# APAC Space Web Conference

**Root Server System (RSS) Information Sharing**

25 February 2021

ICANN

# Agenda

- **Welcome Remarks** by Jia-Rong Low, VP, Stakeholder Engagement & Managing Director, ICANN APAC (3 mins)

- **Introduction to the Root Server System (RSS)** by Anupam Agrawal, RSSAC Caucus Member (15 min)

- **Introduction to the Governance of the RSS** by Hiro Hotta, RSS Governance Working Group (GWG) Representative (20 min)

- **Open Sharing & Community Discussion** facilitated by Edmon Chung, APAC Space Community Facilitator (20 mins)

- **AOB** (2 mins)

# Welcome Remarks

**Jia-Rong Low**
VP, Stakeholder Engagement &
Managing Director, ICANN APAC

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# APAC Space





- ❖ "Space for APAC community members
- ❖ Community-led bi-monthly Sessions — web conference, or face-to-face at ICANN Meetings

- ❖ "Practice ground" to facilitate community discussion for ICANN participation
  - ❖ DNS industry topics
  - ❖ ICANN Policy Development Processes, and
  - ❖ ICANN Reviews

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# Root Server System (RSS) Information Sharing

# History is Important

**1**

## The Beginning

- Domain Name System role is to resolve names to IP Address.

- Jon Postel and Paul Mockapetris published a series of RFCs that laid out the design of the DNS.

- It was 1983. RFC 882.

- To test the DNS software and further develop the Domain Name System, Jon Postel and Paul Mockapetris set up the first root server in 1984 at Information Sciences Institute (ISI) at the University of Southern California (USC).

```
[Docs] [txt|pdf] [Tracker] [Errata]

Obsoleted by: 1034, 1035
Updated by: 973                                         Errata Exist
Network Working Group                              P. Mockapetris
Request for Comments:  882                                    ISI
                                                    November 1983


              DOMAIN NAMES - CONCEPTS and FACILITIES

   +---------------------------------------------------------------+
   |                                                               |
   | This RFC introduces domain style names, their use            |
   | for ARPA Internet mail and host address support,             |
   | and the protocols and servers used to implement              |
   | domain name facilities.                                       |
   |                                                               |
   | This memo describes the conceptual framework of the          |
   | domain system and some uses, but it omits many               |
   | uses, fields, and implementation details.  A                 |
   | complete specification of formats, timeouts, etc.            |
   | is presented in RFC 883, "Domain Names -                     |
   | Implementation and Specification".  That RFC                 |
   | assumes that the reader is familiar with the                 |
   | concepts discussed in this memo.                             |
   |                                                               |
   +---------------------------------------------------------------+
```

https://tools.ietf.org/html/rfc882

# Timeline

**2**

**Timeline of Root Servers**
- Till 1987 – 4 Root servers
- 1991 -7 Root Servers
- 1995 – 9 Root Servers
- 1997 – 13 Root Servers

**3**

**Movement outside North America**
- 28-July-1991 the server NIC.NORDU.NET was added to the root zone and became the first non-U.S. root server.
- It became in 1995 – I.root-servers.net.
- In January 1997 – J, K, L & M were added.
- K was assigned to RIPE NCC and it got hosted in LINX London in May 1997.
- WIDE (Widely integrated Distributed Environment) was chosen for Asia Pacific.
- In August 1997 M root moved to Japan.

Source : https://www.icann.org/en/system/files/files/rssac-023-04nov16-en.pdf

# Moving in APAC

**4**  **Some other key events**

- Renaming Root Servers to root-servers.net happened in 1995.

- Jon Postel died on 16-October-1998

- J remained with NSI which was acquired by Verisign in 2000

- L was transferred to ICANN in 1999 because before Jon's death it was agreed that USC would transfer assets/ personnel to ICANN.

**Table 5: Renaming of Root Servers in 1995**

| Original Name | New Name | Organization |
|---|---|---|
| NS.INTERNIC.NET | A.ROOT-SERVERS.NET | InterNIC (operated by NSI) |
| NS1.ISI.EDU | B.ROOT-SERVERS.NET | Information Sciences Institute, USC |
| C.PSI.NET | C.ROOT-SERVERS.NET | PSINet |
| TERP.UMD.EDU | D.ROOT-SERVERS.NET | University of Maryland |
| NS.NASA.GOV | E.ROOT-SERVERS.NET | NASA Ames Research Center |
| NS.ISC.ORG | F.ROOT-SERVERS.NET | Internet Software Consortium |
| NS.NIC.DDN.MIL | G.ROOT-SERVERS.NET | GSI (operated by NSI) |
| AOS.ARL.ARMY.MIL | H.ROOT-SERVERS.NET | U.S. Army Research Lab |
| NIC.NORDU.NET | I.ROOT-SERVERS.NET | NORDUnet |

Source :
https://www.icann.org/en/system/files/files/rssac-023-04nov16-en.pdf

# The Current Slate…

| Hostname | IP Addresses | Operator |
|---|---|---|
| A.ROOT-SERVERS.NET | 198.41.0.4, 2001:503:ba3e::2:30 | Verisign, Inc. |
| B.ROOT-SERVERS.NET | 192.228.79.201, 2001:500:84::b | Information Sciences Institute, USC |
| C.ROOT-SERVERS.NET | 192.33.4.12, 2001:500:2::c | Cogent Communications |
| D.ROOT-SERVERS.NET | 199.7.91.13, 2001:500:2d::d | University of Maryland |
| E.ROOT-SERVERS.NET | 192.203.230.10 | NASA Ames Research Center |
| F.ROOT-SERVERS.NET | 192.5.5.241, 2001:500:2f::f | Internet Systems Consortium, Inc. |
| G.ROOT-SERVERS.NET | 192.112.36.4 2001:500:12::d0d | U.S. Department of Defense Network Information Center |
| H.ROOT-SERVERS.NET | 198.97.190.53, 2001:500:1::53 | U.S. Army Research Lab |
| I.ROOT-SERVERS.NET | 192.36.148.17, 2001:7fe::53 | Netnod |
| J.ROOT-SERVERS.NET | 192.58.128.30, 2001:503:c27::2:30 | VeriSign, Inc. |
| K.ROOT-SERVERS.NET | 193.0.14.129, 2001:7fd::1 | RIPE NCC |
| L.ROOT-SERVERS.NET | 199.7.83.42, 2001:500:3::42 | ICANN |
| M.ROOT-SERVERS.NET | 202.12.27.33, 2001:dc3::35 | WIDE Project and JPRS |

**Key Changes since publishing of RSSAC 023**

- B has started serving from 199.9.14.201
- E has got IPv6 enabled and is serving from 2001:500:a8::e
- Comparison made on 24-Feb-2021 with root-servers.net

**12 Operators - 1 in Asia Pacific**

- whereas the biggest region in terms of users / Internet growth.
- Even with 1307 Root Server Instances only ~25% in Asia Pacific.
- There will be debates.

Source : https://www.icann.org/en/system/files/files/rssac-023-04nov16-en.pdf

ICANN

# The creation of RSSAC

**1** On July 1, 1997, as part of the Clinton Administration's *Framework for Global Electronic Commerce*,[1] the President directed the Secretary of Commerce to privatize the domain name system (DNS) in a manner that increases competition and facilitates international participation in its management.

**2** The Full Green & White paper process followed, and ICANN formed with the initial bylaws having a space for Root Server System Advisory Committee.

**3** The role of the Root Server System Advisory Committee ("Root Server System Advisory Committee" or "RSSAC") is to advise the ICANN community and Board on matters relating to the operation, administration, security, and integrity of the Internet's Root Server System.

# RSSAC's Journey

**4** ICANN is an unique capacity. It is a Root Server Operator & also the body responsible for oversights of all other Root Servers

- RSSAC 037 – Has been a path breaking document with the intent to look outside in and willing to handle different components and situations. The governance working group will lay down the final structure & practices.

**5** RSSAC First meeting - 02-Mar-1999– Singapore - noted as Action Item - Development of operational procedures for the root server system, including formalization of contractual relationships under which root servers throughout the world are operated

- This has remained an open and tricky issue till now. This is something the GWG will have to close.

# Finally…

**6**    ICANN provides oversight and policy development for the system of unique identifiers of the global Internet, including the DNS. ICANN's affiliate, Public Technical Identifiers (PTI), is responsible for the operational aspects of coordinating the global Internet's unique identifiers, hereto referred to as IANA.

**7**    In its role for coordinating root zone management, ICANN entered into agreement with Verisign, contracting Verisign to continue to perform the root zone maintainer functions.

**8**    ICANN to perform these functions satisfactorily with legal enforceability

https://www.icann.org/en/system/files/files/letter-of-intent-06oct20-en.pdf

# Few Pointers

**1** [dns-stats.org](dns-stats.org)

- Grafna has been used for data of L roots. Excellent Effort !!!
- Opportunity to show the global view of the DNS traffic.

**2** More examples of coordinated efforts among Root Server Operators will be useful. RSSAC Caucus was good start to open up the community.

**3** From India perspective, increased presence of Root Server Instances at the IXP location/s is important. Local IXPs are increasing. It makes sense to do it. At least ICANN can offer to community IX.

# Thanks!!!

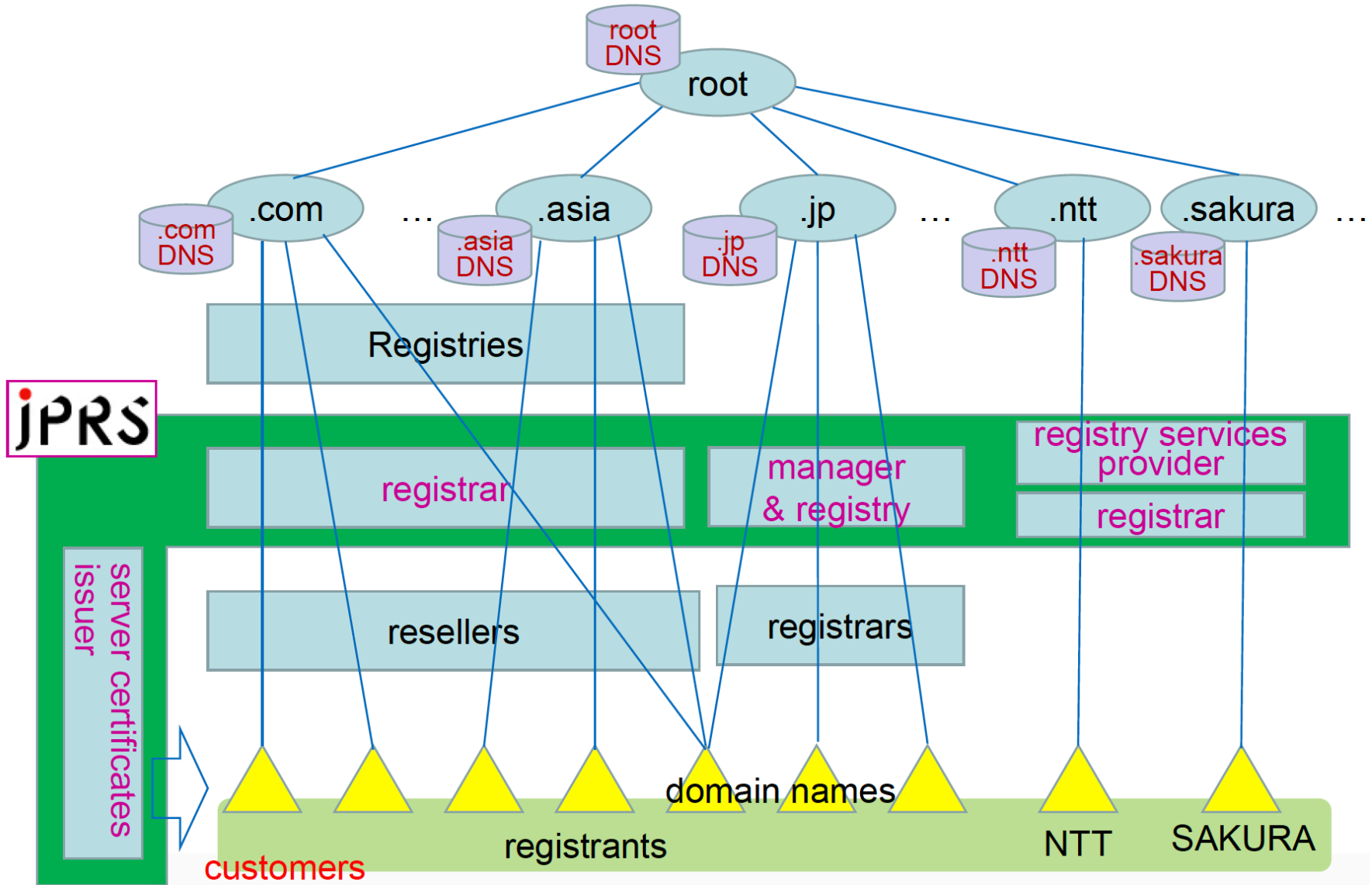Anupam Agrawal
Chair
India Internet Foundation
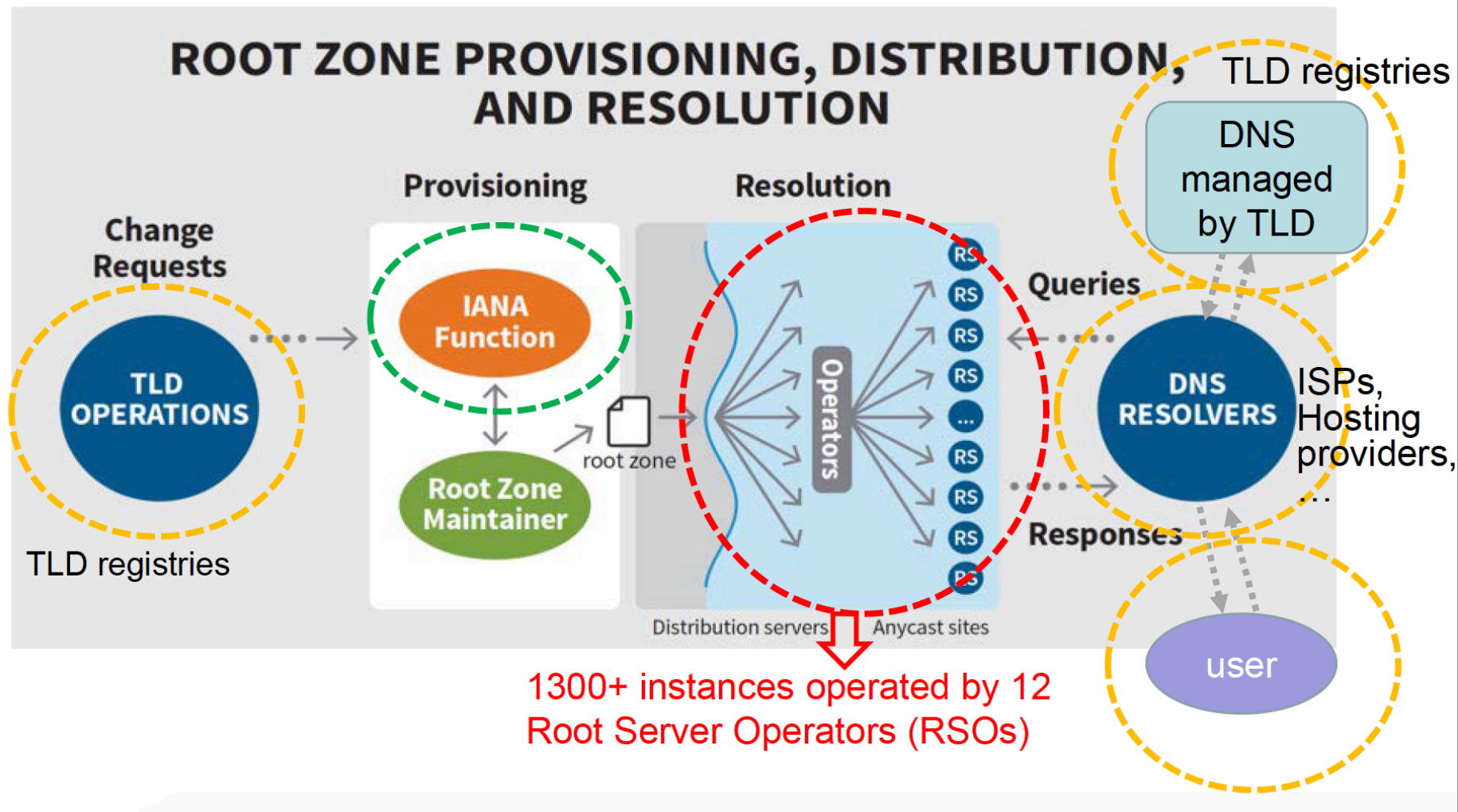anupam@iifon.org

# Introduction to the Governance of the RSS

**Hiro Hotta**
RSS Governance Working Group (GWG) Representative

ICANN

# Who Am I?

- Name
  - Hiro Hotta
- Affiliation
  - JPRS : Japan Registry Services Co., Ltd.
- What JPRS is
  - ccTLD manager of .jp ← main business
  - gTLD registrar of .com, .asia, ..
  - gTLD registry services provider (on behalf of brand owners)
  - server certificate issuer
  - M-Root DNS Operator together with WIDE project
- Positions in ICANN
  - Former ccNSO Councilor
  - RSSAC member (alternate)
  - RSS GWG member (representative from RSOs)

ROOT ZONE PROVISIONING, DISTRIBUTION, AND RESOLUTION

TLD registries

DNS managed by TLD

Provisioning — Resolution

Change Requests

TLD OPERATIONS

TLD registries

IANA Function

Root Zone Maintainer

root zone

Operators

RS RS RS RS ... RS RS RS RS

Distribution servers — Anycast sites

Queries

DNS RESOLVERS

ISPs, Hosting providers, …

Responses

user

1300+ instances operated by 12 Root Server Operators (RSOs)

| name | | Operator | Organizational type |
|---|---|---|---|
| A-Root | 🇺🇸 | Verisign, Inc. | Company (domain name registry) |
| B-Root | 🇺🇸 | Univ. of Sothern California, Information Sciences Inst. | University（laboratory） |
| C-Root | 🇺🇸 | Cogent Communications | Company（ISP） |
| D-Root | 🇺🇸 | Univ. of Maryland | University |
| E-Root | 🇺🇸 | NASA Ames Research Renter | Government (laboratory） |
| F-Root | 🇺🇸 | Internet Systems Consortium（ISC） | Nonprofit organization（DNS soft. developer） |
| G-Root | 🇺🇸 | U.S. DoD Network Information Center | Government |
| H-Root | 🇺🇸 | U.S. Army Research laboratory | Army（laboratory） |
| I-Root | 🇸🇪 | Netnod | Nonprofit organization（operator of IX） |
| J-Root | 🇺🇸 | Verisign, Inc. | Company (domain name registry) |
| K-Root | 🇳🇱 | RIPE NCC | European Regional Internet Registry |
| L-Root | 🇺🇸 | ICANN | Nonprofit organization |
| M-Root | 🇯🇵 | WIDE project & JPRS | Research project & Company (domain name registry) |

# Number of Root DNS Server Instances

jPRS



（as of February 19, 2021）

As of 02/19/2021 11:25 a.m., the root server system consists of 1370 instances operated by the 12 independent root server operators.

https://root-servers.org/

- **What are Root DNS Servers?**
  - Authoritative DNS servers that provides the root zone, which is the top node of the DNS tree of the Internet
  - 13 sets of root DNS servers (called A–M) are in operation
- **History (Root and M–Root)**
  - ˜1987 root DNS servers started their operation
    - 1997 WIDE project (Japan) started M–Root DNS operation
    - 2005 WIDE and JPRS started M–Root DNS joint operation
- **Governance structure**
  - 12 voluntary organizations cooperatively operate 13 sets of root DNS servers
  - A robust governance with accountability to stakeholders will be needed to assure the firm basis of the Internet, to cope with increasing demand and threat
  - →RSSAC investigated the future governance model (2015–2018)

# Potential Issues Regarding RSS

- Root DNS System is operated by 12 voluntary organizations
  - So far, no big visible problems happened

    ⬇ however

  - There's no mechanism for assuring technical ability of RSO and RSS
    → Service quality?
  - Each RSO covers the cost of each root DNS system and operation
    → Financial sustainability? with growing traffic and security threat
  - There's no clear standard and structure to govern the whole RSS
    → Service continuity?

    ⬇ therefore

- 2015-2018
  - RSSAC spontaneously investigated and crafted RSSAC037 about how the future governance of RSO/RSS should be
- 2019/11/07
  - ICANN Board resolved to launch the Root Server System Governance Working Group (RSS GWG) to implement the RSS governance model based on RSSAC proposal (RSSAC037)

- **Purpose and Mandate**
  - core of the community-driven process to develop a final cooperation and governance model for the RSS based on RSSAC037
- **Deliverable**
  - The GWG shall develop a final model ("GWG Model") of cooperation and governance for the RSS
- **Composition**
  - Luis Diego Espinoza Sanchez     ccTLD Registry (associated with .na)
  - Peter Janssen     ccTLD Registry (.eu)
  - Geoff Huston     IAB
  - Ted Hardie     IAB
  - Hanyu Yang     gTLD Registry
  - Kurt Pritz     gTLD Registry
  - Brad Verd     RSO
  - Lars-Johan Liman     RSO
  - Hiro Hotta     RSO
  - Suzanne Woolf     SSAC
  - \+ 3 liaisons (ICANN Board, IANA, Root Zone Maintainer)
- **Timeline**
  - Original plan is for GWG to finish the work in two years

# Information About RSS GWG

👉 web pages
- – search "Root Server System Governance Working Group (RSS GWG)"

  https://community.icann.org/pages/viewpage.action?pageId=120820189

| Type and # | Date | Time | Materials | Recordings and Auto-Transcripts | Records |
|---|---|---|---|---|---|
| Teleconference #1 | Tuesday, 25 February 2020 | 13:00 UTC | • Agenda | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| Teleconference #2 | Thursday, 19 March 2020 | 22:00 UTC | • Agenda<br>• Presentation | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| Teleconference #3 | Thursday, 2 April 2020 | 22:00 UTC | • Agenda<br>• Presentation | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| : | : | : | : | : | : |
| Teleconference #21 | Thursday, 3 December 2020 | 22:00 UTC | • Agenda | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| Teleconference #22 | Thursday, 17 December 2021 | 22:00 UTC | • Agenda | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| Teleconference #23 | Thursday, 14 January 2021 | 22:00 UTC | • Agenda | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | Minutes |
| Teleconference #24 | Thursday, 28 January 2021 | 22:00 UTC | • Agenda | • Visual Recording and Auto-Transcript<br>• Audio-Only Recording and Auto-Transcript | |

jPRS

# Primary Functions in Proposed Governance Model

**jPRS**
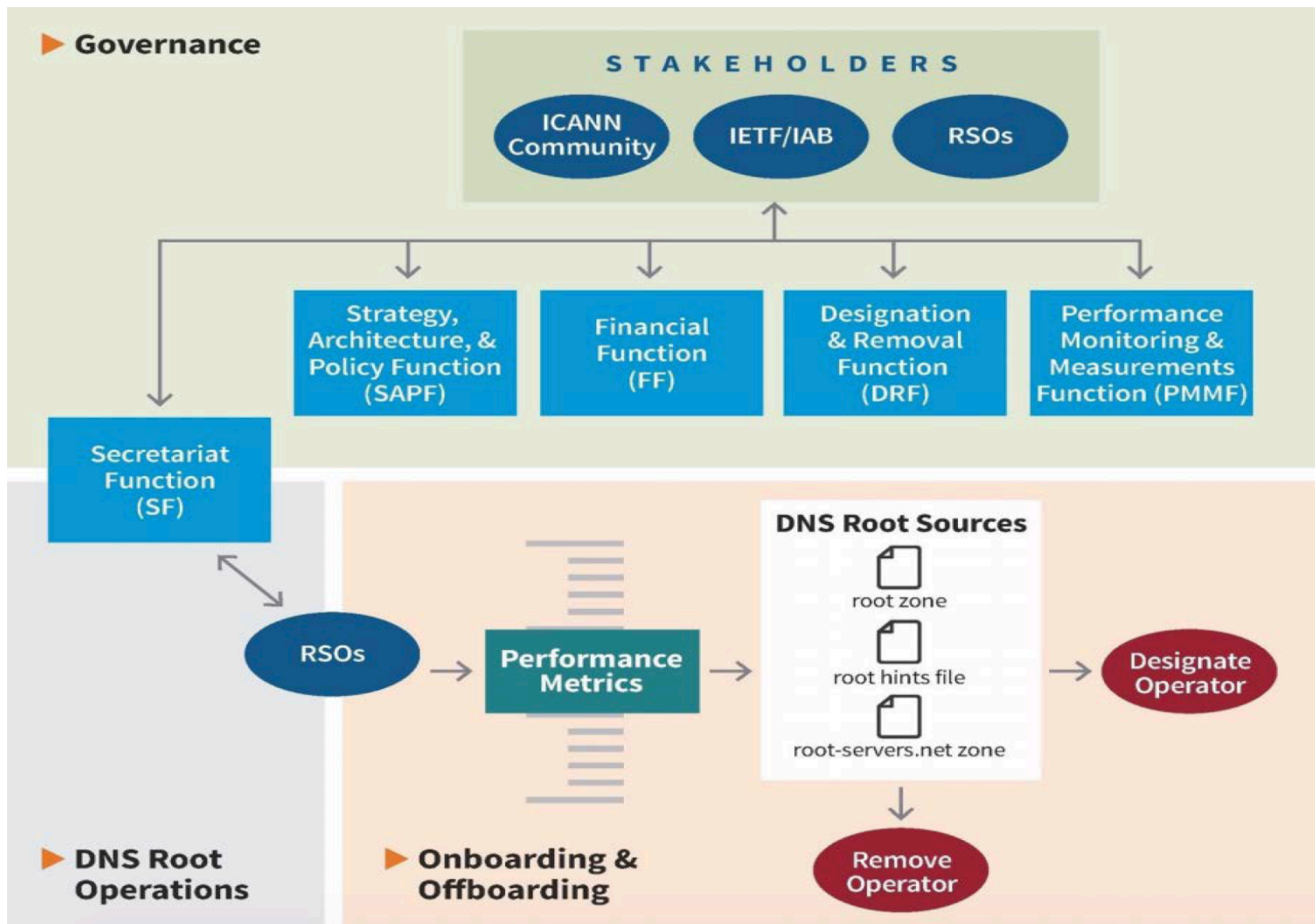
- ## 5 primary functions

| SAPF | Strategy, Architecture, and Policy Function |
|------|---------------------------------------------|

  - Planning future technology and structure for RSS, defining SLA

| PMMF | Performance Monitoring and Measurement Function |
|------|------------------------------------------------|

  - SLA measuring and monitoring of the whole RSS and each RSO

| SF | Secretariat Function |
|----|----------------------|

  - Channeling between RSO's and Internet Community

| DRF | Designation and Removal Function |
|-----|----------------------------------|

  - Designating and/or removing RSO's

| FF | Financial Function |
|----|--------------------|

  - Carrying on sustainable financial provision to all/each RSO's in addition to each RSO's voluntary self finance
  - Including emergency funding, R&D funding for new technology of root DNS

- ## Other terms
  - RSS      Root Server System
  - RSO      Root Server Operator

# Overview of NewOrg Model GWG is Drafting

**jPRS**

## PRS (Public Root Services)

**coordinate entities providing resolution services for the root zone**

**carry out policies developed by the SAPF**

note: this slide shows my understanding of the current status of GWG discussion

**SAPF** Strategy, Architecture, and Policy

community-based group to manage the strategy and architecture of the RSS

guiding principles includes technical ones and other ones such as "RSOs must collaborate and engage with their stakeholder community, and must be neutral and impartial"

**FF** Financial

arrangement with RSOs that request funding support to keep their service level, security, …

**PMMF** Performance Monitoring and Measurement

**SF** Secretariat

LLC agreement (like PTI & ICANN)

ICANN Board/ Community/ Org

IANA

**RZM**
Root Zone Maintainer

## Multistakeholder Review Panels

become existent as requested by PRS Board

**DRF** Designation and Removal

Root Server Operators

# Thank you

Hiro Hotta
hotta@jprs.co.jp

# Open Sharing & Community Discussion

**Edmon Chung**
APAC Space
Community Facilitator

# AOB

# We're Looking for Leaders

The **ICANN Nominating Committee** (NomCom) is looking for leaders who represent a variety of **cultural, geographical, and professional backgrounds,** while also **striving for gender balance.**

## Do you have what we're looking for?

## Why should you apply?

- Critical Thinking
- Cultural Awareness
- Knowledge of the Internet Ecosystem
- Board or Executive Experience
- Background in Legal, Government, Technology, Business, or Nonprofit

- Influence global Internet policy
- Impact the evolution of the Internet
- Develop professional skills
- Collaborate with a diverse group of industry leaders
- Engage with a global community

For more information on how to apply, visit: **https://www.icann.org/nomcom2021**

**3** Members for the ICANN Board of Directors

**3** Regional Representatives to the At-Large Advisory Committee (ALAC)

**2** Members of the Generic Names Supporting Organization (GNSO) Council

**1** Member of the Country Code Names Supporting Organization (ccNSO) Council
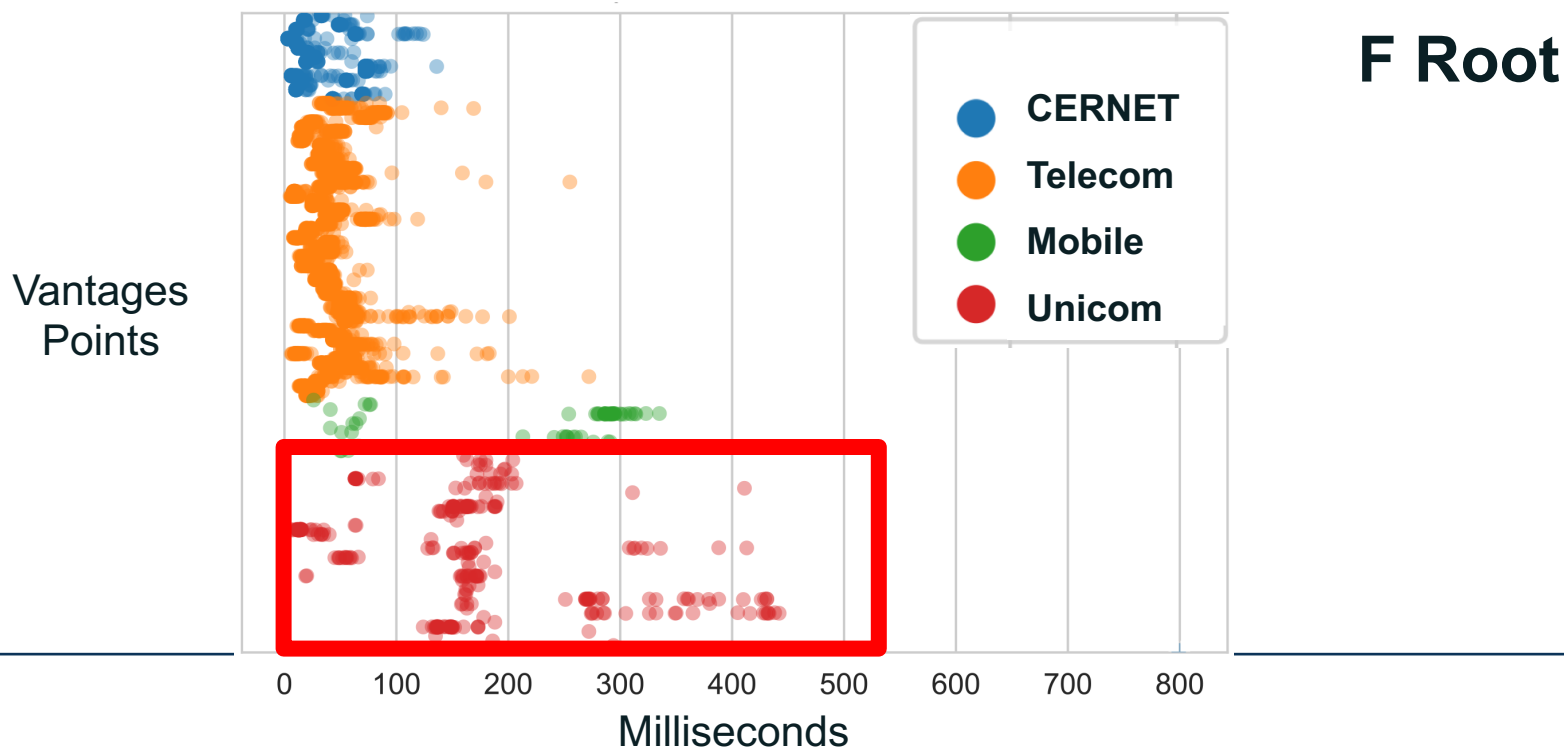
**Learn more about the positions at**
**https://www.icann.org/nomcom2021**

# Appendix

# Baojun Liu (About Me)

- Postdoctoral Research Follow, Tsinghua University
  - Ph.D, Computer Science and Technology, 2020
  - Contacts: lbj@tsinghua.edu.cn, https://www.liubaojun.org

- Research Works: DNS Security
  - Publications: ~10 papers on Top-tier conferences
  - Awards
    - IRTF 2020 ANRP (Applied Network Research Award)
    - NDSS 2019 Distinguished Paper; DSN 2020 Best Paper

- RSSAC Caucus Community
  - Since Nov. 2020
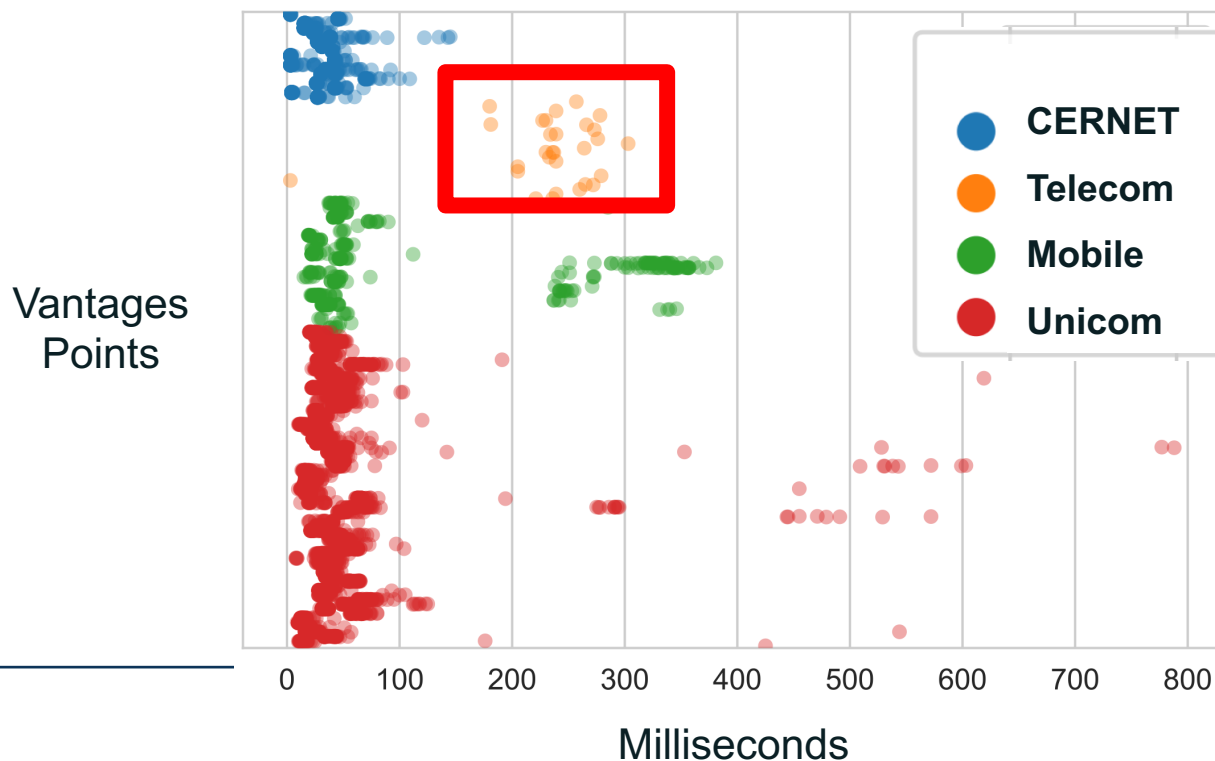  - Critical Internet Resources Forum at 2020 Beijing Cyber Security Conference (BCS)

# Obversation About DNS Root System

- Performance of Root Server Instances in China Mainland
  - F (2), I (1), J (1), K (3), L (6)
  - Measuring the DNS latency from Internet users to Root Servers
  - ~ 200 vantages points (Telecom, Mobile, Unicom, and CERNET)
  - Obversation: The optimization in latency is unbalanced.



**F Root**

Vantages Points

Legend:
- CERNET
- Telecom
- Mobile
- Unicom

X-axis: Milliseconds (0, 100, 200, 300, 400, 500, 600, 700, 800)

# Obversation About DNS Root System

- Performance of Root Server Instances in China Mainland
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  - Measuring the DNS latency from Internet users to Root Servers
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**J Root**

Legend:
- CERNET
- Telecom
- Mobile
- Unicom

Vantages Points / Milliseconds (0, 100, 200, 300, 400, 500, 600, 700, 800)

# Engage with ICANN

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