Monitoring and Accelerating GridFTP

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GlobusWORLD 2013
Globus XIO

- Modular drivers that can be used within the Globus Toolkit

- We have focused on extending features for GridFTP

- XSP for monitoring and path signaling

- Phoebus for WAN acceleration

Source: Globus XIO developer guide
XSP - eXtensible Session Protocol

• Session layer (Layer 5 in the OSI model)

• We can also think of a session in the most literal sense:
  – “a period of time devoted to a particular activity”

• xio-xsp implemented as a Globus XIO driver
  – Loadable with -dcstack and -fsstack

• Use cases:
  – Monitoring with NetLogger, Calipers, and Periscope
  – Dynamic network provisioning (e.g., OSCARS, OpenFlow)
  – WAN Acceleration with Phoebus Gateways
End-to-end measurement perspective

- NetLogger instruments read and write system calls, and Calipers summarizes these in memory
- The XSP collector daemon collates and forwards to Periscope
  - RESTful Measurement Store and Unified Network Information Service (UNIS)
- BLiPP: Basic Lightweight Periscope Probes
Metadata

```json
{
    'eventType': 'nl:tools:calipers:summary:write',
    'id': '8d83ccd4-a708-11e2-b6fa-33d5436b6f2a',
    'parameters': {
        'collectionInterval': 5,
        'datumSchema': 'http://unis.incntre.iu.edu/schema/20120709/datum#'
    },
    'subject': {
        'dport': '41186',
        'dst': '127.0.0.1',
        'sport': '60512',
        'src': '127.0.0.1',
        'stream_id': '60512:41186',
        'task_id': 'xsp_test',
        'type': 'network',
        'xfer_id': '8d83a8a8-a708-11e2-b6fa-33d5436b6f2a'
    }
}
```
### Data

```json
{
  'data': [ 1366166610.043317,
    2,
    5866638858,
    262161,
    262161,
    262161,
    0,
    52064.35928057134,
    0.1114156396090098,
    3.318493670886076,
    2.32658679419838,
    0.4392224221097757,
    0.3013415420295162,
    9945.430479743363,
    0.3013415420295162,
    8.975400612600653,
    0.4444289248254251,
    0.09869011618422469,
    22378,
    5.000102,
    2.607303999999963],
  'mid': '8d83ccd4-a708-1le2-b6fa-33d5436b6f2a'
}
```
TCP throughput

Time series of throughput for representative TCP experiments: (a) 1 stream memory-to-disk with 100ms latency, (b) 1 stream memory-to-memory with no latency, (c) 1 stream disk-to-disk with no latency, (d) 4 streams memory-to-disk with 100ms latency and 1% loss added at 60 seconds.

Half as many read()s. Others return zero, not counted

Less work being done

0.01% loss

Total CPU time for all processors

Legend:  
- System time
- User time

Variance

stdev[instantaneous throughput] (Mb/s)

Topology-aware monitoring
XSP and Dynamic Circuits

- Common interface for path provisioning
  - ESnet OSCARS, Internet2 ION, OpenFlow, Linux end-hosts, OS³E/NDDI
- Prototype installation for DYNES
- DYNES is an NSF MRI that is distributing storage and OSCARS IDCs for ION to various sites
  - Internet2, Caltech, Vanderbilt, U. Michigan
- Recent testing with multi-path GridFTP at SC12 (Science Research Sandbox)
SC12 SRS experiments

- Multi-path GridFTP transfers to DYNES end-sites
- \textit{xio-xsp} and OpenFlow used to dynamically redirect parallel streams over circuit services
- Many lessons learned at SC
GridFTP+XSP using Phoebus

- Phoebus is an open source WAN accelerator funded by the DOE and now the NSF
- Phoebus uses XSP to communicate via gateways that can tune, adapt and translate protocols
  - TCP tuning, UDP, RDMA over the WAN

```
globus-url-copy -vb -p 4 -dcstack
  xsp:"xsp_hop=<host/5006>;xsp_net_path=<TYPE>",
  phoebus:"phoebus_path=<GW1>/5006#<GW2>/5006 "
ftp://<src host>:2811/dev/zero
ftp://<dst host>:2811/dev/null
```
IU-Tokyo with and without Phoebus

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

• Quite a few topics focused on the performance of GridFTP

• Flexible and scalable monitoring for troubleshooting

• Adapt performance using emerging network technologies and protocols

• Ongoing work: early prototype of xio-xsp for GlobusOnline (GCMU installs)
Thank you for your time

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  – https://damsl.cs.indiana.edu/projects/phoebus
  – Email: ezkissel@indiana.edu

• Questions?