

# Registry

NTT Communications  
JPNIC IP Committee / JPNIC IRR-Plan Chair  
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## Internet Registry

- Organization to maintain and management the Internet Resource of IP Address or AS Number etc
- Internet Registry's (IR) category
  - RIR
    - Regional Internet Registry
    - 5 RIRs : ARIN, RIPE NCC, APNIC, LACNIC, AfriNIC
  - NIR ( currently Asia Pacific Region only )
    - National Internet Registry
    - 6 NIRs: JPNIC, KRNIC, TWNIC, CNNIC, APJII, VNNIC
  - LIR
    - Local Internet Registry
    - ISP etc

## Topics

- Internet Registry (IR)
  - What is the Internet Registry
  - The Role of IR
- Internet Routing Registry (IRR)
  - What is IRR
  - The Role of IRR
  - IRR Objects
  - IRR usage of ISP
- Interaction of IR and IRR

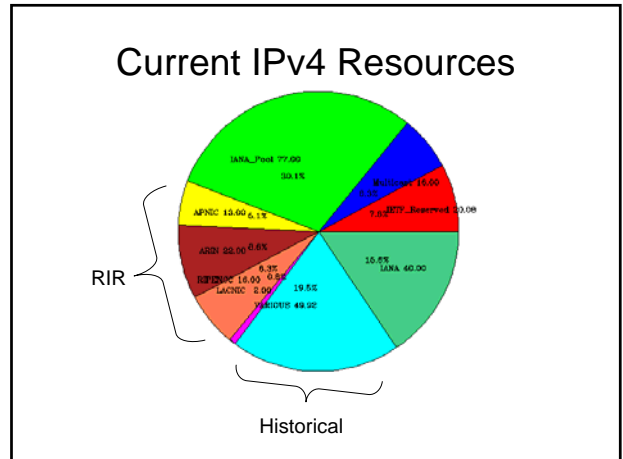
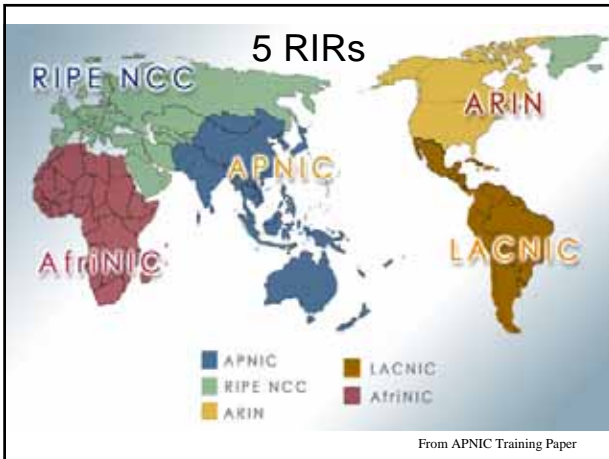
## Internet Resource Management

- Internet resource management is performed for hierarchy structure from IANA
  - IANA – Internet Assigned Numbers Authority
    - Maintain the IP address, Domain name, Protocol number, Port number etc regarding to TCP/IP
      - <http://www.iana.org/numbers.html>
    - Now the name of IANA is the symbol of those ICANN's function
- The maintenance and management of the IP block, AS number, reverse DNS zone are performed by IR (Internet Registry)
  - 5 RIRs (the AfriNIC is a provisional) and 6 NIR's are providing the regional/national internet service for there region

## Internet Registry

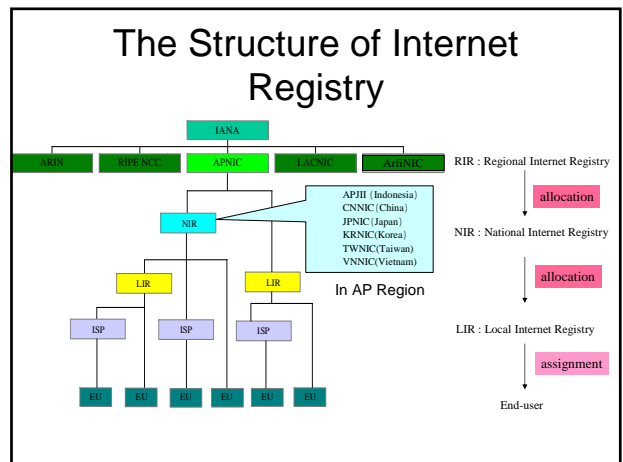
## Old / New Registry

- Old RIR
  - APNIC, ARIN, RIPE NCC
  - For the past, only ARIN exists ( former InterNIC )
- Old NIR
  - APJII, CNNIC, KRNIC, JPNIC, TWNIC
- New Registry
  - LACNIC launce for new RIR (2002.10)
  - VNNIC launce for new NIR (2003.02)
  - AfriNIC is now provisional RIR
    - Preparing for formal RIR



### Comparison of RIRs

- differences in historical circumstances and social environment
  - ARIN: US-rule based, governance
  - RIPE NCC: Engineer community, EU cooperation
  - APNIC: cultural diversity and a language problem
  - LACNIC: eager for startup now
  - AfrinIC: is coming (now: provisional phase)



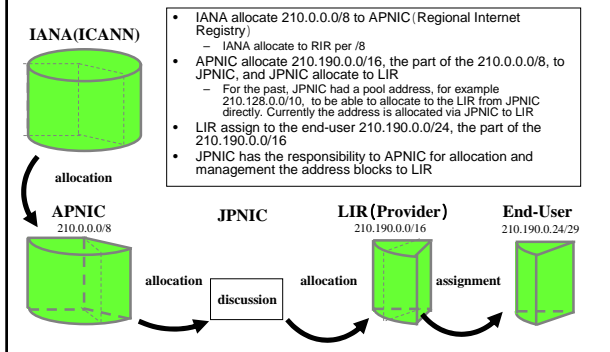
### Allocation and Assignment

- Allocation
 

In order to re-assignment, Upper Internet Registry delegate their IP Blocks to lower
- Assignment
 

Assign the IP Blocks (or AS number) to end side which they use those on their side actually

## Structured Image from IANA



## Internet Routing Registry

- IRR = Internet Routing Registry
  - The Database which stored the routing information or some BGP policy of AS
- Very useful information
  - IRR used by ISP's prefix filtering information or making a router configuration
  - IRR have variety of Objects and stored many important information for routing
- Basically optional information but
  - AS Operator or administrator should register your IP blocks or some information to IRR

## Policy Making Process

- IP Address five principle
  - Uniqueness, Registration, Aggregation, Saving and Fairness
- RIR's Policy has to be discussed openly including the RIR member, and to be enacted by achieving the consensus
- The policy among RIRs needs to have equal nature and transparency

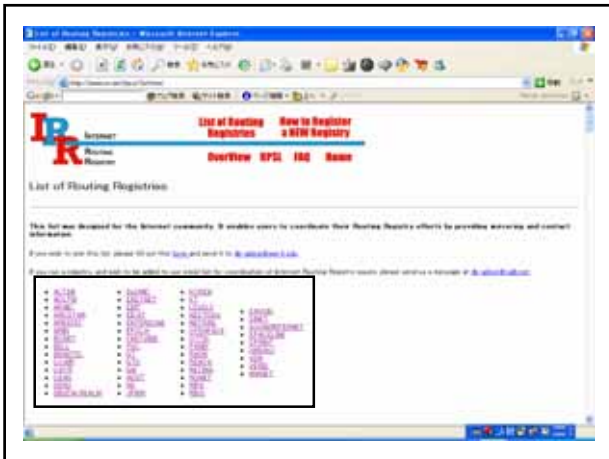
## Worldwide IRR

- There are over 50 IRRs in the world
- The IRR information is distributed
  - Mirroring is needed to propagate the IRR information each other
- Main IRR in the world
  - Public IRR
    - RADB is the most bigger IRR in the world
  - Registry's IRR
    - RIPE NCC, APNIC, JPNIC, ...
  - ISP's IRR
    - ATT, SPRINT, VERIO, LEACH, NTT, ...

## Internet Routing Registry

## Famous IRR

- RADB
  - The Largest IRR in World Wide
  - It is operated by Merit Inc
  - Merit has coordinated many IRRs
    - It is listed on <http://www.radb.net/>
- APNIC
  - The largest IRR in Asia Pacific
  - It is operated by APNIC
  - APNIC operates WHOIS database which has IRR functions.(RIPEv3)
- RIPE NCC
  - RIPE database is the most famous IRR/WHOIS database.
  - RIPE IRR service is operated by RIPE/NCC
- Sprint, VERIO, LEACH ...
  - Private ISP's IRR database which is operated by ISP



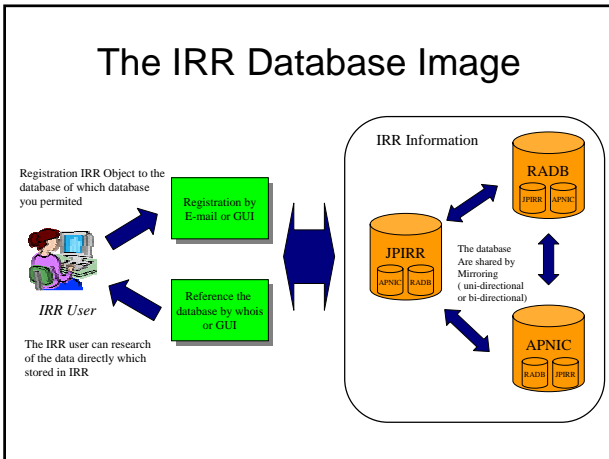
### irrd.conf

```

• !
• !debug all /tmp/irrd.log 0
• !
• ! telnet interface password
• password *****
• ! telnet interface port number
• ui_port 5673
• ! logging
• debug server file-name /var/log/irrd.log
• debug server file-max-size 10000000
• debug server syslog
• !debug submission file-name /var/log/ir-email.log
• ! access-list
• access-list 1 permit 127.0.0.1/32
• access-list 1 permit ::1/128
• access-list 10 permit 192.168.0.35/32
• access-list 10 permit 172.16.31.190/32
• ...

• ! path for database files
• ir_directory /db
• ! directory in which to copy files
• ftp_directory /home/ftp/database
• !
• ! ir_database jpirr authoritative
• ! ir_database jpirr mirror-access 10
• ! ir_database jpirr export 600
• ! ir_database jpirr clean 172800
• ! ir_database radb_mirror_host 202.12.29.16 43003
• ! ir_database radb_clean 172800
• !
• ! ir_database ripe_mirror_host 202.12.29.16 43003
• ! ir_database ripe_clean 172800
• !

```



### irrd.conf

```

• ##### ir_database aprir_mirror_host 202.12.29.8 43
• ##### ir_database aprir_clean 172800
• !!
• ! ir_database apric_mirror_host 202.12.28.16 43003
• ! ir_database apric_clean 172800
• !!

• ! interval for mirror updates (seconds)
• ir_mirror_interval 1800
• ! whois port
• ir_port 43
• !!

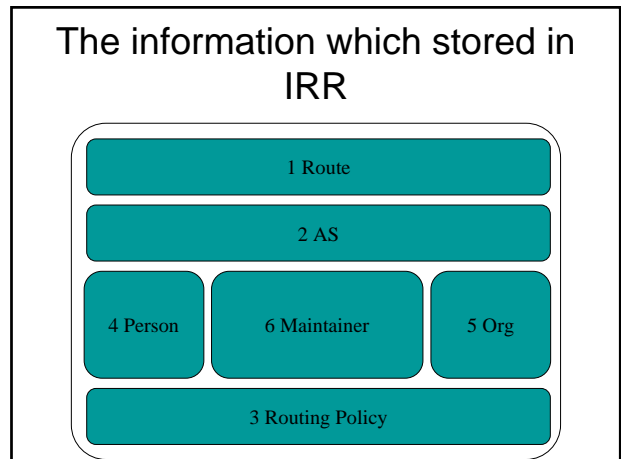
• #####
• !! ir_rpsl_submit
• ! IRRd server
• ir_server jpirr.nic.ad.jp
• ! authentication
• override_cryptpw *****

• ! FGP ring
• fpgp_dir /usr/local/irrd/fpgp
• ! email address of administrators
• db_admin ir-admin@nic.ad.jp
• !!

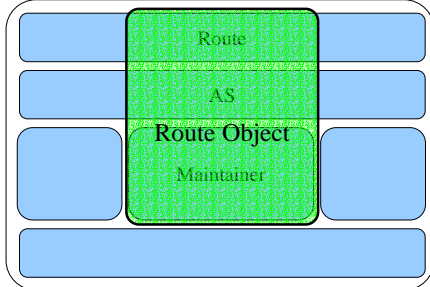
• !rc vty
• login
• access-class 1
• port 5673
• !
• !
• response_footer
  response_footer .....
  response_footer JPNIC IRR (JPIRR) experiment service is provided by JPNIC.
  response_footer If you have any questions, please send them to
  response_footer ir-admin@nic.ad.jp ..... db-admin
  response_footer .....
• !

```

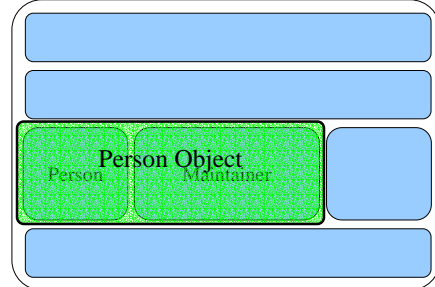
- ### IRRD
- The Software to manage the IRR
    - For the past, Merit did not distribute this software but now opened
  - IRRd can
    - Manage or store the IRR data
    - Mirroring
    - Register the object via e-mail etc and check the grammar of the object
    - Whois service
    - Can support RPSL
    - IPv6 is ready



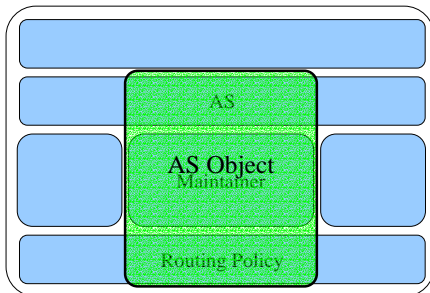
### 1. Route Object



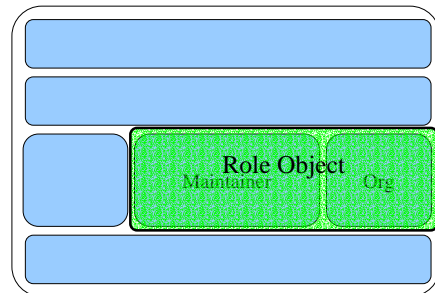
### 4. Person Object



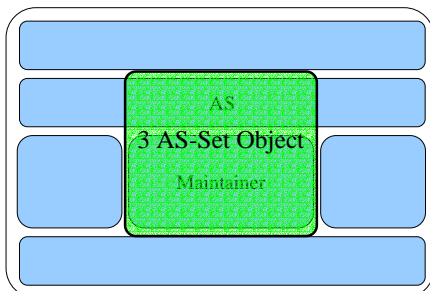
### 2. AS Object



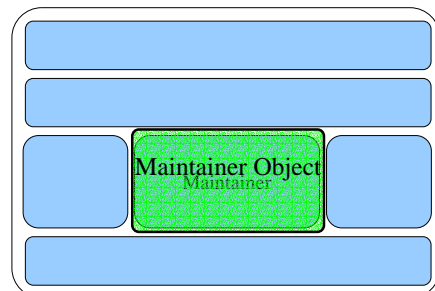
### 5. Role Object



### 3. AS-Set Object



### 6. Maintainer Object



## IRR Object

- Maintainer Object
- Route Object
- AS Object
- AS-Set Object
- Person Object
- Role Object

## Route Object

- The BGP routing information
  - Not assignment information by registry but actual bgp routing information
- prefix, mask, and the origin AS number etc are described

## Maintainer Object

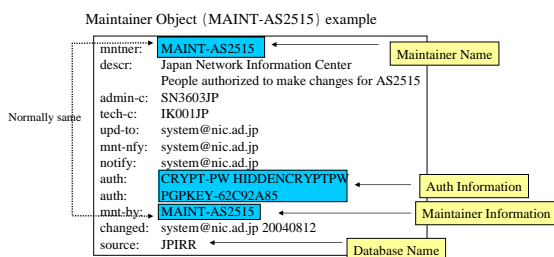
- Administrative/Authenticate Information
  - Those who are permitted to change the registration to any object
  - Like user ID of IRR
- This object must be registered first before any other object by DB admin
- 4 Type's of Authentication
  - NONE no authentication
  - MAIL-FROM check the header of mail-from
  - CRYPT-PW UNIX Crypt authentication
  - PGP PGP authentication

## Route Object

Route Object (202.12.30.0/24) example



## Maintainer Object



## AS Object

- This Object represents an AS (Autonomous System)
- describes AS information and policies for routing information, reception and advertisement
  - Which prefix receive
  - How to receive the route
    - If the as is 100, local-preference is 500
    - If the as is 200, local-preference is 100 and add the community strings 1:200 etc..

## AS Object

```
aut-num: AS2914
descr: Verio
admin-c: VP8-ARIN
tech-c: VP8-ARIN
import: from AS24 accept ANY
import: from AS103 accept ANY
import: from AS145 accept ANY
...
export: to AS-ANY announce AS-VERIO
mnt-by: MAINT-VERIOBB
changed: jared@eng.verio.net 20020118
source: VERIO
```

## Person Object

- Personal Information
- Referred from other objects

```
person: Tomoya Yoshida
address: Open Computer Network (OCN)
address: NTT Otemachi Buld.
address: 2-3-5 Otemachi Chiyoda-Ku
address: Tokyo Japan
phone: +81 3 6800 6325
e-mail: yoshida@ocn.ad.jp
nic-hdl: TY6070
mnt-by: MAINT-AS4713
changed: yoshida@jp.ntt.net 20020509
source: VERIO
```

## AS-Set Object

- Two or more AS(s) are described
- Usually Transit ISP add their AS-Set Object to describe their customer's AS
  - Transit ISP's upstream refer this as-set object to make a filtering
- Must described "AS- $\chi\chi$ " for RFC2622

## Role Object

- Some Organization or group
- Referred from other objects

```
role: HM201-RIPE
e-mail: nic@gxn.net
nic-hdl: HM201-RIPE
notify: notify@gxn.net
mnt-by: AS5413-MNT
changed: mjc@gxn.net 19971211
source: RADB
```

## AS-Set Object

```
as-set: AS-III
descr: ASes routed by III
members: AS109, AS151, AS2497, AS2503, AS2504,
AS2506, AS2512, AS2515, AS2523, AS2525,
AS2526, AS2527, AS4459, AS4672, AS4683,
AS4688, AS4692, AS4695, AS4705, AS4708,
AS4709, AS4710, AS4711, AS4716, AS4718,
AS4719, AS4723, AS4724, AS4725, AS4728,
...
```

## How we use IRR database?

- Refer to the IRR database when some trouble happen
  - Whois –h whois.radb.net 203.139.160.0/19
- ISP make Filtering from IRR Information
- Making a configuration from IRR Information

## Prefix Filtering from IRR

- IRRToolset
  - Subset of tools
  - Get the specific AS information from IRR
  - Make a configuration from IRR
- AS-Set Object and Route Object is mostly used by ISP
  - (ex) AS-OCN
    - AS-OCN is a AS-Set Object which stored OCN routes and OCN customer's route
    - VERIO is a transit ISP of OCN and VERIO adapt prefix filtering
    - VERIO get OCN route Information from AS-OCN IRR AS-Set Object

## RtConfig (juniper\_based)

```
>RtConfig -config junos
RtConfig> @RtConfig access_list filter as4713

policy-statement prefix-list-100 {
  term prefixes {
    from {
      route-filter 47.153.0.0/18 exact accept;
      route-filter 61.112.0.0/15 exact reject;
      route-filter 61.112.0.0/15 upto /16 accept;
      route-filter 61.118.0.0/15 exact reject;
    }
  }
}
....
```

## IRRToolSet

- **RtConfig** : config make tool
  - Support Cisco/JUNOS/Nortel/Bay/Gated/RSd
- **peval** : search prefix
  - Get the route information with some origin AS
- **aoe** : AS Object Editor
- **roe** : Rout Object Editor
- **ptraceroute** : add the as-path on traceroute result
- prcheck** : RPSL syntax check tool
- etc

## RtConfig (others)

```
>RtConfig -config junos
RtConfig>@RtConfig printPrefixes "route %p/%l {
  %n%tdiscard;%n%t%preference 300;%n%t}%n" filter as4713

route 47.153.0.0/18 {
  discard;
  preference 300;
}
route 61.112.0.0/16 {
  discard;
  preference 300;
}
....
```

%p	prefix
%l	length
%L	32-length
%n	n (%p/%l ^%n-%m, e.g. 128.9.0.0/16^24-32
%m	m
%k	mask
%K	inverse of mask (I.e. ~mask)
%%	%
%n	carriage return
%t	tab

## RtConfig(cisco\_based)

```
>RtConfig -cisco_use_prefix_lists
RtConfig> @RtConfig access_list filter as4713

!
no ip prefix-list pl100
ip prefix-list pl100 permit 47.153.0.0/18
ip prefix-list pl100 permit 61.112.0.0/15 ge 16 le 16
ip prefix-list pl100 permit 61.118.0.0/15 ge 16 le 16
ip prefix-list pl100 permit 61.125.176.0/22
ip prefix-list pl100 permit 61.126.0.0/15
....
```

## peval

```
>peval as4713

((218.47.128.0/18, 218.47.0.0/17, 218.44.0.0/16,
218.43.0.0/16, 211.130.0.0/16, 211.129.0.0/16,
211.122.0.0/15, 211.16.0.0/15, 211.11.0.0/16,
211.6.0.0/16, 211.0.0.0/16, 210.254.128.0/17,
210.248.0.0/16, 210.232.0.0/16, 210.226.0.0/15,
210.225.0.0/16, 210.190.0.0/16, 210.170.64.0/18,
210.164.0.0/16, 210.160.0.0/16, 210.161.0.0/16,
210.162.0.0/16, 210.163.0.0/16, 210.154.0.0/16,
210.145.0.0/16, 210.145.0.0/17, 210.145.128.0/17,
....
```

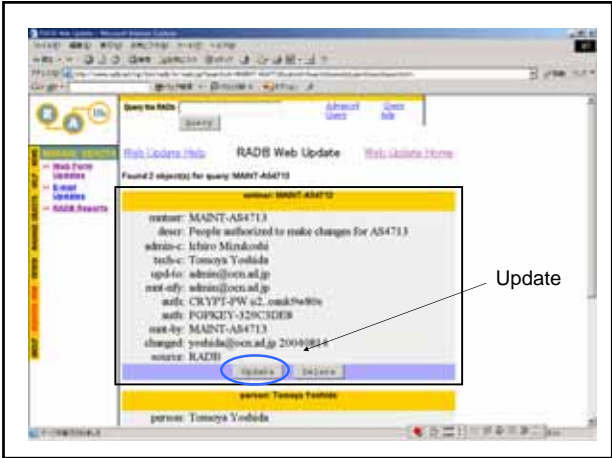
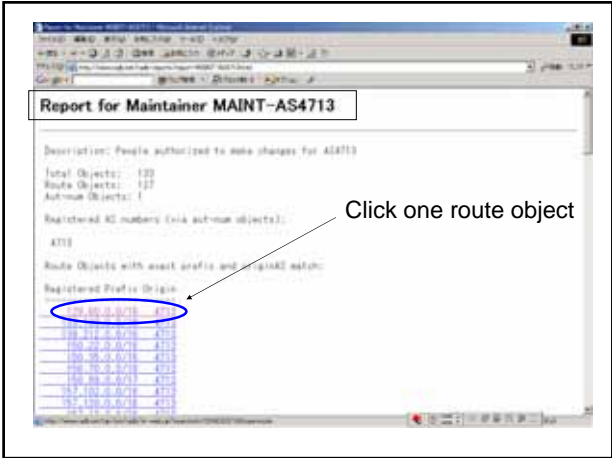
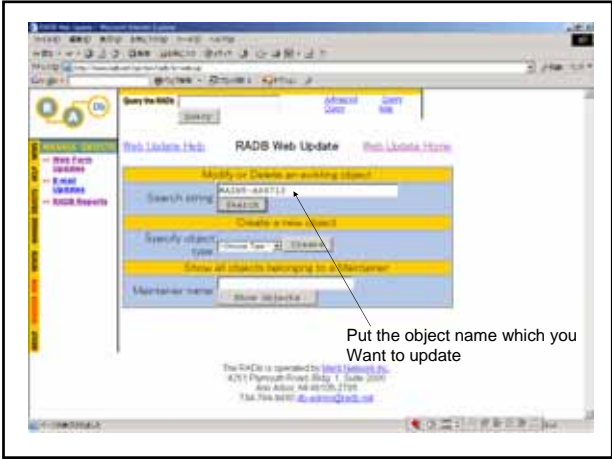
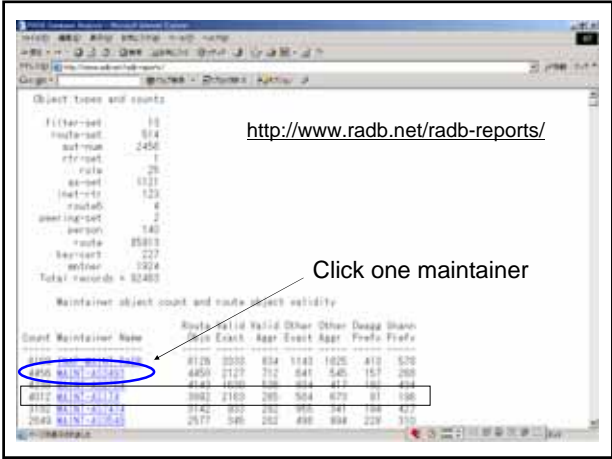
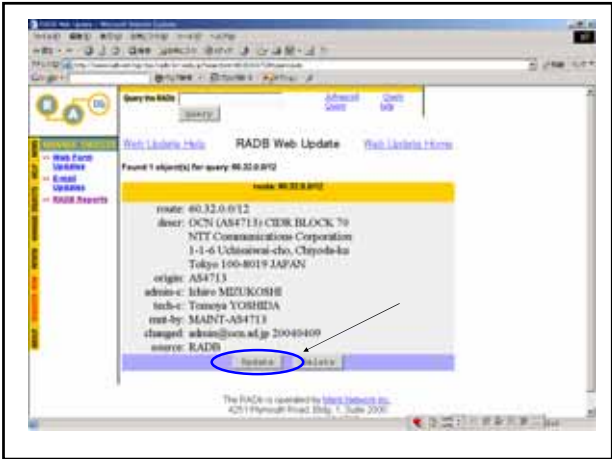


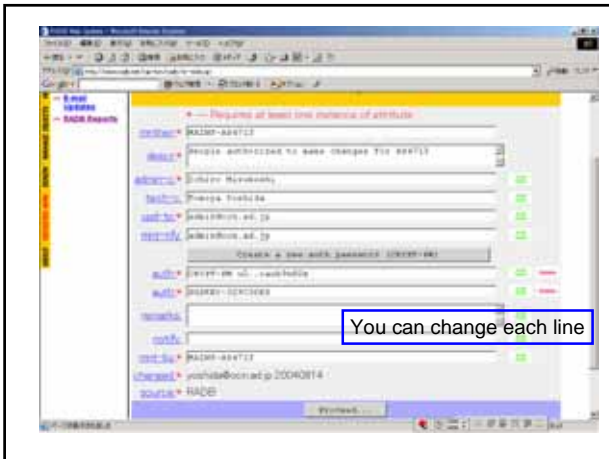
# peval (cont.)

>peval 'as-ocn and as-ij'

Warning: key not found error for query IgAS4710.  
 Warning: key not found error for query IgAS4629.  
 Warning: key not found error for query IgAS7512.  
 Warning: key not found error for query IgAS7662.  
 Warning: key not found error for query IgAS7681.  
 Warning: key not found error for query IgAS7684.  
 Warning: key not found error for query IgAS7691.  
 Warning: key not found error for query IgAS9364.  
 Warning: key not found error for query IgAS9376.  
 Warning: key not found error for query IgAS10018.  
 Warning: key not found error for query IgAS10227.  
 Warning: key not found error for query IgAS17422.  
 Warning: key not found error for query IgAS17961.

((218.42.160.0/19, 218.40.240.0/20, 218.40.208.0/20, 218.40.80.0/21, 211.133.192.0/19, 211.10.96.0/19, 211.7.64.0/20, 211.7.80.0/20, 210.251.160.0/19, 210.236.160.0/19, 210.173.160.0/19, 210.171.128.0/19, 210.156.0.0/22, 210.142.128.0/19, 210.135.16.0/20, 210.133.96.0/19, 203.179.224.0/20, 203.179.144.0/20, 202.255.100.0/22, 202.255.40.0/22, ....





## Route check system on JPIX

- Software
  - Route Server
    - Zebra bgpd
    - <http://www.zebra.org/>
  - Routing Registry
    - Merit IRRd
    - <http://www.ird.net/>
  - Check the Routing Information
    - Original perl script

## Reliability in the route on IX

- Some User use Prefix based filtering
  - When they receive the routes from their peering partner's
  - AS-path filtering or the combination of AS-path filtering and prefix based filtering are used almost
- However we don't know whether the route which we receive from neighbor is correct or incorrect easily
  - "show ip bgp neighbor 1.1.1.1 route"
  - "show ip bgp neighbor 1.1.1.1 received-routes"
  - Check the differences between two result
- Check the route between the route in IRR Database and the actual bgp routing information

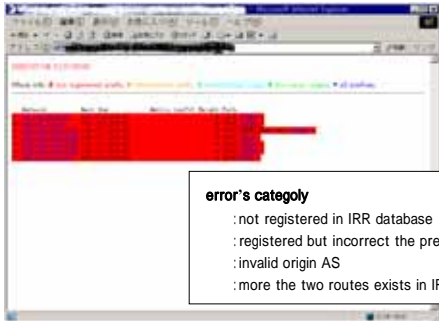
## User Interface (1)

## Route check system on JPIX

- Get other IRR information to JPIX's RR by mirroring
- RS have a bgp session with user and receive their bgp route
- Compare the route between on RR and actual route
- The result of this comparison provide via Web interface to their customer

## User Interface (2)

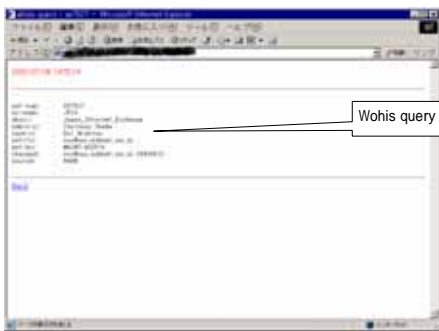
### User Interface (3)



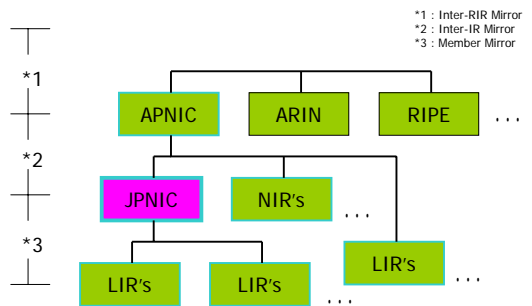
### Reliability of the Database

- IR's Database
  - When they allocate to the LIR, They register the allocation block whois database
  - Some Registry operate IRR also
    - RIR: RIPE NCC, APNIC (ARIN)
    - NIR: JPNIC
- ISP's IRR
  - They do not ensure the address block actually
  - IR can only

### User Interface (4)



### Future IRR model (proposed)



Interaction between IR and IRR

Thank you

