College of Engineering Networking Proposal

12th April 2002

Introduction
This proposal was requested by the College of Engineering Computer Committee and was assigned to the Technical Networking Group which included the following members: Steven Dean from the CADE Lab, Bret Jordan from the Deans Office, Todd Green from the School of Computing, Chad Lake from the School of Computing, and Chris Fredrickson from the Department of Chemical and Fuels Engineering. This document attempts to define the minimum requirements for the College network backbone and lay out a plan that will provide value to the departments and fix problems with the current network.

Current Networking Issues
The computer network for the College currently spans six buildings and covers six departments, the School of Computing, and several other groups including the Deans office, and CADE. All six buildings used by the College have fiber connections pulled back to the main machine room in the Merrill Engineering Building (MEB). This fiber is owned by Netcom and drops into their main distribution node. In each building the fiber is terminated in one of Netcom's demarcation switch or dmarc.

Departments within each building are currently responsible for purchasing and maintaining networking equipment for departmental use. Departmental hubs and switches are connected into Netcom’s dmarc switch. Routing for most departments is provided by Netcom’s main distribution node. Netcom provides Class C subnet address for departmental use. In several cases Netcom has assigned addresses for a building rather then departments which means that in buildings like EMRO several departments share a common address space.

Several conditions currently exist that limit the functionality of this network and create problems for the departmental Lan managers. The continued use of coaxial cable (10Base2) or thin-net in local networks has been mentioned as a serious problem within departments. The topology of thin-net makes it prone

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1 The College has several groups that are located in CHPC and Health Sciences. This document does not cover those groups.

2 In KENNB fiber is pulled back from the Park building and terminates at Netcom’s Dmark. The College has private fiber that is pulled back from MEB and does not terminate at the Dean’s office switch.
to network collisions as well as common disconnections. Users who are on thin-net often notice slow network access times. MEB has the majority of 10Base2 within the College but there may be other locations that still have some thin-net in active use.

Another problem for the network is the lack of defined virtual LANs or VLANS for the College. Currently several departments are located in three or more buildings. Without any defined VLANs they must maintain different address space for each building in which they reside and in some cases share address space with the other departments in the same building. Departments that wish to use networking utilities, such as DHCP\(^4\), and Ghost, that use broadcast traffic to pass information, must have servers on each network segment. Conversely when two or more departments share the same segment they may run into conflicts if they each try to run the same service. Users who are forced to move between buildings may be required to change the network information for their computing equipment. This creates extra work for the departmental LAN managers as they must reconfigure each computer that needs network access. Additionally LAN managers may wish to use VLANs to restrict access for central servers to departmental computers.

Statement of Need
As networks increase in size and complexity it becomes important for LAN managers to have access to networking utilities which allow them to maintain and support their departmental networks. All departments should have access to the same address space that is independent of location and be able to span networks VLANs to any building in which they reside. It is also important that LAN managers have the ability to secure their local networks at the router layer through Access Control Lists (ACL’s). This gives the administrator the ability to filter traffic and block network access as needed.

Networking Recommendations
It is the recommendation of the Technical Networking Group that the College adopt a set of networking standards across all departments which will enhance the capability of the network while making it easier for the network administrator to manage. The standards are the following:

1. Adopt a wiring standard based on category 5e UTP or higher cable. This will support the 10 Mbs and 100 Mbs standard networked hardware as well as supporting 1000 Mbs connections in the future. It is also recommended that the College make it a priority to replace existing coaxial cable with category 5UTP as soon as possible as this will help to alleviate many existing problems with users network connections.

2. Limit the number of cables between the closet and wall plate to 3 data lines per 100 square feet. If a user needs more then the number of lines specified

\(^3\)VLANs are a network technology that allows the same network address space to span switches in remote locations and the separation of network on the same physical switch. Network packets are switched between the same VLAN but must pass through a router between VLANs.

\(^4\)Routers have the ability to pass certain types of broadcast traffic like DHCP. Experience has shown that this is not always a reliable option.
it should be the responsibility of the user or the department to provide a switch that will provide the number of needed ports. The cost of switch ports will in most instances be less than the cost to run the extra lines.

3. Adopt a plan for spanning VLANs across the College network backbone. This can be accomplished through Netcom where they will provide the VLAN and trunk it to every dmarc switch within the College network.

4. For buildings like MEB where there is one dmarc switch for the building and four networking closets it is recommended that the College purchase the networking equipment that will serve as local distribution switches for the College and that this equipment be given to Netcom to manage. This will allow the College to have VLANs for each department that span across the backbone and trunk into each dmarc switch in the networking closet.

Costs and Benefits
Under the proposed plan we would be using the existing network backbone infrastructure provided by Netcom to all buildings. In buildings with more than one networking closet we would expand the infrastructure with the addition of local distribution switches in each closet that does not contain a dmarc switch. In this scenario Netcom will be providing the VLANs that they will trunk to each dmarc switch on the network as well as the distribution switches purchased by the College. This will allow any port on either the dmarc or College distribution switches to be assigned a VLAN for departmental use. Departments can then use these ports to attach hubs or switches which will provide network access to departmental users. This will allow users to move between buildings and within larger buildings with a minimum of impact. This model makes sense since Netcom is already providing the physical backbone infrastructure and has the ability to provide this service to the existing dmarc switches.

Our requirement that Lan managers have the ability to set ACL’s can also be provided by Netcom. Currently they will allow Lan managers to define any access control list provided that you work thru a Netcom representative. While this may not provide the hands on ability that some people would like it does not require us to purchase additional hardware at a cost to the College. Netcom has proposed giving Lan Managers actual physical access to set and modify access control lists in the near future.

The cost for the College to implement this plan would be $1,800 for each dmarc switch. If we assume that we need one switch for each of the network closets in MEB which do not currently contain dmarc switches the cost would be $5,400. These switches have a life-time guarantee so there would be no ongoing maintenance cost for the College to support. In addition Netcom maintains a pool of spares which they would use in case of a failure. This would eliminate the need for the College to have to purchase any extra equipment. The other cost savings to the College would be in the management of the equipment. If we were to maintain the equipment within the College we would have to allocate a percentage of one FTE to running this equipment. Netcom has offered to
manage this equipment without cost to the College.\textsuperscript{5} This includes monitoring
the switches for failures, replacing faulty equipment, managing switch ports,
and upgrading the software as newer version come out. In the long run this
could add up to significant savings for the College.

It has been noted that Netcom may begin charging a per-port network access
fee in the future and that this may change the cost of this model. If this were
to happen it may be beneficial for the College to move to another model.

\textsuperscript{5}It would be the responsibility of the College to negotiate any agreement with Netcom.