

R&E Routing Compath Project

APAN-JP/TEIN2-JP/JGN2 NOCs

KDDI

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Agenda

- Background
- System of Comparing Paths
 - BGP Path Matrix Tool
 - APAN-JP Zebra Server
 - Routing Compath Tool
- Demonstration
- Case Study
- Utilization
- Requests from APAN-JP

Background

- Current Status on R&E Networks
 - The connectivity of R&E networks are improving and progressing.
 - Most user are expecting the high performance of the networks.
 - Network operator have to support such user's research or demonstration.
And if there is any problem with networks, network operator have to resolve the problem as soon as possible.

Background

- Problems on R&E Networks
 - Layer3 routings are becoming complex. As router configuration tend to be complex too, it increase the burden on network operators with routing control.
 - Unexpected routings and asymmetric routings are generated.
 - It is difficult to collect network's or organization's information.
For example they include routing policy, network topology, network status.

Background

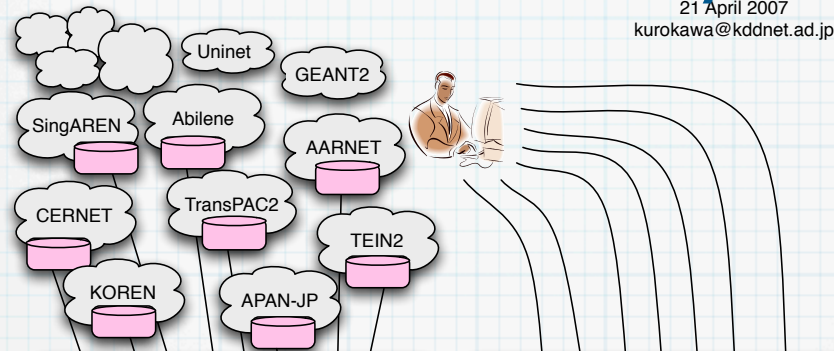
- Solutions from APAN-JP
 - BGP Path Matrix Tool
 - Developing the web page for viewing each organization's routing policy. This routing policy is their choice paths data.
 - ➔ **Enable to understand current BGP routing policy without asking other NOCs.**
 - ➔ **Enable to understand the BGP path information of each organization's choice, not only primary but also backups.**

Background

- APAN-JP Zebra Server
 - Developing the tool of confirming the BGP routing status on each R&E networks in real time.
 - ➔ **Enable to view current “BGP best path” information of other network.**
- R&E Routing Compath Tool
 - Developing the tool which compare the choice path with the current path by each networks, and display the result after comparing.
 - ➔ **By viewing the result, enable to detect the unexpected path.**

Illustration of the System

21 April 2007
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BGP Table of APAN-JP_tpr6

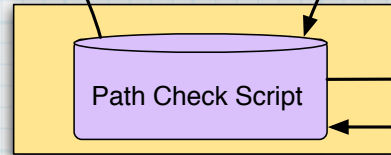
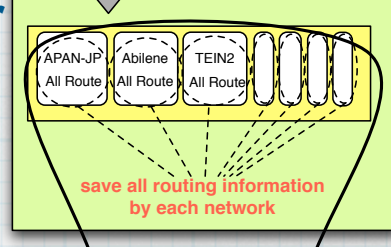
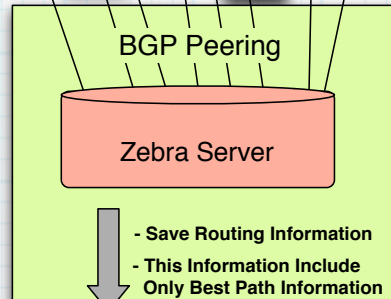
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BGP table version is 0, local router ID is 203.181.248.35
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, B Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

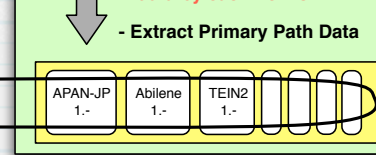
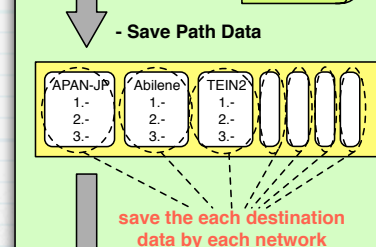
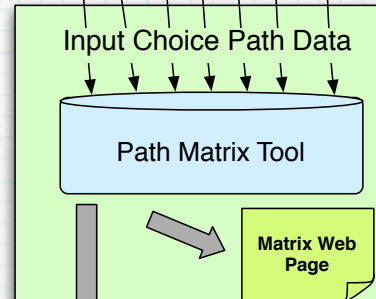
Network          Next Hop          Metric LocPrf Weight Path
--
> 6.1.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.2.0.0/22      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.3.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.4.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.5.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.6.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.7.0.0/16      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.8.0.0/20      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.9.0.0/20      203.181.248.144  0      0  7660 22388 11537 668 i
> 6.10.0.0/15     203.181.248.144  0      0  7660 22388 11537 668 i
> 6.14.0.0/15     203.181.248.144  0      0  7660 22388 11537 668 i
> 6.244.0/23      203.181.248.144  0      0  7660 22388 11537 11096 6356 i
> 8.0.245.0/24    203.181.248.144  0      0  7660 22388 19461 11096 i
> 9.4.0.0/16      203.181.248.144  0      0  7660 22388 11537 20965 559 i
> 12.0.48.0/20    203.181.248.144  0      0  7660 22388 11537 10578 1742 i
> 12.6.208.0/20   203.181.248.144  0      0  7660 22388 11537 10578 1742 i
    
```

APAN-JP Zebra Server

- Save the BGP routing information.
- Display the BGP routing information.



- Compare Real Path with choice Path
- Extract and Display Different Path



AARNET (AAR) 7575

Destination	AARNET (AAR) 7575	Abilene (ABL) 11537	APAN-JP (AJP) 7660	APAN-TW (ATW) 9264	CERNET (CER) 4538
AARNET (AAR) 7575	1 None	1 direct	1 TSG TIP	1 direct	1 TSG THK
	2 None	2	2 HAW	2 7539	2 TP2 AJP
	3 None	3	3	3 ABL	3 HAW AJP
Abilene (ABL) 11537	1 direct	1 None	1 TP2	1 TP2 AJP	1 STL THK
	2 TP2 AJP TJP TSG	2 None	2 SIT	2 STL	2 TP2 AJP
	3 GEA AAR	3 None	3 GEA SIT	3 SIR	3 AJP
APAN-JP (AJP) 7660	1 TJP TSG	1 TP2	1 None	1 direct	1 direct
	2 TP2	2 direct	2 None	2 CST	2 TJP THK
	3 HAW	3 SIT	3 None	3 TP2 ABL	3 KOR
APAN-TW (ATW) 9264	1 direct	1 direct	1 direct	1 None	1 direct
	2 AJP TJP TSG	2 AJP TP2	2 CST	2 None	2 AJP
	3 SIR TSG	3	3 ABL TP2	3 None	3
CERNET (CER) 4538	1 THK TSG	1 direct	1 direct	1 direct	1 None
	2 AJP TP2 ABL	2 AJP TP2	2 THK TJP	2 AJP	2 None
	3 AJP HAW	3 STL	3 KOR	3 STL	3 None

Path Matrix Tool

- Input the choice path information.
- Display the choice path information.

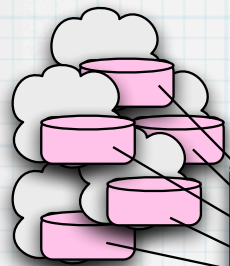
APAN-JP_tpr6

Prefix	AS PATH	Choice AS PATH
40.250.0.0/24	7660 23855 7610 4249	*7660_+(24287_)+(24490_)+(23855_)+
58.83.128.0/18	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.128.0/19	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.128.0/20	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.128.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.136.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.144.0/20	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.144.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.152.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.159.0/24	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.160.0/19	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.160.0/20	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.160.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.168.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.176.0/20	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+
58.83.176.0/21	7660 24287 24489 4538 9406 7497 9308	*7660_+(4538_)+

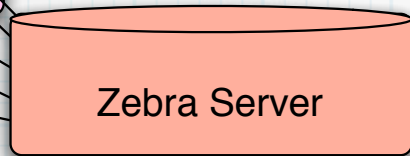
Compath Tool

- Compare the choice path data with current path data and display the result.

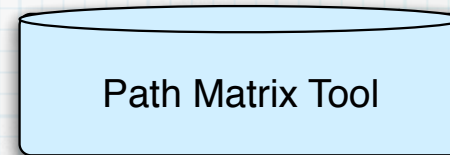
System of Comparing Paths



Peer with R&E Networks and Save BGP Routing Information



Input and Save Choice Path Information of R&E Networks.



Current Path Data



Get the data

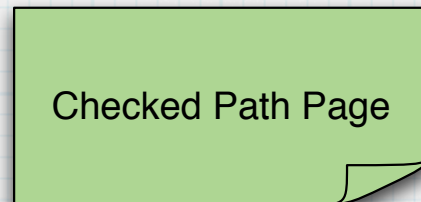


Choice Path Data

Compare Current Path Data with Choice Path Data.



NOC people view this page and confirm the normalization of different path.



Extract and Display Different Path Data from Compared Result.

System of Comparing Paths

BGP Path Matrix Tool

AARNET GO <--- Please select your organization when you input the path data.

Destination Source	AARNET (AAR) 7575	Abilene (ABL) 11537	APAN-JP (AJP) 7660	APAN-TW (ATW) 9264	CERNET (CER) 4538
AARNET (AAR) 7575	1 None 2 None 3 None	1 direct	1 TSG TJP 2 HAW 3	1 direct 2 7539 3 ABL	1 TSG THK 2 TP2 AJP 3 HAW AJP
Abilene (ABL) 11537	1 direct 2 TP2 AJP TJP TSG 3 GEA AAR	1 None 2 None 3 None	1 TP2 2 SIT 3 GEA ST	1 TP2 AJP 2 STL 3 SIR	1 STL THK 2 TP2 AJP 3 AJP
APAN-JP (AJP) 7660	1 TJP TSG 2 TP2 3 HAW	1 TP2 2 direct 3 SIT	1 None 2 None 3 None	1 direct 2 CST 3 TP2 ABL	1 direct 2 TJP THK 3 KOR
APAN-TW (ATW) 9264	1 direct 2 AJP TJP TSG 3 SIR TSG	1 direct 2 AJP TP2 3	1 direct 2 CST 3 ABL TP2	1 None 2 None 3 None	1 direct 2 AJP 3
CERNET (CER) 4538	1 THK TSG 2 AJP TP2 ABL 3 AJP HAW	1 direct 2 AJP TP2 3 STL	1 direct 2 THK TJP 3 KOR	1 direct 2 AJP 3 STL	1 None 2 None 3 None

**Destination
Network**

When both-way path is equal, the path will be colored blue.

When both-way path is not equal, the path will be colored red.

**Source
Network**

By meeting face-to-face and talking with the person in charge of each organization or contacting by E-mail, we could collect the each organization's choice path data in Path Matrix Tool.

System of Comparing Paths

APAN-JP Zebra Server

- About APAN-JP zebra server
 - Software : quagga-0.99.4
 - Host name : zebra.jp.apan.net
 - AS number : 65432
 - IP address : 203.181.248.35
 - Peering way : IBGP or EBGP multihop
 - Advertising routes : None
 - Receiving routes : Please advertise your all R&E routes
- Purpose of Use
 - Collecting BGP routing information on R&E networks.
 - By viewing these information, confirming the BGP routing status on each R&E networks in real time.
 - By saving these information, referring to past information.

System of Comparing Paths

APAN-JP Zebra Server

Peers List of APAN-JP ZEBRA server

Organizaiaon	Neighbor	AS	Up/Down	State/PfxRcd
WIDE	203.178.136.29	2500	4d03h35m	107.6
WIDE	203.178.136.31	2500	4d03h35m	3648
APAN-JP_tpr2	203.181.248.204	7660	4d03h35m	11076
APAN-JP_tpr1	203.181.248.144	7660	4d03h35m	11068
APAN-JP_tpr3	203.181.248.168	7660	4d03h35m	22634
TransPAC2	192.203.116.145	22388	4d03h35m	10642
TEIN2-SG	202.179.248.1	24490	4d03h35m	10387
ARNET_SIN	202.158.192.18	7575	4d03h35m	8464
ARNET_PER	202.158.192.217	7575	4d03h35m	10286

show ip bgp

BGP Table of APAN-JP_tpr6

BGP table version is 0, local router ID is 203.181.248.15
Status codes: s suppressed, d damped, h history, > valid, * best, i - internal,
r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 6.1.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.2.0.0/22	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.3.0.0/18	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.4.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.5.0.0/19	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.6.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.7.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.8.0.0/20	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.9.0.0/20	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.10.0.0/15	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.14.0.0/15	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.6.244.0/23	203.181.248.144	0	0	0	7660 22388 11537 10000 6356 i
*> 8.6.245.0/24	203.181.248.144	0	0	0	7660 22388 19401 1096 i
*> 9.4.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 20965 559 i
*> 12.0.48.0/20	203.181.248.144	0	0	0	7660 22388 11537 10578 1742 i
*> 12.6.208.0/20	203.181.248.144	0	0	0	7660 22388 11537 10578 1742 i

(1) Display the list of peering networks and the status with them.

- Peering organization's name
- Peering organization's status
- The number of receiving routes from peering organization

(2) Select the organization and click "submit button".

(3) Display APAN-JP zebra server's receiving routes from peering network.

- Display the current routing information

System of Comparing Paths

Routing Compath Tool

Destination	AARNET (AAR) 7575	Abilene (ABL) 11537	APAN-JP (AJP) 7660	APAN-TW (ATW) 9264	CERNET (CER) 4538
AARNET (AAR) 7575	1 None	1 direct	1 TSG TJP	1 direct	1 TSG THK
	2 None	2	2 HAW	2 7539	2 TP2 AJP
	3 None	3	3	3 ABL	3 HAW AJP
Abilene (ABL) 11537	1 direct	1 None	1 TP2	1 TP2 AJP	1 STL THK
	2 TP2 AJP TJP TSG	2 None	2 SIT	2 STL	2 TP2 AJP
	3 GFA A A P	3	3 GEA SH	3	3 AJP
APAN-JP (AJP) 7660	1 TJP TSG	1 TP2	1 None	1 direct	1 direct
	2 TP2	2 direct	2 None	2 CST	2 TJP THK
	3 HAW	3 SIT	3 None	3 TP2 ABL	3 KOR
APAN-TW (ATW) 9264	1 direct	1	1 direct	1 direct	1 direct
	2 AJP TJP TSG	2 AJP TP2	2 CST	2 None	2 AJP
	3 SIR TSG	3	3 ABL TP2	3 None	3
CERNET (CER) 4538	1 THK TSG	1 direct	1 direct	1 direct	1 None
	2 AJP TP2 ABL	2 AJP TP2	2 THK TJP	2 AJP	2 None
	3 AJP HAW	3 STL	3 KOR	3 STL	3 None

BGP Table of APAN-JP_tpr6

BGP table version is 0, local router ID is 203.181.248.35
 Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
 r RIB-failure, S Stale, R Removed
 Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 6.1.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.2.0.0/22	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.3.0.0/18	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.4.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.5.0.0/19	203.181.248.144	0	0	0	660 22388 11537 668 i
*> 6.6.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.7.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.8.0.0/20	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.9.0.0/20	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.10.0.0/15	203.181.248.144	0	0	0	7660 22388 11537 668 i
*> 6.14.0.0/15	203.181.248.144	0	0	0	660 22388 11537 668 i
*> 8.6.244.0/23	203.181.248.144	0	0	0	7660 22388 11537 11096 6356 i
*> 8.6.245.0/24	203.181.248.144	0	0	0	7660 22388 19401 11096 i
*> 9.4.0.0/16	203.181.248.144	0	0	0	7660 22388 11537 20965 559 i
*> 12.0.48.0/20	203.181.248.144	0	0	0	7660 22388 11537 10578 1742 i
*> 12.6.208.0/20	203.181.248.144	0	0	0	7660 22388 11537 10578 1742 i

From APAN-JP

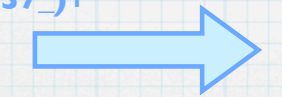
To AARNET ^ (7660_)+(7575_)+

To Abilene ^ (7660_)+(22388_)+(11537_)+

To APAN-TW ^ (7660_)+(9264_)+

To CERNET ^ (7660_)+(4538_)+

:
:
:
:



Compare Path Script



Current Path Data



Display the different paths by prefix after comparing the choice paths with the current path.

“Router#show ip bgp neighbors received-route”

System of Comparing Paths

Routing Compath Tool

- The Example of APAN-JP

Compare Organization's Choice Path with Present Path

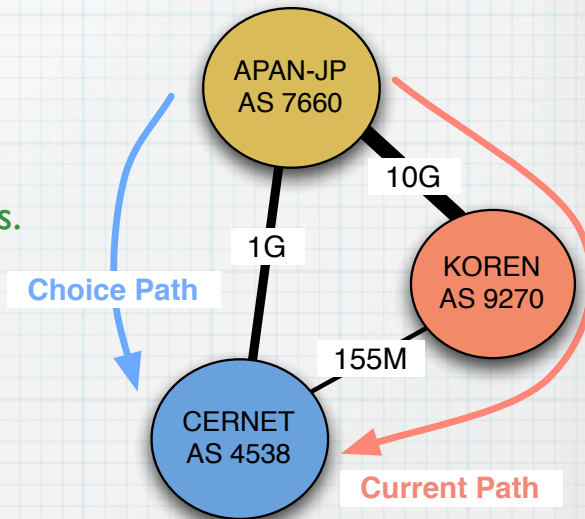
compare path

After comparing the choice path with current path, "Compath Tool" extract and display the different paths on a prefix basis.

APAN-JP (7660) ---> CERNET (AS4538)

Prefix	Current AS PATH	Choice AS PATH
116.213.64.0/19	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
116.213.96.0/19	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
195.66.155.0/24	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.176.0/20	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.176.0/22	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.180.0/22	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.184.0/22	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.190.0/23	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.152.190.0/24	7660 24287 24489 4538 9406 7497 24134 i	^(7660_)+(4538_)+
202.38.108.0/22	7660 9270 4538 4538 i	^(7660_)+(4538_)+
202.38.112.0/21	7660 9270 4538 4538 i	^(7660_)+(4538_)+

Current AS Path Data Choice AS Path Data



Prefix of different path

202.38.108.0/22

Current Path

7660 9270 4538 4538 i

Choice Path

^(7660_)+(4538_)+

Demonstration

URL <http://compath.jp.apan.net/index2.rhtml>

Test Target : APAN-JP(AS7660) ---> Any Network

APAN-JP's(AS7660) choice path data

Reference : http://compath.jp.apan.net/noc/all_path.cgi

APAN-JP's(AS7660) current path data

Reference : URL <http://compath.jp.apan.net/>

Case Study

Prefix	AS PATH	Choice AS PATH
208.65.120.0/22	7660 22388 11537 7575 6360 16538 i	^(7660_)+(6360_)+

detected by Compath Tool

To Univ.Hawaii
From APAN-JP

Prefix of different path

208.65.120.0/22

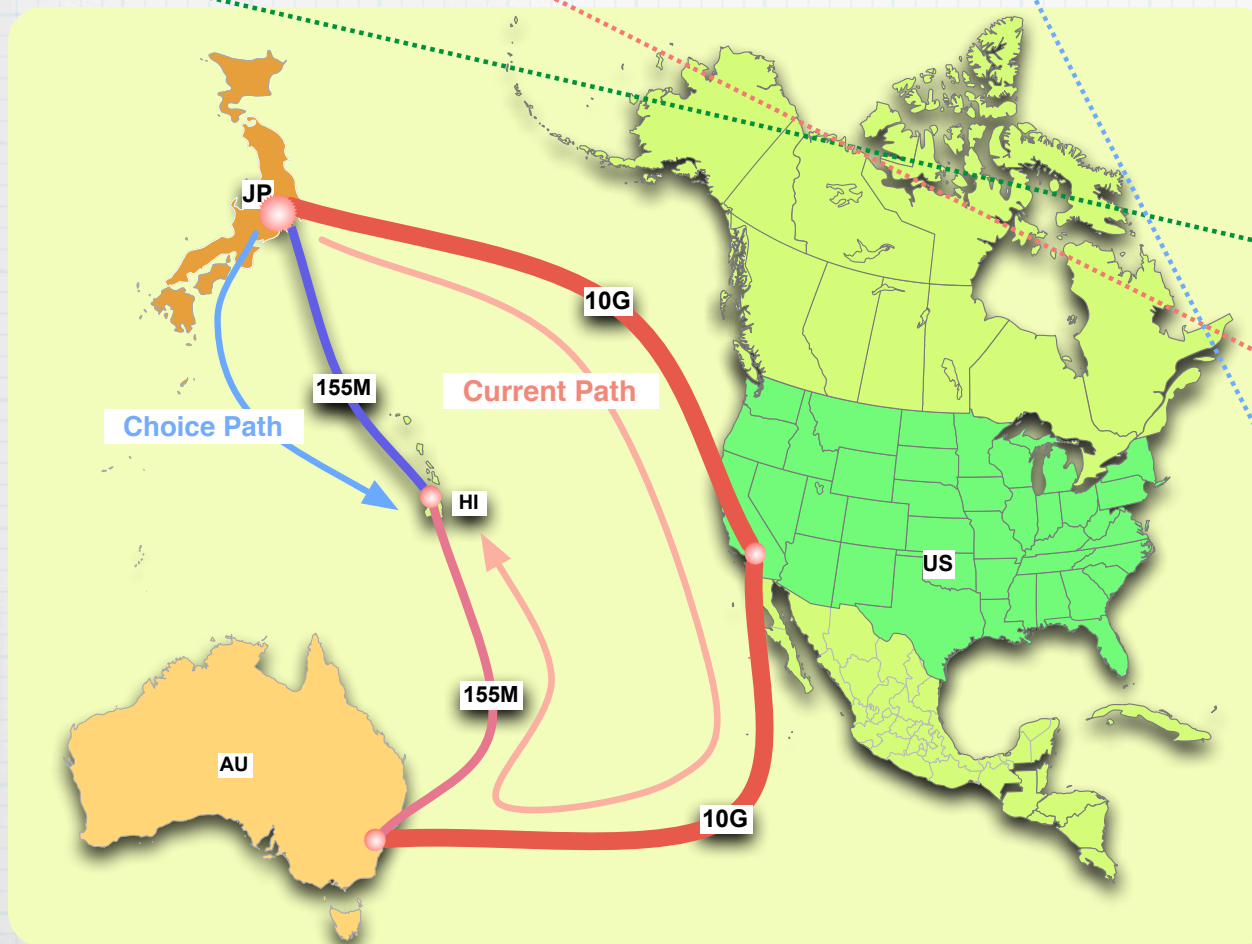
Current Path

7660 22388 11537 7575
6360 16538 i

Choice Path

^(7660_)+(6360_)+

APAN-JP have direct path with Univ.Hawaii but regarding with 208.65.120.0/22, APAN-JP select the path via US and Australia.



Utilization

- By using these Tools ...
 - Enable to view other organization's or network's routing information when we don't have direct connectivity too.
 - If we peer with APAN-JP zebra server, we can so easily disclose own routing information to other NOCs, without “router proxy” or something tool.
These disclosed information will be helpful when NOCs try to do troubleshooting.
 - By viewing the result of the tool's comparing the choice path with the current path in own network, we can find and detect the unexpected routing selection.

Requests from APAN-JP

- We would like to collect R&E network's or organization's BGP Choice Path Information.
Please let us know your network's BGP path selection.
- ➔ Already AARNET, Abilene, APAN-TW, CERNET, KOREN, SINET, TransPAC2 and Uninet have inputed their BGP path selection in "Path Matrix Tool".
- We would like to share the information of R&E network's or organization's routing status with NOCs.
Please peer with APAN-JP Zebra server.
- ➔ Already TransPAC2 ,TEIN2 and AARNET peer with APAN-JP Zebra Server.