Two 6 port MMF (Multimode Fiber) connector panels are to be installed on the left side of the cabinet and two 6 port SMF (Singlemode Fiber) connector panels are to be installed on the right side.

Inside the distribution cabinet, the separate strands would be broke out of the sheath for termination. The 12 strands of MMF would be terminated with ST connectors into the 12 left ports within the cabinet. The SMF bundle would be spliced in a splice tray using a 12 strand preconnectorized pigtail. This system is then placed in the bottom of the cabinet. The pigtail system helps to guarantee the highest quality connection. This is a must if we intend on using this system for high performance applications.

MMF can be terminated using MMF ST connectors. These connectors can then be placed directly into the MMF connector panel and then capped for protection against foreign media. SMF is much more tolerance sensitive than MMF cabling. To give us the highest quality termination, we would use a SMF splicing system instead of manually terminating each SMF strand with an ST connector. Manually polishing SMF for ST termination is generally not very high quality. To keep costs low, we would use a mechanical splice since fusion splicers are far too expensive. No evidence has been provided that indicates that there is a significant loss of quality with mechanical splices. Using the campslice (mechanical splice) within a splice tray, all 12 strands would be spliced into a dual SMF pigtail. This assembly has 2 ST connectors that patch into 2 ports on the SMF connector panel. Six pigtail assemblies would be needed to fill the connector panel. The splice tray then slides into the bottom slot of the 24 port distribution panel.

From the fiber distribution cabinet, the hybrid fiber would be pulled to the 2” conduit fiber riser system. Using riser rated (PVC) hybrid fiber, we would homerun the hybird cable from every closet to the closet in the riser system where the campus trunk is connected to the building networks. All closets will contain the 24 port distribution panel excluding the campus closet. The campus closet will contain a high density fiber distribution cabinet.

As a rule, all fiber must be terminated in each distribution cabinet. This allows us to use dark fiber strands for future applications with minimal installation time. All fiber must conform to the specifications as described by the EIA/TIA 568 specifications. Care must be taken when using tie wraps on fiber cabling since overtight wraps can reduce cabling performance.

This system should be used when the DIDF resides in a different location than the IDF for telecommunications. This number is assigned by Network Services.

In review, the following equipment is used in the DIDF closets (where electronics are not placed):

1) 19” Harris Dracon equipment rack (or equivalent)
   - a) EIA spec threaded hole drill pattern
   - b) grounding kit to conform to EIA/TIA 607 specifications

2) fiber optics
   - a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
   - a) Siecor 24 port distribution cabinet with 2 splice tray slots (P/N FDC-005)
   - b) Siecor 6 port MMF connector panel, 2 per cabinet (P/N FDC-CP1P-25)
   - c) Siecor 6 port SMF connector panel, 2 per cabinet (P/N FDC-CP1P-19)
   - d) Siecor 12 port splice tray, 1 per cabinet (P/N M67-031)
   - e) Siecor MMF ST connectors, count of 12
   - f) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
   - g) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)

3) UTP cabling (plennum rated, red)
   - a) Belden DataTwist350, category 5, 4pr (from jack into DIDF termination block)
   - b) Belden DataTwist350, category 5, 4pr (from DIDF termination block into riser system to EIDF termination block)

4) Krone highband termination system
   - a) Krone highband termination block (P/N 6468-2-060-00)
   - b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
   - c) Krone 20 position mo unting bracket for termination blocks (P/N 6655-2-450-21/2)
   - d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
   - e) Krone 19” rack mount frame for 3 mounting brackets (P/N 6652-2-100-00)

The electronics will be placed in a closet where space is available, the cabling distance is most effectively reduced, and the environmental requirements of the electronics have been met. If sufficient conduit between floors is not available, then electronics may be placed in every closet. Compared to the original UWP, this model is still more cost effective.

The specific electronics that we'll be using in select closets is the Chipcom Oncore 17 slot concentrator. This system should be placed towards the top of the rack leaving 6" of space available for the placement of a fiber junction box and 2500 series CISCO router or other connectivety solutions when in the same closet.

The Oncore concentrator allows us to pick and choose the architecture we want (such as token ring, ethernet, and others) using RJ45 based media modules. All modules accept both UTP and STP cabling and autodetect impedence for easy configuration. This flexibility will allow us to migrate to UTP from an STP environment. All modules support either port or module level segmentation.

The DMM (Data Management Module) controls the entire concentrator. Daughter cards placed directly on the media modules provide SNMP (Simple Network Management Protocol) for each architecture used. With management software, we can collect RMON (Remote Monitoring) statistics for networking planning and troubleshooting. Using the PLC (Private Line Card), security can be added to the concentrator. Security breaches can be posted through SNMP traps to our management console.

The same concentrator can also include an ATM (Asynchronous Transfer Mode) switch module. Services such BUS (Broadcast Unknown Server) and LANE (LAN Emulation) are native to the switch. Using the cabling plant designed, 155Mb/s ATM can be provided to the desktop without altering the termination block, connectors, or jack. ATM between switches can be provided through SMF (Single Mode Fiber) cables that are homerun from each closet.

Modules must be placed in a standard means within the concentrator. Within the chassis, the far right slot should contain the DMM. The DMM provides the intelligence and management interface into the concentrator. This system needs to be configured by Networking Systems before it can be brought on-line. By default, all media interfaces are disabled. If more than 9 modules are placed in the concentrator, a second power supply is required.

For token ring, we will be using 2 types of modules. For general token ring connections, the passive 20 port single slot RJ45 based media modules are to be used. To provide a means for interconnecting token ring networks between concentrators, we will use the active 18 port single slot RJ45 based media modules with RI-RO (Ring In and Ring Out). One 18 port token ring module will be placed in slot 1 on the left of the concentrator. The 20 port token ring modules will be placed in slot 2 of the concentrator working towards the right of the chassis. To provide management of the token ring network, the token ring network monitor daughter card will be plugged directly on the 18 port token ring media module in the chassis.

For ethernet, we will be also be using 2 types of modules. For lower density environments, we'll use the 20 port, single slot RJ45 based media modules. For higher density environments, we'll use the 40 port, dual slot RJ45 based media modules. The higher density modules have a cheaper per port cost than the lower density modules. The ethernet management module plugs directly onto the first ethernet module. In an environment where token ring and ethernet are mixed in the same concentrator, the ethernet modules are to be plugged into slot 10. Subsequent ethernet modules are to be placed to the right of the intial media module. In an environment where no token ring will be present, the ethernet modules will be placed in the contentrator starting from slot 1. The ethernet network monitor daughter card will be plugged directly on the first ethernet media module in the chassis.

Between the concentrator and the termination block are the modular patch cords. This cable is a four prong high performance connector that plugs directly on top of the block. This connector is more durable and higher performing than the traditional 8 pin connector RJ45 in a patch panel system. The other end of this cable has an RJ45 connector for mounting in the RJ45 based media modules in the concentrator. This connector locks onto the terminating block and exceeds the EIA/TIA 568 category 5 UTP specifications for NEXT (Near End Cross Talk). These patch cords should be red to correspond to the color of the DT350 cabling system. All patch cords should be 7' in length and should have at least 2' of slack (within the cable management system) in case the connection is moved to another point in the panel or the rack must be reorganized. This system allows us to easily convert a DIDF to an EIDF in the future. With the new cabling system architecture, we can change network applications as easily as moving patch cords around in the termination block.

Using the D rings at the top of the rack mounted termination blocks, we would manage the patch cabling from the block to the RJ45 jack interface on the desired module in the concentrator. Cabling coming from a rear rack mounted termination system would also need to be pulled through the D rings at the top of the front mounted termination system.

The following equipment should be placed in the EIDF closet (where the Chipcom concentrator will be mounted):

1) 19" Harris Dracon equipment rack (or equivalent)

a) EIA spec threaded hole drill pattern
b) grounding kit to conform to EIA/TIA 607 specifications
c) 6 outlet AC power strip with 6’ cord with surge suppression and line conditioning

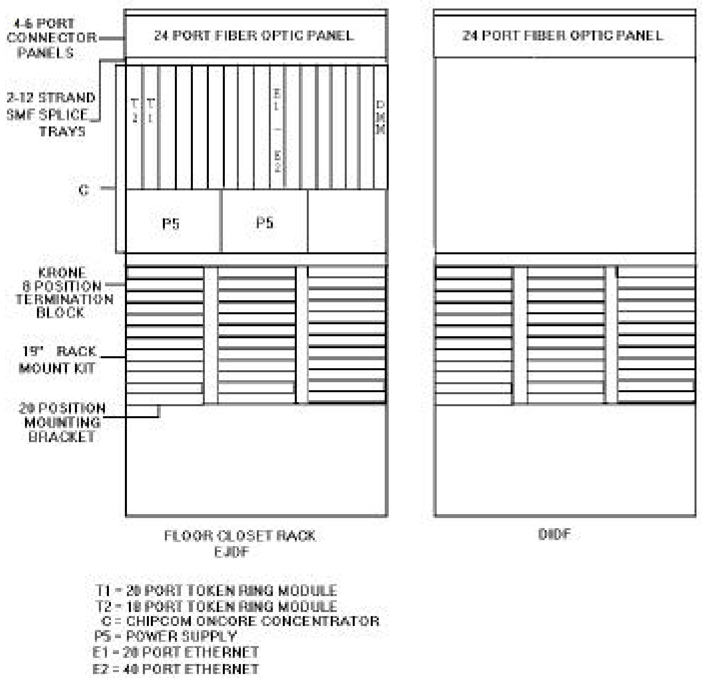
2) fiber optics (if not the same closet as the campus closet)
a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
a) Siecor 24 port distribution cabinet with 2 splice tray slots (P/N FDC-005)
b) Siecor 6 port MMF connector panel, 2 per cabinet (P/N FDC-CP1P-25)
c) Siecor 6 port SMF connector panel, 2 per cabinet (P/N FDC-CP1P-19)
d) Siecor 12 port splice tray for SMF, 1 per cabinet (P/N M67-031)
e) Siecor MMF ST connectors, count of 12
f) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
g) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)

3) Chipcom Oncore Switching Hub, 17 slots (P/N 6017C-A)
a) one Oncore DMM module (without ethernet carrier) (P/N 6000M-MGT)
b) one Oncore token ring network monitor daughter module, MIB II and RMON (P/N 6200D-MGT)
c) multiple Oncore single slot passive 20 port, RJ45 based token ring modules (module segmentation) (P/N 6220M-TP)
d) at least one Oncore single slot active 18 port, RJ45 based token ring module (port level segmentation) with RI-RO (P/N 6218M-ATP)
e) density of 318 token ring ports in each hub
f) one additional Oncore power supply (P/N 6000-PS)

4) UTP cabling (plennum rated, red)
a) Belden DataTwist350, category 5, 4pr (from DIDF termination block into riser system to EIDF termination block)
b) Belden DataTwist350, category 5, 4pr (from EIDF termination block to EBDF or DBDF termination block); 6 cables

5) Krone highband termination system
a) Krone highband termination block (P/N 6468-2-060-00)
b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
e) Krone 19” rack mount frame for 3 mounting brackets (P/N 6652-2-100-00)
f) Krone highband patch cords (8 wire, T568B), red, 7’ in length (P/N 6648-2-122-07)

.
The following graphic depicts the orientation of equipment in the DIDF and EIDF:



Within the campus closet should be the components for delivering fiber into the building riser systems. This equipment includes a high denisty fiber distribution panel. Since each floor will have a 12-12 hybrid fiber homerun to this closet, the density needed in this cabinet is the *total number of closets within the building multiplied by 24 strands*. By default, this panel should have the density for 144 ports with 8 slots for splicing trays. This allows us to easily bring a new fiber strand on-line without additional work. Inside the panel, all fiber will be labeled indicating what location it was pulled from within the building. All fiber is pulled through the 2” conduit throughout the riser systems.

The 12 strands of MMF would be terminated with ST connectors into the left ports within the cabinet. The SMF bundle would be spliced in a splice tray using multiple 12 strand preconnectorized pigtail. This system is then placed in the bottom of the cabinet.

MMF can be terminated using MMF ST connectors. These connectors can then be placed directly into the MMF connector panel. Two dual cordage MMF patch cables are used to interconnect with the fiber optic repeaters used on the building ring.

SMF is much more tolerance sensitive. To give us the greatest quality of termination, we would use a SMF splicing system instead of manually terminating each SMF strand with an ST connector. Using the campslice within a splice tray, all 12 strands could be spliced into a dual SMF pigtail. This assembly has 2 ST connectors that patch into 2 ports on the SMF connector panel. This tray then slides into one of the slots of the 144 port distribution panel.

In our original UWP, only 12 strand MMF (Multi Mode Fiber) was pulled between buildings. With this revision, all new interbuilding fiber pulls will use outdoor 12-12 fiber hybrids (12 strand MMF and 12 strand SMF). This concept is described in the section entitled ***The Revised UWP and Interbuilding Networking*** of this revision. The campus fibers are terminated in the first connector panels in the panel.

From the fiber distribution panel, two duplex MMF patch cords (one strand for TX and the other for RX) are connected to the appropriate fiber strands in the first group of connector panels. The other end of the duplex cable is used to mount to a pair of IBM 8220 fiber repeaters placed inside of an IBM rack mount assembly kit. This kit is mounted just below the fiber distribution panel. The repeater mounted on the far right side of the rack mount assembly is set to RI (Ring In). The repeater mounted on the far left side of the rack mount assembly is set to (Ring Out). The duplex patch cords should be matched up with another pair of repeaters in other building on the campus fiber backbone with opposite assignments (i.e.: ring in to ring out). Proper labeling within the distribution panel is critical to maintaining this system.

Although these repeaters are no longer available on the market, the 8220 can be obtained from Network Services. We have substantial numbers in stock from past upgrades. We have not evolved away from these repeaters because it isn’t possible to mix and match converters and repeaters on the same fiber. Once we begin our proposed migration of ATM on the backbone in the next couple of years, these repeaters will be removed from the network.

A single IBM 8228 MAU (Multistation Access Unit) would be needed to be mounted below the rack mount assembly in the 19” rack. A yellow crossover STP patch cable would connect between the RO repeater and the RI on the MAU. A traditional black STP patch cable would connect between the RI repeater and the RO on the MAU.

An internetwork connectivety solution is needed to connect the building network(s) to the campus fiber trunk. This product would need to allow us to interconnect token ring networks but address issues and concerns that face us today (such as large broadcast domains). The product that we specifically have been deploying to address this and other issues already on ISUnet is the CISCO router.).

CISCO routers are the only routers that satisfy our networking requirements for our UWP revision. These requirements are: 1) full support for SNMP V1 (and development towards SNMP V2 and RMON), 2) remotely manageable, 3) support for TCP/IP, IPX, AppleTalk, DECnet, and bridging, 4) support for multiple routing protocols, and 5) full interoperability in the existing market place.

The original UWP indicated that a single PC based software bridge should be placed between a building ring and a campus trunk ring. Today, this solution is no longer acceptable. In the revised UWP, a CISCO 2500 series router will be used instead of a PC based bridge for two reasons (performance, routing). PC based bridging products are relatively low performing devices (the Local Bridge Program only spouts 2,200pps). A multiprotocol router would allow us to route protocols such as TCP/IP, IPX (Novell), and AppleTalk while simultaneously bridging SNA and NetBIOS. The result is better bandwidth utilization (6,600pps) and a reduction in broadcast traffic. There are probably some locations that warrant token ring switches. However, these products should only be placed in closets where applications warrant them and therefore should be addressed on a case by case basis. If a token ring switch is needed, then the CISCO Catalyst 1600 will be used. Routers and switches must be configured by Networking Systems before it can be brought on-line.

To connect the building token ring networks to the campus network, the CISCO 2515 router (2 token ring and 2 serial interfaces) will be used. There should be at least one CISCO 2515 for every token ring network in a Chipcom concentrator. These routers are to be placed in the IBDF or EBDF. At least 6 UTP cables will be pulled and terminated between the closets containing concentrators and the base riser closet where the CISCO routers are located. The first token ring interface on the 2515 will be connected to the first port of the MAU in the IBDF or EBDF. The second token ring interface will be connected to the first port on the first module in the concentrator through the use of a media filter on the CISCO router. This filter will convert from a DB9 to RJ45 female interface.

To connect the building ethernet networks to the campus network, the CISCO 2513 router (1 token ring, 1 ethernet, and 2 serial interfaces) will be used. There should be at least one CISCO 2513 for every ethernet network in a Chipcom concentrator. Using the 10BaseT AUI transceiver, the highband patch cord would be connected into the corresponding port in the termination block.

In this closet, patch cables can be jumped between ports on the termination block to interconnect token ring networks. Starting from the EIDF, the RI cable is terminated in the block in the same closet and drops to the DBDF or EBDF. This cable then patches over to another port on the same block that rises up to an EIDF where the patch cord connects to an RO. This system should be planned with Networking Systems before picking locations.

If the closet is a EBDF (electronics and the campus fiber are in the same closet), then a UTP patch cable will be used between the media filter and the RJ45 based token ring media module in the concentrator. If the closet is an IBDF (there are no electronics in the closet where the campus fiber enters the riser system), a highband patch cord will then be used between the filter and the termination block. A riser cable will be used to connect to a termination block in each EIDF. Another highband patch cord will be used between the termination block and the RJ45 based token ring media module. In the IBDF, only a single fully populated mounting bracket would be needed in the 19” rack mount assembly.

The following equipment should be placed in the DBDF closet (where campus token ring trunk connects to the building network):

1) 19” Harris Dracon equipment rack (or equivalent)
   a) EIA spec threaded hole drill pattern
   b) grounding kit to conform to EIA/TIA 607 specifications
   c) 6 outlet AC power strip with 6’ cord with surge suppression and line conditioning
2) fiber optics
   a) Siecor outdoor 12 strand, 62.5 (FDDI spec MMF) riser rated (NEC Section 770, OFNR rating) fiber optic cabling, Siecor
   b) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
   c) Siecor fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to ST connectors, count of 2
   d) Siecor 144 port distribution cabinet with 8 splice tray slots (P/N FDC-001)
   e) Siecor 6 port MMF connector panel (P/N FDC-CP1P-25)
   f) Siecor 6 port SMF connector panel (P/N FDC-CP1P-19)
   g) Siecor 12 port splice tray (P/N M67-031)
   h) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
   i) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)
   j) Siecor terminating connectors for MIC-012 cable, industry standard ST connector
   k) Siecor fan out kit for loose tube fiber (if outdoor MMF was used)
3) IBM 8220 Fiber Optic Repeaters (P/N 96X5810), count of 2
   h) IBM Rack Mounting Assembly (P/N 6339139)
   i) yellow crossover STP cable, IBM (P/N 6339137) compatible
   j) black patch STP cable, IBM (P/N 8642551) compatible
4) UTP cabling (plennum rated, red)
   a) Belden DataTwist350, category 5, 4pr (from jack and into DBDF termination blocks)

b) Belden DataTwist350, category 5, 4pr (between termination block in DBDF, through riser, and termination block in EIDF) 6 additional cables need between each EIDF throughout building

5) IBM 8228 MAU (Multistation Access Unit)
   a) 8 data ports
   b) connects to fiber optic repeaters
   c) STP lobe cable to token ring interface on router

6) CISCO multiprotocol routers
   a) 2515 routers, 2 token ring interfaces
   b) 2513 routers, 1 token ring and 1 ethernet interface
   c) 2500 series IOS, desktop set, count of 6 (P/N SF25B-10.2)
   d) 2515 maintenance, Smartnet, count of 3 (P/N CON-SNT-2515)
   e) 2513 maintenance, Smartnet, count of 3 (P/N CON-SNT-2513)
   f) routes TCP/IP, AppleTalk, IPX, and DECnet; bridges for SNA, NetBIOS, and LAT
   g) black lobe STP cable, IBM (P/N 8642551) compatible, connects to open port on MAU
   h) media filter, DB9 to RJ45 (to connect to highband patch cord)
   i) Allied Telesis AUI 10BaseT transceiver, SQL disabled

7) Krone highband termination system
   a) Krone highband termination block (P/N 6468-2-060-00)
   b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
   c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
   d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
   e) Krone 19" rack mount frame for 3 mounting brackets (P/N 6652-2-100-00)
   f) Krone highband patch cords (8 wire, T568B), red, 7' in length (P/N 6648-2-122-07)

With the new infrastructure complete, there needs to be standardization on the jack. To provide high performance networking, we would use a customized single gang outlet system. This outlet we need to contain a jack for both data and telephony. Since the Krone RJ45 category 5 jack is the only product on the market that is certified in writing for supportting transmission speeds of 155Mb/s ATM, these jacks will be used in the revised UWP. These jacks help to guarantee that as we evolve to higher performing networks that there isn't a need to change infrastructure. The Thomas and Betts Epitome dual RJ11 jack will continue to be used for providing telphone service as described in the original UWP.

The stainless steel faceplate contains 3 punched holes. In the new configuration, a single RJ45 jack is placed on the top left port of the faceplate. A blank is placed in the top right port. This port can be used in the future by a second RJ45 jack. The RJ45 jack is used for the access to ISUnet.

The dual RJ11 jack is placed in the bottom port. The dual RJ11 is provided for both phone (left jack) and low grade data service (right jack) such as localtalk or analog phone service All 4 pair of the DT350 are terminated on the RJ45 jack. The 4 pair, category 3 UTP cabling used by Telecommunications is split into 2 pair on the dual RJ11 jack.

In the past, there has been some confusion with the cable numbering system used on the cable and jack faceplates. Today when the Telecommunications Office installs STP cabling with telephone service, the jack is labeled using the numbering system that was designed for the phone system. When Physical Plant installs STP cabling, the jack is labeled with a different numbering system. To resolve this problem, we have developed a new cable numbering system for use with both STP and UTP cabling plants:

aaa-bbbb-c-d-*C*ee where:

aaa	represents the building number
bbbb	represents the room number
c	represents the floor of the closet where the cable terminates
d	represents the specific closet on the floor
C	indicates a computer only port
ee	represents the cable number

The following faceplate components will be used in the UWP revision where both data and telephony are required:

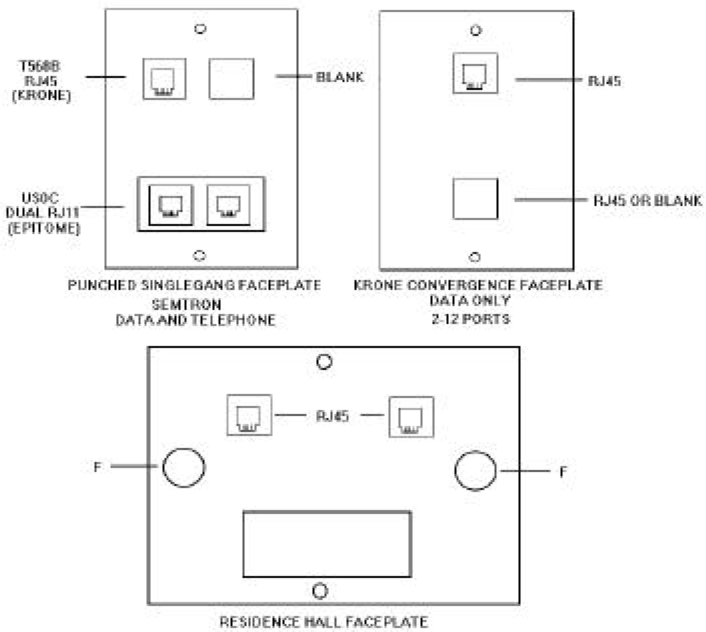
1) faceplate (Semtron)
    a) custom punched stainless steel
    b) single gang, 3 port
2) data (Krone, Convergence Line)
    a) 1 single RJ45 module, 8 conductor, T568B, red (P/N 6645-1-151-05)
    b) top left position in faceplate
3) telephony (Thomas and Betts, Epitome line)
    a) 1 dual RJ11 module, 6 conductor, USOC
    d) bottom position in faceplate
4) blanks
    a) 1 ivory blanks (package of 25, P/N 6645-1-160-02)
    b) blanks are to placed in top right port

In locations where only data is needed, we will use the Krone 2 port single gang faceplate. If the request is for a single jack, it will be placed in the top port. If the request is for 2 jacks, then both ports will be filled.

The following faceplate components will be used in the UWP revision where only data is required:

1) faceplate (Krone, Convergence)
    a) for up to 2 data ports, single gang (P/N 6644-1-152-02)
    b) for between 3 and 4 data ports, single gang (P/N 6644-1-154-02)
    c) for between 5 and 6 data ports, single gang (P/N 6644-1-156-02)
    d) for between 7 and 12 data ports, double gang (P/N 6644-1-157-02)
2) data (Krone, Convergence)
    a) multiple RJ45 modules, 8 conductor, T568B, red (P/N 6645-1-151-05)
    b) starting at top left position
    c) ID tabs w/icons, red, package of 25 (P/N 6631-2-111-05)
3) blanks
    a) multiple ivory blanks (depending upon faceplate and number of jacks), package of 25 (P/N 6645-1-160-02)

The following graphic includes the faceplates for data and telephone service, data only, and the residence hall network faceplate.



Inside the wall, a 4x4 box should be used. These boxes give us the greatest room for growth for future applications such as fiber to the desktop. At least 1” conduit should be used to rise from the box to the ceiling or cabletray system. This system should try and correspond as much as possible to the specifications described in the EIA/TIA 569 standard.

We will continue delivering data cabling wherever there will be telephone service. As a result, where there is a digital phone, there will be an RJ45 jack for token ring or ethernet instead of the IBM data connector (as specified in the original UWP). All future adds for telephone and data service will be arranged by contract with Ericsson in these new locations.

The cable distance from the jack to the electronics must not exceed 90 meters. The patch cable between the jack and the station must not exceed 10 meters. All cabling must be 4 pair, category 5 UTP cabling and conform to the specifications as described in the EIA/TIA 568 standard.

To connect stations to the RJ45 jack, UTP patch cable with RJ45 interfaces should be used. Some token ring interface cards on ISUnet already have female RJ45 interfaces built in. In these cases, a dip may need to be flipped to enable the port. In other cases where the token ring card only has a DB9, a media filter can be used to interface to an RJ45.

VI. The Revised UWP for Residence Hall Networks

The residence hall network was designed to offer students a direct connection to ISUnet in an effort to make Internet services easily accessible. The design was to deliver a “port per pillow” in every room in which each student could have a network connection. This project evolved out of the ***virtual classroom*** initiative which focussed on improving communication between students and faculty through the use of ISUnet.

With the development of our residence hall networks, we have discovered a variety of applications that could be used with the cabling system and components outlined in this UWP revision. For the most part, most components specified in the section entitled ***The Revised ISUnet UWP (Universal Wiring Plan) for Intrabuilding Networking*** pertain to residence hall networks. The difference is that ethernet is used in the residence hall networks and token ring is used elsewhere. A minor difference is that most residence halls at ISU are relatively tall (10 stories or higher). In this configuration, we will have multiple closets in the same riser system that have concentrators. There will be no DIDF closets in this network.

The model that has been designed for the residence hall networks has been to place a Chipcom concentrator on the middle floor of a 5 five floor system. In a 10 story complex, we would have electronics placed in the third and eighth floor closets for each riser system. In locations that are not as conveniently distributed, we will split the height in the riser systems into multiple evenly placed electronics closets. No more than 250 stations be placed in any given closet.

Since the distances are also much greater, fiber will be used between the base riser closet (DBDF) and each closet containing electronics in a given riser system. At least 12 strands of MMF will be needed in each location terminating in the base riser. All fiber colors should conform to the EIA/TIA specifications for fiber riser systems. Some of these fiber strands will be used to connect the residence hall networks to one of the campus fiber trunk rings. Remaining strands will be used for future segmentation and applications. A 2” conduit must be placed between all floors in the riser system for MMF.

A duplex fiber patch cord connecting into a terminated fiber in the junction box will be connected to the TX-RX ports on the ethernet switching module. In the base fiber riser closet, a duplex fiber patch cord connecting into a terminating corresponding fiber in the junction box will be connected to a 10BaseFB fiber optic ethernet transceiver. This transceiver will then be plugged into the AUI interface on the CISCO 2513 router.

To be cost effective, we are using the dual slot, 40 port, RJ45 ethernet modules. These modules can be segmented at the port level. Again, a special patch cord is used to connect between the termination block and the associated RJ45 modules in the concentrator.

Due to the fact that residence hall networks are hostile environments, security is a major concern. To address these issues, we have used components in the Chipcom concentrator that prevent eavesdropping (by scrambling unicast traffic) and provide security intrusion traps and logs for our management console and applications. The PLC (private line card) is a daughter card that provides this security management. One PLC is required for every segment created within the concentrator. The PLC daughter board shall be placed on the DMM module which is in the last slot of the concentrator.

Since we do not intend to introduce additional equipment in other locations along the riser system, we ***do not*** need termination blocks on every floor in the residence hall network. Instead, the cabling will originate from a jack and be pulled horizontally to the appropriate riser closet on the same floor. At this location, the cable will drop (or rise) to the closet where the electronics are placed (EIDF). In this closet, the cable will be terminated on the Krone termination block in the rack mount kit. Again, the rack must be oriented within the closet to allow access to both front and back of the rack. This will also help us defray costs since space isn't needed on every floor to build an DIDF. There should be one 4" conduit between floors for every 100 station cables.

For all fiber connections, proper termination is essential. All fibers should be terminated in a fiber connector panel. This allows us to easily bring new fiber drops on-line without introducing new equipment in the fiber junction box. An indoor 12-12 fiber hybrid cable (12 strand MMF and 12 strand SMF tight buffer fiber) will be used between each EIDF and the DBDF. Fiber is terminated as described in the pervious section. Hybrid fiber is homerun to the base riser system from every closet.

To accommodate these needs, the following equipment should be placed in the closet where the Chipcom concentrator will be mounted:

1) 19" Harris Dracon equipment rack (or equivalent)
   - a) EIA spec threaded hole drill pattern
   - b) grounding kit to conform to EIA/TIA 607 specifications
   - c) 6 outlet AC power strip with 6' cord with surge suppression and line conditioning

2) fiber optics
   - a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
   - a) Siecor 24 port distribution cabinet with 2 splice tray slots (P/N FDC-005)
   - b) Siecor 6 port MMF connector panel, 2 per cabinet (P/N FDC-CP1P-25)
   - c) Siecor 6 port SMF connector panel, 2 per cabinet (P/N FDC-CP1P-19)
   - d) Siecor 12 port splice tray, 1 per cabinet (P/N M67-031)
   - e) Siecor MMF ST connectors, count of 12
   - f) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
   - g) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)

3) Chipcom Oncore Switching Hub, 17 slots (P/N 6017C-A)
   - a) one Oncore DMM module with ethernet carrier (DMM-EC) (P/N 6106M-MGT)
   - b) one Oncore ethernet network monitor daughter module (for MIB II and RMON) (P/N 6100D-MGT)
   - c) one Oncore ethernet PLC (private line card) for security features
   - d) multiple Oncore dual slot, 40 port RJ45 ethernet modules
   - e) up to 280 ethernet ports
   - f) one Online 2 port ethernet switching module, ST connectors, MMF (P/N 5102M-FBP-ST)
   - g) Online adapter kit for OnCore chassis, 4 slots (P/N 6000A-MAKIT4)

4) UTP cabling (plennum rated, red)
   - a) Belden DataTwist350, category 5, 4pr (from jack, through riser, and into EIDF termination blocks)

5) Krone highband termination system
   - a) Krone highband termination block (P/N 6468-2-060-00)
   - b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
   - c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
   - d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
   - e) Krone 19" rack mount frame for 3 mounting brackets (P/N 6652-2-100-00)
   - f) Krone highband patch cords (8 wire, T568B), red, 7' in length (P/N 6648-2-122-07)

As each residence hall ethernet network is created, an internetwork connectivety solution is needed. The product that we specifically have been deploying in the residence hall networks is the CISCO 2513 router (1 token ring, 1 ethernet, and 2 serial interfaces). There should be at least one CISCO 2513 placed in the DBDF for every Chipcom concentrator in the riser.

Using a STP lobe cable, the token ring port on the CISCO 2513 is connected to the first available port on the MAU or CAU in the same closet. A 10BaseFB transceiver should be plugged into the AUI ethernet interface. The fiber transmit and receive cables should then be connected to the fiber transceiver using duplex MMF cordage from the junction box. Care must be taken to make sure that the appropriate pairs are used.

The following equipment should be placed in the DBDF closet (where the residence hall network connects to the building or campus token ring network):

1) 19” Harris Dracon equipment rack (or equivalent)
  a) EIA spec threaded hole drill pattern
  b) grounding kit to conform to EIA/TIA 607 specifications
  c) 6 outlet AC power strip with 6’ cord with surge suppression and line conditioning
2) fiber optics
  a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
  b) Siecor fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to ST connectors, count of 2
  d) Siecor 144 port distribution cabinet with 8 splice tray slots (P/N FDC-001)
  e) Siecor 6 port MMF connector panel (P/N FDC-CP1P-25)
  f) Siecor 6 port SMF connector panel (P/N FDC-CP1P-19)
  g) Siecor 12 port splice tray (P/N M67-031)
  h) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
  i) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)
  j) Siecor MMF terminating connectors for MIC-012 cable, industry standard ST connector
3) CISCO routers
  a) 2513 router, 1 token ring and 1 ethernet interface, count of 1 for every concentrator
  a) 2500 series IOS, desktop set (P/N SF25B-10.2)
  b) 2513 maintenance, Smartnet (P/N CON-SNT-2513)
  c) router for TCP/IP, AppleTalk, IPX, and DECnet; bridge for SNA, NetBIOS, and LAT
  d) black lobe STP cable, IBM (P/N 8642551) compatible, connects to open port on MAU
  e) 10BaseFB fiber optic transceiver for ethernet (AUI)

With the new infrastructure complete, there needs to be standardization on the jack. To provide high performance networking, we would use a customized double gang outlet system. This outlet we need to contain a jack for both data and telephony. Since the Krone RJ45 category 5 jack is the only product on the market that is certified in writing for supportting transmission speeds of 155Mb/s ATM, these jacks will be used in the revised UWP. These jacks help to guarantee that as we evolve to higher performing networks that there isn’t a need to change infrastructure. As a result, future students could take advantage of these technologies as they emerge on campus. The Thomas and Betts Epitome dual RJ11 jack will continue to be used for providing telphone service as described in the original UWP.

The stainless steel doube gang faceplate contains 5 punched holes. In the new configuration, a single RJ45 jack is placed on the top left port of the faceplate and a single RJ45 jack is placed in the top right port. Both RJ45 jacks are used to connect to ISUnet.

In the middle of the outlet are 2 holes for the future installation of video over COAX. Initially, these holes are to be plugged with F-connector blanks.

The dual RJ11 jack is placed in the bottom port. The dual RJ11 is provided for both phone (left jack) and low grade data service (right jack) such as localtalk or analog phone service All 4 pair of the DT350 are terminated on the RJ45 jack. The 4 pair, category 3 UTP cabling used by Telecommunications is split into 2 pair on the dual RJ11 jack.

In review, the following faceplate components will be used in the UWP revision in the residence hall network:

1) faceplate (Semtron)
  a) custom punched stainless steel
  b) double gang, 5 port
2) data (Krone, Convergence line)
  a) 2 single RJ45 modules, 8 conductor, T568B, red (P/N 6645-1-151-05)
  c) top left and top right positions in faceplate
3) telephony (Thomas and Betts, Epitome line)
  a) 1 dual RJ11 module, 6 conductor, USOC
  d) bottom position in faceplate

4) blanks
   a) 2 F-connector blanks, placed in middle ports

Inside the wall, a 4x4 box should be used. These boxes give us the greatest room for growth for future applications such as fiber to the desktop. At least 1” conduit should be used to rise from the box to the ceiling or cabletray system. This system should try and correspond as much as possible to the specifications described in the EIA/TIA 569 standard

In the future, multiple F connectors (for cable TV) may be installed in the ports of the middle row of the faceplate. This task will be probably be done with the replacement RG6 coax.

VII. The Revised UWP and Interbuilding Networking

In the original UWP, either 6 or 12 strand tight buffer MMF (Multi Mode Fiber) was pulled between buildings when ISUnet was initially constructed. In this configuration, 7 fiber backbone networks were extended out to different regions of campus to eventually interconnect nearly 60 buildings. Four of these strands were used for TX and RX pairs for token ring. The other fiber strands remained dark for future applications.

With the ever changing requirements with upcoming technologies, we need to make adjustments to this cabling system. Network applications such as ATM, circuit emulation, and video demand higher bandwidth media than what MMF can allow.

With the UWP revision, we would alter the standard from a 12 strand MMF to a 12-12 fiber hybrid (12 strand MMF and 12 strand SMF) wherever we are intending to pull new MMF where none exists. This would allow us to provide SMF for future backbone applications such as ATM while continuing to address our current needs of token ring on MMF. All 24 strands would be properly terminated in a fiber junction box.

We will also be researching the need for pulling 12 strand SMF where 12 strand MMF is already pulled. With either plan, we will ensure that there is sufficient cabling for our migration into future backbone technologies.

To help guarantee the longevity of these cabling plants, we would also change our specification for all fiber pulled between buildings. In the past, we have used indoor (tight buffer) fiber for outdoor projects. With this revision, only outdoor (loose tube) fiber will be used for interbuilding networking. Loose tube fiber was specifically engineered for unfriendly environmentals such as extreme temperatures and humidity. With all future fiber pulls, loose tube fiber would be used for the new hybrid cable and new SMF pulls buildings regardless of application. This policy will help to assure the life of these cabling systems. Tight buffer fiber will continue to be used in an intrabuilding environment. A fan out kit will be needed in the junction box to convert between loose tube and tight buffer.

In review, the following equipment is needed for the 12-12 hybrid fiber system (no mention is made of electronics):

1) 19” Harris Dracon equipment rack (or equivalent)
   a) EIA spec threaded hole drill pattern
   b) grounding kit to conform to EIA/TIA 607 specifications
2) fiber optics
   a) Siecor 12-12 outdoor hybrid fiber, loose tube (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
   b) Siecor fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to ST connectors, count of 2
   d) Siecor 144 port distribution cabinet with 8 splice tray slots (P/N FDC-001)
   e) Siecor 6 port MMF connector panel (P/N FDC-CP1P-25)
   f) Siecor 6 port SMF connector panel (P/N FDC-CP1P-19)
   g) Siecor 12 port splice tray (P/N M67-031)
   h) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
   i) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)
   j) Siecor MMF terminating connectors for MIC-012 cable, industry standard ST connector
   k) Siecor buffer-tube fiber fan out kit

VIII. Differences Between the Original UWP and the Revised UWP for Token Ring

In the original ISUnet UWP, MMF was used in many buildings between floors. This was an attempt to reduce the impact of technical issues with copper cabling between hubs. In the UWP revision, a fiber hybrid is homerun from each closet in all the riser systems to the campus closet. This cabling system will be used for future applications including the deployment of an ATM infrastruture.

Since a home run system does not require distributed hubs, the cost of fiber between distributed electronics would not be incurred. Although a high density concentrator does cost much more than a single stackable hub, that total cost in a home run system is less than the cost for all the hubs and components in a distributed system. Due to cable density issues, there may be multiple riser and electronics closets in the same building.

With UTP cabling and RJ45 modules, it makes sense to use RJ45 termination block. Since termination blocks are the highest performing systems on the market, these systems are used through the riser system. With the termination of horizontal cables in the DIDF termination block, there needs to be a matching patch cable that terminates on top of the same port in the block. The other end would then terminate at the termination block in the EIDF or EBDF closet. There are no specifications for a termination block system with STP installations in the original UWP.

Today for ISUnet, routers are much better suited than bridges. The scale of ISUnet has grown well beyond what bridges can alone provide. Multiprotocol routers have become part of our campus standard for internetwork connectivety solutions and are now apart of the revised UWP. Routers and packet switches were not apart of the original UWP. In the revised UWP, routers, switches, and higher performaning bridges are used.

Since cables will be home run in the revised UWP, riser conduit becomes a serious consideration. In the original UWP, riser conduit was only needed for copper or fiber patch cables between floors. In the revised UWP, large bundles of UTP cabling will need to be dropped through a vertical riser system. Our standard is that there should be 4” conduit for every 100 station cables between floors.

For interbuilding networking, we will be including SMF as part of our campus fiber cabling standard through future deployments of a 12-12 fiber hybrid cabling system. SMF allows us a migration path into future network technologies such as ATM. We will also be changing our standard for tight buffer fiber to loose tube. This change should help extend the life of these cabling systems since loose tube fiber was specifically engineer for harsh environmentals.

IX. Using the New ISUnet UWP for Token Ring in the New Science Building

In an effort to provide an example of one of our first major implementations of the revised UWP, the model for the new science building will be described. The new science building offered an interesting challenge for us. For the last year, we have been reevaluating our existing wiring plan to see if changes would occur in the development of newer technologies towards STP cabling plants. Since the adoption of 25Mb/s ATM, we believe that we have seen the end of the evolution of STP. Nothing in the market place indicates future development for STP.

The specifications described in the section ***The Revised ISUnet UWP for Intrabuilding Networking*** serve as the model for how the new science building network would be designed. In this case, there are 2 riser systems (north and south). The north riser has 3 floors and the south has 4 floors. Since conduit space is extremely limited (one 2” conduit for fiber and one 4” conduit riser for copper), all 7 closets contain electronics. The fiber interconnects into the building networks in the DBDF in the basement.

On the first floor south riser, a second closet exists for the sole use of multimedia applications. To this closet, we will pull our indoor 12-12 fiber hybrid and terminate in a 24 port fiber distribution panel in the left rack. This cable is then home run to the basement closet where it terminates in the 144 port fiber distribution panel.

The system designed for the new science building incorporates both token ring and ethernet in the same concentrators over the same cabling system. The application is chosen through the use of modular patch cords between the termination blocks and the concentrator modules.

For the new science building, the following equipment will be placed in the EIDF (all floors in both the south and north riser closets):

1) 19” Harris Dracon equipment rack (or equivalent)
 a) EIA spec threaded hole drill pattern
 b) grounding kit to conform to EIA/TIA 607 specifications
 c) 6 outlet AC power strip with 6’ cord with surge suppression and line conditioning
2) Chipcom Oncore Switching Hub, 17 slots (P/N 6017C-A)
 a) 1 Oncore DMM (Data Management Module) (P/N 6000M-MGT)
 b) 1 Oncore token ring network monitor card, daughter board (P/N 6200D-MGT)
 b) 2 Oncore single slot 20 port RJ45 based token ring modules, passive (P/N 6220M-TP)
 c) 1 Oncore single slot 18 port RJ45 based token ring module, RI-RO, active (P/N 6218M-ATP)
 d) 1 Oncore ethernet network monitor card, daughter board (P/N 6100D-MGT)
 e) 1 Oncore dual slot 40 port RJ45 based ethernet module, passive (P/N 6140M-TPP)
3) Krone highband termination system
 a) Krone highband termination block (P/N 6468-2-060-00)
 b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
 c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
 d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
 e) Krone 19” rack mount frame for 3 mounting brackets (P/N 6652-2-100-00)
 f) Krone highband patch cords (8 wire, T568B), red, 7’ in length (P/N 6648-2-122-07)
4) fiber optics
 a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
 a) Siecor 24 port distribution cabinet with 2 splice tray slots (P/N FDC-005)
 b) Siecor 6 port MMF connector panel, 2 per cabinet (P/N FDC-CP1P-25)
 c) Siecor 6 port SMF connector panel, 2 per cabinet (P/N FDC-CP1P-19)
 d) Siecor 12 port splice tray, 1 per cabinet (P/N M67-031)
 e) Siecor MMF ST connectors, count of 12
 f) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
 g) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)

From the 8 different closets, 8 fiber hybrid cables (1 from each closet) and 42 UTP drops (6 from each of the 7 closets), terminate in the basement closet. The UTP drops will either be used to interconnect the RI-RO interfaces in the concentrators or the routers to the networks.

In the basement closet, the following equipment will be placed in the left rack of the DBDF:

1) 19” Harris Dracon equipment rack (or equivalent)
 a) EIA spec threaded hole drill pattern
 b) grounding kit to conform to EIA/TIA 607 specifications
 c) 6 outlet AC power strip with 6’ cord with surge suppression and line conditioning
2) fiber optics
 a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
 b) Siecor fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to ST connectors, count of 2
 d) Siecor 144 port distribution cabinet with 8 splice tray slots (P/N FDC-001)
 e) Siecor 6 port MMF connector panel, count of 7 (P/N FDC-CP1P-25)
 f) Siecor 6 port SMF connector panel, count of 7 (P/N FDC-CP1P-19)
 g) Siecor 12 port splice tray, count of 7 (P/N M67-031)
 h) Siecor dual SMF pigtail, 2M, 28 per cabinet (P/N FSMD-2200-2M)
 i) Siecor Camsplice, pack of 6, mechanical SMF splice, count of 14 (P/N 95-000-04)
 j) Siecor MMF terminating connectors for MIC-012 cable, industry standard ST connector
3) IBM 8220 Fiber Optic Repeaters, count of 2 (P/N 96X5810)
 h) IBM Rack Mounting Assembly, count of 1 (P/N 6339139)
 i) yellow crossover STP cable, IBM (P/N 6339137) compatible
 j) black patch STP cable, IBM (P/N 8642551) compatible
4) IBM 8228 MAU (Multistation Access Unit), count of 1

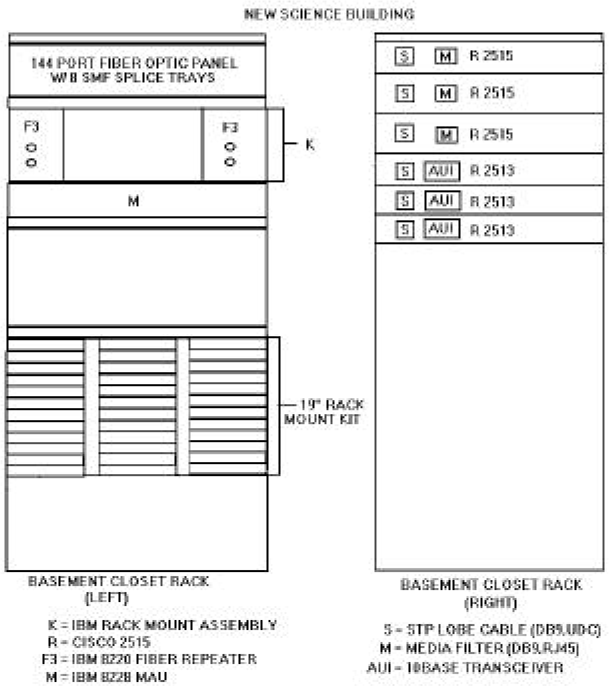
a) 8 data ports
b) connects to fiber optic repeaters
c) router interconnects between MAU and Chipcom hub

5) Krone highband termination system
    a) Krone highband termination block (P/N 6468-2-060-00)
    b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
    c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
    d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
    e) Krone 19” rack mount frame for 3 mounting brackets, count of 1 (P/N 6652-2-100-00)
    f) Krone highband patch cords (8 wire, T568B), red, 7’ in length, count of 48 (P/N 6648-2-122-07)

In the basement closet, the following equipment will be placed in the right rack of the DBDF:

1) 19” Harris Dracon equipment rack (or equivalent)
    a) EIA spec threaded hole drill pattern
    b) IBM grounding kit, (P/N 4716804)
    c) 6 outlet AC power strip with 6’ cord
2) CISCO multiprotocol routers
    a) 2515 routers, 2 token ring interfaces, count of 3
    b) 2513 routers, 1 token ring and 1 ethernet interface, count of 3
    c) 2500 series IOS, desktop set, count of 6 (P/N SF25B-10.2)
    d) 2515 maintenance, Smartnet, count of 3 (P/N CON-SNT-2515)
    e) 2513 maintenance, Smartnet, count of 3 (P/N CON-SNT-2513)
    f) routes TCP/IP, AppleTalk, IPX, and DECnet; bridges for SNA, NetBIOS, and LAT
    g) black lobe STP cable, IBM (P/N 8642551) compatible, connects to open port on MAU
    h) media filter, DB9 to RJ45

The following graphic describes the orientation of equipment within the basement racks in the new science building:



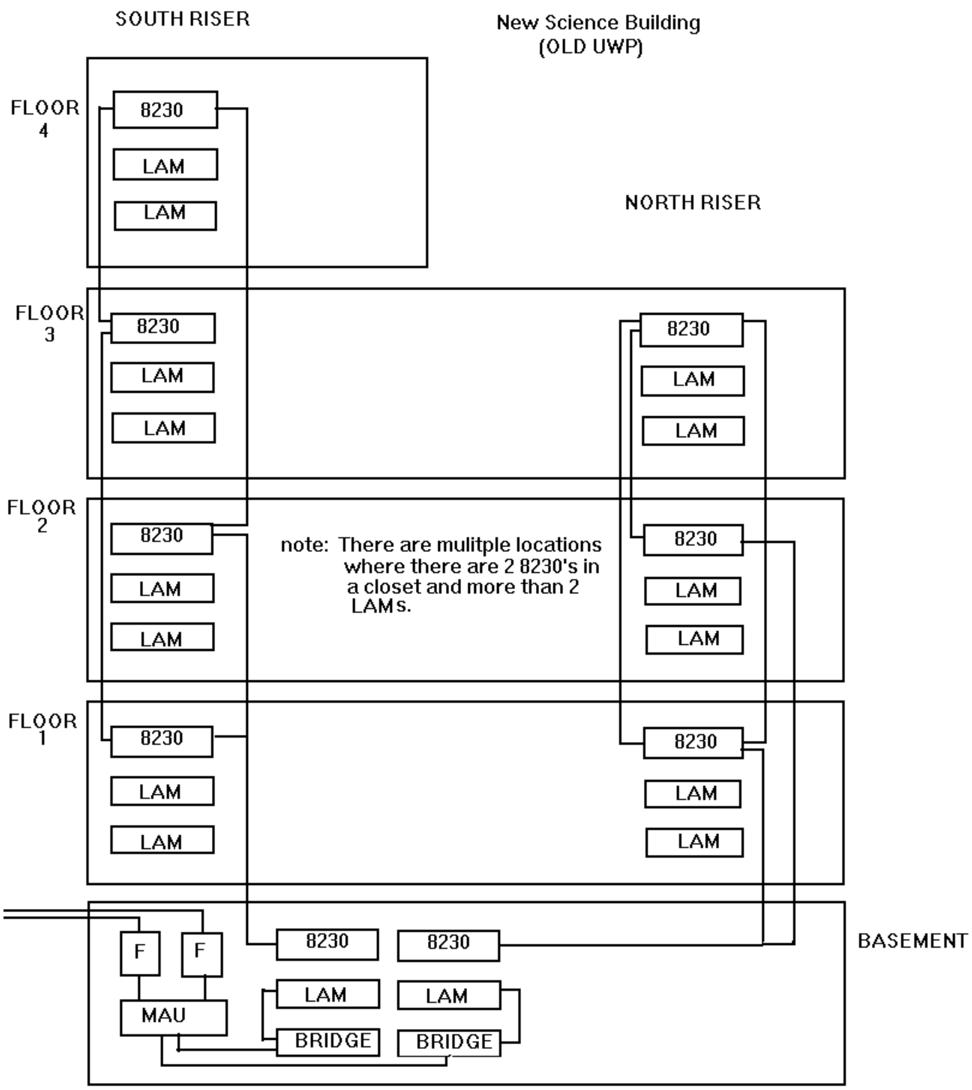
The faceplate will be composed of 2 configurations. The first is the traditional single gang faceplate with data and telephone:

1) faceplate (Semtron)
  a) custom punched plastic, ivory
  b) single gang, 3 port
2) data (Krone, Convergence Line)
  a) 1 single RJ45 module, 8 conductor, T568B, red (P/N 6645-1-151-05)
  b) top left position in faceplate
3) telephony (Thomas and Betts, Epitome line)
  a) 1 dual RJ11 module, 6 conductor, USOC
  d) bottom position in faceplate
4) blanks
  a) 1 ivory blanks (package of 25, P/N 6645-1-160-02)
  b) blanks are to placed in top right port

In locations where only data is needed, we will use the Krone faceplate. The following faceplate components will be used in the new science building where only data is required:

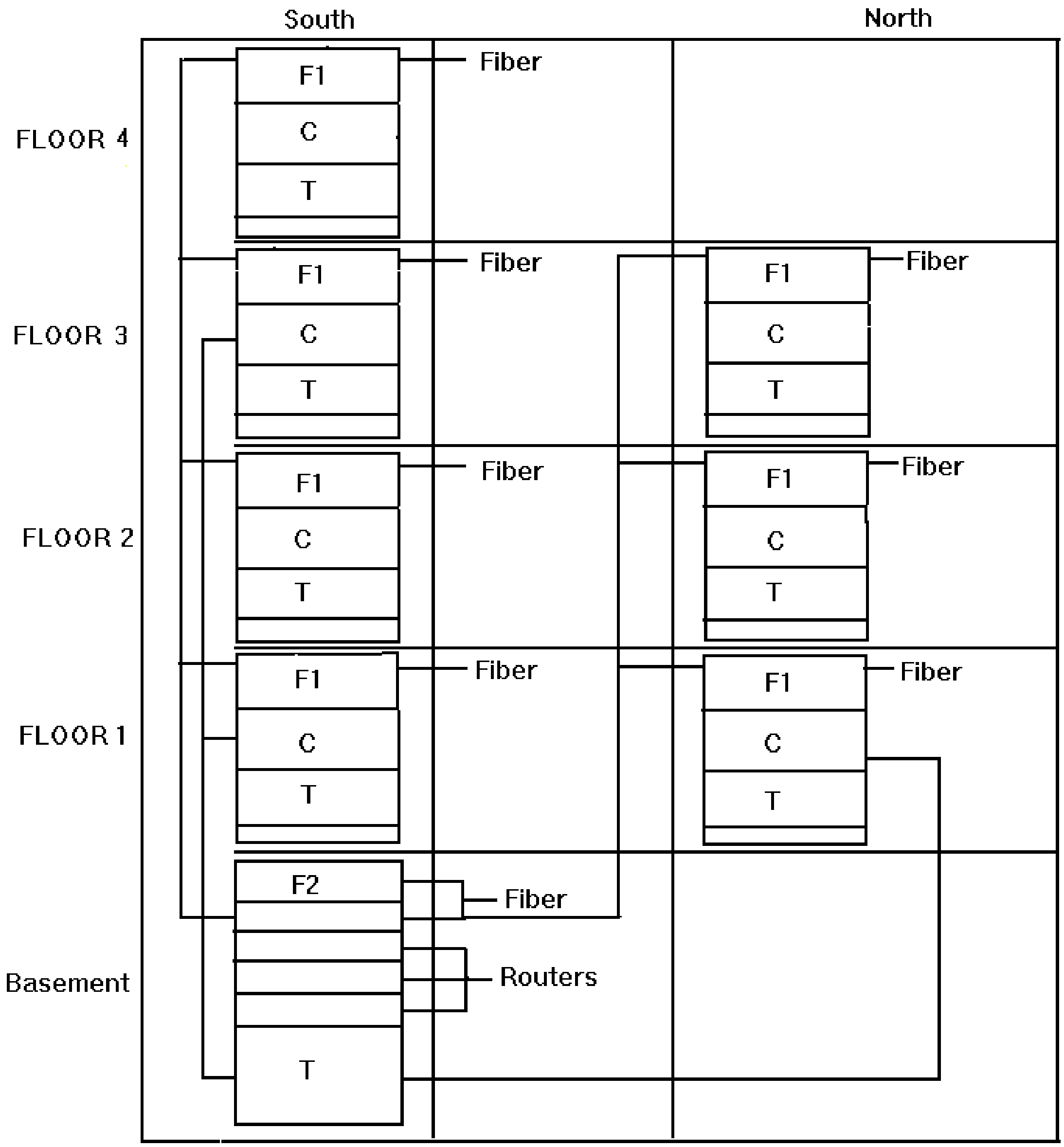
1) faceplate (Krone, Convergence)
  a) for up to 2 data ports, single gang (P/N 6644-1-152-02)
  b) for between 3 and 4 data ports, single gang (P/N 6644-1-154-02)
  c) for between 5 and 6 data ports, single gang (P/N 6644-1-156-02)
  d) for between 7 and 12 data ports, double gang (P/N 6644-1-157-02)
2) data (Krone, Convergence)
  a) multiple RJ45 modules, 8 conductor, T568B, red (P/N 6645-1-151-05)
  b) starting at top left position
  c) ID tabs w/icons, red, package of 25 (P/N 6631-2-111-05)
3) blanks
  a) multiple ivory blanks (depending upon faceplate and number of jacks), package of 25 (P/N 6645-1-160-02)

In an effort to clarify the specific components of revised UWP in the new science building, there is a need to make distinctions between the original and revised plans. The following graphic depicts the model in the new science building as described by the original UWP:



Note that in the original UWP, the IBM 8230 CAU was placed on every floor (including the basement) in the north and south riser systems. Some floors had multiple CAUs in a single closet because the station cable density was greater than 80 (20 ports in every LAM, 4 LAMs for every CAU). Six or twelve strand MMF was pulled between floors and then terminated in every other closet. A pair of fiber optic conveter modules was placed in every CAU.

By contrast, the requirements for the revised UWP are much more flexible. All closets contain fiber optic distribution panels, concentrators, and termination blocks. The basement closet is where we place the equipment that extends the campus fiber trunk into the building (fiber optic repeaters and a MAU) and three CISCO routers (which connect building networks to the campus trunk). The following graphic depicts the new science building using the revised UWP:



F1 = 24 PORT FIBER DISTRIBUTION PANEL
C = CHIPCOM ONCORE CONCENTRATOR W/TOKEN RING MODULES
T = KRONE TERMINATION BLOCKS
F2 = 144 PORT FIBER DISTRIBUTION PANEL
ROUTERS = 2515 CISCO

NEW SCIENCE BUILDING

X. Introducing the Revised UWP in Locations with STP

With the introduction of a new cable specification, the largest concern that we have is what to do about exisitng cabling systems on ISUnet. Does the features of UTP warrant the replacement of STP? In response, we believe that we can continue to work with STP and that we do not need to replace the existing infrastructure. Instead, we need to selectively introduce UTP cabling in environments where STP already exists. As a result, new jacks will be installed using the specifications described in the revised UWP in locations as targeted for migration. The challenge with this model is how to have both cabling systems interoperate in the same electronics at the same time.

In an environment where STP is already installed, we would first need to pick a closet where our electronics could introduced. This location would probably be somewhere in the middle of the riser since conduit limitations are likely to be a major concern. In this closet, we would remove the IBM 8228 MAU or IBM 8230 CAU and C-MIC box and place a 24 port fiber distribution panel, Chipcom Oncore concentrator, rack mounted UTP termination block system and high performance STP patch panel.

In the same riser conduit, our hybrid 12-12 fiber cable should be pulled down to the closet where the campus fiber ties into the building network.

The following equipment is placed in the upgraded closet:

1) fiber optics
- a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
- a) Siecor 24 port distribution cabinet with 2 splice tray slots (P/N FDC-005)
- b) Siecor 6 port MMF connector panel, 2 per cabinet (P/N FDC-CP1P-25)
- c) Siecor 6 port SMF connector panel, 2 per cabinet (P/N FDC-CP1P-19)
- d) Siecor 12 port splice tray for SMF, 1 per cabinet (P/N M67-031)
- e) Siecor MMF ST connectors, count of 12
- f) Siecor dual SMF pigtail, 2M, 6 per cabinet (P/N FSMD-2200-2M)
- g) Siecor Camsplice, pack of 6, mechanical SMF splice, 2 per cabinet (P/N 95-000-04)

2) Chipcom Oncore Switching Hub, 17 slots (P/N 6017C-A)
- a) one Oncore DMM module (without ethernet carrier) (P/N 6000M-MGT)
- b) one Oncore token ring network monitor daughter module, MIB II and RMON (P/N 6200D-MGT)
- c) multiple Oncore single slot passive 20 port, RJ45 based token ring modules (module segmentation) (P/N 6220M-TP)
- d) at least one Oncore single slot active 18 port, RJ45 based token ring module (port level segmentation) with RI-RO (P/N 6218M-ATP)
- e) density of 318 token ring ports in each hub
- f) one additional Oncore power supply (P/N 6000-PS)

3) UTP cabling (plennum rated, red)
- a) Belden DataTwist350, category 5, 4pr (from DIDF termination block into riser system to EIDF termination block)
- b) Belden DataTwist350, category 5, 4pr (from EIDF termination block to EBDF or DBDF termination block); 6 cables

4) Krone highband termination system
- a) Krone highband termination block (P/N 6468-2-060-00)
- b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
- c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
- d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
- e) Krone 19" rack mount frame for 3 mounting brackets, count of 1 (P/N 6652-2-100-00)
- f) Krone highband patch cords (8 wire, T568B), red, 7' in length, count of 48 (P/N 6648-2-122-07)

5) STP patch panel
- a) IBM high performance STP panel, plastic, rack mount
- b) 64 port (P/N 33G2778) or 16 port (P/N 73G3277)

In addition, all closets in the riser need to have the 19" rack mount system installed for UTP cabling. This kit is mounted below the equipment currently placed in the rack. There should be enough room to replace the C-MIC box with a 24 port concentrator and replace the exisitjng hub with an Oncore concentrator. When cabling is pulled from a jack to the floor closet, it will then be terminated on the Krone termination blocks. A new cable will be terminated on top of the horizontal cable in the block and then rise or drop through the copper riser to the targeted closet containing electronics.

In the other closets where electronics are not placed, the Krone termination system should be installed:

1) Krone highband termination system
   - a) Krone highband termination block (P/N 6468-2-060-00)
   - b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
   - c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
   - d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
   - e) Krone 19" rack mount frame for 3 mounting brackets, count of 1 (P/N 6652-2-100-00)
   - f) Krone highband patch cords (8 wire, T568B), red, 7' in length, count of 48 (P/N 6648-2-122-07)

In some locations, sufficient conduit may not be available. In this environment, the abandoned conduit system for the original analog telphone service may be used. Floor coring may also be necessary. Asbestos abatement procedures must be followed for coring procedures.

In the closet where the campus fiber connects to the building token ring network, a high density fiber distribution panel should be installed to replace the existing MMF fiber panels. This new panel should be able to accept both indoor and outdoor fiber hybrid cables. The indoor fiber hybrid should be homerun from each closet containing electronics in the riser. Six UTP patch cables should also be homerun from these closets and terminated at the bottom of the termination block. CISCO routers can be used to interconnect the new building network to the campus fiber.

The following equipment should be placed in this closet:

1) fiber optics
   - a) Siecor 12-12 indoor hybrid fiber, PVC riser rated (12 strand 62.5/125 MMF, 12 strand 8.3/125 SMF)
   - b) Siecor fiber optic patch cords (FDDI spec MMF), duplex cordage, 6' in length, ST to ST connectors, count of 2
   - d) Siecor 144 port distribution cabinet with 8 splice tray slots (P/N FDC-001)
   - e) Siecor 6 port MMF connector panel, count of 7 (P/N FDC-CP1P-25)
   - f) Siecor 6 port SMF connector panel, count of 7 (P/N FDC-CP1P-19)
   - g) Siecor 12 port splice tray, count of 7 (P/N M67-031)
   - h) Siecor dual SMF pigtail, 2M, 28 per cabinet (P/N FSMD-2200-2M)
   - i) Siecor Camsplice, pack of 6, mechanical SMF splice, count of 14 (P/N 95-000-04)
   - j) Siecor MMF terminating connectors for MIC-012 cable, industry standard ST connector

2) CISCO multiprotocol routers
   - a) 2515 routers, 2 token ring interfaces
   - b) 2513 routers, 1 token ring and 1 ethernet interface
   - c) 2500 series IOS, desktop set (P/N SF25B-10.2)
   - d) 2515 maintenance, Smartnet (P/N CON-SNT-2515)
   - e) 2513 maintenance, Smartnet (P/N CON-SNT-2513)
   - f) routes TCP/IP, AppleTalk, IPX, and DECnet; bridges for SNA, NetBIOS, and LAT
   - g) black lobe STP cable, IBM (P/N 8642551) compatible, connects to open port on MAU
   - h) media filter, DB9 to RJ45

3) Krone highband termination system
   - a) Krone highband termination block (P/N 6468-2-060-00)
   - b) Krone termination block label strip, 1 for each block (P/N 6462-2-096-00)
   - c) Krone 20 position mounting bracket for termination blocks (P/N 6655-2-450-21/2)
   - d) Krone label holder for each mounting bracket (P/N 6092-2-012-02)
   - e) Krone 19" rack mount frame for 3 mounting brackets, count of 1 (P/N 6652-2-100-00)
   - f) Krone highband patch cords (8 wire, T568B), red, 7' in length, count of 48 (P/N 6648-2-122-07)

The patch cords will be connected to the top of the terminated cables from the riser. The first cord will be connected to an RJ45 female interface on the media filter plugged into the token ring interface on the CISCO 2515 router.

As new cables are pulled to the floor closets, new faceplates need to be created. The following describes the configuration for providing both data abnd telephone service:

1) faceplate (Semtron)
   a) custom punched plastic, ivory
   b) single gang, 3 port
2) data (Krone, Convergence Line)
   a) 1 single RJ45 module, 8 conductor, T568B, red (P/N 6645-1-151-05)
   b) top left position in faceplate
3) telephony (Thomas and Betts, Epitome line)
   a) 1 dual RJ11 module, 6 conductor, USOC
   d) bottom position in faceplate
4) blanks
   a) 1 ivory blanks (package of 25, P/N 6645-1-160-02)
   b) blanks are to placed in top right port

In locations where only data is needed, we will use the Krone faceplate. The following faceplate components will be used in the new science building where only data is required:

1) faceplate (Krone, Convergence)
   a) for up to 2 data ports, single gang (P/N 6644-1-152-02)
   b) for between 3 and 4 data ports, single gang (P/N 6644-1-154-02)
   c) for between 5 and 6 data ports, single gang (P/N 6644-1-156-02)
   d) for between 7 and 12 data ports, double gang (P/N 6644-1-157-02)
2) data (Krone, Convergence)
   a) multiple RJ45 modules, 8 conductor, T568B, red (P/N 6645-1-151-05)
   b) starting at top left position
   c) ID tabs w/icons, red, package of 25 (P/N 6631-2-111-05)
3) blanks
   a) multiple ivory blanks (depending upon faceplate and number of jacks), package of 25 (P/N 6645-1-160-02)

XII. Maintaining STP Installations

Although the revised UWP focuses on evolving away from STP cabling systems, there may be some environments where this is unpractical. Fiscal, technoligical, or space issues may prevent this migration. To address this issue, the revised UWP refines the original specification using STP.

In the past, the IBM 8230 CAU and LAM were used as intelligent hubs with token ring using STP cabling on ISUnet. However, these products do not provide the level of management that we require. To staisfy these requirements, we have researched replacement products. The resulting products work with STP cabling, provide SNMP and RMON statistics, flexible, higher performing, and less expensive than the IBM 8230.

The product that replaces the 8230 is the Madge SmartCAU Plus. Like the 8230, upto 4 LAM can be connected to the Madge Smart CAU. A Madge Smart LAM can also be connected to an IBM 8230. Unlike the 8230, we can attach an 8228 MAU to a port on the CAU and manage it like a LAM. Stations can also be plugged directly into the CAU.

To improve the overal performance of the cabling system, UDC type connectors will be replaced by EDC type connectors. These connectors rate out at 100Mhz and provide a higher performing interface to whatever application we may be able to run over STP.

The following equipment are used instead of the IBM 8230 product line:

1) 19” Harris Dracon equipment rack
    a) EIA spec threaded hole drill pattern
    b) IBM grounding kit, (P/N 4716804)
    c) 6 outlet AC power strip with 6’ cord
    d) rack shelf (for bridge), IBM (P/N 62173036)
2) fiber optics
    a) Siecor 12 strand, 62.5 (FDDI spec MMF) riser rated (NEC Section 770, OFNR rating) fiber optic cabling (P/N 12K81-31141-00)
    b) 2 fiber optic patch cords (FDDI spec MMF), duplex cordage, 6’ in length, ST to mini BNC connectors
    c) Siecor 24 port patch panel, rack mountable (P/N C-MIC-024)
    d) Siecor connector panel (P/N FDC-CROP)
    e) Siecor interconnect sleeves (P/N TER-067)
    f) terminating connectors for MIC-012 cable, industry standard ST connector
3) Madge
    a) SmartCAU Plus, upto 4 LAM (80 stations)
    b) SmartLAM, STP, upto 20 stations
    c) wire managers for each LAM
    d) FTL (Fiber Trunk Link) modules, 2 per CAU
4) STP-A cabling (type 1, plennum)
    a) Belden
    b) IBM EDC (Enhanced Data Connectors)

With these products, we can provide management using LAN Network Manager (our exisiting management system), True View for Windows (a low end SNMP manager), and True View/6000 (a high end management system that runs with NetView/6000). Through this combination of management systems, we can obtain much more detailed about network statistics and connection information.

All STP and fiber specifications as described in the original specification for the UWP remains unaltered in these environments for this revision.

XIII. Conclusion

With the changes specified in this revision, we can posture ourselves to take advantage of the great potentials of future technologies. These new applications are only a year or so away from becoming feasible products that could be deployed on ISUnet. As a result, we must take action now to guarantee that we can offer these services in order to maintain our high level of service and responsiveness.

This document is designed to provide a model for the process of evolving ISUnet. Topics such as new construction and renovations, migration, coexistance, and enhancing the original specification are all addressed.