From Science DMZ to a Global Research Platform

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**STRATEGIC RESEARCH THRUSTS**

**SPECIAL FOCUS ON AREAS OF GLOBAL SIGNIFICANCE**

- WATER
- FOOD
- ENERGY
- ENVIRONMENT

**TECHNOLOGY AND RESEARCH ENABLEMENT**

- Supercomputing
- 3D Visualization
- Bioinformatics
- Imaging

**GLOBAL PARTNERS**

- Schlumberger
- Siemens
- Boeing
### Key Numbers

#### Faculty and Staff
- **2,200** Workforce
- **150** Faculty
- **650** Research scientists

#### Students
- **940** Students
  - 80% PhD | 20% MS
- **37%** Female
- **31%** Saudi
- **1,300** Graduates

#### Community
- **7,000** Community members
- **1,500** School children
- **100+** Different nationalities

*Numbers as of March 2017*
Network Numbers

14 KM² Footprint
6000 KM Fiber
7000 Active components
3500 Homes with FTTH

100 Gbps Core
2x10 Gbps International links
6 Gbps public Internet
Unique situation requires unique solutions

- 2 x 10Gbps links to Amsterdam
- Campus in Thuwal, KSA connected to NetherLight Open Exchange
- R&E connections to Internet2 and GEANT
- Commercial internet via Level3
- Connect up on 2 separate undersea cables and diverse terrestrial routes
A GLOBAL COLLABORATION

Started as an international university with over 70 partnerships and will remain international
A Science DMZ integrates four key concepts into a unified whole:

- A network architecture designed for high-performance applications, with the science network distinct from the general-purpose network
- The use of dedicated systems for data transfer
- Performance measurement and network testing systems that are regularly used to characterize and troubleshoot the network
- Security policies and enforcement mechanisms that are tailored for high performance science environments
START SMALL: POC DEPLOYMENT

• Add-on to existing network infrastructure
  • All that is required is a port on the border router
  • Small footprint, pre-production commitment

• Easy to experiment with components and technologies
  • DTN prototyping
  • perfSONAR testing

• Limited scope makes security policy exceptions easy
  • Only allow traffic from partners
  • Add-on to production infrastructure – lower risk
SCIENCE DMZ — CONCEPT IN KAUST CONTEXT

• Least friction path on both backend and front-end segments
• Purpose specific/tuned devices in the path (wire-speed, deep queues)
• Optimized data transfer tools such as Globus and GridFTP on DTN
• Security enforcement specific to science workflows
TESTING INFRASTRUCTURE — perfSONAR

• perfSONAR is:
  • A widely-deployed test and measurement infrastructure
    • ESnet, Internet2, US regional networks, international networks
    • Laboratories, supercomputer centers, universities
  • A suite of test and measurement tools
  • A collaboration that builds and maintains the toolkit

• By installing perfSONAR, a site can leverage over 1100 test servers deployed around the world

• perfSONAR is ideal for finding soft failures
  • Alert to existence of problems
  • Fault isolation
  • Verification of correct operation
Dedicated Systems — Data Transfer Node

• The DTN is dedicated to data transfer
• Set up specifically for high-performance data movement
  • System internals (BIOS, firmware, interrupts, etc.)
  • Network stack
  • Storage (global filesystem, Fibrechannel, local RAID, etc.)
  • High performance tools
  • No extraneous software

• Limitation of scope and function is powerful
  • No conflicts with configuration for other tasks
  • Small application set makes cybersecurity easier
KAUST SCIENCE DMZ – PHYSICAL & LOGICAL ARCHITECTURE

• NETWORK
  • Public front-end segment
    • Reachable only through R&E networks
    • White-list ACL’s on network devices in front of DTN’s/Perfsonar nodes
  • Storage back-end connectivity as a host on the existing storage network
  • Ability to stretch infrastructure to remote lab DTNs at 10Gbps

• DTN / MONITORING NODES
  • Hardened Linux systems
    • Globus transfer tools on DTN node
    • PerfSonar software on monitoring node
    • Host level exposing of only science transfer services
    • Management only enabled from the secure management network
### Data Mobility in a Given Time Interval

<table>
<thead>
<tr>
<th>Data set size</th>
<th>1 Minute</th>
<th>5 Minutes</th>
<th>20 Minutes</th>
<th>1 Hour</th>
</tr>
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<tr>
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<td>1,333.33 Tbps</td>
<td>266.67 Tbps</td>
<td>66.67 Tbps</td>
<td>22.22 Tbps</td>
</tr>
<tr>
<td>1PB</td>
<td>133.33 Tbps</td>
<td>26.67 Tbps</td>
<td>6.67 Tbps</td>
<td>2.22 Tbps</td>
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<tr>
<td>100TB</td>
<td>&gt; 100Gbps</td>
<td>1.33 Tbps</td>
<td>266.67 Gbps</td>
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This table available at: [http://fasterdata.es.net/fasterdata-home/requirements-and-expectations/](http://fasterdata.es.net/fasterdata-home/requirements-and-expectations/)
Initial testing – No path tuning
Need to also graph disk to disk performance

A good start – much more to come!
ESnet perfSONAR Dashboard

So What?

What's Next?

Average throughput is 0.909Gbps
Average throughput is 5.302Gbps

More information on MaDDash available [here](http://example.com)

Last page refresh time: November 30, 2017 08:52:06 AM Arab Standard Time
PRP focuses on enabling the science communities across the Pacific region to make effective use of the high performance infrastructure.

Kick-off in December 2014: take advantage of the regional infrastructure; perfSONAR for measurement / analysis and MaDDash for visualization.

Include DTN’s: use a common software suite for data movement; reflect disk-to-disk performance on MaDDash.

Demonstrated as a proof-of-concept at the CENIC Spring meeting (March 2015).
FROM PRP TO GRP (GLOBAL RESEARCH PLATFORM)

Link all the Science DMZs together in the same way as the PRP and take it international!

What about this region?

Source: Larry Smarr & GLIF
BUILD AND JOIN TOGETHER!
Thank you!

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