TLD labs
- .jprs R&D Platform -

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Agenda

1. Concept of ".jprs"
2. Background of First Activity
3. .jprs R&D: First Activity
4. Future Works

1. Concept of ".jprs"

".jprs" R&D Platform

■ **What is ".jprs"**

- ✓ For the Internet to keep growing, we will need an environment to create innovations …

- ✓ Experimental TLD for domain names and DNS
  - ● As demonstration experiment
    - – For innovative technologies and productions
      - » Difficult to implement in a production environment
  - ● For collaborative R&D with researches and businesses
    - – Autonomous research pertaining to the Internet

2. Background of First Activity

Japan is a Disaster-prone Country

■ Natural disasters in/around Japan

✓ Earthquake, tsunami and volcanic eruption etc…

Collapsed highway
The Great Hanshin/Awaji Earthquake on Jan 17, 1995 [*1]

Tsunami Surging to town
The Great East Japan Earthquake on Mar 11, 2011 [*2]

The importance of being prepared for natural disasters

[*1] http://sciencewindow.jst.go.jp/html/sw23/sp-003   [*2] http://www.bousai.go.jp/kohou/kouhoubousai/h23/63/special_01.html

Physical Geography of Japan
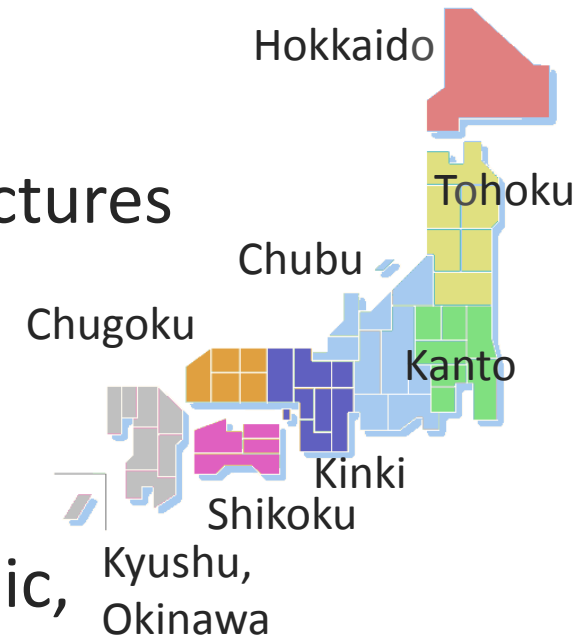
■Japan has 8 regions

  ✓Each region contains several prefectures

    ●c.f. Japan has 47 prefectures

      – Tokyo, Osaka, Fukushima, Kumamoto …

  ✓Each region has historical, economic, and cultural feature

Hokkaido

Tohoku

Chubu

Chugoku

Kanto

Kinki

Shikoku

Kyushu, Okinawa

Such geographical features do not always pose potential danger to all regions of Japan but specific regions in many cases

Logical Structure of Internet in Japan

■ Characteristic of Internet structure

✓ Concentration of Internet resources
in Tokyo/Osaka, which are major urban areas

- Internet Exchanges (IXs),
Transit connections,
Data Centers, etc…
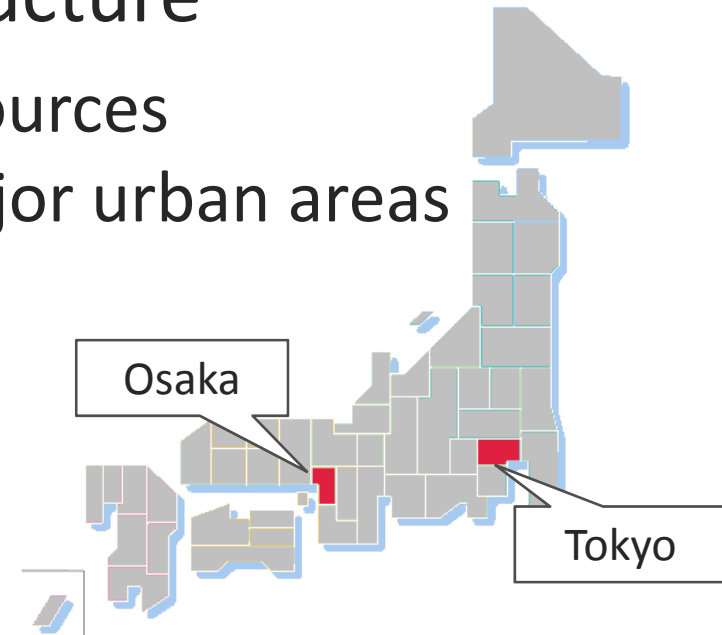
Osaka

Tokyo

Natural disasters that occur in/around Tokyo/Osaka can intensely affect Internet connectivity

Enhancing the Fault-Tolerant DNS

■ **Locations of DNS servers**

  ✓ Install DNS servers in several regions other than Tokyo and Osaka

  ● Decentralization of DNS servers in other regions

  ● Mitigation/distribution of DNS traffic concentration

  ✓ In case of an outage of the DNS servers in a particular region…

  ● Continuous provision of DNS/Internet services

Enhancing the Fault-Tolerant DNS

■Operations of DNS servers

✓Designate DNS operators in every region

●Responsibility for the operations of DNS servers installed at each region
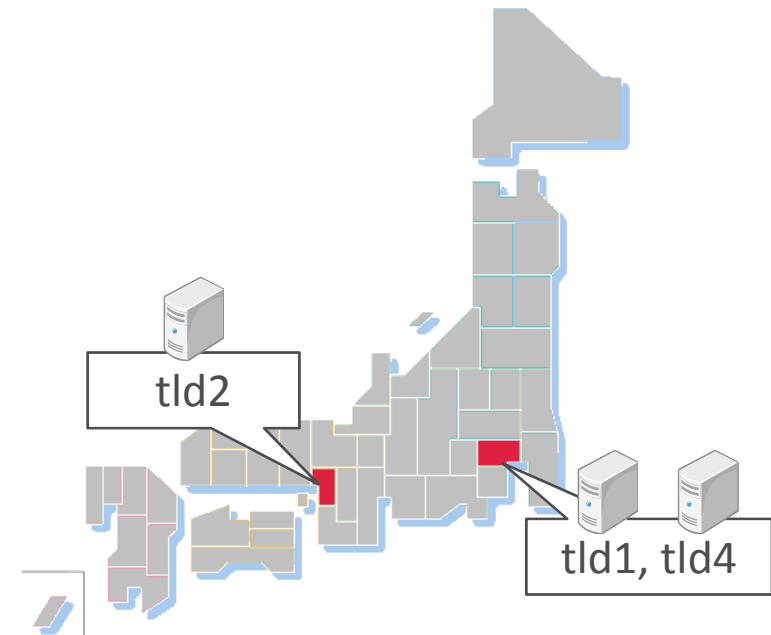
✓In case of losing the physical/Internet connections …

●Prompt Restoration of DNS servers

3. .jprs R&D : First Activity

Installation Sites

■ .jprs DNS servers

Hostname	Location	Remarks
tld1.nic.jprs	Tokyo	
tld2.nic.jprs	Osaka	
tld3.nic.jprs	Worldwide	
tld4.nic.jprs	Tokyo	R&D
tld5.nic.jprs	Worldwide	

tld2

tld1, tld4

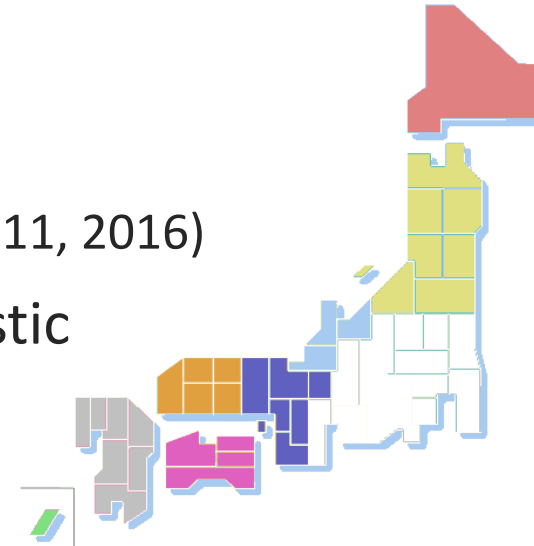- Installation sites of .jprs DNS servers resemble those of .jp DNS

■ .jprs DNS operations

✓ JPRS is operating .jprs DNS servers in Tokyo/Osaka

Recruiting Participants

■Participants

✓8 domestic regional ISPs (as of May 11, 2016)

●Parent companies are/were domestic power supply companies
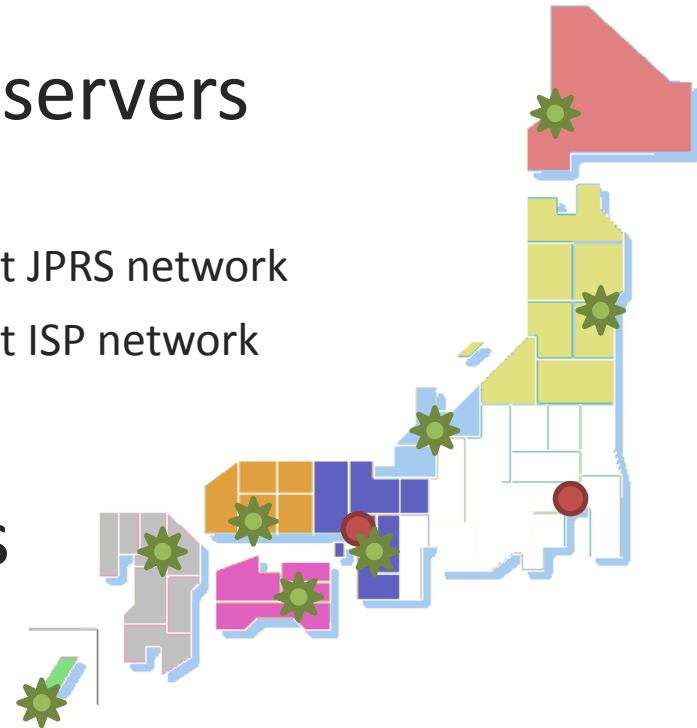
■Characteristics of participants' service area

✓Each participant's service area covers the "region" where it belongs to without overlapping

●Power supply business had been monopolized in regions until Apr. 2016

Approach

- **Where to install .jprs DNS servers**
  - ✓ Into 8 ISPs' networks

  🔴 at JPRS network
  ✳ at ISP network

- **How to direct DNS queries**
  - ✓ Routing configuration
    - Using routing protocol
      - i.e. BGP (IP Anycast)
  - ✓ Resolver configuration
    - Specifying DNS servers' IP addresses
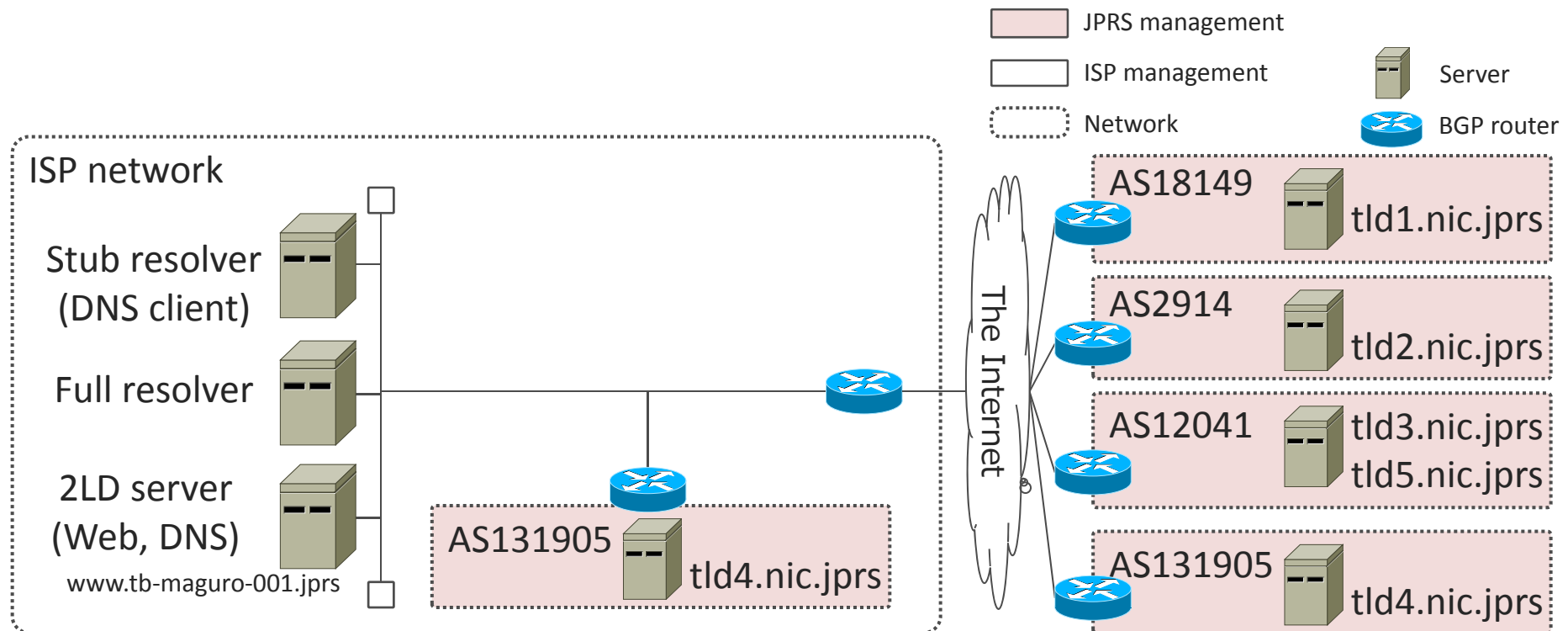   - i.e. "static-stub" zone type for BIND

Measurement Schedule

■ 1st Phase

- ✓ Participants: 1 ISP at Kyushu
- ✓ Period:
  - ● Dec. 25, 2015 ~ Feb. 10, 2016

■ 2nd Phase

- ✓ Participants : 8 ISPs
- ✓ Period:
  - ● Feb. 12, 2016 ~ Apr. 11
 - ● Apr. 13, 2016 ~ Jun. 6 (in progress)

Measurement Environment

Data	Source	Destination(s)	Method	Interval [minute]
Continuous ISP's Internet service	Stub resolver	2LD server – Web	wget	1
Continuous Name Resolution	Stub resolver	2LD server – DNS	dig	1
Reachability of .jprs DNS servers	Full resolver	a) tld[1-5].nic.jp at JPRS b) tld4.nic.jprs at ISP	ping	1
			traceroute	1
			tcpdump	without a pause

Evaluation Method

■ Continuous Internet service and Reachability of .jprs DNS
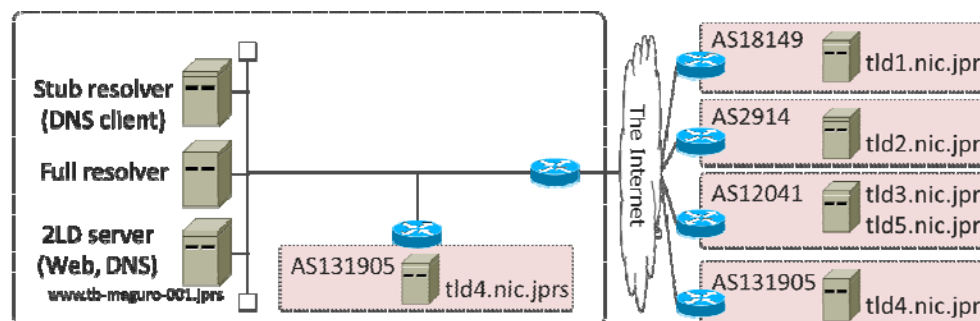
✓ Evaluation Scenario: 2 states of environments

● Before installing .jprs DNS
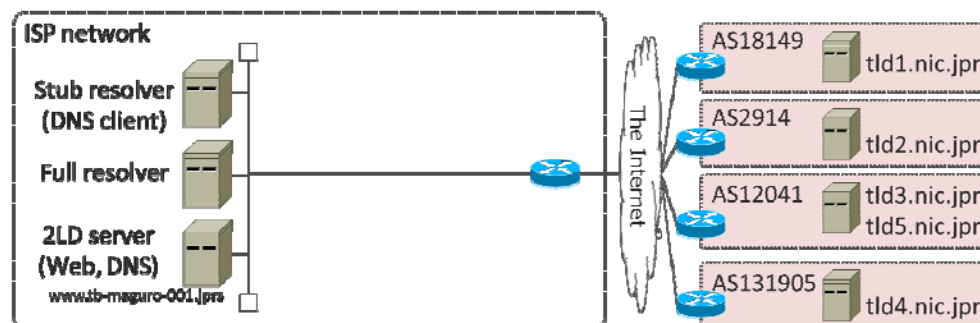
.jprs DNS servers are located only outside ISP network
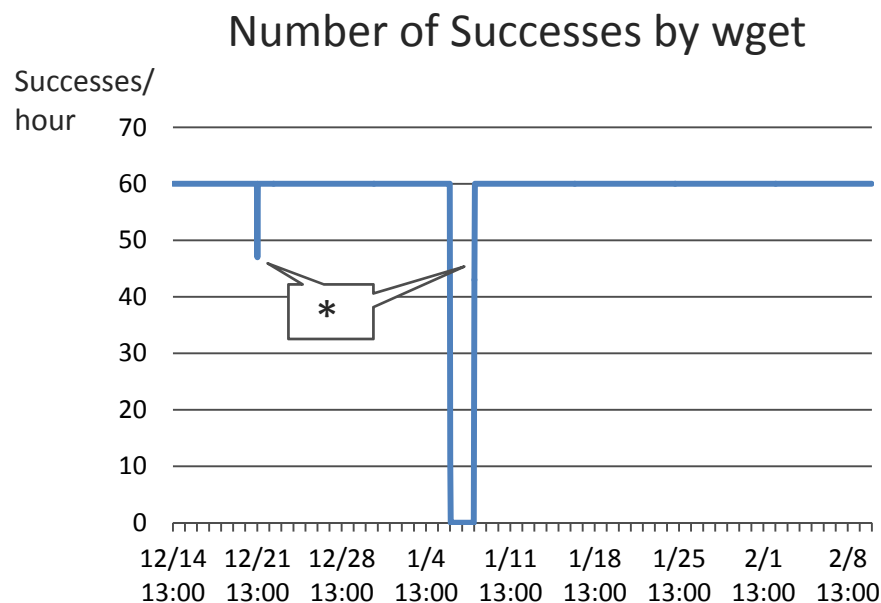
● After installing .jprs DNS

.jprs DNS servers are located inside/outside ISP network

Results of 1st Phase

■ Continuous provision of Internet services

✓ ISP was able to continue offering its Internet service by installing .jprs DNS on its ISP network

Number of Successes by wget

Successes/
hour

70	
60	
50	
40	*
30	
20	
10	
0	

12/14   12/21   12/28   1/4   1/11   1/18   1/25   2/1   2/8
13:00   13:00   13:00   13:00   13:00   13:00   13:00   13:00   13:00

*: These are due to scenario's operation mistakes.

● Measuring the continuity of Internet service with wget command

✓ Execute on a minute-by-minute basis

● Continuing to receive the results of success

✓ Except duration of operation mistakes

Results of 1ˢᵗ Phase

■ **Distribution of .jprs DNS queries**

✓ Destination of .jprs DNS queries from full resolver had inclined toward .jprs DNS server on ISP network

Number of DNS queries to each .jprs DNS
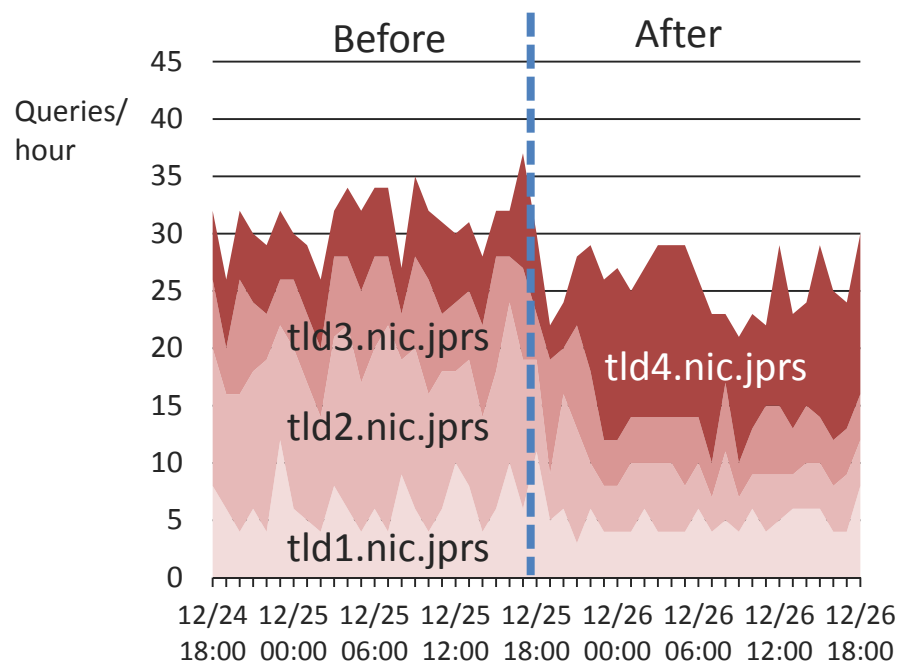
● **Before installing .jprs DNS into ISP network**
  ✓ tld2.nic.jprs, which is in Osaka, had received the largest number of DNS queries in .jprs DNS servers

● **After installing .jprs DNS into ISP network**
  ✓ tld4.nic.jprs became the most

4. Future Works

Future Works

- ■ **Relating to the First Activity**
  - ✓ Collaboration with Japan-/world-wide ISPs
  - ✓ By using not only TLD servers but also root servers

- ■ **Other Planned Projects**
  - ✓ KSK Algorithm Rollover on TLD
    - ● With ISPs who offer full resolver service
  - ✓ Trial of DANE services

Contact Us

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