Overseer: Bandwidth and Latency Aware Routing using OpenFlow

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PRAGMA26, Tainan
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Laboratory for
Software
Design & Analysis

established in 2005

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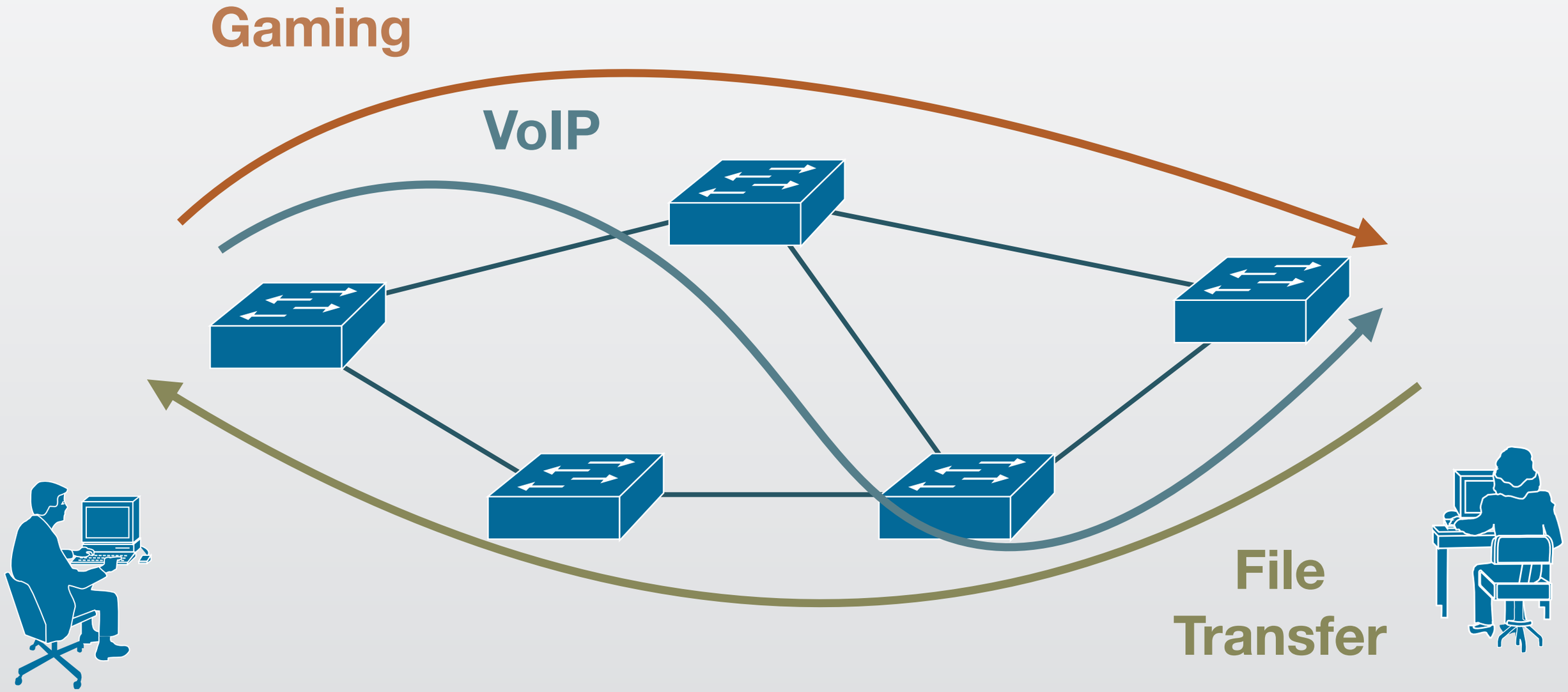
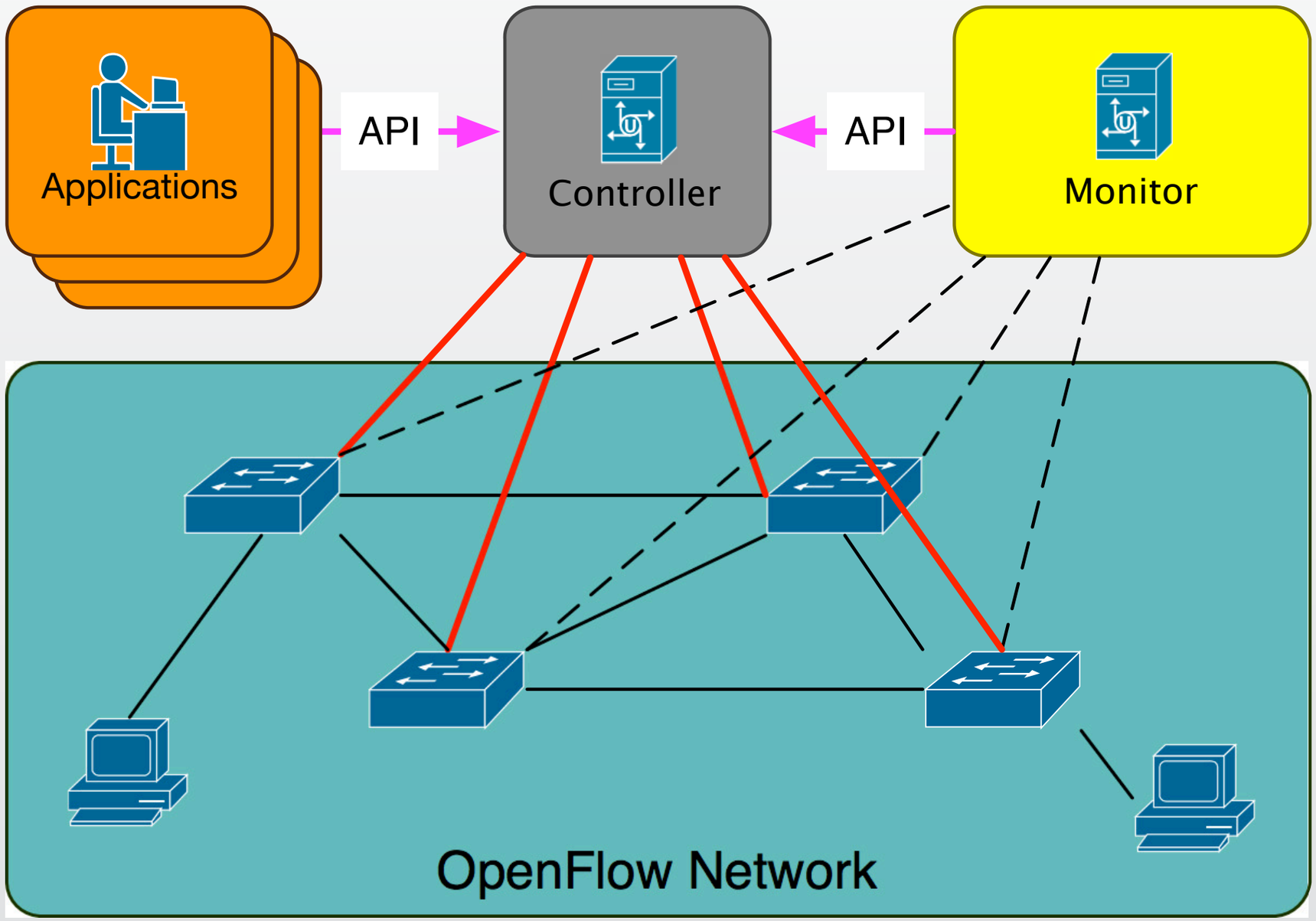
NARA INSTITUTE of SCIENCE and TECHNOLOGY

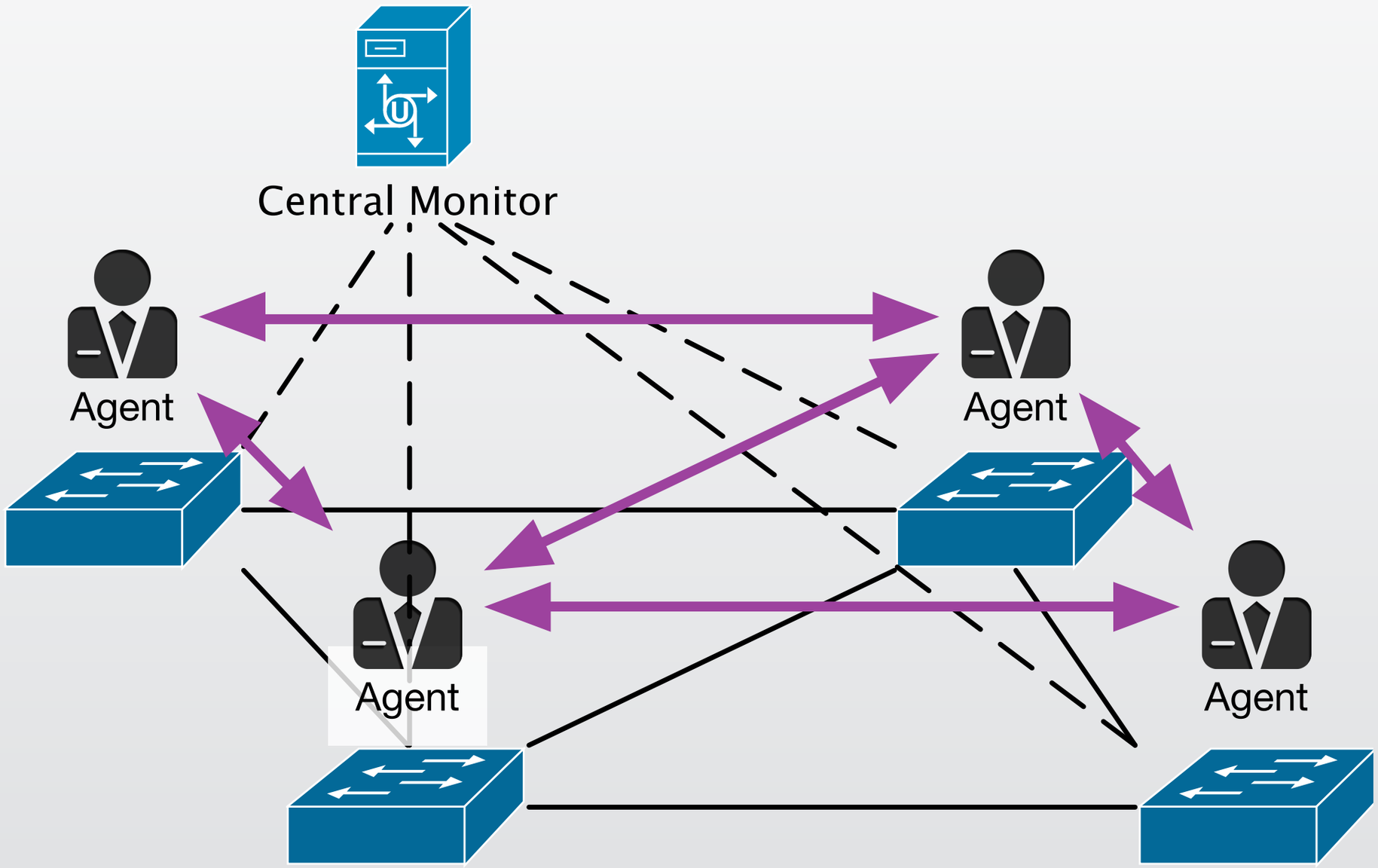
Bandwidth and Latency Aware Routing



Overseer: Bandwidth and Latency Aware OpenFlow Controller



Overlord

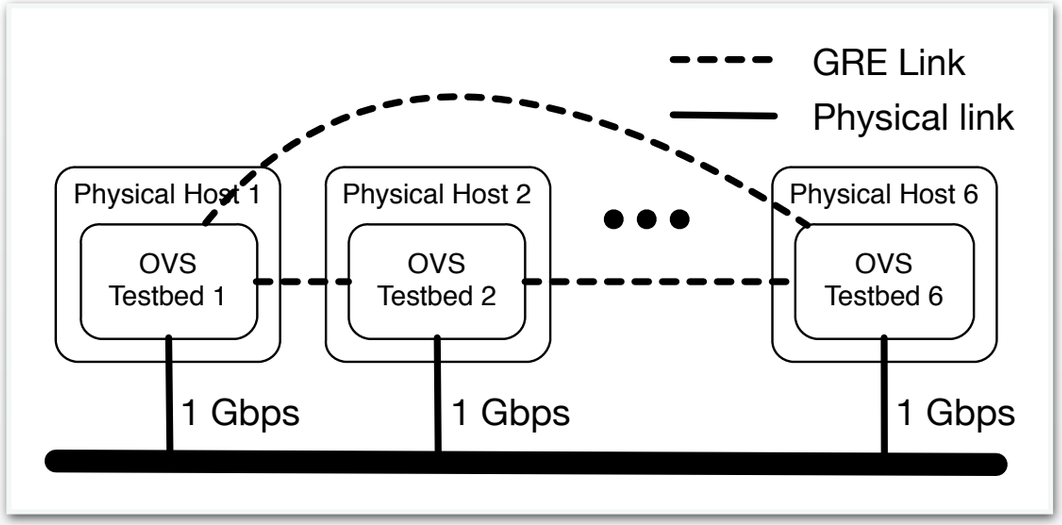


N. Kessaraphong, P. Uthayopas, and K. Ichikawa, “Building a Network Performance Benchmarking System Using Monitoring as a Service Infrastructure,” in The 18th International Computer Science and Engineering Conference, 2014, pp. 2–5.

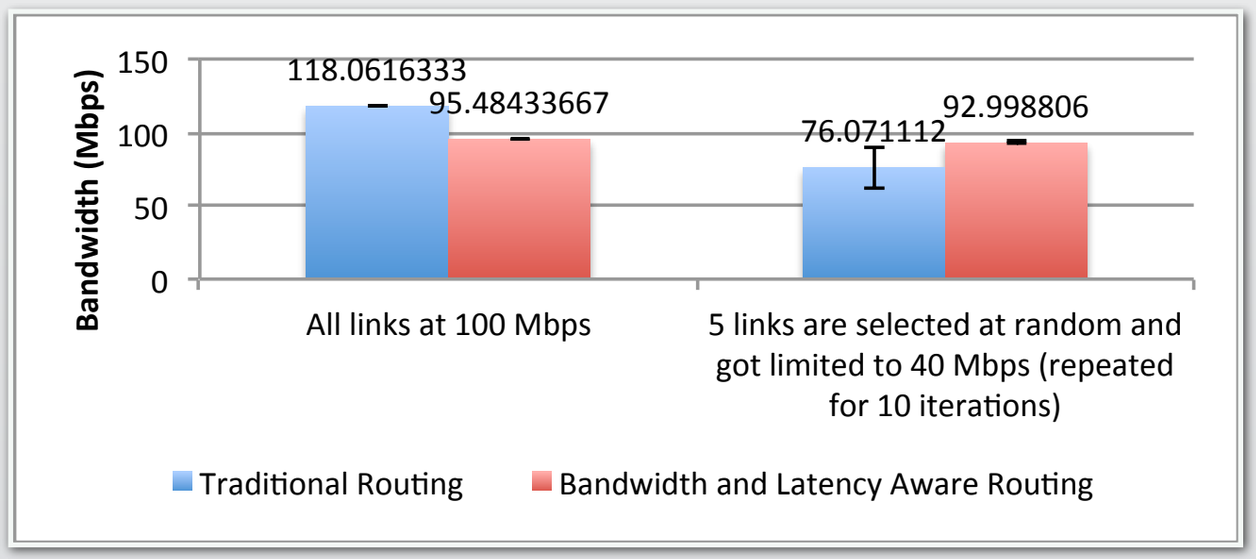
Path Preference Table

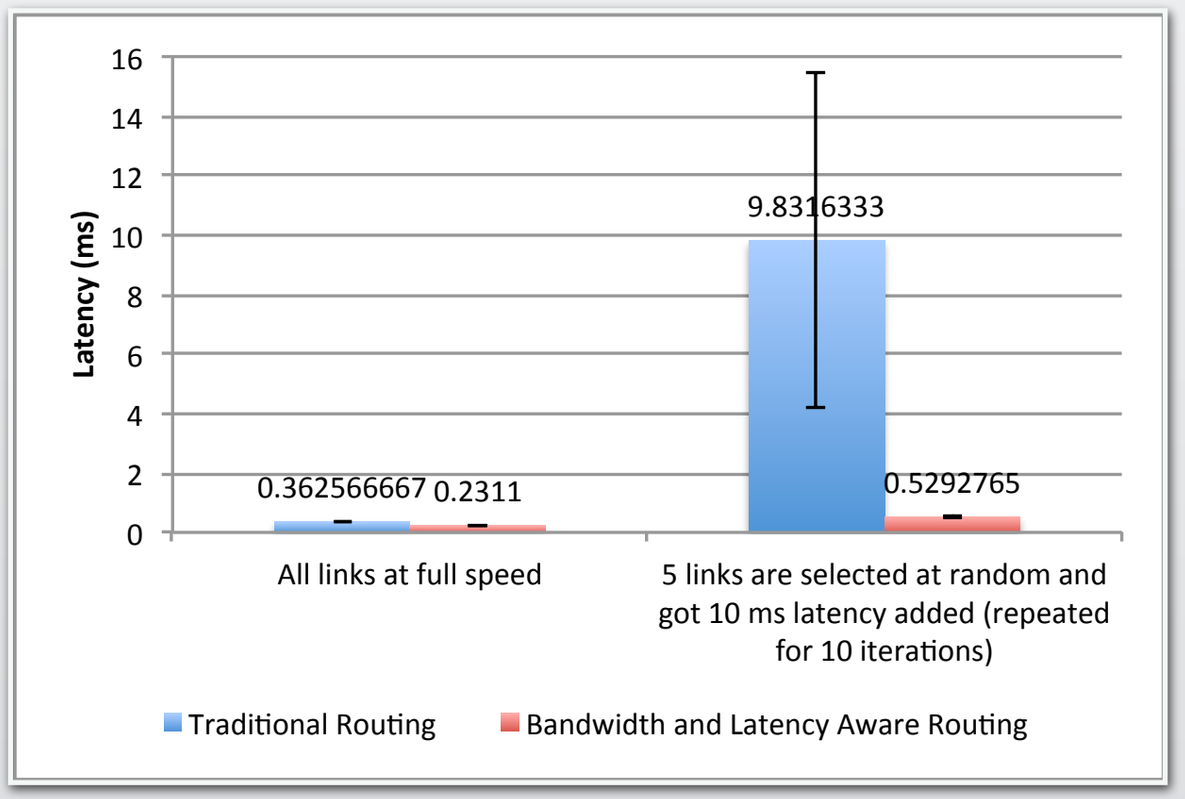
Path Identifier (src_ip, src_port, dst_ip, dst_port)	Preference (DEFAULT / MAX_BW / MIN_LAT)
(10.0.0.1, 1234, 10.0.0.2, 80)	DEFAULT
(10.0.0.1, *, 10.0.0.2, 80)	MAX_BW
(10.0.0.2, 80, 10.0.0.1, *)	MAX_BW
(10.0.0.1, *, 10.0.0.2, *)	MIN_LAT
(*, *, *, *)	DEFAULT

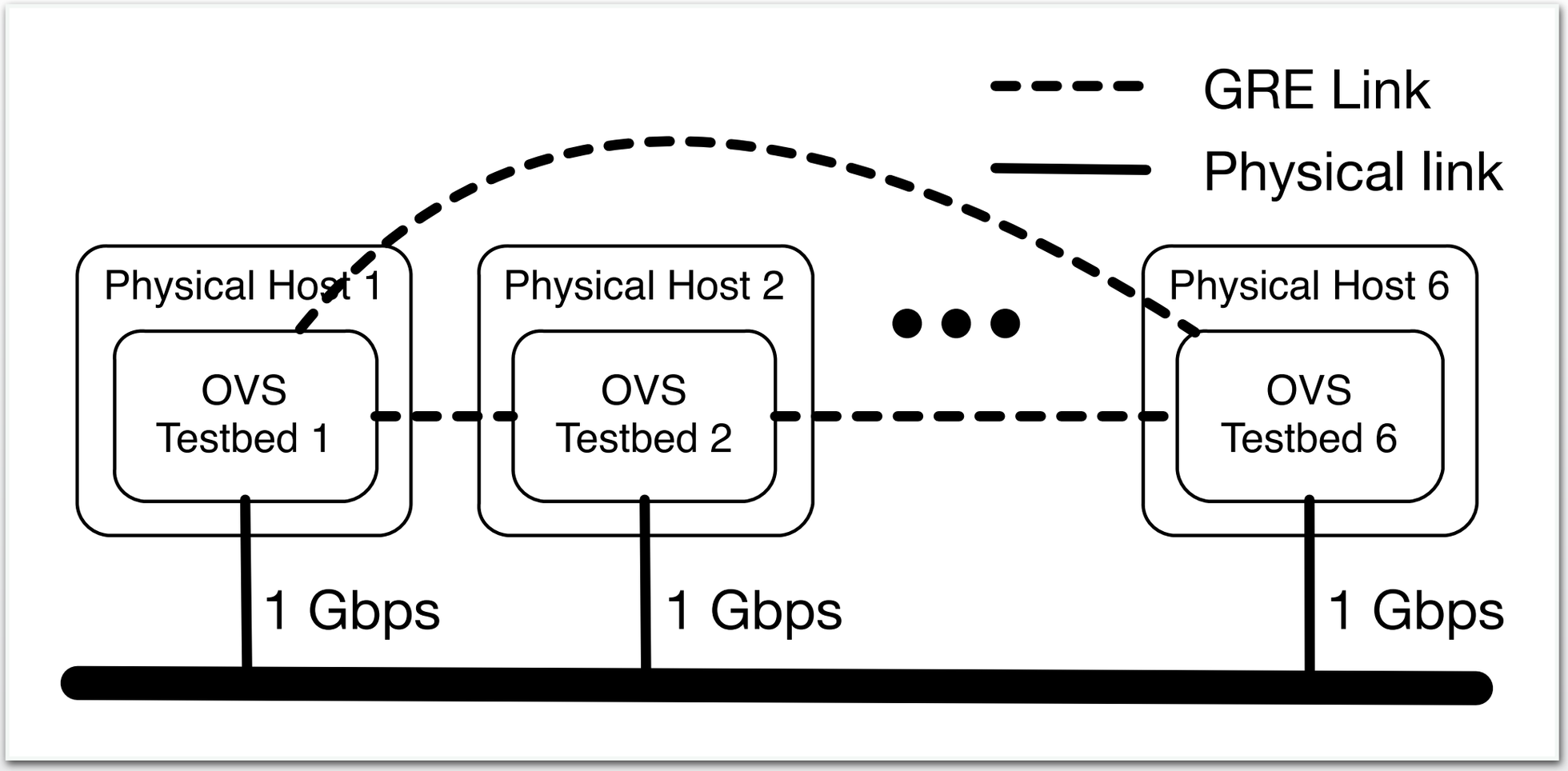
Evaluation



- *Eligibility:* Emulation with Mininet
- *Feasibility:* Experiments using Virtual Environment
  - Bandwidth Experiment
  - Latency Experiment

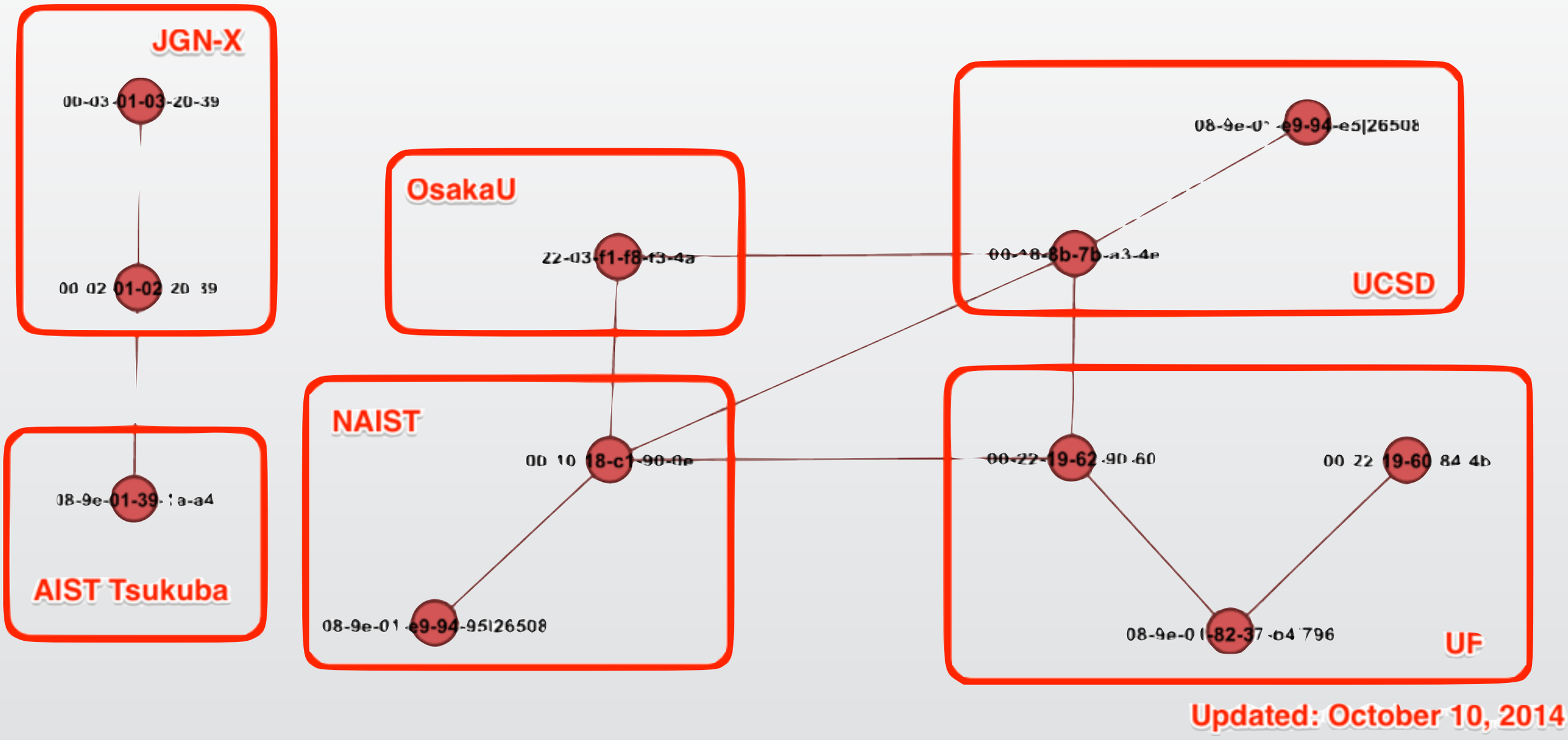






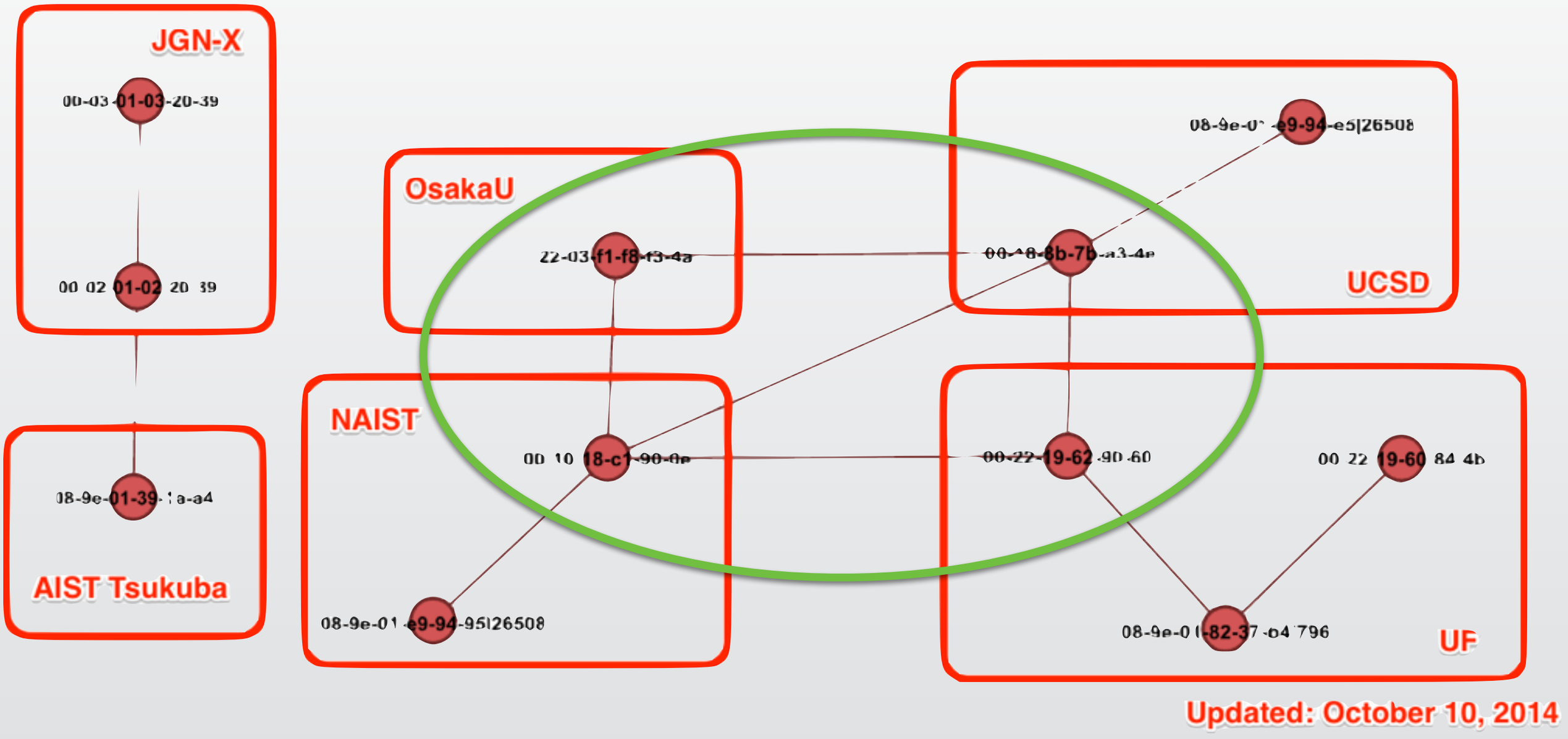
Structure of the Testbed in Virtual Environment

PRAGMA-ENT

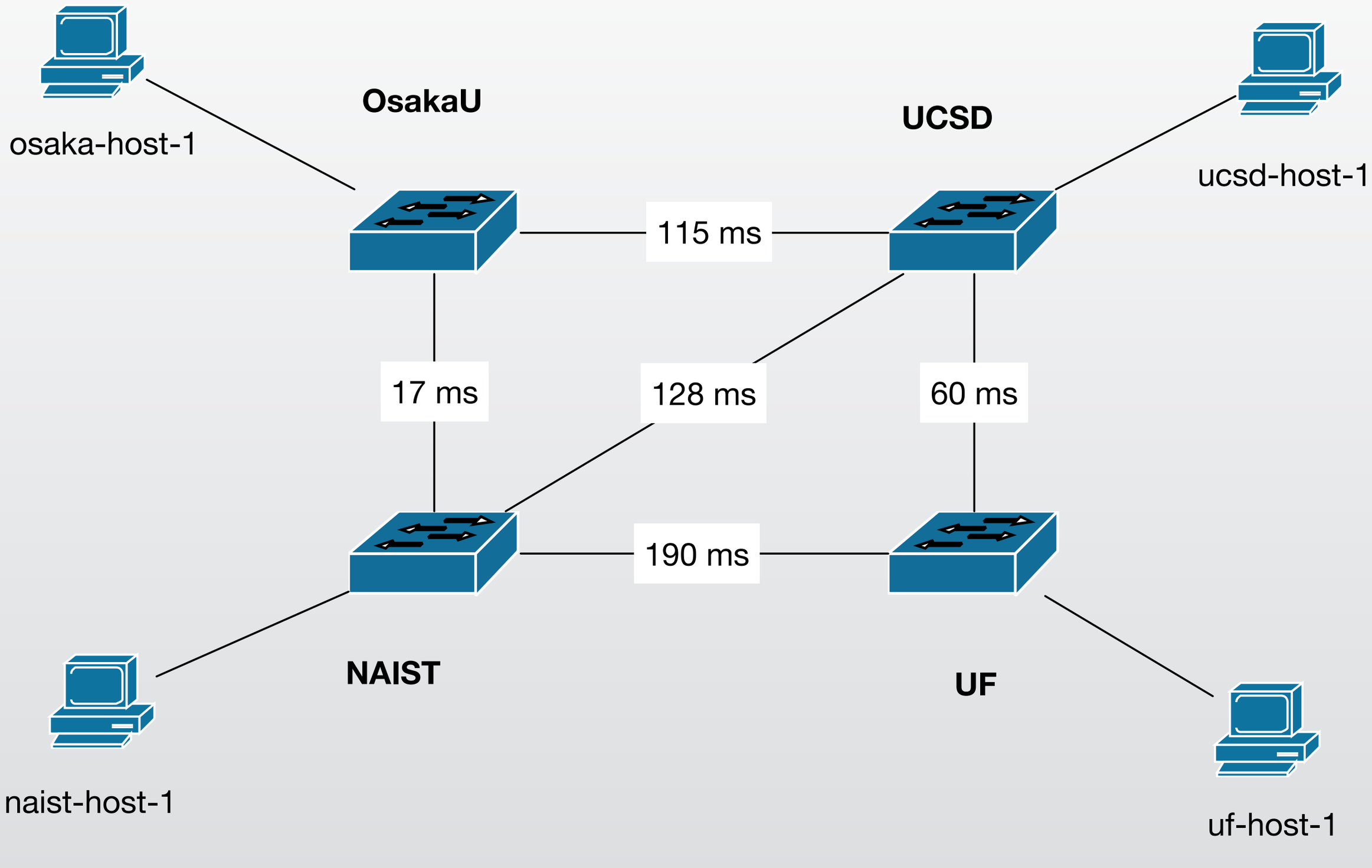


Updated: October 10, 2014

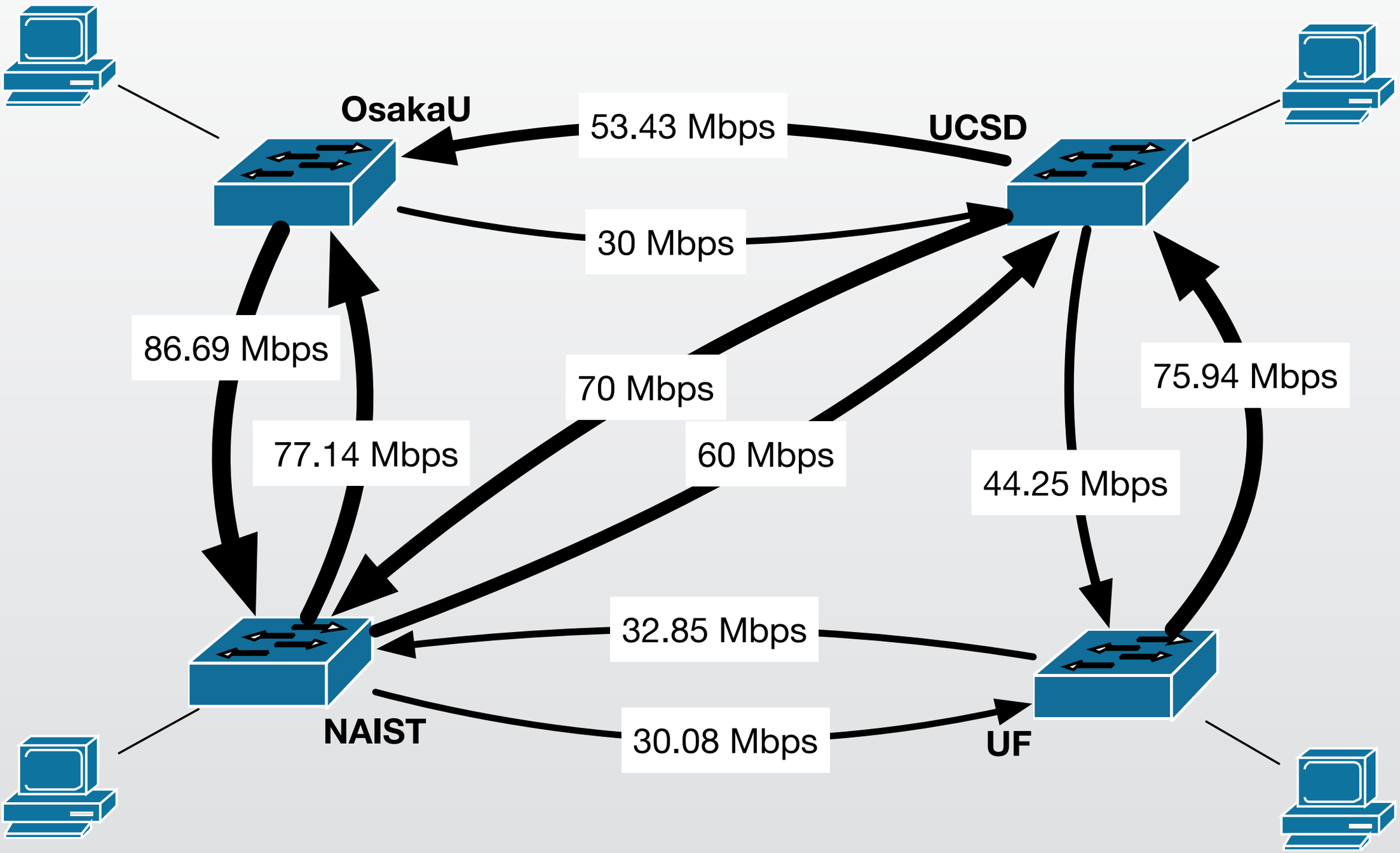
PRAGMA-ENT


JGN-X
00-03-01-03-20-39
00 02 01-02 20 39
AIST Tsukuba
08-9e-01-39-1a-a4
OsakaU
22-03-f1-f8-f3-4a
NAIST
00 10 18-c1-90-0e
08-9e-01-e9-94-95|26508
08-9e-0[illegible]-e9-94-e5|26508
00-[illegible]-8b-7b-a3-4e
UCSD
00-22-19-62-90-60
00 22 19-60 84 4b
08-9e-0[illegible]-82-37-64 796
UF
Updated: October 10, 2014

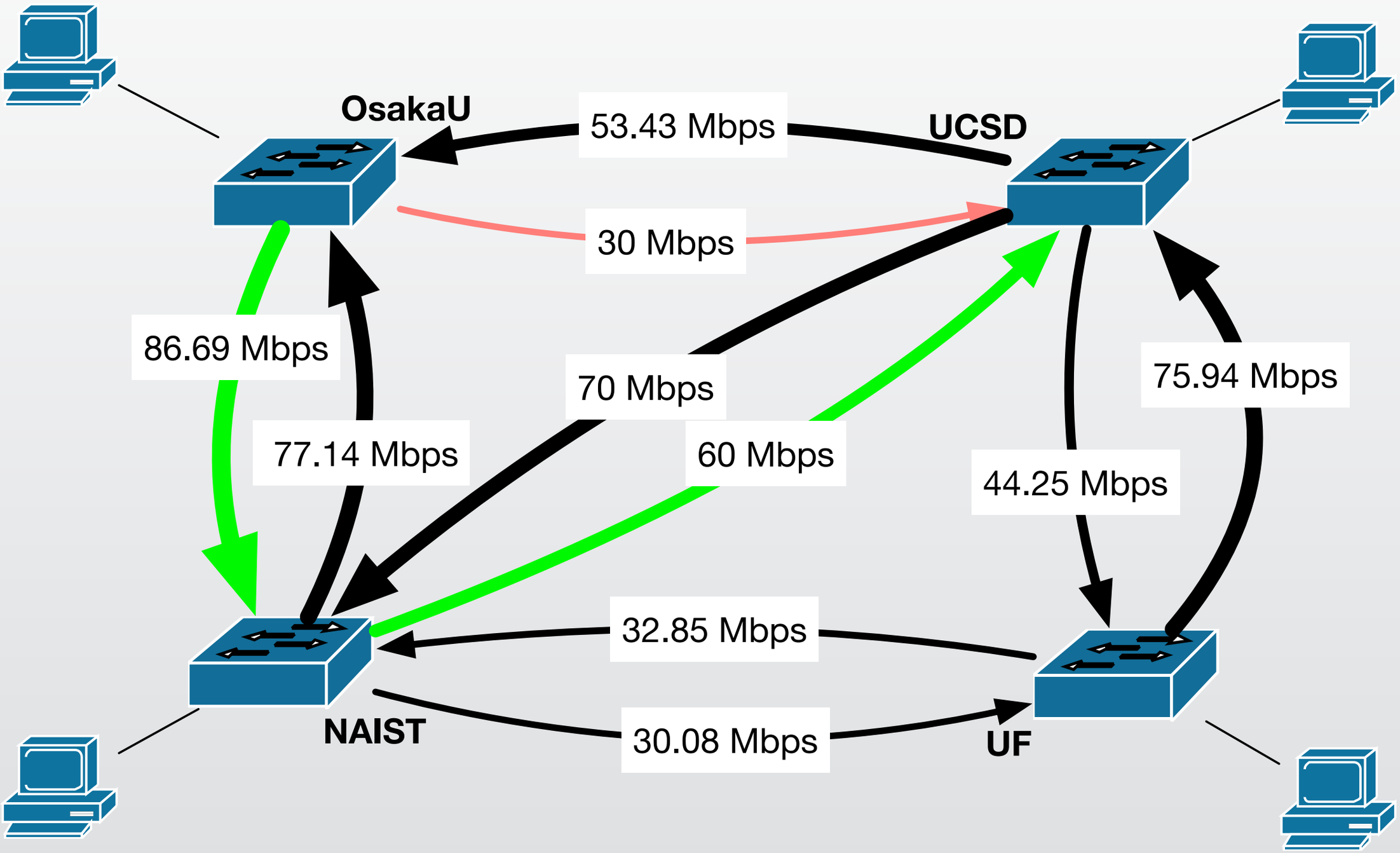
Experimented Portion

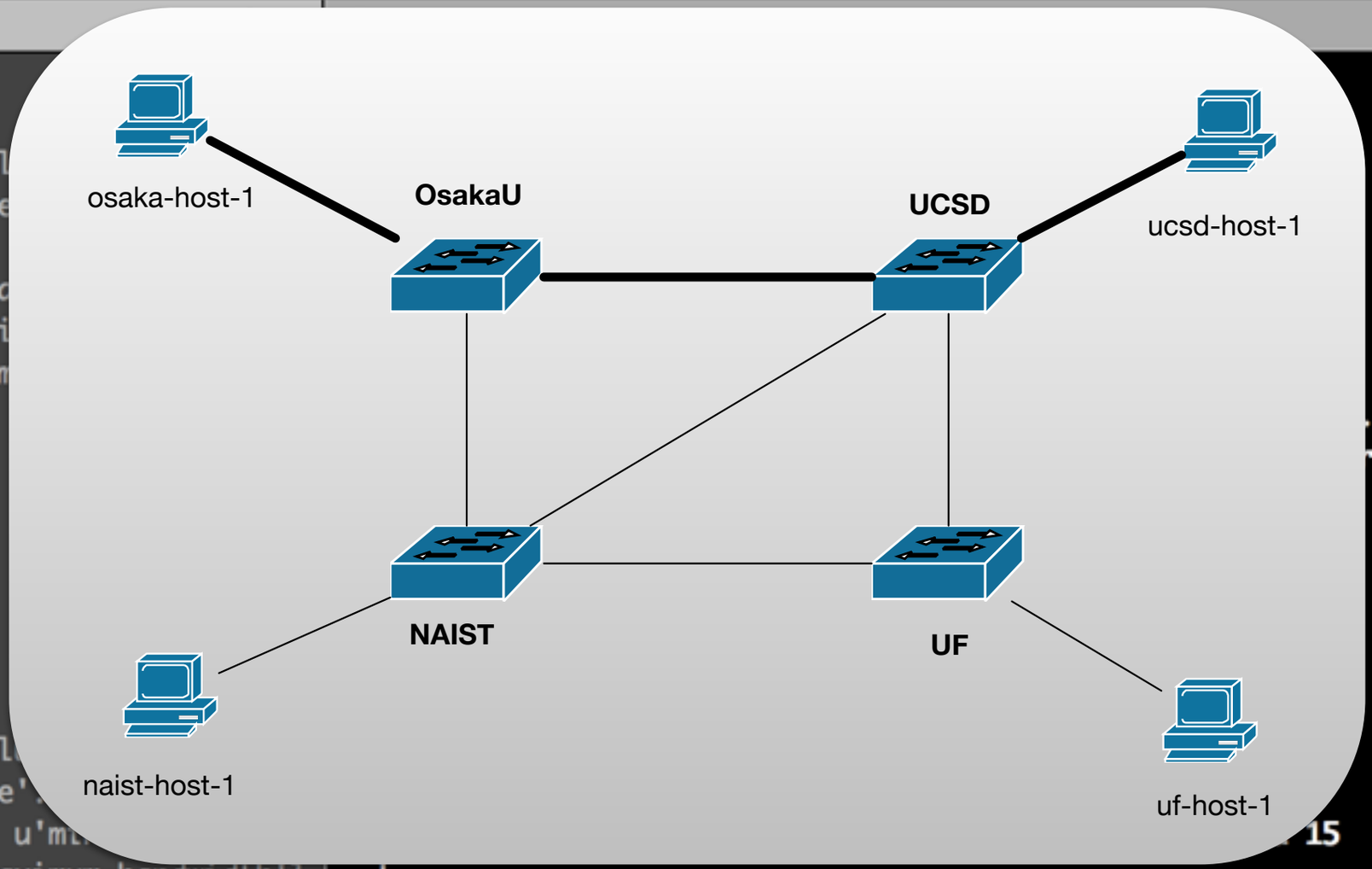


Measured Bandwidth



Measured Bandwidth



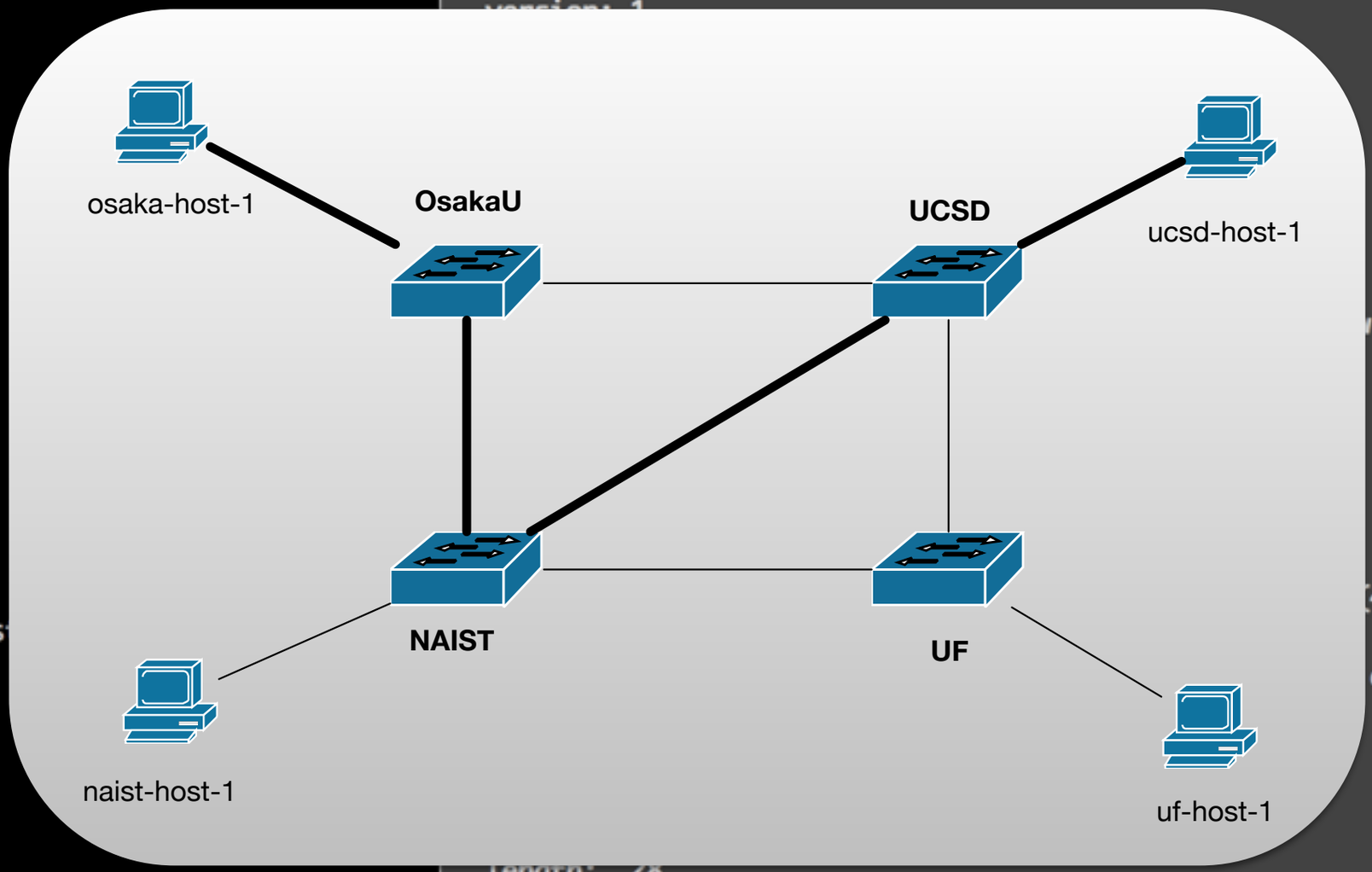



```
..|
[overseer.overseer      ] Finding path from host 52:54:00:57:a6:a4 to host 52:54:00:7b:74:29
[overseer.overseer      ] Installing path from host 52:54:00:57:a6:a4 to host 52:54:00:7b:74:29
[overseer.overseer      ] Installing flow from switch 188b7ba34e to switch 2203f1f8f34a
[overseer.overseer      ] Installing final flow from switch 2203f1f8f34a to host 52:54:00:7b:74:29
[overseer.overseer      ] Finding path from host 52:54:00:7b:74:29 to host 52:54:00:57:a6:a4
[overseer.overseer      ] Installing path from host 52:54:00:7b:74:29 to host 52:54:00:57:a6:a4
[overseer.overseer      ] Installing flow from switch 2203f1f8f34a to switch 188b7ba34e
[overseer.overseer      ] Installing final flow from switch 188b7ba34e to host 52:54:00:57:a6:a4
[overseer.overseer      ] OF:header:
  version: 1
  type:    1 (OFPT_ERROR)
  length:  28
  xid:     2599
type: OFPET_BAD_ACTION (2)
code: OFPBAC_BAD_OUT_PORT (4)
datalen: 16
0000: 01 0d 00 10 00 00 0a 27  1a 48 34 2a 00 06 00 00  |.......'.H4*....|
```

Path Preference Table

Path Identifier (src_ip, src_port, dst_ip, dst_port)	Preference (DEFAULT / MAX_BW / MIN_LAT)
(10.10.13.1, *, 10.10.14.1, *)	MAX_BW
(10.10.14.1, *, 10.10.13.1, *)	MAX_BW

```
[00-02-01-02-20-39 32] Error:   type:    1 (OFPT_ERROR)
[00-02-01-02-20-39 32] Error:   length:  28
[00-02-01-02-20-39 32] Error:   xid:     4734
[00-02-01-02-20-39 32] Error: type: OFPET_BAD_ACTION (2)
[00-02-01-02-20-39 32] Error: code: OFPBAC_BAD_OUT_PORT (4)
[00-02-01-02-20-39 32] Error: datalen: 16
[00-02-01-02-20-39 32] Error: 0000: 01 0d 00 10 00 00 12 7e  1a 49 41 45 00 06 00 00   |.......~.IAE.
...|
[overseer.overseer      ] Finding path from host 52:54:00:57:a6:a4 to host 52:54:00:7b:74:29
[overseer.overseer      ] Installing path from host 52:54:00:57:a6:a4 to host 52:54:00:7b:74:29
[overseer.overseer      ] Installing flow from switch 188b7ba34e to switch 1018c1900e
[overseer.overseer      ] Installing flow from switch 1018c1900e to switch 2203f1f8f34a
[overseer.overseer      ] Installing final flow from switch 2203f1f8f34a to host 52:54:00:7b:74:29
[overseer.overseer      ] Finding path from host 52:54:00:7b:74:29 to host 52:54:00:57:a6:a4
[overseer.overseer      ] Installing path from host 52:54:00:7b:74:29 to host 52:54:00:57:a6:a4
[overseer.overseer      ] Installing flow from switch 2203f1f8f34a to switch 188b7ba34e
[overseer.overseer      ] Installing final flow from switch 188b7ba34e to host 52:54:00:57:a6:a4
[overseer.overseer      ] OF:header:
```




```
[0] 0:[tmux]*                                   "pongsakorn-u@sd-lemon:" 01:27 14-Oct-14
```

```
Recv   Send    Send
Socket Socket  Message  Elapsed
Size   Size    Size     Time     Throughput
bytes  bytes   bytes    secs.    10^6bits/sec

 87380  16384  16384    10.28      38.32
[root@pragma-ucsd-01 ~]# netperf -H osaka-host-1
MIGRATED TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to osaka-host-1 () port 0 AF_INET
Recv   Send    Send
Socket Socket  Message  Elapsed
Size   Size    Size     Time     Throughput
bytes  bytes   bytes    secs.    10^6bits/sec

 87380  16384  16384    10.49      28.62
[root@pragma-ucsd-01 ~]# netperf -H osaka-host-1
MIGRATED TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to osaka-host-1 () port 0 AF_INET
Recv   Send    Send
Socket Socket  Message  Elapsed
Size   Size    Size     Time     Throughput
bytes  bytes   bytes    secs.    10^6bits/sec

 87380  16384  16384    10.41      26.84
[root@pragma-ucsd-01 ~]# netperf -H osaka-host-1
MIGRATED TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to osaka-host-1 () port 0 AF_INET
Recv   Send    Send
Socket Socket  Message  Elapsed
Size   Size    Size     Time     Throughput
bytes  bytes   bytes    secs.    10^6bits/sec

 87380  16384  16384    10.24      61.52
[root@pragma-ucsd-01 ~]# netperf -H osaka-host-1
MIGRATED TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to osaka-host-1 () port 0 AF_INET
Recv   Send    Send
Socket Socket  Message  Elapsed
Size   Size    Size     Time     Throughput
bytes  bytes   bytes    secs.    10^6bits/sec

 87380  16384  16384    10.24      56.98
[root@pragma-ucsd-01 ~]#
```

Shortest Path

Maximum Bandwidth Path

Issues / Future Work

- Instability of PRAGMA-ENT
- Compatibility with Physical OpenFlow Switch
- Implementation Performance
- Preciseness of Monitoring Solution
- More comprehensive options for Path Preference Table
- Path Preference Table requires Manual Configuration

Q & A

Thank you for your attention