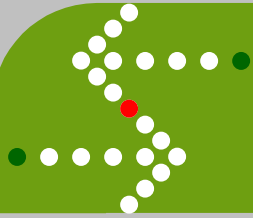


## Improving reliability of IRR database

The University of Tokyo  
Kengo Nagahashi ([kenken@elab.ic.i.u-tokyo.ac.jp](mailto:kenken@elab.ic.i.u-tokyo.ac.jp))

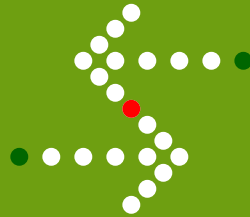
Nara Institute of Science and Technology  
Masasi Eto ([masash-e@is.aist-nara.ac.jp](mailto:masash-e@is.aist-nara.ac.jp))

**JPNIC IRR Planning Team**



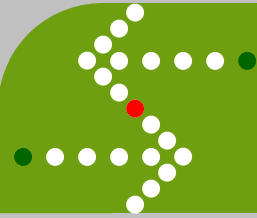
## Research Activity of JPIRR

- Nagahashi
  - Prefix Validation using IRR Database
- Eto
  - Improvement of consistency among AS policies on IRR database
- Our goal is
  - Improving reliability of IRR database
  - More widespread use of IRR



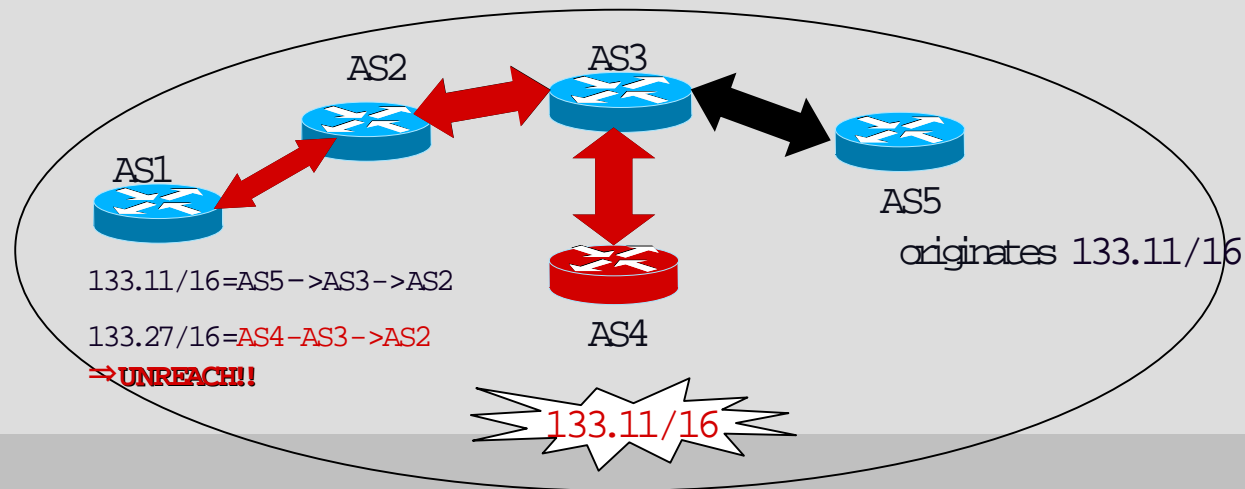
## Prefix Validation using IRR Database

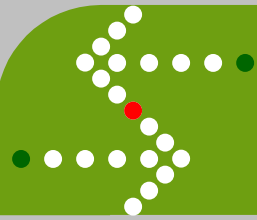
The University of Tokyo  
Kengo Nagahashi ([kenken@elab.ic.i.u-tokyo.ac.jp](mailto:kenken@elab.ic.i.u-tokyo.ac.jp))



# Background

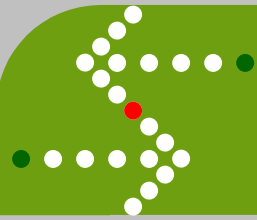
- One of severe problems in Inter-domain routing;
  - Hijacking prefix (black hole)
- Why happen?
  - One AS propagates invalid origin prefix





## Counter major Approach

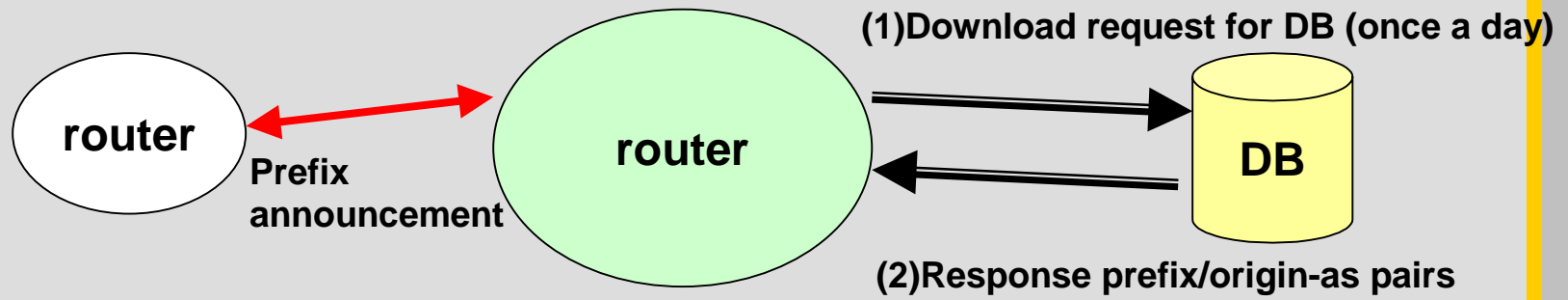
- Authenticate prefix in BGP update
  - BGP Routers exchange Certificate
  - Candidates: s-BGP, soBGP
  
- Problem
  1. Heavy protocol:
    - To verify certificate per one prefix
    - BGP holds over 120,000 prefixes...
  2. Take long time to deploy



## Motivation

- To check a correct prefix by lightweight and simple
  - What to “check” ?
    - To identify invalid origin prefix
    - To use certificate is too heavy (same as sBGP, soBGP)
  - How to verify?
    - Using IRR Database

# Approach



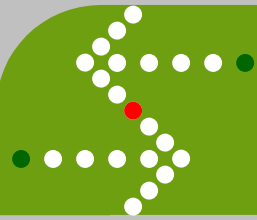
## (3) Comparison with (1) and (2)

Example:

```
#show invalid route
```

Network	origin	origin in DB
199.31.20.0/24	2400	568

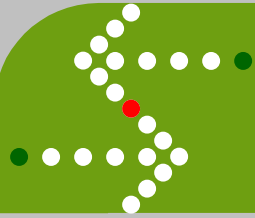
- Using IRR as Database



## simple protocol

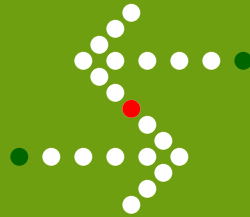
- Download
  - Router requests Download to DB
  - Frequency is once a day
- Response
  - DB responses to router
  - Response prefix/origin-as pairs which stores in DB





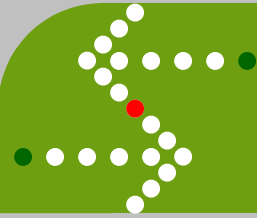
## Problems to be solved

- Future Work
  - Router Overhead
    - To hold 120,000 prefix/origin-as pairs is overhead?
  - Utilization of IRR
    - All entries are registered in IRR database?
  - Duration of update
    - Is Once a day too long ?



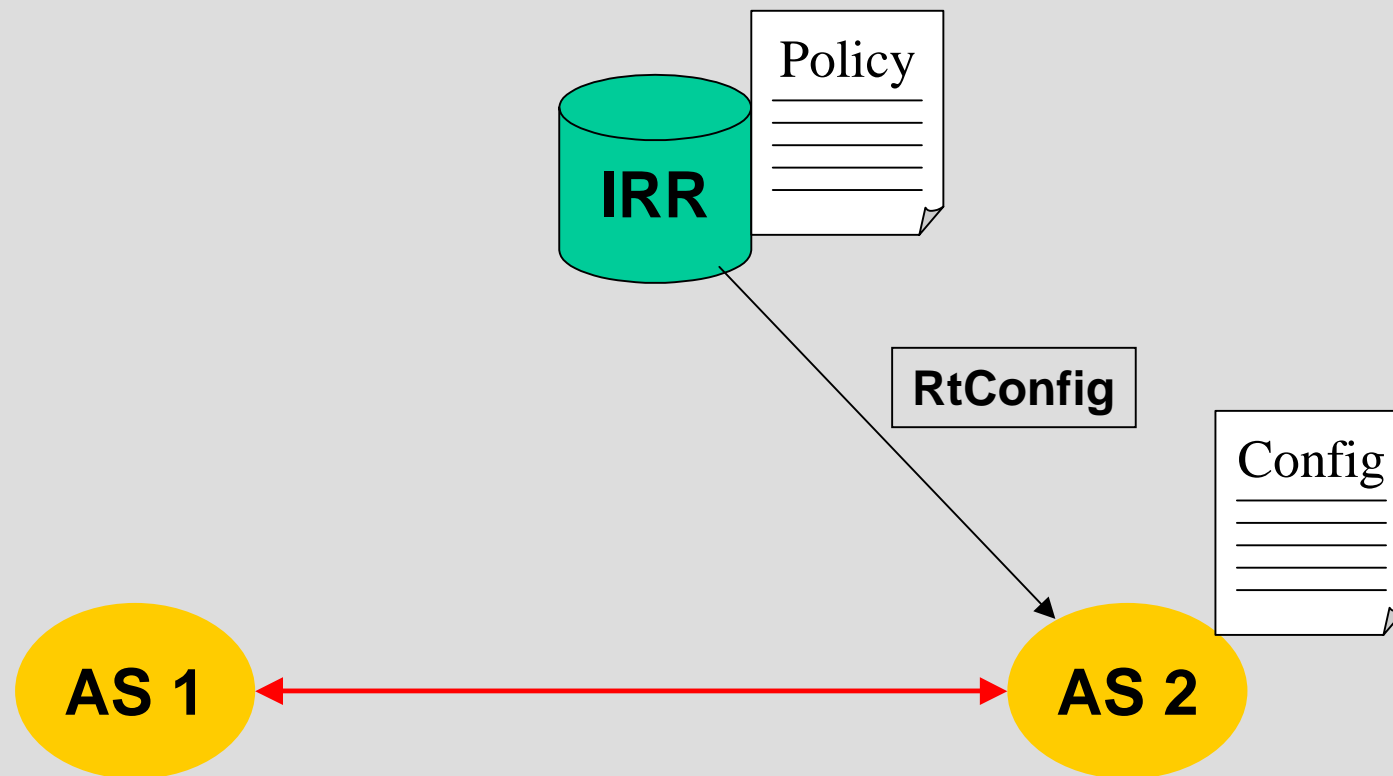
## Consistency Check among AS policies

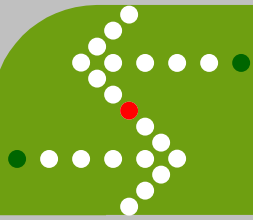
**Nara Institute of Science and Technology**  
**Masaki Eto (masash-e@is.aist-nara.ac.jp)**



## auto-configuration with IRR

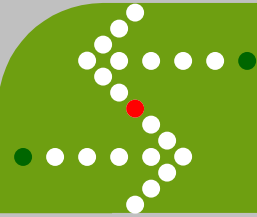
- Generate router configuration from routing policy registered in IRR with “RtConfig”



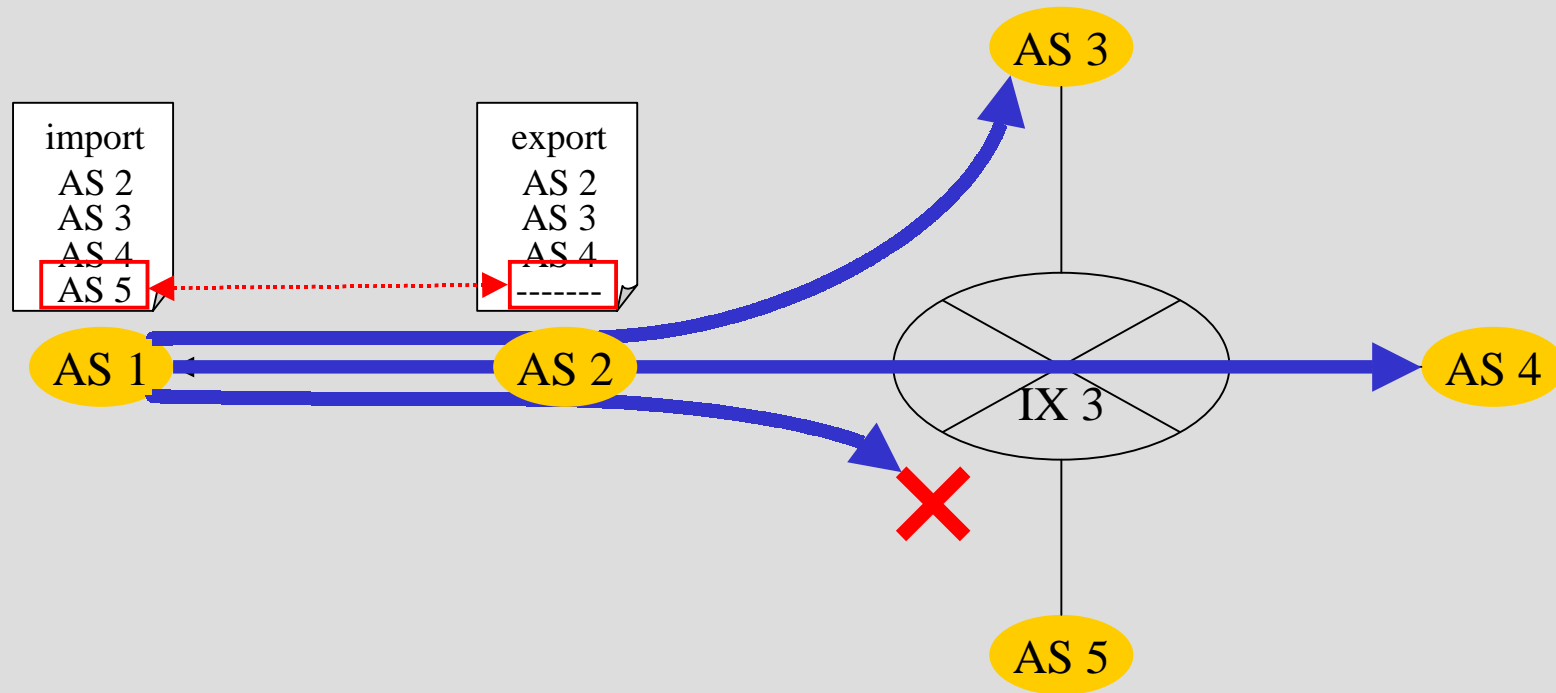


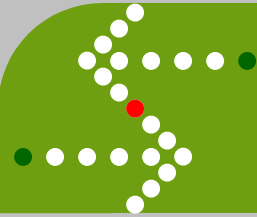
## Consistency among AS policies

- Inconsistencies
  - Inconsistency of import in routing information
  - Inconsistency of export in routing information
- As a result
  - When we generate the router configurations from IRR database, the connectivity between peering ASes will be lost.
- IRR inspects only policy's syntax.
  - **Need to inspect policy's semantics**

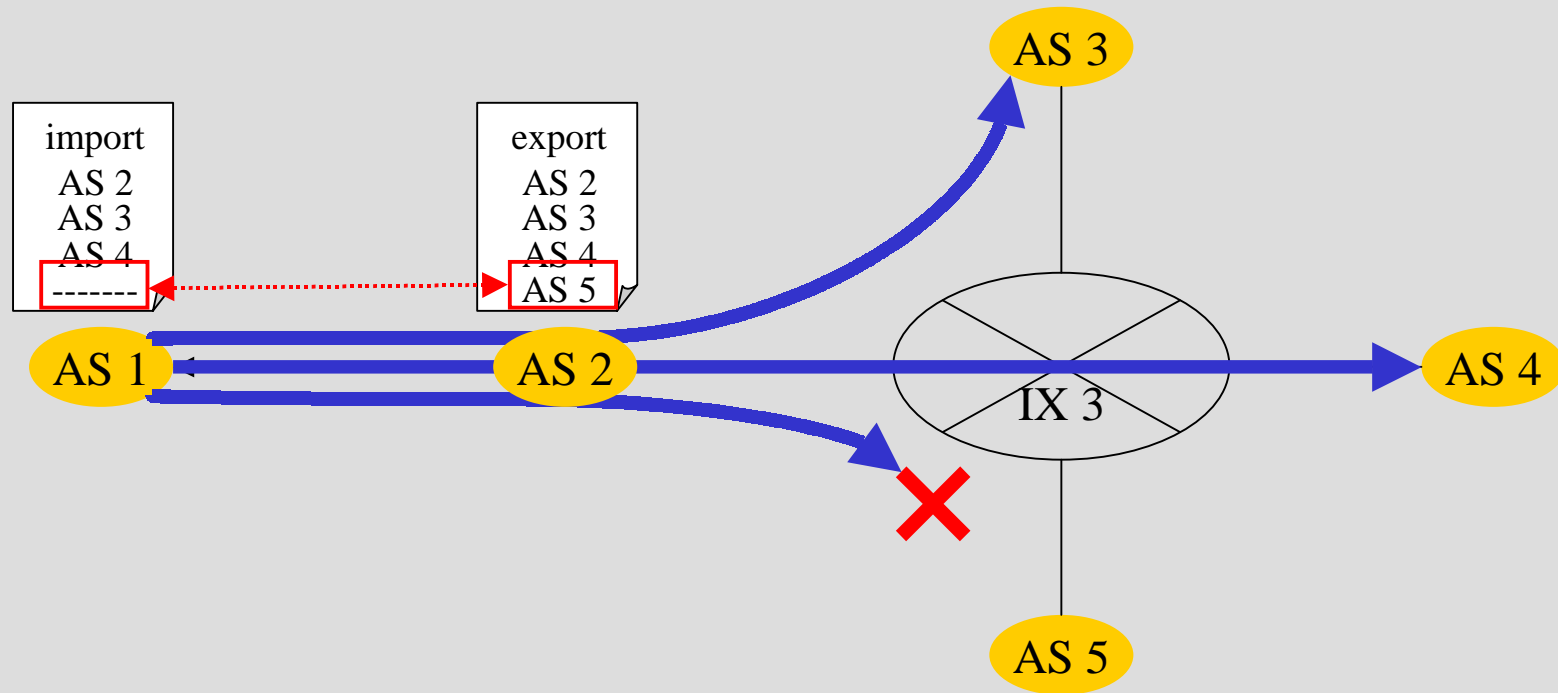


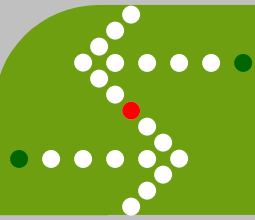
# Inconsistency of import





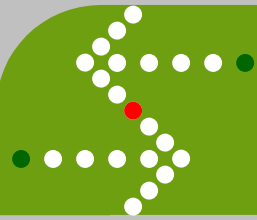
# Inconsistency of export





## Classification of Inconsistencies

Inconsistencies of import	Peer AS-SET doesn't exist on IRR database
	Peer AS doesn't exist on IRR database
	Peer AS doesn't export any route to the AS
	Peer AS doesn't export route which the AS imports
Inconsistencies of export	Peer AS-SET doesn't exist on IRR database
	Peer AS doesn't exist on IRR database
	Peer AS doesn't import any route from the AS
	Peer AS doesn't import route which the AS exports

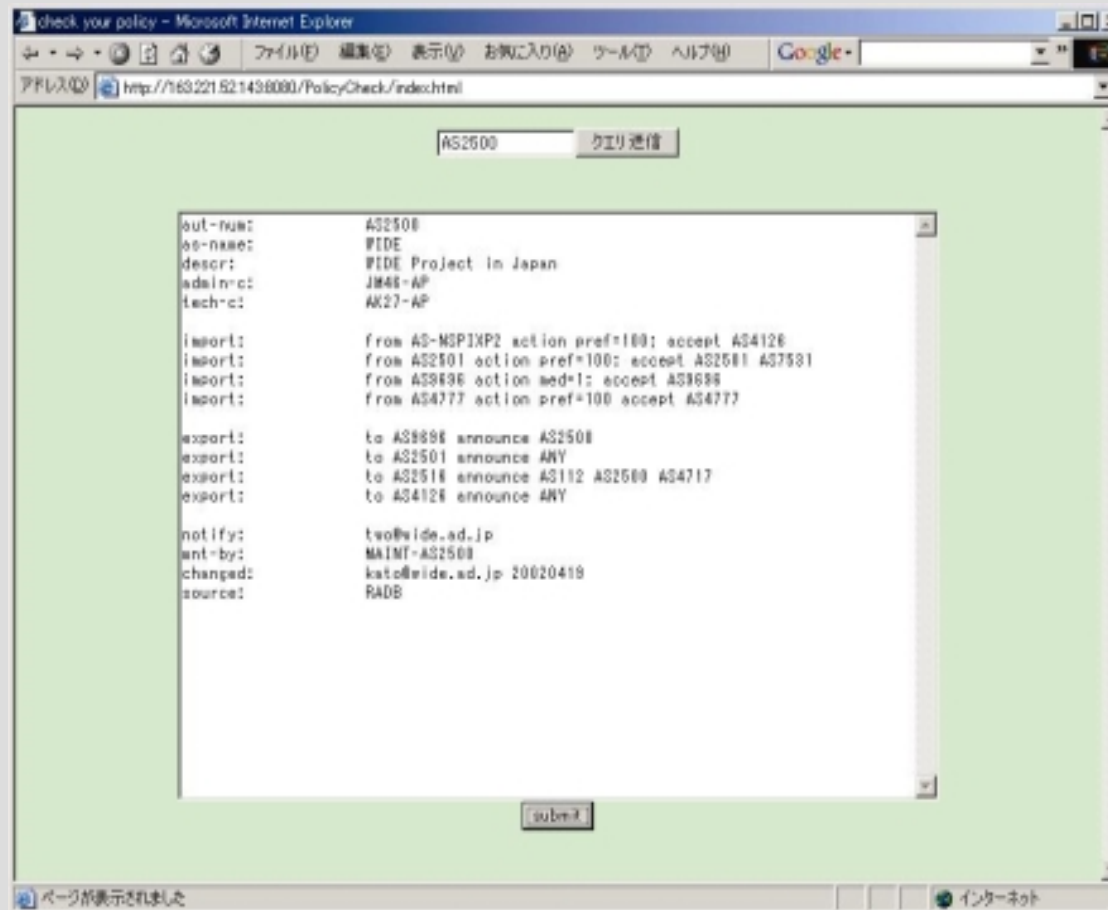


## Policy Check Server

- **Policy Checker**
  - Inspects if the policy is consistent with peer ASes' policies
- **Database Checker**
  - Inspects how many inconsistencies exist on unified IRR database.



## Example - query



```
AS2500   クエリ送信

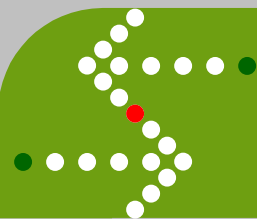
out-num:      AS2500
as-name:      WIDE
descr:        WIDE Project in Japan
admin-c:      JM48-AP
tech-c:       AK27-AP

import:       from AS-MSP1XP2 action pref=100; accept AS4128
import:       from AS2501 action pref=100; accept AS2501 AS7531
import:       from AS3696 action med=1; accept AS3696
import:       from AS4777 action pref=100 accept AS4777

export:       to AS3696 announce AS2500
export:       to AS2501 announce ANY
export:       to AS2518 announce AS112 AS2500 AS4717
export:       to AS4128 announce ANY

notify:       two@wide.ad.jp
mnt-by:       MAINT-AS2500
changed:      kato@wide.ad.jp 20020419
source:       RAB

submit
```

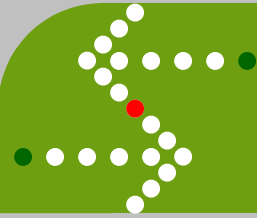


## Example - result

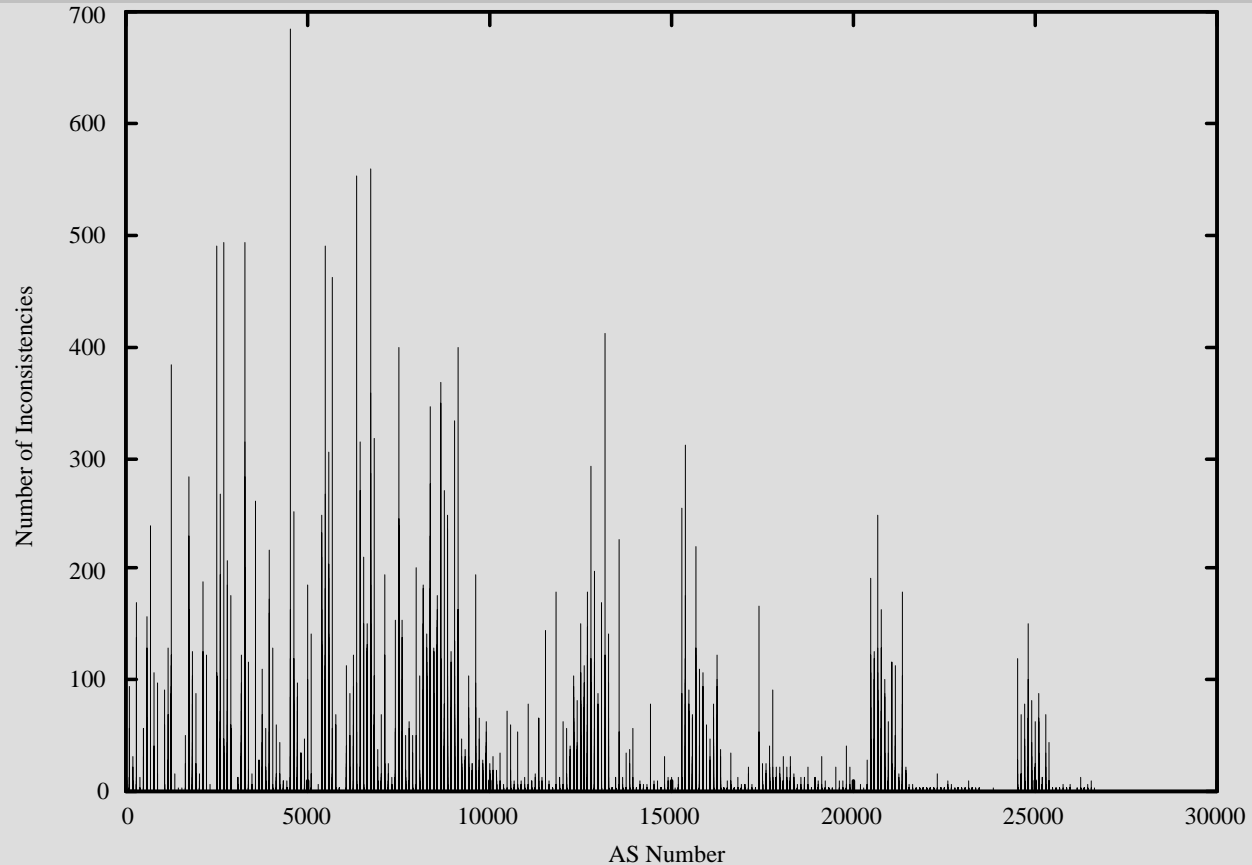
```
Result - Microsoft Internet Explorer
http://163.221.52.143:8080/PolicyCheck/PolicyCheck

Result of inspection : AS2500
import: from AS-NSPIXP2 action pref=100 accept AS4126
      peering AS-NSPIXP2 does not export route of "AS4126" to this AS.
import: from AS2501 action pref=100 accept AS2581 AS7531
import: from AS9696 accept AS9696
      peering AS9696 does not export any routes to this AS.
import: from AS4777 action pref=100 accept AS4777
export: to AS9696 announce AS2500
      peering AS9696 does not import any routes from this AS.
export: to AS2501 announce ANY
export: to AS2518 announce AS112 AS2500 AS4717
      peering AS2518 does not import route of "AS112" from this AS.
      peering AS2518 does not import route of "AS4717" from this AS.
export: to AS4126 announce ANY
      peering AS "AS4126" is not found on database.

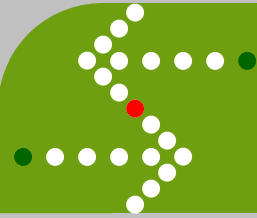
Time spent for inspection : 13234 (msec)
```



# Analysis of Inspection Result



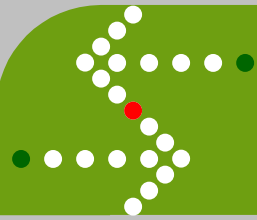
**Registered Ases: 11696 -> 55.8% of AS has at least one inconsistency**



## Detail of Inconsistencies

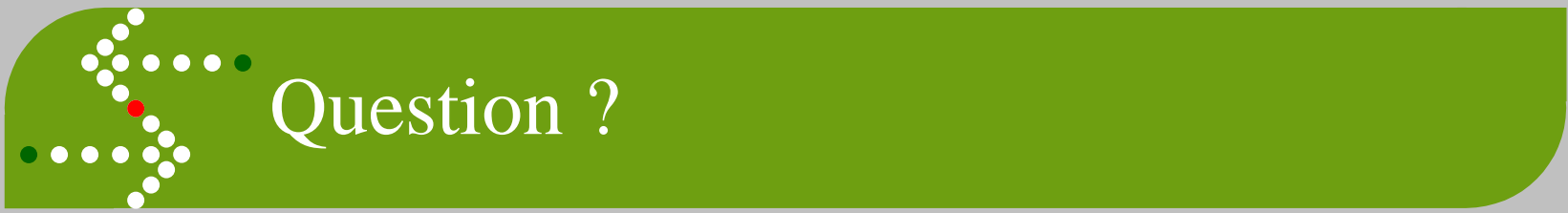
No	Classification	Number	Rate
1	Peer AS-SET doesn't exist on IRR database	482	0.2 %
2	Peer AS doesn't exist on IRR database	7,971	4.0 %
3	Peer AS doesn't export any routes to the AS	36,333	18.6 %
4	Peer AS doesn't import any routes from the AS	34,710	17.8 %
5	Peer AS doesn't export route which the AS imports	11,436	5.8 %
6	Peer AS doesn't import route which the AS exports	17,753	9.1 %
	Total	108,685	55.8 %

- Rate of each inconsistency in all 194,820 import and export sentences



## Future Work

- Deploy Policy Checker on JPIRR.
- Implement a function to notify result of investigation to JPIRR users periodically.



Question ?

