Phoebus Update

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- Martin Swany (swany@indiana.edu)
- Ezra Kissel (ezkissel@indiana.edu)

- Indiana University – School of Informatics and Computing
Protocol tuning necessary in order to achieve good performance
- Not always successful for a number of reasons
- Well-known problems with existing transport protocols
- “wizard gap”

“Hybrid” networks
- Dynamically allocate some links for high-demand flows
- Virtual circuits
- SDN

How to effectively utilize these high-performance paths?
Phoebus and XSP

- Designed to help bridge the end-to-end performance gap
  - Shorter RTTs from the edge to PG
  - Automatic tuning on a per-segment basis
  - Use of alternative protocols over the WAN

- eXtensible Session Protocol (XSP), a session-layer protocol for IP networks, provides generalized messaging between gateways and intermediate devices and services

- Phoebus offers a gateway for legacy application to use advanced networks such as the Internet2 ION virtual circuit network
  - Support for AL2S via OESS on the way

- Standard interfaces at the edge, innovation at the core
Using Phoebus

- Transparent wrapper
  - Intercept socket calls (LD_PRELOAD)
  - No code modifications needed

- XSP client library (*libxsp_client*)
  - Authentication with X.509 certificates, SSH subchannel for client connection

- iptables redirection

- Packages for setting up new gateways
  - RPMs for CentOS
A modular Phoebus Transport driver to be used within the Globus Toolkit

Based on the XIO TCP driver allowing for compatibility with existing configurations and options

Simplifies use of Phoebus architecture for Globus applications (eliminates need for shim library)

http://damsl.cs.indiana.edu/phoebus/wiki/GridFTP

Source: Globus XIO developer guide
Phoebus and GridFTP

- `globus-gridftp-server` may load the Phoebus XIO driver as requested by a client application
- New connections are made to the specified Phoebus Gateways
  - `globus-url-copy` extended to support Phoebus
    - `-ph` flag
    - `-dcstack` when explicitly specifying the network stack
- Maintains support for third-party transfers as well as PASV and extended block mode (MODE E) with parallel streams
Building virtual paths for GridFTP

- Phoebus/XSP drivers enable signaling into the network
- Prototype now working with GlobusOnline

```
globus-url-copy -v -p 4 -d
xsp:"xsp_hop=<XSPd-SDN>/5006;xsp_net_path=<TYPE>"; phoebus:"phoebus_path=<GW1>/5006#<GW2>/5006"
globus-url-copy -v -p 4 -d
```

```
ftp://<src host>:2811/dev/null
```

**Phoebus TCP performance and scalability**

**Phoebus in real networks**
CERN to Vanderbilt
Transatlantic link

4G max, 2 PGs (Chicago and Atlanta), 154ms RTT

**Phoebus scaling to 10G**

10G network testbed with clean links, 2PGs

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- Direct read
- Direct write
- Phoebus read
- Phoebus write

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- Phoebus–TCP
- Phoebus–TCP * 8 streams

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Phoebus at 10G

GridFTP over 25ms WAN RTT, no loss
Phoebus I2 deployment
TransPAC testing

- IU to Tokyo
- Using Phoebus Gateways on I2 and TP3 host in LA

```bash
$ traceroute 203.181.249.202
traceroute to 203.181.249.202 (203.181.249.202), 30 hops max, 60 byte packets
1  c-1.mgmt-sw.bldc.testlab.grnoc.iu.edu (156.56.5.1)  2.821 ms  2.791 ms  2.774 ms
2  ge-4-0-6.576.cr3.bldc.net.uits.iu.edu (156.56.249.73)  0.188 ms  0.174 ms  0.170 ms
3  ae-13.0.br2.bldc.net.uits.iu.edu (134.68.3.58)  0.227 ms  0.246 ms  0.220 ms
4  ae-0.0.br2.ictc.net.uits.iu.edu (134.68.3.34)  1.072 ms  1.060 ms  1.066 ms
5  xe-0-1-0.9.rtr.ictc.indiana.gigapop.net (149.165.254.229)  1.115 ms  1.117 ms  1.094 ms
6  et-3-0-0.1.rtr.11.indiana.gigapop.net (149.165.255.194)  1.224 ms  1.213 ms  1.233 ms
7  xe-0-0-1.110.rtr.atla.net.internet2.edu (149.165.254.21)  15.736 ms  15.750 ms  15.728 ms
8  xe-1-0-0.0.rtr.hous.net.internet2.edu (64.57.28.112)  39.117 ms  39.069 ms  39.095 ms
9  * * *
10 transpac-1-lo-jmb-702.lsanca.pacificwave.net (207.231.240.136)  70.062 ms  70.002 ms
11 tokyo-losa-tp2.transpac2.net (192.203.116.146)  185.641 ms  185.727 ms  185.726 ms
12 jm-e600-v34.jp.apan.net (203.181.248.109)  198.723 ms  185.922 ms  185.908 ms
13 nms8.jp.apan.net (203.181.249.202)  185.845 ms !X  185.819 ms !X  185.764 ms !X
```
IU-Tokyo with and without Phoebus

Single TCP stream (CUBIC), 185ms, well-connected end-hosts

Transfer Amount (GBytes)
Ongoing development

- Efficient gateway discovery
  - Find nearest available gateway based on network location

- Improved client support
  - Windows and OSX widgets

- Openstack appliance

- Phoebus RoCE/SLaBS backend
  - “buffer and burst” model with protocol adaptation
Thank you!

- **Support:**
  - DOE – DE-FG02-04ER25642
  - NSF – OCI-1127349

- **Always looking for new users and use-cases**
  - Happy to help integrate with trial applications
  - Big Data Testbed

- **Questions?**

http://damsl.cs.indiana.edu/phoebus