



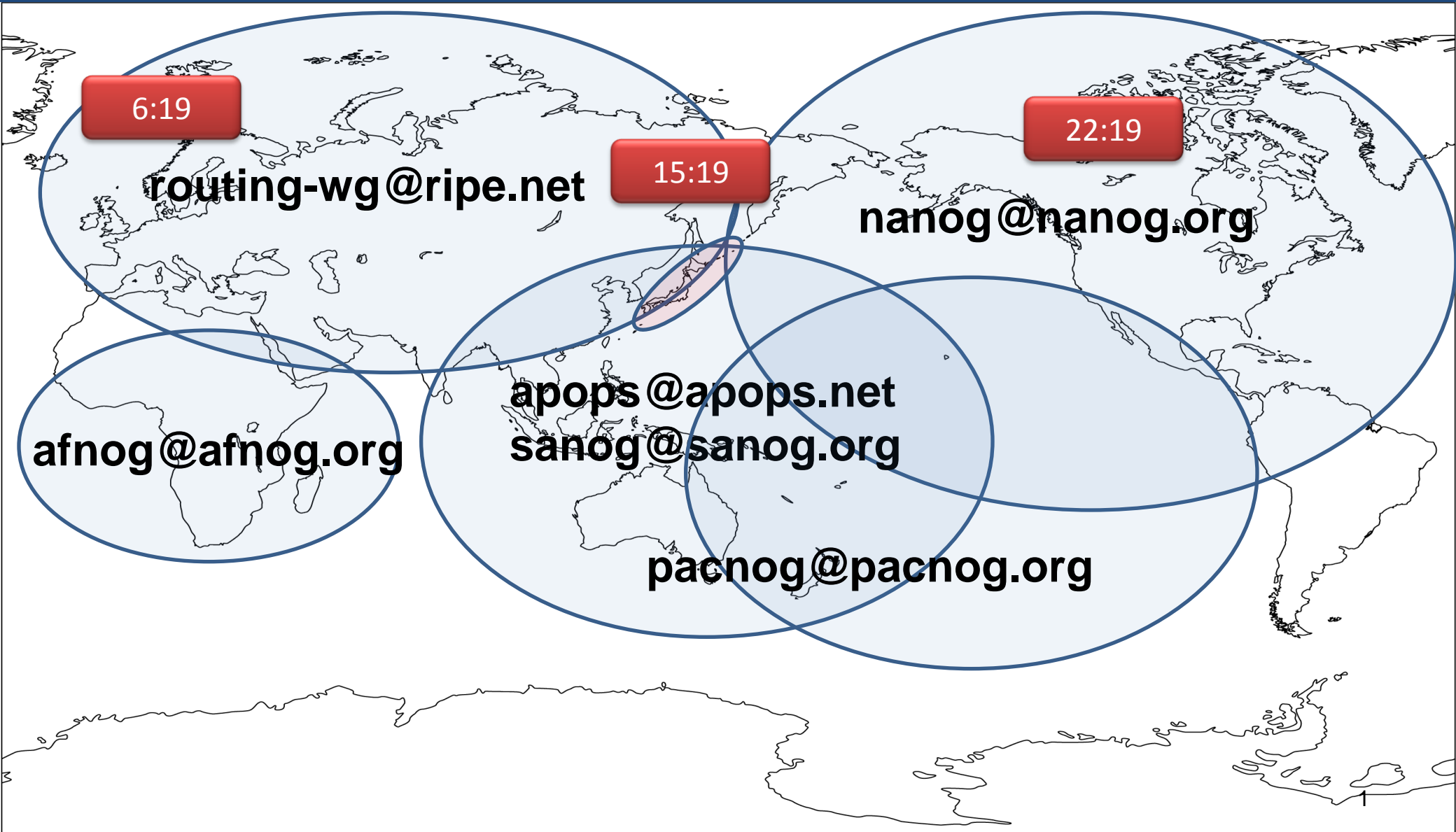
Inter-networking during disaster

Remember M9.0 Earthquake 14:46 11th Mar. 2011

Tomoya Yoshida @ Internet Multifeed (JPNAP)

We memorize this disaster and move forward

2011/3/11 15:19(JST), 33min's later



2011/3/11 15:19(JST)

6:19

routing-wg@ripe.net

15:19

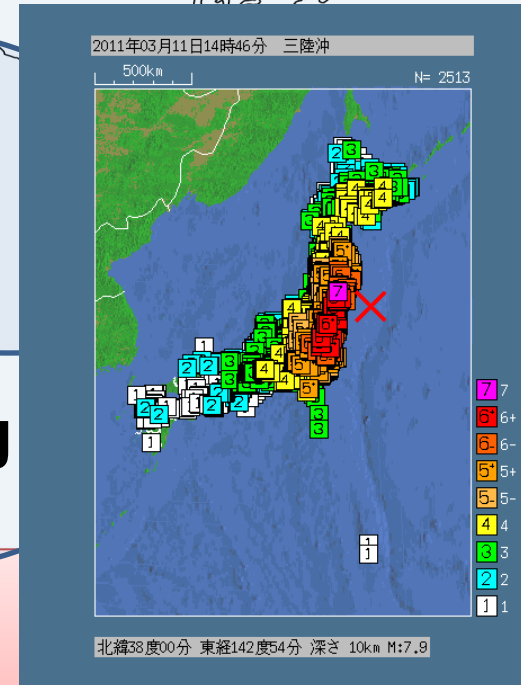
22:19

nanog@nanog.org

afnog@afnog.org

apops@apops.net
sanog@sanog.org

pacnog@pacnog.org



Just one sentence:
Japan had so big terrible earthquake

9 min's later

15:28

On Fri, 11 Mar 2011 15:28:37 +0900 (JST)

Yasuhiro Orange Morishita / 森下泰宏 <yasuhiro@jprs.co.jp> wrote:

超速報ですが、JP DNSサーバーは現時点で無事の模様。

-- 森下泰宏/Orange

9 min's later

15:28

JP DNS is working 😊

On Fri, 11 Mar 2011 15:28:37 +0900 (JST)

Yasuhiro **Orange** Morishita / 森下泰宏 <yasuhiro@jprs.co.jp> wrote:

超速報ですが、JP DNSサーバーは現時点で無事の模様。

-- 森下泰宏/**Orange**



apops@apops.net : We verified all JP DNS servers are still fine.

A record for about 40 min's after the quake

- 14:46 M9.0 Great East Japan Earthquake
- 15:15 M7.7 big aftershock
- 15:19 Subject: so big earthquake in JP
 - To : apops@apops.net, nanog@nanog.org, routing-wg@ripe.net, afnog@afnog.org, sanog@sanog.org, pacnog@pacnog.org
- 15:28 “JP DNS is working” by Mr. Morishita@JPRS

A record for about 40 min's after the quake

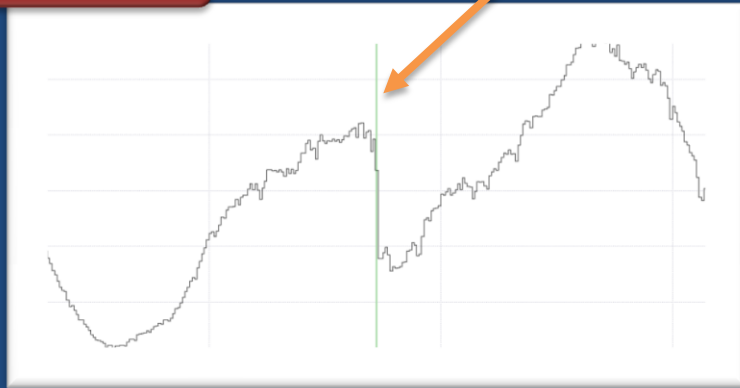
- **14:46 M9.0 Great East Japan Earthquake**
- **14:5X Called my home but not available**
- **14:59 Sent e-mail to my wife mobile phone**
- **15:05 Could reach my home by skype_out [2:05]**
- **15:09 Sent an empty e-mail nttv6.jp → ntt.com**
 - checking whether a mail of ntt.com could be received via internet ; OK
- **15:15 M7.7 big aftershock**
- **15:16 Sent to parents "I am OK"**
- **15:19 Subject: so big earthquake in JP**
 - To : apops@apops.net, nanog@nanog.org, routing-wg@ripe.net, afnog@afnog.org, sanog@sanog.org, pacnog@pacnog.org
- **15:27 "We are OK" from a parent**
- **15:28 "JP DNS is working" by Mr. Morishita@JPRS**

2011年3月11日	
Call to 自宅, duration 02:05.	15:05
Call to 自宅, duration 02:41.	17:51
Call to 自宅, no answer.	20:36
Call to 自宅, no answer.	20:37
Call to 自宅, no answer.	20:38
Call to 自宅, no answer.	20:57
Call to 自宅, no answer.	20:57
Call to 自宅, no answer.	20:58
Call to 自宅, no answer.	22:33
Call to 自宅, no answer.	22:34
Call to 自宅, duration 00:13.	22:34
Call to 自宅, no answer.	22:35
Call to 自宅, no answer.	22:36
Call to 自宅, no answer.	22:49
Call to 自宅, no answer.	22:51
Call to 自宅, no answer.	22:53

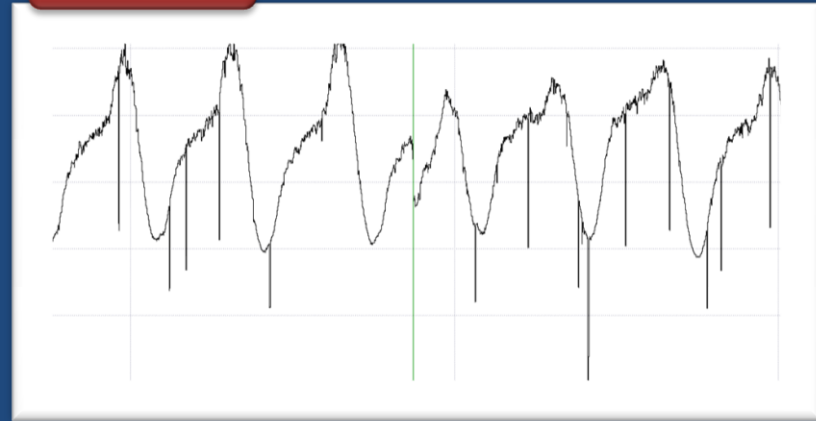
Traffic – 1 day, 1 week, 1month

1day

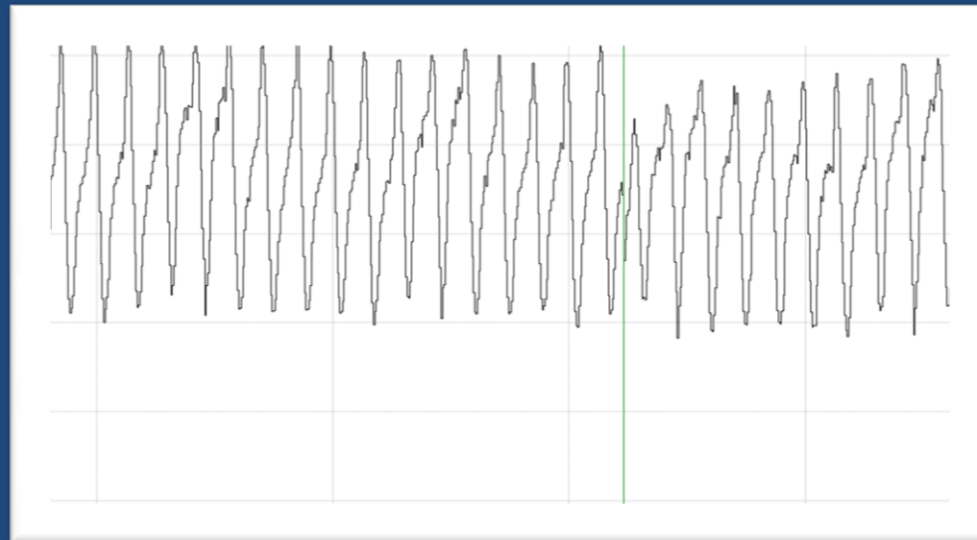
14:46 11th Mar. 2011



1week

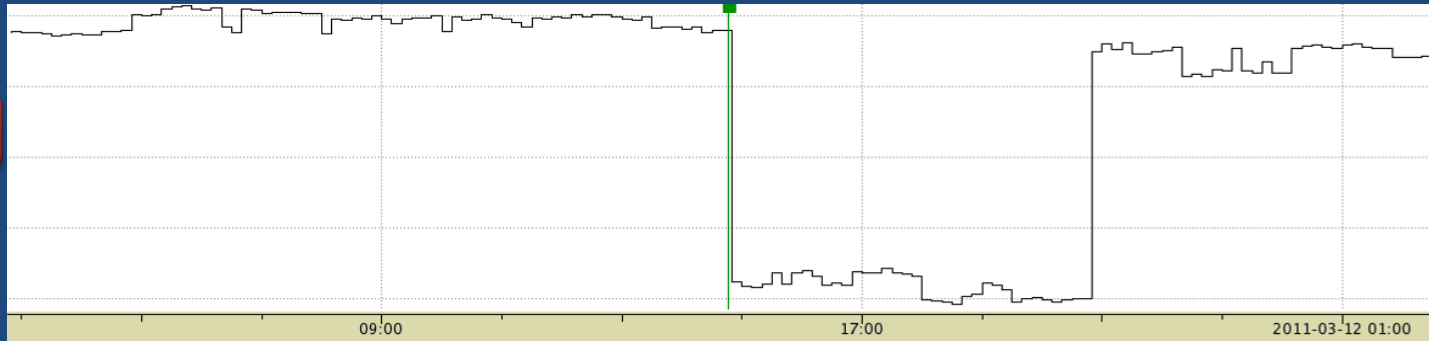


1month



BGP Routes – 1 day, 1 week, 1 month

1day



1week



1month



not zero

2011/3/11 Traffic

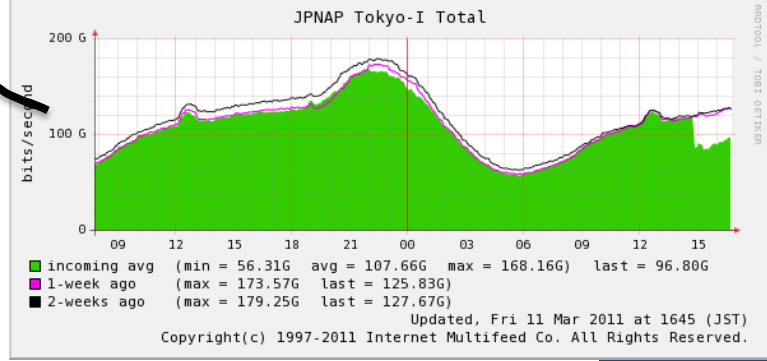
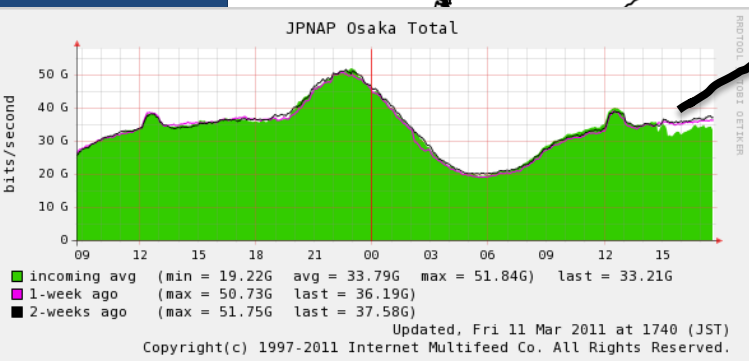
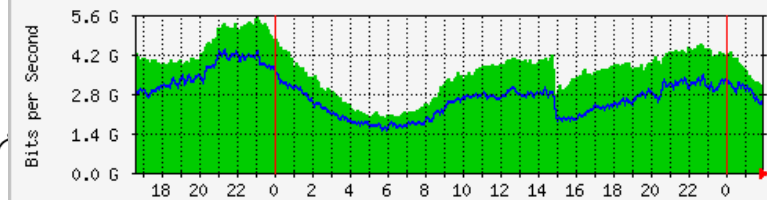
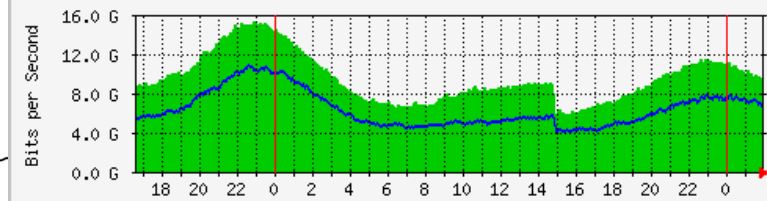
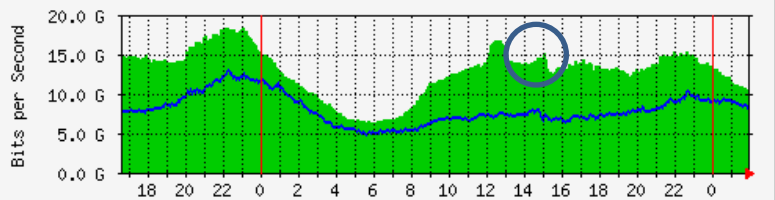
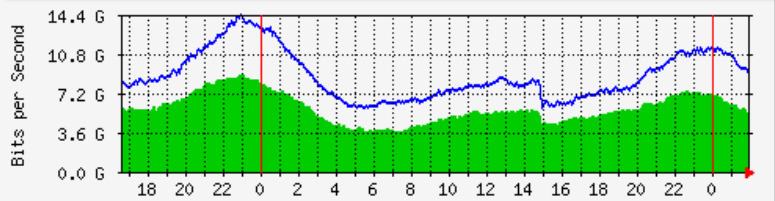
Possible traffic rerouted and the internet in whole Japan kept functioning

West

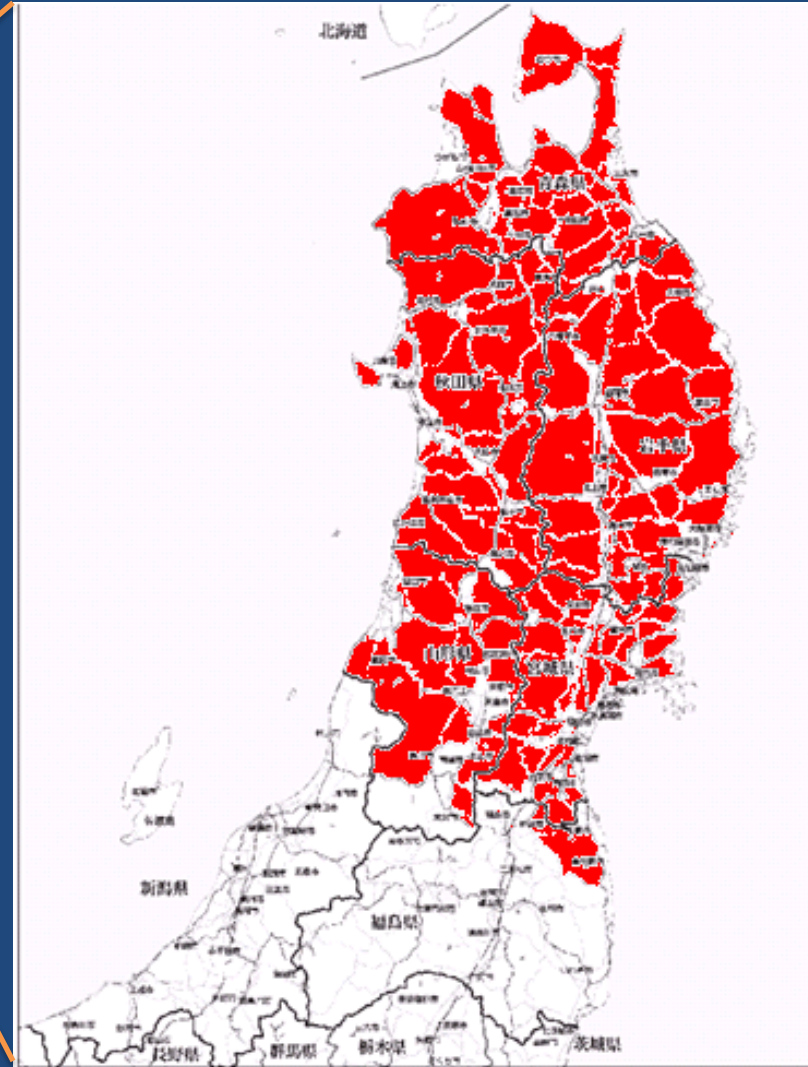
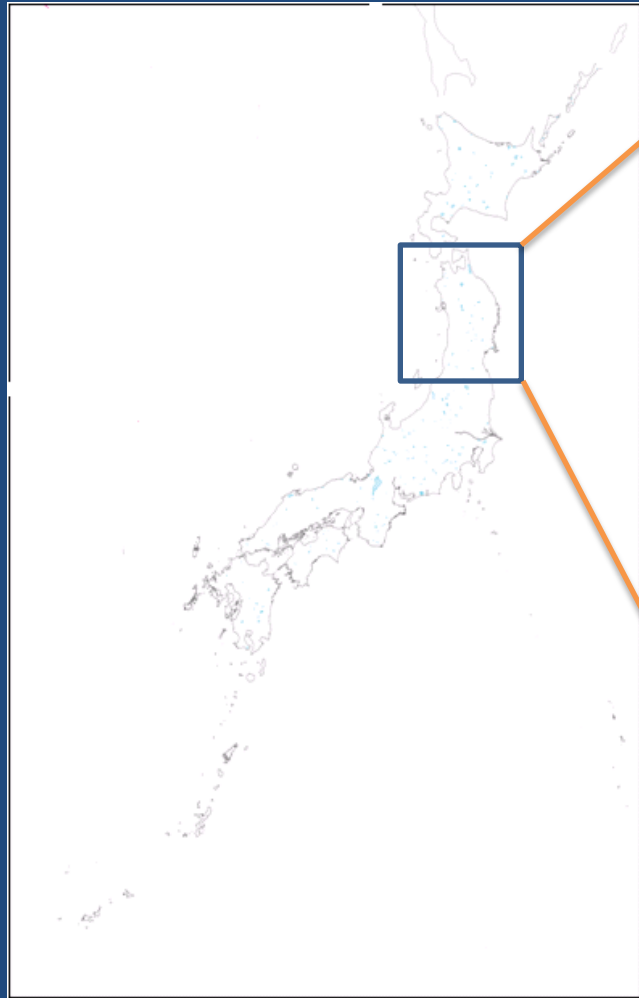
Also observed traffic down in west area (especially the ISP who deploy hot-potato routing)

East

30% down

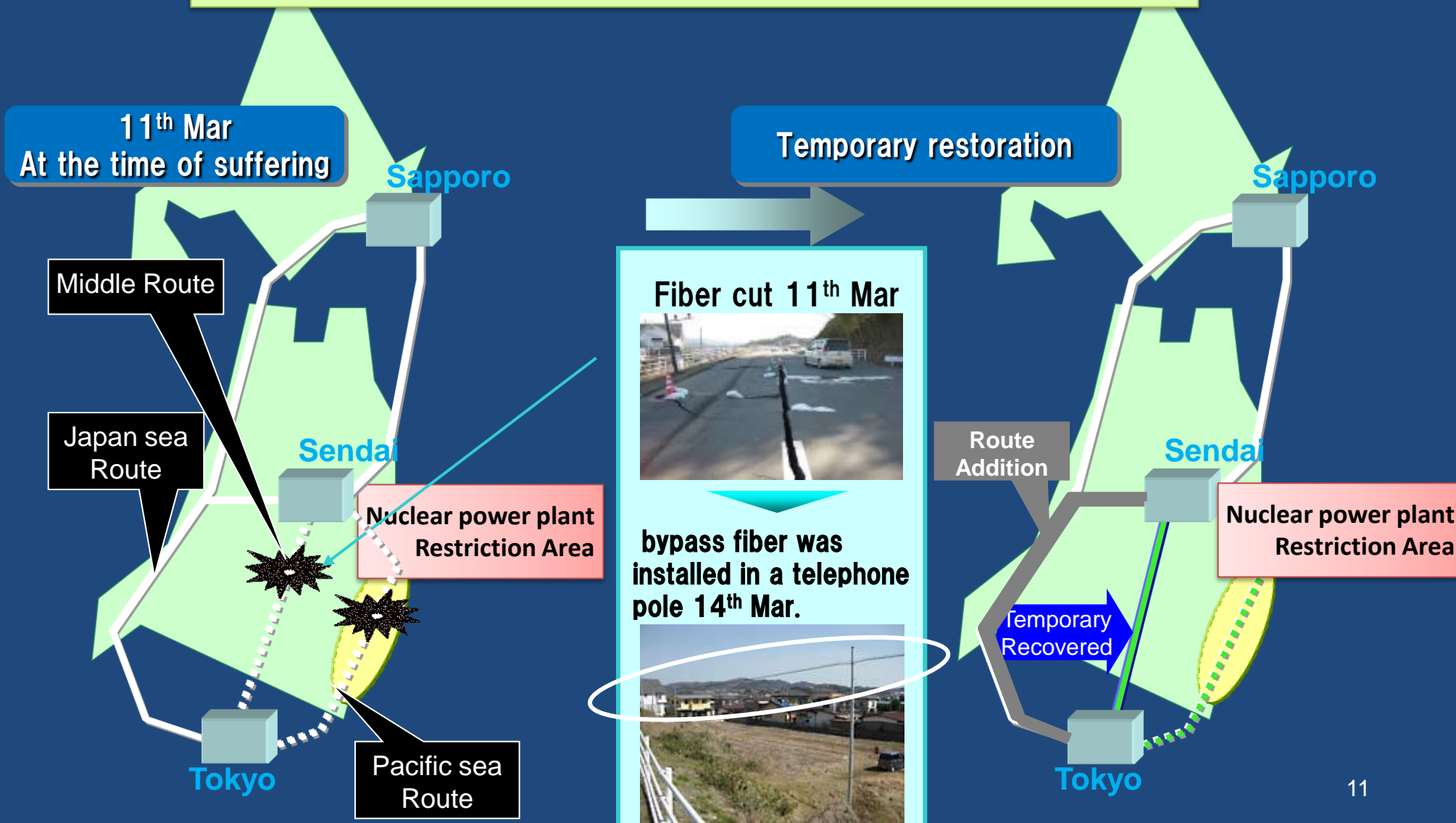


Influence of a blackout 2011/3/11 22:00(JST)



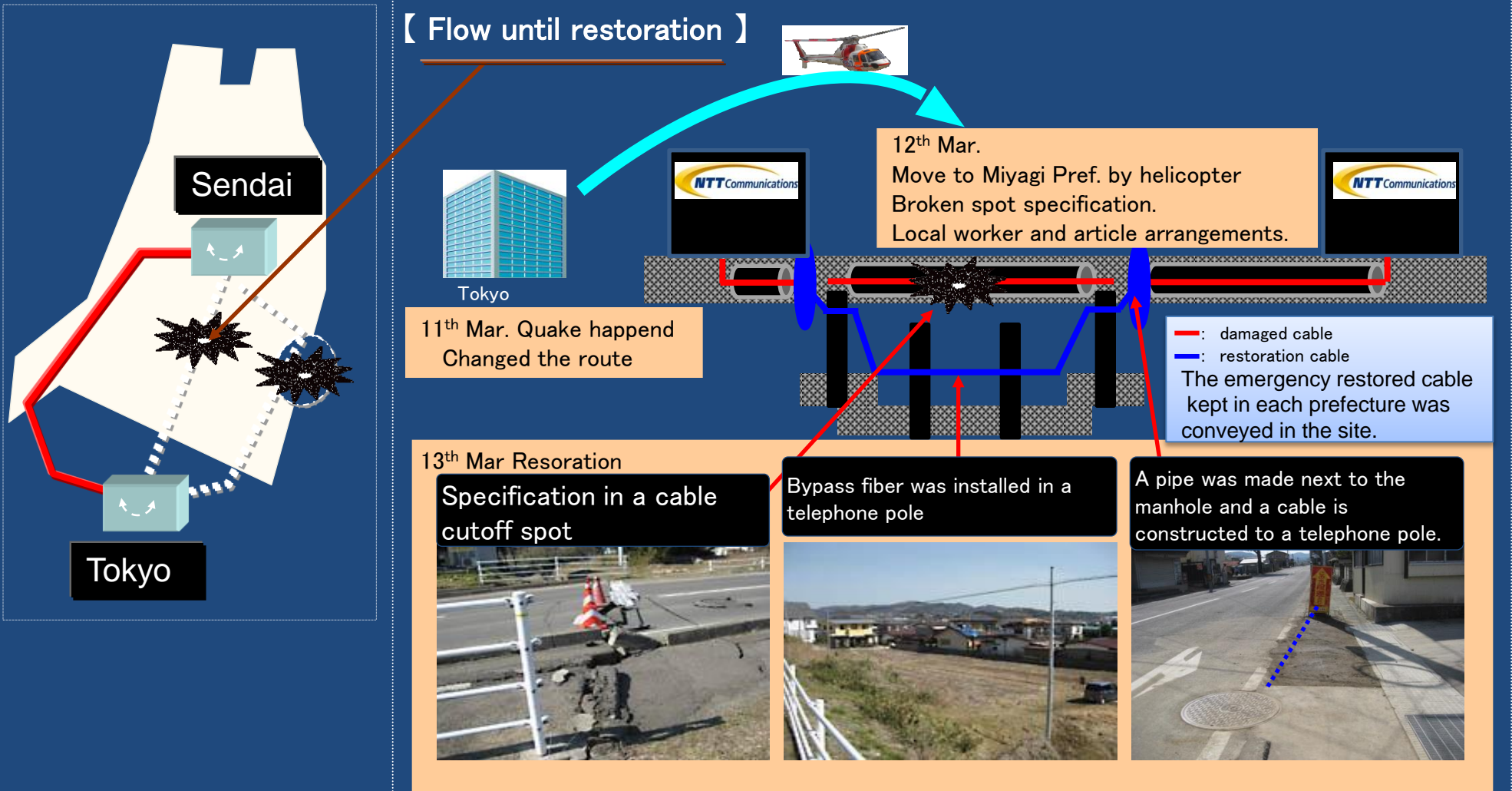
Cutoff of a domestic relay cable (NTTCom)

Among 3 routes, 2 routes were hit at the same time



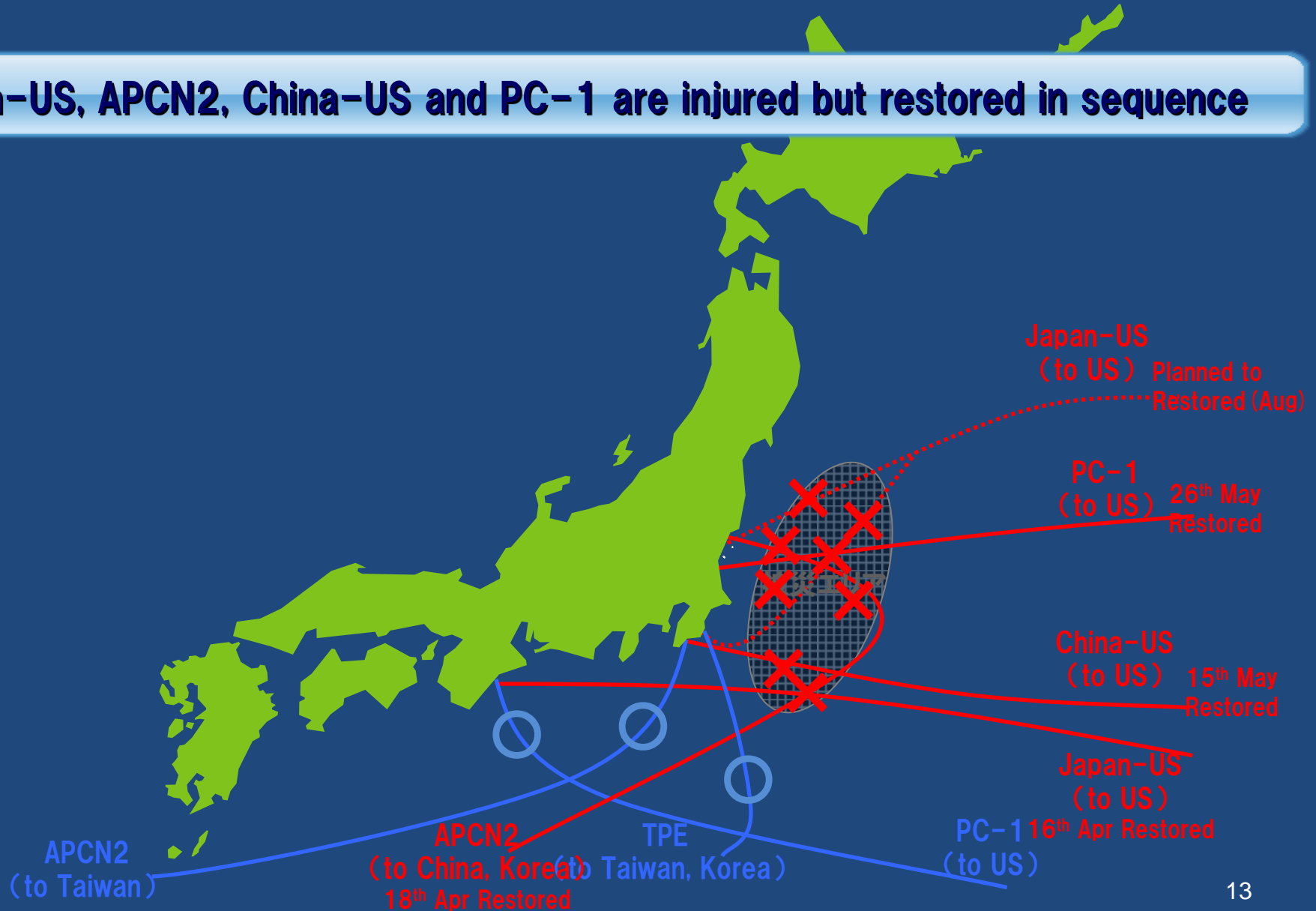
Restoration of relay cable (NTTCom)

- Restoration of cutoff points, building a bypass route, changing a route etc,
- Emergency restoration has been completed 2 days later



Submarine cable outage (NTTCom)

Japan-US, APCN2, China-US and PC-1 are injured but restored in sequence



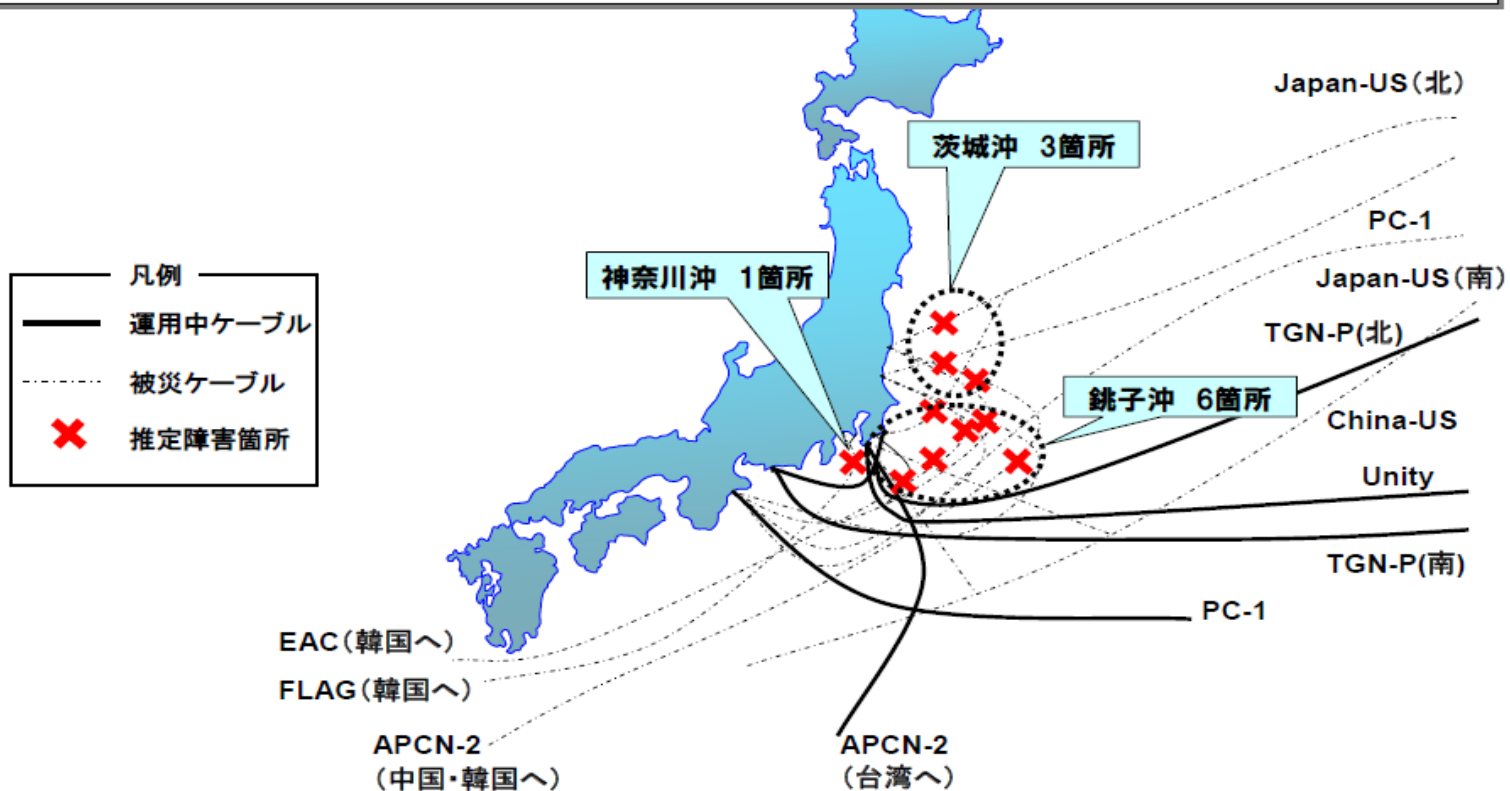
Submarine cable outage (KDDI)



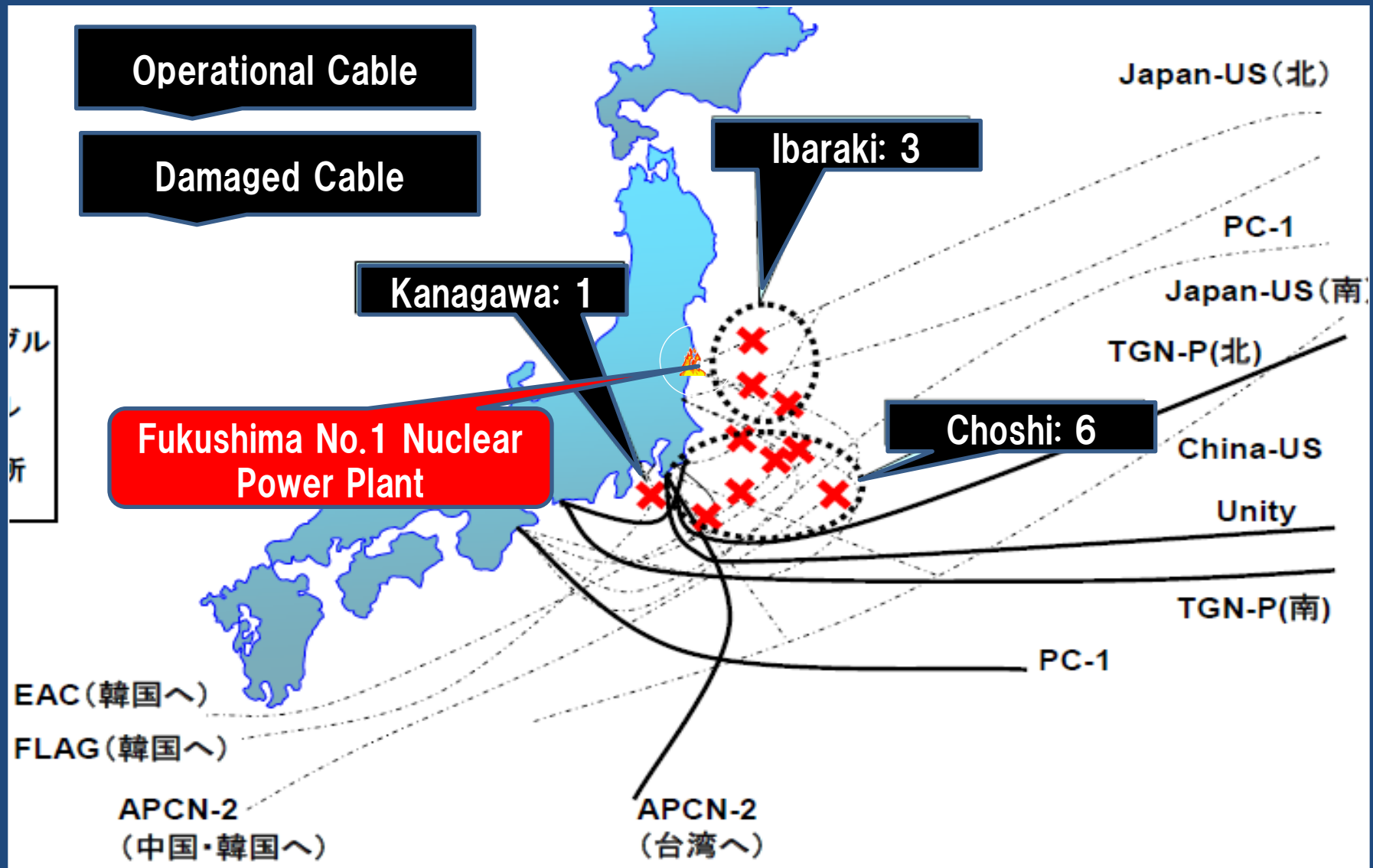
サービス影響状況について(4)

3. 国際通信サービス

・海底ケーブルの故障により、国際専用線・国際IP-VPN・国際電話付加サービスにサービス影響が発生したが、3月15日15時9分に復旧。



Submarine cable outage (KDDI)



Damages on Access Lines/Domestic Backbone(NTT-East)

過去の被災との比較《物量》

項目		東日本大震災	新潟中越地震	阪神・淡路大震災
発災時期		平成23年3月	平成16年10月	平成7年1月
ピーク時のトラヒック		約9倍	約50倍	約50倍
り障回線数		約150万	約0.5万	約28.5万
サービス回復に要した期間		約50日 (原発エリア、避難エリア除く)	約4日	約2週間
設備被害	中継伝送路	約90ルート(原発エリア除く)	6ルート	—
	通信建物	全壊18、浸水23ビル	—	—
	電柱	約65,000本(沿岸部)	約3,400本	約3,600本
	管路	約3,000km	約11km	約220km
	マンホール	約2,800個	約180個	約2,650個
	架空ケーブル	約6,300km(沿岸部)	約100km	約330km
	地下ケーブル	約1,700km	約100km	約25km

出典: <http://www.riec.tohoku.ac.jp/sympo201106/>

Damages on Access Lines/Domestic Backbone

Date		11 th Mar. 2011	23 rd Oct 2004	17 th Jan 1995
Area		East Japan	Niigata	Hanshin-Awaji (West Area)
Magnitude		M9.0	M6.8	M7.3
Damages	Access Lines	150,000,000	5,000	285,000
	Time to Recover	50days	4days	14days
	Domestic Backbone	90lines	5lines	0lines
	Teleco Buildings	Demolished: 18, Flooded: 23		0
	Cables	8,000km	200km	355km

from Toyama-san @ JPNAP

NTT teleco building

局舎損壊



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

Inside also

内部も激しく損壊



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

Removal of mud etc.

瓦礫・泥・被災設備の撤去



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

Repair in a building, install the electric power equipment

建物の補修 と 通信・電力機器搬入



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

Reinforcement in an outer wall

外壁補強



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

At night

ヘッドライトとランタン

- ぎりぎり③

- 電力は、通信機器最優先
- その他用はガソリンエンジン(発電)で発電

Tepco(Tokyo Electronic power Co.)



<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

Repairing of power, access line

局舎に添うように電力・アクセス線回復

• ぎりぎり④

- 局舎、避難所など要所を縫うように電線・ケーブル
- 他の場所は後回し

<http://www.janog.gr.jp/meeting/janog28/doc/janog28-robust-akiyama-after.pdf>
(in Japanese) from Akiyama-san @ NTT East

opposite side...

局の反対側はこの状態



- **ぎりぎり⑤**

- 局まで復旧しても、アクセスラインはこれから

Issues, next-step

- More layer-1 level redundant design
- Desperation to Osaka
 - Backbone level redundancy
 - Contents level redundancy from tokyo
- Desperation of DNS/MAIL/RADIUS etc
- Traffic Control at savior disaster
 - Preparing between ISP and Content Provider
 - guideline
- Desperation of Operation
- Internet disaster simulation day



Thank you very much for all of your support