KFUPM Enterprise Network

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Outline

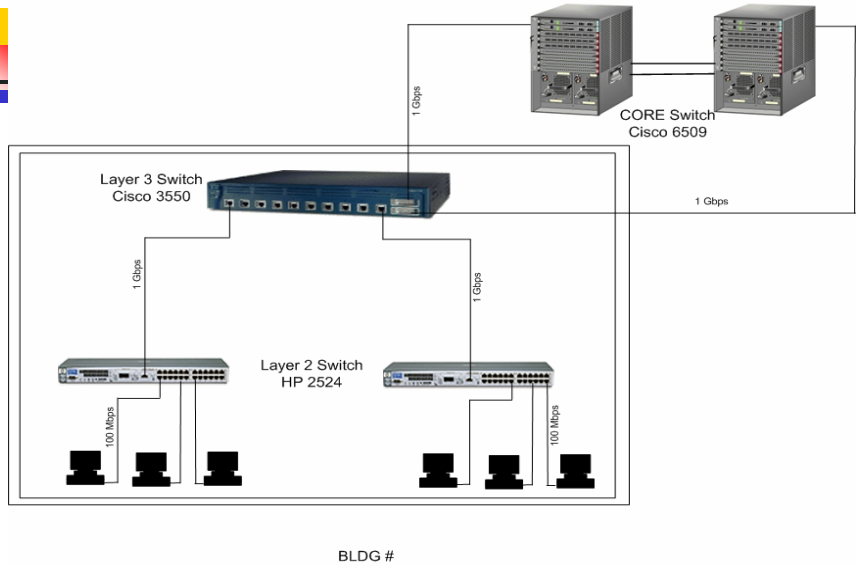
- KFUPM Network Model
- KFUPM Backbone
- Academic Buildings Connectivity
- Remote Buildings Connectivity
- KFUPM network services

- IP address management
- VLAN Scheme
- Ongoing projects
- Services which will be offered
- Advantages of present network

KFUPM Network Model

- Three layer hierarchical model
- Core layer – Cisco Catalyst 6509
- Distribution layer – Catalyst 3550
- Access layer – HP Procurve 2524

KFUPM Network Structure



Core Layer

- Cisco 6509 switch
- Responsible for transporting traffic both reliably and quickly
- Provides high speed switching between the buildings

Distribution Layer

- Cisco 3550-12T
- Is the communication point between the core layer and access layer
- Handles any traffic for remote service
- Provides policy based network connectivity

Access Layer

- HP procurve 2524
- Also known as desktop layer
- Controls user and workgroup access to the internetwork resources
- Provides workgroup connectivity into the distribution layer
- Connected to the distribution layer using gigabit over copper

KFUPM Backbone

- Gigabit IP backbone
- Two core switches to provide full redundancy and load sharing
- Enterprise servers directly connected to core switch
- Switching fabric 256 Gbps

KFUPM Enterprise Network

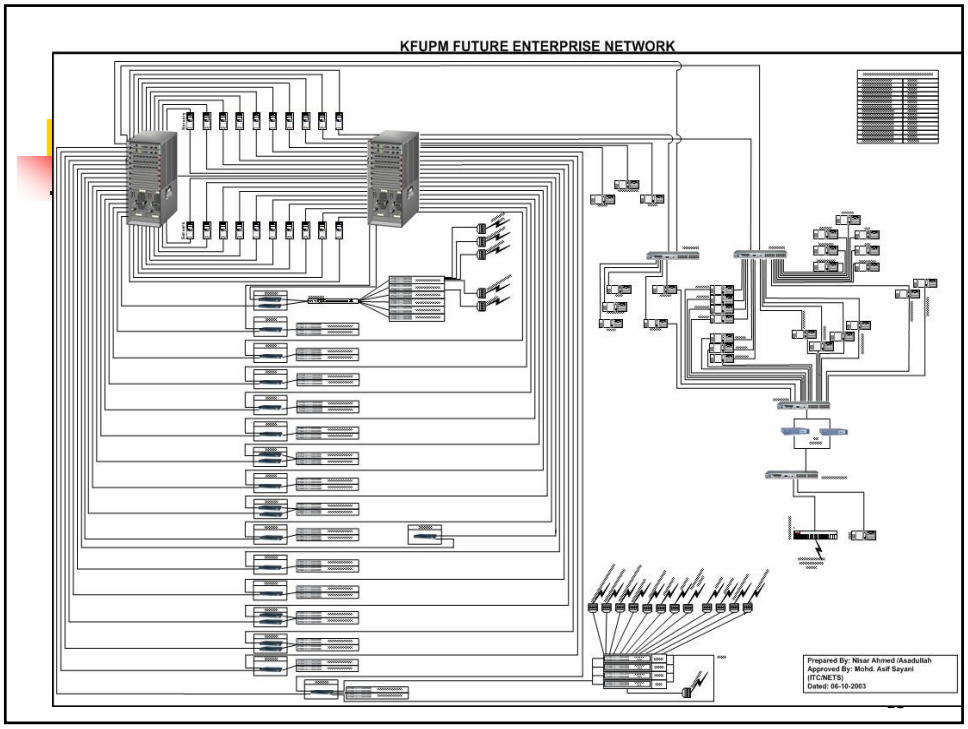
- Can support next generation of Video and Voice applications such as video on demand, audio/video streaming, voice chatting
- Is an important part of the university's overall e-learning strategy
- Is redundant in the backbone to ensure high availability
- Capable of handling video on demand, video streaming programs

Academic Buildings Connectivity

- 20 Academic and Administrative buildings are connected through single mode fiber at 1 Gbps
- All the buildings are connected to ITC using 8 core single mode fiber
- More than 3000 network points

Remote Buildings Connectivity

- 16 remote buildings are connected to the backbone using HDSL links at 2Mbps
- Many of these bldgs shall be connected through FO cables through on going projects


KFUPM FUTURE ENTERPRISE NETWORK
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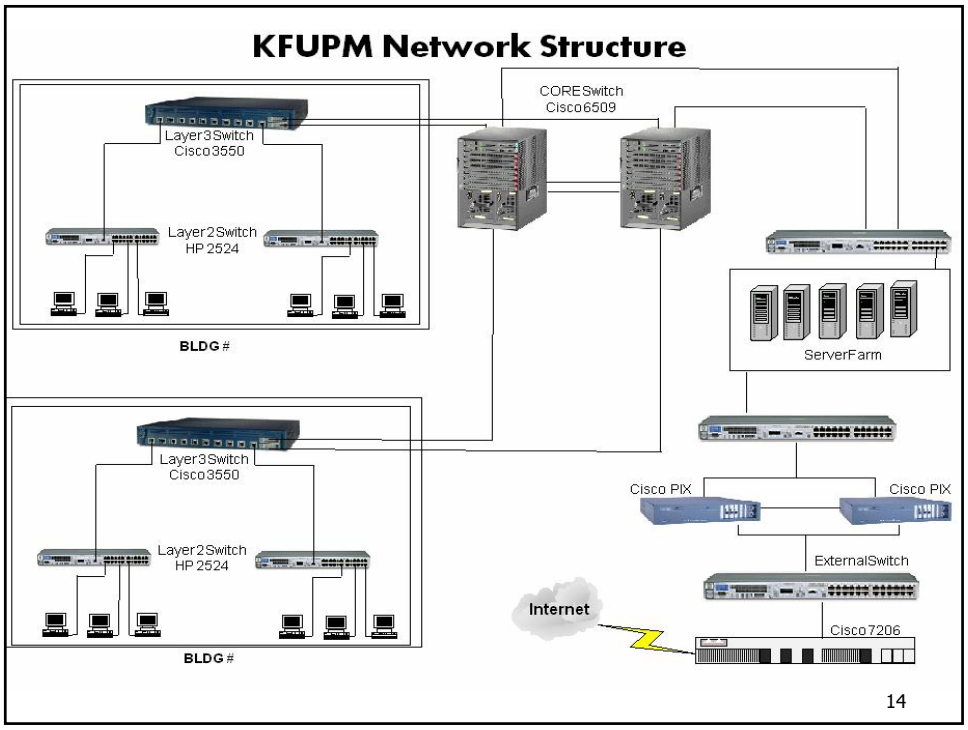
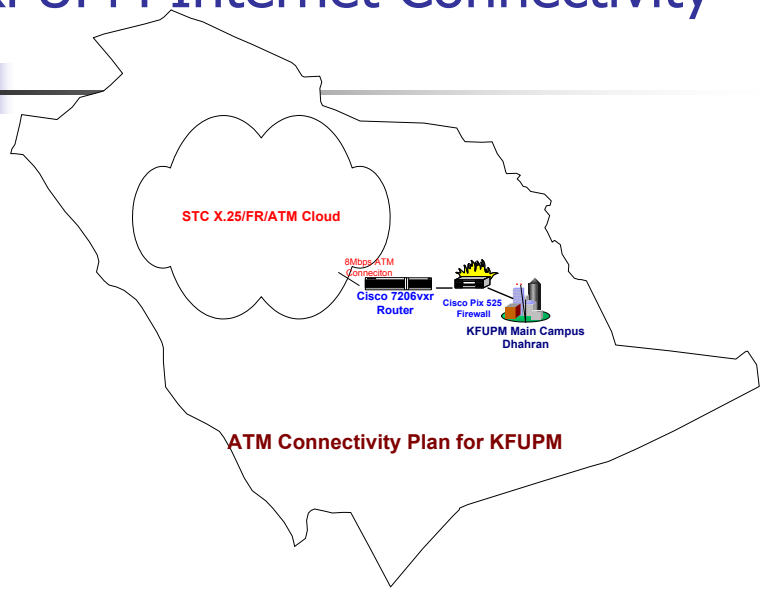
Dated: 06-10-2003


KFUPM Network Structure
CORE Switch
Cisco 6509
Layer 3 Switch
Cisco 3550
Layer 2 Switch
HP 2524
BLDG #
ServerFarm
Layer 3 Switch
Cisco 3550
Layer 2 Switch
HP 2524
BLDG #
Cisco PIX
Cisco PIX
External Switch
Internet
Cisco 7206

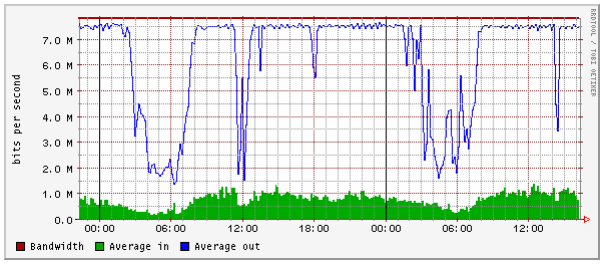
Internet Connectivity

- ATM (Asynchronous Transfer Mode) is being used for internet connectivity
- Directly connected to KACST Riyadh using STC ATM backbone over fiber
- 8 Mbps of bandwidth (being fully utilized)
- 500 users are simultaneously using internet at peak times (16 kbps bandwidth per user)
- Technically can go up to 155Mbps
- PIX firewall is being used to ensure high level of security

KFUPM Internet Connectivity



Internet Bandwidth usage statistics



Last updated at Tue Oct 7 16:15:28 2003

Bandwidth (for the day):
Cur: 8.19 Mbits/sec
Avg: 8.19 Mbits/sec
Max: 8.19 Mbits/sec

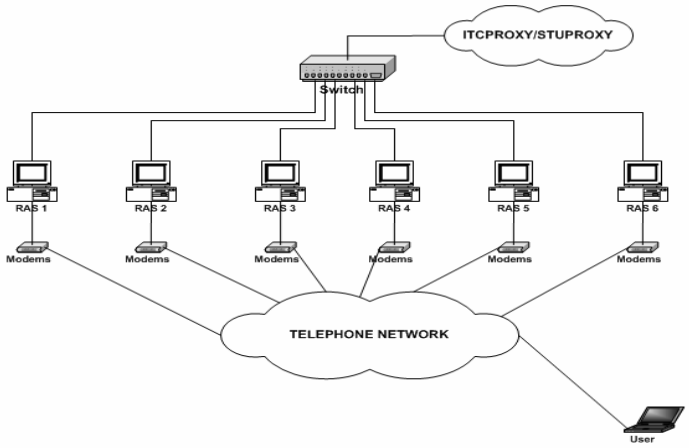
Average in (for the day):
Cur: 736.99 kbits/sec
Avg: 823.78 kbits/sec
Max: 1.59 Mbits/sec

Average out (for the day):
Cur: 7.46 Mbits/sec
Avg: 6.57 Mbits/sec
Max: 7.76 Mbits/sec

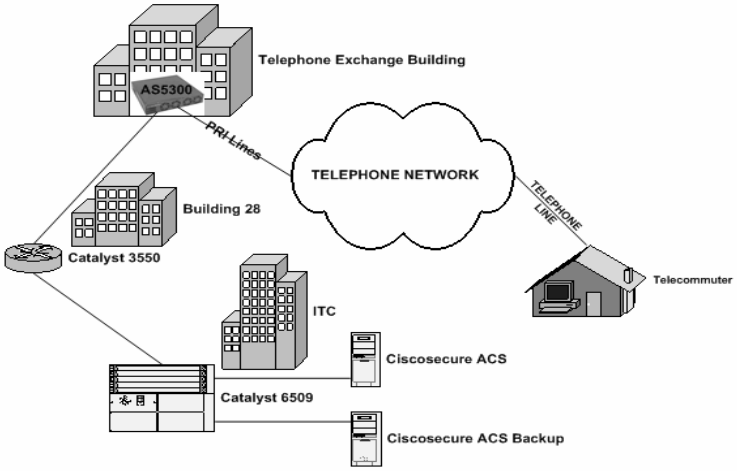
KFUPM Network Services

- WWW, Email
- Online journal
- Student Information System
- E-Learning
- Smart Classrooms
- Online Registration
- Active Directory
- NAS (online storage facility)
  - 100MB for fac/staff and 25 MB for students
- RAS

RAS System-old setup



RAS System-new setup



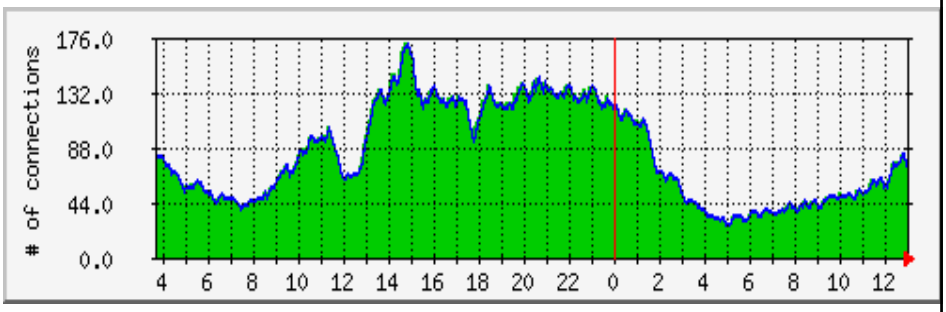
RAS

- All faculty and staff dial (860)1010 to connect to the RAS system.
- All KFUPM students dial 8601820 to connect to the RAS system.
- Special services (increased connect time and callback service) are provided for limited users depending on their requirement.

AAA and monitoring or RAS

- AAA is done using Cisco's ACS software.
- User information and connect history is completely logged.
- The daily utilization statistics of the RAS system is generated through MRTG graphs in real time. These graphs can be viewed on http://monitor.kfupm.edu.sa

RAS utilization



Max: 174 connections (72.5%)

Avg: 84 connections (35.0%)

Current: 68 connections (28.3.5%)

Smart Classrooms

- Smart classrooms equipped with high resolution projectors and high end instructor PC
- Port security is applied to the network points to prohibit unauthorized access
- Instructors and students can take advantage of all the available online material

IP address management

- Two DHCP servers are serving the whole KFUPM community
- Allows automatic assignment of unique IP addresses and other configuration information to each node on a network.
- The IP address structure is as follows:
  - 10. X.0.0/20 where X is the building number
  - This would allow us to create up to 16 VLANs
- The IP address range are:
  - 10.X.0.0 – 10.X.15.254 (for fac/staff VLAN)
  - 10.X.16.0 – 10.X.31.254 (for student VLAN)
  - 10.X.32.0 – 10.X.47.254 (for wireless VLAN)
- This addressing scheme will accommodate more than 4000 computers per VLAN
- These IP address range are distributed on the two DHCP servers for redundancy

VLANS

- Each Academic building will be divided into 3 non-default VLAN's
  - VLAN for Faculty & Staff
  - VLAN for Students
  - VLAN for Wireless access
- Each student dorm building will have one non-default VLAN

Objectives

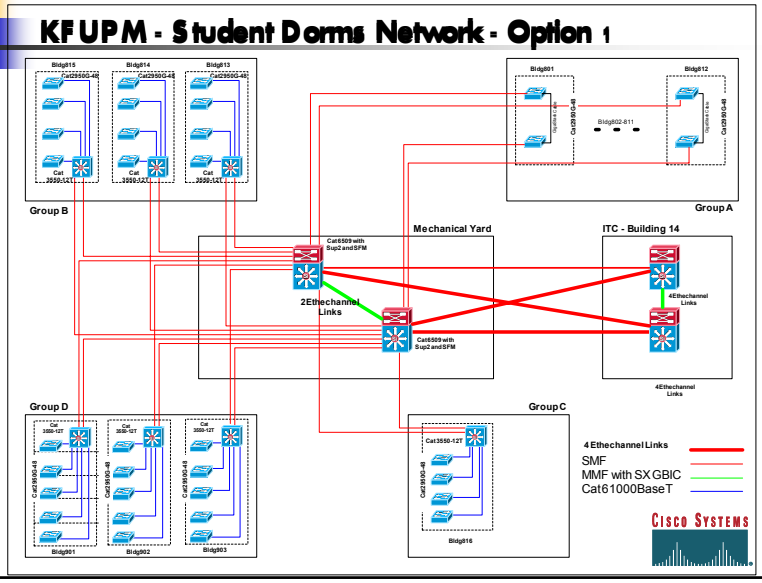
- To create separate VLANs for faculty/staff, Students and Wireless users.
- To define layer-3 ACLs for students and wireless LAN users to restrict services.
- To prevent broadcast of network traffic outside the VLAN and take advantage of Bandwidth.
- To prevent access/view of faculty PCs from student PC's network neighborhood.

Ongoing Projects

- Provide network connectivity to student dorms
- Gigabit IP technology is being used
- 21 new buildings will be connected
- Each room equipped with 2 network pts
- More than 2000 network pts
- Will double the network size
- Shall be completed in Oct 2003

Overview of student dorms

- Four groups of buildings based on similarity
- Group A Twelve Buildings (801-812)
  - 38 rooms → 76 network nodes
- Group B Three Buildings (813-815)
  - 76 rooms → 154 network nodes
- Group C One Building (816)
  - 88 rooms → 176 network nodes
- Group D Three Buildings (901-903)
  - 102 rooms → 204 network nodes



Ongoing Projects cont…

- Provide high speed 24/7 network connectivity to faculty housing using ADSL technology
- Internet & telephone use at the same time over the same copper access line
- Field testing is underway
- Shall be completed by Jan 2004

Ongoing Projects cont…

- Fiber optic network connectivity will be provided to projects & maintenance dept., work control office , Bldg-1, bldg-26, security building, store house and student dorms lab
- The project is expected to finish by Jan. 2004
- Network connectivity will be provided to the multipurpose building
- Network connectivity to the New prep year buildings

Wireless LAN

- Benefits to both Users & Administrators
- Seamless roaming
- No Copper, Ethernet Cables or Fiber Optic
- Standards
  - IEEE 802.11 1997 @ 2Mbps
  - IEEE 802.11b 1999 @ 11Mbps
  - IEEE 802.11a & IEEE 802.11g @ 54 Mbps
- WLANs can be standalone or overlays

Components

- Typical WLANs require 2 components
  - Client Adapters: enables computing device to connect to the WLAN
  - Access Points: serves as a hub, much like a cell phone tower in telecommunications

Features & Benefits

- Mobility
- Flexibility
- Scalability
- Return on Investment (ROI)
- Low Total Cost of Ownership
- Manageability

WLANs @ KFUPM

- Surveys and tests conducted at KFUPM Library, Student Lines, Bldg 24 lounge, Multipurpose Bldg.
- Should be deployed in the very near future

Security

- Major concern, encompasses:
  - Access Control: sensitive data can be accessed only by authorized users
  - Privacy: ensuring data transmitted can be received and encrypted by intended audience
- A complete plan has been devised by our security team to protect the wireless users as well as our network resources

Ongoing Projects cont…

- Providing wireless connectivity to some of the student lines to enable users to access the network resources through their laptops
- KFUPM Schools are already having wireless connectivity
- Wireless connectivity in the library
- Wireless connectivity for the area between Bldg 22 and Bldg 24

Summary

- Students will be able to access all the kfupm voice/data network services and resources from their rooms
- Faculty will be able to do research and submit the grades sitting in their homes.
- University envisions an E-Learning environment where users would be able to access a wealth of educational material online
- ITC is constantly working on projects to satisfy the demands of its customers

Major Achievements

- New Gigabit IP backbone for KFUPM with redundancy in the core
- New Gigabit IP backbone for Student dorms with redundancy in the core
- Inside the buildings, Gigabit over Copper is being used (cost effective, easy to maintain)

Services which can be offered

- IP/TV service which will enable KFUPM to broadcast live conferences and live TV to KFUPM enterprise backbone using state of the art technology
- Conferences can be recorded and can be made available on demand
- Video on demand enables users to use the available educational material online

Summary of network nodes

- Academic buildings → 3250 nodes
- Student Dorm buildings → 2250 nodes
- Buildings on HDSL → 600 nodes
- New prep year buildings → 600 nodes
- Multipurpose building → 300 nodes
- ADSL connectivity → 1000 nodes
- RAS → 240 lines

Advantages of Present Network

- Quality of service (QoS) guarantee.
- Scalable
- Faster network access to the end users with no collisions
- Multimedia application support.
- High link speeds (100 Mbps)
- Efficient bandwidth utilization.
- Network security.

Advantages of Present Network (Contd.)

- Better support for distributed OS and applications.
- Priority-based network traffic management.

Thank You for Your Attendance