

IEEE 802.1ag Ethernet OAM

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SARA

IEEE 802.1ag standard

- ▶ IEEE 802.1ag is used for Connectivity Fault Management
- ▶ CFM protocol at Ethernet layer
 - ▶ Uses Ethernet frames (ethertype 0x8902)
 - ▶ Uses MAC addresses, no IPv4 or IPv6 involved
 - ▶ Confined to one broadcast domain
- ▶ Support for multi-domain Ethernet networks
- ▶ Implemented on Ethernet switches and router Ethernet interfaces

802.1ag Concepts

- ▶ Ethernet network split into Maintenance Domains
- ▶ 802.1ag frames operate at a certain Maintenance Domain Level (8 levels supported)
- ▶ Maintenance Points (interfaces) send and process 802.1ag frames
 - ▶ Maintenance End Points (MEPs)
 - ▶ Maintenance Intermediate Points (MIPs)
- ▶ MEPs and MIPs only interact when configured at the same Maintenance Domain Level
- ▶ Interfaces can be a MEP at one level and a MIP at another

IEEE 802.1ag OAM Types

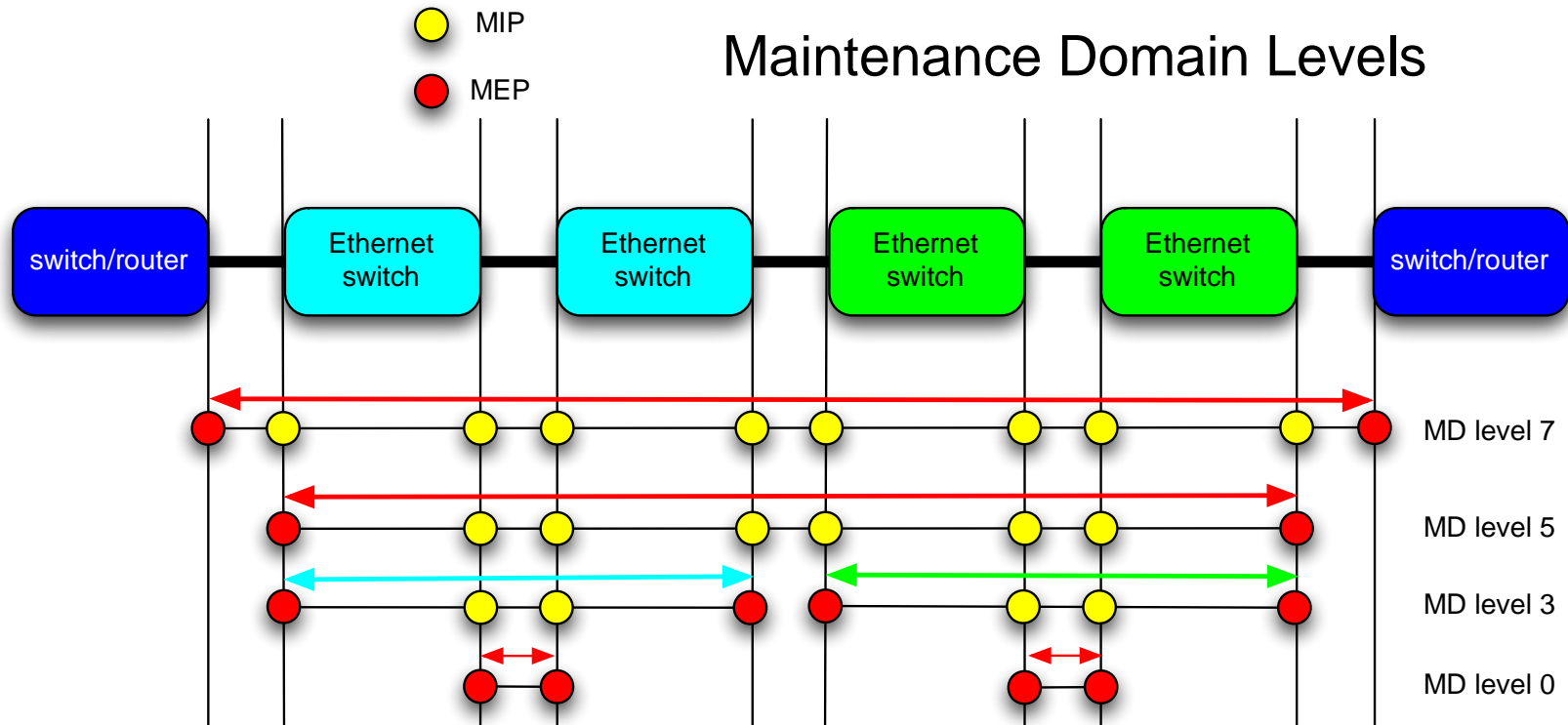
- **Continuity Check (CC)**
 - Detect loss of connectivity
 - Periodic hello messages from MEPs
 - Processed by MEPs
 - CC frames sent to multicast group, no replies are sent
- **Loopback Message/Reply (LBM/LBR)**
 - Check for reachability
 - Sent manually from MEPs via CLI
 - Processed by MIPs/MEPs
 - Unicast request, unicast reply
- **Link Trace Message/Reply (LTM/LTR)**
 - Path information
 - Sent manually from MEPs via CLI
 - Processed by MIPs/MEPs in path
 - Multicast request including TTL, unicast replies

Continuity Check Messages

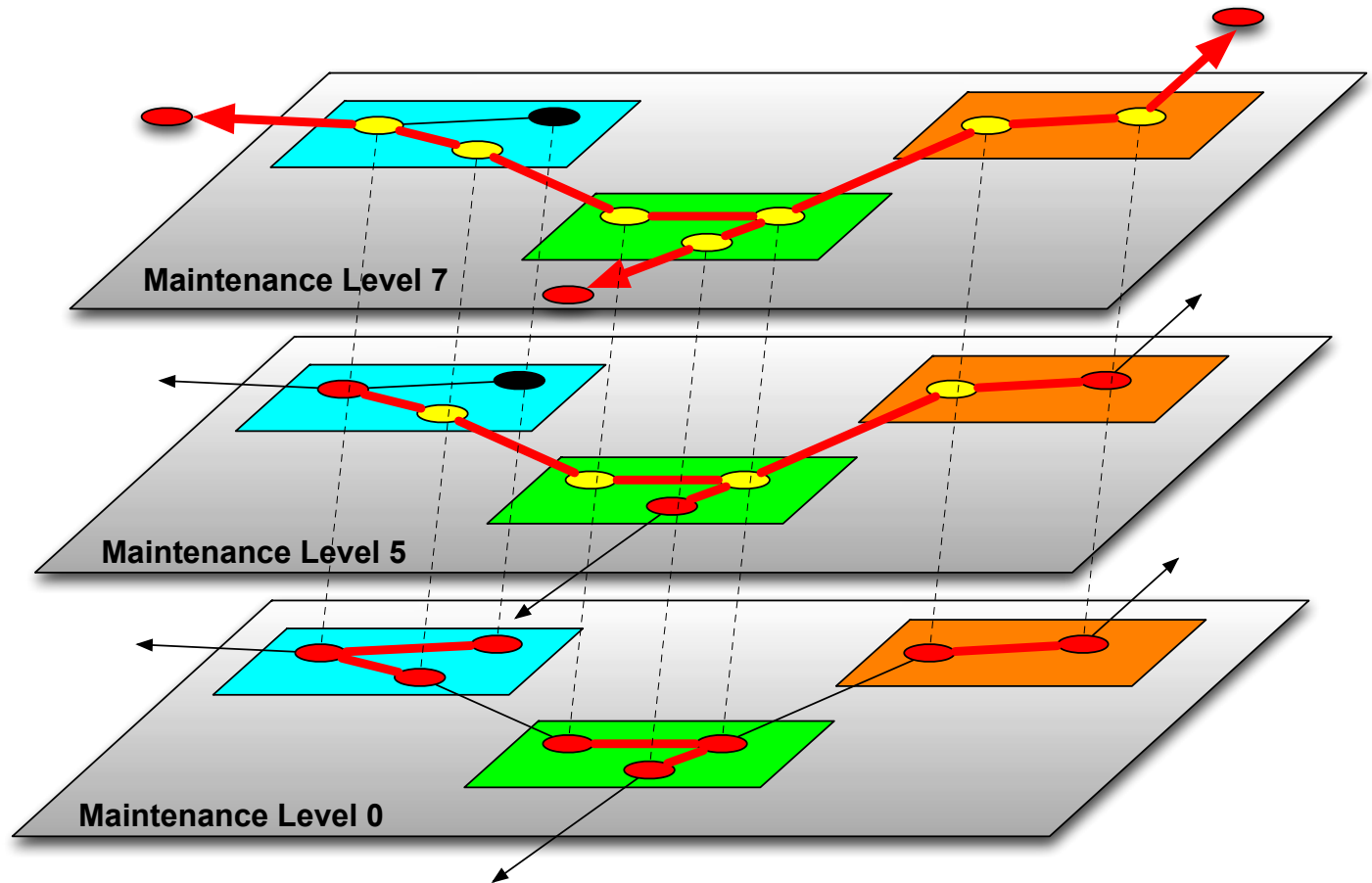
- ▶ **Periodic hello messages, supported intervals:**
 - ▶ 3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min
- ▶ **Maintenance Association with 2 or more MEPs**
- ▶ **No replies sent, only listen to associated MEPs**
 - ▶ Same Maintenance Association
 - ▶ Same Maintenance Domain Name
 - ▶ Same Maintenance Domain Level
- ▶ **Declare link failure when missing 3 consecutive messages**

802.1ag MEPs and MIPs

Maintenance Domain Levels



Maintenance Domain Levels

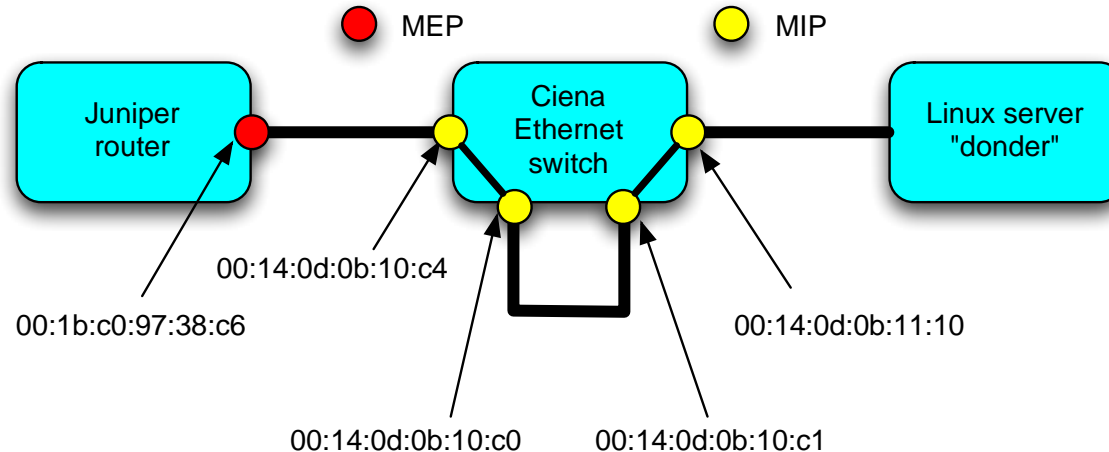


What are the *dot1ag-utils*?

- ▶ **Open Source implementation of IEEE 802.1ag**
- ▶ **Simplified BSD License**
- ▶ **Supported on Arista, FreeBSD, Linux and MacOSX**
- ▶ **User space implementation**
- ▶ **Work In Progress**

- ▶ **Powerful debugging tool for Ethernet based lightpaths, VPNs, etc.**
- ▶ **No need to configure IP addresses on each VLAN on switches**
- ▶ **Ping to Ethernet MAC addresses of routers and switches**
- ▶ **You only need a server and install the software on it**

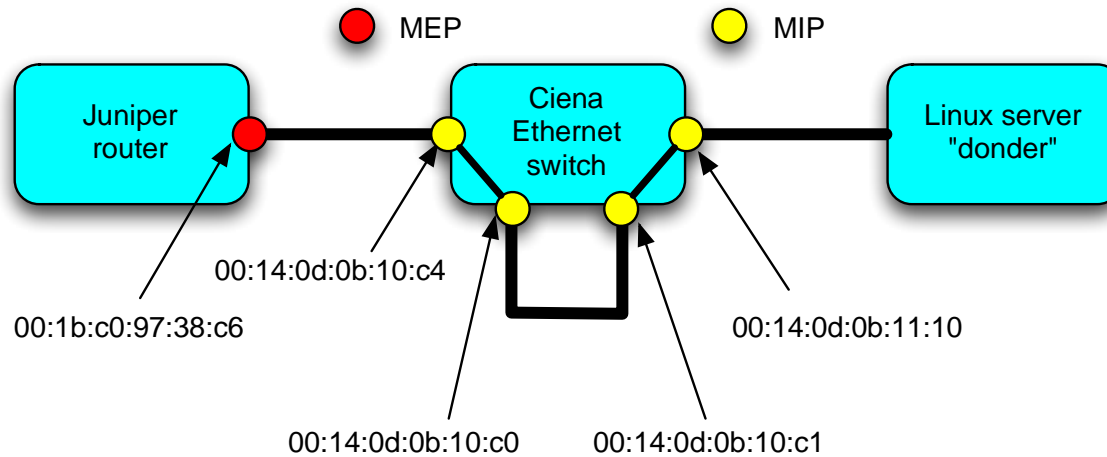
ethping demo



```

root@donder:~# ethping -i eth5 -v 123 -l 7 -c 10 00:1b:c0:97:38:c6
CFMLBM to 00:1b:c0:97:38:c6
60 bytes from 00:1b:c0:97:38:c6, sequence 477635892, 0.839 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635893, 0.872 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635894, 0.817 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635895, 0.829 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635896, 0.851 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635897, 0.718 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635898, 0.713 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635899, 0.917 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635900, 0.731 ms
60 bytes from 00:1b:c0:97:38:c6, sequence 477635901, 0.713 ms
root@donder:~#
  
```

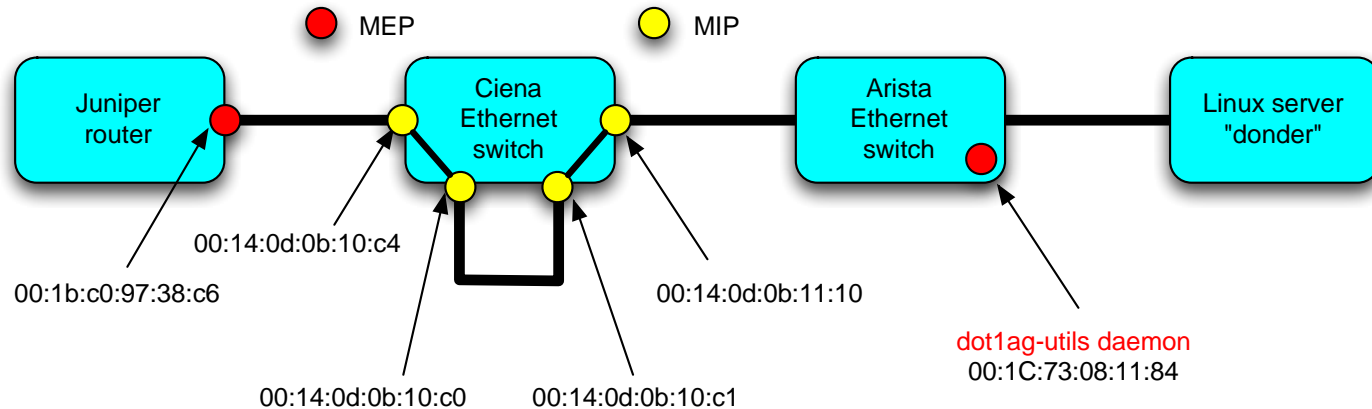
ethtrace demo



```

root@donder:~# ethtrace -i eth5 -v 123 -l 7 00:1b:c0:97:38:c6
Sending CFM LTM probe to 00:1b:c0:97:38:c6
ttl 1: LTM with id 1784875395
    reply from 00:14:0d:0b:10:c1, id=1784875395, ttl=0, RlyFDB
ttl 2: LTM with id 1784875396
    reply from 00:14:0d:0b:10:c4, id=1784875396, ttl=0, RlyFDB
    reply from 00:14:0d:0b:10:c1, id=1784875396, ttl=1, RlyFDB
ttl 3: LTM with id 1784875397
    reply from 00:14:0d:0b:10:c4, id=1784875397, ttl=1, RlyFDB
    reply from 00:14:0d:0b:10:c1, id=1784875397, ttl=2, RlyFDB
    reply from 00:1b:c0:97:38:c6, id=1784875397, ttl=0, RlyHit
root@donder:~#
  
```

LBM from Juniper to Arista



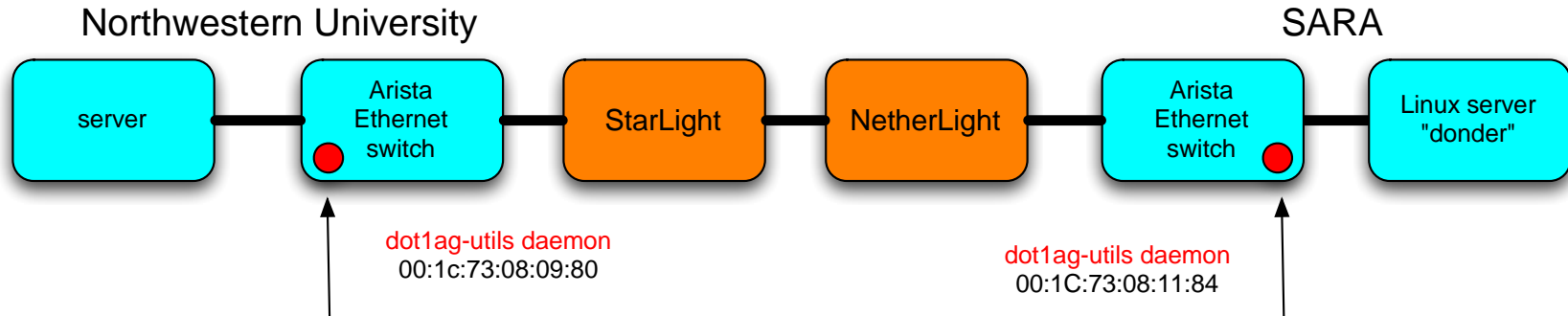
```

--- JUNOS 10.3I built 2011-04-05 18:23:14 UTC
rvdp@re0-ed> ...ntenance-association test 00:1C:73:08:11:84
PING to 00:1c:73:08:11:84, Interface ge-0/3/9.123
64 bytes from 00:1c:73:08:11:84: lbm_seq=81
64 bytes from 00:1c:73:08:11:84: lbm_seq=82
64 bytes from 00:1c:73:08:11:84: lbm_seq=83
64 bytes from 00:1c:73:08:11:84: lbm_seq=84
--- ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss

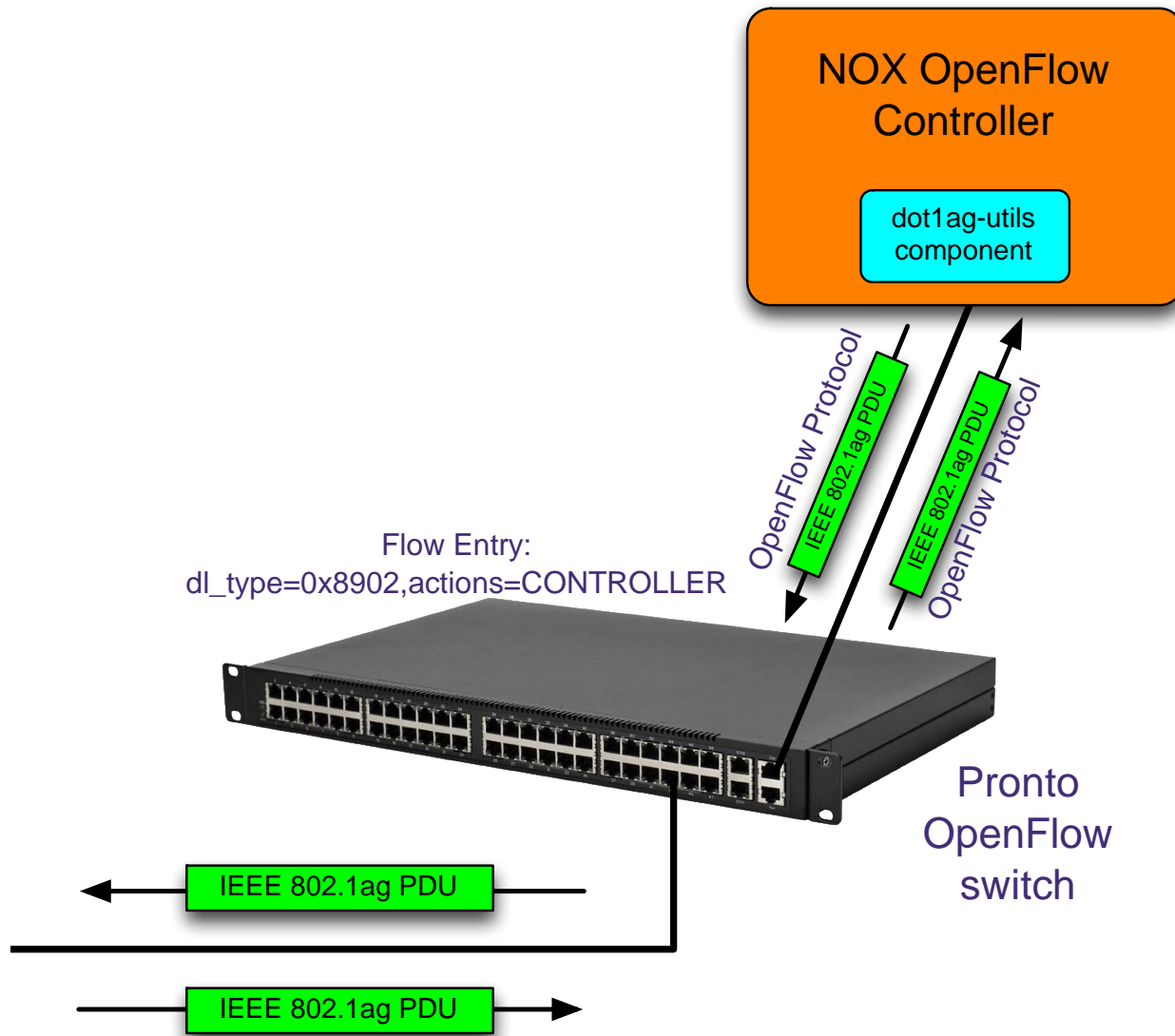
rvdp@re0-ed>

```

ethping Amsterdam to Chicago








```
donder# ethping -i eth5 -v 400 -l 7 00:1c:73:08:09:80
Sending CFM LBM to 00:1c:73:08:09:80
60 bytes from 00:1c:73:08:09:80, sequence 1114864898, 103.453 ms
60 bytes from 00:1c:73:08:09:80, sequence 1114864899, 103.432 ms
60 bytes from 00:1c:73:08:09:80, sequence 1114864900, 103.439 ms
60 bytes from 00:1c:73:08:09:80, sequence 1114864901, 103.455 ms
60 bytes from 00:1c:73:08:09:80, sequence 1114864902, 103.455 ms
#
```



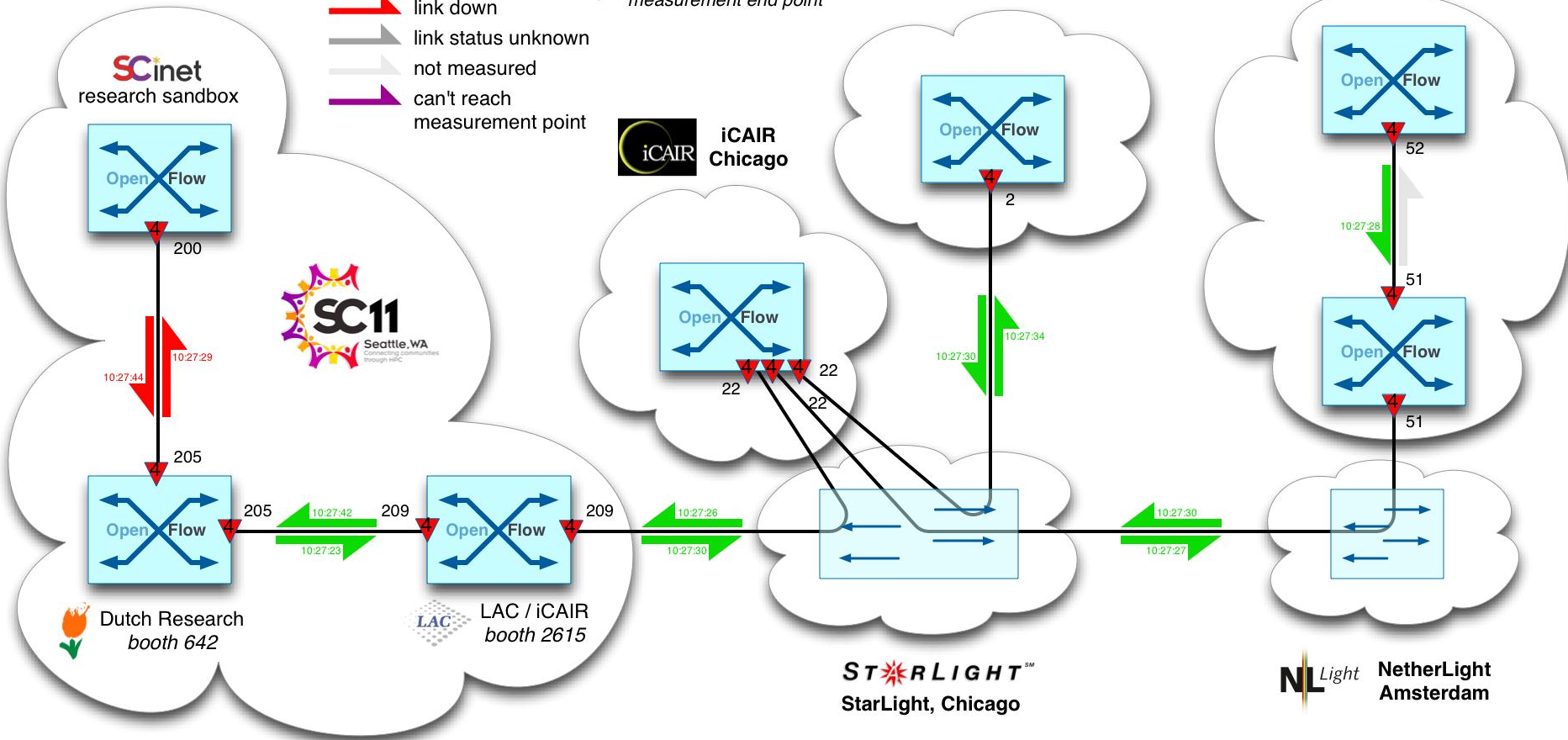
Ethernet Sandbox

Supercomputing 2011
Seattle

-  link up
 -  link down
 -  link status unknown
 -  not measured
 -  can't reach measurement point
-  MEP
measurement end point

 CRC
Ottawa

 SARA
Amsterdam



More Information

- ▶ Mail to rudp@sara.nl or nrg@sara.nl
- ▶ <http://nrg.sara.nl/dot1ag-utils>
- ▶ Subscribe to mailman mailing list

