Multi-layer, Multi-domain SDN

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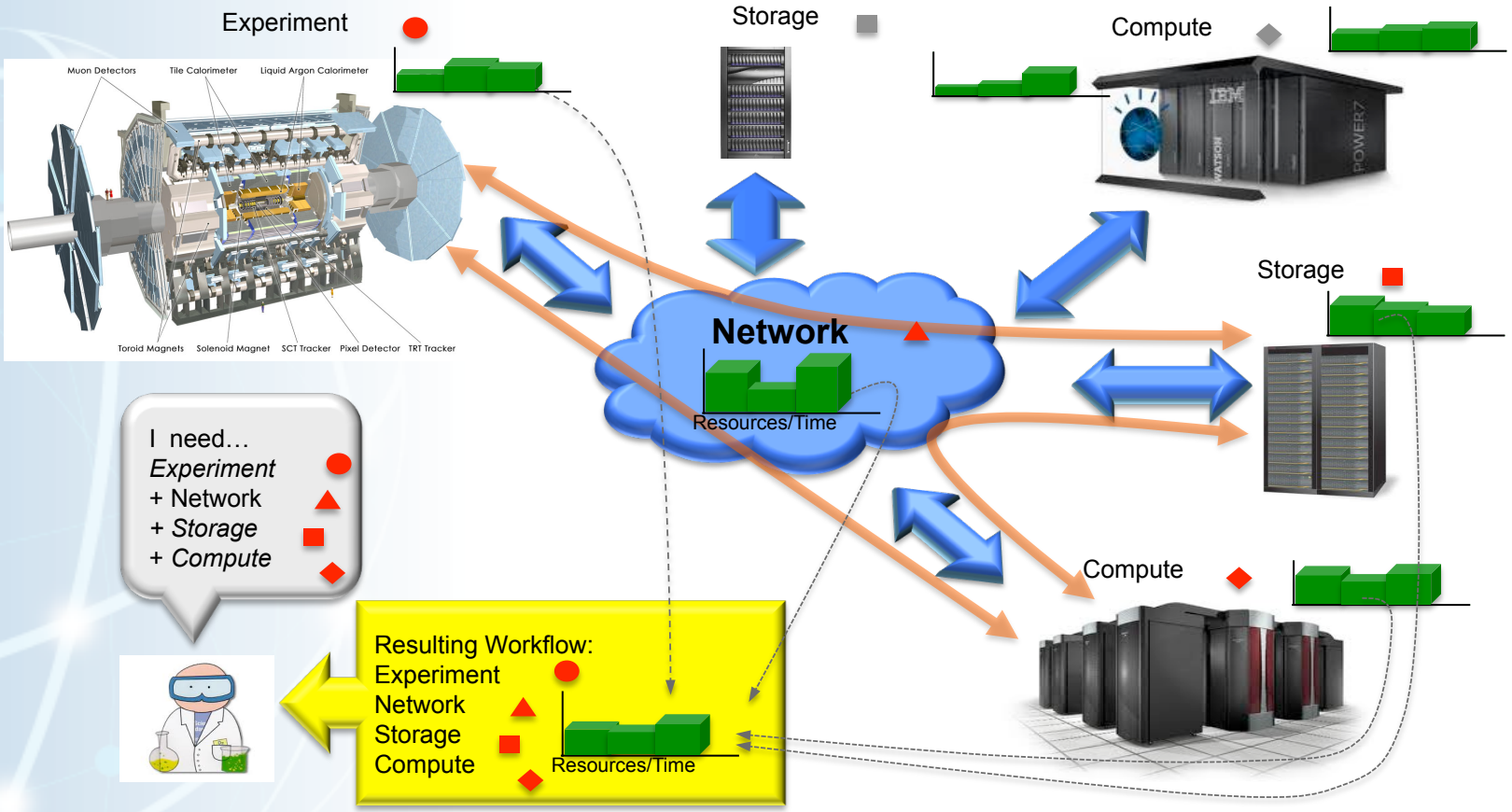
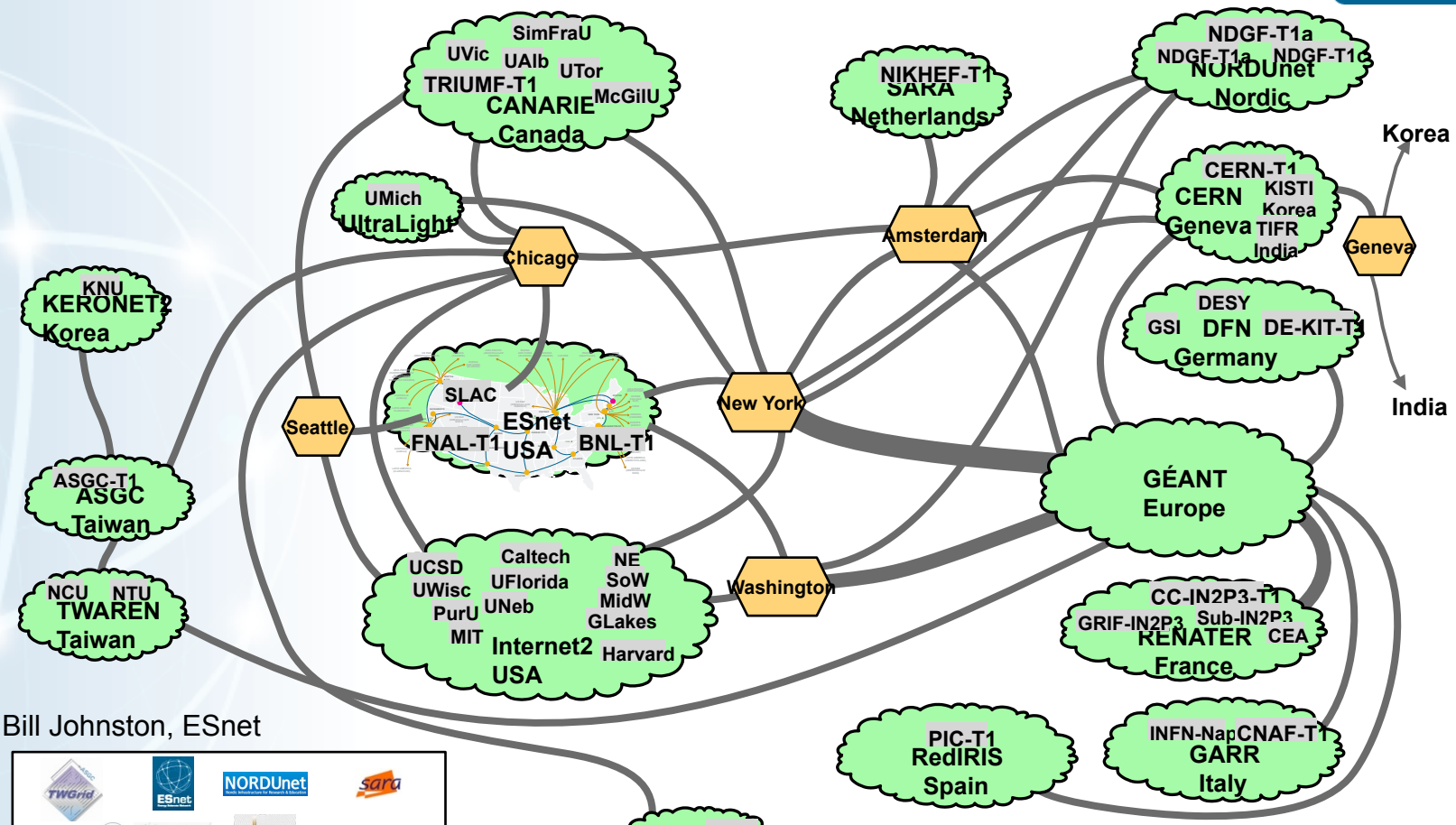
Science Use Case 1: Scheduling of Network Resources as Part of a Large Scientific Distributed Workflow



The Network needs to be available to application workflows as a first class resource in this ecosystem

Science Use Case 2: Dynamically Building Large Scale Multi-Domain VPNs



Source: Bill Johnston, ESnet

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Requirements: Anytime, Anywhere

- Distributed compute and storage
- On-demand model
- Multi-domain
- Multi-institutional

Science & Cloud

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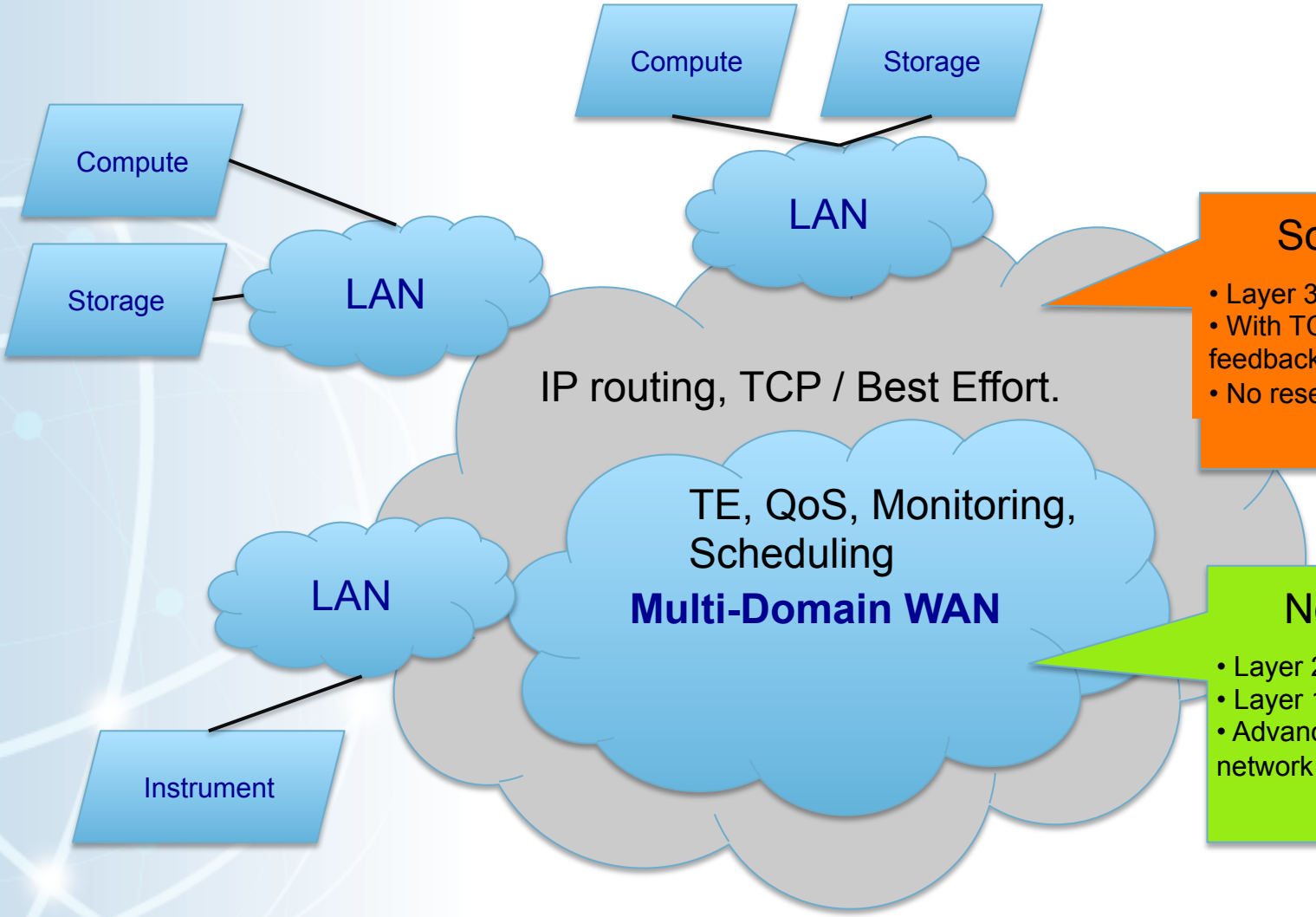
Optimized for Science in the core, Best Effort to the endpoints.



Socket API

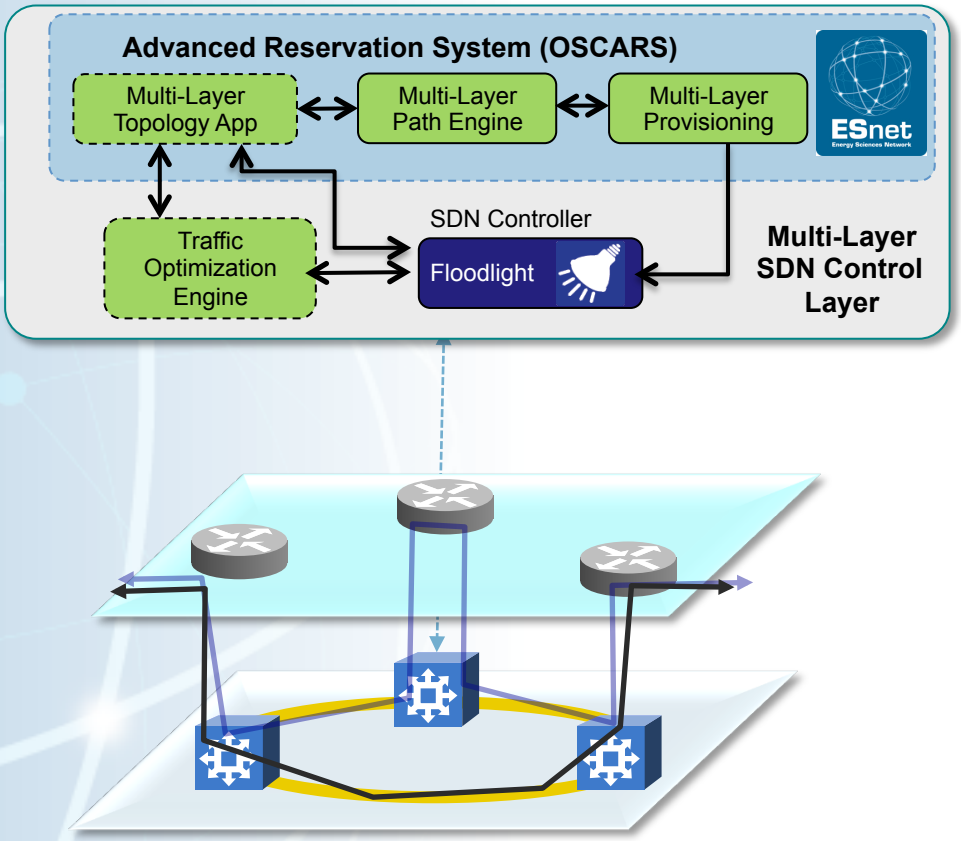
- Layer 3 only, no QoS
- With TCP, only success/fail feedback
- No reservation

Northbound API

- Layer 2 virtual circuits with QoS
- Layer 1 bypass
- Advanced Reservation of network resources

Lack of end to end automation, still mostly static, semi-permanent configurations

Bridging the Gap Between Networks and Scientific Applications



Historically, networks have been manually configured and relatively static..

The Challenge:

Improve science outcomes by transferring large flows to dedicated 'fast lanes' for predictable performance.

The Solution:

An approach that exposes a programmable interface to the network while building on three prior ESnet innovations.

- architecture optimized for data transfer: ScienceDMZ
- ubiquitous performance monitoring: perfSONAR
- guaranteed resources: OSCARS

ESnet's Approach:

Programmatic, multi-layer provisioning and flow optimization (using SDN/ OpenFlow).

Enabling High Performance Applications in a multi-layer, multi-domain context.

Different categories of Applications:

- Non network aware applications consume an existing network service
- Network Aware applications request service from the network:
  1. Use it directly
  2. Make it available for non network aware applications

(some) Open Questions:

- Both types of applications need standard northbound(s) (does not need to be the same)
- Topology information is key to network aware apps. Need to have topology information allowing multi-domain/multi layer SDN. Needs standard description language (and much more)

Thank You. Questions ?

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