Planning, Design, Maintenance and Evolution of a State-of-the-Art University Campus Network

June 8, 2011

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Vision for the SCU Network

• In 1983
  “Access to information *anytime, anywhere,*” and very transparently.

• In the 21st century
  Security requirements have changed much of that

• Goal now includes: Access requires Authentication

• Evolution of a single data network to a converged network
  – VOIP decision
  – Audio / Visual
    • Digital video, IPTV
Architecture Overview

• Single vendor vs. “Best of Breed”
  – Partnerships are key
  – Interoperability and standards
  – Model: “Responsible for our own destiny”

• Bandwidth - 10G / 1G / 100M / 10M
  – 1G internet connection
  – Fiber vs. Copper
    • Backbone and building interconnects

• Wired and wireless philosophy

• Resiliency
  – Service Area Interconnect (SAI) ring

• And “Sustainability” has an increasing influence
Broad Network Topology Overview
Planning and Design

• Planning/Designing the architecture
• Partner / vendor role (vendor “lock-in”) 
• Life cycle planning
• Managing Costs
• Security
  – Threats
  – Compliance Issues
  – Peer-to-peer and DMCA
  – Computers, mobile devices, entertainment & gaming
Fiber Benefits

• “Future proofing” with respect to bandwidth
• Upgrading ➔ just change the electronics
• Impact on cable plant
  – Planning for Single-Mode / Multi-Mode fiber balance
  – Cost of copper
  – Conduit size/capacity
  – Different skill sets needed
• Fiber to the Telco issues
Network Operations

• Public vs private network segmentation - why this evolution
  – Segregating traffic:
    • Fac/Staff vs Student
    • Recreational vs Scholarly vs academic

• Securing
  – Firewalling
  – DMZ (De-Militarized Zone)
  – Remote access issues

• Evolution of Internet/Wan connection
  – T-1/ATM/DS1-DS3/Frame vs Native Ethernet
  – Bandwidth shaping
  – Single pipe \(\rightarrow\) Redundant pipes \(\rightarrow\) Single pipe
Network Operations

• Audio and Video impact on the network
  – Video will drive future needs
  – Planning for higher bandwidth traffic
    • CAD/CAM
    • Video – SDTV $\rightarrow$ HDTV
    • Multimedia content in general
    • All the expanding traffic due to smart phones and devices

• Handling network congestion and/or saturation
  – QoS – mission critical traffic
  – Shaping

• Interoperability
• Trunking
Data Center

- Evolution of the data center
  - Virtualization Impact to the network
  - Sustainability (2009 PilotHouse Innovator Award: Sustainable Data Center)
- Lab environments and imaging impact
- VDI – Virtual Desktop Infrastructure
  - BW implications
  - Streaming applications
- Disaster recovery – Network perspective
  - Incidents
  - AJCU collaboration and activity
- Issues: disk-to-disk backup/archiving
- Cloud opportunities
Challenges

• Anticipating and meeting evolving demands
  – Video
  – Mobile devices
  – Entertainment devices
• Cyber Security and Compliance
• Legal
  – Copyright and DMCA
  – Peer-to-Peer networking
• Security and bandwidth challenges of the “cloud”
• Staffing and resource allocation
VoIP

• 3 Year Initial plan to move the campus to VoIP
  – Issues
    • We have buildings so old that when build, electricity was not even an option ➔ building retro-fits

• Technology issues
  – Integrating with our legacy phone system
  – Dedicated connections vs “daisy-chaining”
  – Integration with old PBX system

• Service improvements

• What about services like Skype?
Lessons Learned?
(after 25 years)

• Governance is key (Especially when resources are finite)
• Plan – Plan – Plan
  – Waiting until after a need manifests, leaves all dissatisfied
• Security is a “bitch”
  – It’s like fighting the “cold war”
  – Users never like security (it’s always an inconvenience)
  – It consumes resources like no other single activity
  – AND you absolutely have to do it.
• Being in charge of your future is preferable to handing it over to vendors
Questions