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PERFSONAR TELEMETRY IN KENT'S MUTI-CAMPUS SYSTEM

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Abstract As a part of NSF Grant Award Kent State university has established a sci.DMZ and a 100 Gbps node of national Data Transfer Network (DTN) in its main campus. It also has deployed a PerfSONAR infrastructure in its eight campuses. This document provides a technical description of the perfSONAR deployment in 8-campuses of Kent and some sample network visualization.

1.Introduction

Campus network engineering must be provided with flawless access to many network paraments such as effective throughput, delay, packet-loss, hops, etc. to monitor and proactively trouble shoot and keep the network healthy for faculty and researchers who collaborate regionally, nationally and globally for their data and research resource access needs. There are classical network utilities such as 'ping' or 'traceroute' [6,7] and many research/prototyped measurement tools and systems [1-10].

However, most end-to-end measurement depends on the mercy of many network elements which are in between and their ability to gain information. The ability of obtain reasonable end-to-end can quickly diminish with the path span across myriads of networks with varying practices, policies, and administrative domains. While any engineering team from any of the networks wants to trouble shoot a problem-unfortunately they don't have control on the visibility from other networks involved in the path.

As a part of NSF Grant Award Kent State university has established a sci.DMZ and a 100 Gbps node of national Data Transfer Network (DTN) in its main campus [12]. It also has deployed a PerfSONAR infrastructure in its eight campuses. This document provides a technical description of the perfSONAR deployment in 8-campuses of Kent. This science DMZ (sDMZ) houses a node in the national Data Transfer Network (DTN)-capable of supporting high-volume high-data-rate (HV-HDR) transfers. The shared sDMZ connects to OARnet's optical exchange and is designed to provide an immense (upto) 100 Gbps unimpeded transfer rate capacity. We have also engineered a special virtual DMZ perimeter built over a highly responsive managed-delay WAN. This allows researchers from all other allied regional campuses access to the facility with uniform

and consistent user experience. Researchers form other campuses, despite the lack of high bandwidth infrastructure, will have access to exclusive sDMZ with uniform user experience. All the campuses will deploy perfSONAR network telemetry permitting precision network engineering essential to maintain the low-delay perimeter and the trouble free operation of HV-HDR visualization and other interactive/real-time applications working on sDMZ data-sets.

Campuses also enjoy InCommon membership enabling faculty to have secured and seamless access to vast scientific and academic resources.

1.1. What is PerfSONAR?

perfSONAR- the **perf**ormance **S**ervice-**O**riented **N**etwork monitoring **AR**chitecture is a federate framework for network measurement [11]. perfSONAR is framework which enables end-to-end state of network paths with much greater consistency when the path spans across myriads of independent but federated network elements and can create network views with much bigger success. It benefits network engineers to much more effectively and consistently learn about the characteristics of the paths. Thousands of perfSONAR instances have been deployed worldwide, many of which are available for open testing of key measures of network performance. This global infrastructure helps to identify and isolate problems as they happen, making the role of supporting network users easier for engineering teams and increasing productivity when utilizing network resources.

1.2. KSU Multi-Campus Systems & Network Architecture

PerfSONAR is a federated system. Each network operator needs to agree to provide relatively help by installing and enabling the measurement on their network. While more network operators deploy perfSONAR, its collective measurement span and effectiveness increases. In return, each network operator gains reliable and consistent end-to-end performance report for their subscribers.

Kent State is a multi-campus system. Like any other institution it has classical network measurement tool deployed open its domains. This creates perfect view and awareness about the state of its network. However, KSU has seven additional campuses nestled around northeast Ohio. These are connected via third part ISPs to Kent campus.

It is important for a mulicampus system to ensure that all faculty from all campuses must have equal, low-latency and consistent access to the science DMZ, which is often located in one of their main campus.

We have deployment a perfSONAR node at each of our campuses. This technical report presents some of the sample performance data from the perfSONAR system.

2.Some PerfSONER Observations

2.1. Crosssite Matrix

Kent State is an 8-campus system. To ensure researchers can interactively access the sci.DMZ resource remotely we have ensured a low-latency perimeter with the deployment of a perfSONAR grid across all the campuses.

We also used a node at Ohio Super Computer Center (OSC)- a remote site frequently used by our researchers. We have also requested another perSONAR node at our ISP OARNet site. We designed our PerfSONAR with a Maddah grid manger and automated the build of the test boxes. The Grid manager, 100Gb/s bare metal test box live in the DTN network. We have added remote [??] boxes and peering on and off the main campus.

Observations:

1) No packet-loss (<.0001) observed for communication from sci.DMZ to any of the other sites.

2) Return path observed slightly higher packet loss (.1> loss >.001) for Stark (6) and Ashtabula (7), and significant packet loss (>0.1) for Salem Campus (5).

3) Return path to Salem (5), Stark (6) and Ashtabula (7) sites consistently has higher packet loss from almost all other campuses.

2.2. Campus Views

1) It provided the real-time monitoring of the end-to-end bandwidth from

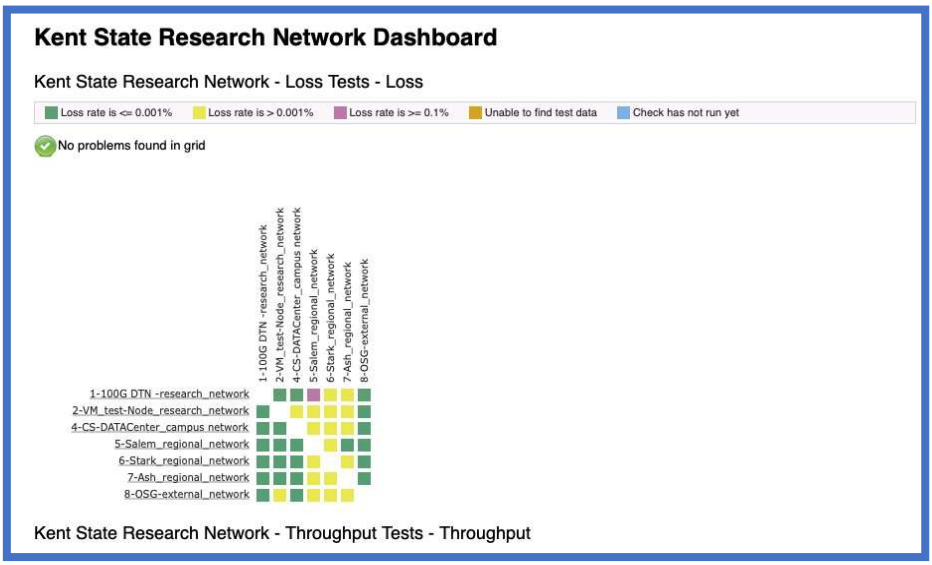

Fig. 4 PerfSONAR Grid

all sites for example the throughput significantly fluctuated for DTN to Kent and Stark Campuses (frequently dipped form 1 G 60% to 400 Mbs). While all other locations observed stable throughput.

2) The one way latency fluctuated significantly for Kent, Stark and particularly for Astabula Campus.

3) The throughput to OSC was mostly stable to 8Gbps. The one-way latency was also lowest (~4 ms)- almost half of any other location. It was also stable.

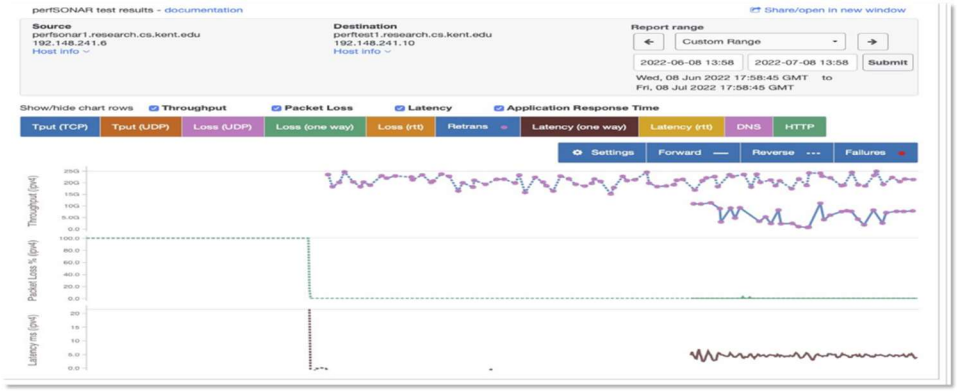

Fig. 5. PerfSONAR Results DTN Network to Internal DTN Network VM Tester

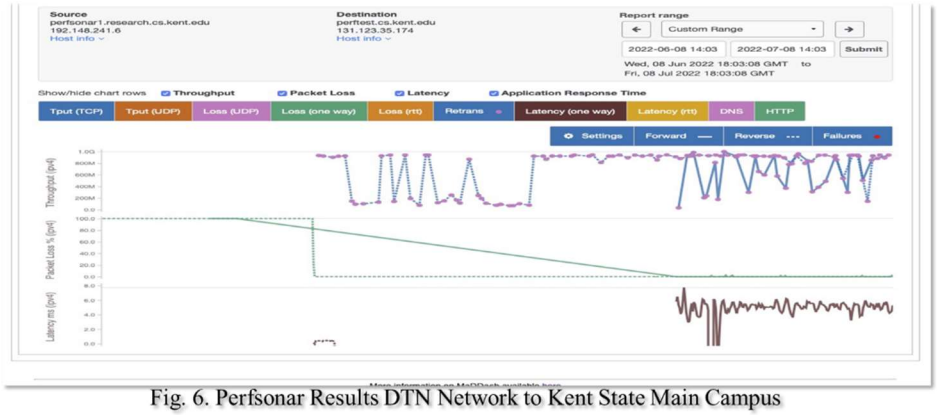

Fig. 6. Perfsonar Results DTN Network to Kent State Main Campus

Fig. 7. PerfSONAR Results DTN Network to Kent State Salem Regional

Fig. 8. PerfSONAR Results DTN Network to Kent State Stark Regional

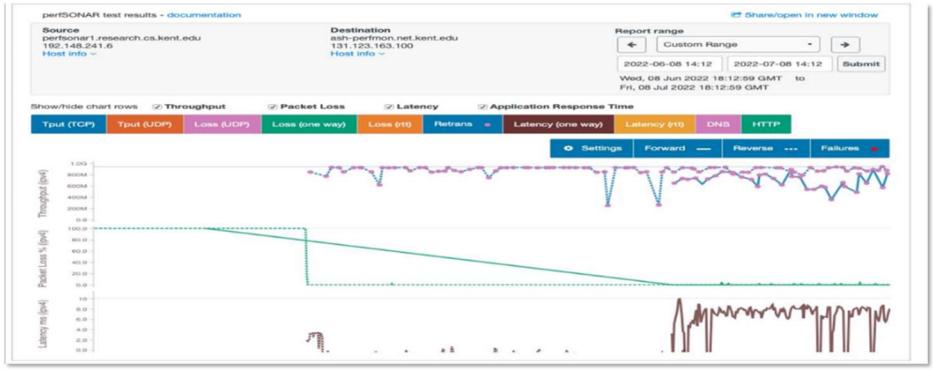

Fig. 9. PerfSONAR Results DTN Network to Kent State Ashtabula

Fig. 10. PerfSONAR Results DTN Network to Ohio Super Computer

3.Conclusions

PerfSONAR represents one of the major advancements in recent network measurement. Its also a unique example of network instrumental of global scale. This novel deployment makes Kent State a part of this global instrument- enabling engineering world-wide to better manage global communication- particularly, if any team is trying to trouble shoot any transfer that involve Kent State.

Conversely, this deployment enables Kent IT team to proactively ensure that its science teams at regional campuses are also getting low-latency access to the science DMZ located at Kent campus. But it is not limited to Kent's intranet. Kent Engineering cn better trouble shoot end-to-end pathway issues where the other end-point can be anywhere in the world where PerfSONAR has been deployed.

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