

Using Business Class Broadband Services for Campus Metro Ethernet Access

“The Gophers are Tunneling through Comcast”

*ESCC/Internet2 Joint Techs
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UNIVERSITY OF MINNESOTA

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The Business Case

- T1s are no longer enough bandwidth
 - Even for most small offices
- Advanced Broadband Services are becoming available
 - Fiber to the Premise (FTTP)
 - DOCSIS 3.0
 - Fiber to the Node (FTTN)
 - XDSL to the Premise

Advanced Broadband Services

- Verizon (FTTP) 30/15 and 50/20
 - Comcast (DOCSIS 3.0) 22/5 and 50/10
 - Qwest (FTTN) 15/1 and 20/1
 - AT&T (FTTN) 12/1 and 18/1
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- Usually have a business class service available with better service level response
 - for \$150 to \$250 per month

Other Options

- T1s are not a lot of bandwidth
 - Price per Mb very high
- Metro Ethernet can be too expensive, especially for most small sites
 - \$1000 to \$3000 a month for 100Mbps to 1Gbps
- Dark Fiber usually has a longer term payoff
 - Probably not be a good answer for short-term leased office space

Summary of Options

- Advanced Broadband Service
 - Good for smaller offices around 50 users
 - Inexpensive backup for medium or larger offices
- Metro Ethernet 100Mbps
 - Good for medium offices around 100 users
- Metro Ethernet 1Gbps or Dark Fiber
 - Good for large offices 200 users or more

Integrating into Campus Network

- T1s, Metro Ethernet, and Dark Fiber are generally a Private Line service
- Advanced Broadband Services are generally an Internet service

• **Internet ≠ Private Line**

Making Internet = Private Line

- Use a tunnel back to campus
 - Use campus IP addresses for End-Users
- Encrypt the tunnel
 - Security – do you need to say more
- Keep latency down
 - Peer locally with Provider, or
 - Dedicated Tunnel hub end-point connection to Provider

Tunnels, Tunnels, Tunnels

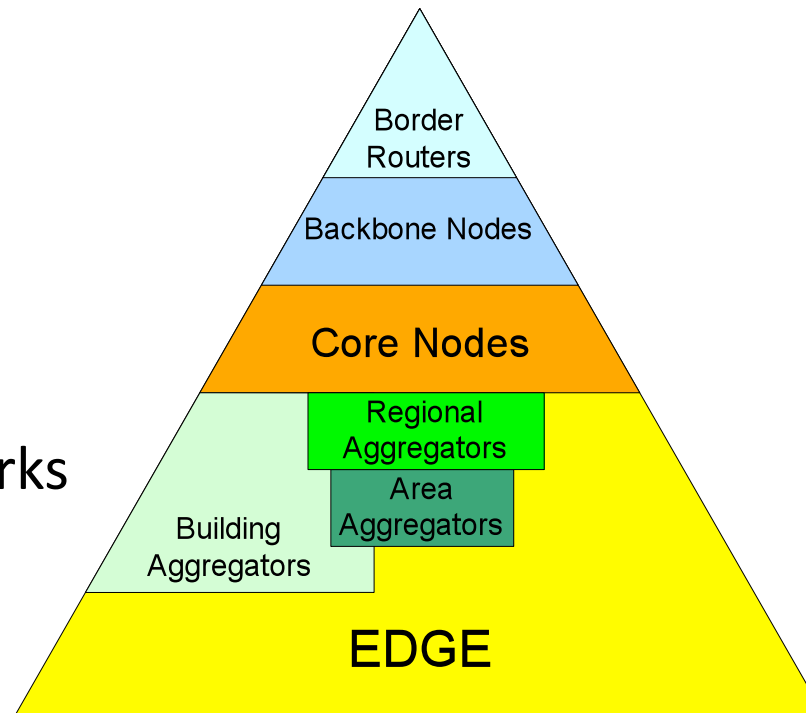
- IPSec in Tunnel Mode
 - Encrypted tunnel
- GRE (Generic Router Encapsulation)
 - General IP-in-IP tunnels
- L2TPv3 (Layer 2 Tunnel Protocol)
 - Pseudo Wires over IP, or
 - Ethernet Frames over IP

Why Pseudo Wires?

- Campus Ethernet Architecture may be extended to remote sites connected via Internet Services
- Makes remote sites look like they are connected via LAN technologies
 - Can use normal LAN Management tools between Remote sites
 - Can use IP and IP management tools in the wide area domain

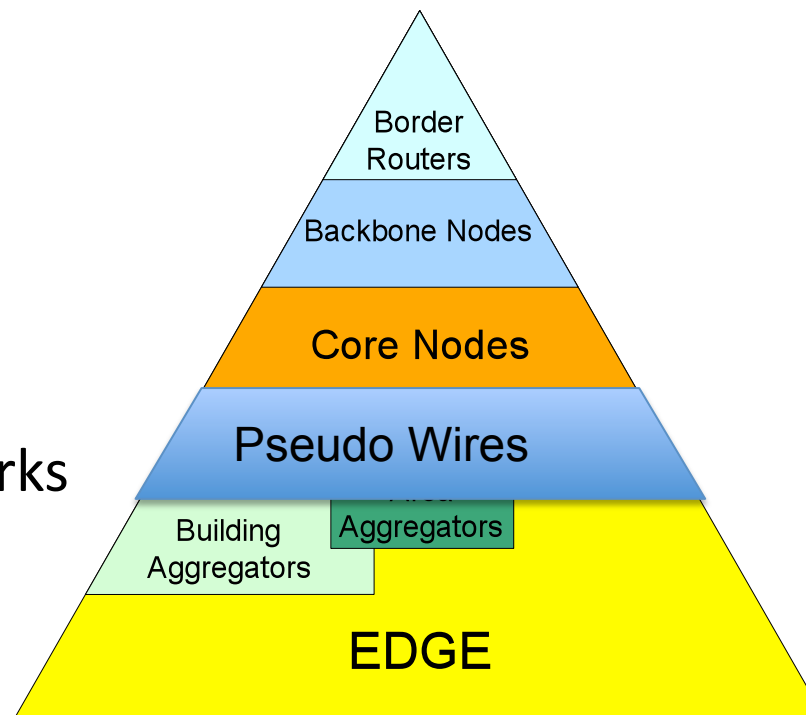
UMN Architecture

- Campus Border
- Core Network
- Aggregation Networks
- Edge Nodes

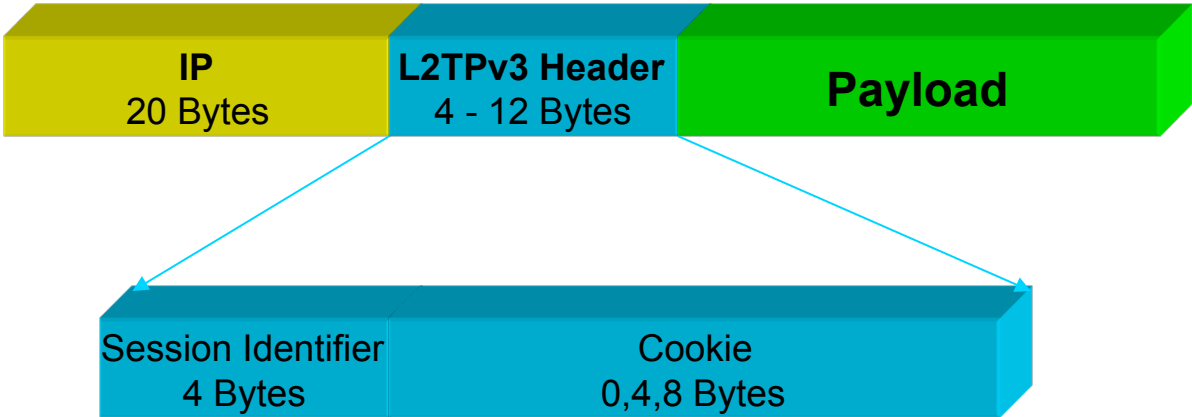
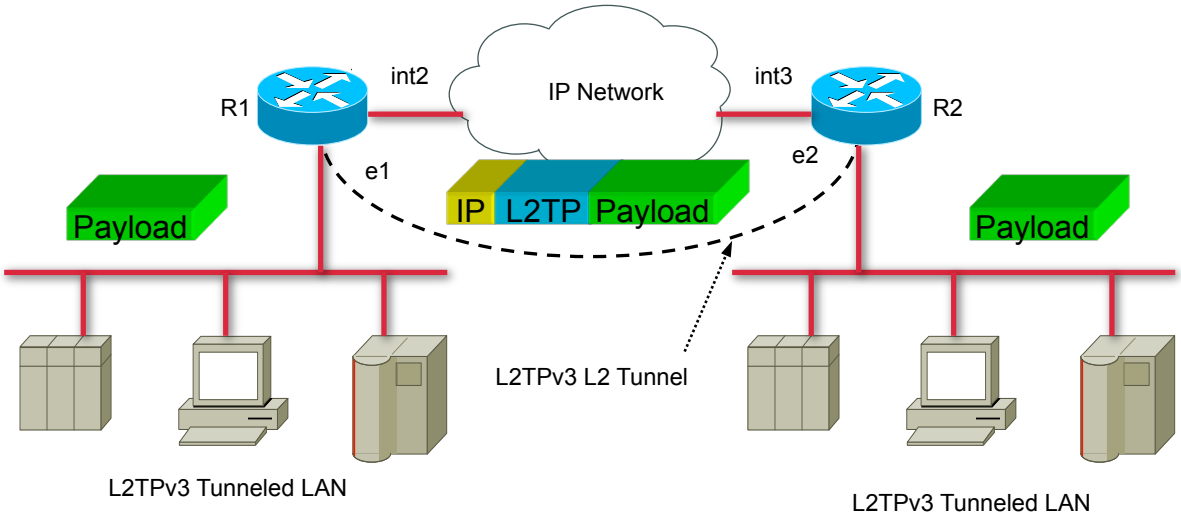


UMN Architecture With Pseudo Wires

- Campus Border
- Core Network
- Aggregation Networks
- Edge Nodes



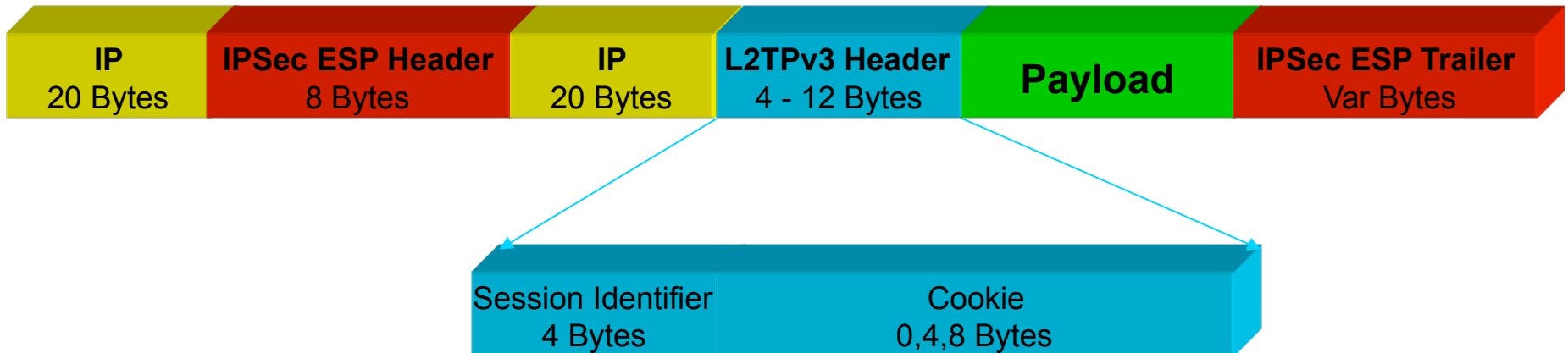
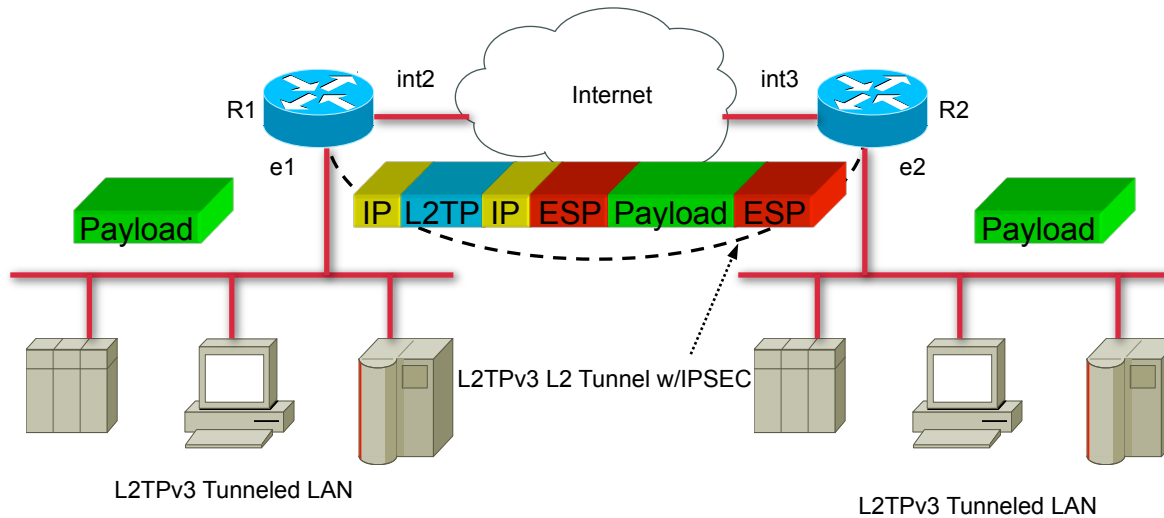
L2TPv3 Encapsulation



Encryption

- Going over the Internet you probably want to Encrypt the traffic
- Add IPSec ESP Tunnel mode to encrypt L2TPv3 packets over the Internet

L2TPv3 with IPSec



What is UMN doing?

- Naked L2TPv3 over State of MN statewide IP Backbone
- IPSec protected L2TPv3 over Comcast

Questions?

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