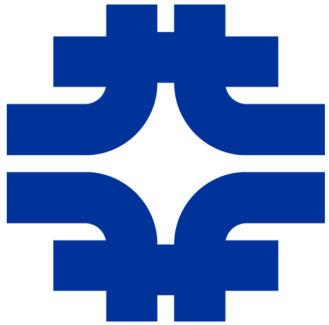

Lambda Station in T1-T2 Networking

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Fermilab

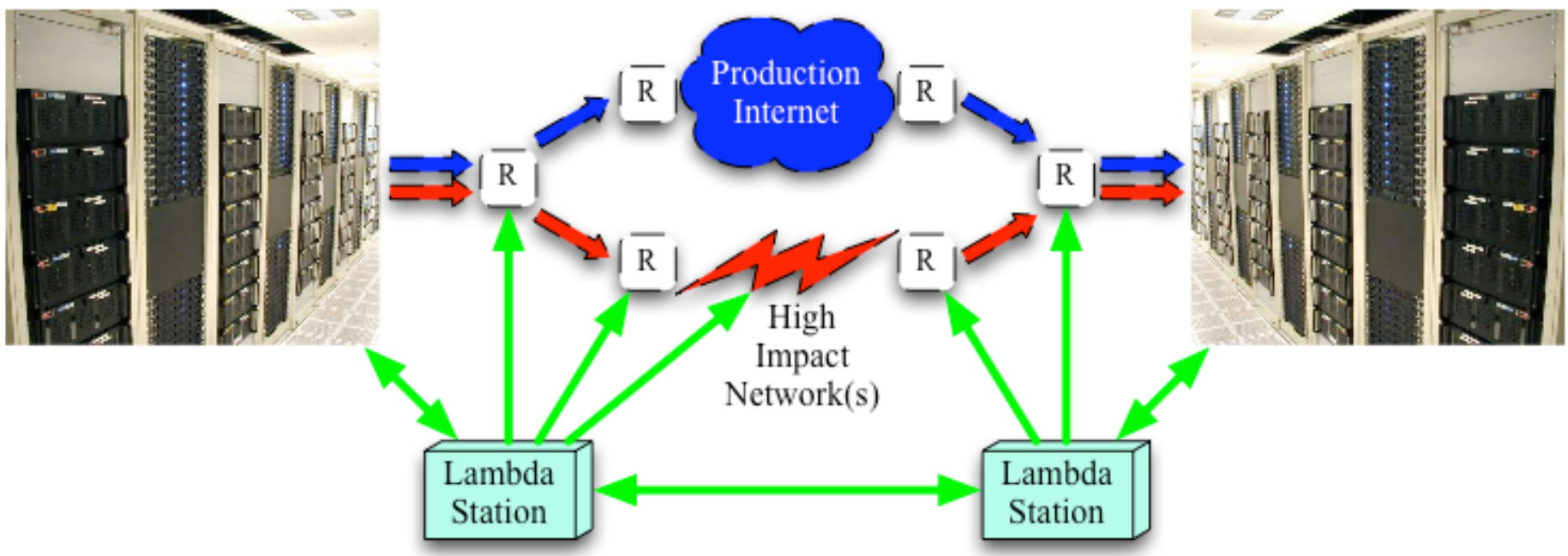
Basic Premise

- You have major resources which are
  - Network intensive
  - Communicate with multiple external peers
  - Would benefit from use of special paths in the wide area – but don't always require it

Lambda Station functions

- It's a site-based service called by applications or wrapper scripts.
- Schedules use of reservable network paths available to the site.
- Arranges site routing and edge ACLs to forward traffic onto such paths.
- Controls (only) its own site LAN configuration and makes requests of WAN
- Coordinates with Lambda Stations at remote sites.

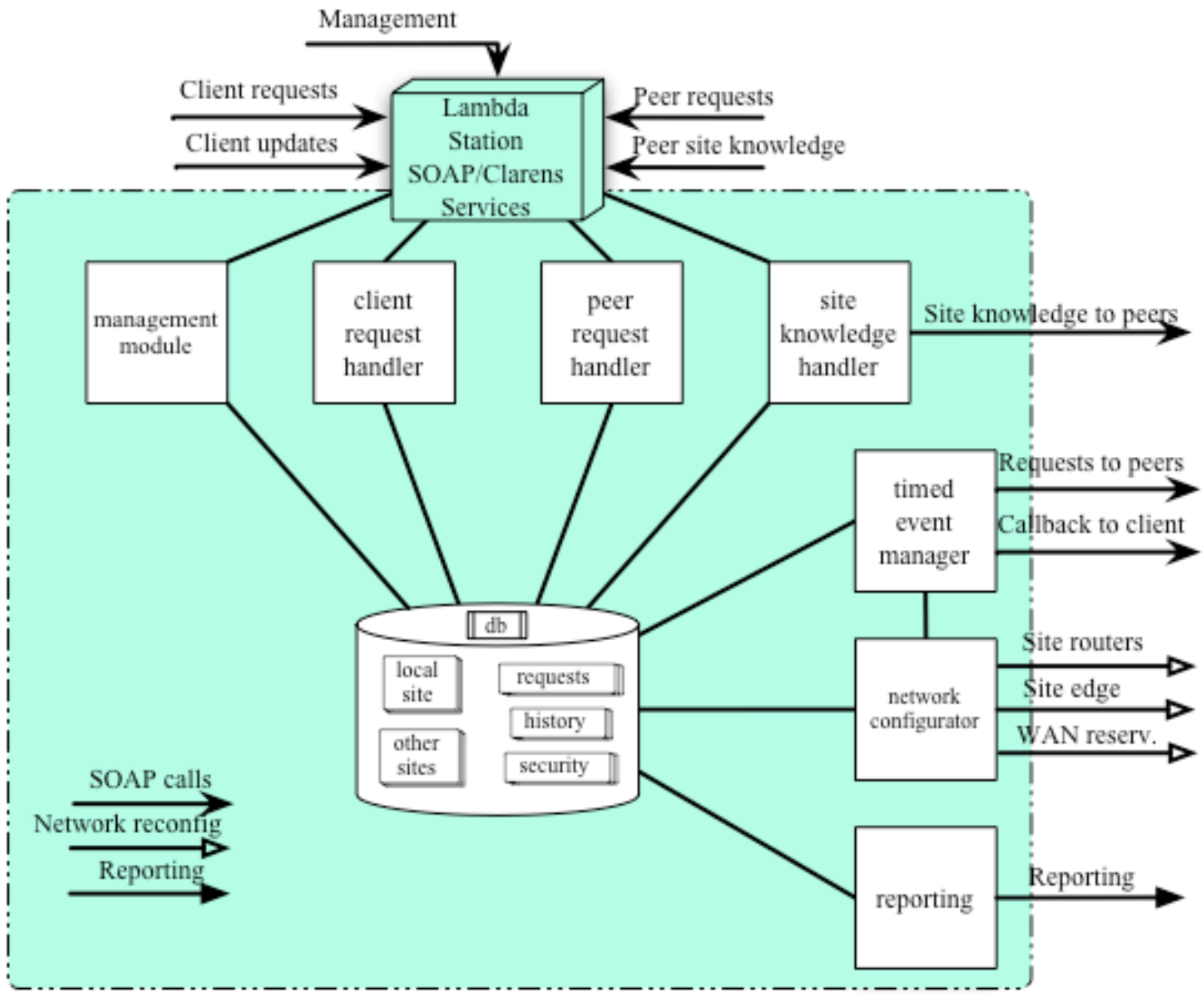
Dynamic path selection



Interfaces

- To application (or wrapper or manual request system)
- To authentication/authorization infrastructure
- To site's internal network (dynamic reconfiguration of packet forwarding rules)
  - Operate at any granularity, down to single flows
- Site's edge/connection point to reservable path
- Peer site's Lambda Station
- To advanced WANs, through network operator-defined setup protocol, as needed
- Monitoring, accounting, status reporting

Block diagram



Client interface

- Application describes traffic to be steered
  - Traffic selectors: 6-tuples [IP version, {src cidr(s)}, {dst cidr(s)}, protocol, {src port(s)}, {dst ports(s)}]
  - Transfer rate, volume, duration, desired start time
- LS and host agree on packet-identification method - DSCP preferred.
- LS informs application of BW allocated & setup status.
- Host or LS should inform the other of early termination, if it occurs.

Site network interface

- Configure local site's internal routing to divert traffic to the alternate path.
- Graceful teardown – resume normal internal routing before WAN path is torn down.
- Different version of this module will deal with different varieties of site network.
  - Each site configures LS with its topology and policy information.

Edge router interface

- Graceful setup – Enable the reserved WAN path before internal routing directs traffic onto it.
- ACL may be in effect on this device to prevent unauthorized use.
- ACL very likely to be in effect with respect to incoming traffic from the WAN.
  - At some sites, this path bypasses firewalls!

LS-to-LS protocol

- Exchange traffic selectors.
- Coordinate setup and teardown.
- Verify path continuity (*future*).
  - Implies that Lambda Stations must communicate simultaneously over reserved and commodity network paths.
- Inform of early traffic termination.
- Flood resource (client cluster) definitions.

Interface to advanced WANs

- Lambda Station's WAN module will parameterize an abstract view of each available WAN.
  - UltraScience Net, OSCARS, BRUW, HOPI, ...
- Lambda Station acts as intermediary for end systems, saving diversity in implementation.

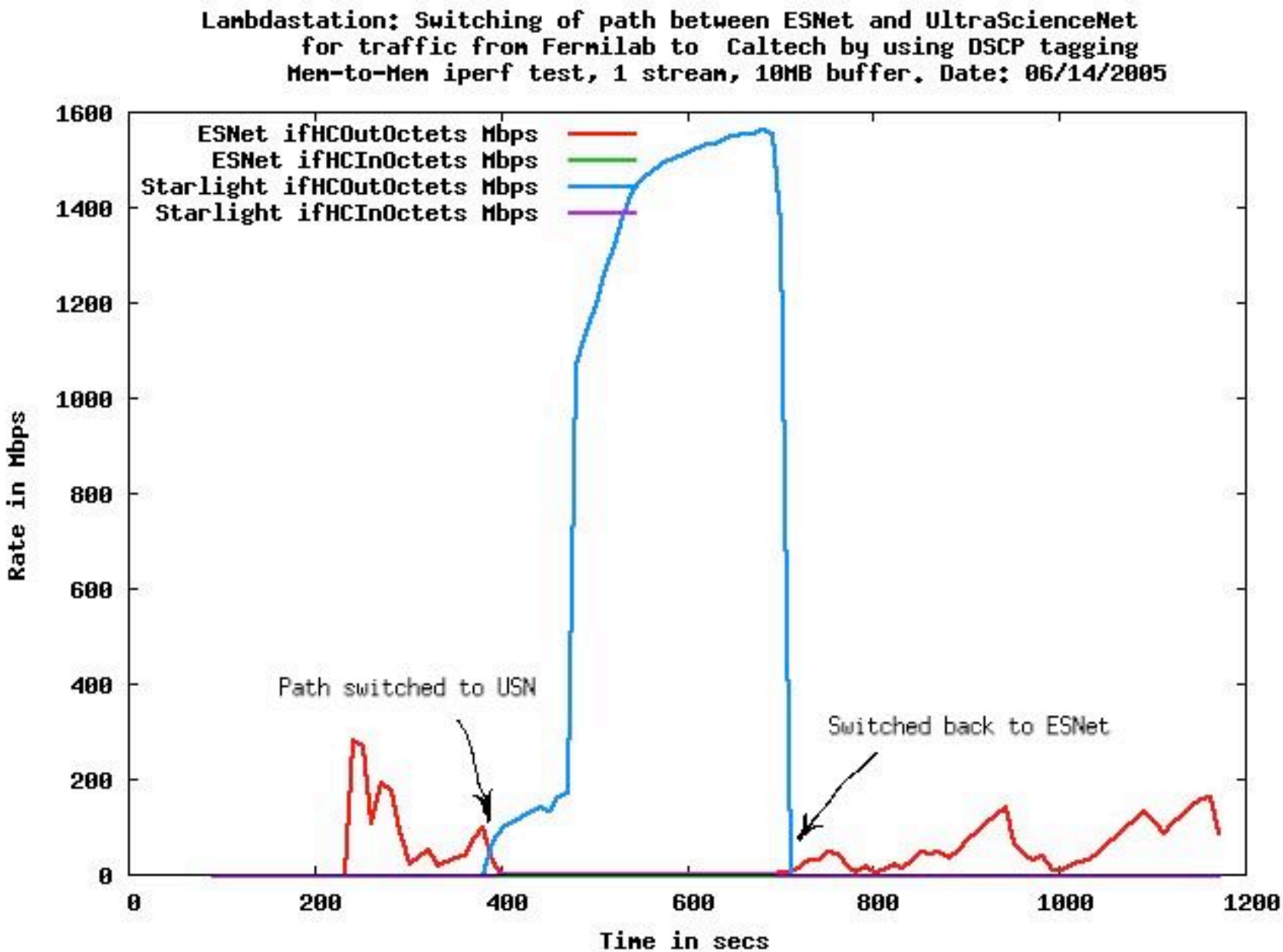
Requirements for production readiness

- Robustness
  - LS must enable production systems to make trial use of advanced networks, and cleanly restore default forwarding behavior upon completion or path failure.
- Monitoring
  - Lambda Station must present its own state and history. Currently it serves this info through its web server. Next implementation in jClarens will send to MonaLisa (OSG component).
- Accounting
  - In many environments, different sub-organizations share the network resource. LS must gather usage information to support accounting.

Current status

- Release 1.0 – Feb 2006.
  - Perl with SOAP::Lite, MySQL.
- Release 2.0 – 2007
  - Axis/Tomcat
- Client calls integrated in dCache v1.7.0, now in distribution.
  - Presents end user's credential to Lambda Station.

Path switching effects



Steps to site deployment

- (Update dCache to 1.7.0.)
- Define "PBR Clients" (Clusters to use LS).
- Define router-paths from each PBR client to site edge router(s).
- Choose a set of capabilities (next slide).
- Define your available high-impact WANs and request methods. (* Create new WAN module for LS if necessary.)
- Create dCache Lambda Station config. file.

Deployment scenarios

Client capabilities: identifying high-impact traffic ...

1. Specify src & dst address groups, but no more.
2. Specify src and/or dst ports as well as addresses.
3. Apply DSCP label selected by client
4. Apply DSCP label as directed by Lambda Station.

Client capabilities: Lambda Station integration level ...

1. Lambda Station called manually via web interface
2. SOAP call by wrapper around client application
3. SOAP calls from within the client application

Site network capabilities ...

1. Static router config w/ fixed PBR based on DSCP
2. Router ACLs activated and inactivated by LS
3. Lambda Station constructs and applies ACLs for PBR

Summary

- Lambda Station's role in data-intensive science is to dynamically connect production end-systems to advanced high-performance wide-area networks.
  - Bring the systems to the network
  - Bring the network to the systems
- Prototyping has shown the feasibility of using dynamically selected network paths for traffic between production site networks.

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