Gathering Basic Metrics and Telemetry

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I2 community Measurement, Metrics and Telemetry Project -- What is it?

- Community project of Performance Working Group started from I2 Next Gen Architecture meeting in July 2019
- Initial Phase 1 Question -- Is the community willing to identify and share basic metric data from Science DMZ endpoints and all hops between in a secure manner?

https://docs.google.com/document/d/1A_6Ooowm33MZR3A-fuTnhGwIUX6UEeaPumRfGUSBEgI/edit

- Phase 2: Pilots -- Lessons to learn, gathering data, initial visualization and analysis

Phase 1: Are people willing to share?

- Why?
  - Hop-by-Hop End-to-End information about usage and basic characteristics **ACROSS** multiple domains
  - Transparency for Research, Academic and Operations
- Reaching out to Universities, Regionals, National Backbones
  - Creating a simple “At-a-Glance” spreadsheet to document
    - https://docs.google.com/spreadsheets/d/1pMW_PNVpeT42nAxa3bW4QostMxccHTXkWSPbZOplFwE/edit#gid=0
- Getting guidance from the community about simple, non-intrusive data to share
  - Talking to security representatives, operational representatives, directors, and other leaders
  - Respectful of privacy

Phase 1: Are people willing to share?

- Creation of basic templates that describe data willing to share initially *(Still iterating - welcome modifications)*
  - Campus Template
  - Regional Template
  - National Backbone Template

Examples: Packets in/out, Interface speeds, discards, utilization, errors, runts, jumbos, queue buffers

- Creation of "Letter of Intent to Share" among groups
  - Some entities require formal notes of collaboration
  - Respect need for documentation among groups
  - *Still iterating - welcome modifications*

Phase 2: Pilots, Lessons learned, initial data gathering, early visualizations

- Moving in parallel with Phase 1
- Work with willing collaborators for early pilots
  - Take templates and collect from Science DMZ to Science DMZ
  - If acceptable, instrument Data Transfer Nodes too
- Explore patterns of collection
  - Direct SNMP polling to GRNOC Time Series database
  - Local Telegraf instance feeding to GRNOC
  - Streaming telemetry
- Explore filtering techniques
  - Only share what is appropriate

Phase 2: Pilots, Lessons learned, initial data gathering, early visualizations

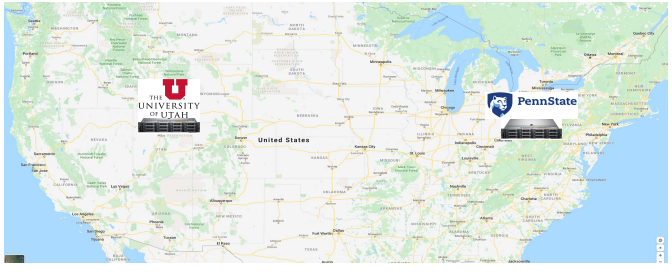
- Explore visualization techniques and mashups of these techniques
  - Augmented Traceroute -- GRNOC
  - Global Research Map -- GRNOC
  - Parallel Traceroute Visualization (demo)-- Univ of Utah
  - Augmented Traceroute + Parallel Traceroute + NetBeam API (ESnet)
- Explore integration with other research projects
  - Current bundling of telegraf instance as a sample app with SLATE project

Pilot collections so far

Univ of Utah to Penn State (Instrumented DTN to Instrumented DTN pilot)	NCSA (Telemetry pilot)	Clemson (Regional and Science DMZ pilot)
Univ of Michigan (Campus Backbone pilot)	Univ of Hawaii (Astrophysics pilot)	LinkOregon (Regional pilot)
FRGP (Regional pilot)	Utah Education and Telehealth Network (Regional and Streaming Telemetry pilot)	Imperial College/JISC/GEANT (International pilot)
ESNet (National Backbone with API) - tool integration	Internet2 (National Backbone transparency)	

Emerging workflow instrumentation

- University of Utah to Penn State hop-by-hop demo
- Wrapper script around Globus CLI Transfer (Internet2 TechEx 2019 demo)
- Produces email result with links
  - Augmented Traceroute results
  - perfSONAR results (before/after)
  - multiple traceroutes in both directions (leverages pscheduler on DTNs)



Transfer command: `globus transfer 'ddb59aef-6d04-11e5-ba46-22000b92c6ec:/share/godata/file1.txt' '63215e4c-0594-11ea-be98-02fcc9cdd752:/home/pphysch/file1.txt'`

Transfer status: SUCCEEDED (Click here for your Globus transfer overview)

Start: Wed Dec 4 15:17:11 MST 2019

End: Wed Dec 4 15:17:20 MST 2019

Source address: habanero.chpc.utah.edu

Destination address: dtn01-dmz.chpc.utah.edu

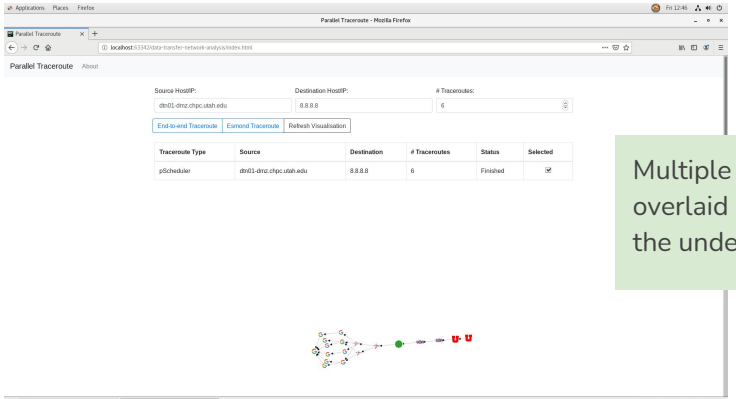
Click Here For Your GlobalNOC Augmented Traceroute

		Throughput
iperf3 Test	Source → Dest	939.68 Mbps (1252 retransmits)
	Dest → Source	766.20 Mbps (524 retransmits)
Your Transfer		1 B/s (4 B Total)

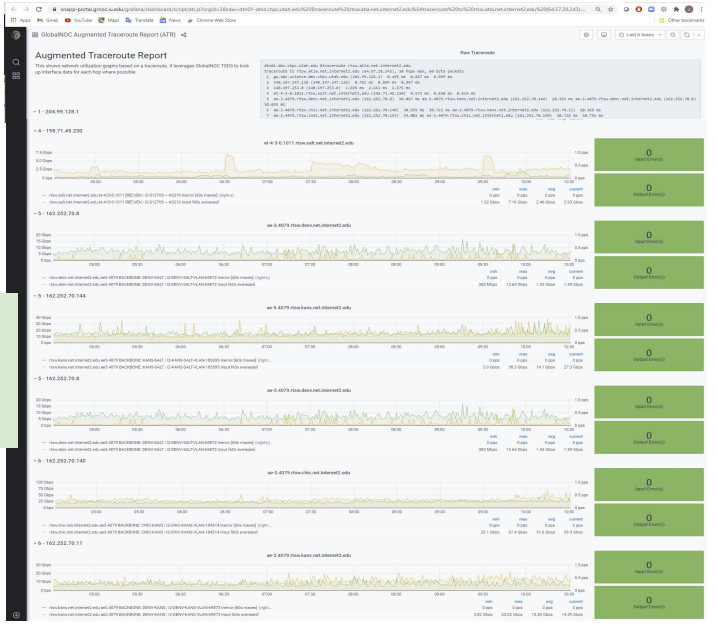
Route Analysis		Pre-transfer	Post-transfer	Pre-transfer (Reverse)	Post-transfer (Reverse)
Traceroute Hops	1	[UTAH] gw-chpc.chpc.utah.edu	[UTAH] gw-chpc.chpc.utah.edu	[UTAH] gw-ddc-science-dmz.chpc.utah.edu	[UTAH] gw-ddc-science-dmz.chpc.utah.edu
	2	[UTAH] rt-park-inscc-ul.chpc.utah.edu	[UTAH] rt-park-inscc-ul.chpc.utah.edu	[WEST-NET-WEST] 140.197.247.138	[WEST-NET-WEST] 140.197.247.138
	3	[UTAH] 155.99.130.13	[UTAH] 155.99.130.15	[WEST-NET-WEST] 140.197.252.81	[WEST-NET-WEST] 140.197.252.81
	4	[UTAH] 155.99.130.58	[UTAH] 155.99.130.56	[WEST-NET-WEST] 140.197.252.76	[WEST-NET-WEST] 140.197.252.76
	5	[UTAH] 199.104.93.101	[UTAH] 199.104.93.101	[WEST-NET-WEST] 140.197.252.84	[WEST-NET-WEST] 140.197.252.84
	6	[UTAH] 199.104.93.118	[UTAH] 199.104.93.118	[WEST-NET-WEST] 140.197.253.139	[WEST-NET-WEST] 140.197.253.139
	7	[WEST-NET-WEST] 140.197.253.138	[WEST-NET-WEST] 140.197.253.138	[UTAH] 199.104.93.117	[UTAH] 199.104.93.117
	8	[WEST-NET-WEST] 140.197.252.85	[WEST-NET-WEST] 140.197.252.85	[UTAH] 199.104.93.102	[UTAH] 199.104.93.102
	9	[WEST-NET-WEST] 140.197.252.77	[WEST-NET-WEST] 140.197.252.77	[UTAH] 155.99.130.57	[UTAH] 155.99.130.59
	10	[WEST-NET-WEST] 140.197.252.80	[WEST-NET-WEST] 140.197.252.80	[UTAH] 155.99.130.14	[UTAH] 155.99.130.12
	11	[WEST-NET-WEST] 140.197.247.139	[WEST-NET-WEST] 140.197.247.139	*Unknown*	*Unknown*
	12	[UTAH] dtn01-dmz.chpc.utah.edu	[UTAH] dtn01-dmz.chpc.utah.edu	[UTAH] habanero.chpc.utah.edu	[UTAH] habanero.chpc.utah.edu

The Augmented Traceroute feature is supported by the GlobalNOC at Indiana University.

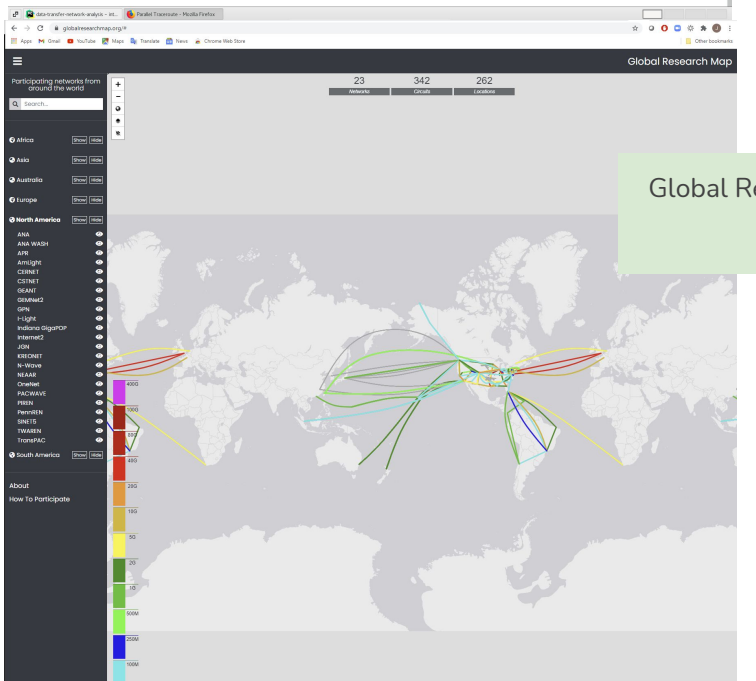
Emerging tools



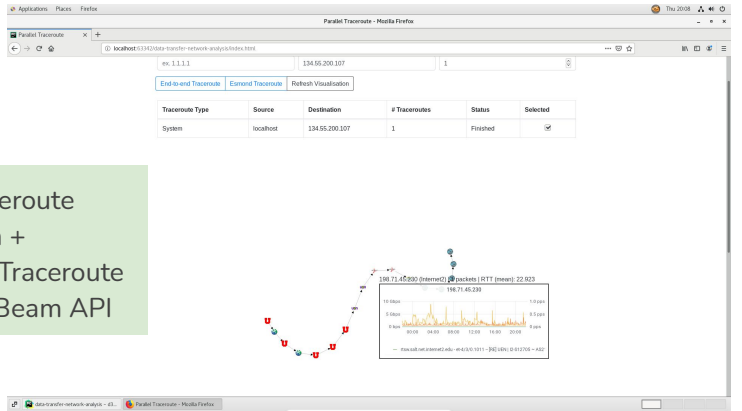
Multiple traceroutes in parallel and overlaid with a graph database expose the underlying network (UofUtah)



Augmented Traceroute - hop by hop web interface (GRNOC)



Global Research Map (GRNOC)



Parallel Traceroute Visualization + Augmented Traceroute + ESnet NetBeam API

Questions for community

- Are groups willing to share at an international level?
- How might we share this data at an international level?
  - The initial pilots in the US are leveraging the Internet2 and Indiana GRNOC data repositories as well as ESnet's Netbeam API. Are there other national or international repositories that might help smaller groups who are willing to share?
  - We have a tractable problem: There are a finite # of R&E groups. If groups work together in geographic areas, the problem shrinks.
- What are some baby step pilots the community might take?
  - What are some simple standards or agreed approaches we might explore to expose data to research and operational tools?
    - Many groups are using similar tools such as Influxdb, Prometheus, ThanOS, Grafana, Telegraf
- Are there volunteers to help in respective geographic regions?
- How to sustain and make sure data gathering stays current?