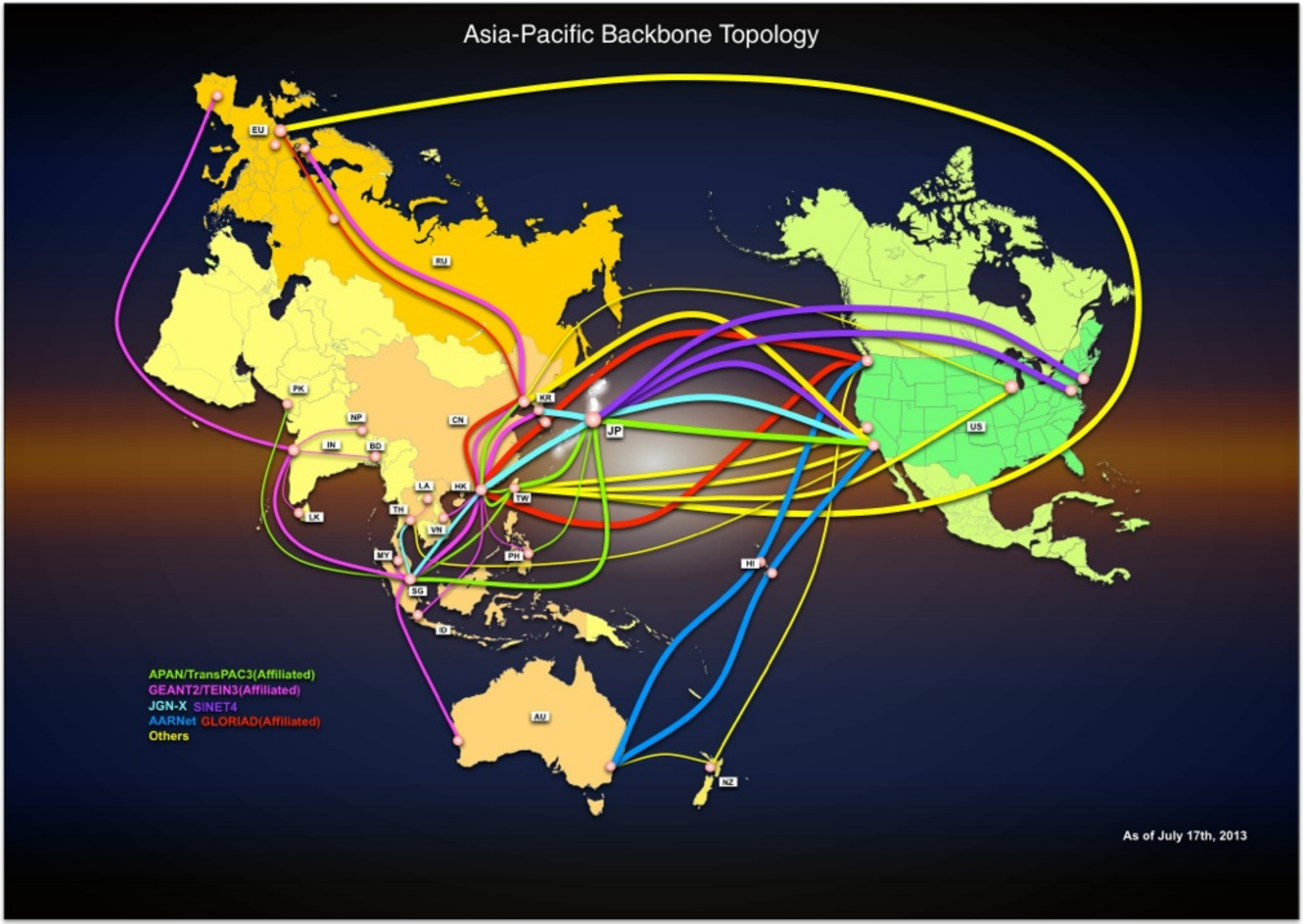
NREN update

- APAN-JP
  - operation of keeping the interconnectivity
  - JGN-X, SINET, TSUKUBA-WAN, MAFFIN, QGPOP, WIDE, AIII, …
  - TransPAC3, JGN-X, SINET, MAFFIN, TEIN4, ASGC, TWAREN, …
- http://www.jp.apan.net/NOC

Asia-Pacific Backbone Topology



- Network Engineering Workshop
- SC13
  - perfSONAR monitoring over Google Earth
    - http://kote-ps-1.ps.jgn-x.jp/ps/ps-gearth/
- Quatre
  - MCU for DVTS
  - up to 16 sites

Case Study about “QoS”

QoS parameters…

- Availability
- Delivery
- Latency
- Bandwidth
- Mean time between failures of service
- Mean time between failures after reporting the fault

Network Performance Metrics

- Availability
  - Connectivity, Functionality
- Loss
  - One way loss, Round trip loss
- Delay
  - One way delay, Round trip time delay, Delay variance
- Utilization
  - Capacity, Bandwidth, Throughput

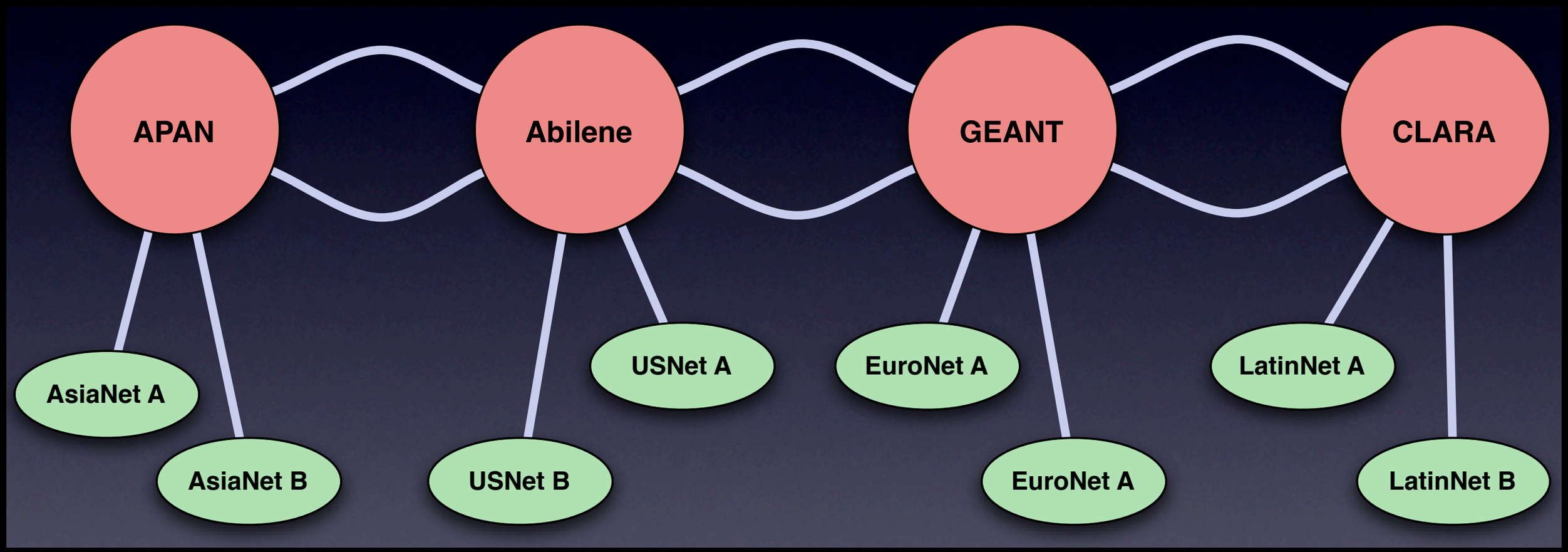
QoS parameters from the experience from the telemedicine support

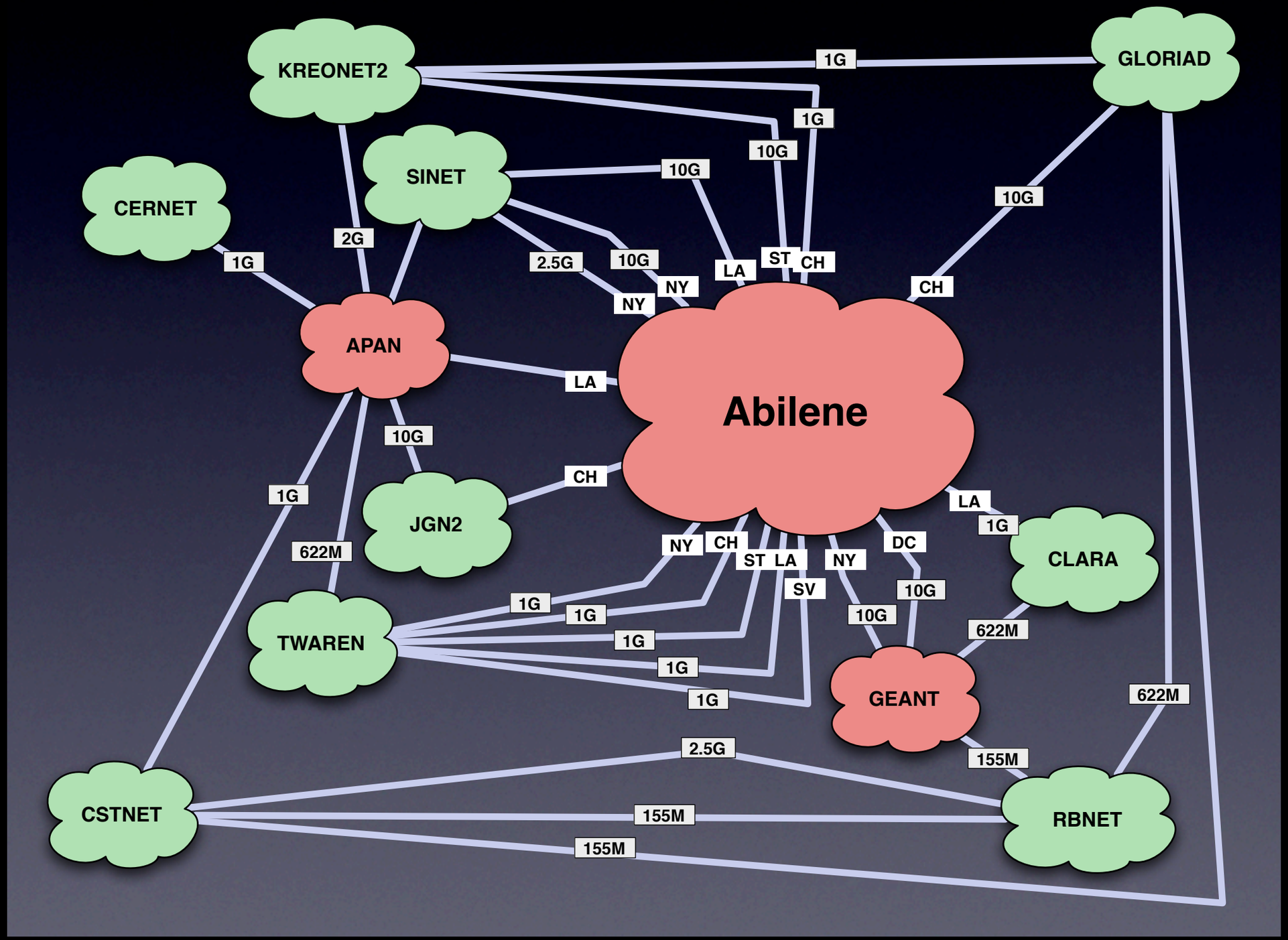
- Routing
- Bandwidth or throughput
- video management
- audio management

Fiber cut in 2006

Issues of R&E networks

- circuit speed for the contracted bandwidth
- strict Acceptable Use Policy (AUP)
- management of the routing information
- implementation of the advanced applications
- regular traffic usage


APAN
Abilene
GEANT
CLARA
AsiaNet A
AsiaNet B
USNet B
USNet A
EuroNet A
EuroNet A
LatinNet A
LatinNet B


KREONET2
GLORIAD
SINET
CERNET
APAN
Abilene
JGN2
TWAREN
GEANT
CLARA
CSTNET
RBNET
1G
2G
10G
2.5G
NY
LA
ST
CH
SV
DC
622M
155M

APAN Backbone Topology

Last Updated May. 2007

EU
RU
CN
KR
JP
US
HK
TW
VN
TH
MY
SG
ID
PH
HI
AU

APAN/TransPAC2(Affiliated)
TEIN2(Affiliated)
JGN2 SINET WIDE/IEEAF
AARNet GLORIAD(Affiliated)
Others

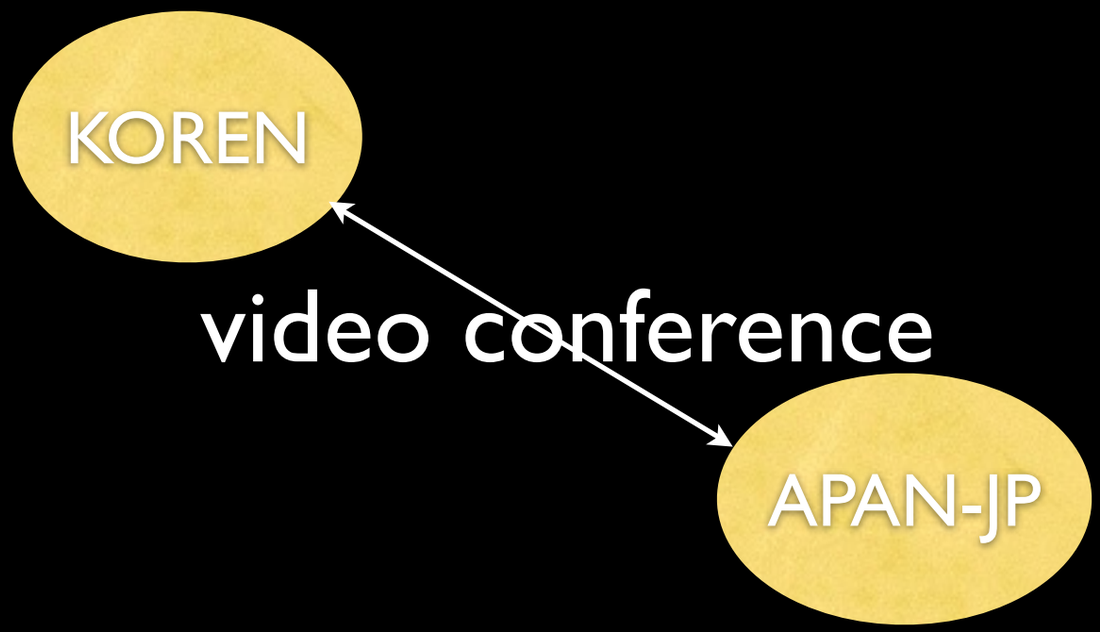
APAN Backbone Topology

Last Updated May. 2007

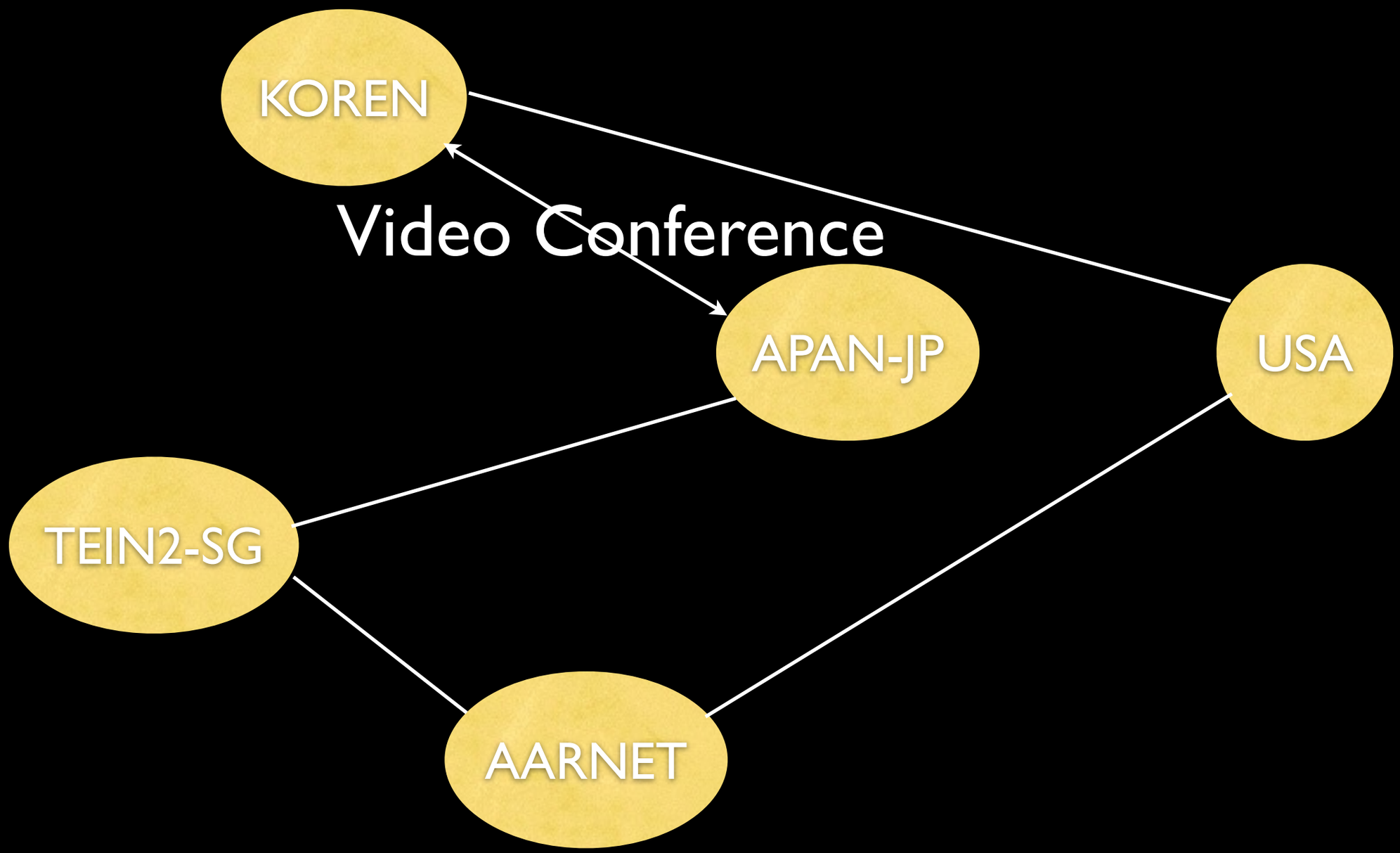
EU
RU
CN
KR
JP
US
HK
TW
VN
TH
MY
PH
SG
ID
HI
AU

APAN/TransPAC2(Affiliated)
TEIN2(Affiliated)
JGN2 SINET WIDE/IEEAF
AARNet GLORIAD(Affiliated)
Others

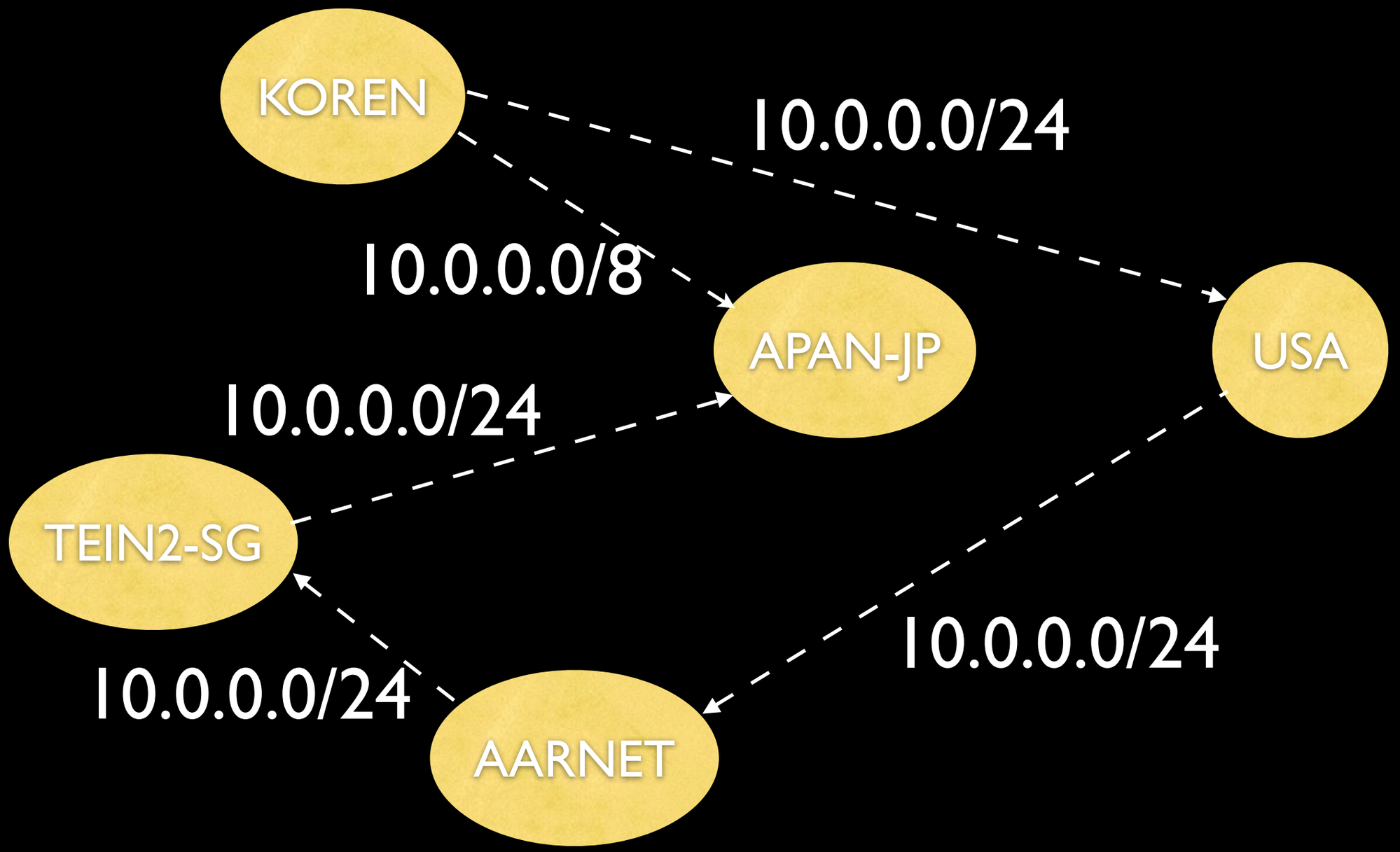
My experience

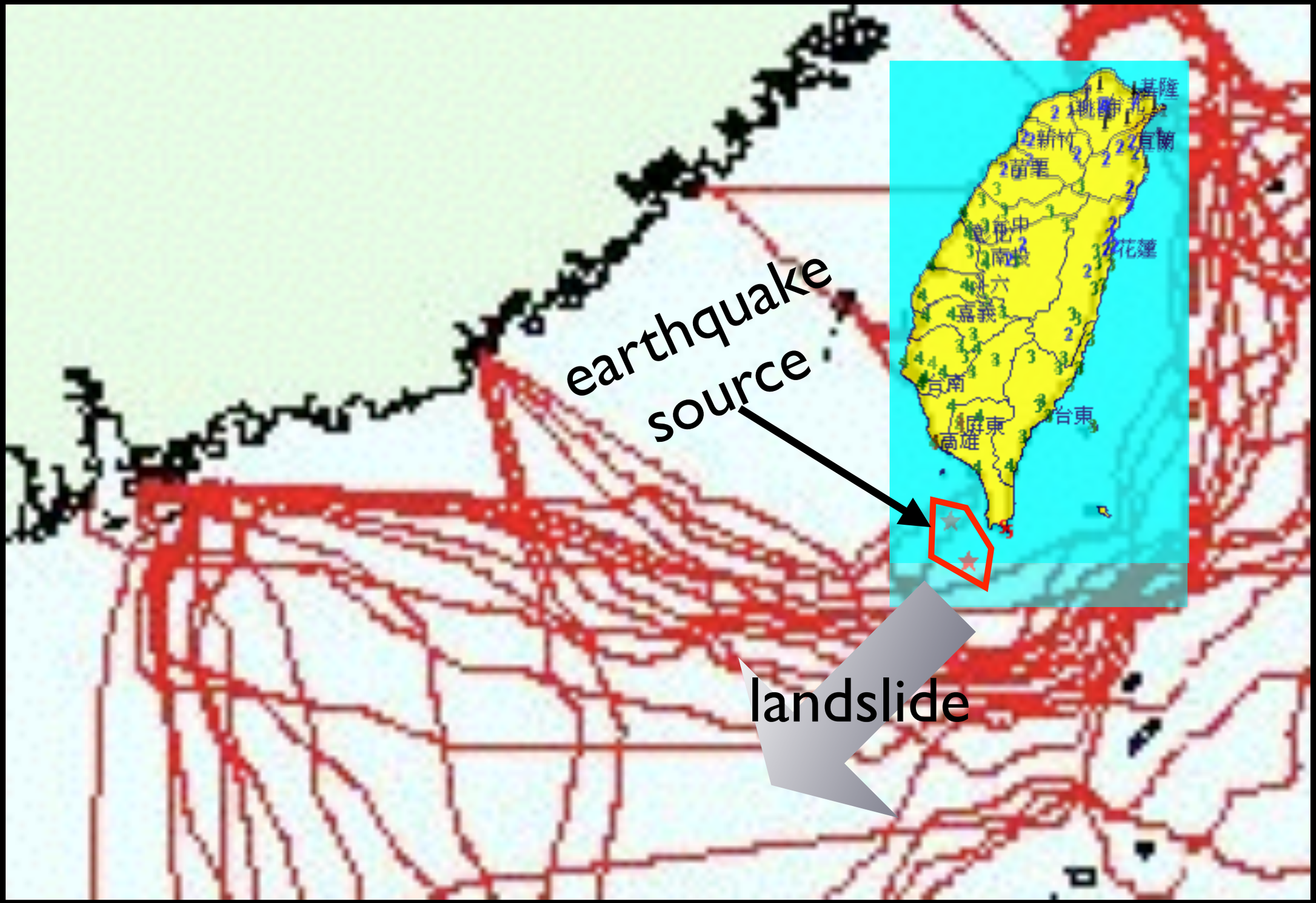


unexpected routing



details


KOREN
10.0.0.0/24
10.0.0.0/8
APAN-JP
USA
10.0.0.0/24
TEIN2-SG
10.0.0.0/24
10.0.0.0/24
AARNET

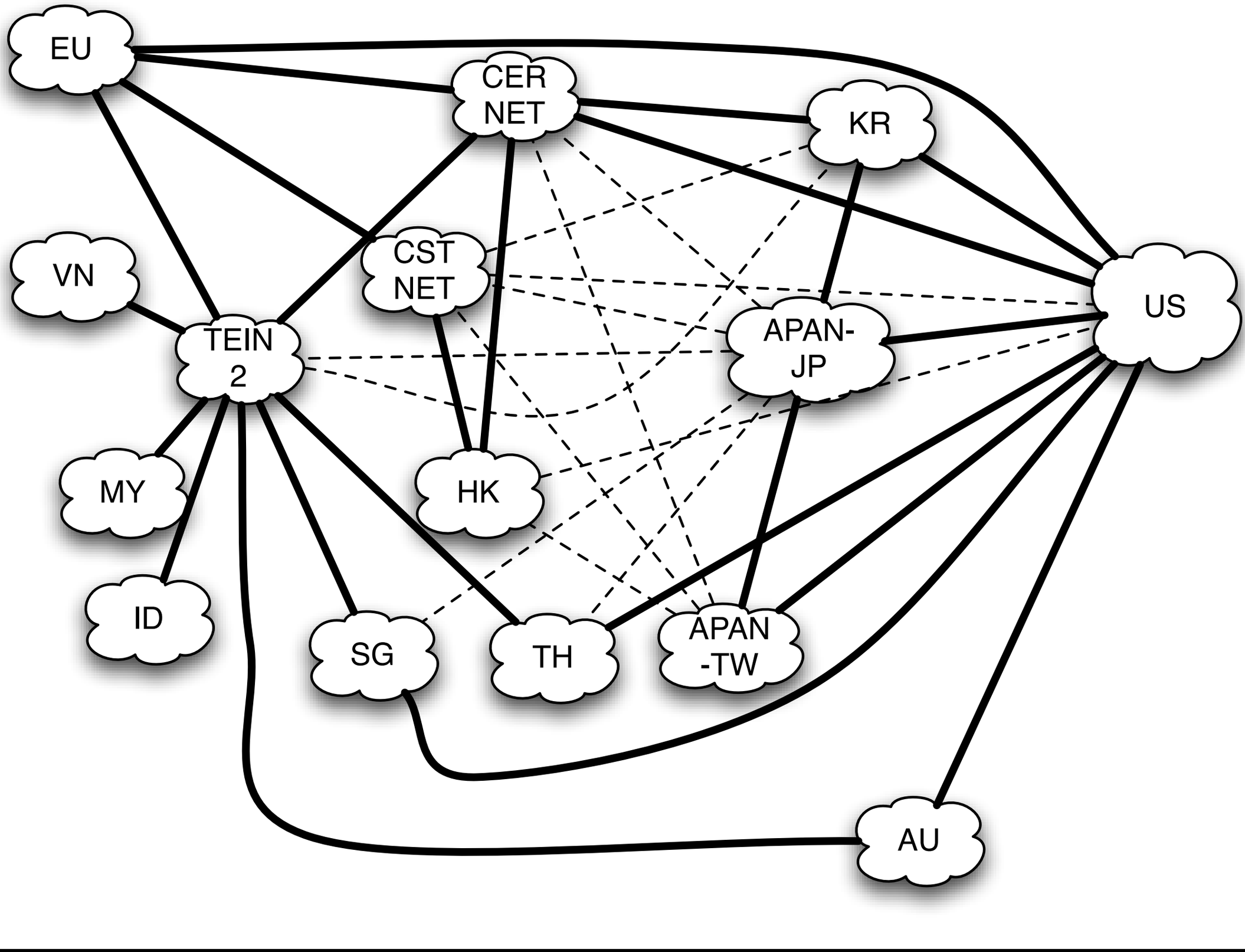

earthquake
source
landslide
基隆
新竹
宜蘭
苗栗
花蓮
台中
南投
嘉義
台南
台東
屏東
高雄

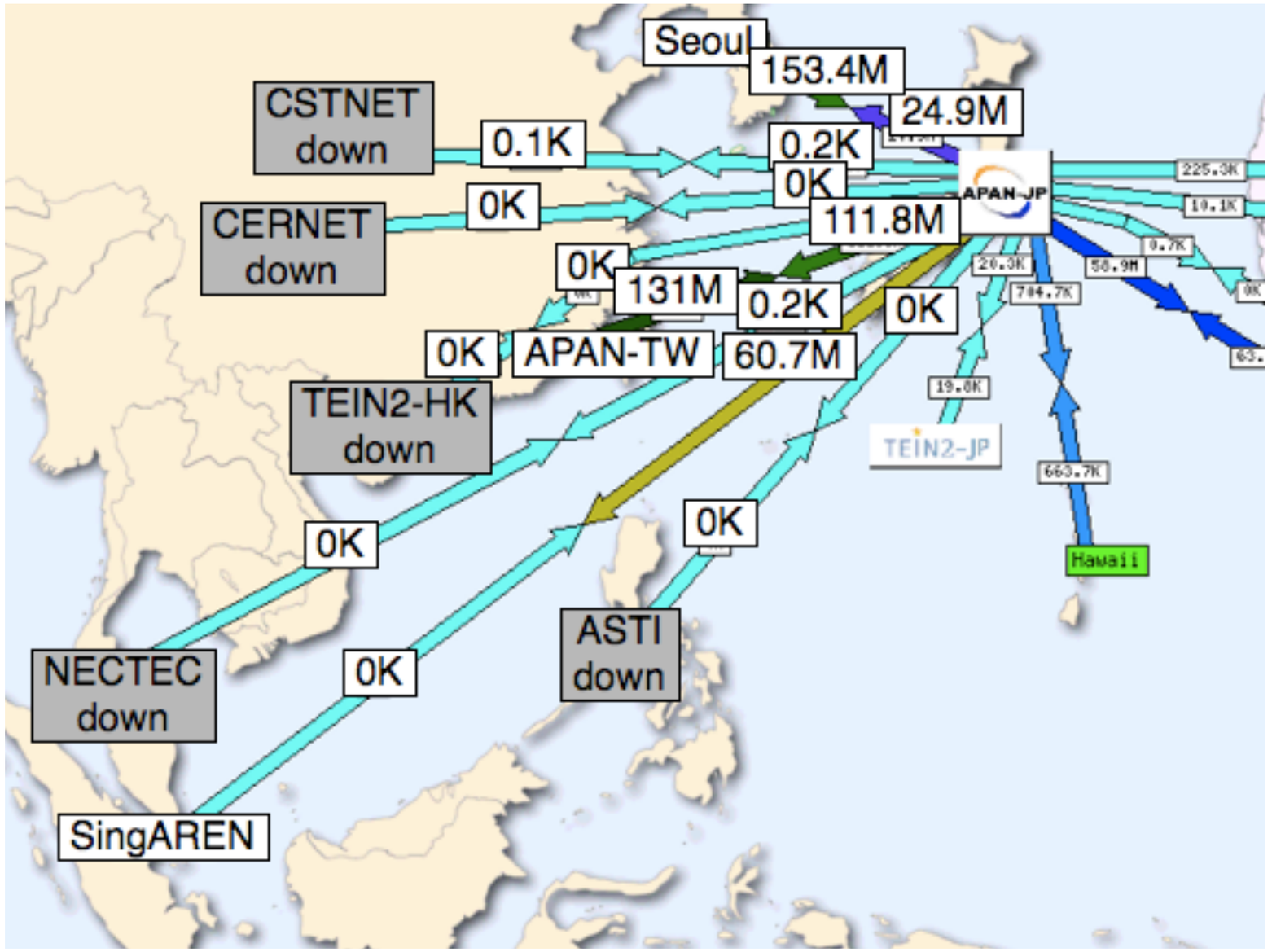
What happened under the sea?

CN-US Cable Outside

CN-US Cable Inside

These pictures were provided by KDDI.

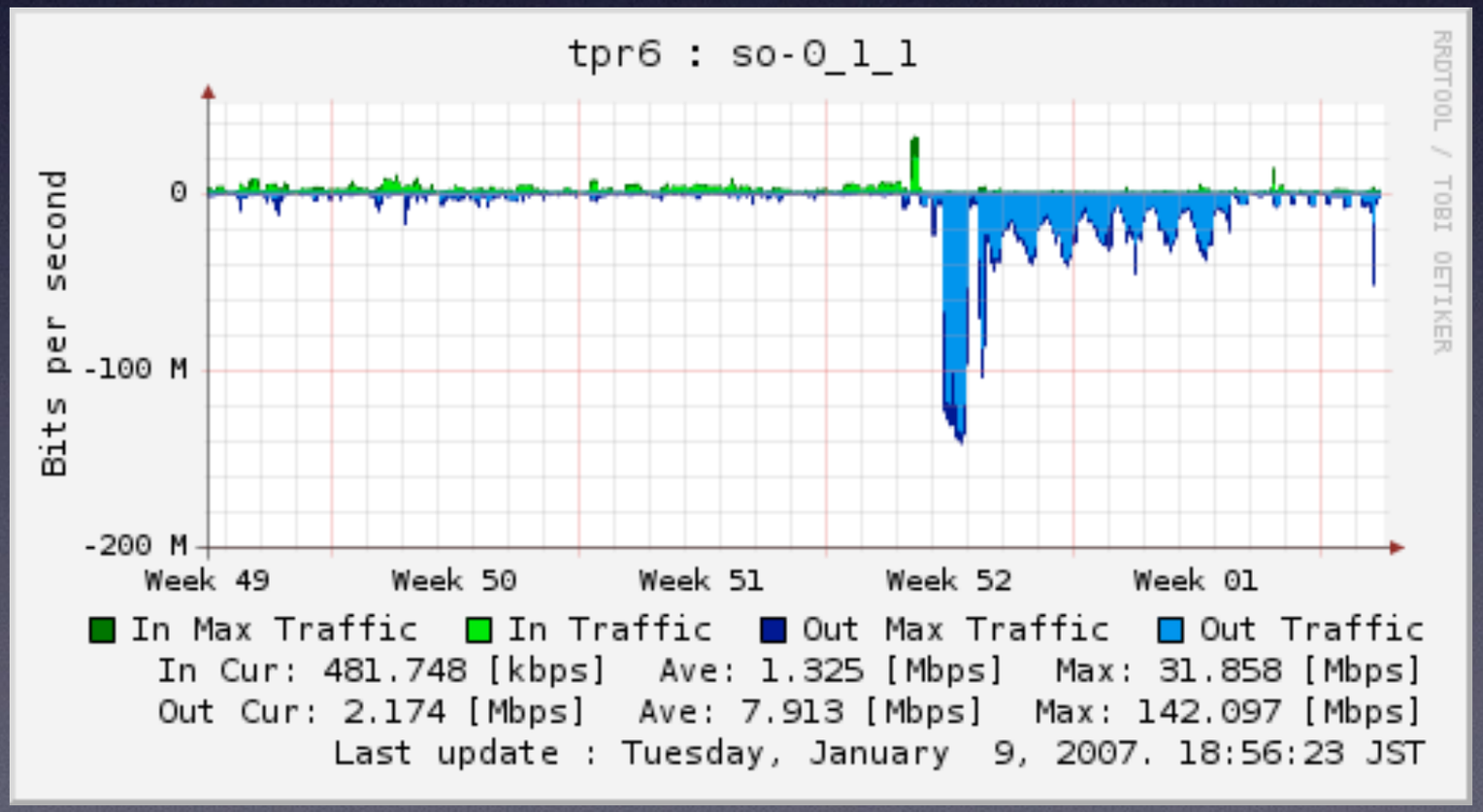

EU
CER
NET
KR
VN
CST
NET
US
TEIN
2
APAN-
JP
MY
HK
ID
SG
TH
APAN
-TW
AU

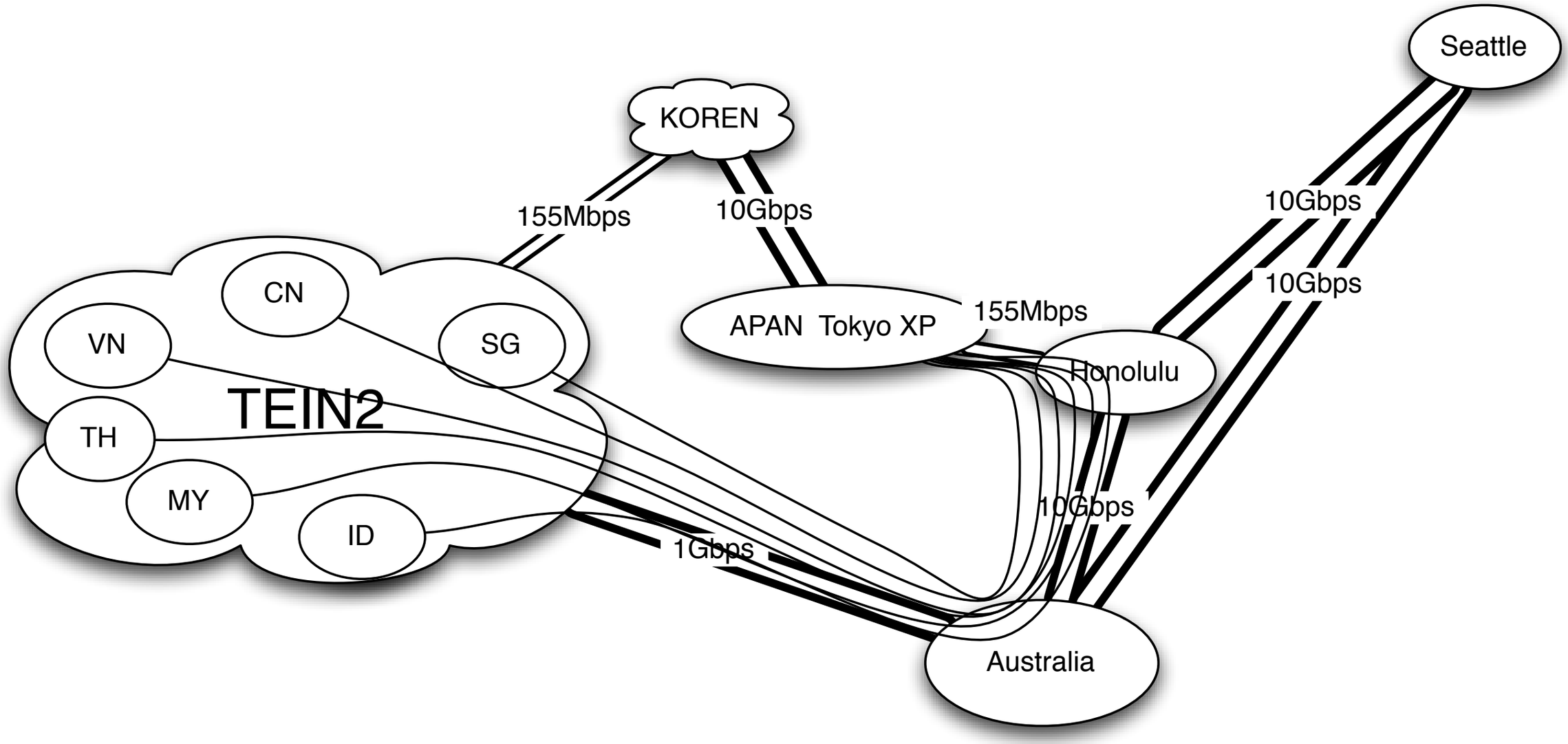


Just after the earthquake

Trial for keeping the connectivity -1-

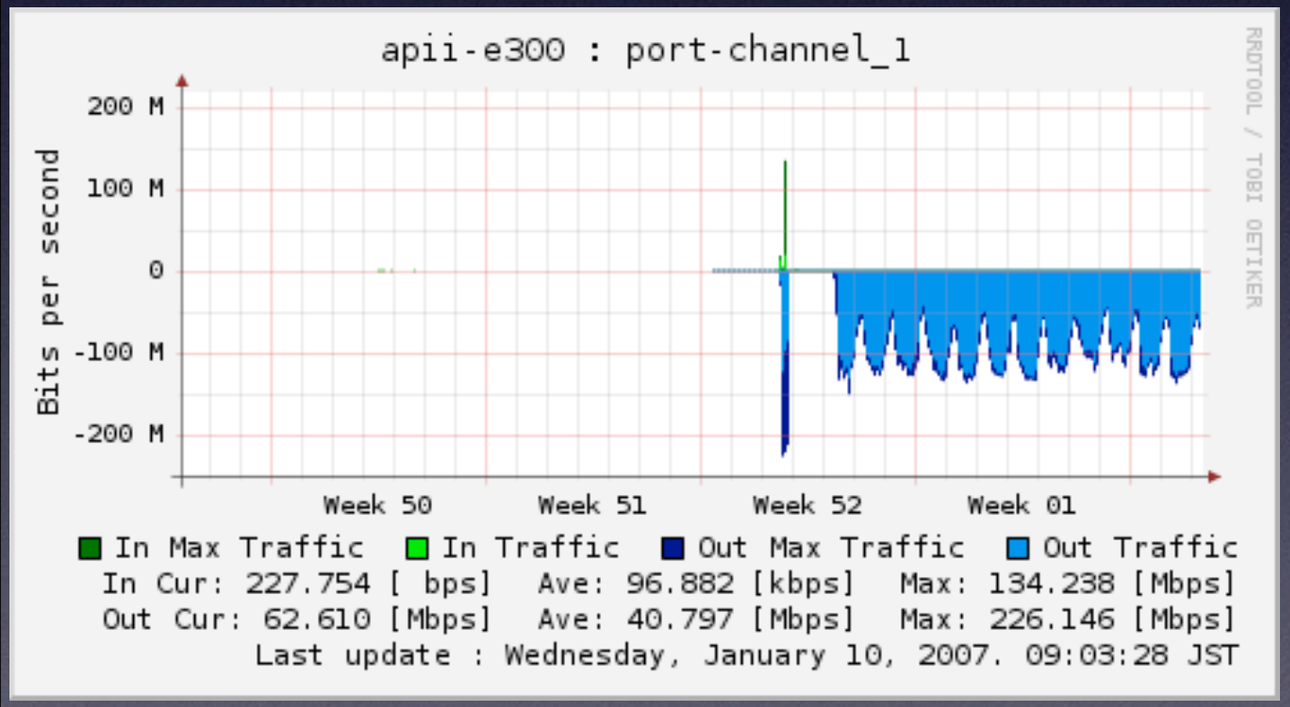
- Solution by Hawaii link
  - When TEIN2 stated, the routing information of TEIN2 was filtered and such route as APAN - Hawaii - AARNet - TEIN2 was set not to happen. Mark Prior/AARNet proposed this filter should be deactivated and the routing information of TEIN2 through Hawaii was recovered.(12/27)
  - Because of the quick growth of the link utilization of the Hawaii link,(140/155Mbps), another solutions were required.



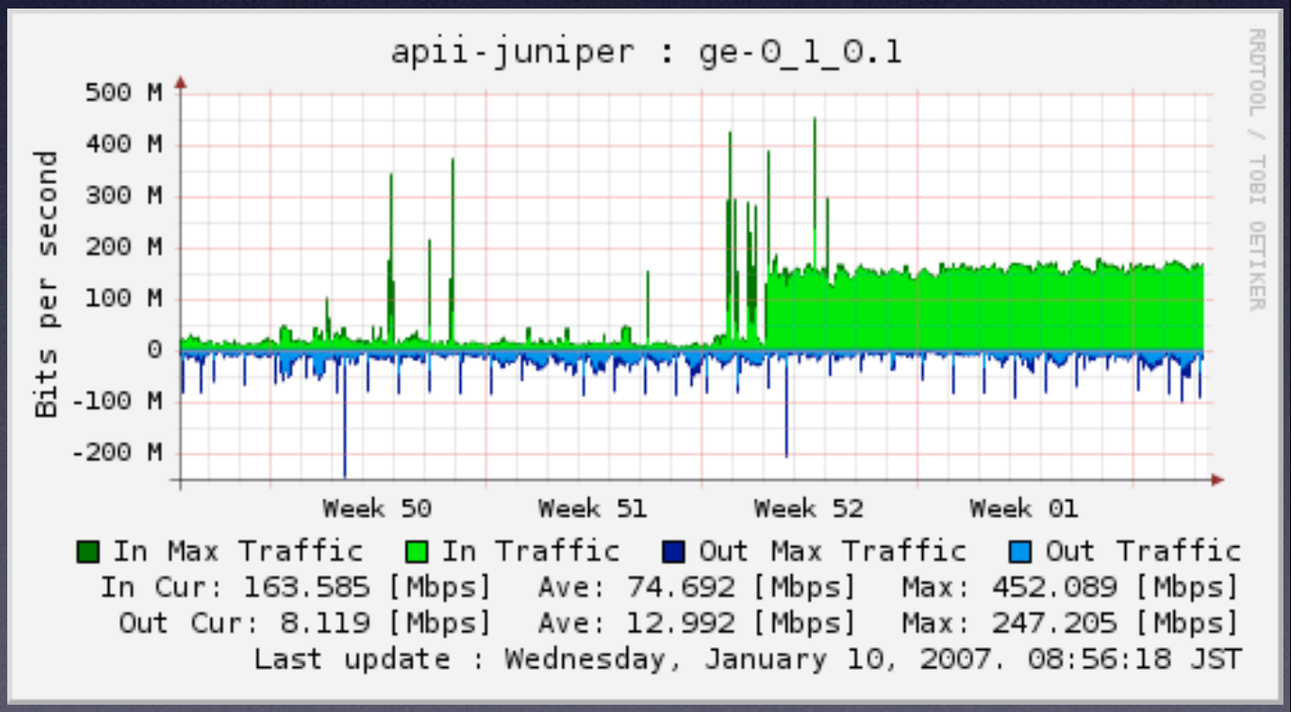

Seattle
KOREN
155Mbps
10Gbps
10Gbps
10Gbps
CN
VN
SG
TEIN2
TH
MY
ID
APAN Tokyo XP
155Mbps
Honolulu
10Gbps
1Gbps
Australia

Trial of keeping the connectivity -2-

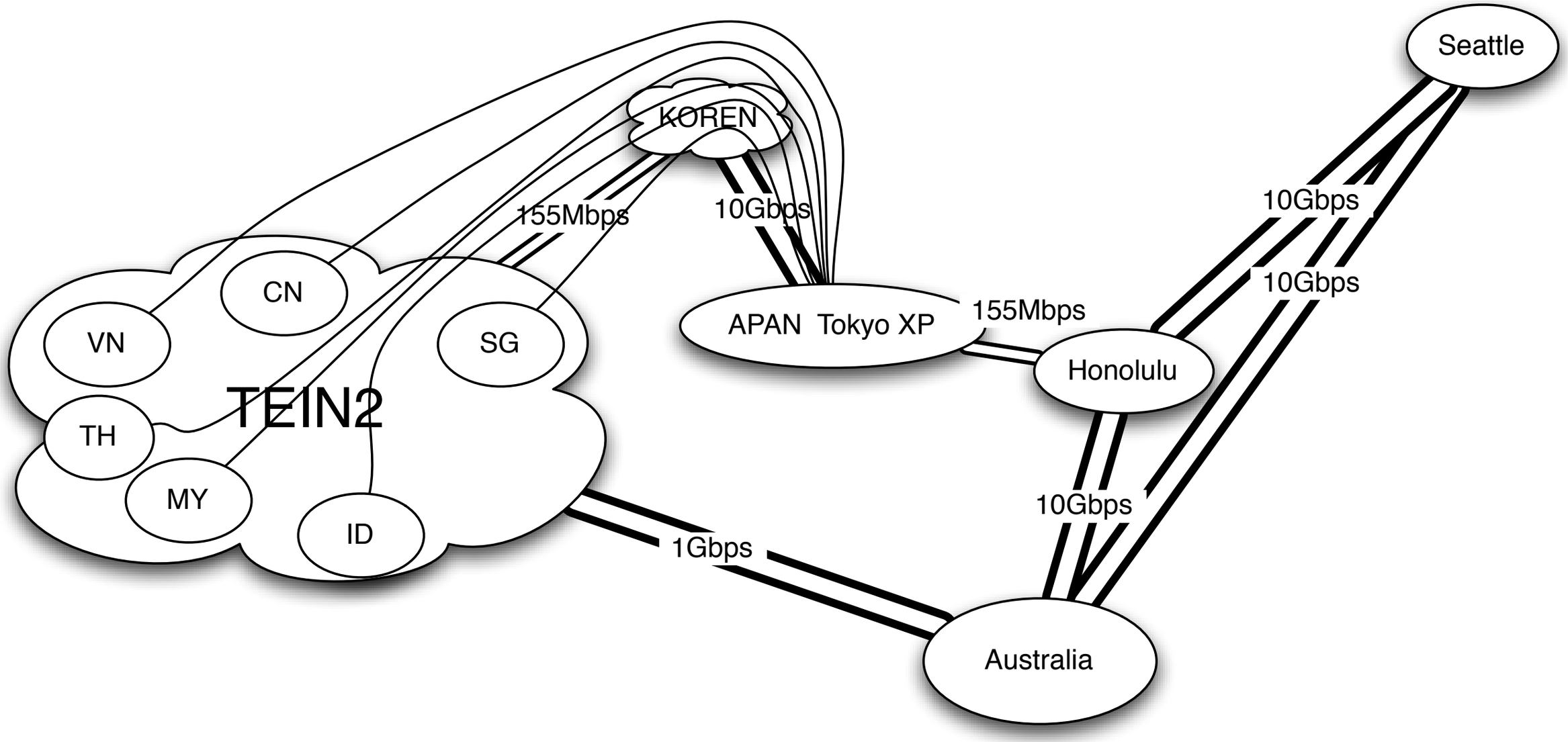
- Solution by APII JP-KR link
  - Because of the heavy congestion of the Hawaii link, APII-KR was set as the backup route. For the KOREN NOC, the transit of the routing information both of CERNET and TEIN2 was requested. After this solution, the traffic of more than 150Mbps was transferred of the APII JP-KR link.
  - Because the bandwidth between KOREN and CERNET was 155Mbps, the congestion was occurred.



APII new 10G link

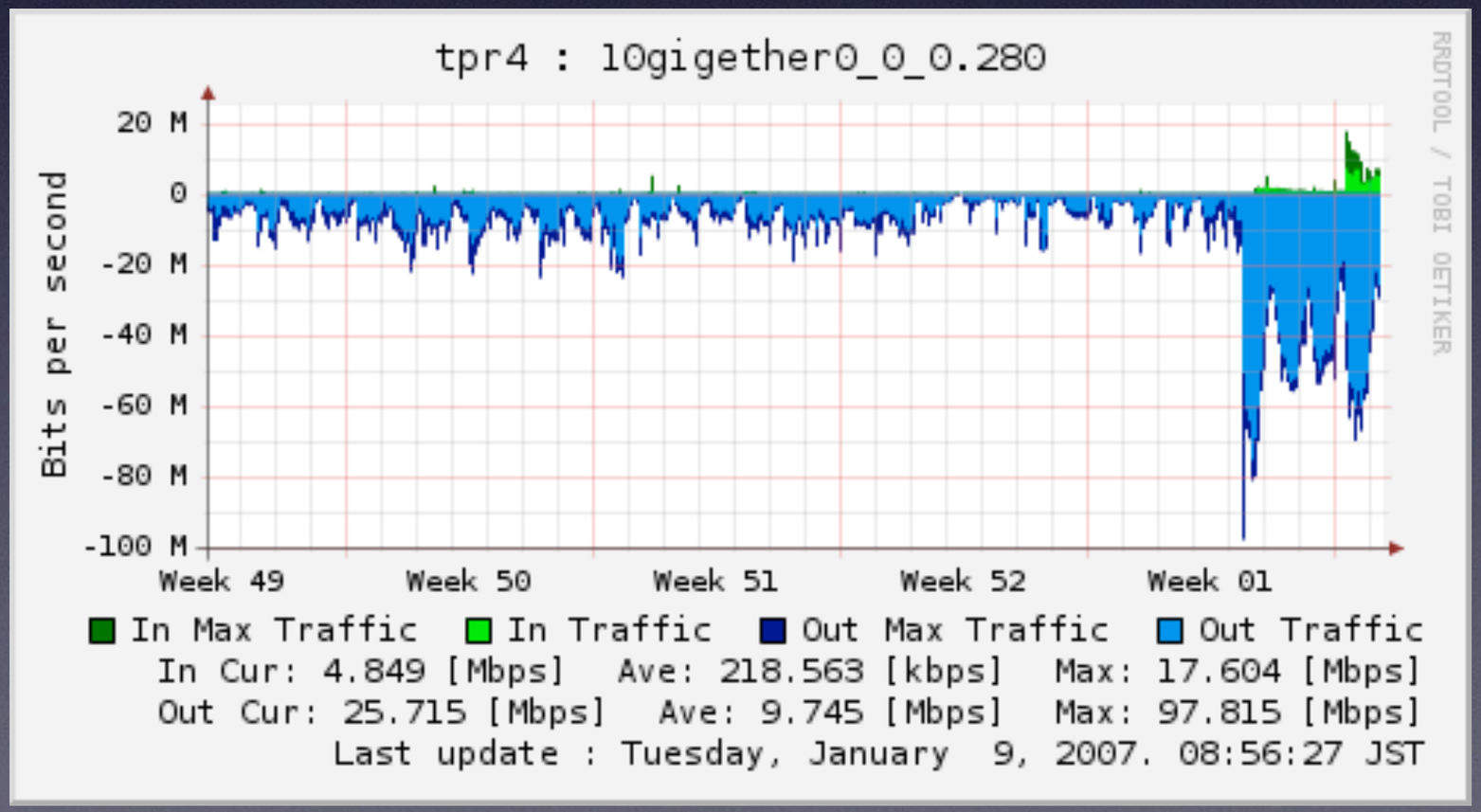


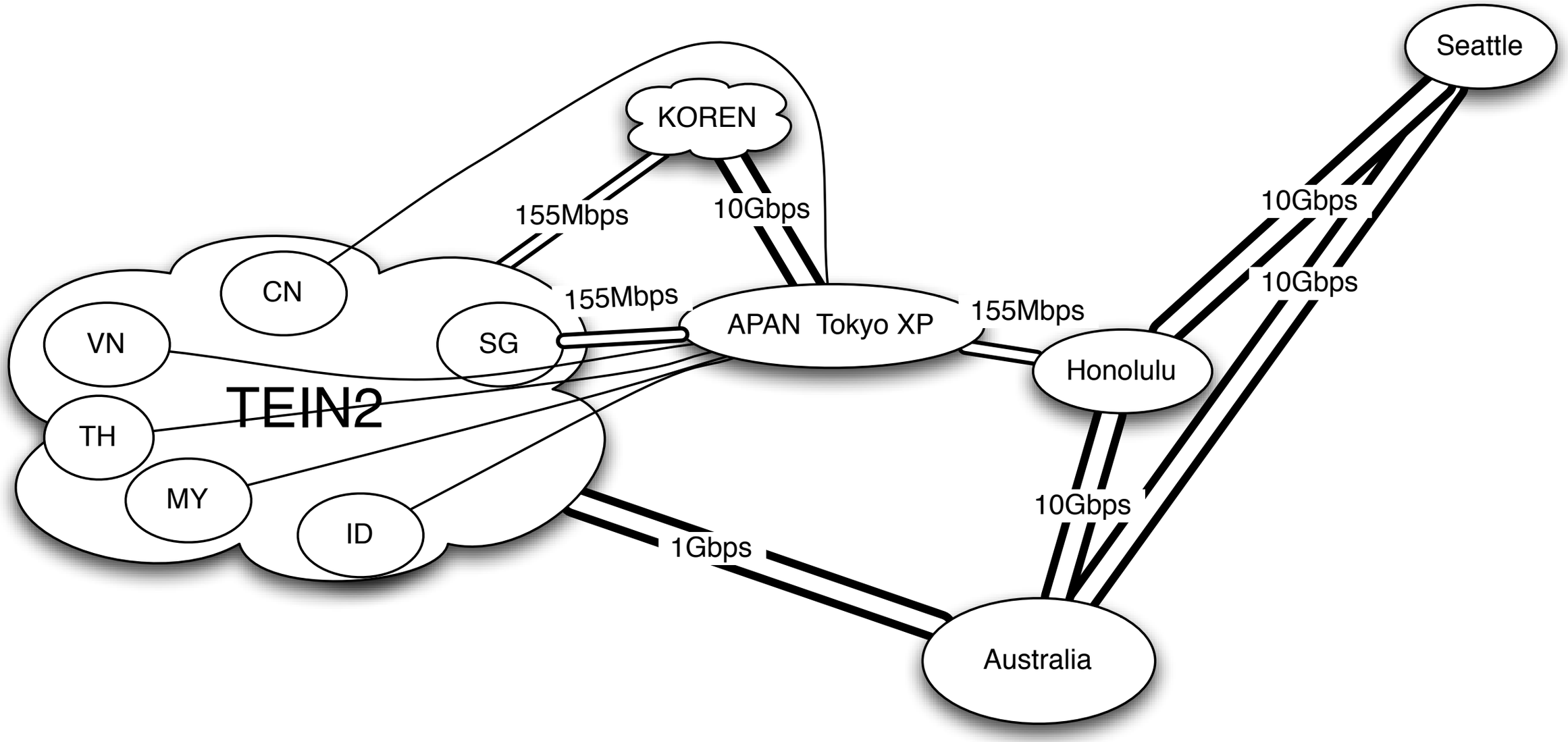
APII 1G link


KOREN
155Mbps
10Gbps
CN
VN
SG
TH
MY
ID
TEIN2
APAN Tokyo XP
155Mbps
Seattle
10Gbps
10Gbps
Honolulu
10Gbps
1Gbps
Australia

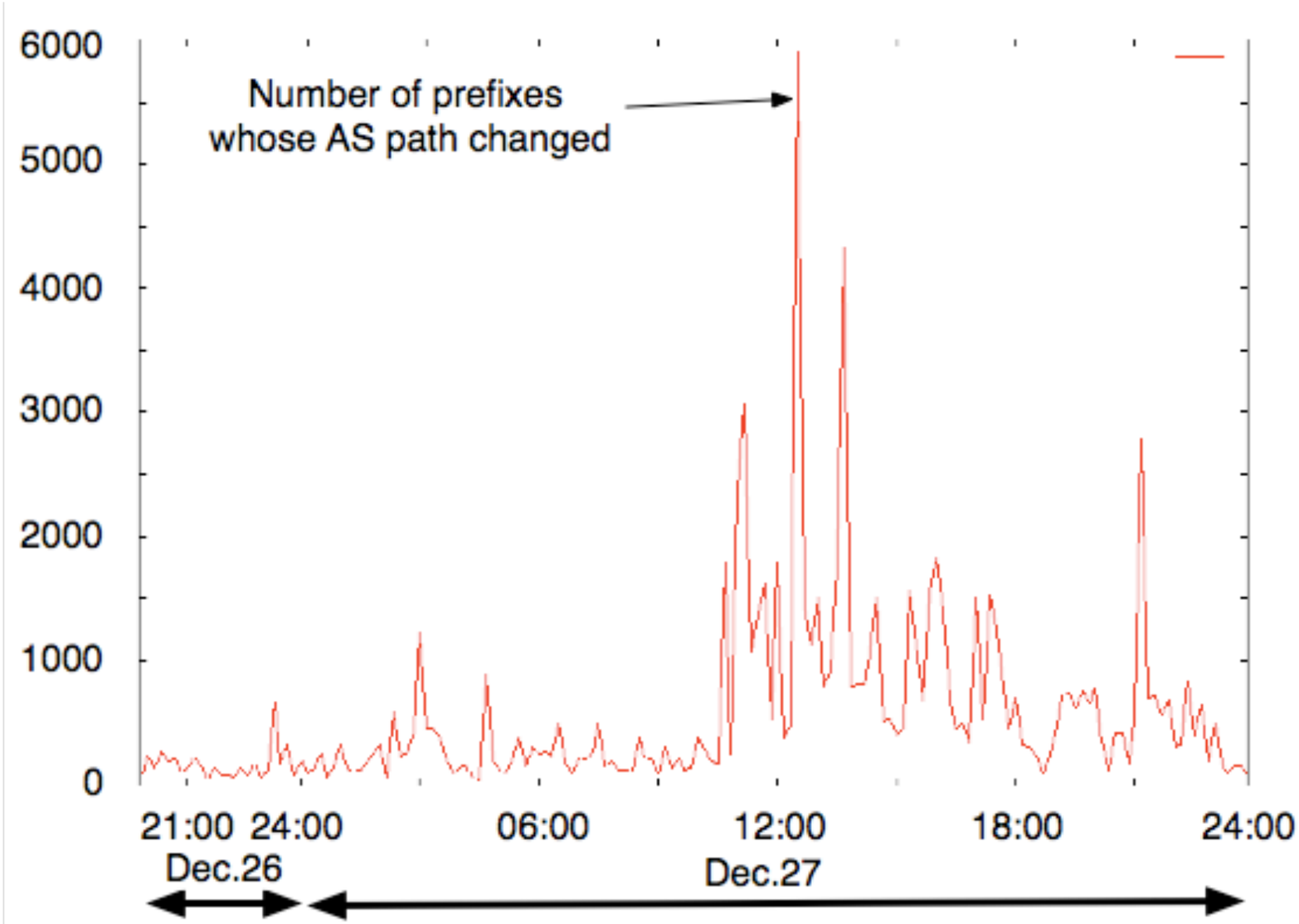
Trial of keeping the connectivity -3-

- Solution of using JGN2 Singapore to have the connectivity to SingAREN
  - Because of the heavy congestion at the link of KOREN - CERNET, after the discussion by the NOC staff of SingAREN, JGN2, and TEIN2, all the TEIN2 traffic was set on the detoured route through SingAREN.
  - Most of the traffic of TEIN2 started passing through JGN2 Singapore, the communication for CERNET became stable of the APII JP-KR link.




Seattle
KOREN
155Mbps
10Gbps
10Gbps
CN
155Mbps
APAN Tokyo XP
155Mbps
10Gbps
VN
SG
Honolulu
TEIN2
TH
MY
ID
10Gbps
1Gbps
Australia

- AS paths became dramatically changed at the QGPOP. (The regional GIGPOP of the JP side of the APII JP-KR link)



Definition of the line weight for the number of prefix

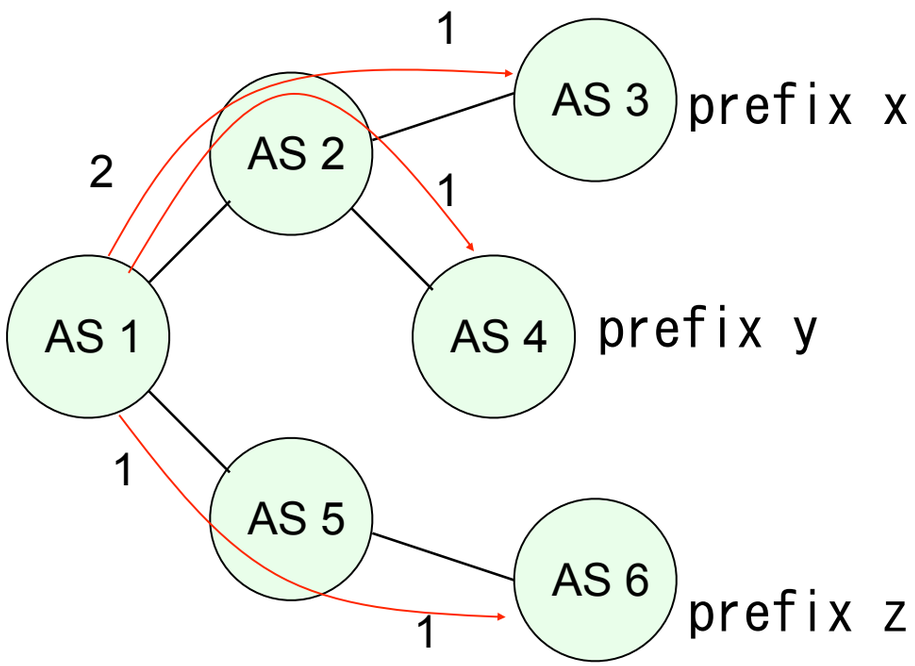
- At ABEL2, the number of the prefix paths was counted as the weight of each link between ASs.

Network	Path
prefix x	AS 2 AS 3
prefix y	AS 2 AS 4
prefix z	AS 5 AS 6

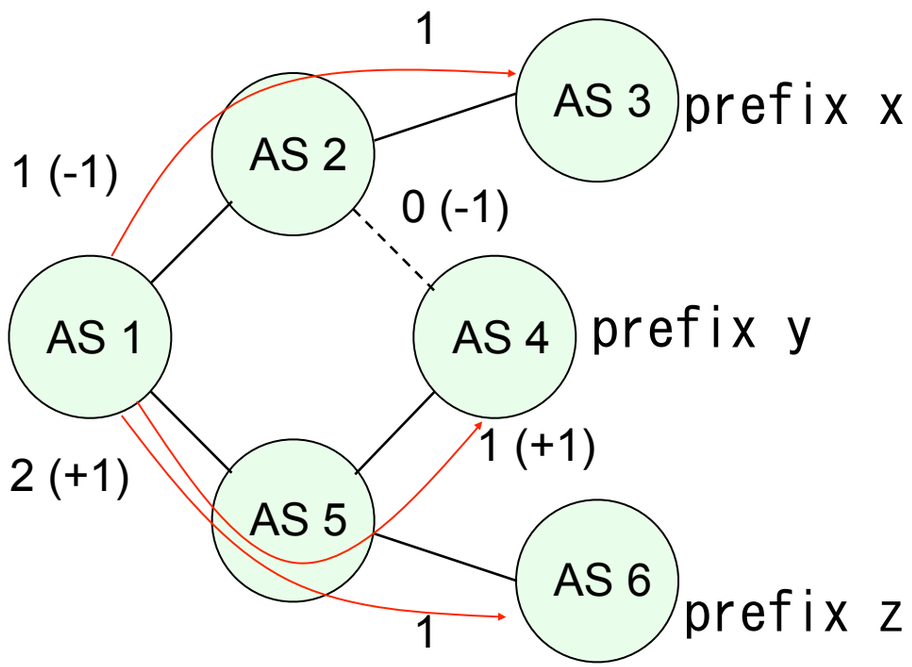
(a) AS1's Routing Table at t_0

Network	Path
prefix x	AS 2 AS 3
prefix y	AS 5 AS 4
prefix z	AS 5 AS 6

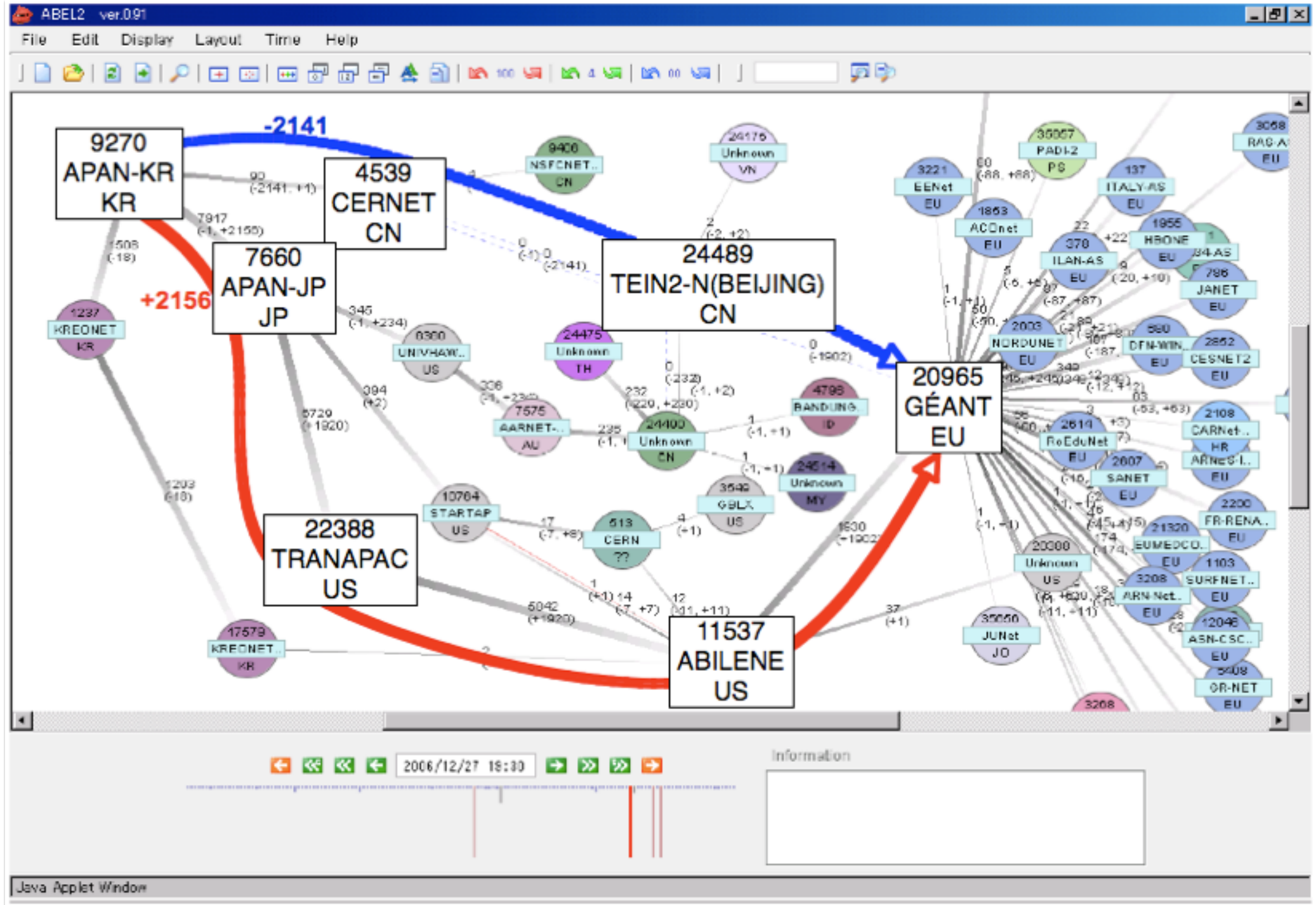
(b) AS1's Routing Table at t_1



(c) Route from AS1 at t_0

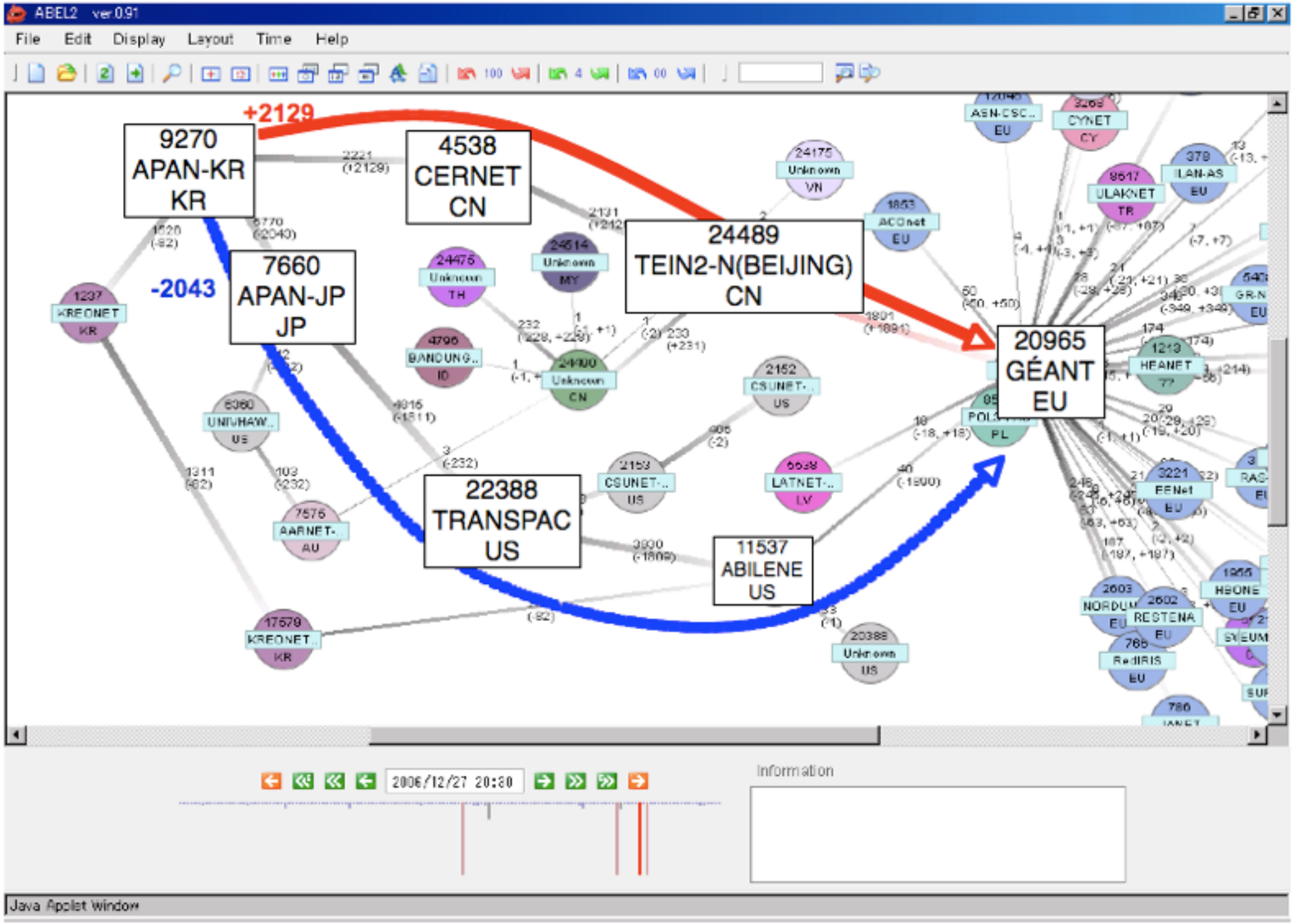


(d) Route from AS1 at t_1



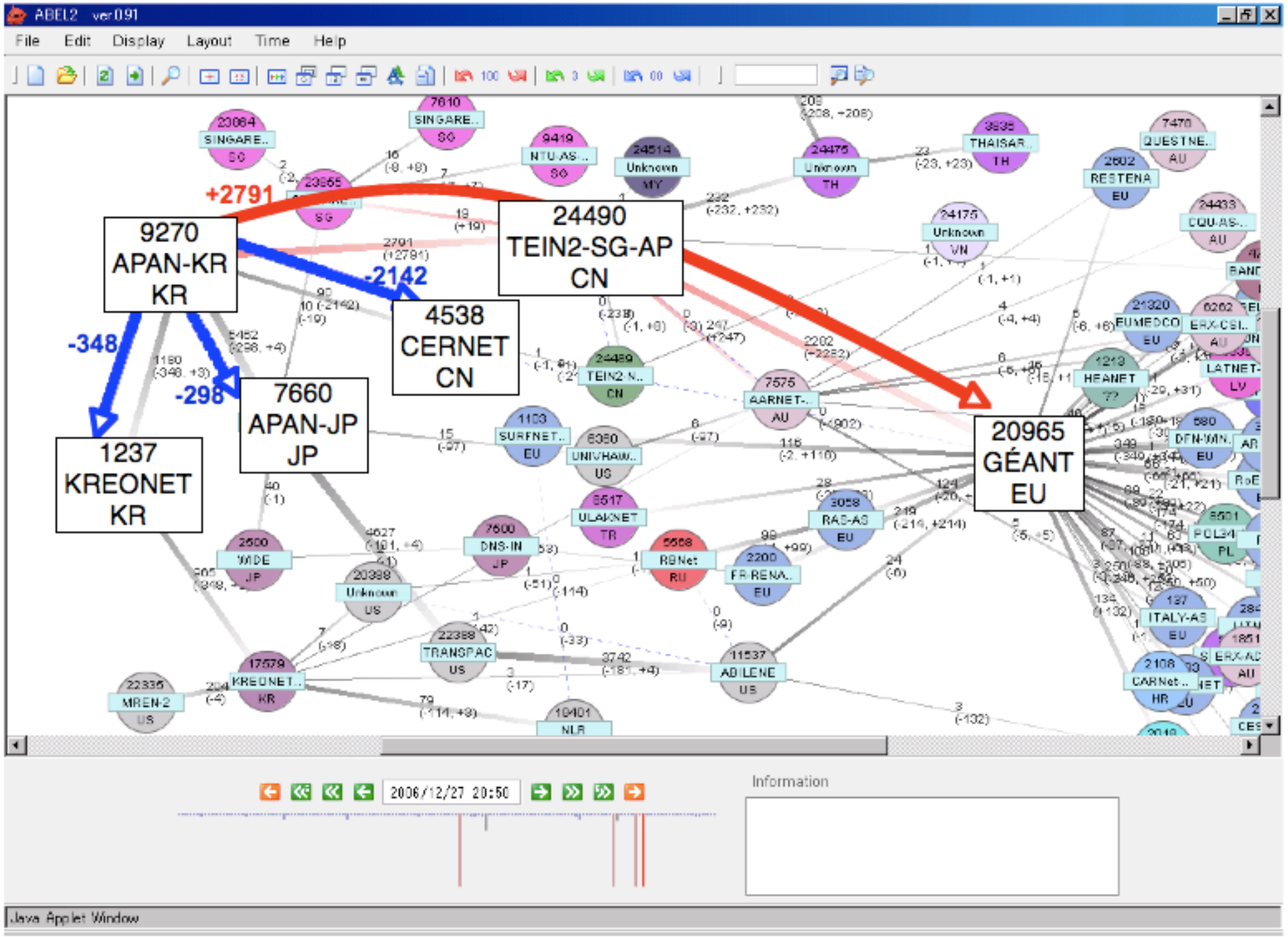
December 27

- At 18:30 (+0900)
  - The route from KR to EU started to choose the route through JP and US.



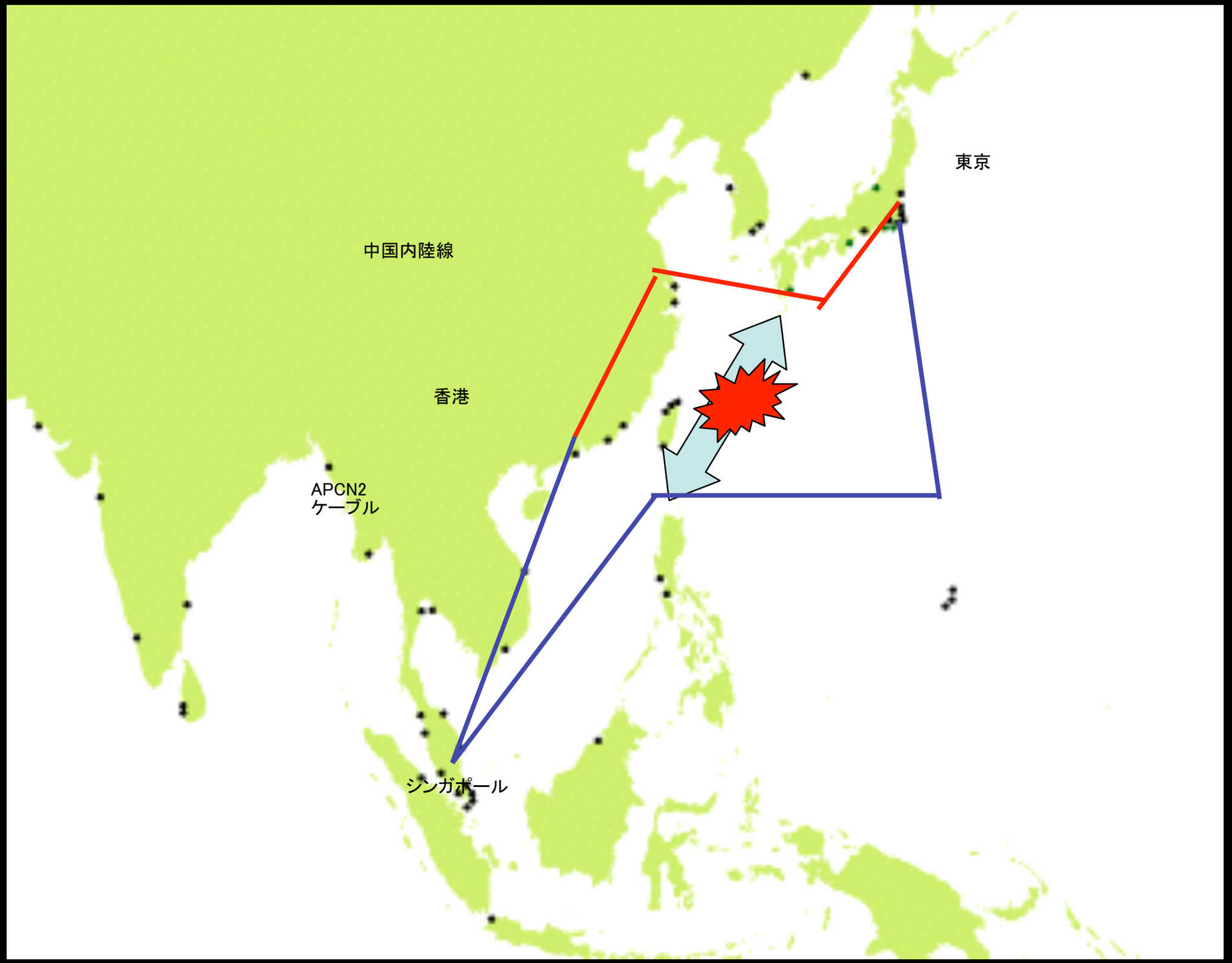
December 27

- At 20:30 (+0900)
  - The route from KR to EU started to choose through CN.

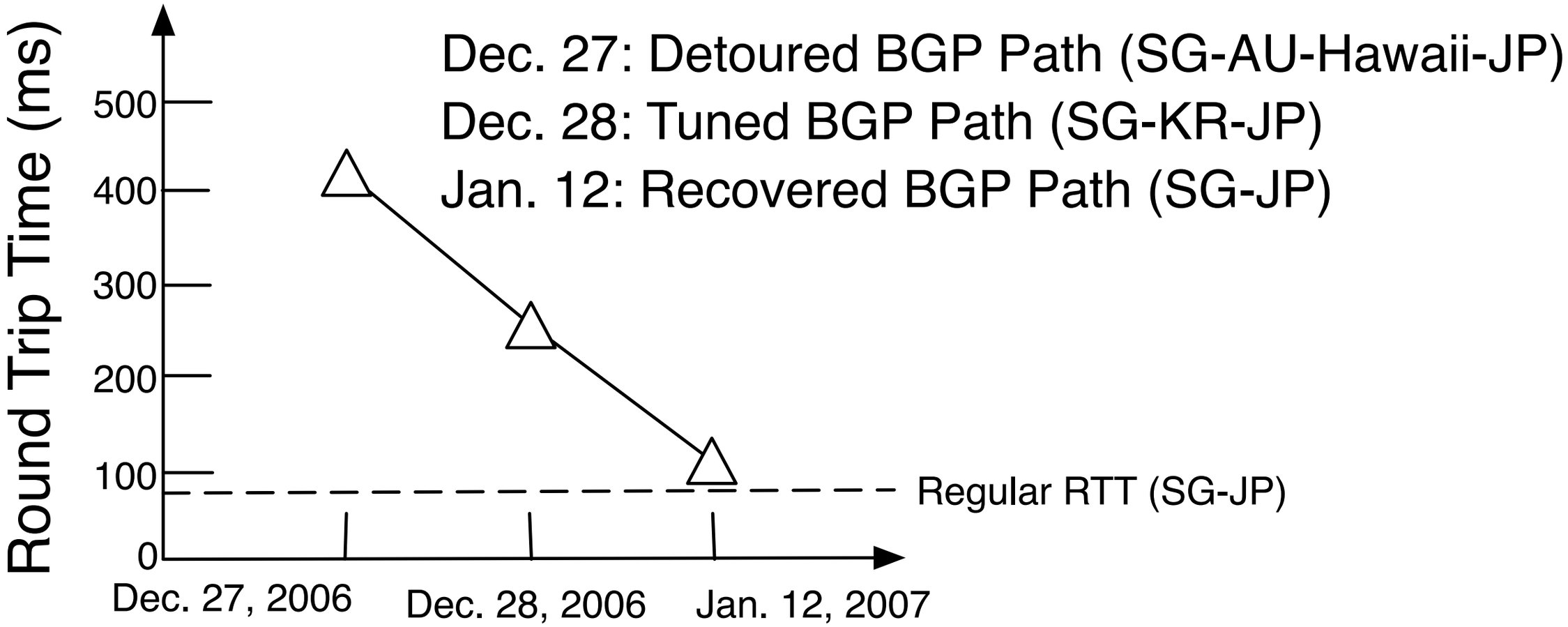


December 27

- At 20:50 (+0900)
  - All the path from KR to EU was the one through SG.



This figure is composed by KDDI.


Dec. 27: Detoured BGP Path (SG-AU-Hawaii-JP)
Dec. 28: Tuned BGP Path (SG-KR-JP)
Jan. 12: Recovered BGP Path (SG-JP)
Round Trip Time (ms)
500
400
300
200
100
0
Regular RTT (SG-JP)
Dec. 27, 2006
Dec. 28, 2006
Jan. 12, 2007

Routing Path in Asia Pacific

(Estimated Path except APAN-JP)

Normal

Poor Path

Always been anomaly Path

Multiple Path

Connectivity Lost or Commodity

Dec. 27. 2006

Src \ Dest	APAN-JP	CERNET	APAN-TW	KOREN	ASTI	CSTNET	TEIN2	SingAREN	UniNet	ThaiSARN	KREONET 2	AARNET
APAN-JP		TP2-Abilene	JP-TW Direct	APII	None	KDDI-GW	None	SingARENvia JGN2 SG	TP2-Abilene	None	TP2-Abilene	TP2-Abilene / Hawaii
CERNET	TP2-Abilene US?		APAN-APAN-JP US?	CN-KR Direct	None	?	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs
APAN-TW	JP-TW Direct	APAN-JP US?		APAN-JP	None	None	None	?	?	?	APAN-JP APII	APAN-JP
KOREN	APII	CN-KR Direct	APAN-JP		None	None	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	Direct	TEIN2 PoPs
ASTI	None	None	None	None		None	None	None	None	None	None	None
CSTNET	KDDI-GW	?	None	None	None		None	?	?	?	None	?
TEIN2	None	TEIN2-PoPs	None	TEIN2 PoPs	None	None		TEIN2 PoPs	TEIN2 PoPs	TEIN2	KOREN	TEIN2 PoPs

Routing Path in Asia Pacific

(Estimated Path except APAN-JP)

Normal

Single Path

Always been anomaly Path

Multiple Path

Connectivity Lost or Commodity

Jan. 4. 2007

Src \ Dest	APAN-JP	CERNET	APAN-TW	KOREN	ASTI	CSTNET	TEIN2	SingAREN	UniNet	ThaiSARN	KREONET 2	AARNET
APAN-JP		APII SingAREN Hawaii	JP-TW Direct	APII	None	TP2 Abilene - RBnet KDDI-GW	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	TP2-Abilene	TP2-Abilene Hawaii
CERNET	APII SingAREN Hawaii		APAN-JP	CN-KR Direct	None	?	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	?	TEIN2 PoPs
APAN-TW	JP-TW Direct	APAN-JP		APAN-JP	None	None	None	Direct	APAN-JP	APAN-JP	?	APAN-JP
KOREN	APII	CN-KR Direct	APAN-JP		None	None	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	Direct	TEIN2 PoPs
ASTI	None	None	None	None		None	None	None	None	None	None	None
CSTNET	TP2 Abilene - RBnet KDDI-GW	?	?	None	None		?	?	?	?	None	?
TEIN2	SingAREN via JGN2-SG	TEIN2-PoPs	APAN-KR APAN-JP	TEIN2 PoPs	None	None		TEIN2 PoPs	TEIN2 PoPs	TEIN2	KOREN	TEIN2 PoPs

Routing Path in Asia Pacific

(Estimated Path except APAN-JP)

Normal

Single Path

Always been anomaly Path

Multiple Path

Connectivity Lost or Commodity

Jan. 4. 2007

Src \ Dest	APAN-JP	CERNET	APAN-TW	KOREN	ASTI	CSTNET	TEIN2	SingAREN	UniNet	ThaiSARN	KREONET 2	AARNET
APAN-JP		APII SingAREN Hawaii	JP-TW Direct	APII	None	TP2 Abilene - RBnet KDDI-GW	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	TP2-Abilene	TP2-Abilene Hawaii
CERNET	APII SingAREN Hawaii		APAN-JP	CN-KR Direct	None	?	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	?	TEIN2 PoPs
APAN-TW	JP-TW Direct	APAN-JP		APAN-JP	None	None	None	Direct	APAN-JP	APAN-JP	?	APAN-JP
KOREN	APII	CN-KR Direct	APAN-JP		None	None	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	Direct	TEIN2 PoPs
ASTI	None	None	None	None		None	None	None	None	None	None	None
CSTNET	TP2 Abilene - RBnet KDDI-GW	?	?	None	None		?	?	?	?	None	?
TEIN2	SingAREN via JGN2-SG	TEIN2-PoPs	APAN-KR APAN-JP	TEIN2 PoPs	None	None		TEIN2 PoPs	TEIN2 PoPs	TEIN2	KOREN	TEIN2 PoPs

Routing Path in Asia Pacific

(Estimated Path except APAN-JP)

Normal

Single Path

Always been anomaly Path

Multiple Path

Connectivity Lost or Commodity

Jan. 9. 2007

Src \ Dest	APAN-JP	CERNET	APAN-TW	KOREN	ASTI	CSTNET	TEIN2	SingAREN	UniNet	ThaiSARN	KREONET 2	AARNET
APAN-JP		APII SingAREN Hawaii	JP-TW Direct	APII	MAFF-PH Direct	TP2 Abilene - RBnet KDDI-GW	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	SingAREN via JGN2-SG	TP2-Abilene	TP2-Abilene Hawaii
CERNET	APII SingAREN Hawaii		APAN-JP	CN-KR Direct	APAN-JP	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs
APAN-TW	JP-TW Direct	APAN-JP		APAN-JP	APAN-JP	TEIN2APA PAN-JP	None	Direct	APAN-JP	APAN-JP	APAN-JP APII	APAN-JP
KOREN	APII	CN-KR Direct	APAN-JP		APAN-JP	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	Direct	TEIN2 PoPs
ASTI	MAFF-PH Direct	APAN-JP	APAN-JP	APAN-JP			APAN-JP	APAN-JP	APAN-JP	APAN-JP	APAN-JP	APAN-JP
CSTNET	TP2 Abilene - RBnet KDDI-GW	TEIN2 PoPs	TEIN2APA PAN-JP	TEIN2 PoPs	TEIN2APA PAN-JP		TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs
TEIN2	SingAREN via JGN2-SG	TEIN2-PoPs	APAN-KR APAN-JP	TEIN2 PoPs	APAN-JP	None		TEIN2 PoPs	TEIN2 PoPs	TEIN2	KOREN	TEIN2 PoPs

Routing Path in Asia Pacific

(Estimated Path except APAN-JP)

Normal

Single Path

Always been anomaly Path

Multiple Path

Connectivity Lost or Commodity

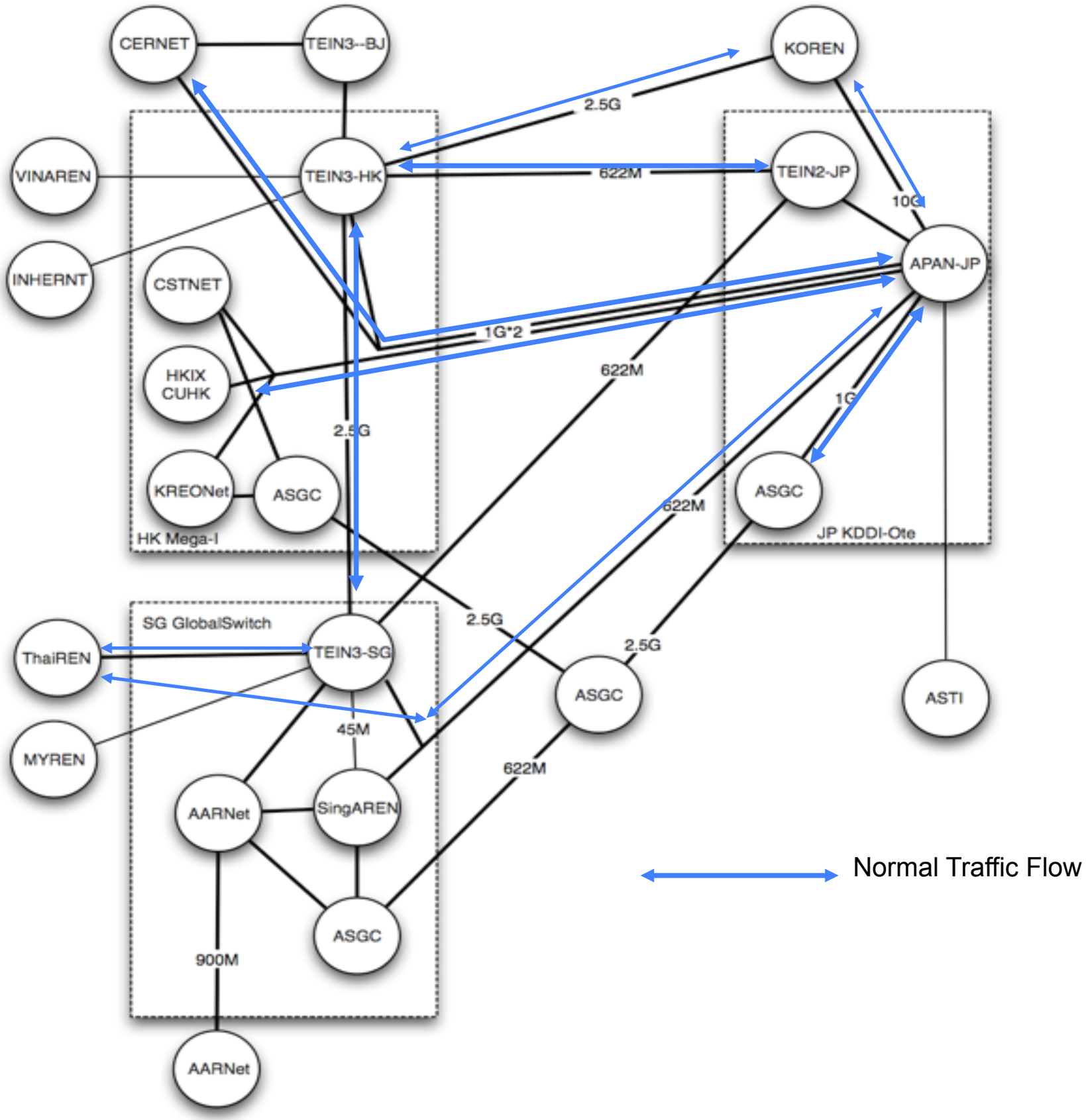
Feb. 20. 2007

Src \ Dest	APAN-JP	CERNET	APAN-TW	KOREN	ASTI	CSTNET	TEIN2	SingAREN	UniNet	ThaiSARN	KREONET 2	AARNET
APAN-JP		JP-CN Direct	JP-TW Direct	APII	MAFF-PH Direct	JP-CN Direct	TEIN2 JP-SG JP-HK	JGN2 SG Direct	TEIN2 JP-SG JP-HK	TEIN2 JP-SG JP-HK	TP2-Abilene	TEIN2 PoPs / Hawaii
CERNET	JP-CN Direct		APAN-JP	CN-KR Direct	APAN-JP	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs
APAN-TW	JP-TW Direct	APAN-JP		APAN-JP	APAN-JP	TEIN2APAPAN-JP	None	Direct	APAN-JP	APAN-JP	APAN-JP	APAN-JP
KOREN	APII	CN-KR Direct	APAN-JP		APAN-JP	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	TEIN2 PoPs	Direct	TEIN2 PoPs
ASTI	MAFF-PH Direct	APAN-JP	APAN-JP	APAN-JP			APAN-JP	APAN-JP	APAN-JP	APAN-JP	APAN-JP	APAN-JP
CSTNET	JP-CN Direct	TEIN2 PoPs	TEIN2APAPAN-JP	TEIN2 PoPs	TEIN2APAPAN-JP		None	APAN-JP	APAN-JP	APAN-JP	Direct	APAN-JP
TEIN2	TEIN2 JP-SG JP-HK	TEIN2-PoPs	APAN-KR APAN-JP	TEIN2 PoPs	APAN-JP	None		TEIN2 PoPs	TEIN2 PoPs	TEIN2	KOREN	TEIN2 PoPs

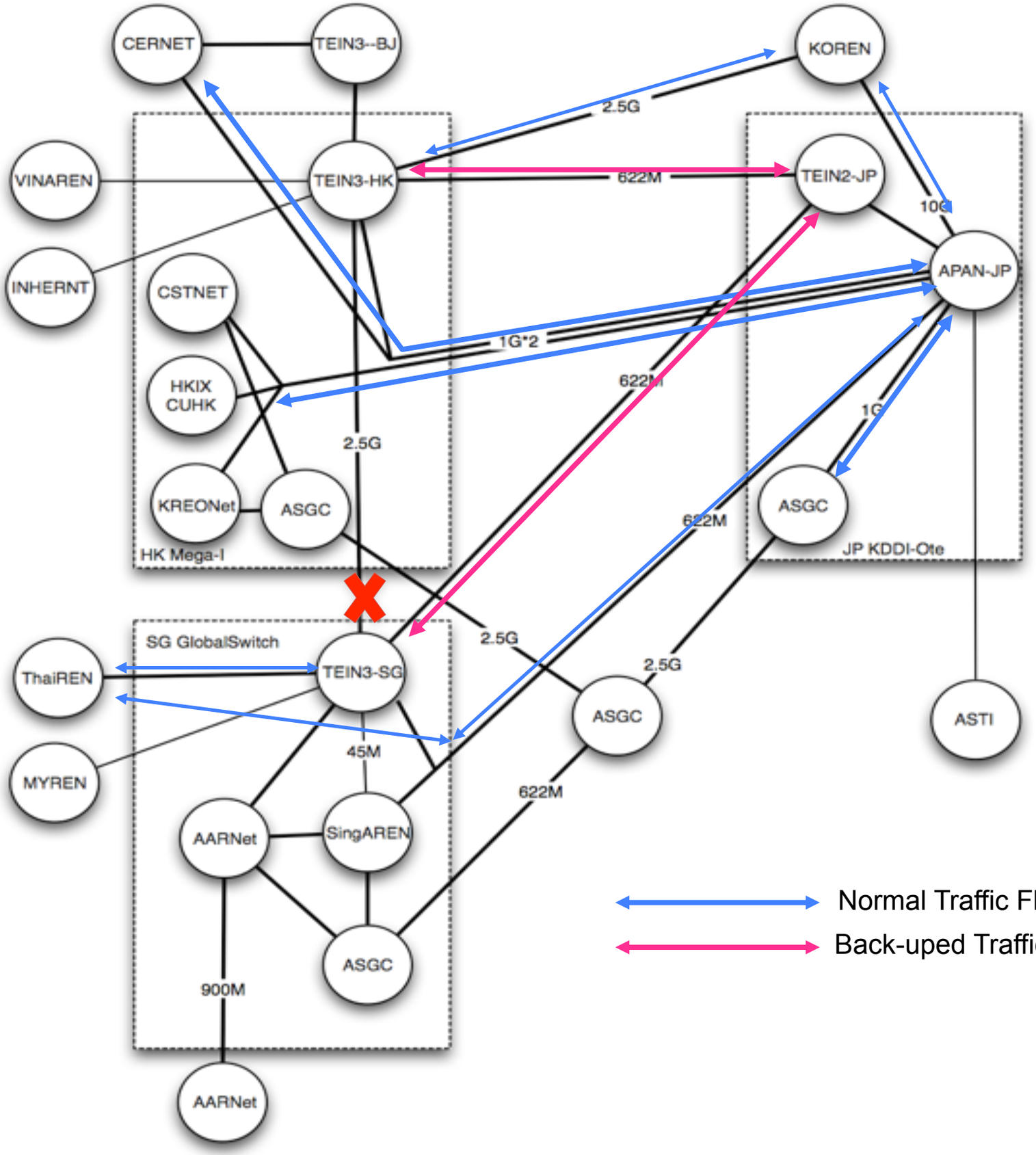
- Typhoon No. 8 (Japanese name), Morakot (English name) attacked Kaohsiung in 2008.

Prof. Kasahara's report

Normal Layer3 Topology and Traffic of Asian NRENs

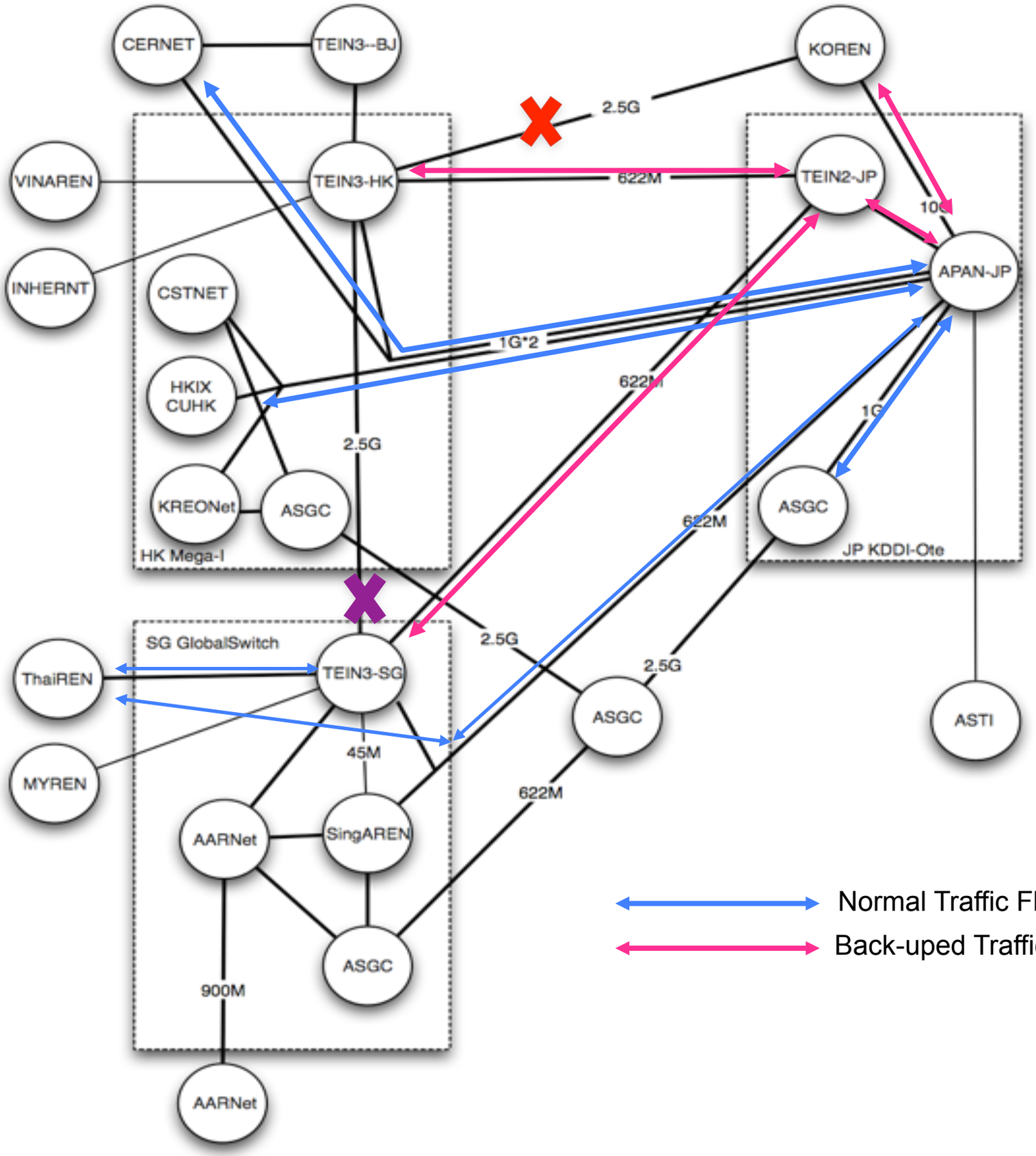


First impact on August 6th



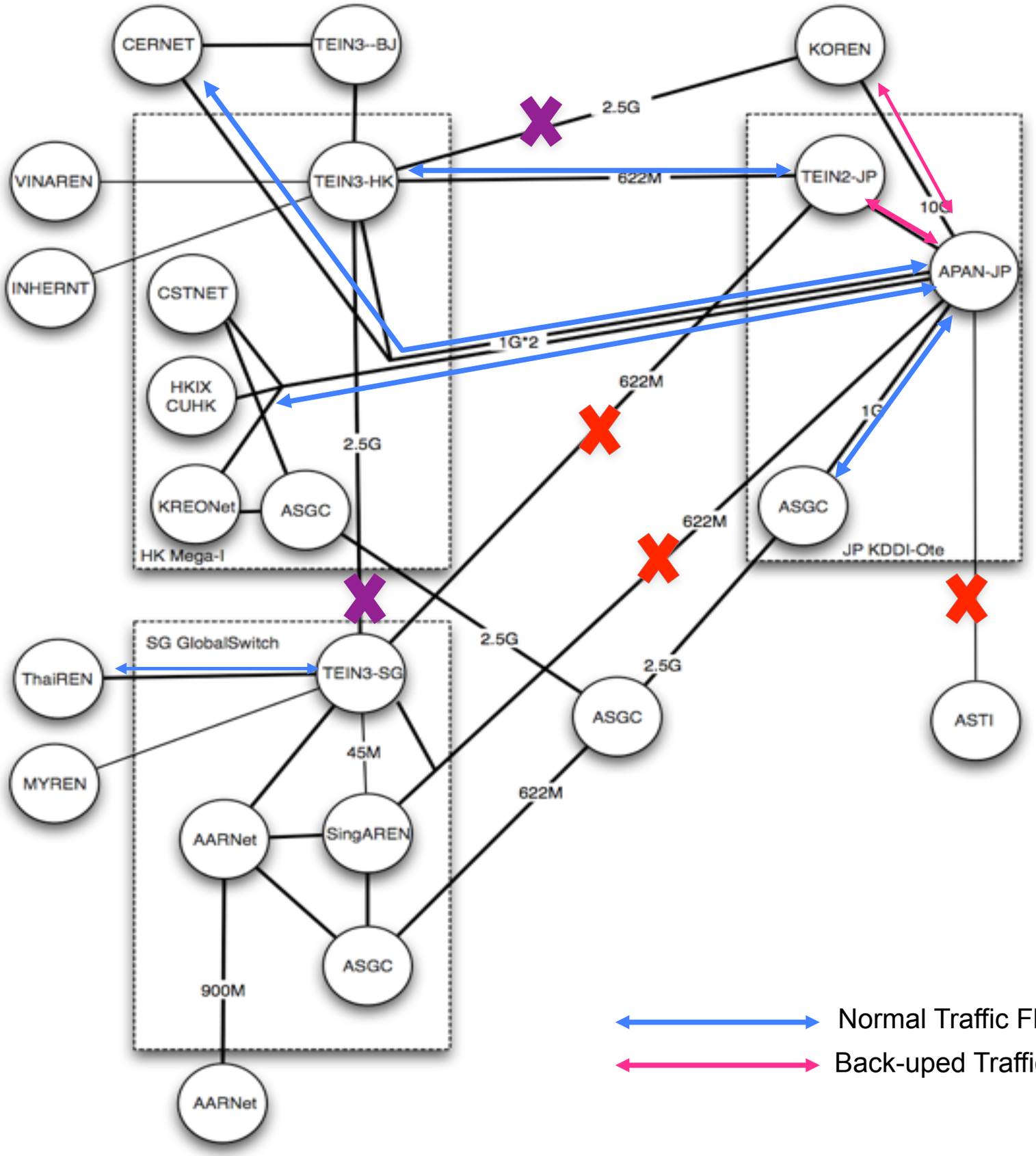
- TEIN3 HK-SG 2.5G circuit was interrupted due to EAC cable system frailer
- The traffic between TEIN3-HK and SG Pops shifted to NII's TEIN3-JP back up links

Second impact on August 9th



- TEIN3 SG-KR 2.5G circuit was interrupted due to “EAC cable system” frailer
- The traffic between KOREN and TEIN3 network shifted to APII/ JGN2plus 10G link

Third impact on August 12th (Current)



- The fault was detected on Segment 7 of APCN2
- Additionally, segment 1 of the APCN2 is also currently under repair
- Both NII and JGN2plus JP-SG 622 circuit were outage
- The connectivity of TEIN3 SG(and around NREN) and other Asian NREN was interrupted
- JP MAFF's JP-PH 155M circuit was also affected. ASTI has been disrupted the connectivity with R&E network

Routing affected as Undersea Cable Disruption

Source	Destination	AARNet (7575)	APAN-JP (7660)	ASCC (9264)	ASGC (24167)	ASTI (9821)	CERNET (4538)	CSTNET (7497)	KOREN (9270)	KREONET (17579)	SingAREN (23855)	TEIN3-HK (24489)	TEIN3-SG (24490)	ThaiSARN (3836)	TWAREN (7539)	UniNet (4621)	Internet2 (11537)	GEANT2 (20965)
	AARNet (7575)	-	I2 - TP2	I2 - TP2 AJP	direct	None	TEIN3 - GEA - TEINH	TEIN3 - GEA - TEINH - CERNET	I2 - TP2 - AJP	I2	direct	TEIN3 - GEA	direct	TEIN3 - TREN	direct	TEIN3 - TREN	direct	TEIN3
	APAN-JP (7660)	TP2-I2	-	direct	direct	None	direct	direct	direct	direct	TEINJ - TEINH - GEA - TEIN3	TEINJ	TEINJ - TEINH - GEA	TEINJ - TEINH - GEA - TEIN3 - TREN	ASCC	TEINJ - TEINH - GEA - TEIN3 - TREN	TP2	TP2 - I2
	ASCC (9264)	AJP - TP2 I2	direct	-	direct	None	direct	direct	AJP	AJP	None	CERNET	None	None	direct	AJP - TP2 - I2	AJP - TP2	AJP - TP2 - I2
	ASGC (24167)	direct	direct	SINET	-	None	direct	direct	AJP	direct	direct	SINET - TEINJ TEINH - GEA	SINET - TEINJ TEINH - GEA	SINET - TEINJ TEINH - GEA TEIN3 - TREN	direct	I2	direct	I2
	ASTI (9821)	None	None	None	None	-	None	None	None	None	None	None	None	None	None	None	None	None
	CERNET (4538)																	
	CSTNET (7497)																	
	KOREN (9270)	AJP - TP2 I2	direct	AJP	AJP	None	AJP	AJP	-	None	AJP - TEINJ - TEINH - GEA - TEIN3	AJP - TEINJ	AJP - TEINJ - TEINH - GEA	AJP - TEINJ - TEINH - GEA - TEIN3 - TREN	AJP - ASCC	AJP - TEINJ - TEINH - GEA - TEIN3 - TREN	AJP - TP2	AJP - TP2 - I2
	KREONET (17579)	direct	direct	CSTNET	direct	None	direct	direct	None	-	None	I2 - TP2 AJP - TEINJ	I2 - AAR	I2 - AAR - TEIN3 - TREN	direct	I2	direct	I2
	SingAREN (23855)	direct	ASGC	ASGC - SINET	direct	None	TEIN3 - GEA - TEINH	TEIN3 - GEA - TEINH - CERNET - 9406	ASGC - AJP	ASGC	-	TEIN3 - GEA	direct	TEIN3 - TREN	ASGC	TEIN3 - TREN	ASGC	TEIN3
	TEIN3-HK (24489)	AJP - TP2 I2 - AAR	AJP	None	None	None	direct	CERNET - 9406	TEINJ - AJP	None	GEA - TEIN3	-	GEA	GEA - TEIN3 TREN	None	GEA - TEIN3 TREN	TEINJ-AJP	direct
	TEIN3-SG (24490)	direct	AAR - I2 - TP2	AAR - I2 - TP2 - AJP	AAR - I2	None	GEA - TEINH	GEA - TEINH - CERNET -9406	AAR - I2 - TP2 - AJP	AAR - I2	direct	GEA	-	TREN	AAR - I2 - TP2 - AJP - ASCC	TREN	AAR - I2	direct
	ThaiSARN (3836)	TEIN3	TEIN3 - AAR	TEIN3 - AAR - I2 - TP2 - AJP	None	None	TEIN3 - GEA - TEINH	TEIN3 - GEA - TEINH - CERNET - 9406	TEIN3 - AAR - I2 - TP2 - AJP	TEIN3 - AAR - I2 - TP2 - AJP	TEIN3	TEIN3 - GEA - TEINH	direct	-	TEIN3 - AAR - I2 - TP2 - AJP	TREN	TEIN3 - AAR	TEIN3
	TWAREN (7539)	direct	ASCC	direct	direct	None	ASCC	ASCC	ASCC - AJP	ASCC - AJP	ASGC	ASCC - CER	I2 - AAR	I2 - AAR - TEIN - TREN	-	I2	direct	I2
	UniNet (4621)	TREN - TEIN3	I2 - TP2	I2 - TP2 - AJP	I2	None	TREN - TEIN3 - GEA - TEINH	TREN - TEIN3 - GEA - TEINH - CERNET - 9406	I2 - TP2 - AJP	I2	TREN - TEIN3	TREN - TEIN3 - GENAT	TREN - TEIN3	TREN	I2	-	direct	TREN - TEIN3

Connectivity Lost or Commodity

Intercontinental Loop Routes

Unknown (no peering with Compath Project)

Proposal for temporary backup routing

- According to our investigation by comPATH tool, currently there are many intercontinental loop / inefficient routes on Asian NRENs.
- It is important to restore the connection from APAN, TEIN3 to Singapore area.
- We have only one choice to get the connectivity to Singapore area by creating temporary TEIN3-SG - AARnet - ASGC - APAN-JP – TEIN3-HK path.
- The table on next slide shows the expected routing when we implement this temporal backup routing, and Intercontinental loop routes will be disappeared.

Temporal Routing in Asia during Undersea Cable Disruption

Source		Destination																
		AARNet (7575)	APAN-JP (7660)	ASCC (9264)	ASGC (24167)	ASTI (9821)	CERNET (4538)	CSTNET (7497)	KOREN (9270)	KREONET (17579)	SingAREN (23855)	TEIN3-HK (24489)	TEIN3-SG (24490)	ThaiSARN (3836)	TWAREN (7539)	UniNet (4621)	Internet2 (11537)	GEANT2 (20965)
Source	AARNet (7575)	-	I2 - TP2	I2 - TP2 AJP	I2	None	ASGC- AJP	ASGC- AJP	2 - TP2 - AJP	2	direct	ASGC - AJP - TEINJ	direct	TEINS - TREN	direct	TEINS - TREN	direct	TEINS
	APAN-JP (7660)	TP2-I2	-	direct	direct	None	direct	direct	direct	direct	ASGC- AAR - TEINS	TEINJ	ASGC- AAR - TEINS	ASGC - AAR - TEINS - TREN	ASCC	ASGC - AAR - TEINS- TREN	TP2	TP2 - I2
	ASCC (9264)	AJP - TP2 I2	direct	-	direct	None	direct	direct	AJP	AJP	(*1) -TEINS	CERNET	None	(*1) - TREN	direct	AJP - TP2 - I2	AJP - TP2	AJP - TP2 - I2
	ASGC (24167)	direct	direct	SINET	-	None	direct	direct	AJP	direct	direct	AJP	AAR	AAR - TEINS - TREN	direct	AAR - TEINS - TREN	direct	I2
	ASTI (9821)	None	None	None	None	-	None	None	None	None	None	None	None	None	None	None	None	None
	CERNET (4538)																	
	CSTNET (7497)																	
	KOREN (9270)	AJP - TP2 I2	direct	AJP	AJP	None	AJP	AJP	-	None	(*1) - TEINS	AJP - TEINJ	(*1) - TEINS	(*1) - TEINS - TREN	AJP - ASCC	(*1) - TEINS - TREN	AJP - TP2	AJP - TP2 - I2
	KREONET (17579)	direct	direct	CSTNET	direct	None	direct	direct	None	-	(*1) - TEINS	I2 - TP2 AJP - TEINJ	I2 - AAR	I2 - AAR - TEINS - TREN	direct	I2	direct	I2
	SingAREN (23855)	direct	ASGC	ASGC - SINET	direct	None	TEINS - (*2)	TEINS - (*2) - CERNET - 9406	ASGC - AJP	ASGC	-	TEINS - (*2) - TEINJ	direct	TEINS - TREN	ASGC	TEINS - TREN	ASGC	TEINS
	TEIN3-HK (24489)	TEINJ - AJP - ASGC	AJP	None	None	None	direct	CERNET - 9406	TEINJ - AJP	None	TEINJ - (*2) - TEINS	-	TEINJ - (*2)	TEINJ - (*2) - TEINS - TREN	None	TEINJ - (*2) - TEINS - TREN	TEINJ-AJP	direct
	TEIN3-SG (24490)	direct	AAR - ASGC	AAR - I2 - TP2 - AJP	AAR	None	(*2)	(*2) - CERNET	(*2)	AAR - I2	direct	(*2)	-	TREN	AAR - I2 - TP2 - AJP - ASCC	TREN	AAR - I2	direct
	ThaiSARN (3836)	TEINS	TEINS - AAR	TEINS - AAR - I2 - TP2 - AJP	TEINS - (*2)	None	TEINS - (*2)	TEINS - (*2)	TEINS - (*2)	TEINS - (*2)	TEINS	TEINS - (*2) - TEINJ	direct	-	TEINS - AAR - I2 - TP2 - AJP	TREN	TEINS - AAR	TEINS
	TWAREN (7539)	direct	ASCC	direct	direct	None	ASCC	ASCC	ASCC -AJP	ASCC - AJP	ASGC	ASCC - CER	ASGC - AAR - TEINS - TREN	ASGC - AAR - TEINS - TREN	-	2	direct	I2
	UniNet (4621)	TREN - TEINS	TREN - TEINS - AAR - ASGC	I2 - TP2 - AJP	TREN - TEINS - AAR	None	TREN - TEINS - (*2)	TREN - TEINS - (*2)	TREN - TEINS - (*2)	2	TREN - TEINS	TREN - TEINS - (*2) - TEINJ	TREN -TEINS	TREN	I2	-	direct	TREN - TEINS

Connectivity Lost or Commodity

Intercontinental Loop Routes

Unknown (no peering with Compath Project)

improved routes

*(*1)* *AJP – ASGC – AAR*

*(*2)* *AAR – ASGC – AJP*

Summary

- If the applications are based on the regular protocols, the quality of service becomes better with taking appropriate route.
- Most of the video conference QoS are not on the Internet communication QoS.
- R&E networks have the special community to optimize the routing with free.

- comPATH project is still going on at the APAN Tokyo XP.
- All the account holders can see if the actual paths look normal or not.
- Such the tables at this presentation is not available because of the keeping the NREN's privacy.
- The registration is required.