The Future of High-Volume, High-Reliability Data Networks

Dick Willson and Dan Lutter
Allied Partners LLC
NASPI Workgroup Meeting
October 23, 2014 - Houston, Texas
The Future is Here!

Our issues have already been solved by others
Transport Network

Congested intra-campus

NREN

Regional

Transport Network

Source Campus

Congested or faulty links between domains

Backbone

Latency dependant problems inside domains with small RTT

Destination Campus
3 Major Factors That Effect Network Performance

• Packet Loss
• Latency (round trip time, or RTT)
• Buffer/Window Size
• there are others, but these are the big three.

All three are interrelated.
Even a very small packet loss has a huge impact on data integrity and network reliability and performance.
What is the effect of packet loss?
Max throughput = \( \frac{\text{Max. segment size}}{\text{Round trip time}} \times \frac{1}{\text{packet loss rate}} \)

Source: http://fasterdata.es.net/assets/bw-vs-lat.pdf
What Did ESnet Need To Do?

• Reduce or eliminate packet loss that impacts data integrity and produces poor network performance
• Implement appropriate security architectures and controls so that high-performance applications are not hampered by unnecessary constraints.
• Provide an on-ramp for critical resources to access wide area services including virtual circuits, network overlays, and software defined networking.
• Incorporate network testing, network measurement, and performance analysis.
Elephant and Mice Flows

- Video Surveillance
  - Elephant Flows
- "Real time"
  - Sensor network
    - e.g. PMU data

Packet Transport

Mark

Priority

Schedule

Mark

Jitter

Confidential
Next-Gen Flow Routing for Grid

Control and Orchestration

General Purpose

Security

Sensors

Actuators

Cyber Physical Systems

Real Time

Best Effort

Security

Big Data

Science Applications

Security

Next-Gen Flow Routing

Wide Area Network Services
Next-Gen Network for Grid

- Transport of flows of different sizes and priorities; e.g. realtime mice flows and best-effort elephant flows
- Scalable multicast with zero packet loss and fast restoration
- Management of disparate traffic flows over heterogeneous networks - Multi-domain, multi-service network overlays
- Integrated, data-centric publish and subscribe architecture
- GPS-independent “global” time
- Separation of control plane from data plane
- Security, Reliability & Resilience

...more at next NASPI meeting!
CONTACT INFORMATION

Dick Willson
dickwillson@appliedpartnersllc.com

Dan Lutter
danlutter@alliedpartnersllc.com