

Schadenfreude: Impact of the Tohoku Quake & Tsunami as Seen by a Japanese ISP

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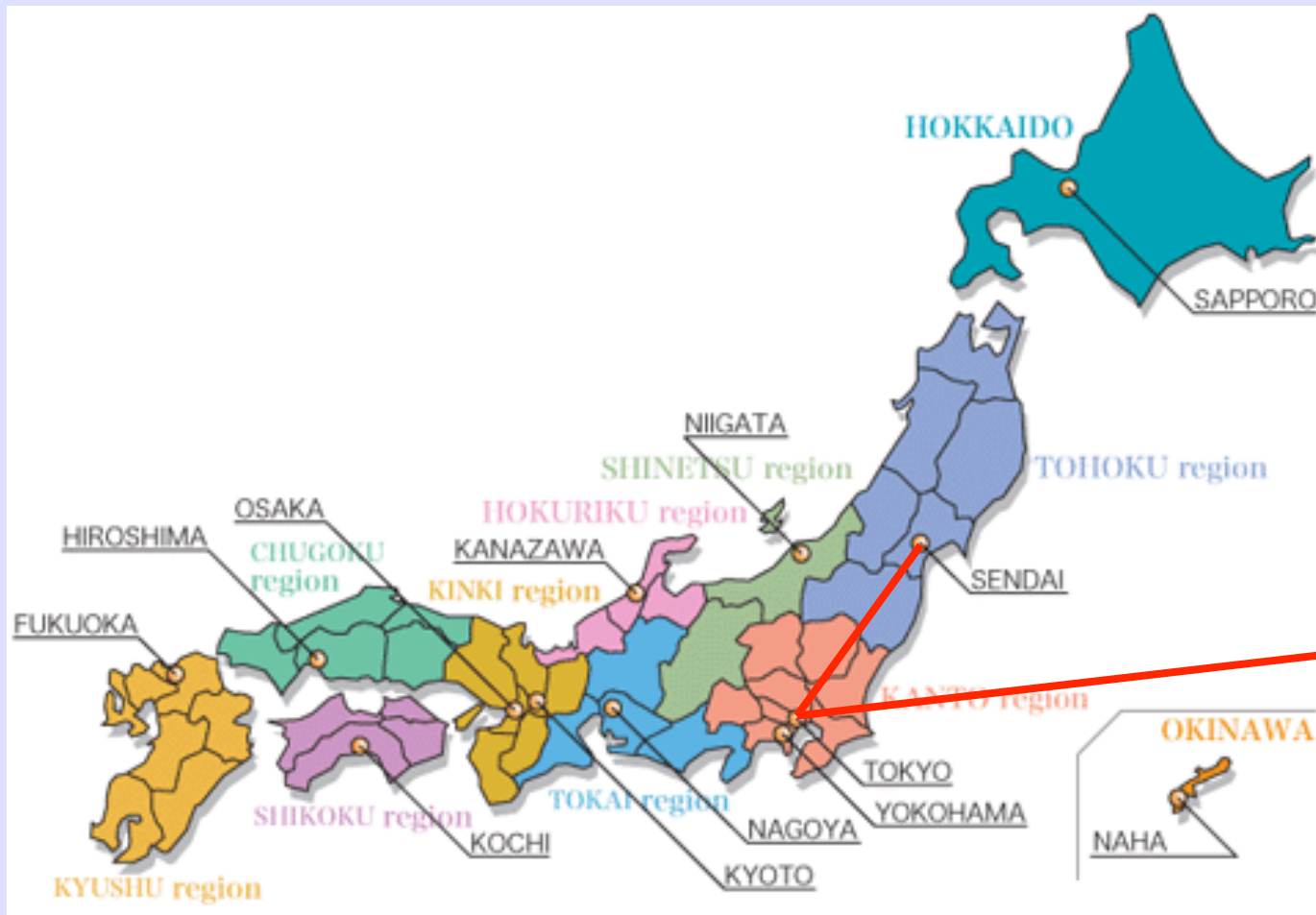
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Agenda

- List of events
- Routing observations
 - OSPF
 - BGP
- Traffic observations
- Impact of other disasters

Japan



| | |
|-------------------|--|
| March 11th | |
| 14:46 | The earthquake of Magnitude 9.0 about 130km east of Sendai city |
| 14:48 | Sendai Datacenter switched to in-house power generator |
| 14:48 | The two links to Sendai are lost |
| 21:50 | One link to the US fails |
| March 12th | |
| 01:13 | Two more links between Tokyo and the US fail |
| 06:16 | One of two links to Sendai is recovered |
| 11:30 (~) | External power supply of Sendai Datacenter is restored |
| 20:41 | Recovery of one of three Japan- US links |
| 20:51 | Recovery of a second Japan- US link (link was disabled at the beginning of the month) |
| March 13th | |
| 04:36 | Recovery of a third Japan- US link |
| 21:20 | Recovery of the second link to Sendai |
| March 14th | Monday - Back in Business |

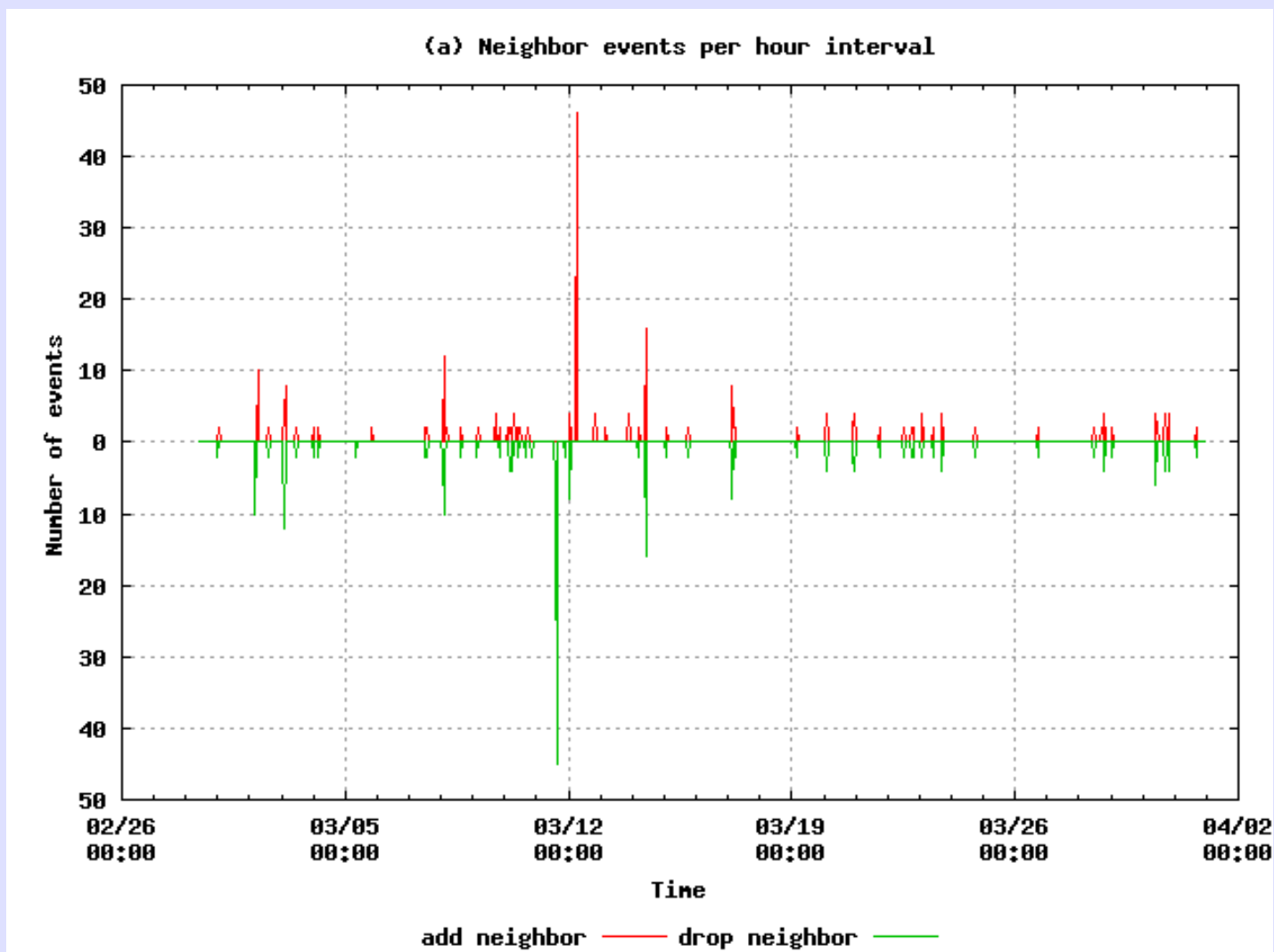
Routing Viewpoints

- Internal behavior: OSPF
- An external view: BGP in a neighboring ISP (Provider)

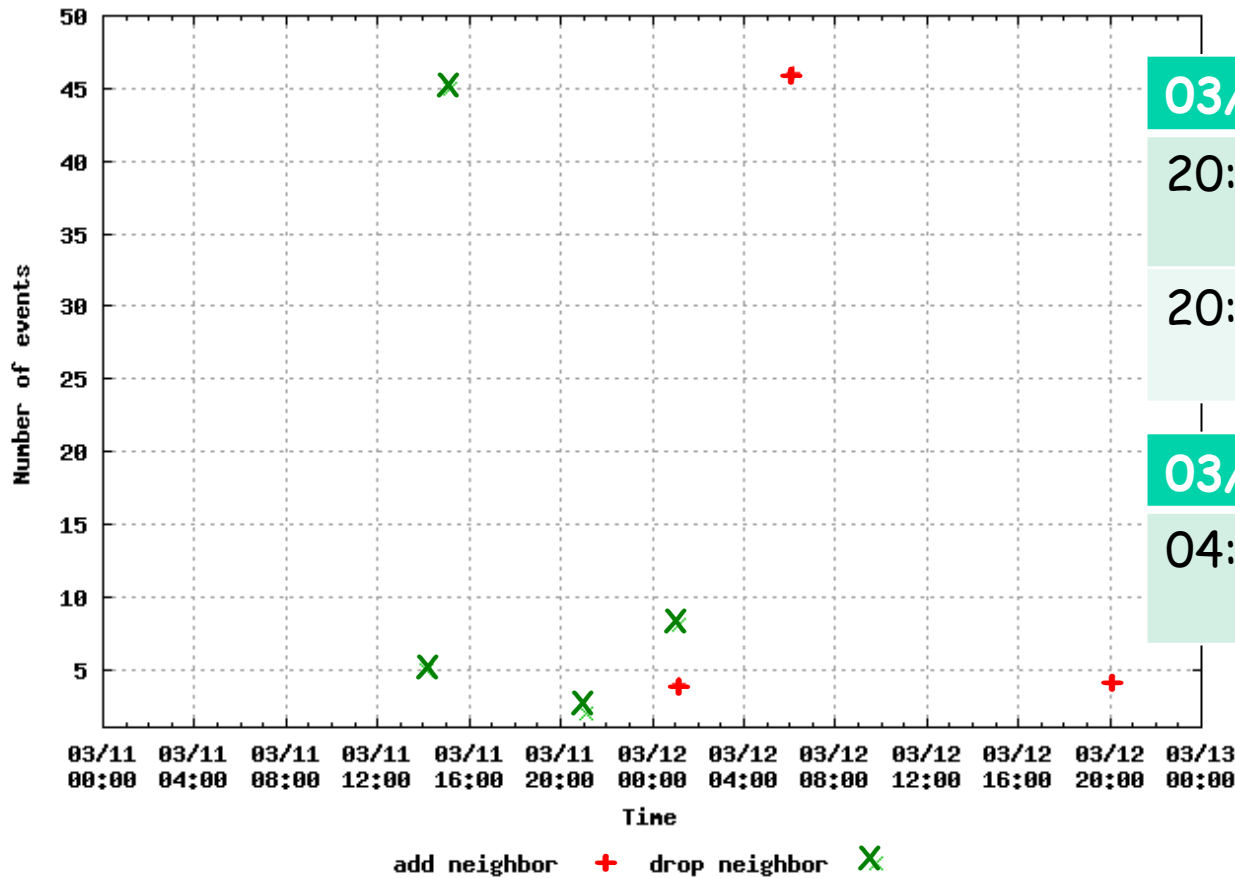
OSPF Behavior

- Route Explorer - Packet Design
- Trace for the backbone
 - ~ 1525 links (Feb 28th 00:00:00)
 - ~ 325 nodes (Feb 28th 00:00:00)
- Count number of events occurring within an hour

OSPF Analysis



(a) Neighbor events per hour interval



03/12

20:41

Recovery of one Japan-**US** link

20:51

Recovery of second Japan-**US** link

03/13

04:36

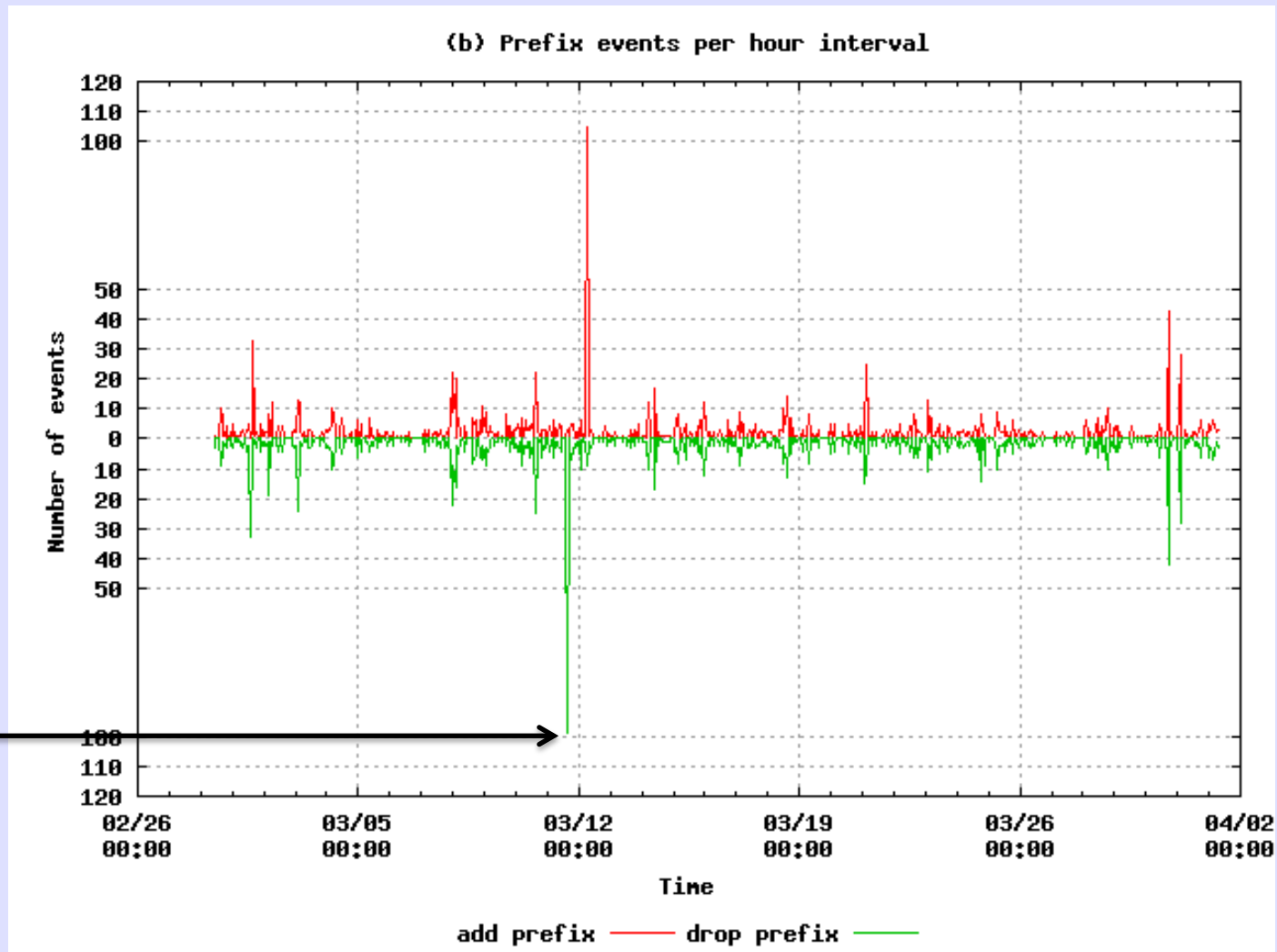
Recovery of third Japan-**US** link

| 03/11 | | 03/12 | |
|-------|---------------------------------|-------|--|
| 14:48 | Two links to Sendai lost | 1:13 | 2 more links between Tokyo and the US flap and fail (drop - add -drop events) |
| 15:34 | OSPF timeouts for Tohoku | | |
| 21:50 | One link to the US fails | 6:16 | One link to Sendai is recovered |

Internal Behavior: OSPF

- Connectivity to Sendai lost for 15 hours 28 min
- Out of a dozen or so trans-Pacific links, three links fail
- OSPF churn is very low compared to the number of refresh LSAs

Prefix Events in OSPF

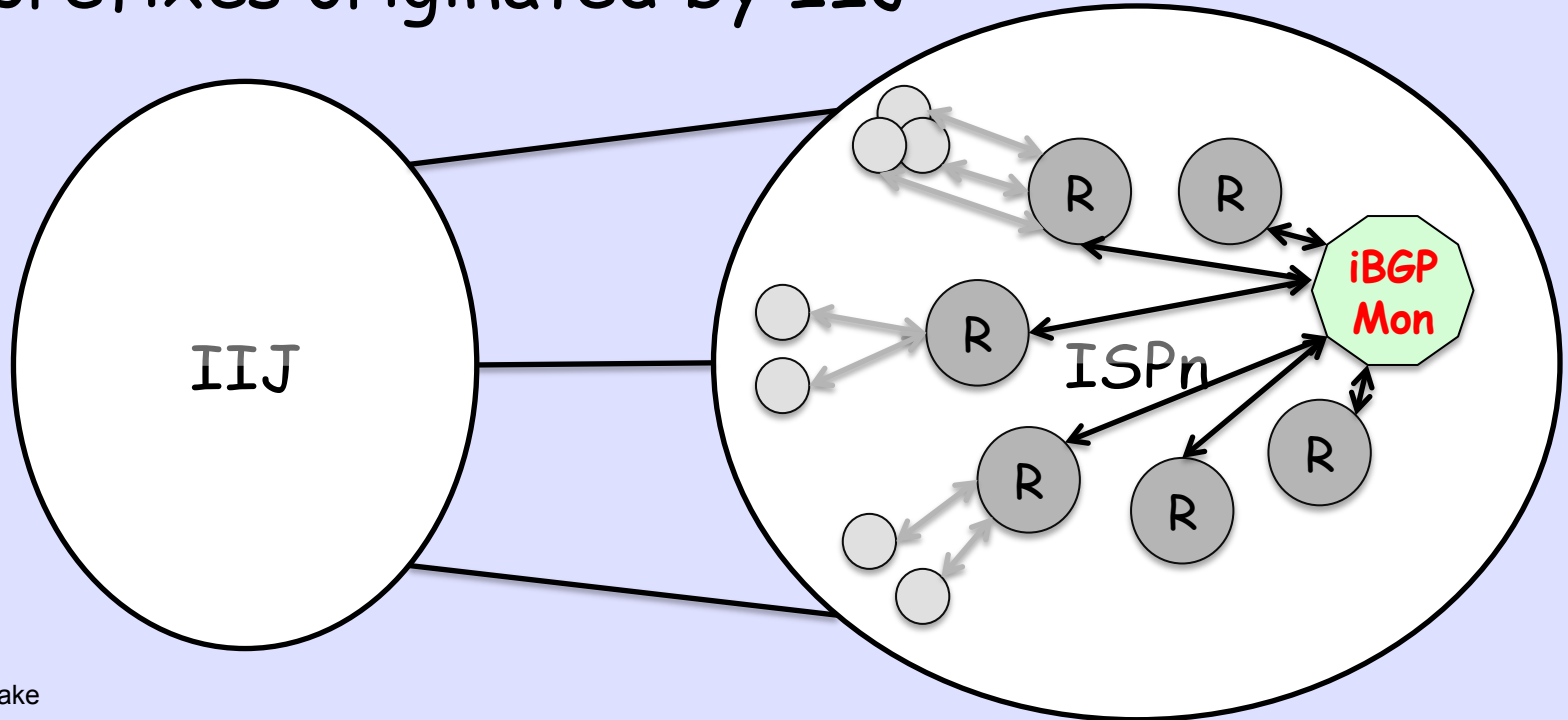


Around 100 prefixes disappear

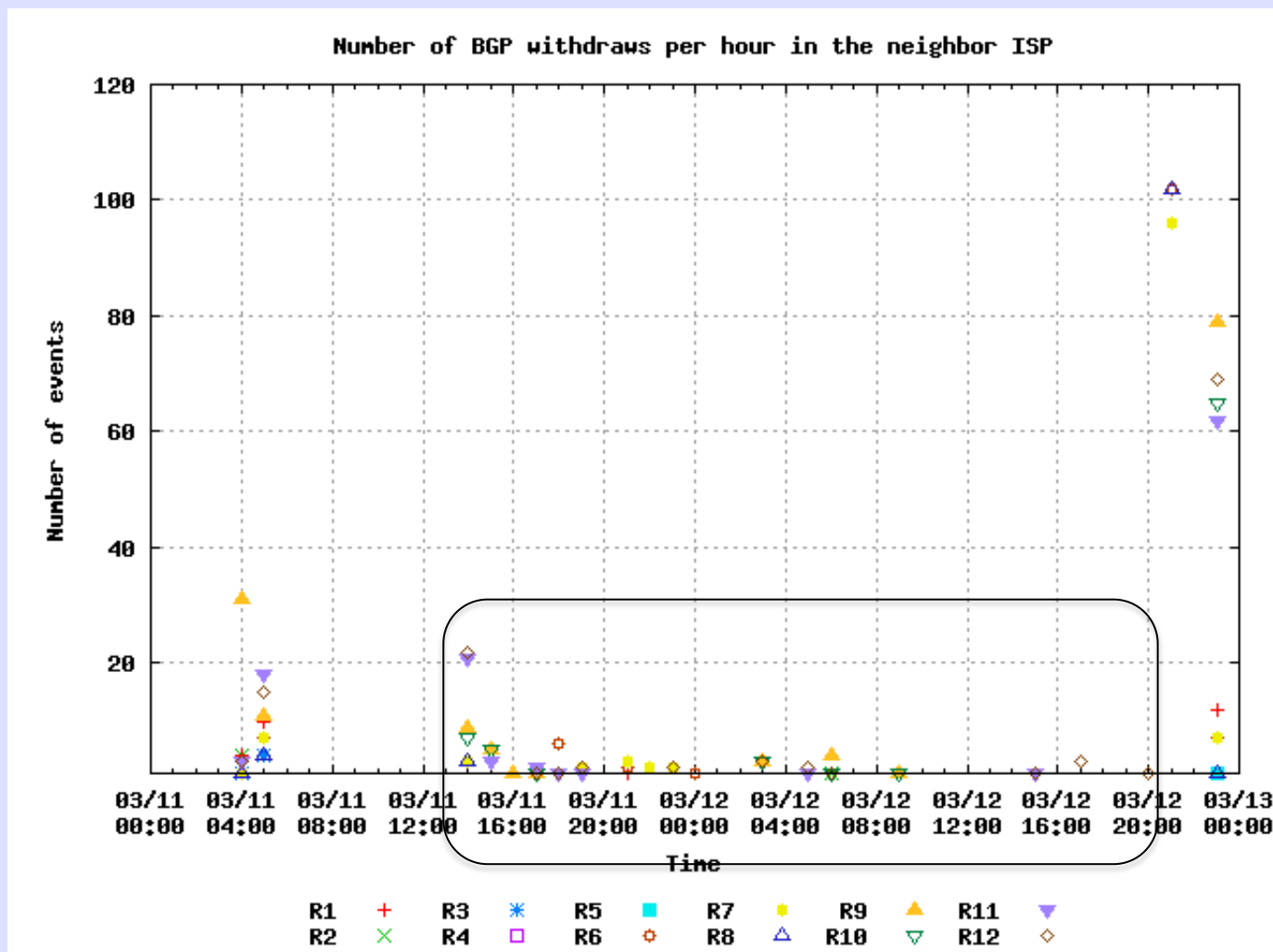
External View: BGP Analysis

iBGP data inside a neighboring ISP (ISPn)

What does the iBGP monitor in ISPn see for prefixes originated by IIJ

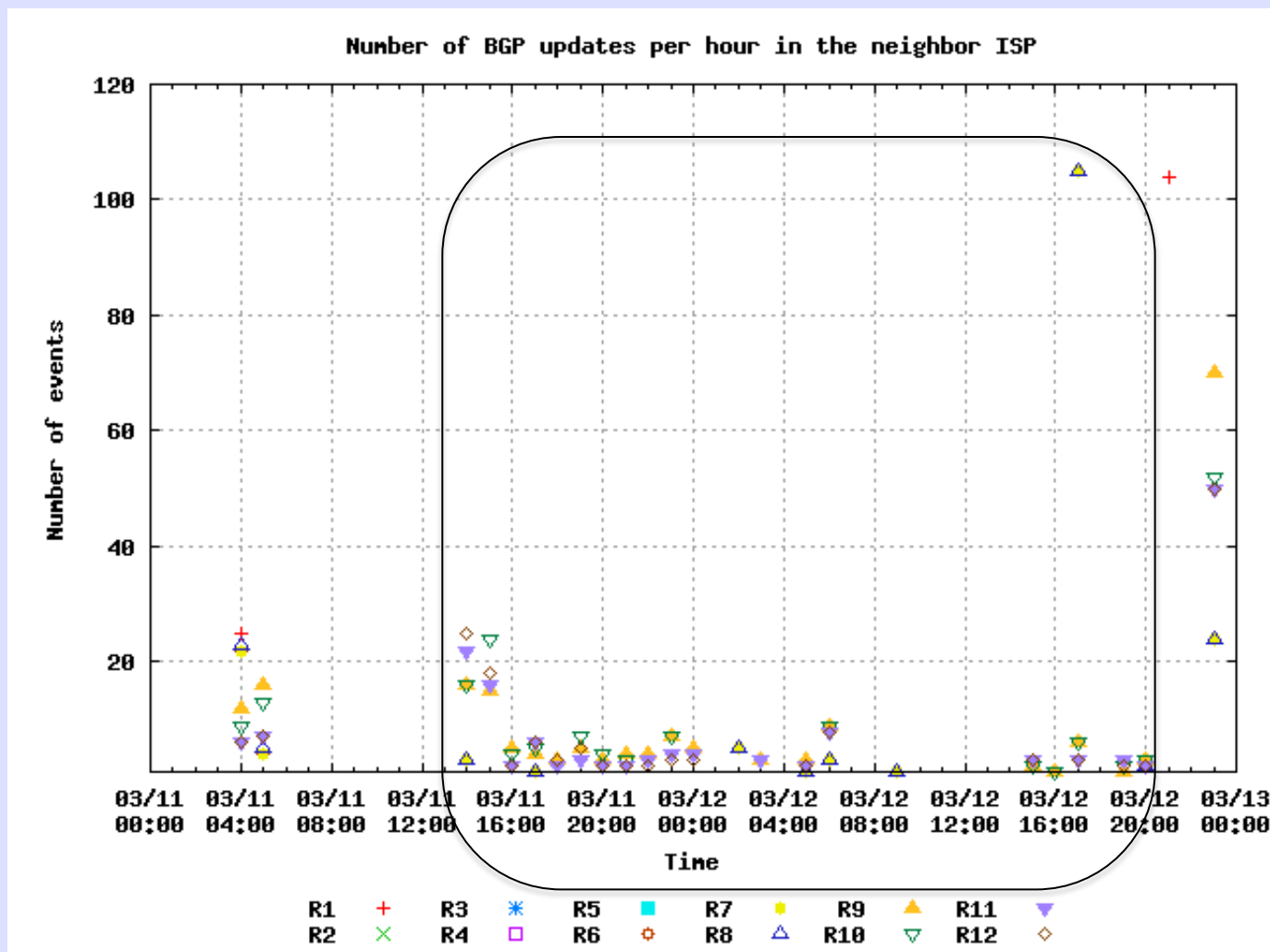


Withdraws Seen by Peer

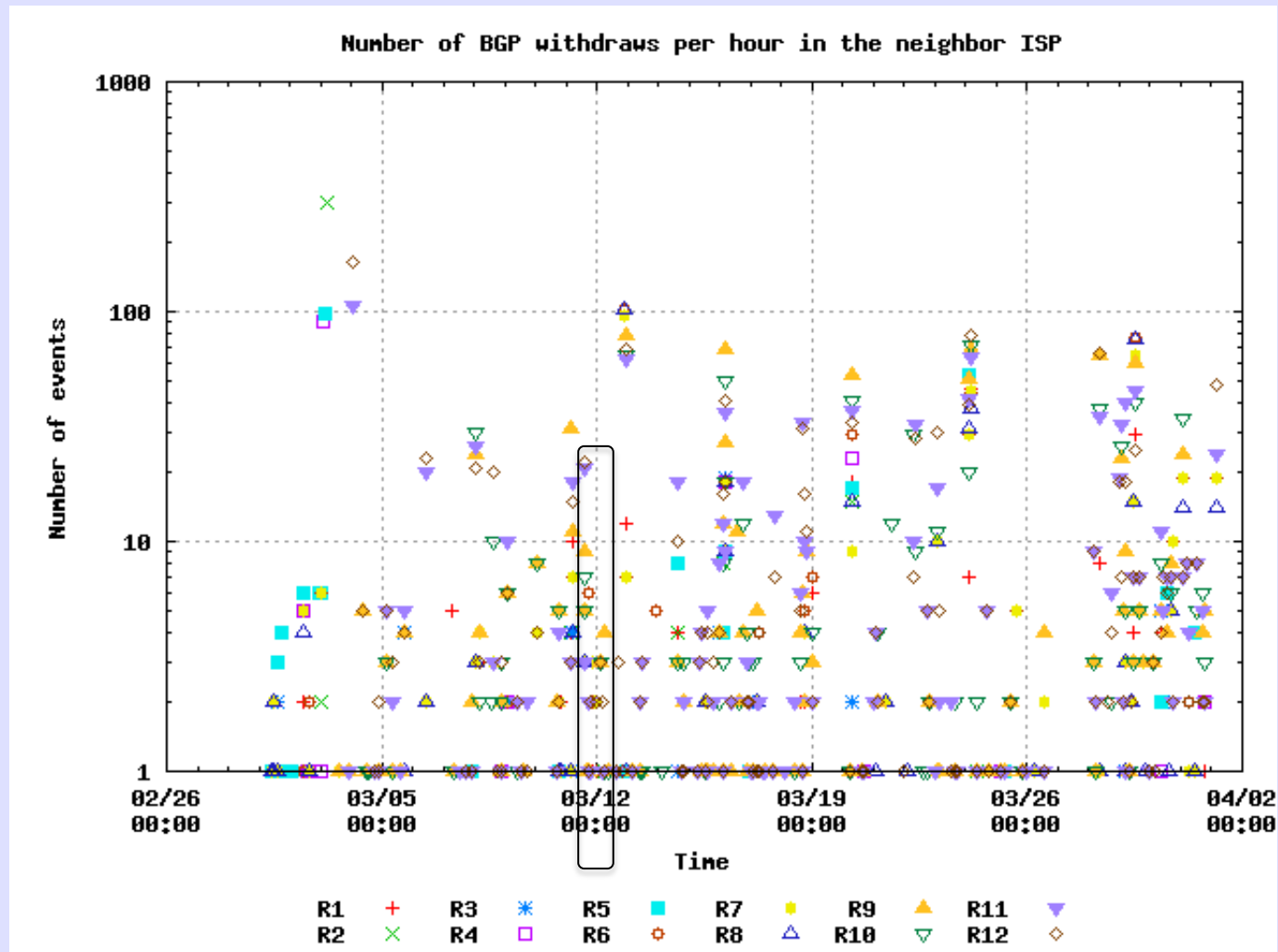


1412 prefixes advertised by IIJ

Updates Seen by Peer



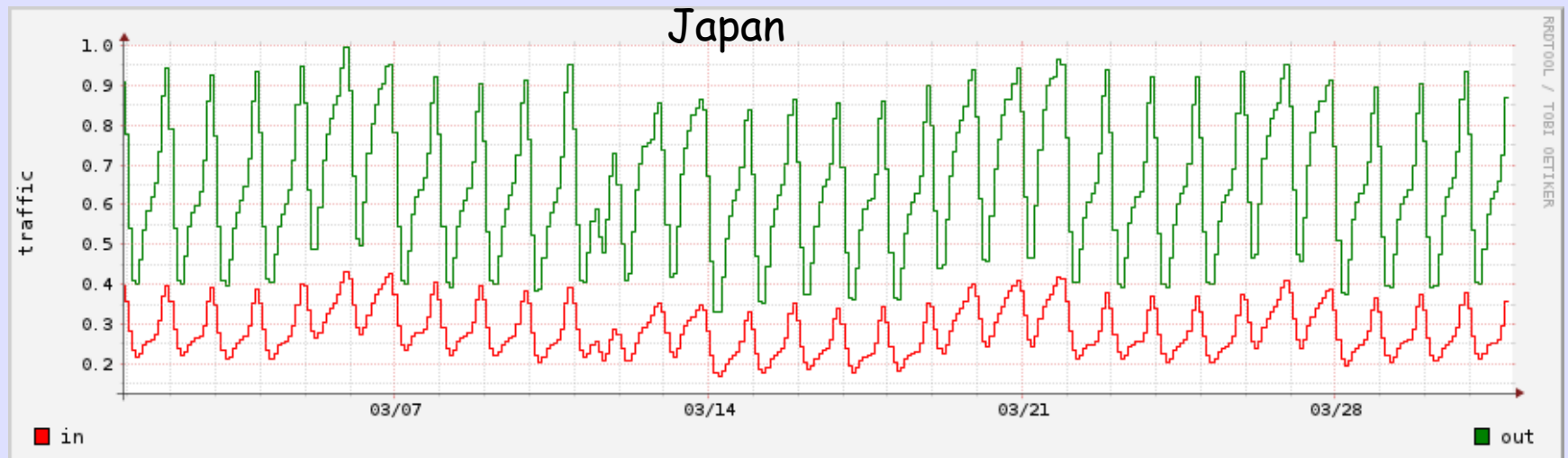
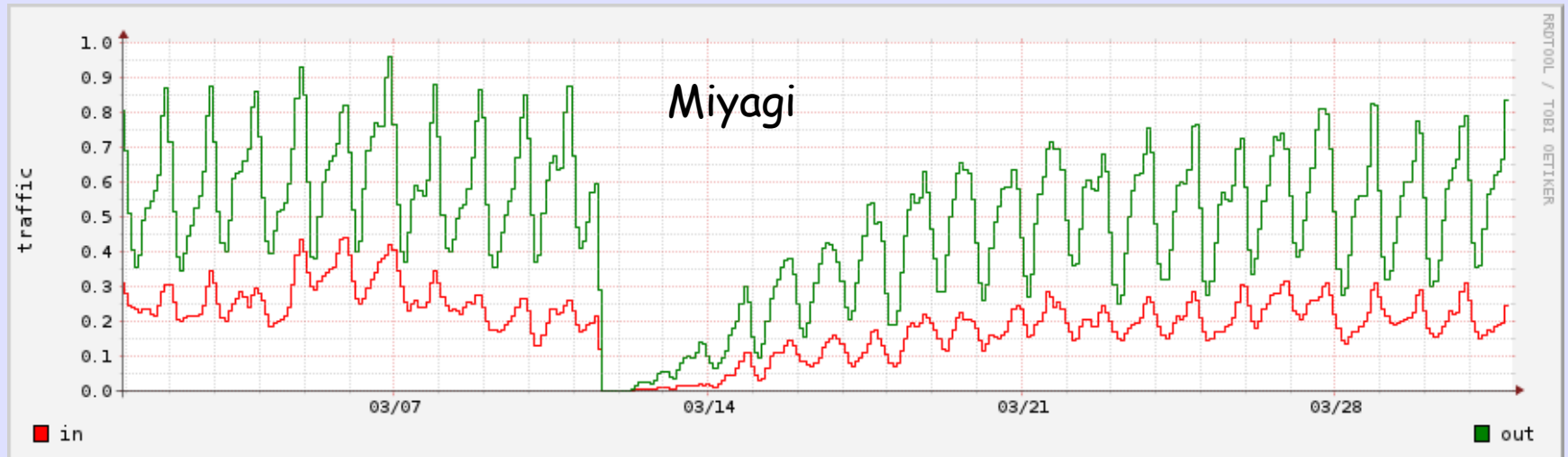
But are Drowned in Normal BGP



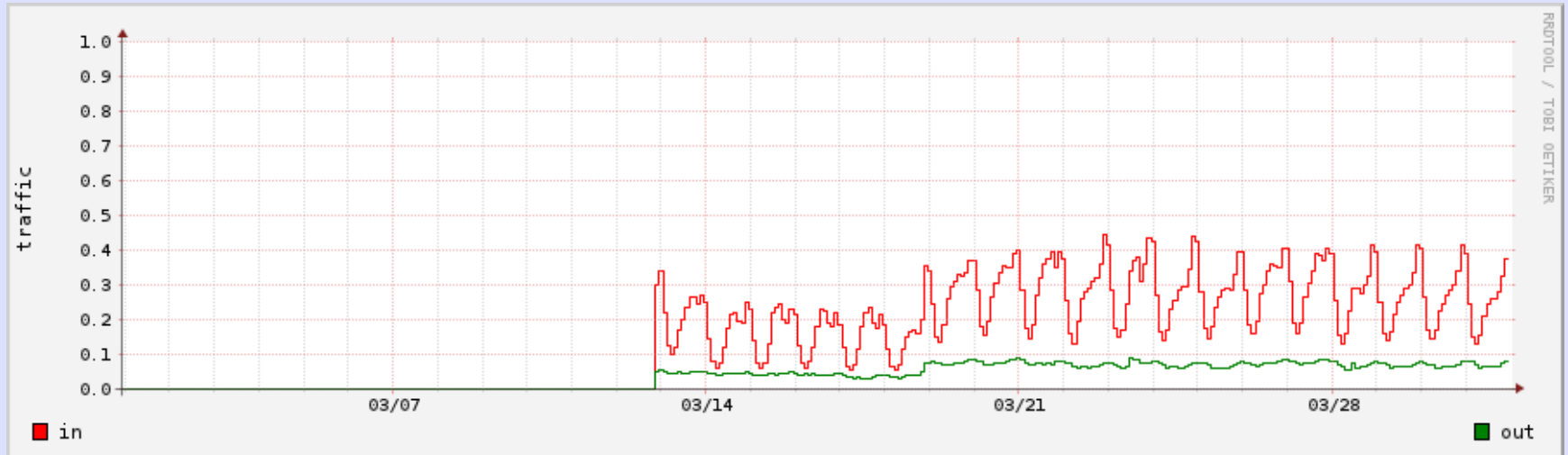
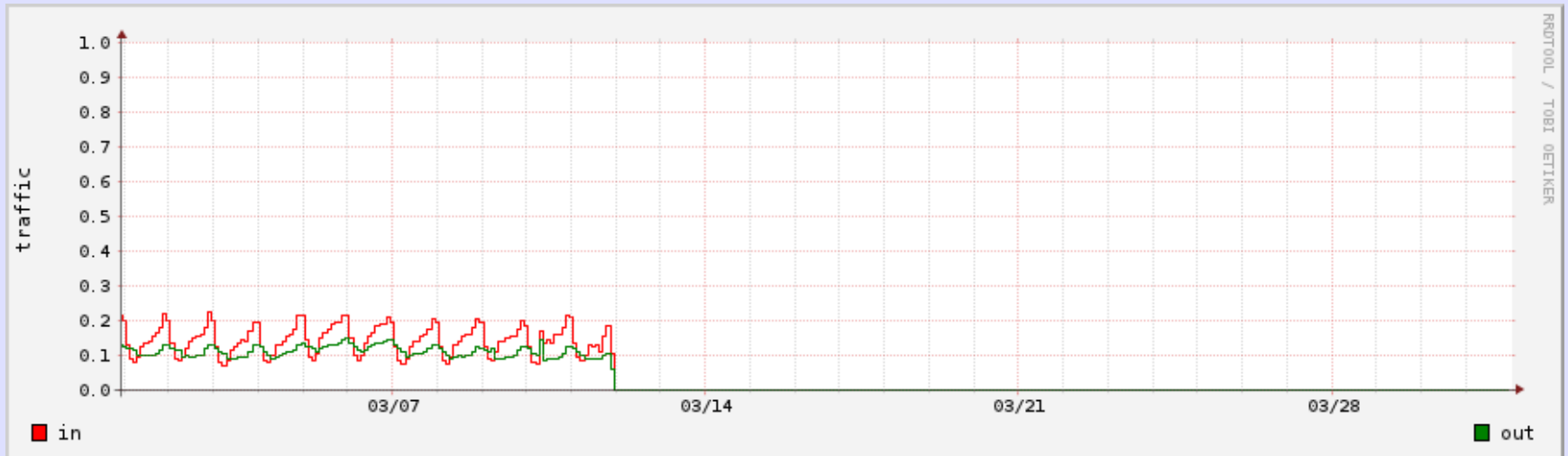
Traffic

- Broadband traffic
- 3 trans-Pacific links under the microscope
- JPNAP

Broadband Traffic

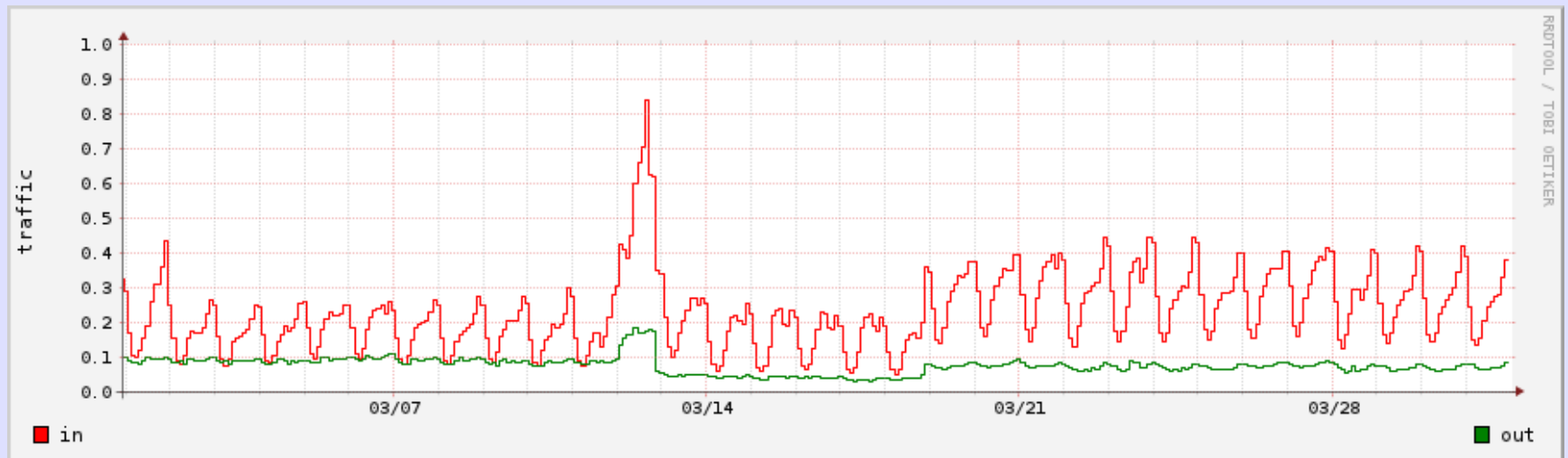


2 Trans-Pacific Links



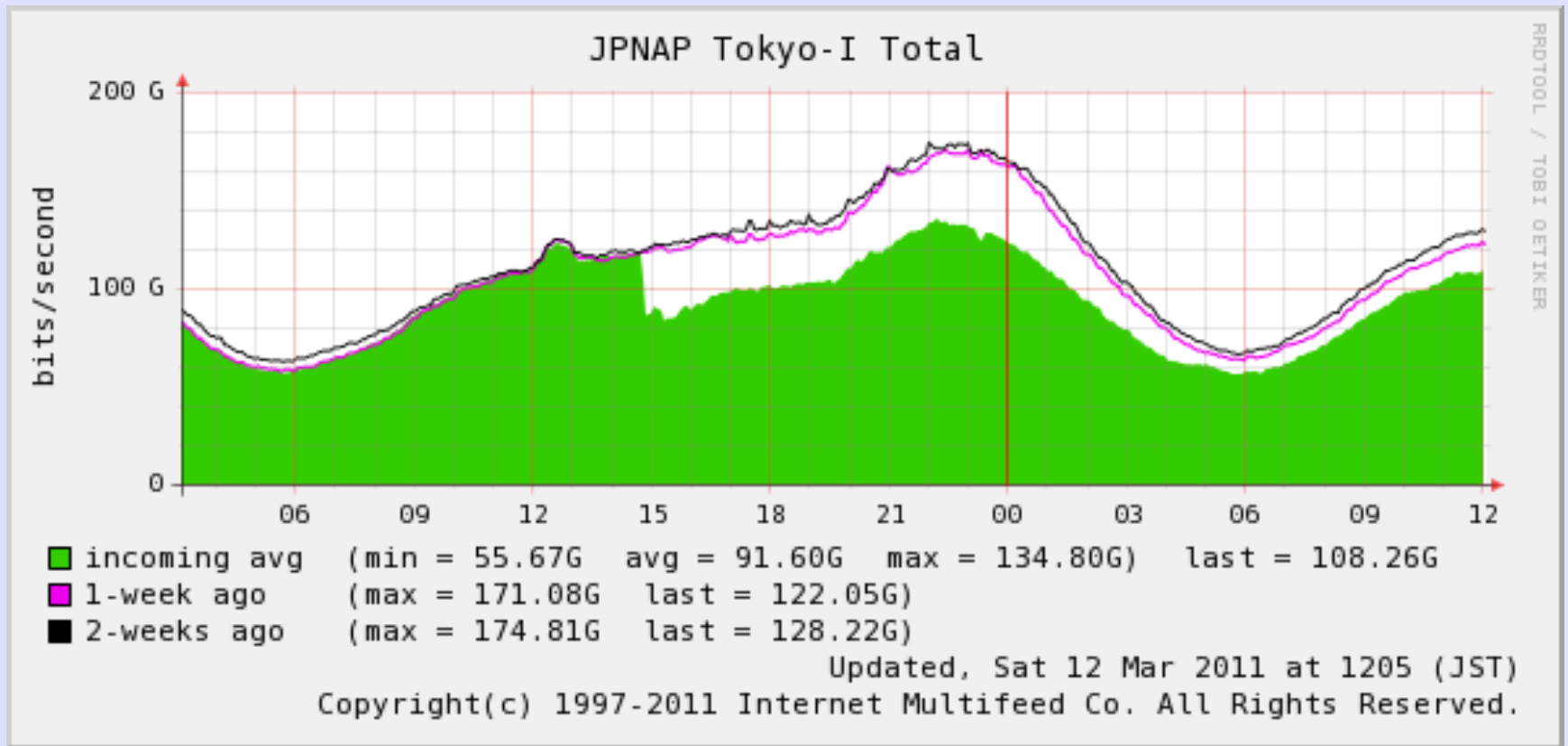
Traffic reroutes to another existing link

Another Trans-Pacific

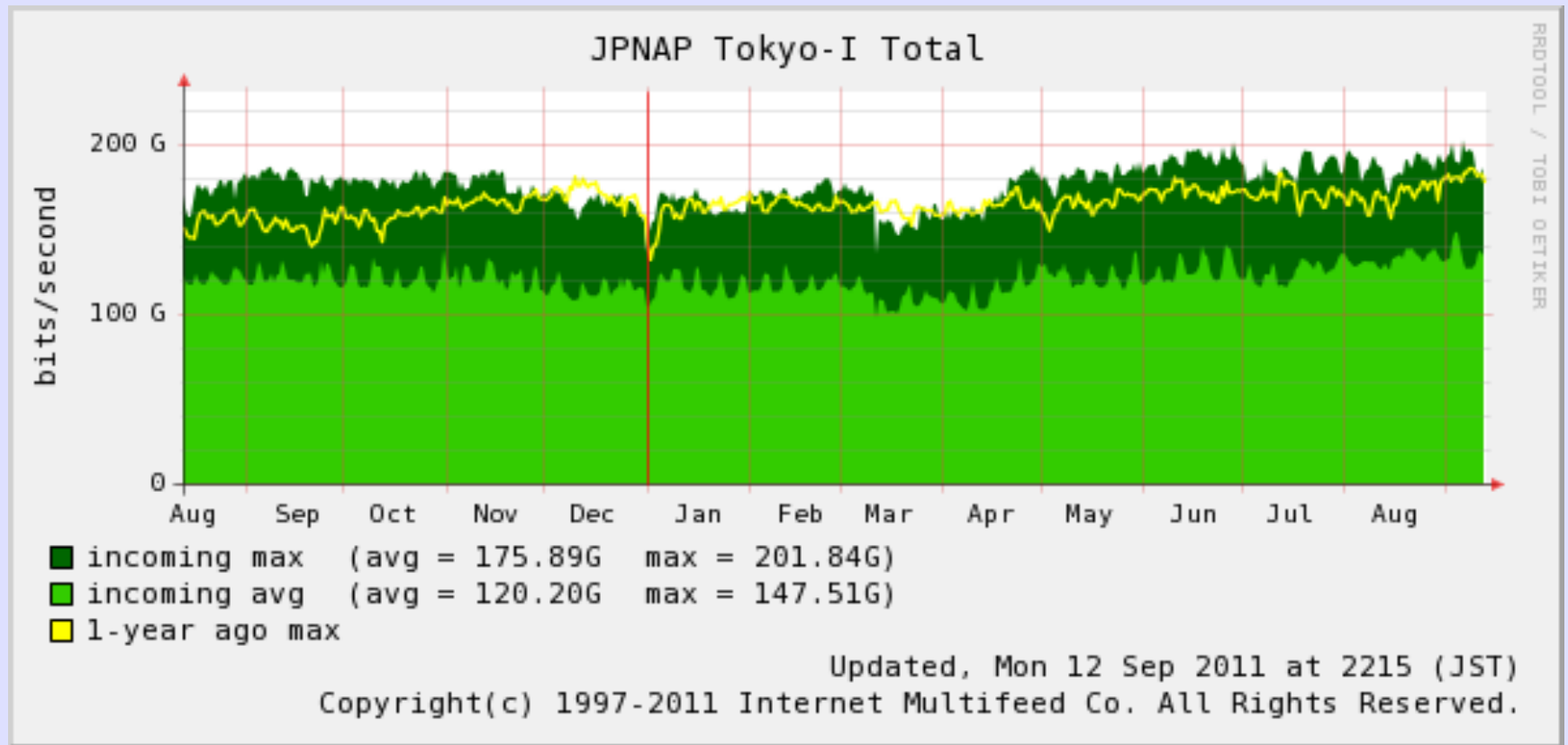


This one Stayed Up
and Had No Congestion

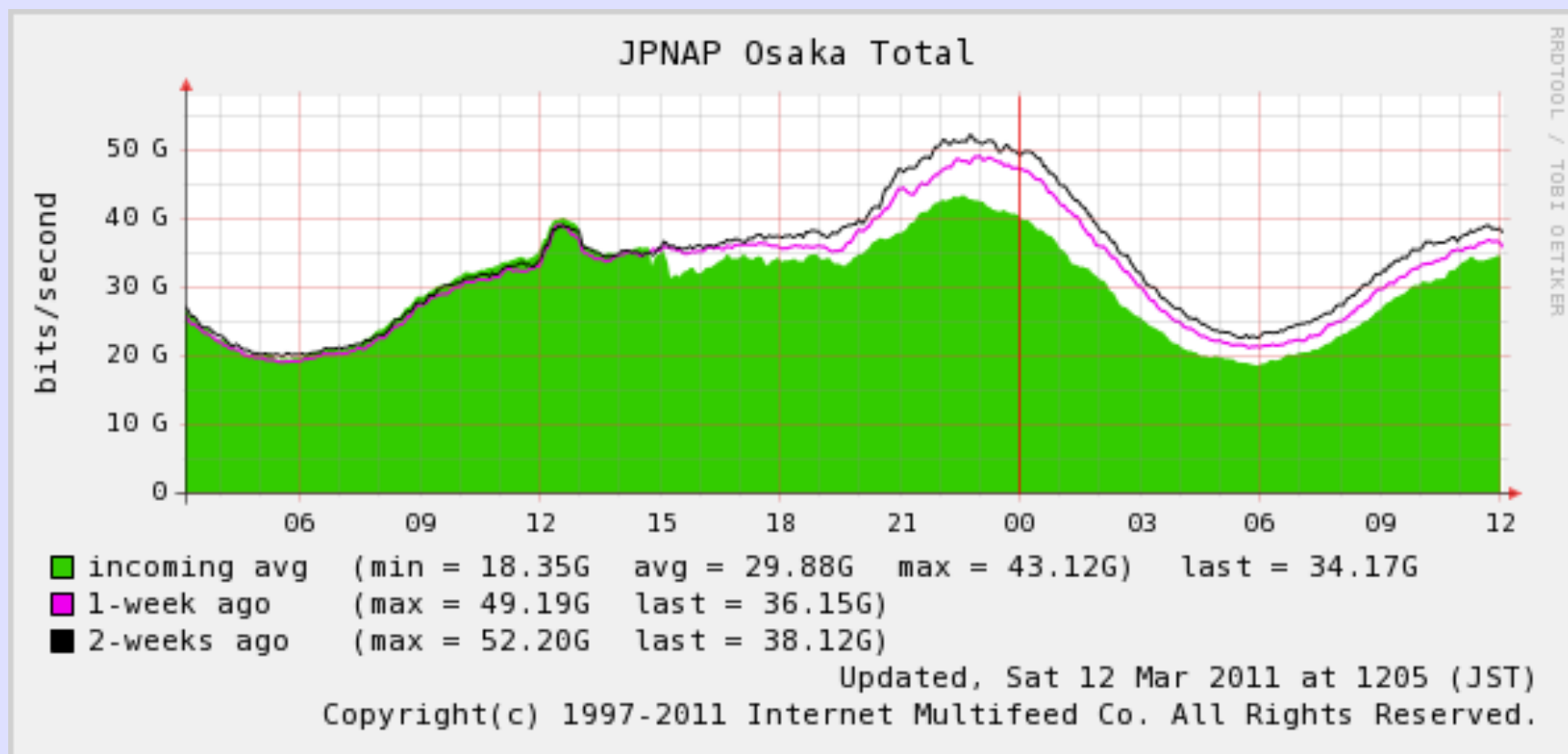
JPNAP: Tokyo 1



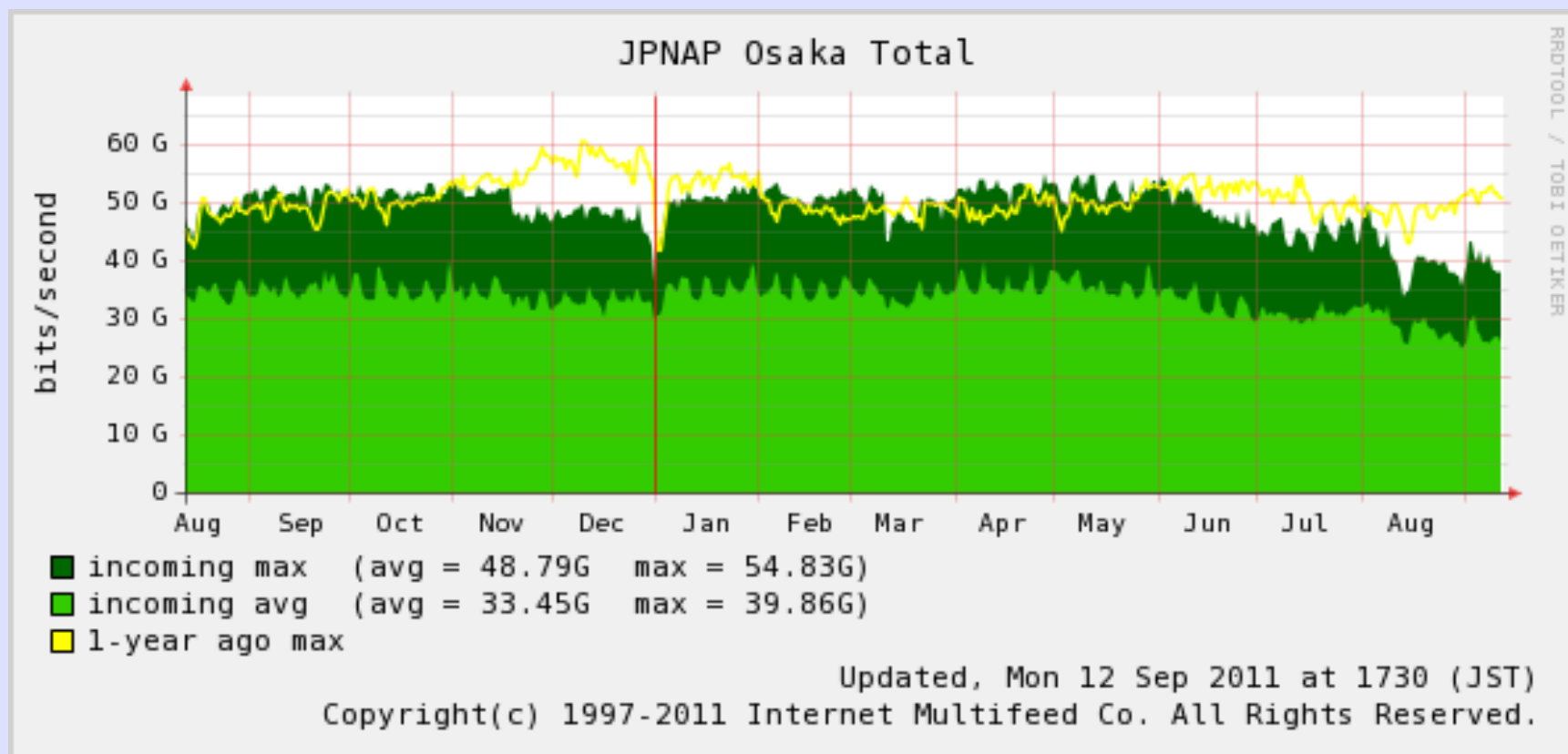
JPNAP: Tokyo 1



JPNAP: Osaka



JPNAP: Osaka



What Else Did We See?

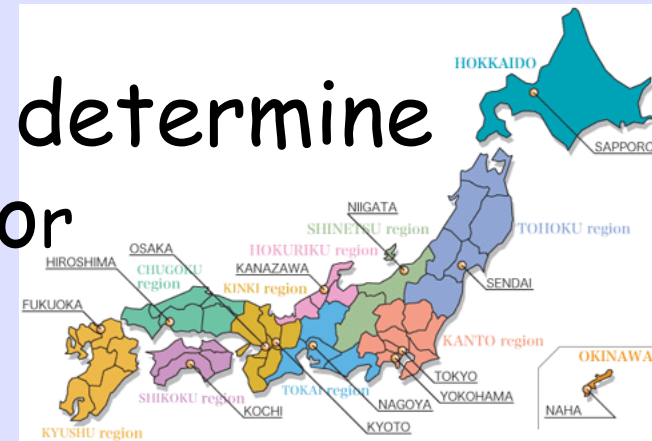
OSPF

One link to Sapporo failed because it shared fate with one of the links to Sendai, no customer effect

BGP

One neighbor router sends peaks of updates every day at the same time

Such a study is useful to determine abnormal behavior



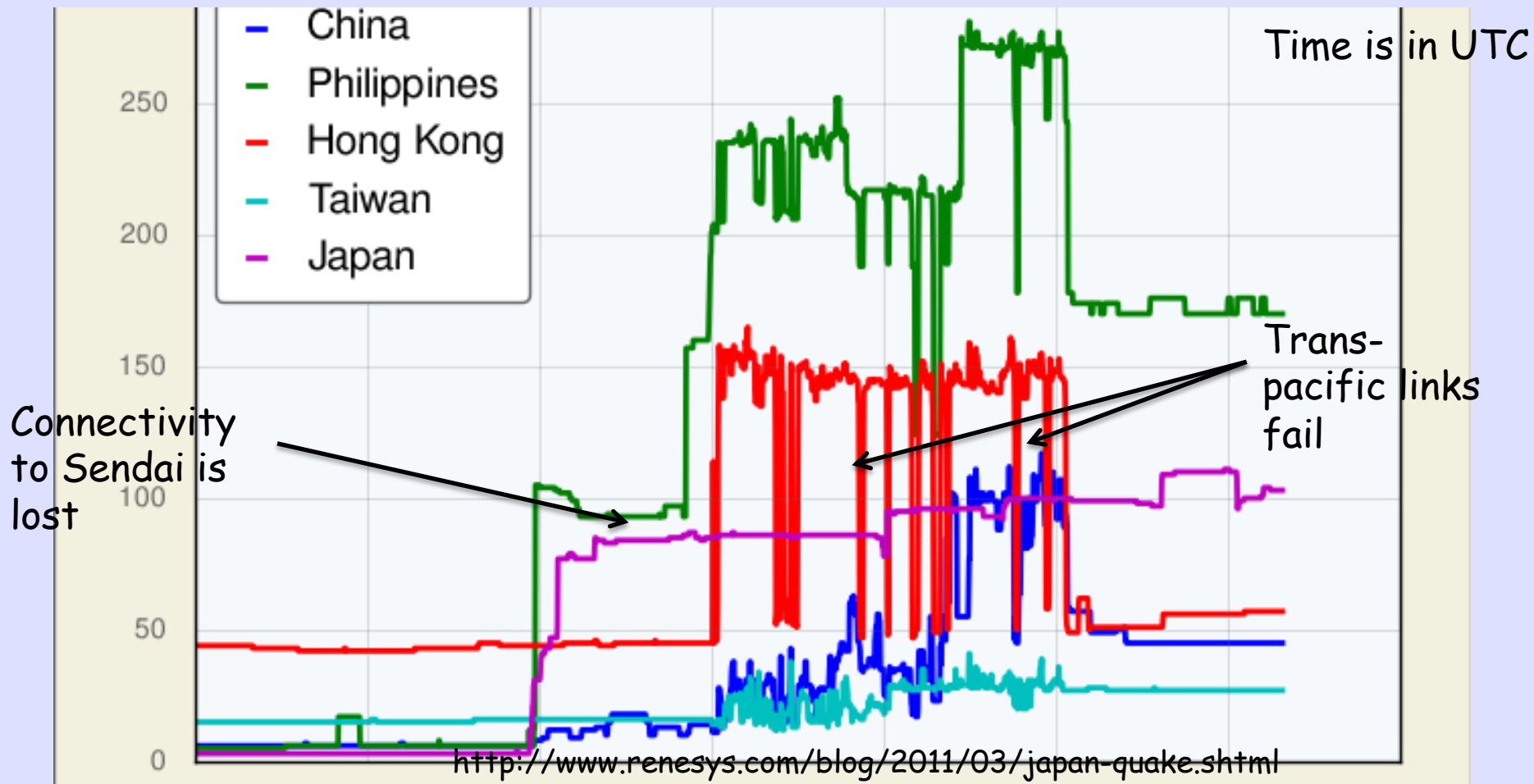
Conclusion

- Sendai disconnected for more than 15 hours
- No effect on non-Sendai customers
- Significant trans-Pacific links impacted by the quake and aftershocks
- Almost nothing to see as IGP and BGP healed the wounds

The Internet Works

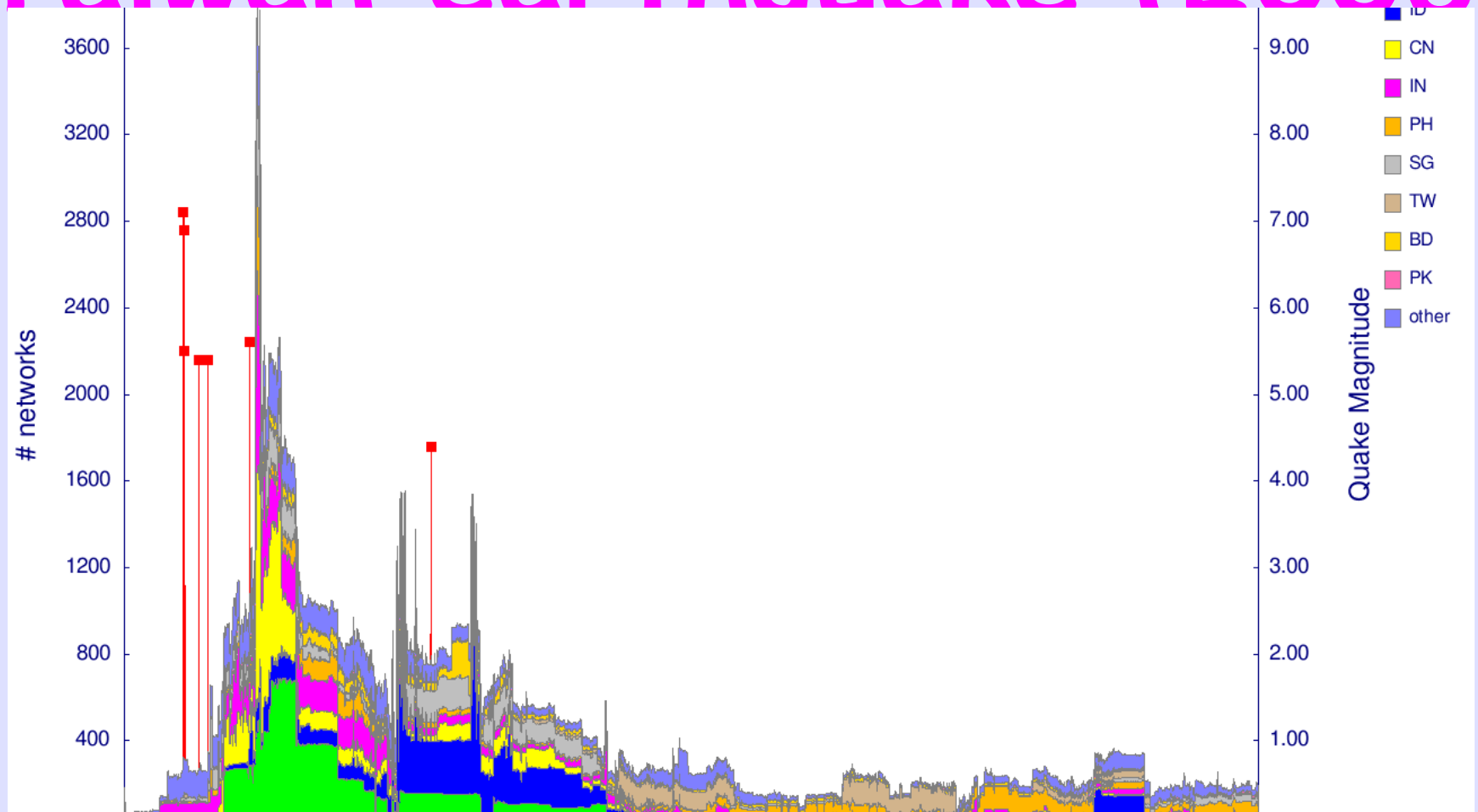
- No MPLS, real IPv6, no secret sauce
- Just IP routing and prudent operations
- Aside from down-times due to physical isolation of Sendai
- No impact on customer traffic
- Routing spikes to work around cuts
- Boring, as it should be

Other studies: Renesys



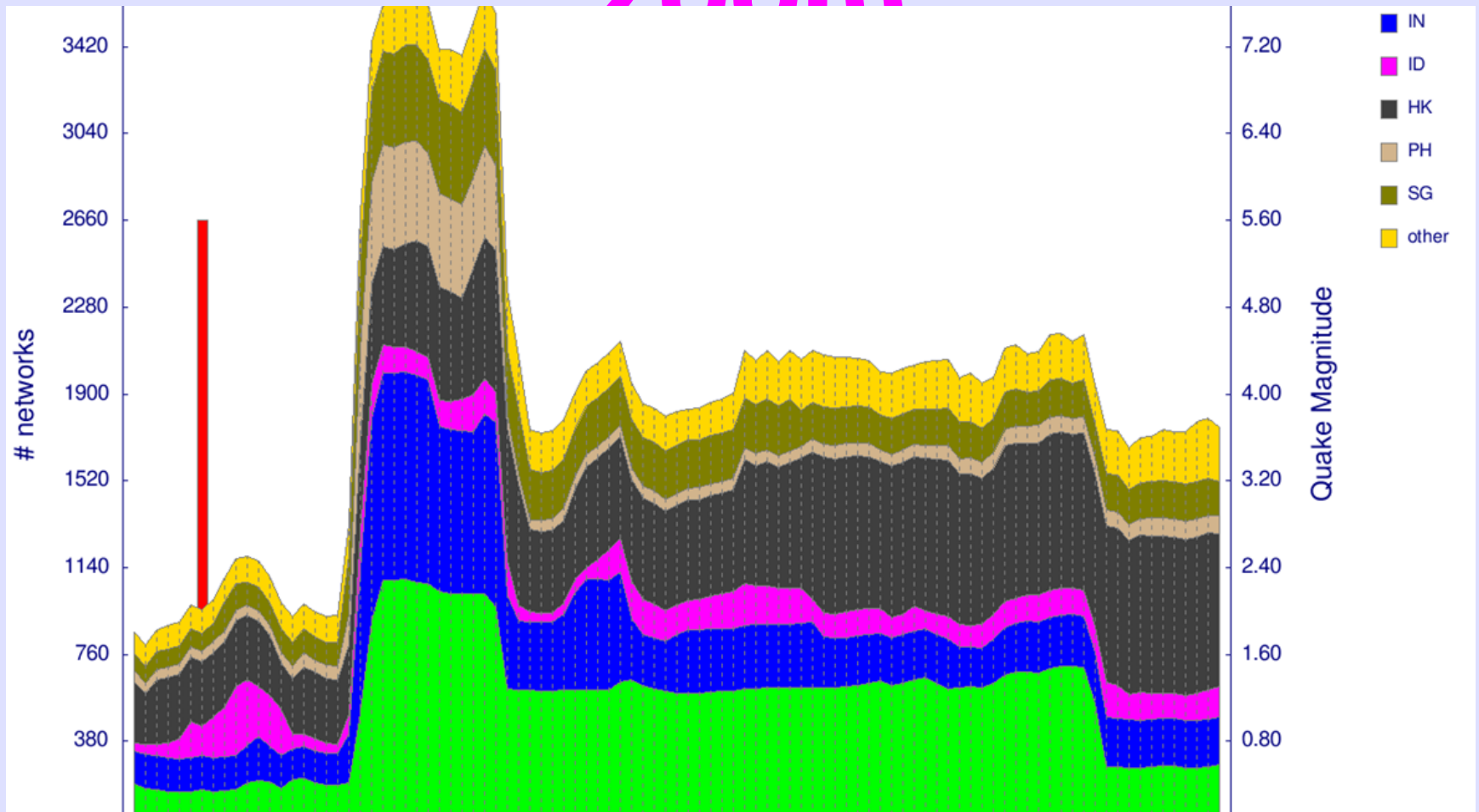
Other disasters:

Taiwan earthquake (2006)

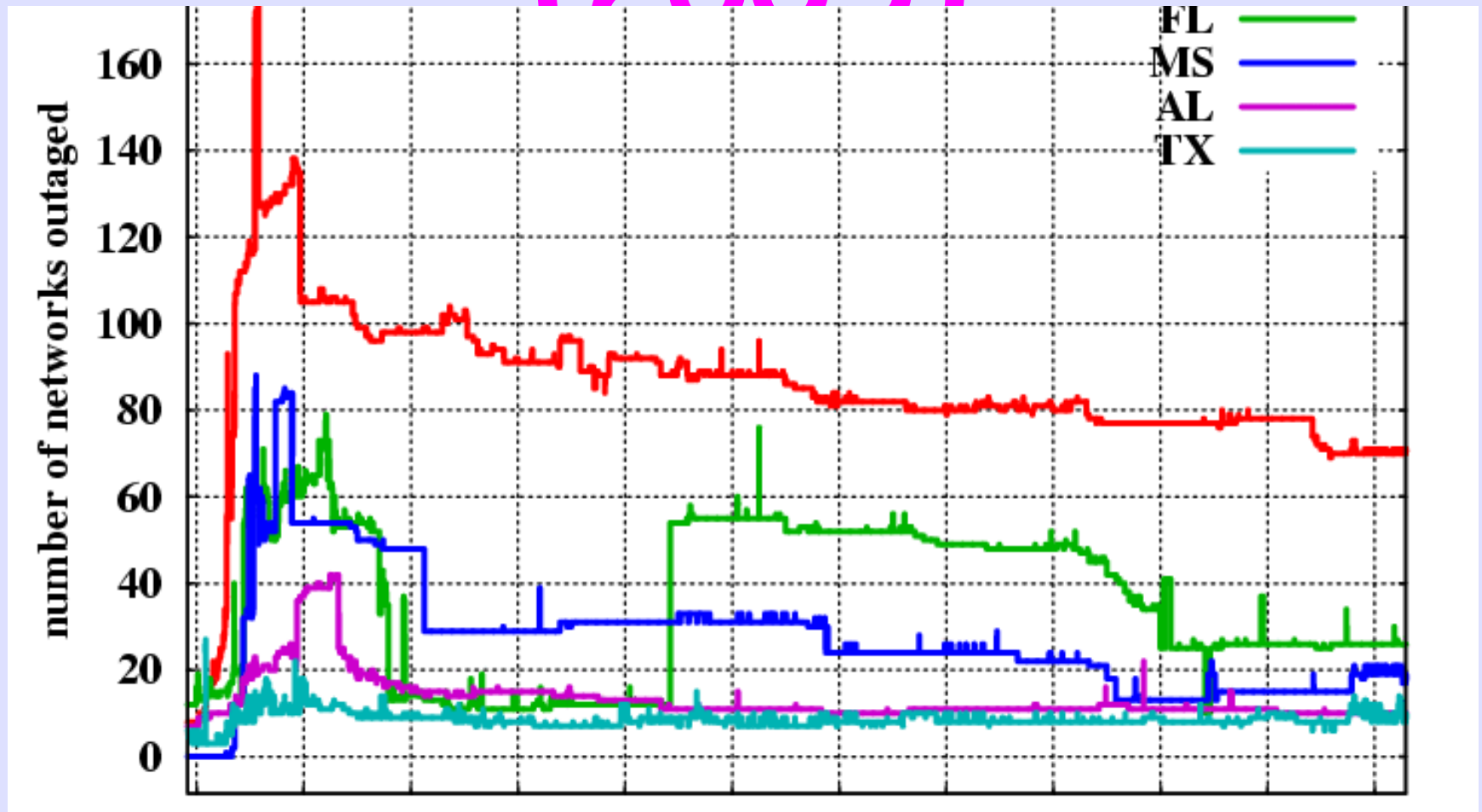


Taiwan earthquake -

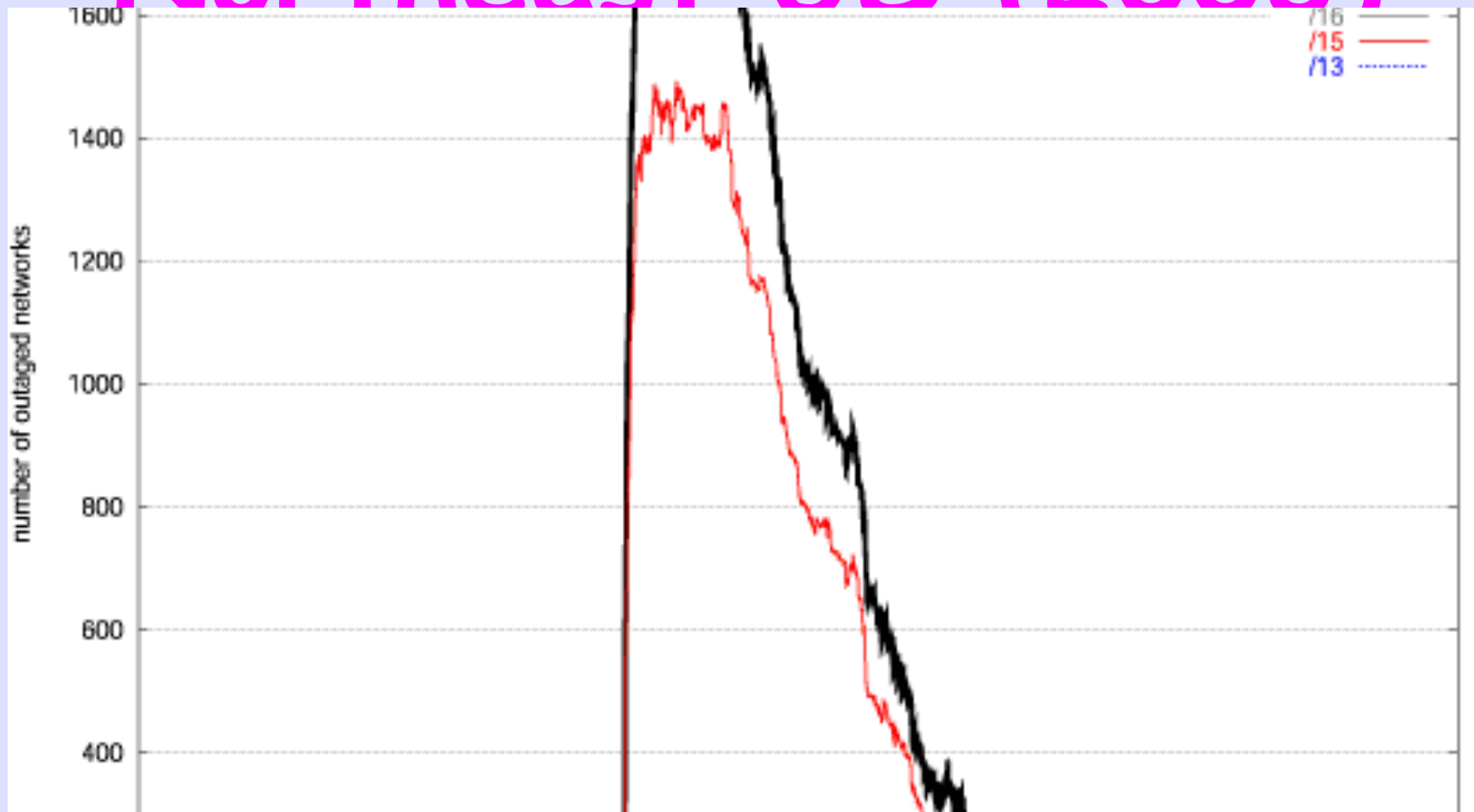
zoom



Hurricane Katrina (2005)



Power outage in the Northeast US (2003)



Comparison

Japan quake effect is very low on the Internet

Only a few hundred prefixes disappear

Similar to Hurricane Katrina

Taiwan earthquake and power outage in the US had much more impact on the global routing table

Demo of Rex

Sendai disconnectivity

Video starting at 5:45, March 11th (UTC)

OSPF activity

History navigator -> Graphs -> OSPF activity

Other studies

Renesys

SINET

...

Ref for outages

[http://japan.zdnet.com/cloud/analysis/
35000414/](http://japan.zdnet.com/cloud/analysis/35000414/)

See JANOG

A few other disasters

Hurricane Irene (East coast of the US,
End of August 2011)

Taiwan earthquake (2006)

Hurricane Katrina (2005)

Power outage in the Northeast US (2003)

9/11 (2001)