

The background of the slide is a solid red color. In the center, there is a large, faint, circular seal of Rutgers University. The seal features a sunburst in the center and the words "RUTGERS UNIVERSITY" around the perimeter. In the top left corner, the word "RUTGERS" is written in a large, white, serif font. Below it, in a smaller, white, sans-serif font, are the words "THE STATE UNIVERSITY OF NEW JERSEY".

**RUTGERS**

THE STATE UNIVERSITY  
OF NEW JERSEY

# RUNet: State of the State

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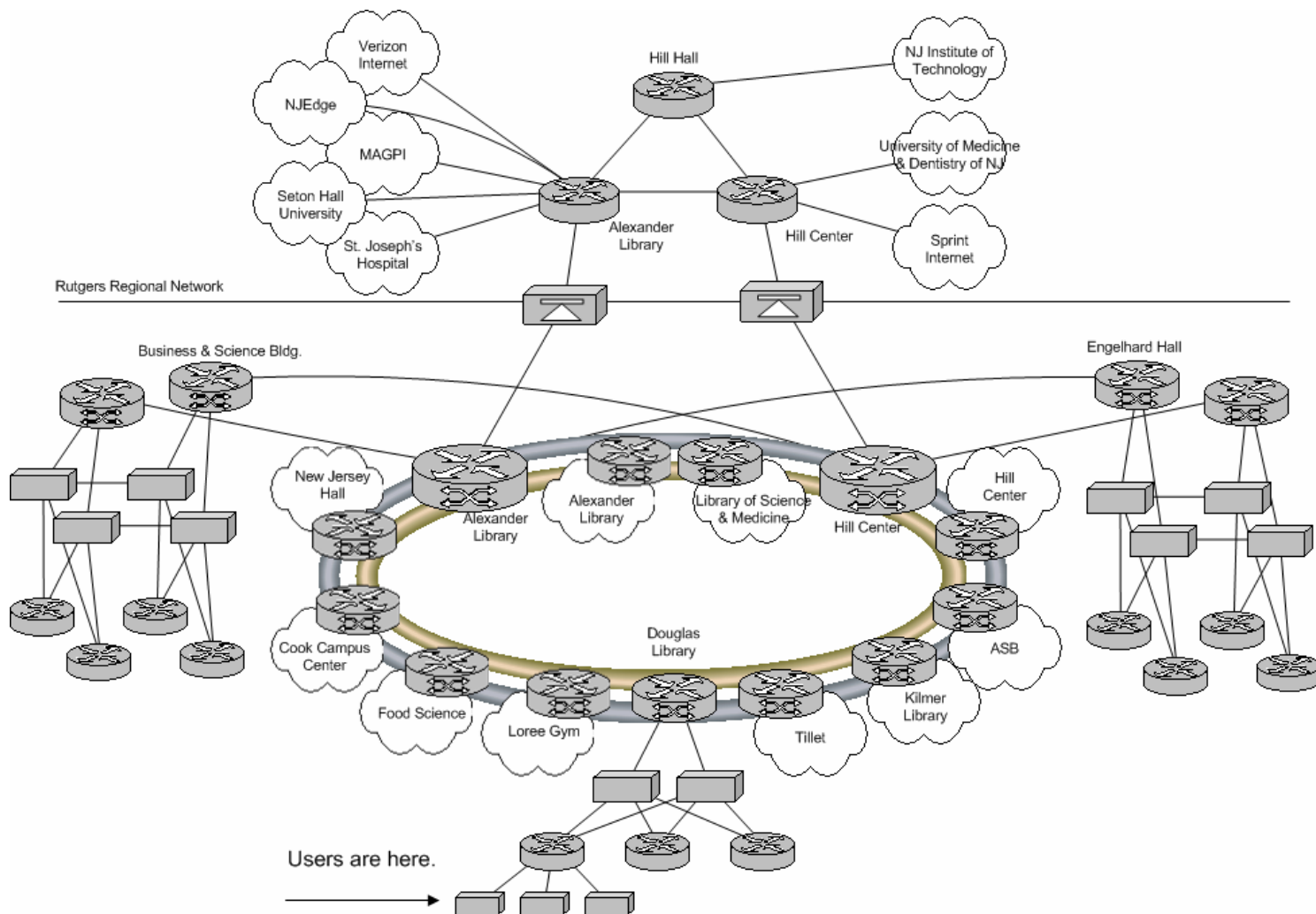
Manager, Network Architecture and Applications

10 April 2007

# Today's discussion

- Quick review of RUNet structures and services
- New RUNet technologies
- New RRN structure and services
- RUNet Tips and Tricks for UCS
- Up and coming technologies

# RUNet Structure



# RUNet Services

- Services are offered either globally, or within each A-tree
- Global services include
  - Internet & Internet 2
  - Routed, private address space
  - Network Address Translation
  - Device monitoring & management
  - DNS management (Hostmaster service)
- A-tree services include
  - Domain Name Service
  - Network Time (also available on your router!)

# Why is RUNet successful?

- Design standards and best practices
- Common, modular solutions replicated many times
- Core – Distribution – Access
- Planned aggregation practices
- Designed-in fault management
- Automated monitoring and management
- Our staff!

# RUNet: New initiatives

## Evergreen proposal

- Funding proposal requests \$3M per year for upgrades
  - A get-well plan to refresh the oldest, at-risk technologies
  - Incorporate new technologies where it has the greatest impact
  - Recycle current equipment into at-risk locations
- Aging equipment introduces new challenges
  - Vendors stop supporting older equipment and software
  - Availability of spare and replacement parts
  - Older equipment not meeting current or anticipated demands
- Legacy depopulation project
  - Some areas of RUNet are still on legacy hardware
  - These areas are at greatest risk for support
  - Contact the NOC to arrange a meeting with the PMO to discuss options

## RUNet: New initiatives

- Introducing the Catalyst 4500
- For use in the access closet
- Modular chassis
- High density port capacity
- New capabilities in the closet
  - 28 or 64Gbps; 21 or 48Mpps
  - L3/L4 capability
  - Supports current 802.1 standards
  - Future support for voice and video applications, PoE
- Reduces access layer complexity
- Scalability



## RUNet: New initiatives

- Introducing the Catalyst 6500E
- For use as an access router
- Sup32 processor
  - 32Gpbs, 15Mpps in hardware
  - Support for PFC3B on-board
  - MSFC2A on-board
  - More RAM, CEF table space
- Distributed switching
- L3/L4 hardware switching
- NSF/SSO fault recovery
- Sup720 and 10GE capable



# RUNet: New initiatives

## Metro Ethernet services from Verizon

- New Transparent LAN Services from Verizon include SES and lit-ring services
- Available UNI speeds from 10Mbps to 1Gbps
- Customizable bandwidth from 1Mbps to 1Gbps with Best Effort (BE), Priority Data (PD) and Real Time (RT) traffic classification
- E-Line offering for point-to-point service, supports most L2 control protocols
- E-LAN offering for multipoint service, without control protocols
- Pricing competitive with traditional SONET/SDH for T3 speeds and above

# Rutgers Regional Network

- Introducing the Juniper M10i
- 12.8Gbps backplane
- Carrier-class solution for Internet routing applications
- JUNOS policy language offers rich command set
- Simplified upgrade path



# Rutgers Regional Network

## NJEdge updates

- Rutgers transitioned to NJEdge's new service in April 2007
- New DWDM 10Gbps lit-services ring
- IP-based backbone services
- Strategic relationships with Verizon and UUNet
- Co-location services at Halsey St. CLEC facility in Newark
- Internet2 Commons and other .EDU initiatives

# Rutgers Regional Network

## Internet2/MAGPI Updates

- Rutgers transitioned its Internet2 in February 2007
  - Old connection was 155Mbps via leased OC12
  - New connection is 200Mbps GE E-Line connection via NJEdge ring
- Institutional peers currently in the process of migrating from RRN to private E-Line connections with MAGPI
- Rutgers will continue to carry traffic for UMDNJ until June 2007

# Rutgers Regional Network

## Verizon Internet updates

- Secondary Internet connection to Verizon migrated to E-Line service in April 2007
- Converged Ethernet Virtual Circuit (EVC) to NJEdge carries 35Mbps of UUNet Internet services
- 35Mbps is not an adequate backup, and TD is currently exploring ways to make this secondary connection more useful

# Rutgers Regional Network

## Sprint Internet Updates

- Primary Internet connection much improved over last report
- Sprint Internet connection approximately 40% utilized over 24 hour period
- 350 to 400Mbps sustained bitrate during peak periods
- Enough capacity to handle another two years' growth
- TD is developing new measurement and trending methods to manage growth

# RUNet Tips & Tricks

## Layer 2 Peering with 802.1q Tag Sharing

- IEEE 802.1s standard moved Spanning Tree into the VLAN, which solved several major architectural issues
- Upshot: TD can provide peering for 802.1q VLAN trunk links to “untrusted” devices
  - UCS may establish a peering relationship between their own non-managed devices and TD's managed infrastructure
  - Devices MUST be able to support 802.1q VLAN ID numbers 1 through 1000
  - Devices MUST NOT attempt to participate in TD's VTP management domain
  - Devices MUST NOT attempt to modify Spanning Tree topology
  - Contact the NOC to find out more!

# RUNet Tips & Tricks

## Security structures

- TD can support end-user firewall, IDS and packet analyzer devices, with the following caveats
  - Layer 3 solutions are best-- we can always route it to you
  - Layer 2 solutions using 802.1s are supportable, but the UCS must cover the cost of the additional interfaces
- TD supports 802.1q for firewalls protecting multiple LANs at a single site
- TD recommends using coordinated RFC 1918 address space when using firewalls
- The “safest” interpretation of the RUNet AUP is to ask the NOC

# RUNet Tips & Tricks

## Voice and Video applications

- TD has published a position paper on Voice over IP on the TD website (<http://www.td.rutgers.edu/papers>)
- VoIP on RUNet is possible, but still experimental and unsupported – Your mileage will vary
- Free services such as Skype and Gizmo work great as long as Internet performance is good
- Currently working on a feasibility study to evaluate VoIP as a strategic technology for Rutgers University
- Video applications have similar demands from the network, but need more bandwidth
- Let us know what you're doing, and how it works!

# RUNet Tips & Tricks

## Multicast

- Multicast has been active on RUNet since June 1999
- RUNet supports both Sparse mode and SSM multicast
- New operating systems support IGMPv3, inter-operate with SSM
- One caveat: the network is not designed to handle HD quality video multicast
- TD is developing documentation on how to use multicast and generate multicast content
- Multicast group addresses are available for public multicast projects
- Ad-hoc addresses are available for Rutgers-local use
- Please contact the NOC for an address assignment

# RUNet Tomorrow

## Technologies being evaluated for use on RUNet

- Wave Division Multiplexing (CWDM and DWDM)
- MPLS Virtual Routers and Traffic Engineering
- 10 Gigabit Ethernet
- Firewall Service Module service
- IPv6
- Wireless backbone connections
- Central VoIP services

# Questions?

## Websites referenced during the presentation

- TD presentations and papers (<http://www.td.rutgers.edu/papers>)
- TD Tools (<http://www.td.rutgers.edu/tools/>)
- NJEdge Website (<http://www.njedge.net>)
- MAGPI Website (<http://www.magpi.net>)
  
- For any follow-up questions about this presentation, please contact the NOC at 5-7541, or by email at [noc @ rutgers.edu](mailto:noc@rutgers.edu)