An availability model of exchange point and availability of JPNAP

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JPNAP

by Internet Multifeed Co.

Outline

- Brief introduction of JPNAP
- Presenting an availability model of exchange point
- JPNAP solution for improving availability

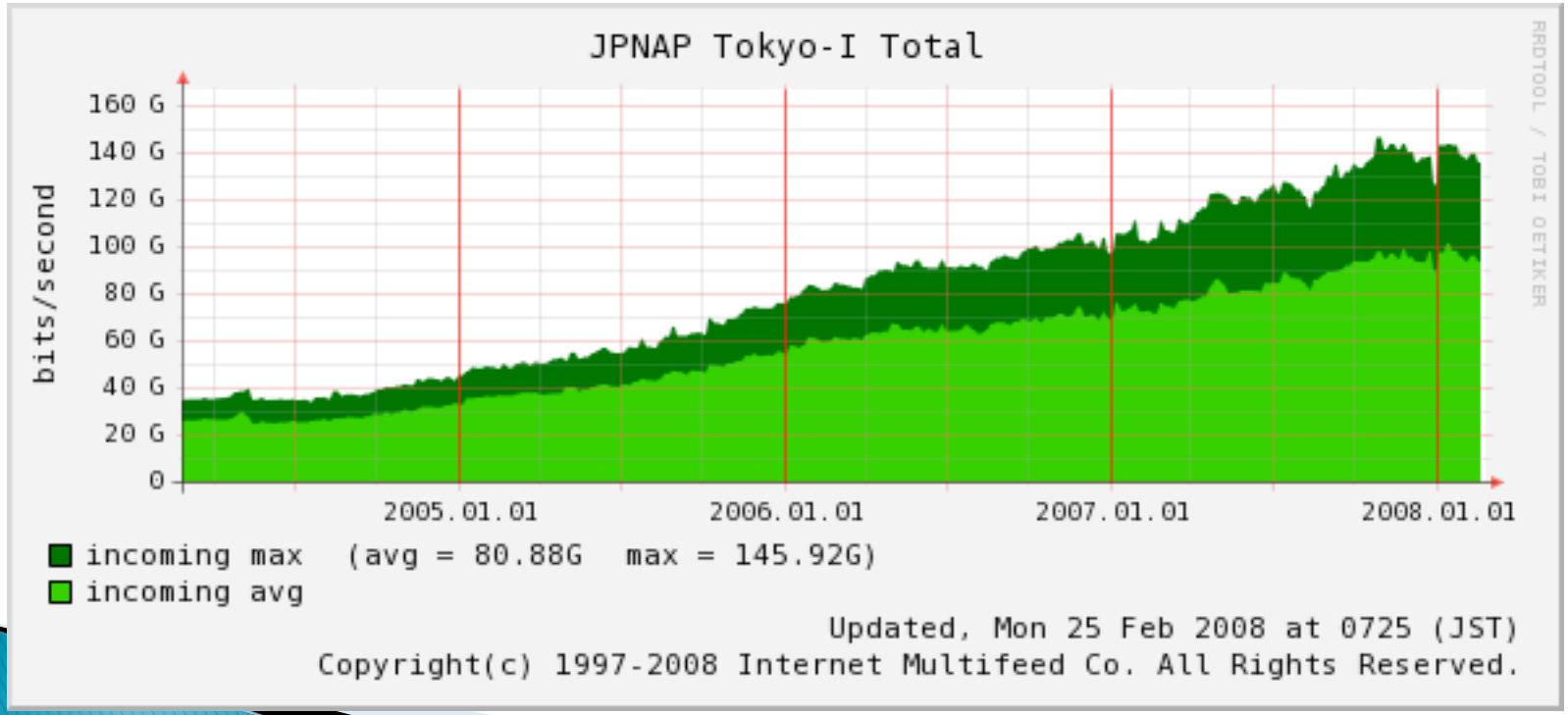
JPNAP: the largest exchange point in Japan

- JPNAP
  - Provided by INTERNET MULTIFEED CO. since 2001
  - Currently **three** locations:
    - JPNAP Tokyo I (Otemachi, the center of Tokyo)
    - JPNAP Tokyo II (Ikebukuro, the hill side of Tokyo)
    - JPNAP Osaka (Dojima, the center of Osaka)

JPNAP Tokyo II started trial service on January 2008.

JPNAP: the largest exchange point in Japan

- JPNAP
  - The largest volume of traffic in Japan
    - 145Gbps at peak, at JPNAP Tokyo 1



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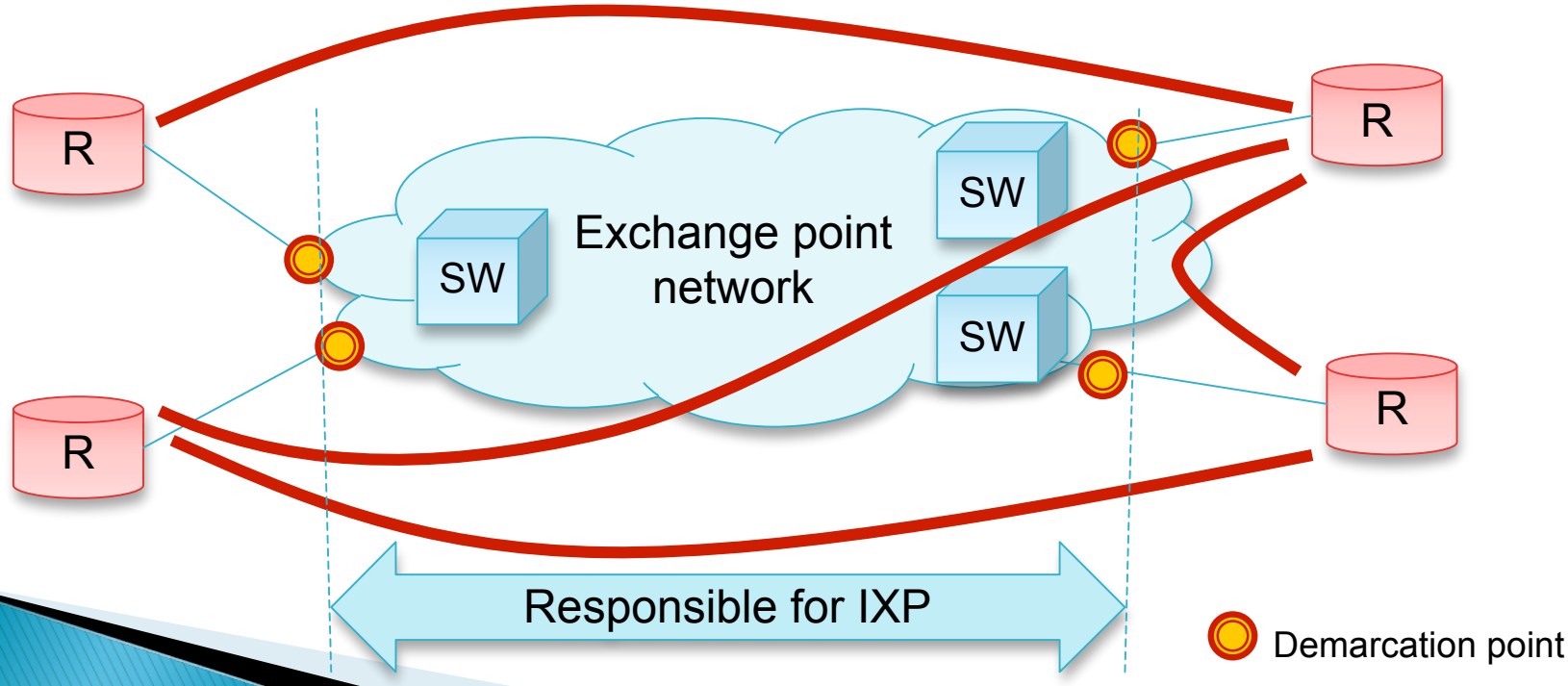
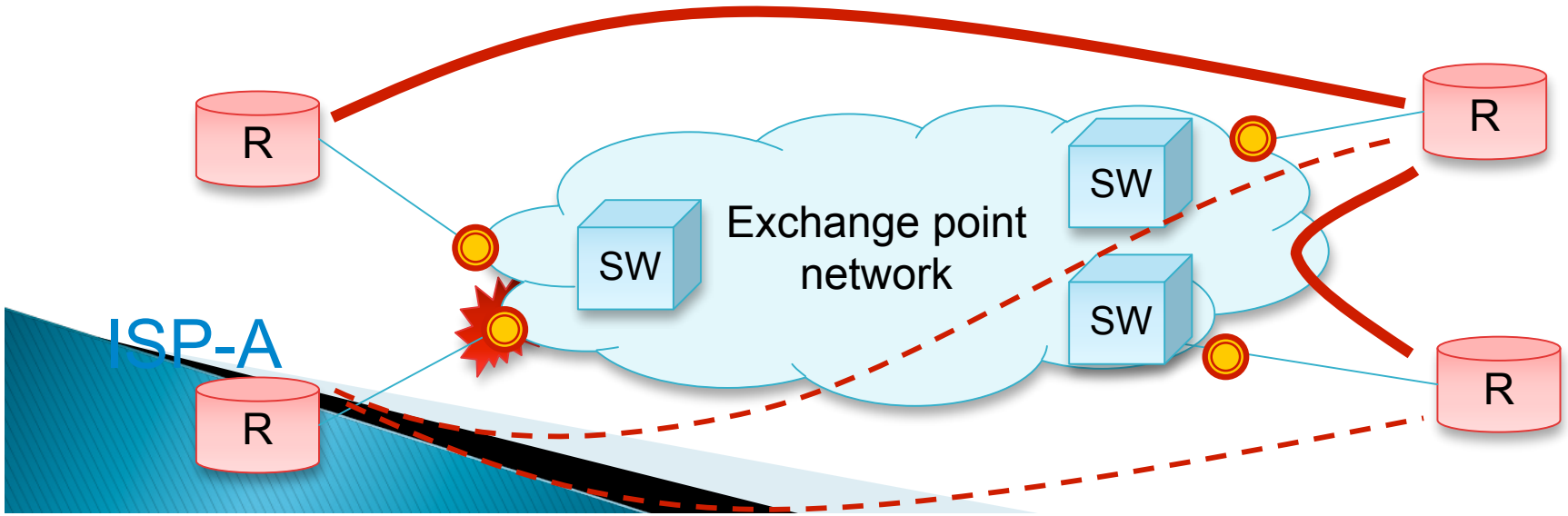
Availability model of exchange point

- Definition: exchange point is “available,” if:
  - All ports for customers are up and running, and
  - No packet loss and no link failure in the switch cloud



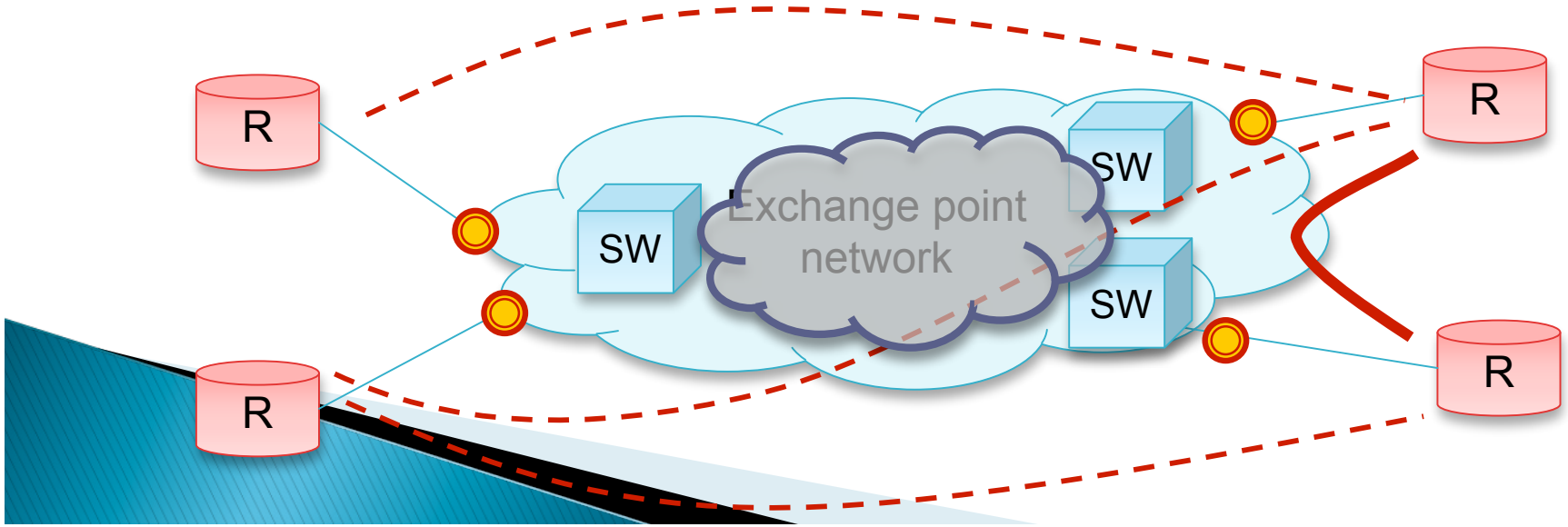
“Not available” cases (1)

- One port for ISP-A is down
  - Due to device failure or maintenance
    - *Other customers who do not peer with ISP-A are not affected. However, an exchange point provider should maintain the environment where all the customers can peer with each other anytime.*



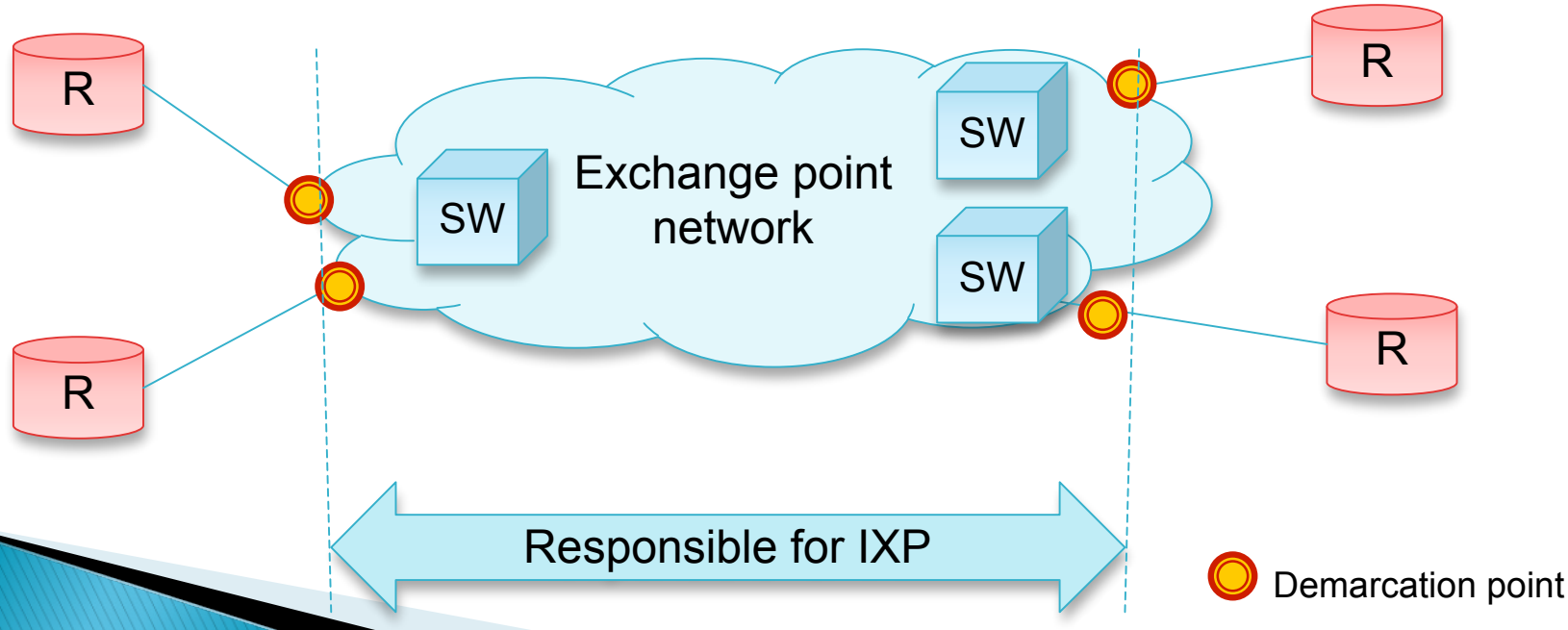
“Not available” cases (2)

- Packet loss or link down in the switching cloud
  - Exchange point should be regarded as big pipe for all the customers, with enough capacity/bandwidth.
    - *It is not the case that a customer is going to push more traffic into the switching cloud than the contacted bandwidth.*



Availability:

- All ports for customers are up, and
- No packet loss and no link failure in the switch cloud



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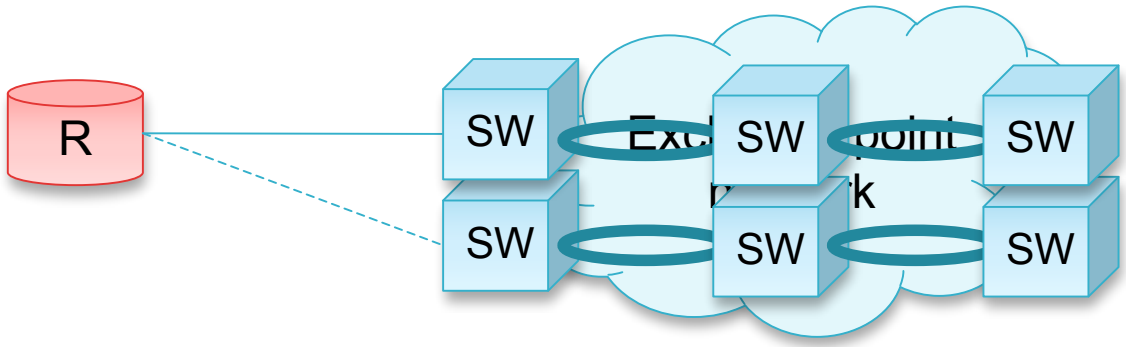
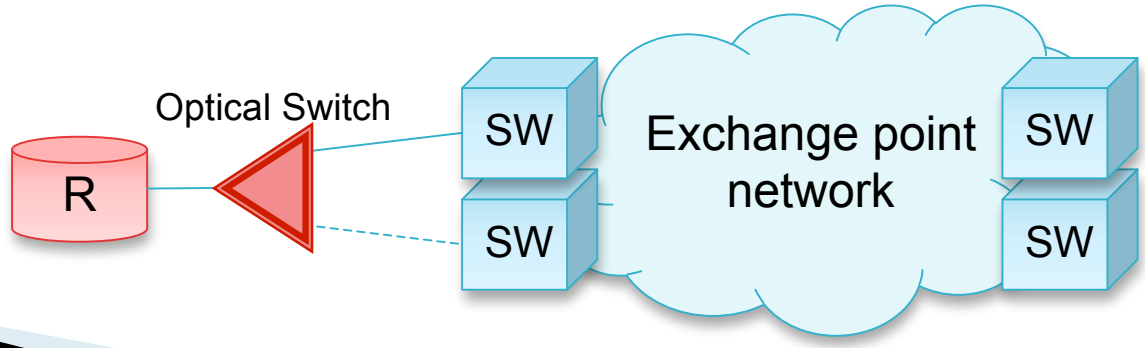
How does JPNAP improve availability?

- (1) Switches and network are redundant
  - We provide main and backup ports to customers



How does JPNAP improve availability?

- (2) Optical switch instanteniously changes troubled port to backup in tens of milliseconds
  - This means most routers do not sense link down, consequently the bgp sessions are not down.
  - Also maintenance can be done by changing some of customer ports to backup.



Case study in JPNAP

- JPNAP service not available (Jul.07-Dec.07)

	Date	Start	Recovered	Reason	Impact	Detailed reason
1	2007/7/6	8:26:28	8:27:00	switch trouble	potentially all the customers	one linecard reset (for trunk)
2	2007/7/7	3:00:00	6:36:00	maintenance	Approx. 10 customers, and their peers	some linecards replaced, software upgraded, and rebooted
3	2007/7/15	3:00:00	6:48:00	maintenance	Approx. 20 customers, and their peers	some linecards replaced, software upgraded, and rebooted
4	2007/7/29	3:00:00	8:00:00	maintenance	no impact on all the customers	switching fabric modules replaced (hot swapped)
5	2007/11/21	15:36:17	15:42:32	human error	two specific customers	forgot to change configuration (regarding port security)
6	2007/11/21	14:20:57	14:25:06	human error	two specific customers	forgot to change configuration (regarding port security)
7	2007/12/1	3:00:00	4:58:00	maintenance	Approx. 5 customers, and their peers	some linecards replaced
8	2007/12/28	18:50:00	19:49:00	switch trouble	one specific customer, and its peers	one port failed partially

Focusing on maintenance work(1)
"no redundancy" case

- If we did not have redundant network, the IX service would not be available during the maintenance window:
- **9 hours and 22 minutes**

	Date	Start	Recovered	Impact time (A)	Reason	Impact	Detailed reason
2	2007/7/7	3:00:00	6:36:00	3:36:00	maintenance	Approx. 10 customers, and their peers	some linecards replaced, software upgraded, and rebooted
3	2007/7/15	3:00:00	6:48:00	3:48:00	maintenance	Approx. 20 customers, and their peers	some linecards replaced, software upgraded, and rebooted
4	2007/7/29	3:00:00	8:00:00	0:00:00	maintenance	no impact on all the customers	switching fabric modules replaced (hot swapped)
7	2007/12/1	3:00:00	4:58:00	1:58:00	maintenance	Approx. 5 customers, and their peers	some linecards replaced

Focusing on maintenance work(2) "*switch network redundancy*"

- If the switch network was redundant but customer cables had to be removed and inserted to backup port manually,
- each customer's downtime would be estimated 30 seconds (remove and insert).
- **17 minutes 30 second**

	Date	Start	Recovered	Impact time (B)	Reason	Impact	Detailed reason
2	2007/7/7	3:00:00	6:36:00	0:05:00	maintenance	Approx. 10 customers, and their peers	some linecards replaced, software upgraded, and rebooted
3	2007/7/15	3:00:00	6:48:00	0:10:00	maintenance	Approx. 20 customers, and their peers	some linecards replaced, software upgraded, and rebooted
4	2007/7/29	3:00:00	8:00:00	0:00:00	maintenance	no impact on all the customers	switching fabric modules replaced (hot swapped)
7	2007/12/1	3:00:00	4:58:00	0:02:30	maintenance	Approx. 5 customers, and their peers	some linecards replaced

Focusing on maintenance work(3) "*customer port redundancy*"

- Optical switch is used for customer ports,
- Each customer's downtime is approximately tens of millisecond.
  - router interface does not sense link-down, accordingly bgp session is kept up.
- **A few seconds**

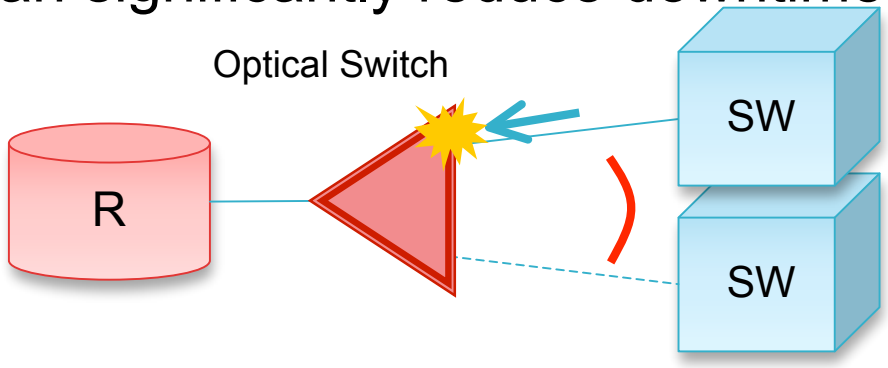
	Date	Start	Recovered	Impact time (c)	Reason	Impact	Detailed reason
2	2007/7/7	3:00:00	6:36:00	0:00:01	maintenance	Approx. 10 customers, and their peers	some linecards replaced, software upgraded, and rebooted
3	2007/7/15	3:00:00	6:48:00	0:00:01	maintenance	Approx. 20 customers, and their peers	some linecards replaced, software upgraded, and rebooted
4	2007/7/29	3:00:00	8:00:00	0:00:00	maintenance	no impact on all the customers	switching fabric modules replaced (hot swapped)
7	2007/12/1	3:00:00	4:58:00	0:00:01	maintenance	Approx. 5 customers, and their peers	some linecards replaced

How much availability differs?

- Focusing only on these maintenance works, downtime/availability is in each case
  - (1) 9h 22m 0.0831% (99.9169%)
  - (2) 17m 20s 0.0026% (99.9974%)
  - (3) 3s 0.0001% (99.9999%)
    - 2007/7/1 – 2007/12/31 (184 days)
    - Actual availability including other outage during this period: 99.9897%

Benefits of our optical switches

- This period we had no case that a Tx port down of our switches.
  - If this optical switch detects the loss of light, it changes **instanteniously** to the backup port.
    This can significantly reduce downtime.



  - Downtime is only tens of millisecond,
    while it would be 10 minutes or 1 hour to change it manually.

Conclusion

- We presented an availability model of exchange point.
- Using the model, we calculated JPNAP availability.
- JPNAP provides high availability to customers by:
  (1) redundant switch network, and
  (2) optical switches

Thank you!

- Any questions or comments?

Not available (Jul.07-Dec.07)

	Date	Start	Recovered	Impact time (A)	Impact time (B)	Impact time (c)	Reason	Impact	Detailed reason
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6	2007/11/21	14:20:57	14:25:06	0:04:09	0:04:09	0:04:09	human error	two specific customers	forgot to change configuration (regarding port security)
7	2007/12/1	3:00:00	4:58:00	1:58:00	0:02:30	0:00:01	maintenance	Approx. 5 customers, and their peers	some linecards replaced
8	2007/12/28	18:50:00	19:49:00	0:59:00	0:59:00	0:59:00	switch trouble	one specific customer, and its peers	one port failed