Measurement for "Next-Generation" Networks

Matt Zekauskas matt@internet2.edu

GLIF Meeting

30-Sep-2005

Note

- This talk is a follow-on to "(Next-Generation Network) Measurement Infrastructures BoF" at the Vancouver Joint Techs in July. Slides are expanded…

- http://people.internet2.edu/~matt/talks/ 2005-07-19-NGNmeasBoF.pdf

- http://people.internet2.edu/~matt/talks/ 2005-07-19-NGNmeasBoF-notes-draft01.pdf

- My view of the problem in general
- Tease out some specifics
- HOPI as an example

- Very much a work in progress…
- What do you do / What do you think?

My view…

"Next Generation"?

- Looking at not-too-distant service offerings, based on
  - NLR L1 / L2
  - Connections facilitated by Dragon / Cheetah…
  - Connections using the GLIF
  - HOPI
  - Ultralight, UltraScienceNet, …

$\Rightarrow$ circuits

- Operational planning

- Debugging

- Feedback to the control plane

Specifics…

Measurement/Monitoring: A loss of functionality?

- divide-and-conquer by adding active equipment
- Statistics from routers (utilization, malformed data packets)
- Convenient points for passive traces

$\Rightarrow$ A loss of visibility

(personal bias: debugging performance problems)

A new need?

- As you glue together different technologies (L2+L1+MPLS+…) if there is a problem, finding that problem will be harder;

- If you don't use SONET at L1, indications from network are potentially fewer (or different); GFP operations and monitoring functions?

- Errors / errored frames
  - Before and after error correction?
- Light levels
- Current state (what maps to what)

- And ?

- Utilization
- Errors
- Possibility of injecting traffic parallel to other VLANs
- Possibility of passive measurement by port replication
- Packets tossed because of internal resource limits?

- Use IP-based ones (packet oriented)
  - Latency
  - Loss
  - Throughput verification
- Use telephony-based ones
  - Circuit setup time
  - Errored seconds
  - Whatever the ITU has been doing for years (need to investigate, don't have any kind of systematic or exhaustive list)

What are the right tools?

- Could some passive measurement architecture, such as Lambdamon or PIANO, get us back some visibility?

HOPI as an Example

HOPI

- As a testbed, it lives (mostly) in an Ethernet world
  - 10GE on NLR northern route
  - 10 or 1 GE to connectors
  - Can leverage Force10 switches [also sFlow]
- However
  - Can optically bypass Force10
  - Southern route might be OC192

- Use optical switch to cycle through switch ports (☞ transponders)
- Use optical switch or attenuator to intentionally lower light levels near minimums ("margin testing").
- Monitor pre-FEC errors too

- Hook into control plane/middleware: when a connection is torn down, get a report on connection (errors, jitter, performed to specification)
  - Only if paths are fairly dynamic, and application to application

- Think about applications
  - Why are paths being used/created?
  - Bulk transport: mostly loss
  - Interactive: mostly latency
  - Augmentation of IP infrastructure?
  - How often will paths change?

Initial Plan

- Collect control plane decisions
- Leverage Force10 statistics
- "Router proxy" to examine switch state

- Measurement machines
  - continuously/periodically…
  - signal network
  - measure resulting path (throughput, latency)
  - Cycle through full mesh of 5 HOPI nodes (will initially, at least, pre-compute schedule)
  - Exercise control plane as much as verifying circuits

Other Examples

- Has agents to control switches on-demand based on requests
- Monitoring is state it created, and light level indications from the optical switches
- Nifty graphs of paths created with levels

INTERNET®

- The measurement SIG (nee WG) list is appropriate to start, we can create something more specific if it becomes necessary.
- wg-measurement@internet2.edu
- Subscribe via:
  https://mail.internet2.edu/wws/info/wg-measurement