

High-Speed Networking and Applications in Research & Education Networks

CUDI Meeting
Reunión de Otoño - 2002

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Company Profile

- ◆ **Service Provider Market Focus**
 - ❖ **Purpose-built IP Infrastructure**
- ◆ **Worldwide Presence**
 - ❖ **60 offices worldwide**
- ◆ **Excellence**
 - ❖ **#1 BRAS**
 - ❖ **#1 Broadband Access & IP Services**
 - ❖ **#2 Core Router**
 - ❖ **#2 Edge Router**

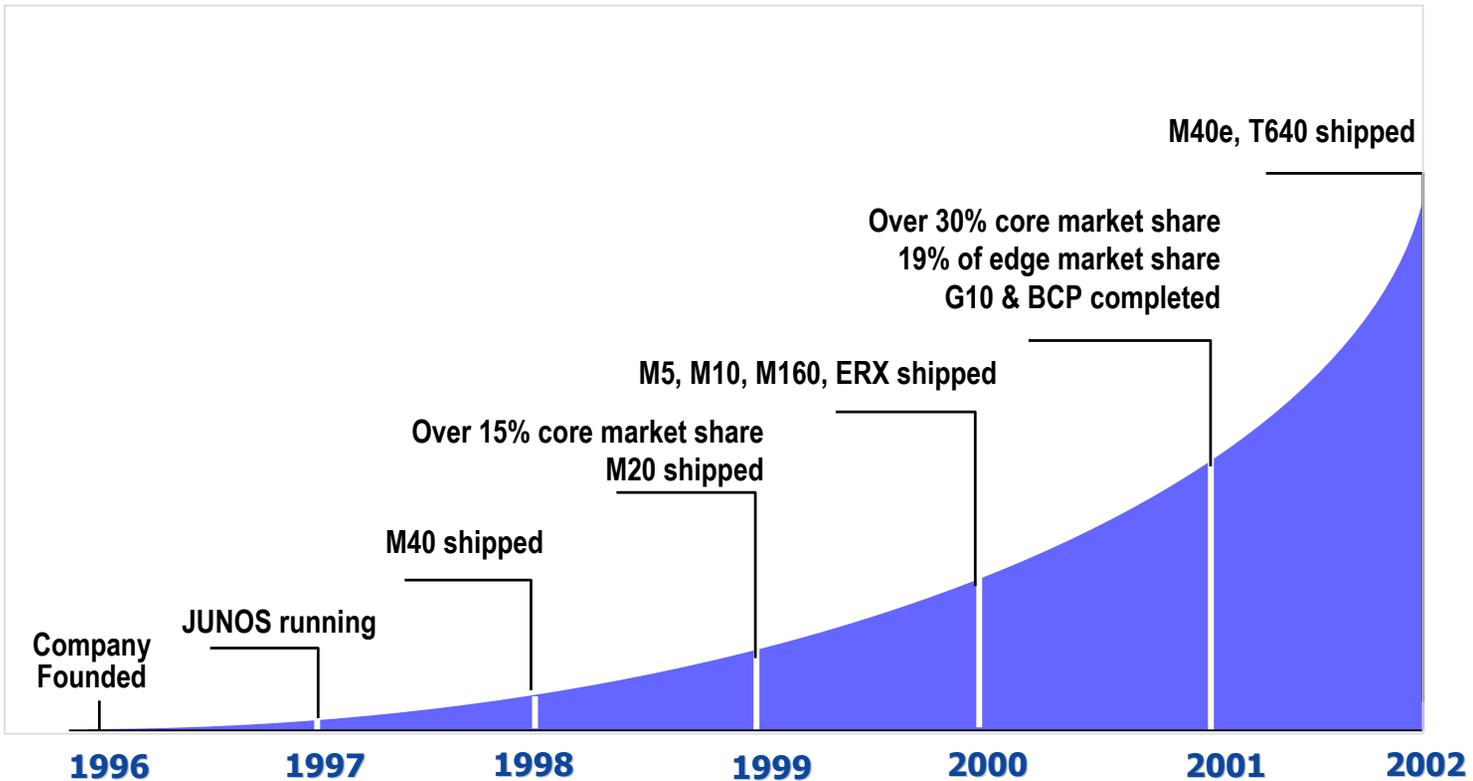


Source: Infonetics, Synergy, Dell'Oro



Company Milestones

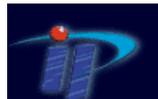
**Trusted Partner for State of the Art IP Systems
and Services for the New Public Network**



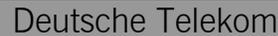


Global Base of over 600 Leading SPs

Americas



Europe Middle East Africa



Asia Pacific





Agenda

- ◆ **Juniper in R&E Networks**
 - ❖ **Application Examples**
 - ❖ **R&E References**
- ◆ **Juniper Product Technical Overview**
 - ❖ **Architecture & Platforms**



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Juniper Applications in R&E Nets

- ◆ **HDTV over IP**
- ◆ **Passive Monitoring via Port Mirroring**
- ◆ **Wire speed filtering for firewalls**



HDTV Over IP at the University of Washington

- ◆ **The University of Washington is a leading innovator in HDTV over IP applications**
- ◆ **At the Supercomputing 2001 show, UW demonstrated for the first time that it was possible to run uncompressed, broadcast quality HDTV that required a 1.5 Gbps stream of data across a wide area Internet backbone**
- ◆ **By using Juniper Networks routers, UW engineers concentrate on their applications instead of tracking down network bottlenecks and troubleshooting network problems**



1.5 Gbps Uncompressed HDTV over IP

SEATTLE

DENVER

PNW GigaPoP

SCinet

1.5 Gbps Uncompressed HDTV Stream

University of Washington

NCO Booth

HDTV Source

**Tektronix/
DARPA UNAS**

OC-48

HDTV Display

**SC01 Demo by
Tektronix/USC-ISI/UW/
Research Channel/DARPA**

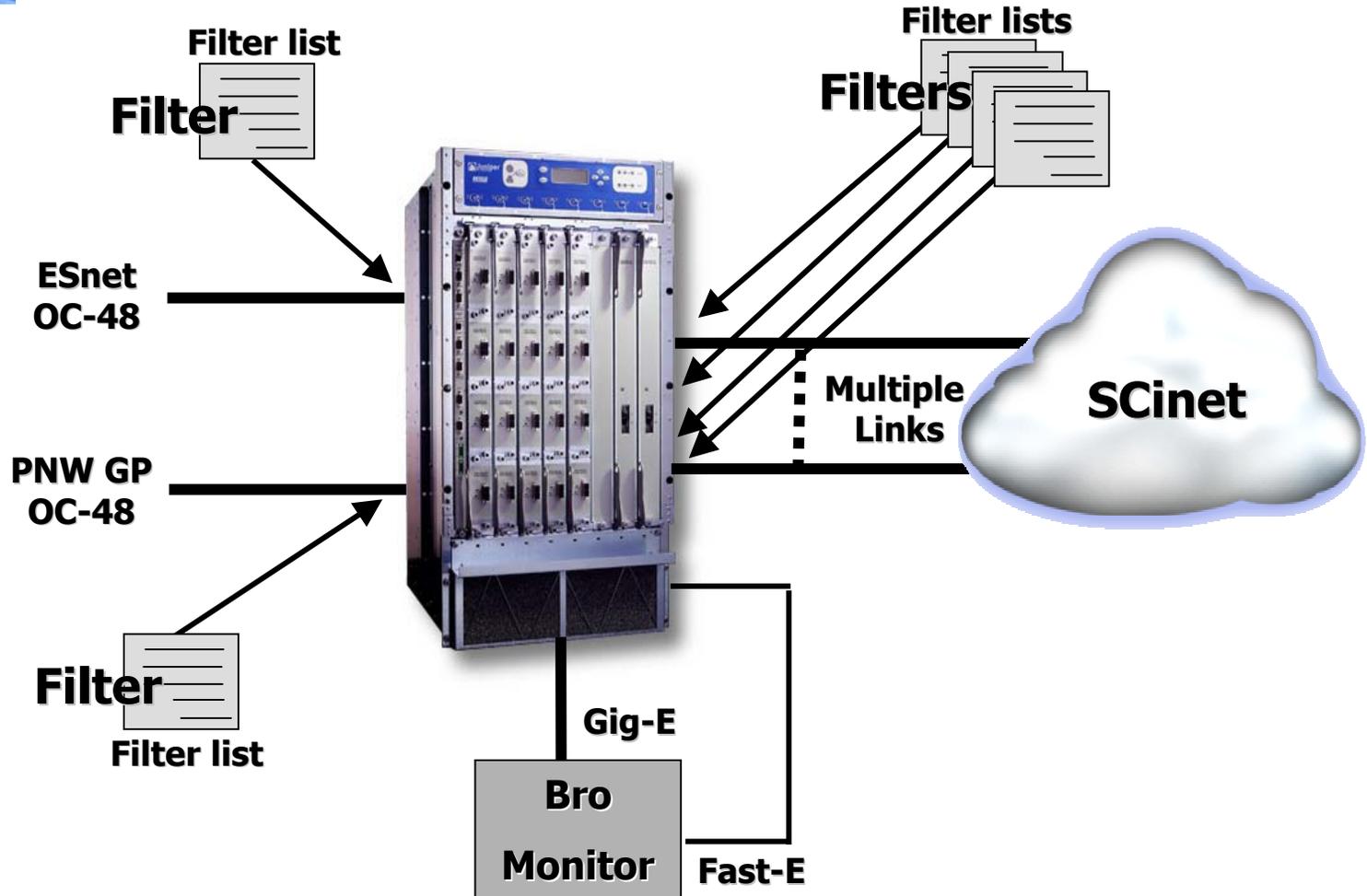


Passive Monitoring via Port Mirroring

- ◆ **LBNL set up Bro (its security monitor) on a Gig-E link attached to the Juniper M160 at SCinet**
- ◆ **Filters were set up on all links to mirror all TCP: SYN, FIN, and Reset packets to Bro**
- ◆ **Bro modified the filters on the fly to block attack traffic**
 - ❖ For example FTP traffic for which there was no session set up was blocked
- ◆ **Port Mirroring can also be used with OCXMONs and other passive monitoring devices**
 - ❖ Monitors do not have to be upgraded with bandwidth increases
 - ❖ A passive monitor can watch more than one link at a time



Port Mirroring and Bro at SC01



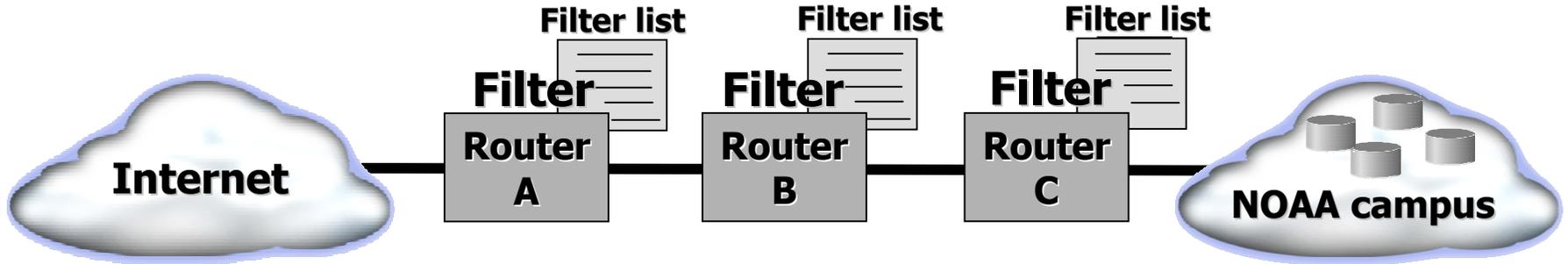


Wire Speed Filtering for Firewalls

- ◆ **NOAA uses Juniper's line speed filtering capability to do all of their security filtering on one router**
- ◆ **As part of NOAA's acceptance process Juniper ran lab demonstrations using filters with up to 40,000 terms implemented on an OC-48 interface running at line speed with no performance loss**
- ◆ **Several R&E customers have been able to replace a firewall made up of two or more routers linked serially with a single Juniper router**

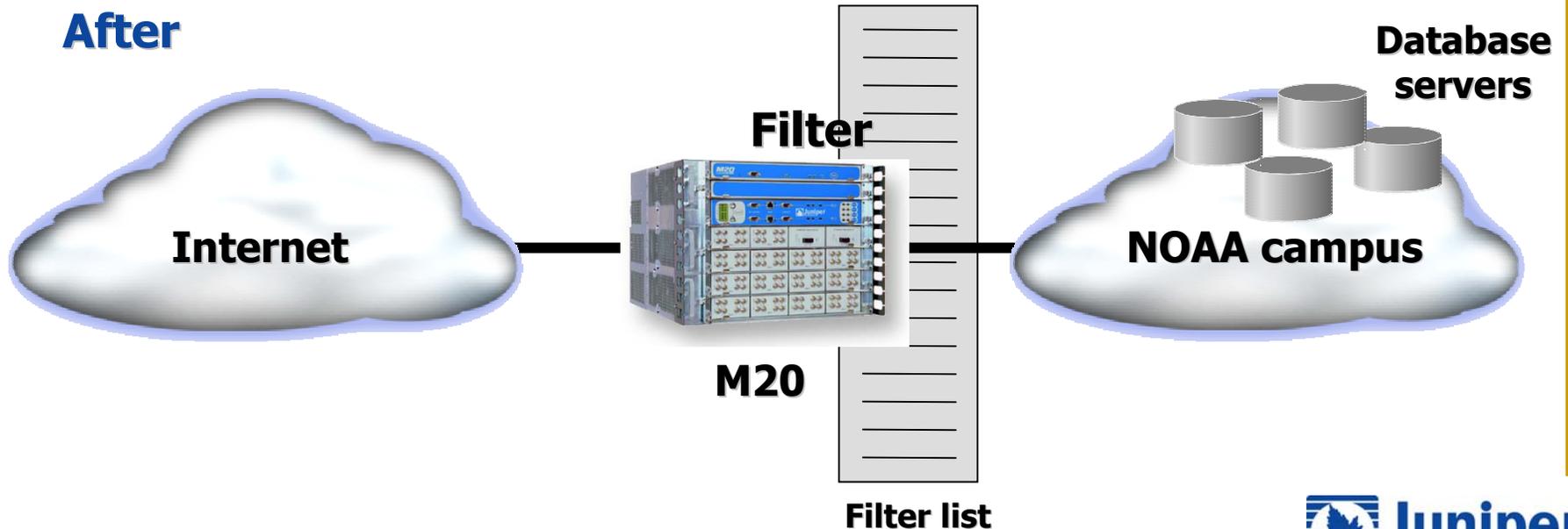


Improving Network Efficiency at NOAA



Before

After

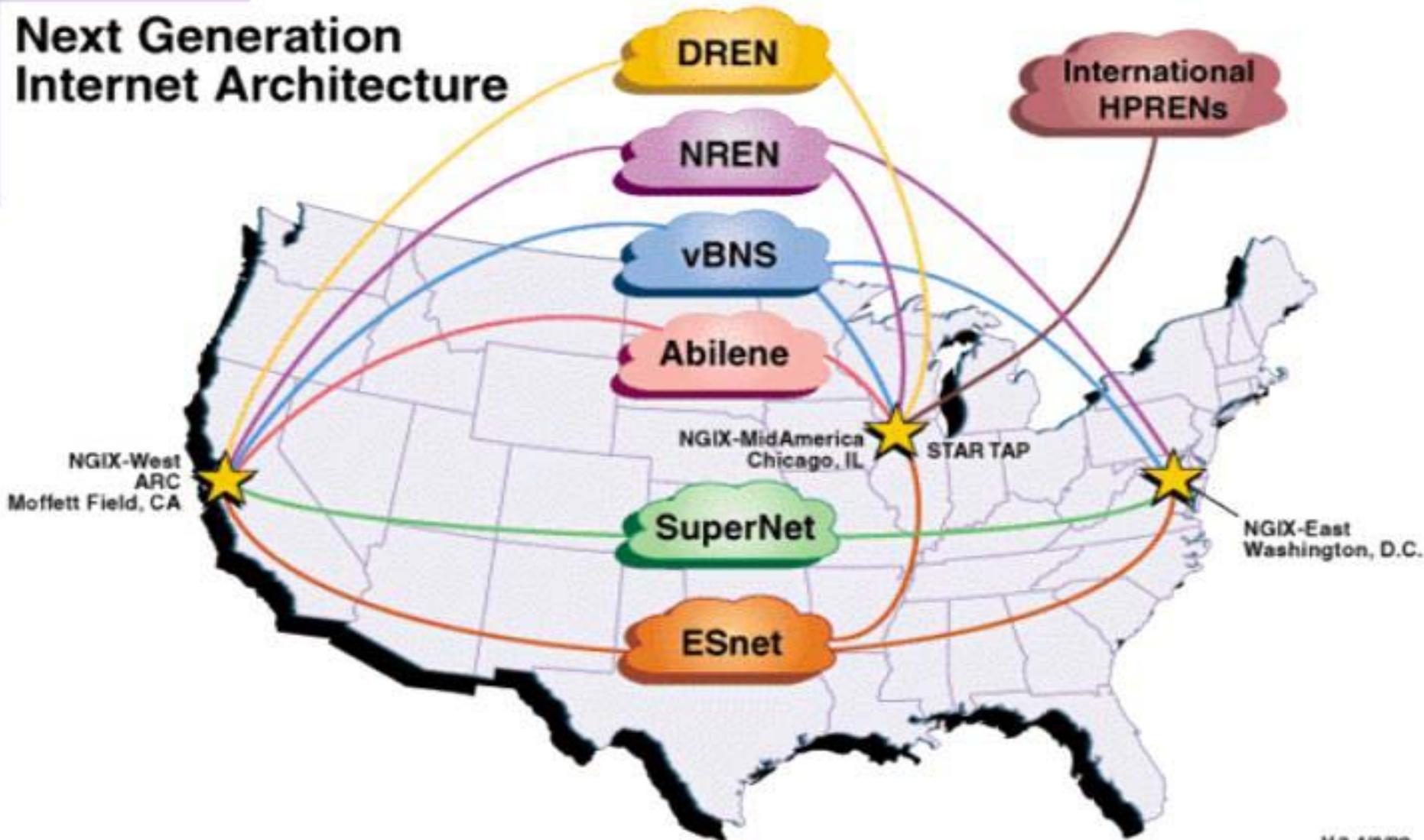




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Next Generation Internet Architecture



V.3 4/8/99

- DREN** - Defense Research & Engineering Network
- NREN** - NASA Research and Education Network
- vBNS** - Very High Performance Backbone Network Service (NSF)

- Abilene** - University Corporation for Advanced Internet Development (UCAID)
- SuperNet** - Terabit Research Network (DARPA)
- ESnet** - Energy Sciences Network (DOE)

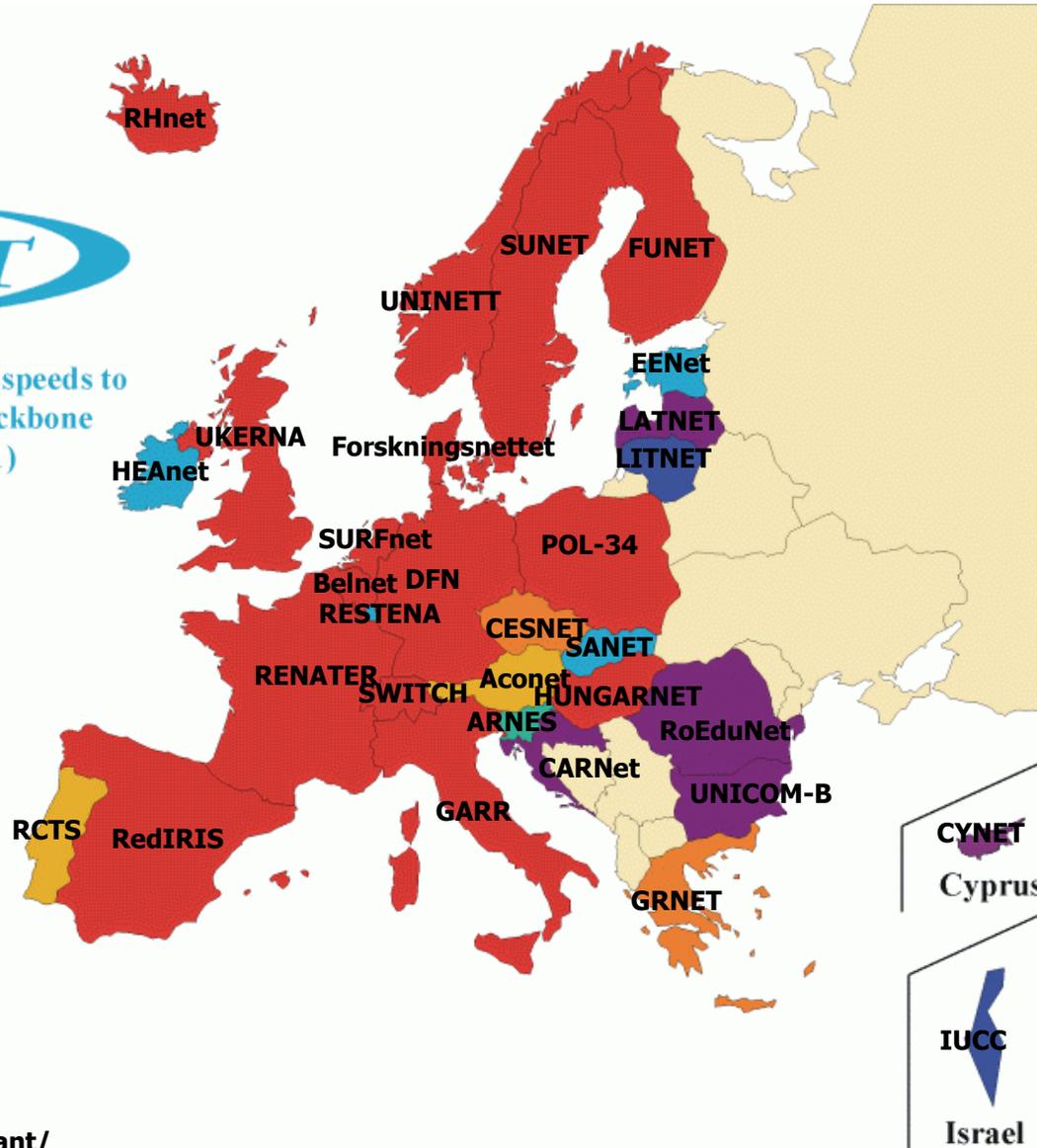


Pan-European Research Networking



Planned national access speeds to the pan-European backbone (November 2001)

- 2.5 Gbit/s
- 1.2 Gbit/s
- 622 Mbit/s
- 310 Mbit/s
- 155 Mbit/s
- 45 Mbit/s
- 34 Mbit/s



10 Gb/s backbone with Juniper M160s

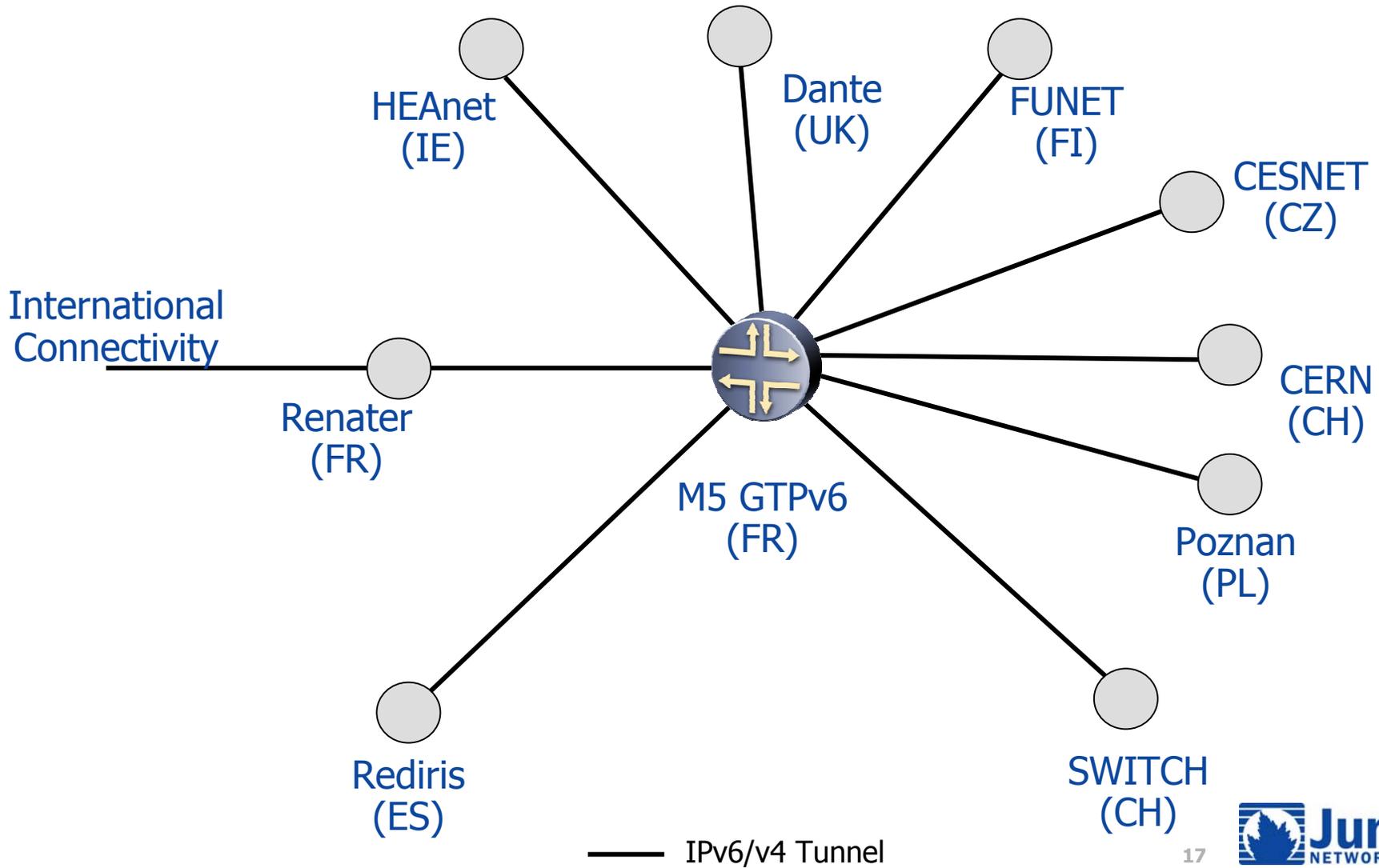
WDM optical technology

30 R&E connected organizations

European connectivity to over 3000 R&E institutions



Juniper IPv6 router Peerings





Research and Education Customers

National Research Networks & Meet Points

Global

- ◆ GTRN (Global Terabit Research Network)

North America

- ◆ Abilene - Internet2
- ◆ AMPATH - Latin American Meet Point (Miami)
- ◆ CA*net4 - Canada
- ◆ ESnet - Department of Energy
- ◆ vBNS+ - Worldcom
- ◆ STAR TAP - Global Meet Point (Chicago)
- ◆ SUPERNET - DARPA's NGI Network
- ◆ TeraGrid - NSF's distributed Super Computer project

Europe

- ◆ ARNES - Slovenia
- ◆ FUNET - Finland
- ◆ GÉANT - DANTE (Pan-European)
- ◆ RedIRIS – Spain
- ◆ VTHD - France

Asia

- ◆ APAN - Asia-Pacific Advanced Network Consortium
- ◆ JGN - Japan Gigabit Network
- ◆ SINET - Japan
- ◆ TransPac (Tokyo-Chicago)

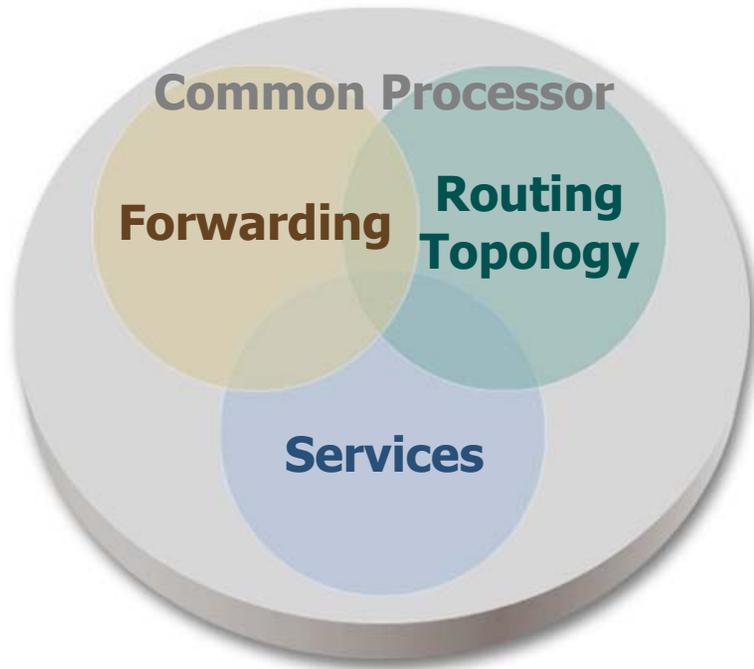


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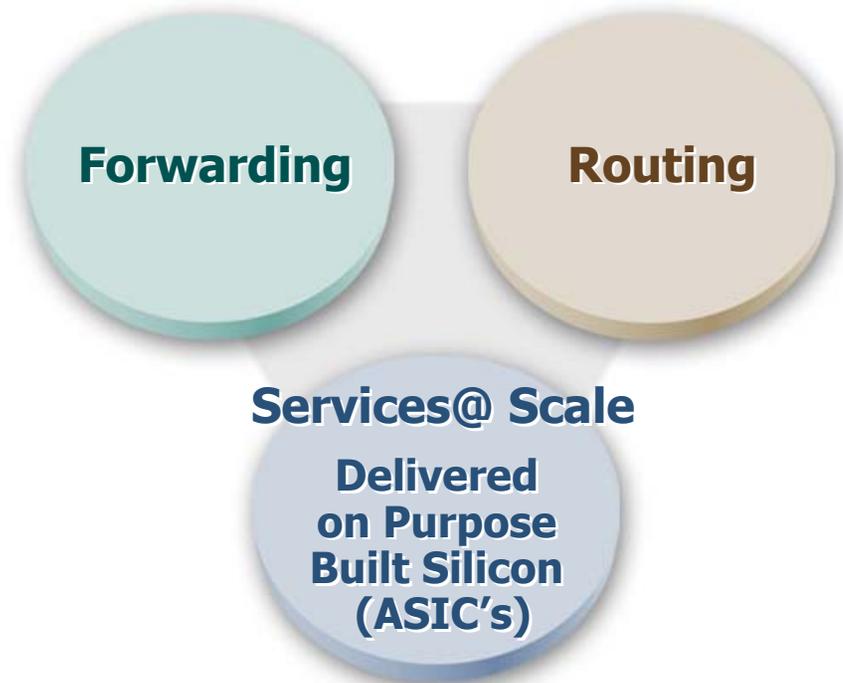
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Purpose Built Architecture



'Traditional' CPU-Based Router



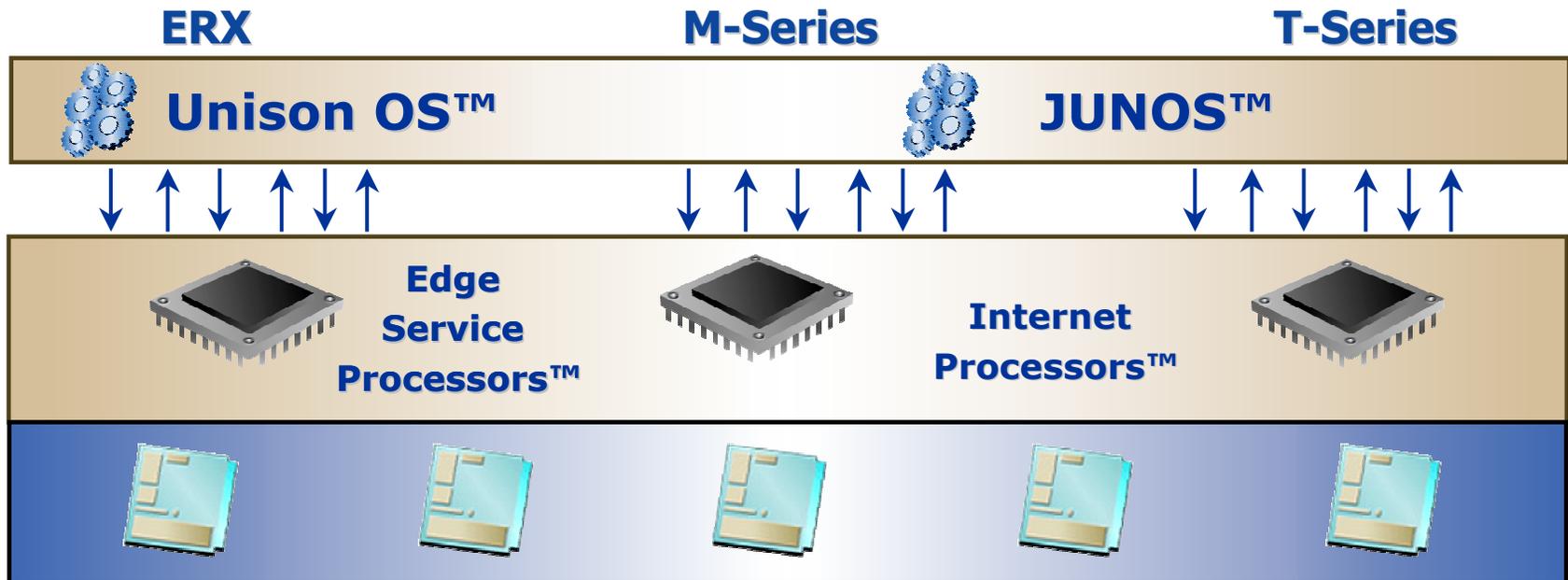
Juniper Networks Architecture



Juniper Networks

Unprecedented Control Plane Scale

- ◆ Clean separation of control and forwarding planes
- ◆ Modular OS enables scale
- ◆ Unison™ optimized for granular control of many interfaces
- ◆ JUNOS™ optimized for high bandwidth, dynamic routing





Best in Class IP Portfolio

Dependable

**Uncompromising
Performance**

Security

**BRAS &
Circuit Aggregation**



ERX Family



SDX - Service Deployment Portal

**Service Activation, Deployment
& Accounting**

**HS Circuit Aggregation
& Small/Medium Core**



M-Series Family

**Metro
Aggregation**



T-Series Family

**Large
Core**

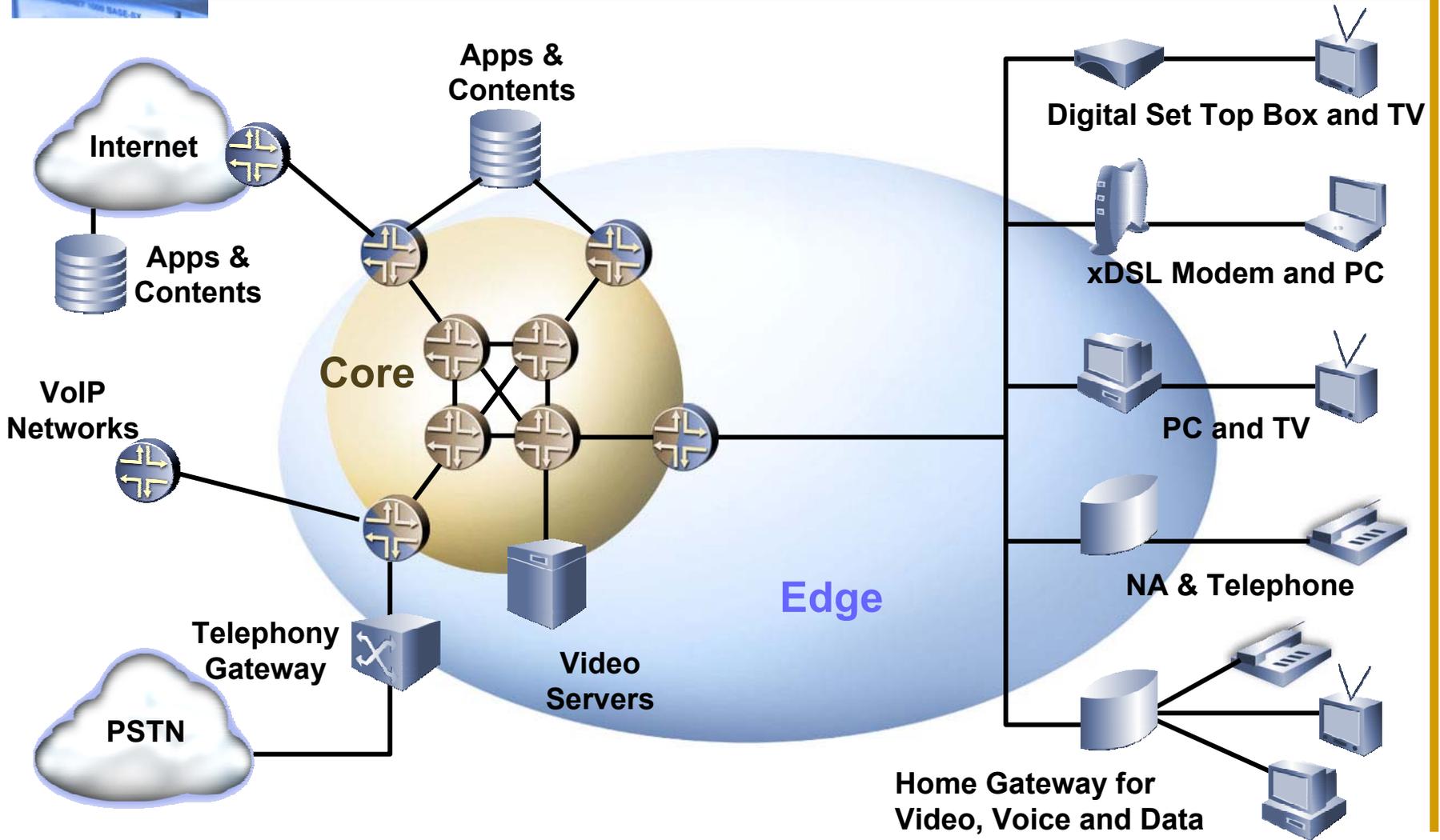
Seamless Scale

**Operational
Simplicity**

Rich Services



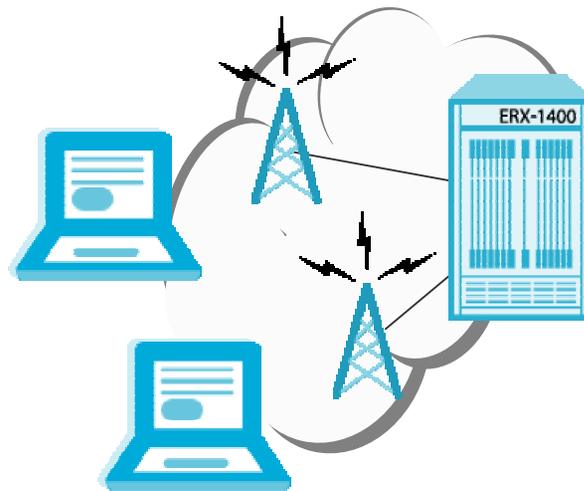
Video, Voice, and Data Convergence





802.11 Wi-Fi "HotSpot" Networks

- ◆ **Internet & VPN access using 802.11 Wi-Fi technology**
- ◆ **Enable network access anywhere with notebooks and PDAs**
- ◆ **Integrated with ERX and SDX platforms**

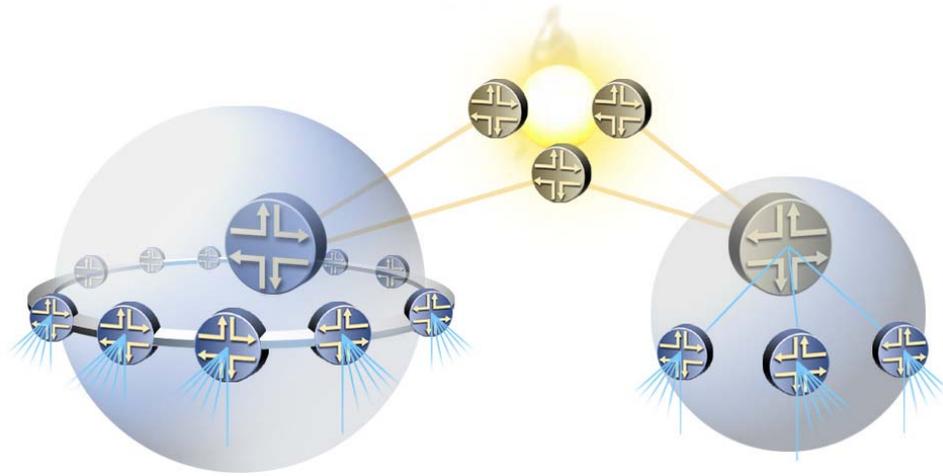
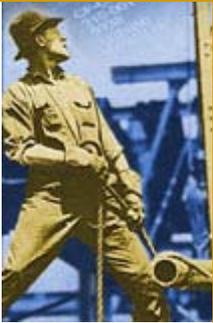




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Thank You