جامعة الملك عبدالله للعلوم والتقنية
King Abdullah University of Science and Technology

ESnet
ENERGY SCIENCES NETWORK

From Science DMZ to a Global Research Platform

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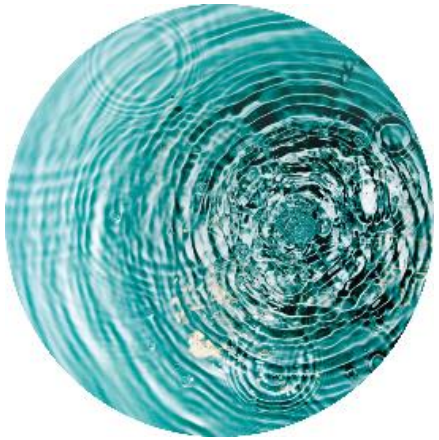
Strategic Research Thrusts

Special focus on areas of global significance



WATER

FOOD

ENERGY

ENVIRONMENT

Technology and Research Enablement

Supercomputing

3D Visualization

Bioinformatics

Imaging

Global Partners

ارامكو السعودية
Saudi Aramco

Schlumberger

SIEMENS

BOEING

GE

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

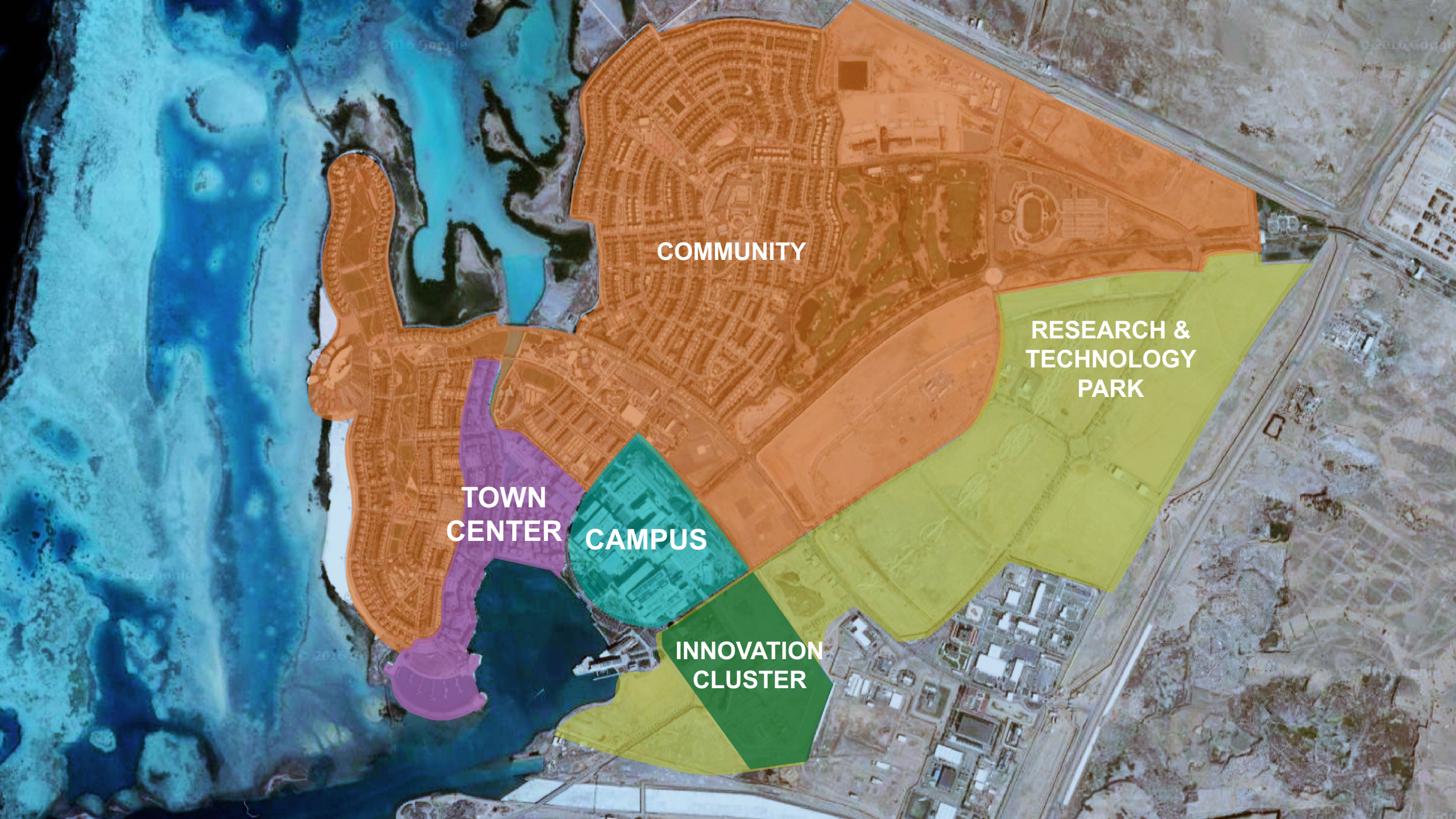
Community

7,000 Community members

1,500 School children

100+ Different nationalities

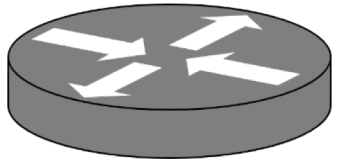
Numbers as of March 2017


COMMUNITY
RESEARCH &
TECHNOLOGY
PARK
TOWN
CENTER
CAMPUS
INNOVATION
CLUSTER

Network Numbers

14
KM² Footprint

6000
KM Fiber



7000
Active components

3500
Homes with FTTH

100
Gbps Core

STC
الاتصالات السعودية

2x10
Gbps International links

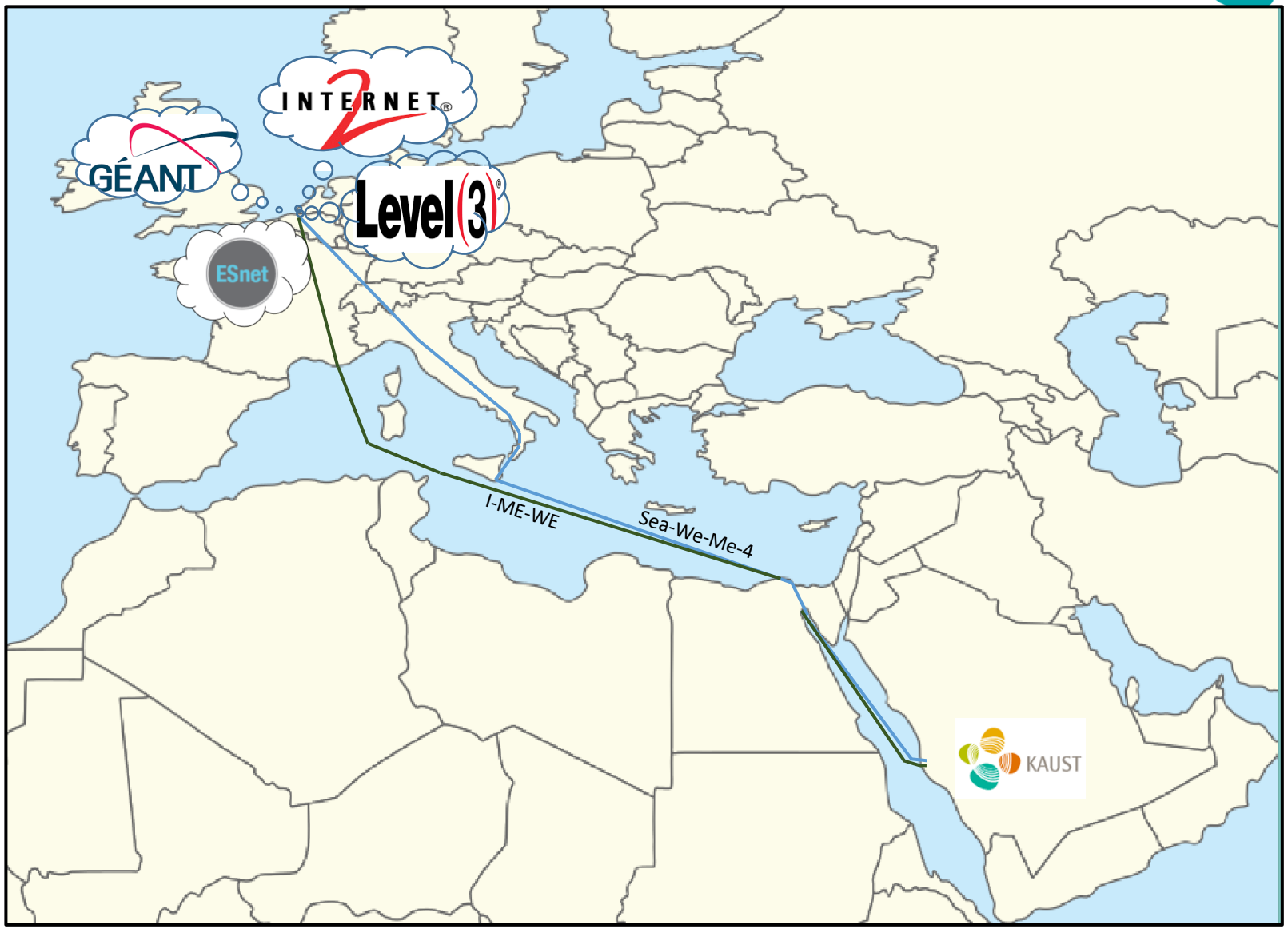
Level (3)

6
Gbps public Internet

CONNECTIVITY @ KAUST

Unique situation requires unique solutions

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



A Global Collaboration

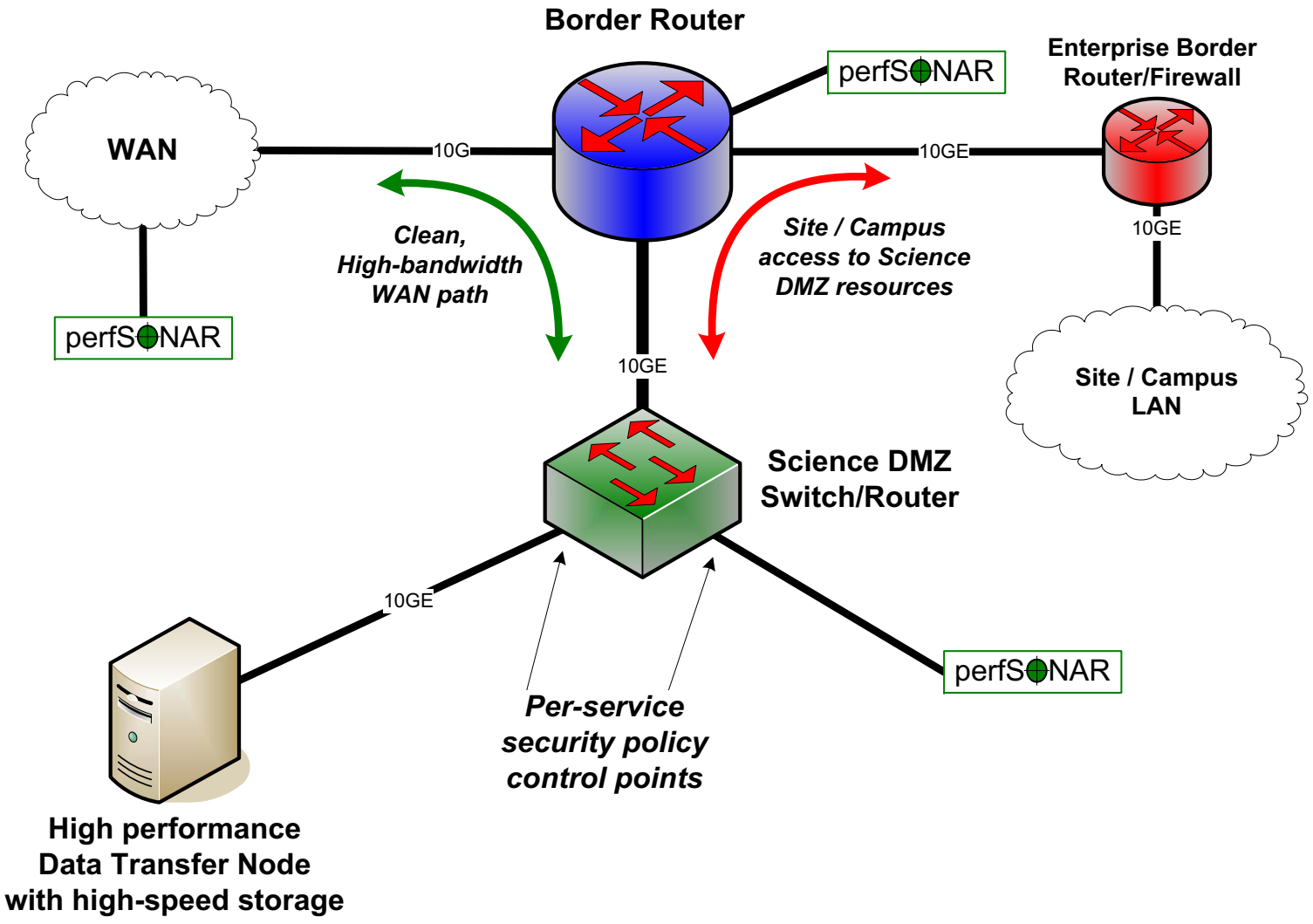
Started as an international university with over 70 partnerships and will remain international

Science DMZ: A Scalable Network Design Model for Optimizing Science Data Transfers

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

Science DMZ (Abstract Design)

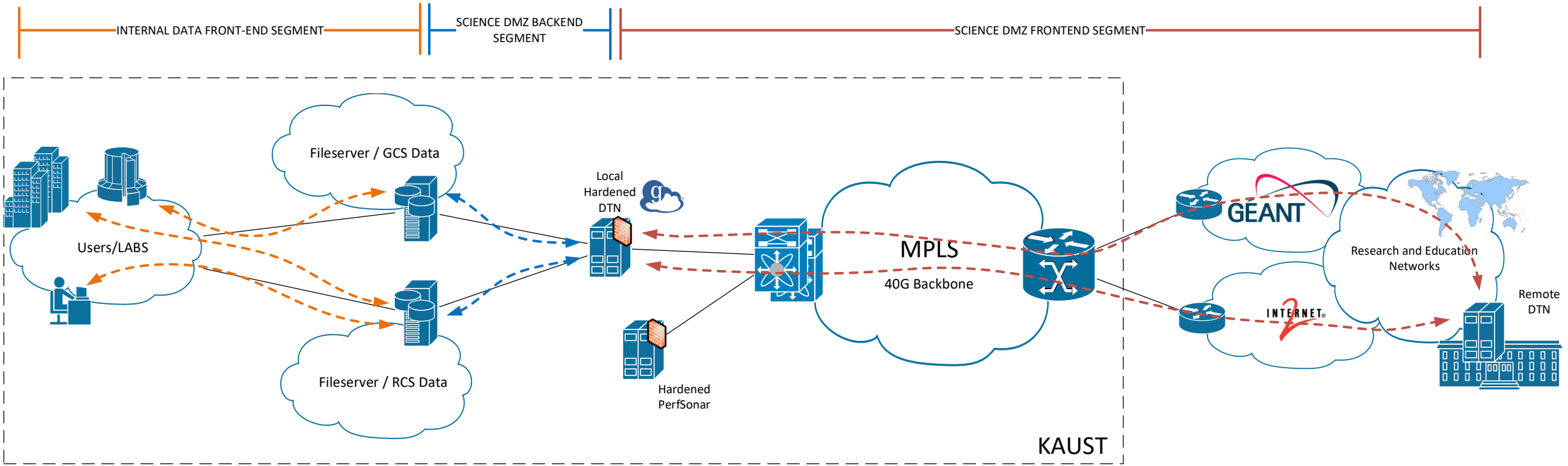


START SMALL: POC DEPLOYMENT

- 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 2000 test servers deployed around the world
- perfSONAR is ideal for finding soft failures
  - Alert to existence of problems
  - Fault isolation
  - Verification of correct operation

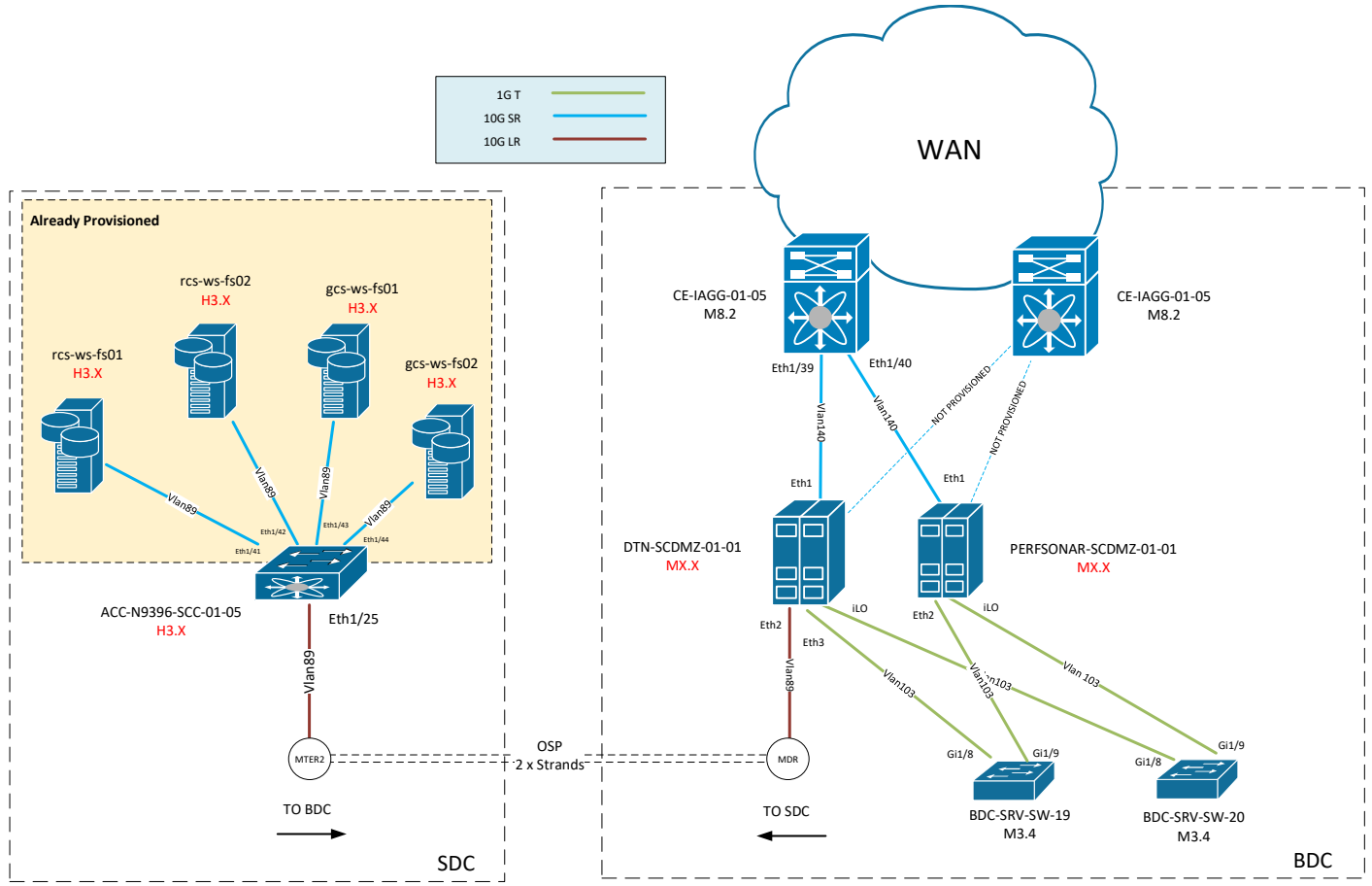
Dedicated Systems – Data Transfer Node

- 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

Data set size	1 Minute	5 Minutes	20 Minutes	1 Hour
10PB	1,333.33 Tbps	266.67 Tbps	66.67 Tbps	22.22 Tbps
1PB	133.33 Tbps	26.67 Tbps	6.67 Tbps	2.22 Tbps
100TB	13.33 Tbps	2.67 Tbps	666.67 Gbps	222.22 Gbps
10TB > 100Gbps	1.33 Tbps	266.67 Gbps	66.67 Gbps	22.22 Gbps
1TB	133.33 Gbps	26.67 Gbps	6.67 Gbps	2.22 Gbps
100GB 100Gbps	13.33 Gbps	2.67 Gbps	666.67 Mbps	222.22 Mbps
10GB < 10Gbps	1.33 Gbps	266.67 Mbps	66.67 Mbps	22.22 Mbps
1GB	133.33 Mbps	26.67 Mbps	6.67 Mbps	2.22 Mbps
100MB < 100Mbps	13.33 Mbps	2.67 Mbps	0.67 Mbps	0.22 Mbps
Time to transfer				

This table available at:

http://fasterdata.es.net/fasterdata-home/requirements-and-expectations/

ps-dashboard.es.net/index.cgi?grid=ESnet%20-%20KAUST%20Testing%20-%20Throughput

ESnet perfSONAR Dashboard

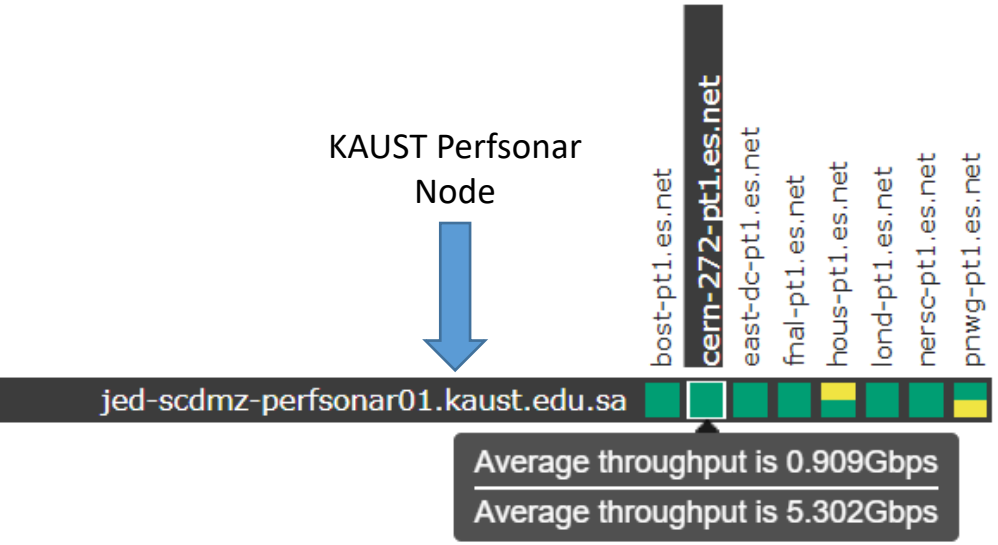
☰ Dashboards Reports Add Your Node ⚙ Settings External Resources

Last page refresh time: November 30, 2017 08:52:06 AM Arab Standard Time

ESnet - KAUST Testing - Throughput

Throughput >= 500Mbps | Throughput < 500Mbps | Throughput <= 100Mbps | Unable to retrieve data | Check has not yet run

No problems found in grid



Initial testing – No path tuning
Need to also graph disk to disk performance

A good start – much more to come!

More information on MaDDash available here

Thank you!

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