ARIN + NANOG

ON THE ROAD

Portland, Oregon

10 September 2013

ARIN Welcome

Aaron Hughes
ARIN Board of Trustees

NANOG Welcome

Steven Feldman
NANOG Board Member

North American Network Operator Group (NANOG)

Collaborating to Make the Internet Better

- Educational 501(c)(3) nonprofit
- Conferences, educational programs, and online resources
- Membership based
- Community driven

History http://www.nanog.org/history

- Initial funding from the National Science Foundation 1987-1995
- Activity of Merit Network Inc. – 1994-2011
- Community Owned Non-Profit – 2010-present
- Strategic Initiatives
  - Education Series – Routing Fundamentals
  - On the Road – Joint with ARIN
  - Best Current Operational Practice – Online resource
  - Outreach to other Internet policy and operator forums

Today's NANOG Outline

- Sample of NANOG Meeting Content
- Featured Social Time
- Access to NANOG Board Members
- Welcome!

Meeting Logistics

Susan Hamlin
ARIN

Welcome. Who is here today?

From ARIN:

- **De' Harvey,** Meeting Planner
- **Susan Hamlin**, Director of Communications and Member Services
- **Aaron Hughes**, Board of Trustees
- **Mark Kosters,** Chief Technology Officer
- **John Springer,** Advisory Council
- **John Sweeting**, Advisory Council
- **Bill Woodcock**, Board of Trustees
- **Jon Worley**, Senior Resource Analyst

Welcome. Who is here today?

From NANOG:

- **Betty Burke**, Executive Director
- **Greg Dendy**, Program Committee
- **Steven Feldman**, Board of Directors
- **Gina Haspilaire**, Development Committee
- **Merike Kaeo**, Community Member
- **Sylvie LaPerrière**, Board of Directors
- **John van Oppen**, Program Committee
- **Eric Rosenberry**, Community Member
- **Duane Wessels**, Board of Directors

Today's Agenda

- Welcome from ARIN and NANOG
- ARIN: An Overview
- Requesting and Managing Internet Number Resources
- Automating Your Interactions with ARIN
- IPv4 Depletion and IPv6 Adoption in the ARIN Region
- IPv4 Transfer Market
- ARIN's Policy Development Process and Current Discussions
- **Lunch**
- Securing Routing: RPKI Overview
- DNS Tutorial
- Mitigating DNS Amplification Attacks
- Northwest Access Exchange
- BGP Tutorial
- Best Current Operational Practices
- Open Microphone / Q&A
- **Happy Hour**

Win a $100 Amazon gift card!

Fill out our survey and submit it for 2 drawings at the end of the program.

ARIN: An Overview

Aaron Hughes
ARIN Board of Trustees

What is an RIR?

- An organization that manages the allocation and registration of Internet number resources within a particular region of the world.
  - Internet number resources include IP addresses and autonomous system (AS) numbers.

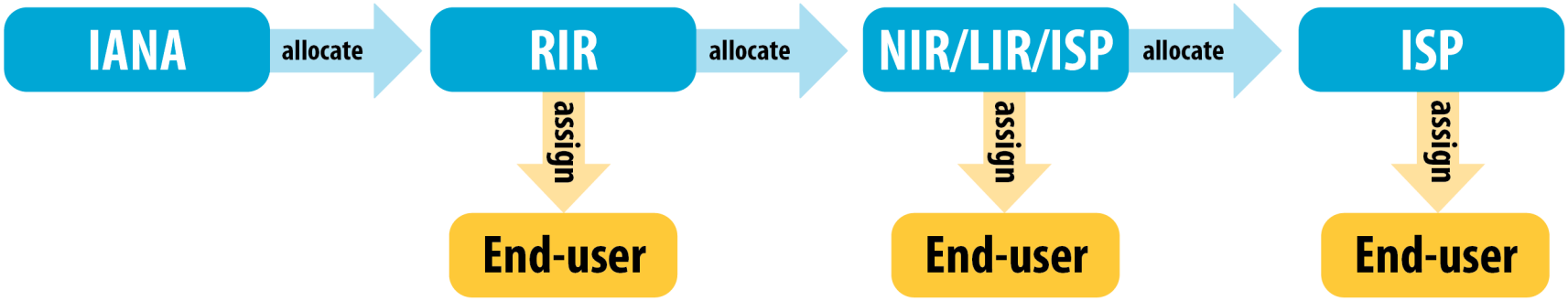
Who Provisions IP Addresses & ASNs?

ICANN IANA	• Top level technical coordination of the Internet (Names, Numbers, Root Servers) • Manage global unallocated IP address pool • **Allocate number resources to RIRs**

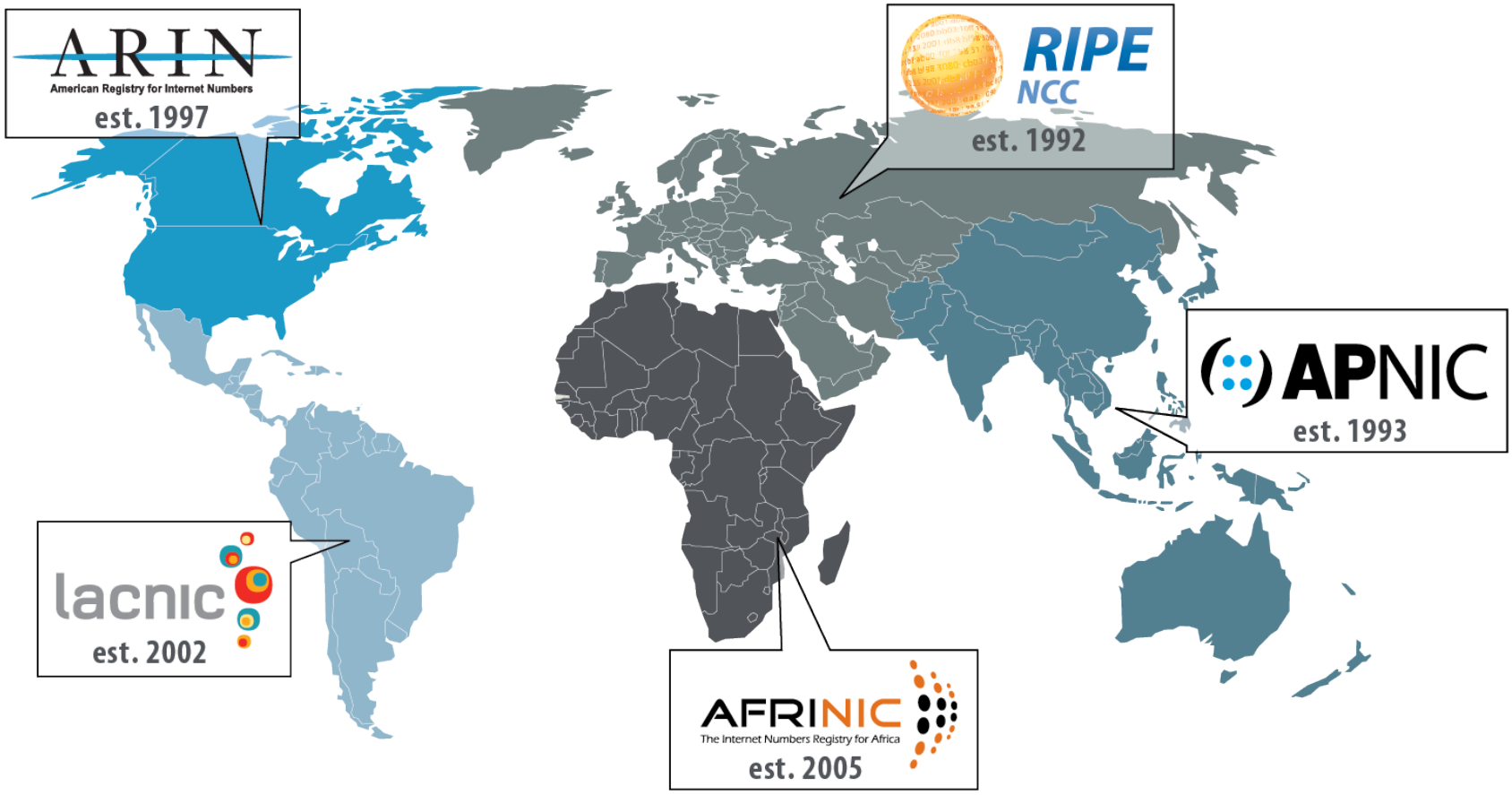
RIR	• Manage regional unallocated IP address pool
	  • **Allocate number resources to ISPs/LIRs**
	  • **Assign number resources to End-users**

ISP/LIR	• Manage local IP address pool for use by customers and for infrastructure
	  • **Allocate number resources to ISPs**
	  • **Assign number resources to End-users**

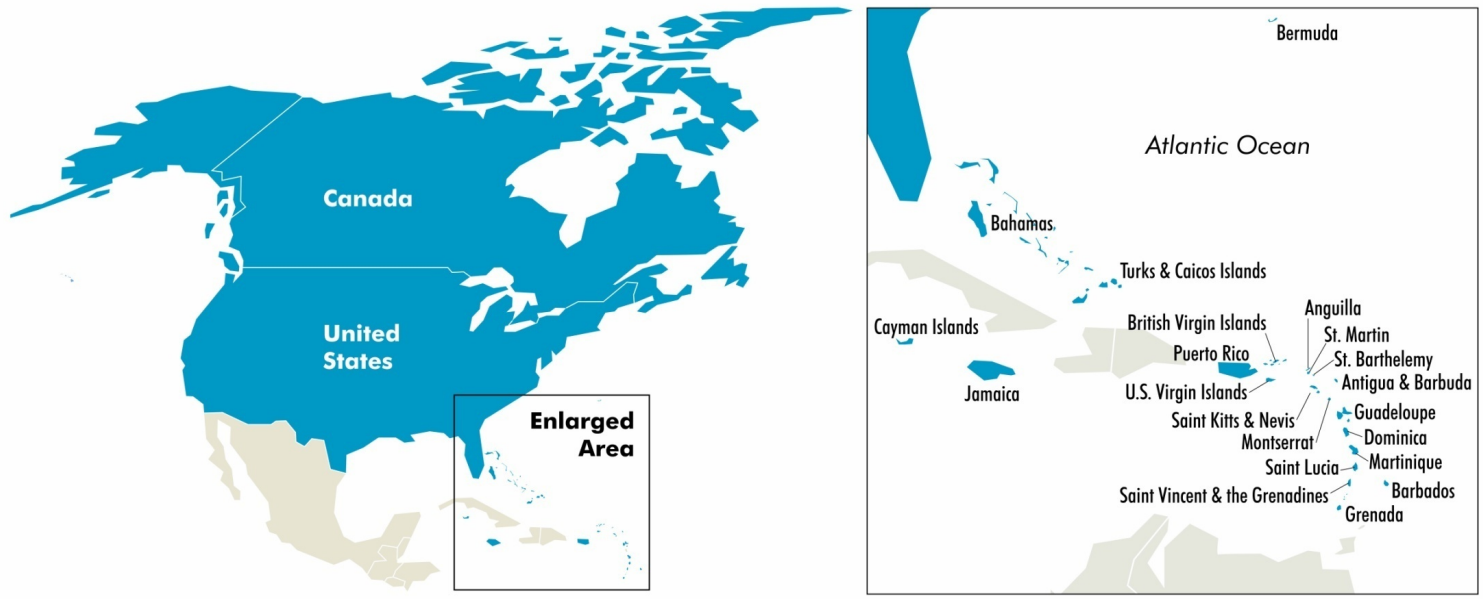
Number Resource Provisioning



Regional Internet Registries



ARIN's Service Region



ARIN's region includes many (20) Caribbean and North Atlantic islands, Canada and the United States and outlying areas.

ARIN

American Registry for Internet Numbers

"ARIN, a nonprofit member-based organization, supports the operation of the Internet through the **management of Internet number resources** throughout its service region; **coordinates the development of policies by the community** for the management of Internet Protocol number resources; and advances the Internet through **informational outreach**."

ARIN Structure

Not-for-profit	Membership Organization	Community Regulated
• Fee for services, not number resources • 100% community funded	• Broad-based - Private sector - Public sector - Civil society	• Community developed policies • Member-elected executive board • Open and transparent

ARIN Structure

ARIN Services

Number Resources	Organization	Policy Development

• IP address allocation & assignment
• ASN assignment
• Directory services
  • Whois -RWS
  • WhoWas
  • IRR
• Reverse DNS
• DNSSEC
• Resource Certification (RPKI)
	• Information dissemination
	  • Website
	  • Educational materials
	  • IPv6 Wiki
	  • Social media
	• Meetings
	• Elections
	• Outreach
		• Maintain email discussion lists
		• Conduct public policy meetings and public policy consultations
		• Publish policy documents

ARIN Community

- Anyone interested in Internet number resource policy or has a stake in ARIN's mission
- Membership – 4529 as of August 30; organizations receiving direct allocations of IPv4 or IPv6 addresses = membership

ARIN Governance

Board of Trustees: 7 members; 3 year terms; 2 seats up for election each year

- Maintains authority over scope and mission
- Along with the President & CEO establishes strategic direction and maintains financial oversight

Current Members:
Paul Andersen, Vice Chair
John Curran
Vint Cerf, Chair
Tim Denton
Aaron Hughes
Paul Vixie
Bill Woodcock

ARIN Governance

ARIN Advisory Council: 15 members; 3 year terms, 5 seats up for election each year

- Advise the Board of Trustees on Internet resource policy and related matters
- Develop clear, technically sound and useful number policy based on community initiated proposals
- Participate in many outreach events

Current Members:

Dan Alexander, Vice Chair
Cathy Aronson
Kevin Blumberg
Tim Denton
Bill Darte
Owen DeLong
David Farmer
Chris Grundemann
Stacy Hughes
Scott Leibrand
Milton Mueller
Bill Sandiford
Robert Seastrom
Heather Schiller
John Springer
John Sweeting, Chair

ARIN Elections

**Board of Trustees, Advisory Council,
NRO Number Council**

- 1 member = 1 vote
- Nominations open to all member organizations and self-nominations by anyone
- Statements of support – open to all
- Voting by designated member representative – new this year – available through ARIN Online

Election Headquarters:
https://www.arin.net/public/election/index.xhtml

Community Outreach

- ARIN on the Roads throughout the region
- Industry trade exhibits:
  - Interop
  - Consumer Electronics Show
  - WISPA (Wireless ISP Association)
  - North American IPv6 Summit
- Regional events
  - CANTO – Caribbean
  - Caribbean Telecommunications – ICT Roadshows
  - Canadian ISP Summit
  - Operator forums – NANOG, CaribNOG
- International forums
  - Internet Governance Forum
  - ITU meetings
  - CITEL (Inter-American Telecommunication Commission)
  - RIR meetings
-

Participate in ARIN

Contribute your opinions and ideas:

- Public Policy Mailing List
- IPv6 Wiki
- Attend Public Policy and Members Meetings, Public Policy Consultations, outreach events
- ARIN Suggestion and Consultation Process
- Best Current Operational Practices (through NANOG)

Vote in ARIN elections – member organizations

http://www.arin.net/participate/

ARIN Mailing Lists

ARIN Announce: arin-announce@arin.net

ARIN Discussion: arin-discuss@arin.net (members only)

ARIN Public Policy: arin-ppml@arin.net

ARIN Consultation: arin-consult@arin.net

ARIN Issued: arin-issued@arin.net

ARIN Technical Discussions: arin-tech-discuss@arin.net

Suggestions: arin-suggestions@arin.net

http://www.arin.net/participate/mailing_lists/index.html

Join us at an ARIN Meeting

ARIN PUBLIC POLICY CONSULTATION

arin 32 PHOENIX, AZ · 10-11 OCT

ARIN 33 CHICAGO, ILLINOIS | 13-16 APRIL 2014

- Discuss policies
- Network with colleagues
- Participate remotely

FELLOWSHIP PROGRAM
American Registry for Internet Numbers

Apply for the fellowship to attend an ARIN meeting, all expenses paid!

www.arin.net/participate/meetings

ARIN on Social Media

www.TeamARIN.net

www.facebook.com/TeamARIN

www.twitter.com/TeamARIN

www.gplus.to/TeamARIN

www.linkedin.com/company/ARIN

www.youtube.com/TeamARIN

Internet Governance

Bill Woodcock
ARIN Board of Trustees

Internet Governance

- What is it?
- Who is involved?
- What is ARIN doing?
- Why should I care?

INTERNET GOVERNANCE =

COORDINATION OF THE MANY ASPECTS

INCLUDING

TECHNICAL STANDARDS, POLICIES, INFRASTRUCTURE

THAT MAKE THE INTERNET **WORK** & **DETERMINE HOW IT IS USED**

INVOLVING

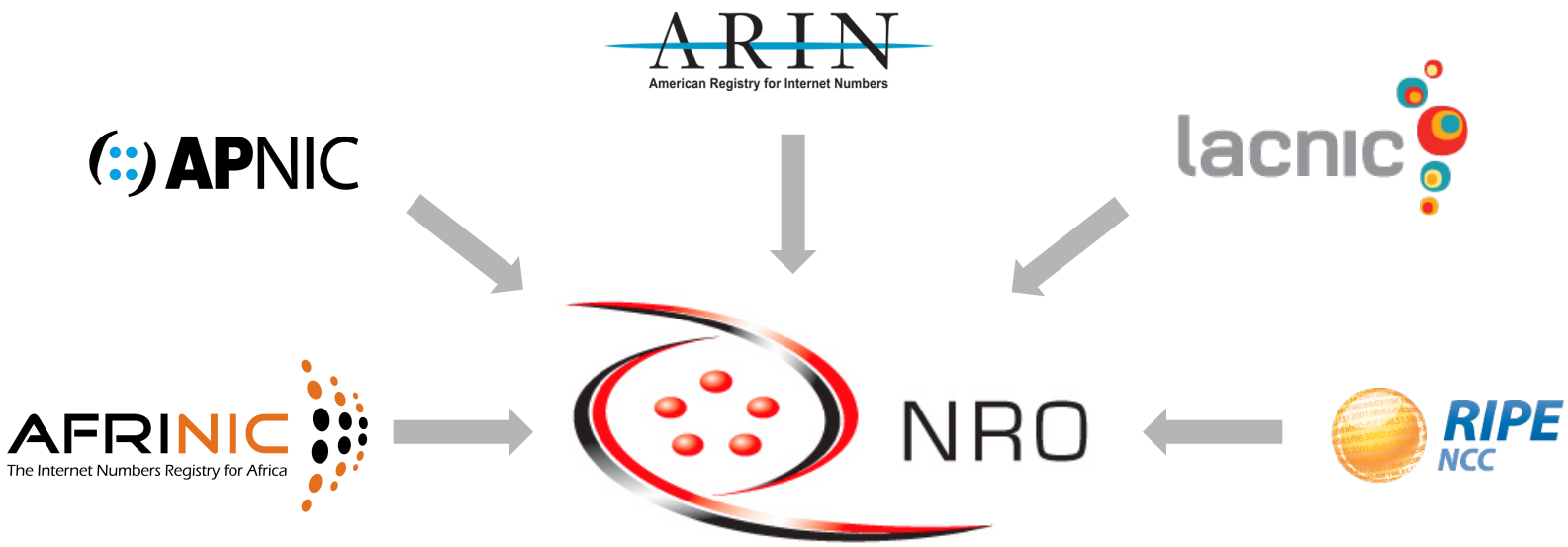
- GOVERNMENTS
- PRIVATE SECTOR
- CIVIL SOCIETY

What is Internet Governance?

The development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet

The World Summit on the Information Society (WSIS) (Tunis Agenda 2005)

Number Resource Organization



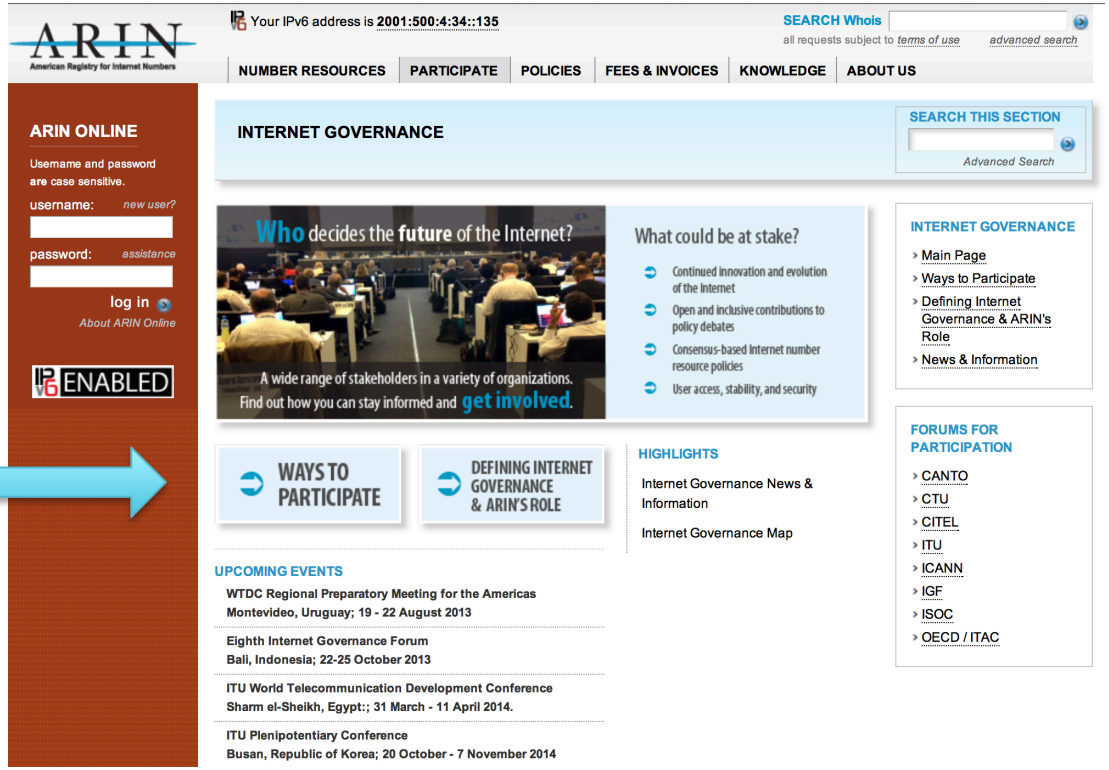
The NRO exists to protect the unallocated number resource pool, to promote and protect the bottom-up policy development process, and to act as a focal point for Internet community input into the RIR system.

Information on Joining in the Internet Governance Discussion

Visit ARIN's webpage:

Ways to Participate

in Internet Governance



https://www.arin.net/participate/governance/participate.html

ARIN Participation in Internet Governance

- Represent Internet community in key forums – decision making or discussion
- Educate governments and international organizations on: RIR structure, bottom-up community driven number resource management model
- Serve as key resource within debate contributing information, ideas and technical knowledge

Where ARIN Participates

- International Telecommunication Union (ITU); sector members
- Internet Governance Forum (IGF)
- Working groups, such as UN Commission on Science and Technology for Development (CSTD)
- Regional organizations and fora:
  - CITEL, CTU, CANTO, OECD – ITAC and more

International Telecommunication Union (ITU)

- United Nations (**UN**) agency for information and communication technologies (**ICTs**)
- Participation limited to
  - Member States - 193
  - ITU Sector Members and Associates
  - Academia
- Creates globally recognized treaties

Current Environment

2013:

- Internet Governance Forum (IGF)

2014:

- Word Telecommunication Development Conference (WTDC)
- ITU Plenipotentiary

Internet Governance Forum

- A non-decisional open multi-stakeholder forum for collaborative Internet policy dialogue
- Many stakeholders
  - Equal opportunity & voice for developing and developed countries
- Provides info and insight for public & private sector policy makers
  - No negotiated outcomes
- 8th Annual IGF
  - Bali, Indonesia in October
  - NRO contributes financial support, others can too

IGF Internet Governance Forum

How Can You Get Involved?

- Get informed
  - ARIN's website: https://www.arin.net/participate/governance/index.html
- Contribute to ITU public consultations
- Discuss with your government
- Participate and contribute financial support to Internet Governance Forum
- Advocate
  - Public debate, online forums, etc.

Q&A

Requesting & Managing Internet Number Resources

Jon Worley
Senior Resource Analyst

Overview

- Current Qualification Requirements
- Typical Documentation Requested
- New Fee Schedule

Qualifying for an AS number

- Confirm multi-homing within 30 days
- Provide verification of connectivity with 2+ ISPs
  - signed connectivity agreement
  - recent bill/invoice

Qualifying for IPv4 - ISPs

- multi-homed
  - 2 /24s reassigned to you
  - data to show 2 /24s efficiently used
- single-homed
  - 16 /24s reassigned to you
  - data to show 16 /24s efficiently used
- immediate need

IPv4 ISP Data Typically Requested

- Mapping of static IPs/subnets to customer names
  - may include customer justification
- List of all dynamic pools with prefix/ range assigned, area served, util %
- Mapping of internal subnets with description and # IPs used

3 Month Supply Calculation

- NRPM: Justified need, not solely predicted growth
- Utilization rate of last allocation
- Immediate need for exceptional circumstances

Qualifying for IPv4 – End Users

- multi-homed
  - 64 IP addresses used immediately
  - 128 IP addresses used within one year
- single-homed
  - 1,024 IP addresses used immediately
  - 2,048 IP addresses used within one year

IPv4 End User Data Requested

- Subnet mapping showing each subnet to be created and for each subnet
  - description of its purpose
  - # IPs used within 30 days
  - # IPs used within one year

Qualifying for IPv6 - ISPs

- have a previous v4 allocation from ARIN
- intend to multi-home
- provide a technical justification which details at least 50 assignments made within 5 years

IPv6 ISP Data Typically Requested

- If requesting more than a /32, a spreadsheet/text file with
  - # of serving sites (PoPs, datacenters)
  - # of customers served by largest
  - block size to be assigned (/48 typical)

Qualifying for IPv6 – End Users

- have a v4 direct assignment
- intend to multi-home
- 2000 IPv6 addresses or 200 IPv6 subnets used within a year
- technical justification as to why provider-assigned IPs are unsuitable

IPv6 End Users – Data Requested

- List of sites in your network
  - site = distinct geographic location
  - street address for each
- Campus may count as multiple sites
  - technical justification showing how they're configured like geographically separate sites

New Fee Schedule

- Went into effect 1 July
- Fees continue to be based on cost recovery
- Goal to balance overall fees to better align fees with services provided

New Fee Schedule

- Lower initial assignment/allocation fees
- ISP annual renewal fee based on total holdings
- End user maintenance fee based on number of address blocks and ASNs

Q&A

Automating Your Interactions with ARIN

Mark Kosters
Chief Technology Officer

Why Automate?

- Interact with ARIN faster
- Build a customized system using standards-based technologies
- Improved accuracy
- Integrate multiple services

REST – The New Services

- Three RESTful Web Services (RWS)
  - Whois-RWS
    - Provides public Whois data via REST
  - Reg-RWS (or Registration-RWS)
    - Allows customers to register and maintain data in a programmatic fashion
  - Bulk Whois
    - Permits download of bulk data under an AUP

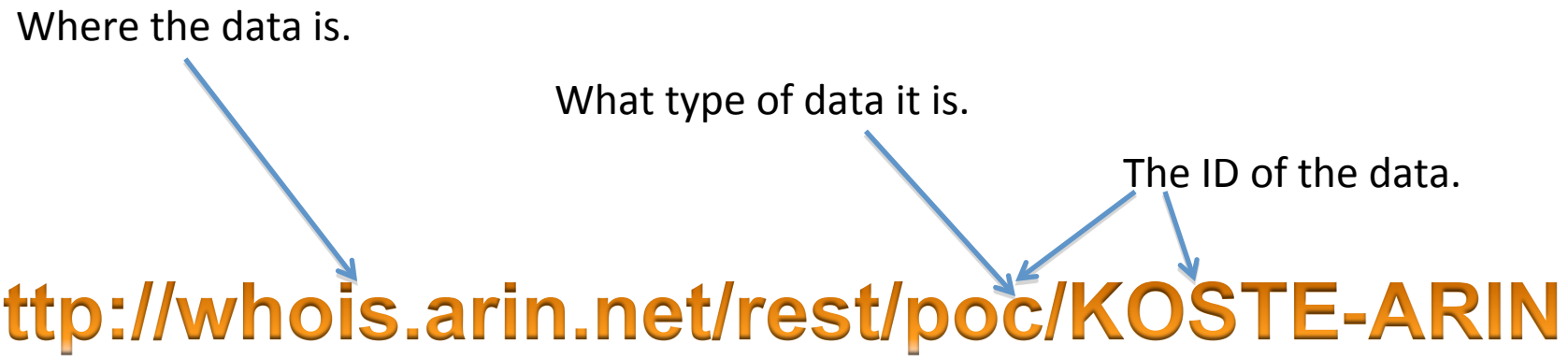
What is REST?

- Representational State Transfer
- As applied to web services
  - defines a pattern of usage with HTTP to create, read, update, and delete (CRUD) data
  - "Resources" are addressable in URLs
- Very popular protocol model
  - Amazon S3, Yahoo & Google services, …

The BIG Advantage of REST

- Easily understood
  - Any modern programmer can incorporate it
  - Can look like web pages
- Re-uses HTTP in a simple manner
  - Many, many clients
  - Other HTTP advantages
- This is why it is very, very popular with Google, Amazon, Yahoo, Twitter, Facebook, YouTube, Flickr, …

What does it look like?
Who can use it?



It is a standard URL. Anyone can use it.
Go ahead, put it into your browser.

Where can more information on REST be found?

- *RESTful Web Services*
  - O' Reilly Media
  - Leonard Richardson
  - Sam Ruby

Whois-RWS

- Publicly accessible, just like traditional Whois
- Searches and lookups on IP addresses, AS numbers, POCs, Orgs, etc…
- Very popular
  - As of September 2012, constitutes 60% of our query load
- For more information:
  - http://www.arin.net/resources/whoisrws/index.html

Registration RWS (Reg-RWS)

- Programmatic way to interact with ARIN
  - Intended to be used for automation
  - Not meant to be used by humans
- Useful for ISPs that manage a large number of SWIP records
- Requires an investment of time to achieve those benefits

Reg-RWS

- Requires an API Key
  - You generate one in ARIN Online on the "Web Account" page
- Permits you to register and manage your data (ORGs, POCs, NETs, ASes)
  - But only your data
- More information
  - http://www.arin.net/resources/restful-interfaces.html

Anatomy of a RESTful request

- Uses a URL (just like you would type into your browser)
- Uses a request type, known as a "method", of GET, PUT, POST or DELETE
- Usually requires a payload
  - Adheres to a published structure
  - Depends upon the type of data
  - Depends upon the method

Example – Reassign Detailed

- Your automated system issues a PUT command to ARIN using the following URL:

http://www.arin.net/rest/net/NET-10-129-0-0-1/reassign?apikey=API-1234-5678-9ABC-DEFG

The payload contains the following data:

```
<net xmlns="http://www.arin.net/regrws/core/v1" >
    <version>4</version>
    <comment></comment>
    <registrationDate></registrationDate>
    <orgHandle>HW-1</orgHandle>
    <handle></handle>
    <netBlocks>
        <netBlock>
            <type>A</type>
            <description>Reassigned</description>
            <startAddress>10.129.0.0</startAddress>
            <endAddress>10.129.0.255</endAddress>
            <cidrLength>24</cidrLength>
        </netBlock>
    </netBlocks>
    <parentNetHandle>NET-10-129-0-0-1</parentNetHandle>
    <netName>HELLOWORLD</netName>
    <originASes></originASes>
    <pocLinks></pocLinks>
</net>
```

Example – Reassign Detailed

ARIN's web server returns the following to your automated system:

```
<net xmlns="http://www.arin.net/regrws/core/v1" >
<version>4</version>
<comment></comment>
<registrationDate>Tue Jan 25 16:17:18 EST 2011</registrationDate>
<orgHandle>HW-1</orgHandle>
<handle>NET-10-129-0-0-2</handle>
<netBlocks>
<netBlock>
<type>A</type>
<description>Reassigned</description>
<startAddress>10.129.0.0</startAddress>
<endAddress>10.129.0.255</endAddress>
<cidrLength>24</cidrLength>
</netBlock>
</netBlocks>
<parentNetHandle>NET-10-129-0-0-1</parentNetHandle>
<netName>netName>HELLOWORLD</netName>
<originASes></originASes>
<pocLinks></pocLinks>
</net>
```

Reg-RWS Has More Than Templates

- Only programmatic way to do IPv6 Reassign Simple
- Only programmatic way to manage Reverse DNS
- Only programmatic way to access your ARIN tickets

Reg-RWS adoption at ARIN

- In 2012…
  - 1.01M transactions processed
    - 375K processed via Reg-RWS (37%)
    - 635K processed via Template (63%)
- In 2013…
  - 600K transactions processed thru March
    - 415K processed via Reg-RWS (69%)
    - 185K processed via Template (31%)

Testing Your Reg-RWS Client

- We offer an Operational Test & Evaluation environment for Reg-RWS
- Your real data, but isolated
  - Helps you develop against a real system without the worry that real data could get corrupted
- For more information:
  - http://www.arin.net/announcements/2011/20110215.html

Obtaining RESTful Assistance

- http://www.arin.net/resources/restful-interfaces.html
- ARIN Online's Ask ARIN feature
- arin-tech-discuss mailing list
  - Make sure to subscribe
  - Someone on the list will help you ASAP
  - Archives on the web site
- Registration Services Help Desk telephone not a good fit
  - Debugging these problems requires a detailed look at the URL, method, and payload being used

Bulk Whois

- You must first sign an AUP
  - ARIN staff will review your need to access bulk Whois data
- Requires an API Key
- More information
  - http://www.arin.net/resources/request/bulkwhois.html

Q&A

IPv4 Depletion and IPv6 Adoption in the ARIN Region

Jon Worley
Senior Resource Analyst

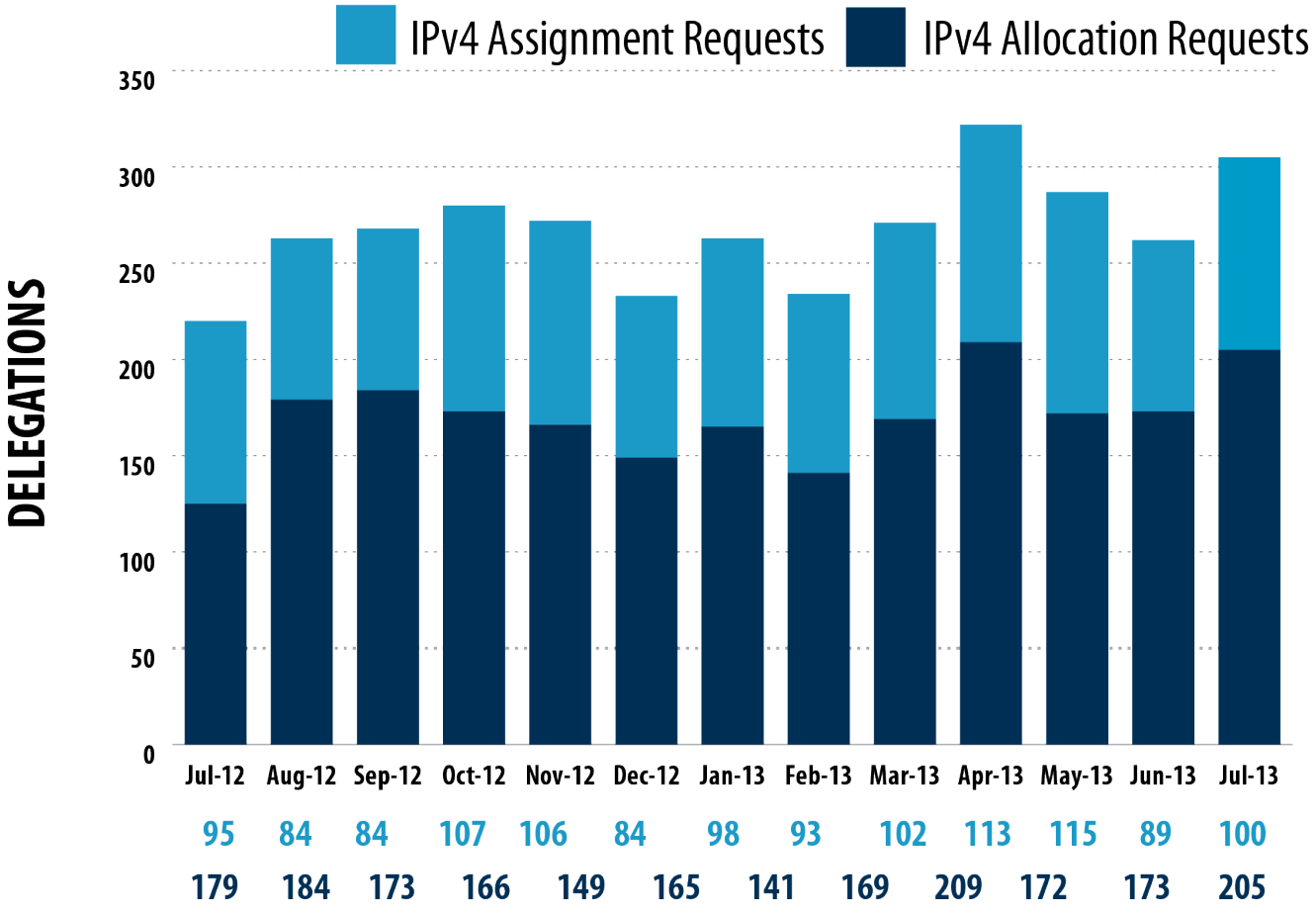
ARIN's IPv4 Inventory

As of 5 September 2013, ARIN has 1.83 /8 equivalents of IPv4 addresses remaining

IPv4 inventory published on ARIN's website: www.arin.net

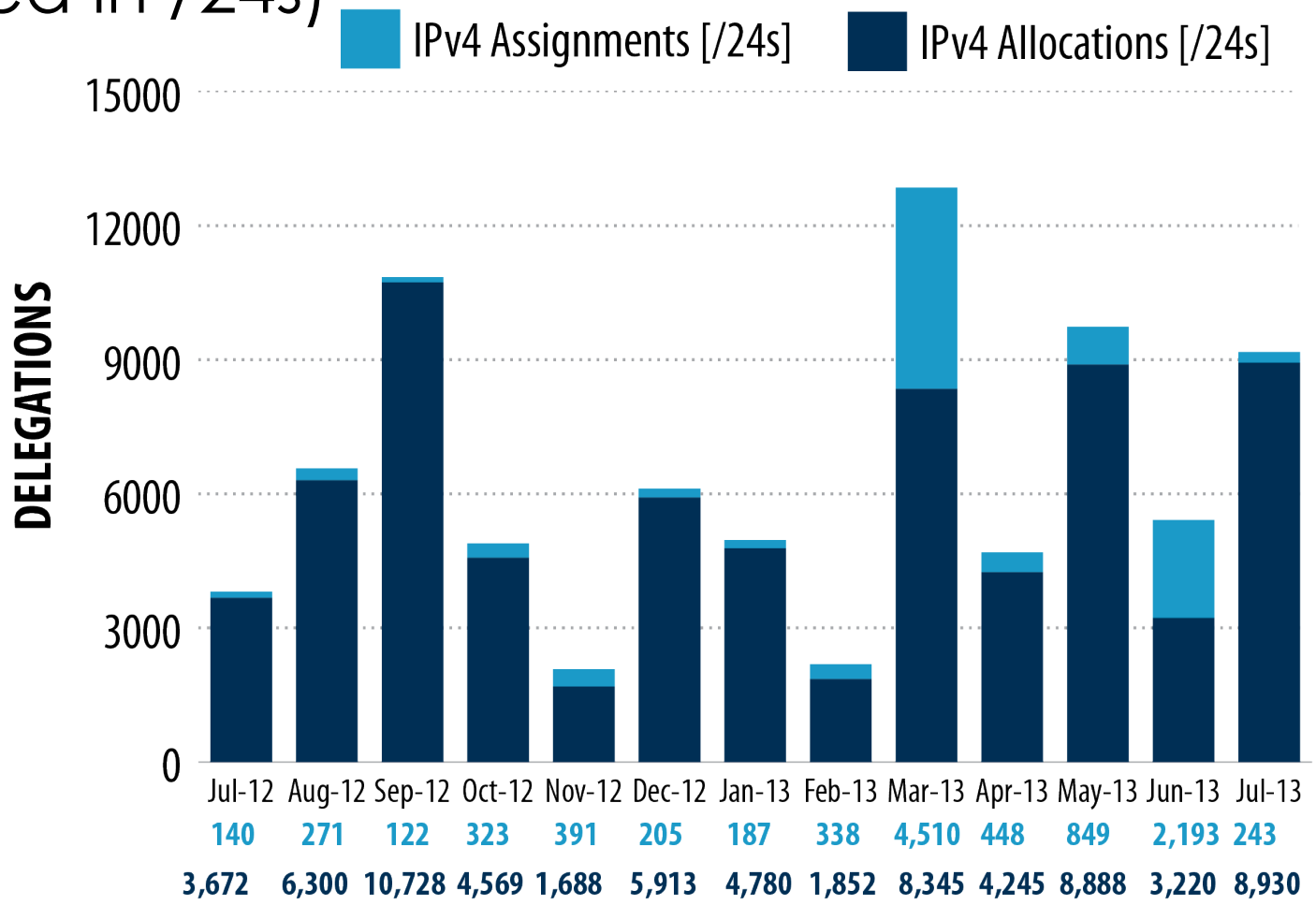
Updated daily @ 8PM ET

ARIN 2013 Requests for IPv4 Address Space
(by category)

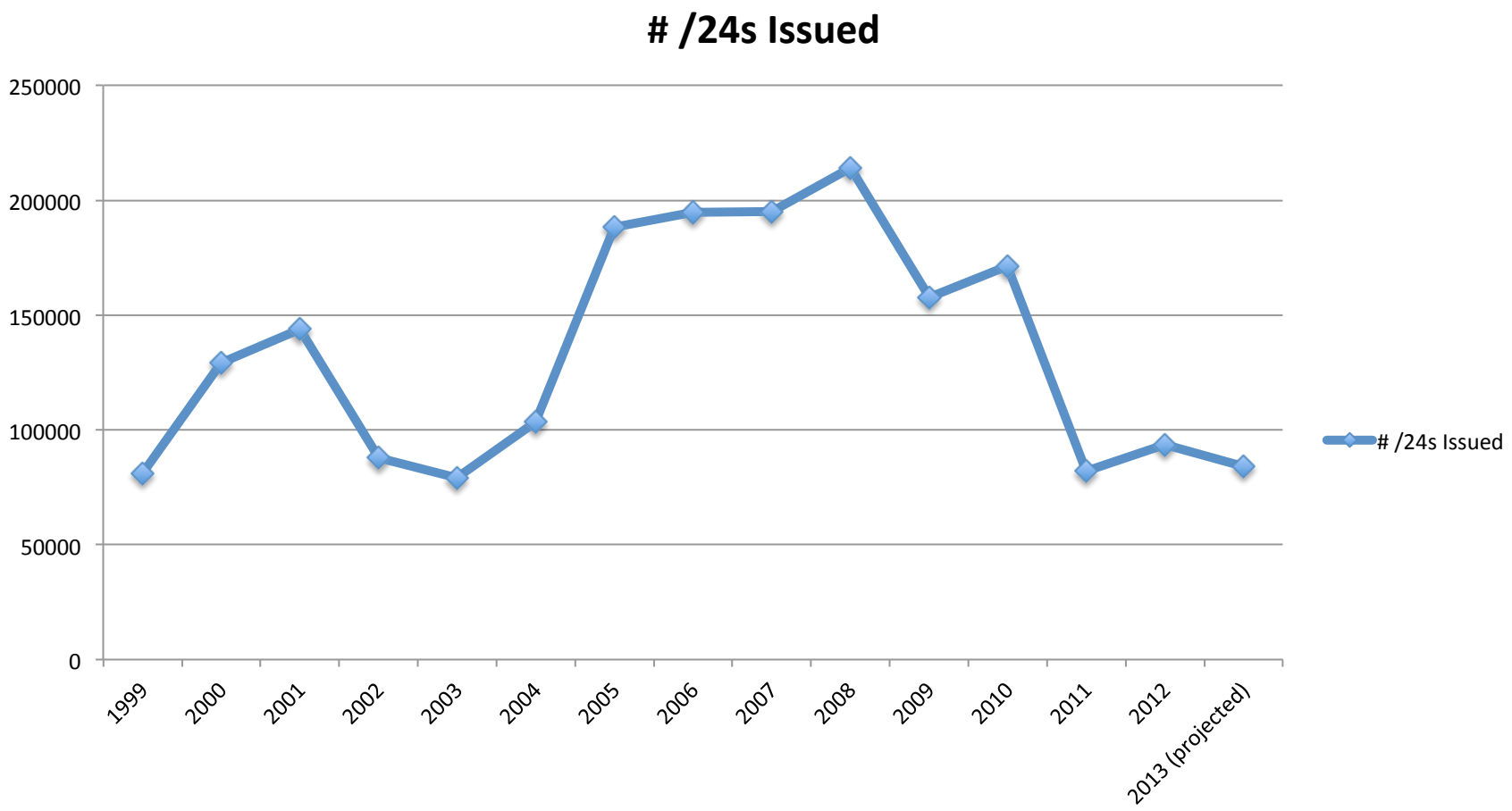


2013 IPv4 Delegations Issued by ARIN

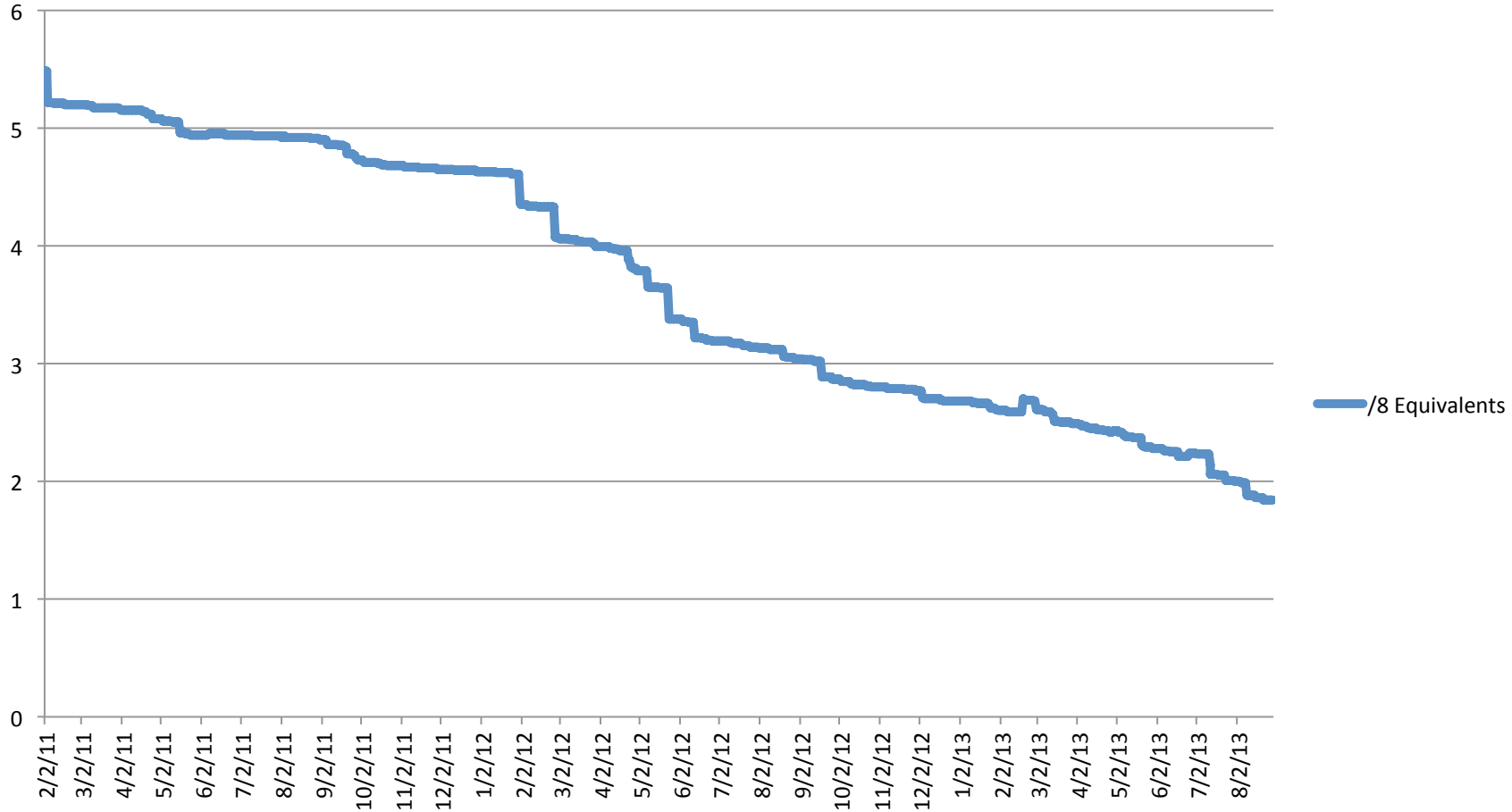
(listed in /24s)



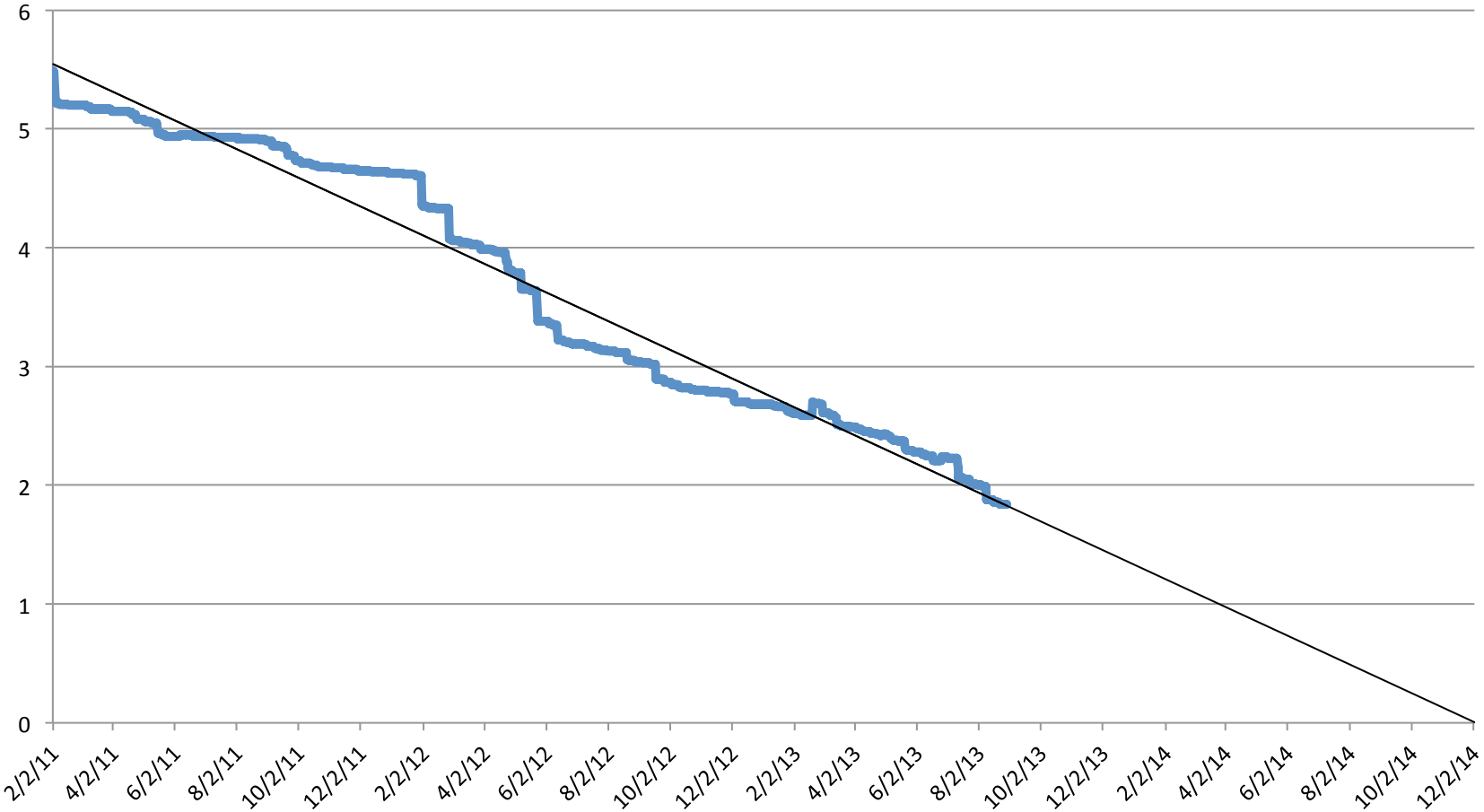
IPv4 ISP Annual Burn Rate



ARIN's IPv4 Free Pool



Linear Depletion Projection



ARIN's IPv4 Countdown Plan

- Phased implementation
- Phase 2: 3 /8 Equivalents Left
  - /16 and larger requests team-reviewed in a first in, first out fashion
  - 60 days to complete payment/RSA for IPv4 requests
  - IPv4 hold period moves from 6 to 3 months

ARIN's IPv4 Countdown Plan

- Phase 3: 2 /8 Equivalents Left
  - Examine process changes implemented in phase 2 and adjust as necessary
- Phase 4: 1 /8 Equivalent Left
  - All IPv4 requests team-reviewed and processed on a first in, first out basis
  - IPv4 hold period drops to 1 month

IPv4 Waiting List

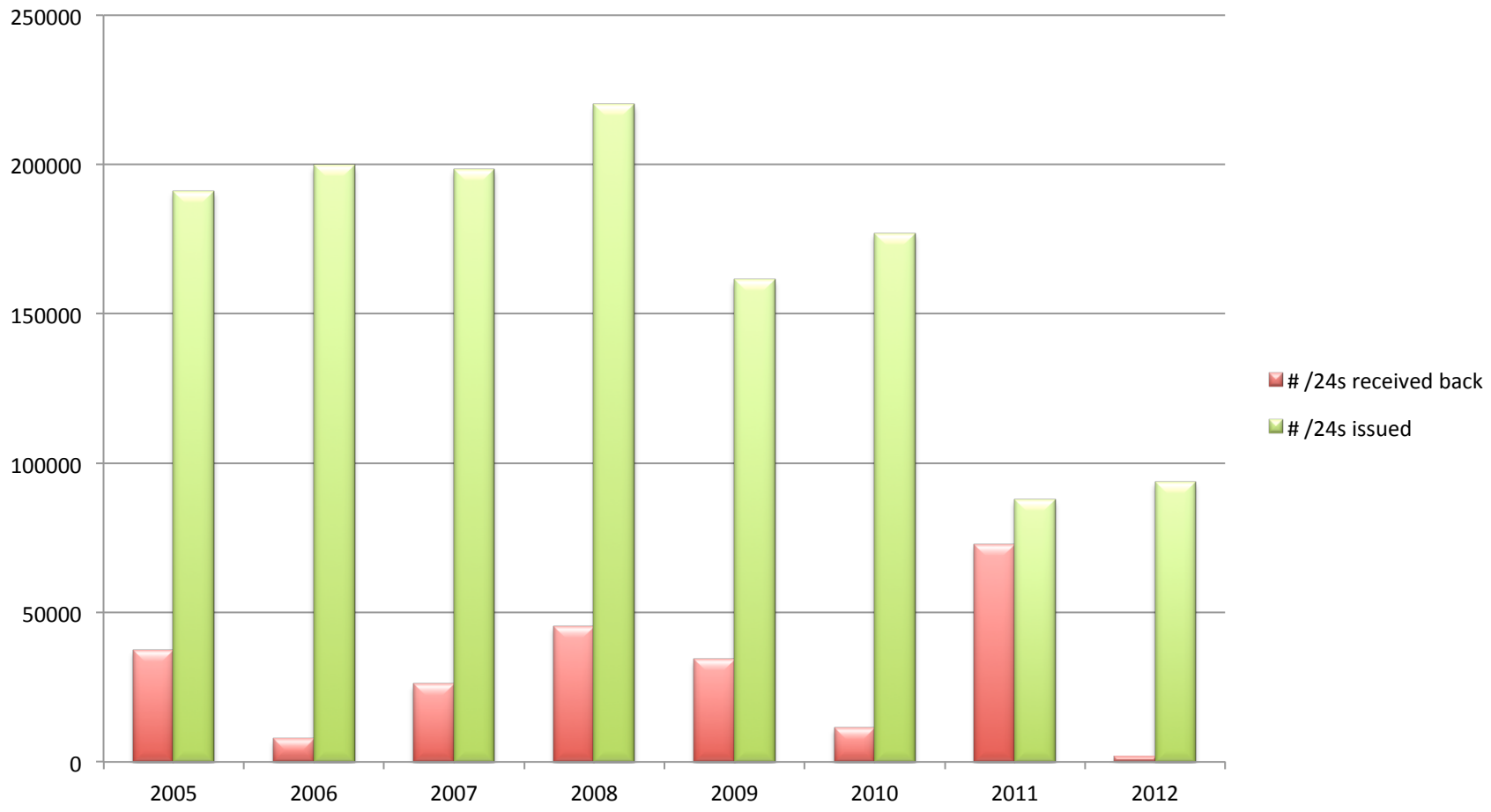
- Starts when ARIN can't fill a justified request
- Option to specify smallest acceptable size
- If no block available between approved and smallest acceptable size, option to go on the waiting list
- May receive only one allocation every three months

IPv4 Churn

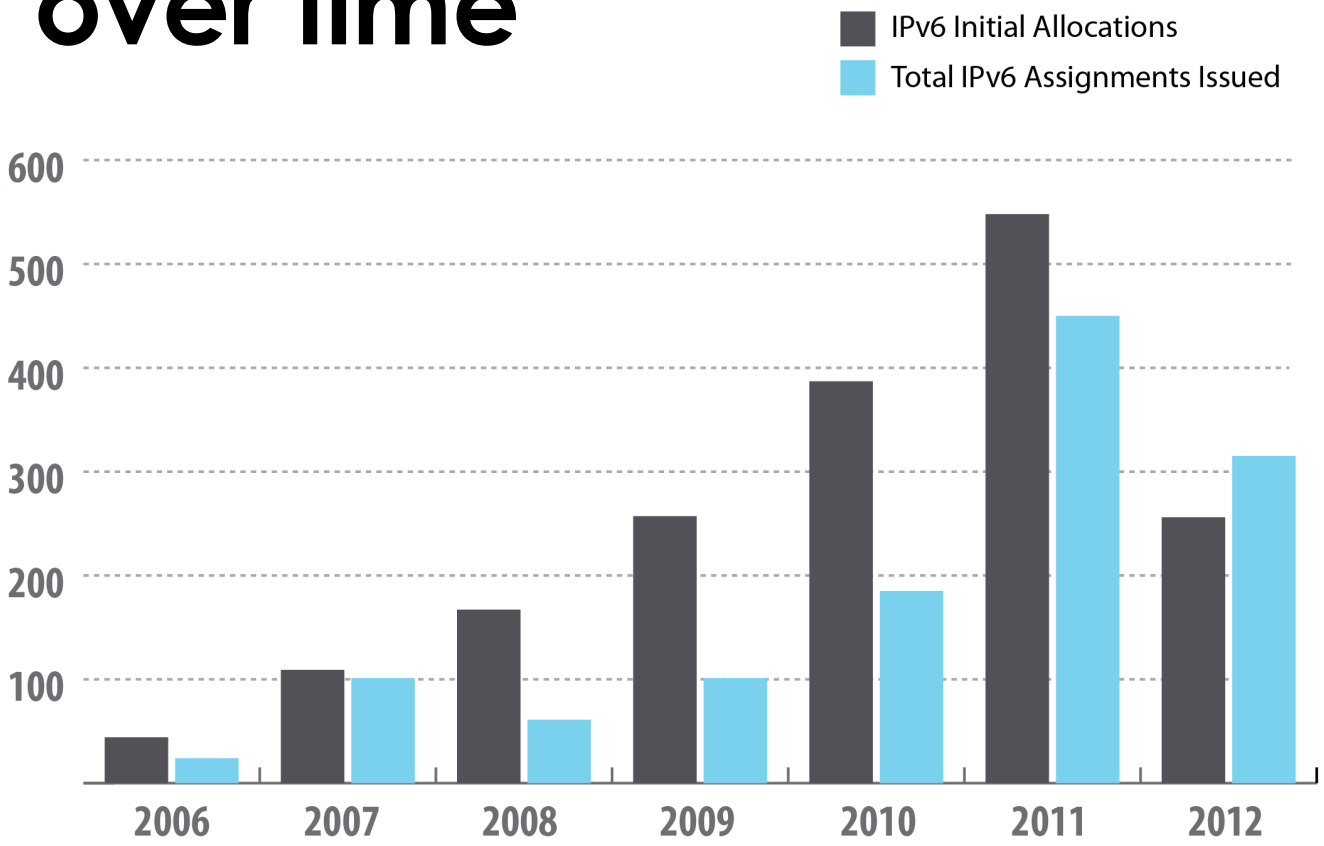
- IPv4 addresses go back into ARIN's free pool 3 ways
  - Return = voluntary
  - Revoke = for cause (usually nonpayment)
  - Reclaimed = fraud or business dissolution

- 3.54 /8s received back since 2005
  - /8 equivalent returned to IANA in 2012

Burn Rate vs. Churn Rate

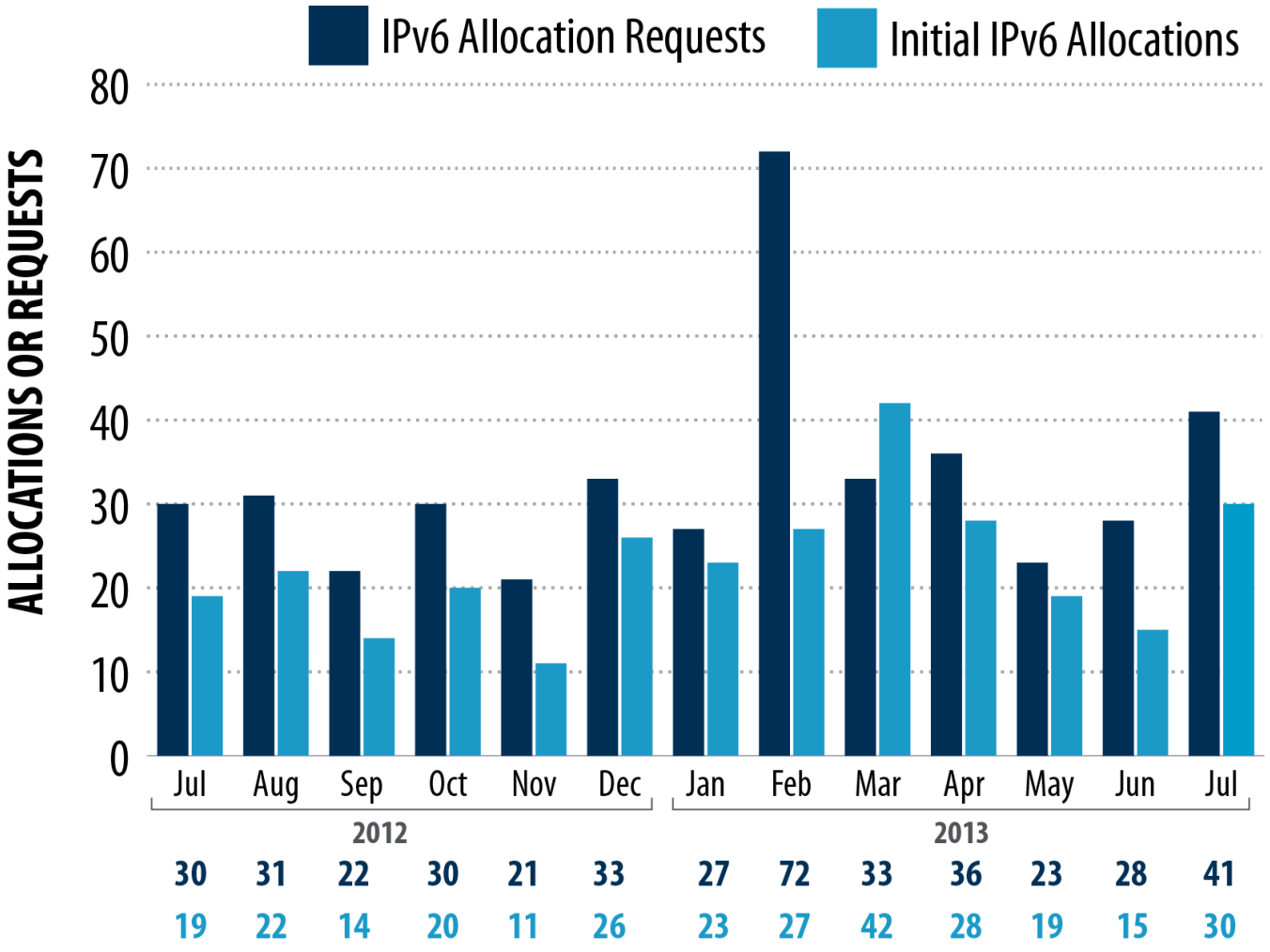


IPv6 over time



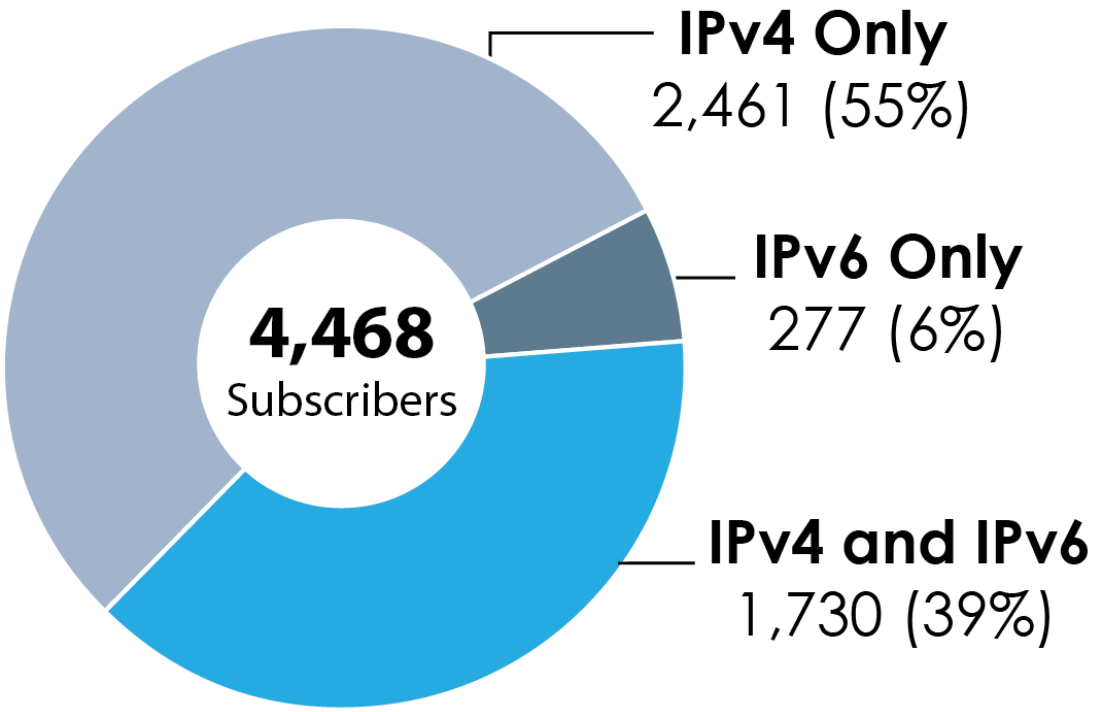
ARIN IPv6 Allocations and Assignments

2013 IPv6 Address Allocations & Requests

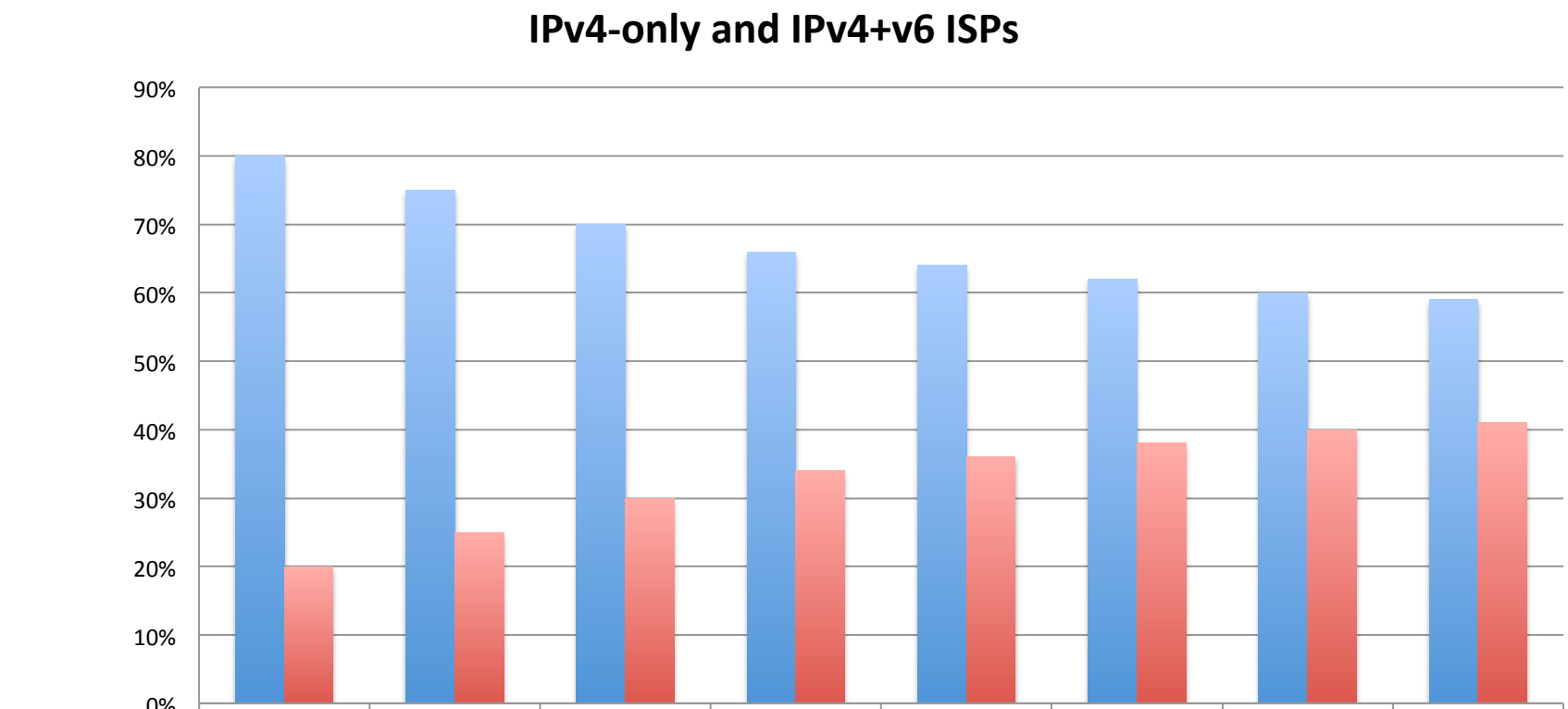


IPv4 vs IPv6 Subscribers

Total of 4,468 ISP Subscriber Members



ISP Members with IPv4 and IPv6



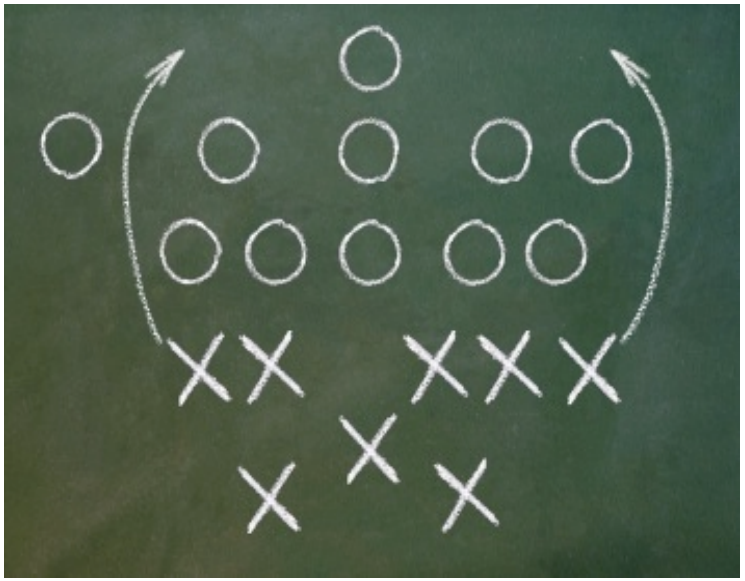
	2010Q1	2010Q3	2011Q1	2011Q3	2012Q1	2012Q3	2013Q1	2013Q3
% IPv4 Only	80%	75%	70%	66%	64%	62%	60%	59%
% IPv4 and IPv6	20%	25%	30%	34%	36%	38%	40%	41%

The Solution to IPv4 Depletion

- IPv6 must be adopted for continued internet growth
- Now is the time to deploy IPv6

Everyone needs an IPv6 Plan

- Each organization must decide on a unique IPv6 deployment plan right for them
  - Timeline will vary
  - Investment level will vary



Your IPv6 Check List

- [x] IPv6 address space
- [x] IPv6 connectivity (native or tunneled)
- [x] Operating systems, software, and network management tool upgrades
- [x] Router, firewall, and other hardware upgrades
- [x] IT staff and customer service training

ARIN Resources

www.GetIPv6.info

ARIN
American Registry for Internet Numbers

IPv6 Info Center
www.arin.net/knowledge/ipv6_info_center.html

IPv6 WIKI

TEAM ARIN
POWERED BY PARTICIPATION

www.TeamARIN.net

Operational Guidance

www.InternetSociety.org/Deploy360/

www.NANOG.org/archives/

bcop.NANOG.org

www.hpc.mil/cms2/index.php/ipv6-knowledge-base-general-info

Q&A

IPv4 Transfer Market

Jon Worley
Senior Resource Analyst

Types of Transfers

- Mergers and Acquistions
- Transfers to Specified Recipients
- Inter-RIR transfers from ARIN
- Inter-RIR transfers to ARIN

https://www.arin.net/resources/transfers/index.html

Transfers to Specified Recipients

- Org releasing resources must not have received IPv4 from ARIN in the past 12 months and may not request additional IPv4 for 12 months
- Recipient must qualify to receive resources under ARIN policy
- Recipient may receive up to a 24 month supply

IPv4 Specified Recipient Transfers

- 47 transfers completed (34,688 /24s)
- Transactions typically arranged through IPv4 brokers

Inter-RIR Transfers From ARIN

- RIR must have reciprocal, compatible needs-based Inter-RIR transfer policy
  - Currently: APNIC
  - Under discussion in the RIPE NCC, Lacnic, & AFRINIC regions
- Org releasing resources must not have received IPv4 from ARIN within the past 12 months
- Recipient must meet other RIR's Inter-RIR transfer policy requirements

Inter-RIR Transfers To ARIN

- RIR must have reciprocal, compatible needs-based Inter-RIR transfer policy
  - Currently: APNIC
- Recipient must qualify to receive resources under current policy
- Recipient may request up to a 24 month supply

Inter-RIR Transfer Notes

- 11 transfers completed (1,825 /24s total)
- ARIN & APNIC for now
- Expectation is primarily ARIN to APNIC given the early exhaustion of IPv4 in the APNIC region

Specified Transfer Listing Service (STLS)

- 3 ways to participate
  - Listers: have available IPv4 addresses
  - Needers: looking for more IPv4 addresses
  - Facilitators: available to help listers and needers find each other
- Major Uses
  - Matchmaking
  - Obtain preapproval for a transaction arranged outside STLS

Misconceptions

- IPv4 transactions will never be allowed
  - Transfer of unused IPv4 started June 2009
- It's a trap!
  - This isn't a sting operation
- ARIN recognizes all IPv4 transactions
  - Must meet policy requirements

Tips and Tricks

- Involve ARIN as early as possible
  - Make sure a contemplated transfer meets ARIN requirements before finalizing
- Use ARIN's STLS to pre-qualify
- ISPs must still show efficient use of all previous allocations and 80% of their most recent allocation

More Tips and Tricks

- 12 month waiting period
  - Prevents "flipping" of IPv4
  - Can't release unused addresses if you have received IPv4 from ARIN or via specified transfer in the past 12 months
  - Can't get more IPv4 addresses from ARIN or via specified transfer for 12 months after releasing unused IPv4

Other Notes

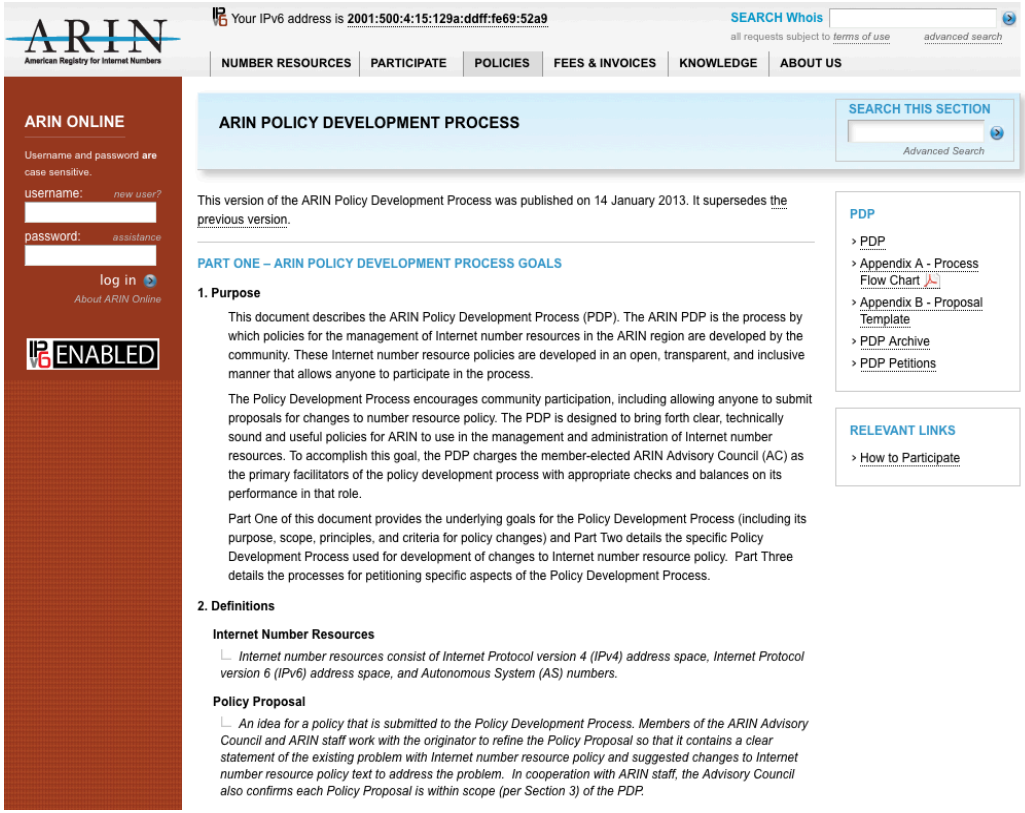
- ISPs can receive 24 month supply via transfer vs 3 month supply from ARIN
- ARIN still has IPv4 addresses and will have a post-depletion waiting list
- IPv6 transition still required

Q&A

ARIN's Policy Development Process and Current Policy Discussions

John Sweeting
Chair, ARIN Advisory Council

Policy Development Process (PDP)



Flowchart

Proposal Template

Archive

http://www.arin.net/policy/pdp.html

Policy Development Principles

Open

- Developed in open forum
  - Public Policy Mailing List
  - Public Policy Meetings
- Anyone can participate

Transparent

- All aspects documented and available on website
  - Policy process, meetings, and policies

Bottom-up

- Policies developed by the community
- Staff implements, but does not make policy

Who Plays a Role in the Policy Process?

Community

- Submits proposals
- Participates in discussions
- May petition against actions taken

Advisory Council (elected volunteers)

- Facilitates the policy process
- Develops policy:
  - Enables fair and impartial resource administration
  - Technically sound
  - Supported by the Community
- Determines consensus based on community input

Roles…

ARIN Board of Trustees (elected volunteers)

- Provides corporate fiduciary oversight
- Ensures the policy process has been followed
- Ratifies policies

ARIN Staff

- Provides feedback to community
  - Staff and legal assessments
  - Policy experience reports
- Implements ratified policies

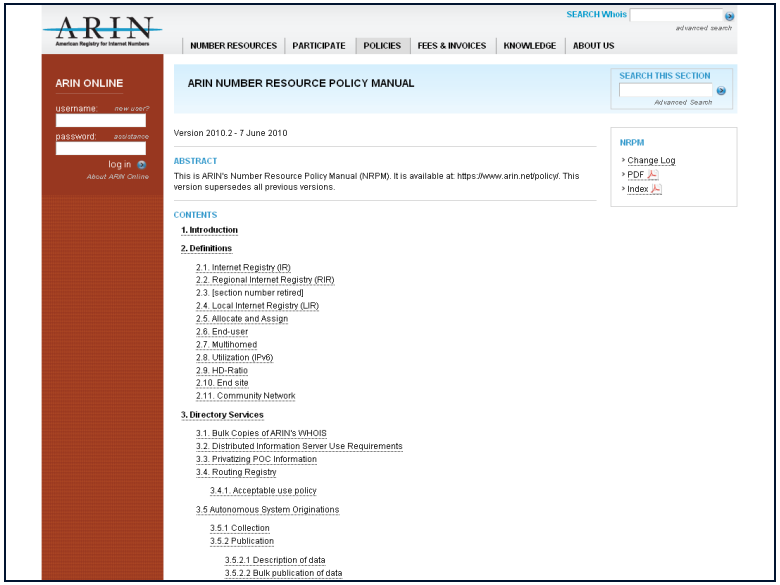
Basic Steps

1. Community member submits a Proposal
2. AC works with submitter to ensure clear problem statement and suggested policy change
3. AC puts Draft Policy on PPML for community discussion/ feedback (possibly presented at PPC/PPM)
4. AC decides: continue work or abandon
5. AC recommends fully developed Draft Policy (fair, sound and supported by community) for adoption
6. Recommended Draft Policy presented at PPC/PPM
7. If AC still recommends adoption, then Last Call and review of last call
8. Board review
9. Staff implements

Number Resource Policy Manual

ARIN's Policy Document

- Version 2013.3 (24 July 2013)
- 30th version



Contains

- Change Log
- HTML/PDF/txt

http://www.arin.net/policy/nrpm.html

Policies in the NRPM

- IPv4 Address Space
- IPv6 Address Space
- Autonomous System Numbers (ASNs)
- Directory Services (Whois)
- Reverse DNS (in-addr)
- Transfers
- Experimental Assignments
- Resource Review Policy

References

Policy Development Process
http://www.arin.net/policy/pdp.html

Draft Policies and Proposals
http://www.arin.net/policy/proposals/index.html

Number Resource Policy Manual
http://www.arin.net/policy/nrpm.html

Current Draft Policies and Proposals

- 4 Draft Policies
  - To be presented at the ARIN Public Policy Consultation at NANOG 59 and at ARIN 32 in Phoenix
- Policy Proposals
  - None at this time

Draft Policies

- **Draft Policy ARIN-2013-4: RIR Principles**
  - Would add principles such as "stewardship" from RFC 2050 to ARIN number policy.
- **Draft Policy ARIN-2013-5: LIR/ISP and End-user Definitions**
  - Would clarify who is who. Proposal says if you are not clearly an end user, you're an ISP.

Text available at: https://www.arin.net/policy/proposals/

Draft Policies cont.

- **Draft Policy ARIN-2013-6: Allocation of IPv4 and IPv6 Address Space to Out-of-region Requestors**
  - Current proposal text says in order for an organization to get address space from ARIN, the organization must have a "majority of their technical infrastructure and customers in the designated ARIN region".
- **Draft Policy ARIN-2013-7: Merge IPv4 ISP and End-User Requirements**
  - Would remove the differentiation between end users and ISPs for requests for IPv4 space.

Text available at: https://www.arin.net/policy/proposals/

How Can You Get Involved?

There are two ways to voice your opinion:

- **Public Policy Mailing List**
- **Public Policy Consultations/Meetings**
  (in person or remotely)

ARIN Meetings

- **Two/three ARIN meetings a year**
  - Attend and participate in person or remote
    - Check the ARIN Participate/Meetings site about **two weeks prior to meeting**
    - Look at the Proposals/Draft Policies on Agenda (what and when?)
    - Get a copy of the Discussion Guide (summaries and text)
    - Attend/log in and state your opinion
- AC meeting results
  - Watch PPML for AC's decisions (once a month)
  - Draft Policies – good or bad ideas, for or against?
  - Last Calls – For or against?

Public Policy Mailing List (PPML)

- Open to anyone
- Easy to subscribe to
- Contains: ideas, proposals, draft policies, last calls, announcements of adoption and implementation, petitions, and more…
- Archived
- RSS feed

https://www.arin.net/participate/mailing_lists/index.html

Q&A

Lunch Break

Please return on time for a prompt 1:00 PM start time.

Take your valuables as the room will not be locked.

Today's Agenda

- Welcome from ARIN and NANOG
- ARIN: An Overview
- Requesting and Managing Internet Number Resources
- Automating Your Interactions with ARIN
- IPv4 Depletion and IPv6 Adoption in the ARIN Region
- IPv4 Transfer Market
- ARIN's Policy Development Process and Current Discussions
- **Lunch**
- Securing Routing: RPKI Overview
- DNS Tutorial
- Mitigating DNS Amplification Attacks
- Northwest Access Exchange
- BGP Tutorial
- Best Current Operational Practices
- Open Microphone / Q&A
- **Happy Hour**

Securing Routing: RPKI Overview

Mark Kosters
Chief Technology Officer

Why are DNSSEC and RPKI important?

- Two of the most critical resources
  - DNS
  - Routing
- Hard to tell when resource is compromised
- Focus of increased attention globally

Why DNSSEC? What is it?

- Standard DNS (forward or reverse) responses are not secure
  - Easy to spoof
  - Notable malicious attacks
- DNSSEC attaches signatures
  - Validates responses
  - Can not spoof

Reverse DNS

- ARIN issues blocks without any working DNS
  - Registrant must establish delegations after registration
  - Then employ DNSSEC if desired
- Authority to manage reverse zones follows SWIP
  - "Shared Authority" model

Reverse DNS: Querying ARIN's Whois

Query for the zone directly:

```
whois> 81.147.204.in-addr.arpa

Name:              81.147.204.in-addr.arpa.
Updated:           2006-05-15
NameServer:        AUTHNS2.DNVR.QWEST.NET
NameServer:        AUTHNS3.STTL.QWEST.NET
NameServer:        AUTHNS1.MPLS.QWEST.NET

Ref:    http://whois.arin.net/rest/rdns/81.147.204.in-addr.arpa.
```

Changes completed to make DNSSEC work at ARIN

- Permit by-delegation management
- Sign in-addr.arpa. and ip6.arpa. delegations that ARIN manages
- Create entry method for DS Records
  - ARIN Online
  - RESTful interface
  - Not available via templates

Reverse DNS in ARIN Online

First identify the network that you want to put Reverse DNS nameservers on…

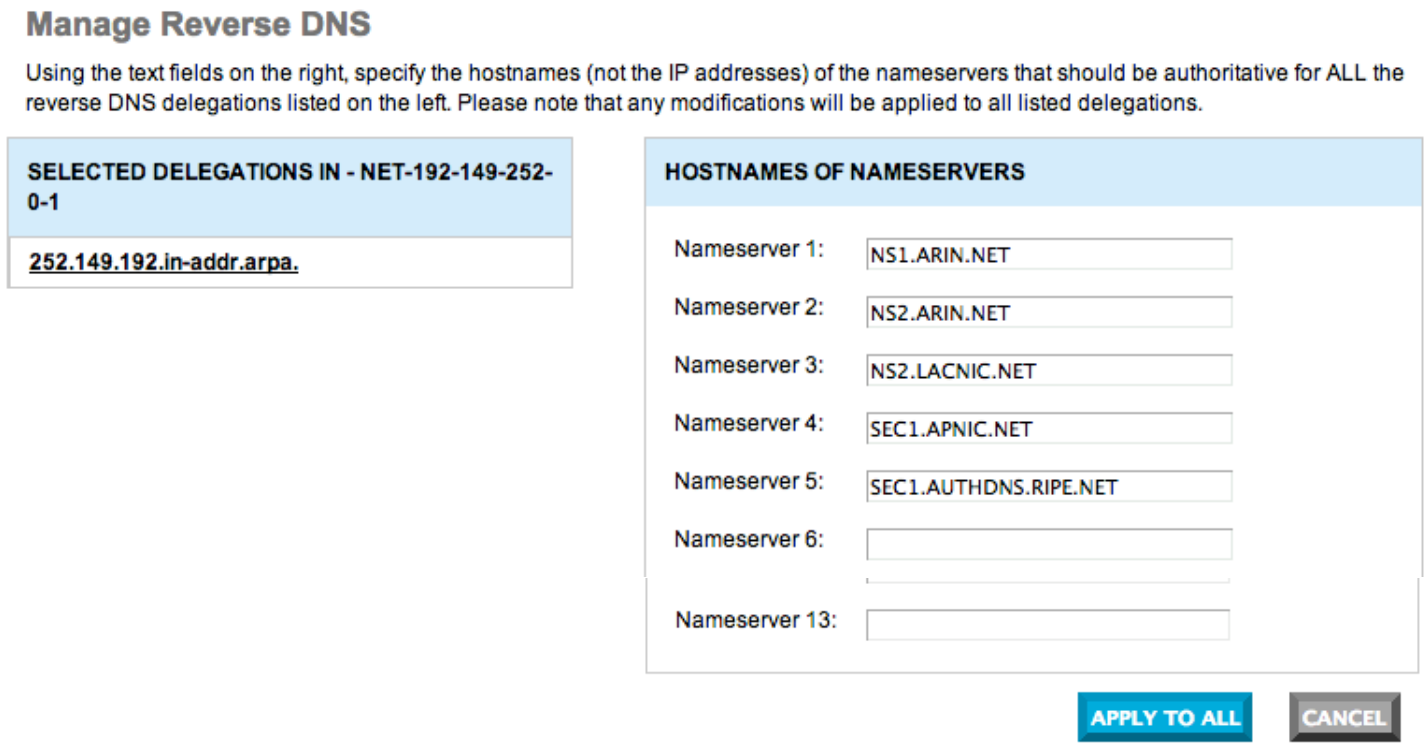
REVERSE DNS INFORMATION FOR NET-192-149-252-0-1

SELECT	DELEGATION	NAMESERVERS	DS RECORD KEY TAGS	AUTHORIZED ORGANIZATIONS
☑	252.149.192.in-addr.arpa.	NS1.ARIN.NET NS2.ARIN.NET NS2.LACNIC.NET SEC1.APNIC.NET SEC1.AUTHDNS.RIPE.NET		ARIN Operations

MODIFY NAMESERVERS MODIFY DS RECORDS

Reverse DNS in ARIN Online

…then enter the Reverse DNS nameservers…



DNSSEC in ARIN Online

…then apply DS record to apply to the delegation

DS RECORDS

	KEY TAG	ALGORITHM	DIGEST TYPE	DIGEST

The DS records should be in the following format:

ZONE	CLASS	RR TYPE	KEY TAG	ALGORITHM	DIGEST TYPE	DIGEST
Optional, ignored	Optional, "IN"	Must be "DS"	2 byte integer	1 byte integer (5, 7 or 8)	1 byte integer (1 or 2)	The hex encoded digest

PASTE DS RECORD DATA BELOW Parse DS Record

Choose File No file chosen UPLOAD FILE

File contents must be plain text

APPLY TO ALL CANCEL

Reverse DNS Management and DNSSEC in ARIN Online

- Available on ARIN's website

http://www.arin.net/knowledge/dnssec/

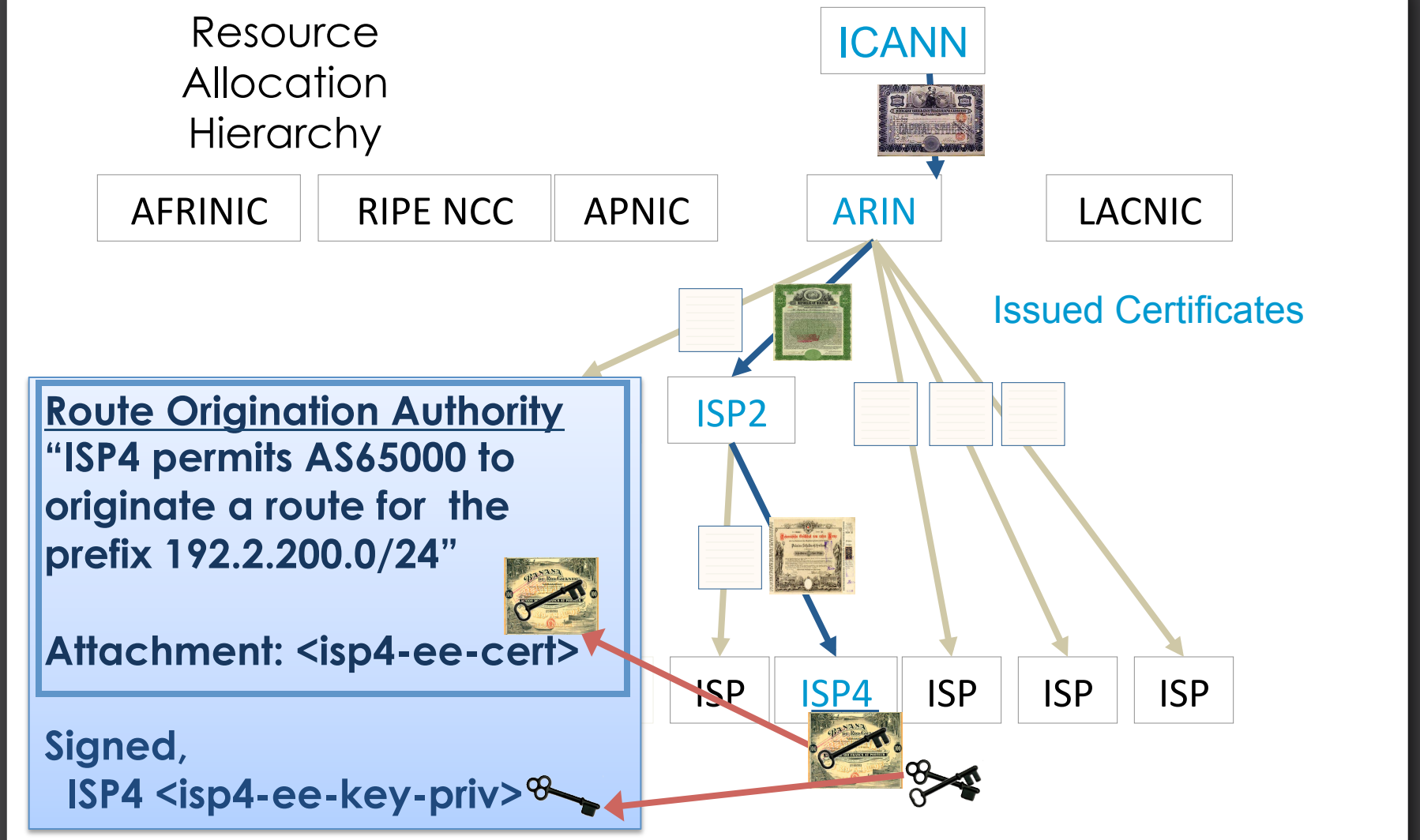
What is RPKI?

- **R**esource **P**ublic **K**ey **I**nfrastructure
- Attaches digital certificates to network resources
  - AS Numbers
  - IP Addresses
- Allows ISPs to associate the two
  - Route Origin Authorizations (ROAs)
  - Can follow the address allocation chain to the top

What does RPKI accomplish?

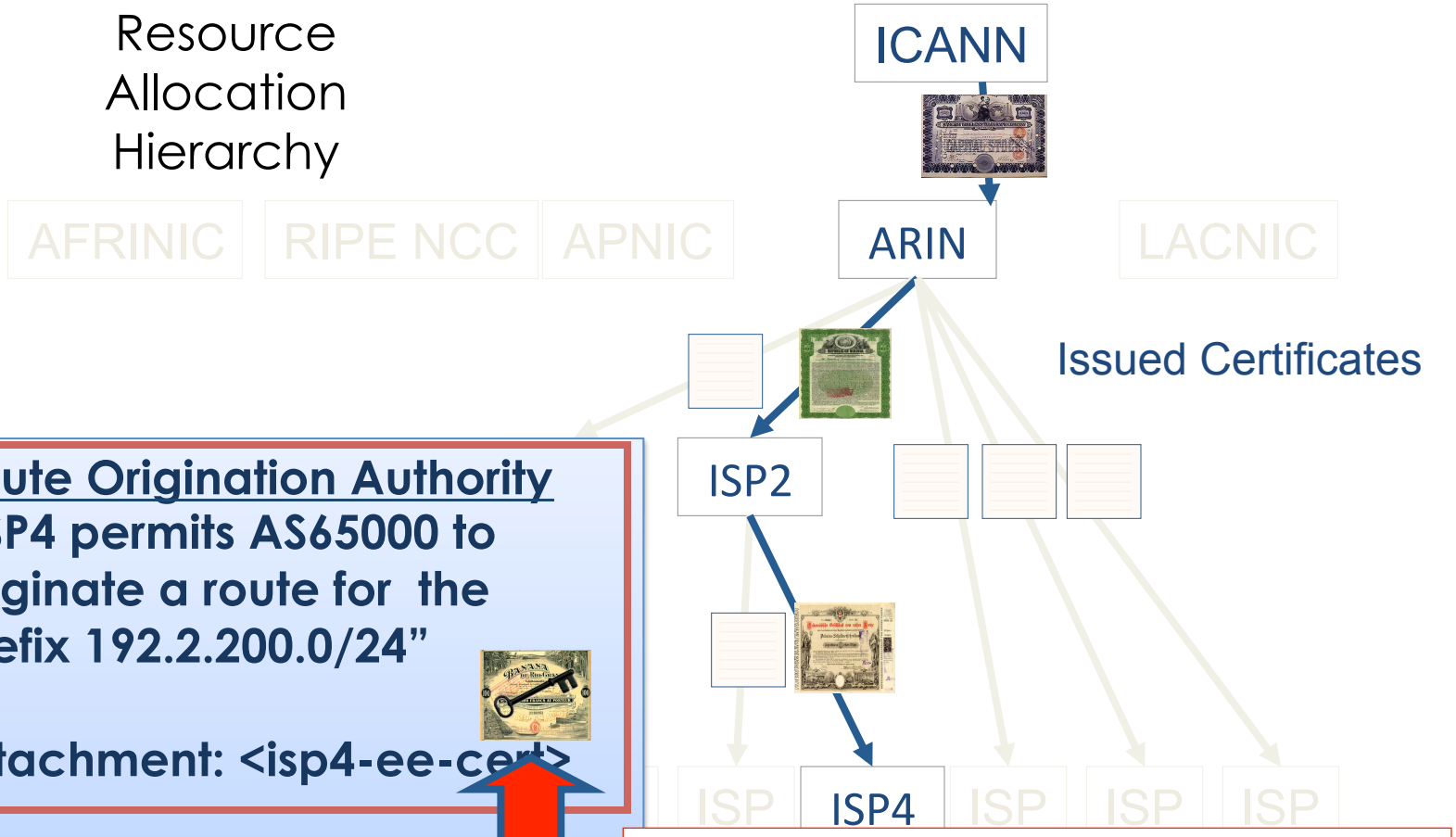
- Allows routers or other processes to validate route origins
- Simplifies validation authority information
  - Trust Anchor Locator
- Distributes trusted information
  - Through repositories

Resource Cert Validation



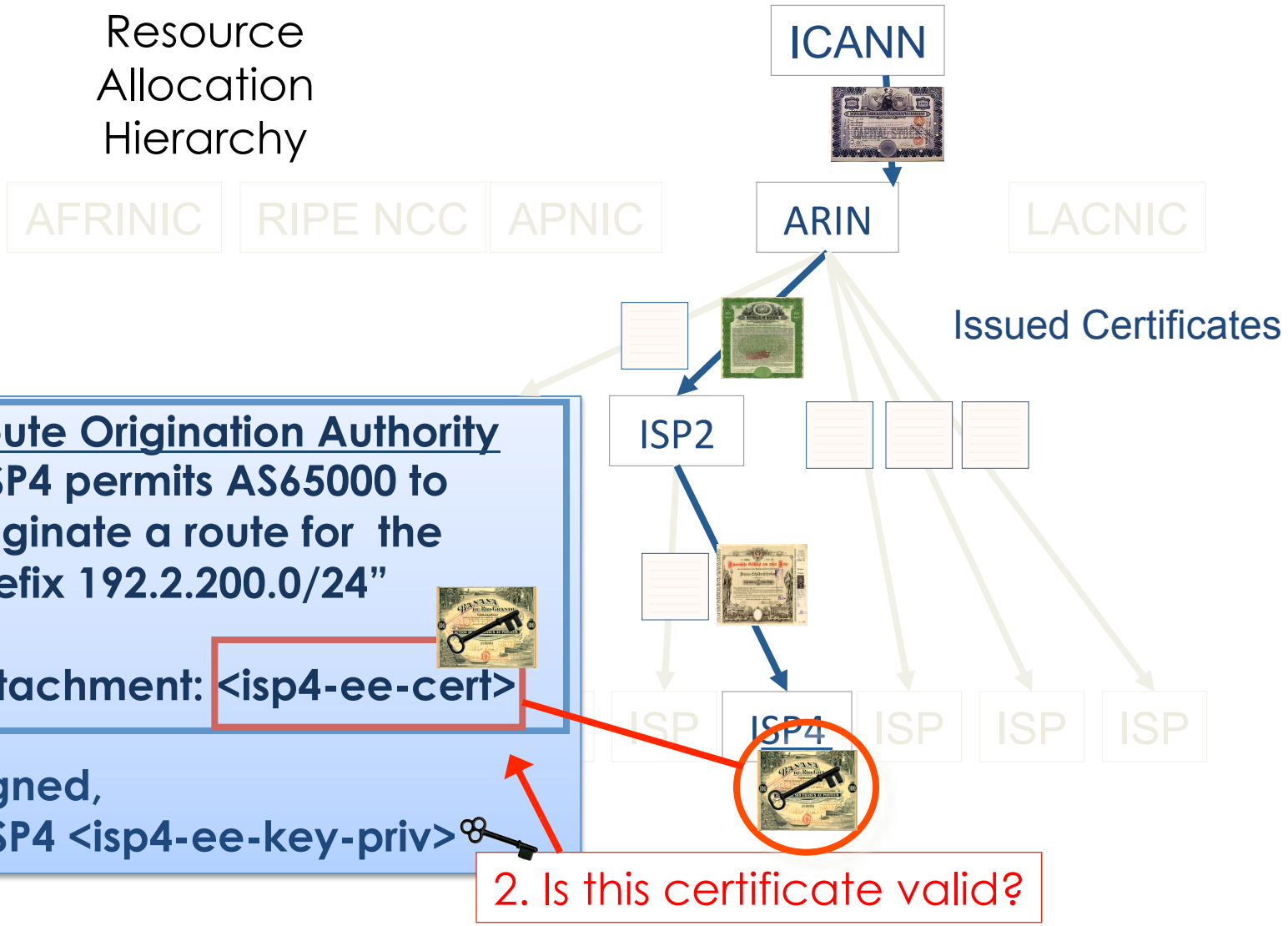
Resource Cert Validation

Resource Allocation Hierarchy



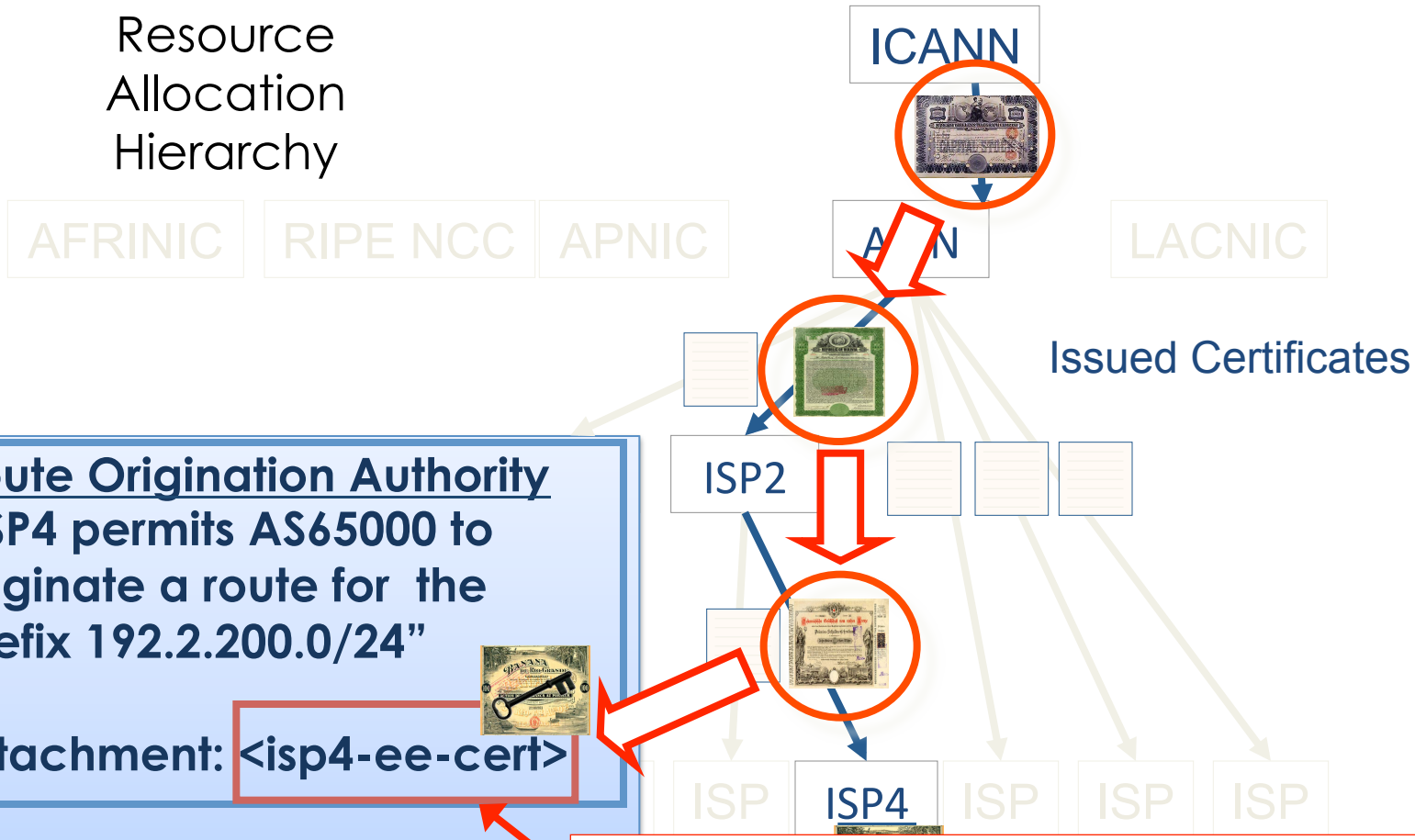
Resource Cert Validation

Resource Allocation Hierarchy



Resource Cert Validation

Resource Allocation Hierarchy



Route Origination Authority
"ISP4 permits AS65000 to originate a route for the prefix 192.2.200.0/24"

Attachment: <isp4-ee-cert>

Signed,
ISP4 <isp4-ee-key-priv>

3. Is there a valid certificate path from a Trust Anchor to this certificate?

What does RPKI Create?

- It creates a repository
  - RFC 3779 (RPKI) Certificates
  - ROAs
  - CRLs
  - Manifest records

Repository View

```
./ba/03a5be-ddf6-4340-a1f9-1ad3f2c39ee6/1:
total 40
-rw-r--r--  1 143  143  1543 Jun 26  2009 ICcaIRKhGHJ-TgUZv8GRKqkidR4.roa
-rw-r--r--  1 143  143  1403 Jun 26  2009 cKxLCU94umS-qD4DOOkAK0M2US0.cer
-rw-r--r--  1 143  143  485  Jun 26  2009 dSmerM6uJGLWMMQTl2esy4xyUAA.crl
-rw-r--r--  1 143  143  1882 Jun 26  2009 dSmerM6uJGLWMMQTl2esy4xyUAA.mnf
-rw-r--r--  1 143  143  1542 Jun 26  2009 nB0gDFtWffKk4VWgln-12pdFtE8.roa
```

A Repository Directory containing an RFC3779 Certificate, two ROAs, a CRL, and a manifest

Repository Use

- Pull down these files using a manifest-validating mechanism
- Validate the ROAs contained in the repository
- Communicate with the router marking routes “valid”, “invalid”, “unknown”
- Up to ISP to use local policy on how to route

Possible Flow

- RPKI Web interface -> Repository
- Repository aggregator -> Validator
- Validated entries -> Route Checking
- Route checking results -> local routing decisions (based on local policy)

How you can use ARIN's RPKI System

- Hosted
- Web Delegated
- Delegated using Up/Down Protocol

Hosted RPKI

- Pros
  - Easier to use
  - ARIN managed
- Cons
  - No current support for downstream customers to manage their own space
  - We hold your private key

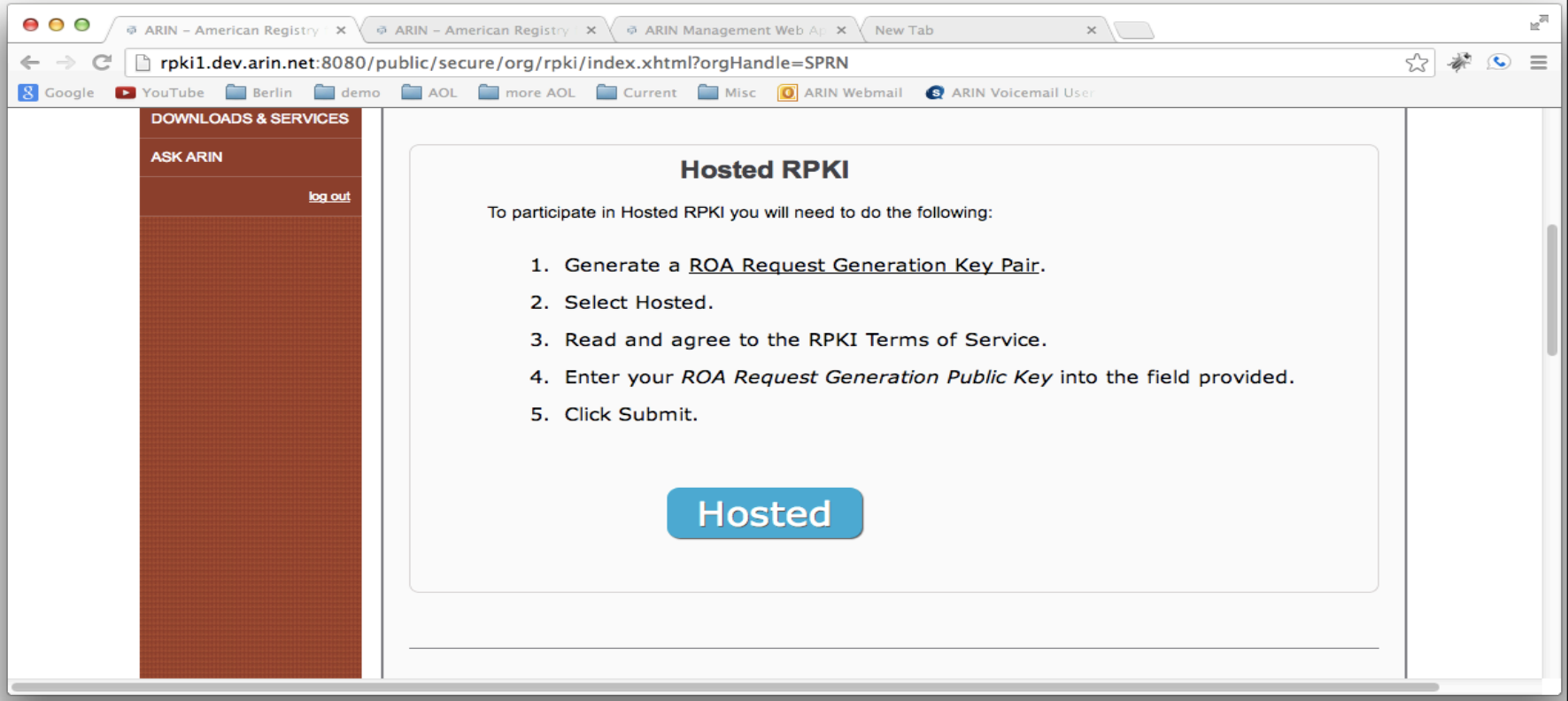
Web Delegated RPKI

- Pros
  - Harder than Hosted, Easier than Delegated (Up/Down)
  - Manage your own RPKI system
  - Control your own private keys
- Cons
  - Need to setup your own RPKI environment
  - Fairly complex

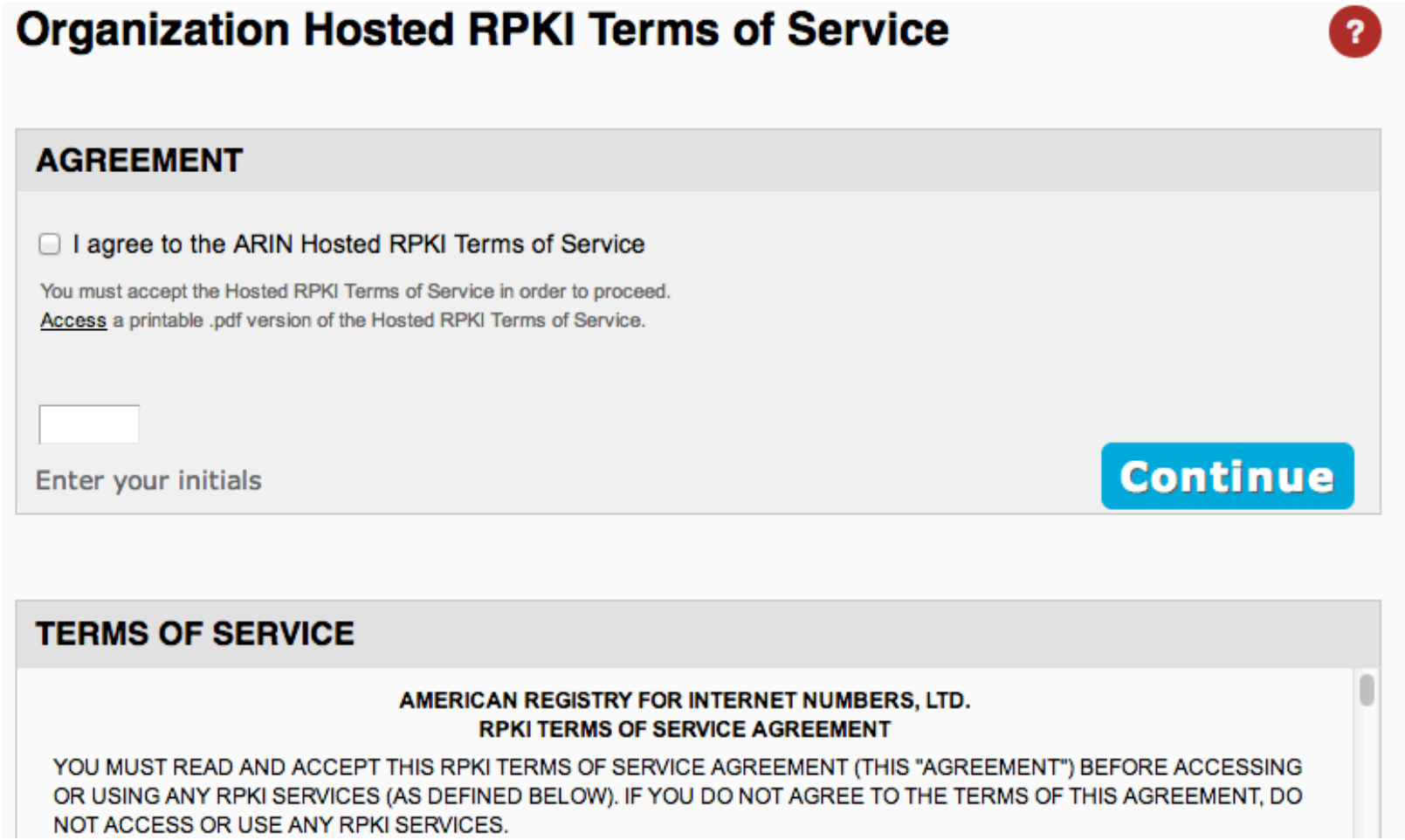
Delegated RPKI with Up/Down

- Pros
  - Same as web delegated
  - Follows the ietf up/down protocol
- Cons
  - Extremely hard to setup
  - Need to operate your own RPKI environment

Hosted RPKI in ARIN Online



Hosted RPKI in ARIN Online



Hosted RPKI in ARIN Online

Enter your *ROA Request Generation Public Key* below.

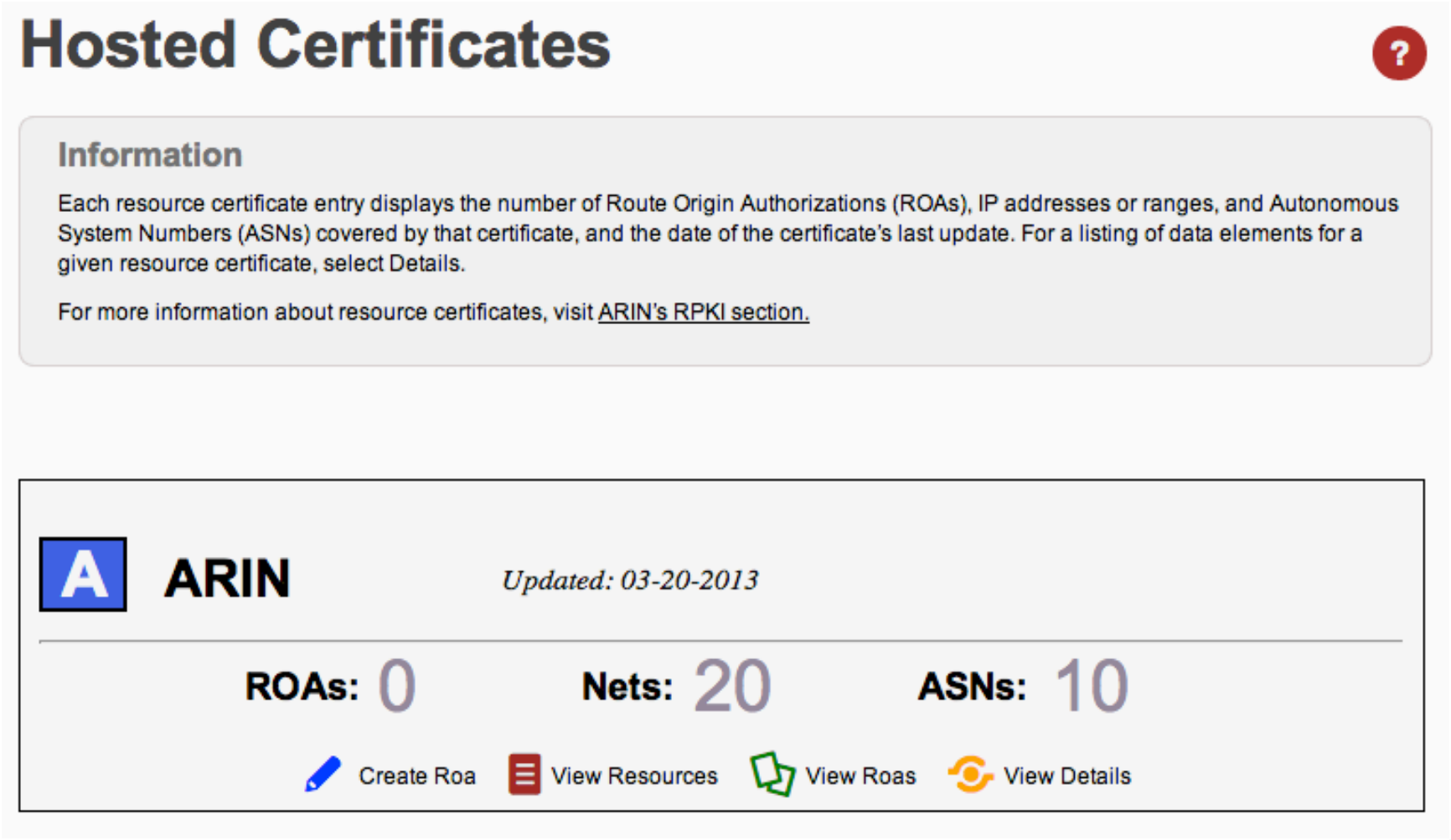
ROA Request Generation Public Key:

Learn more about the ROA Request Generation Key Pair. Or, just how to create one and extract the public key.

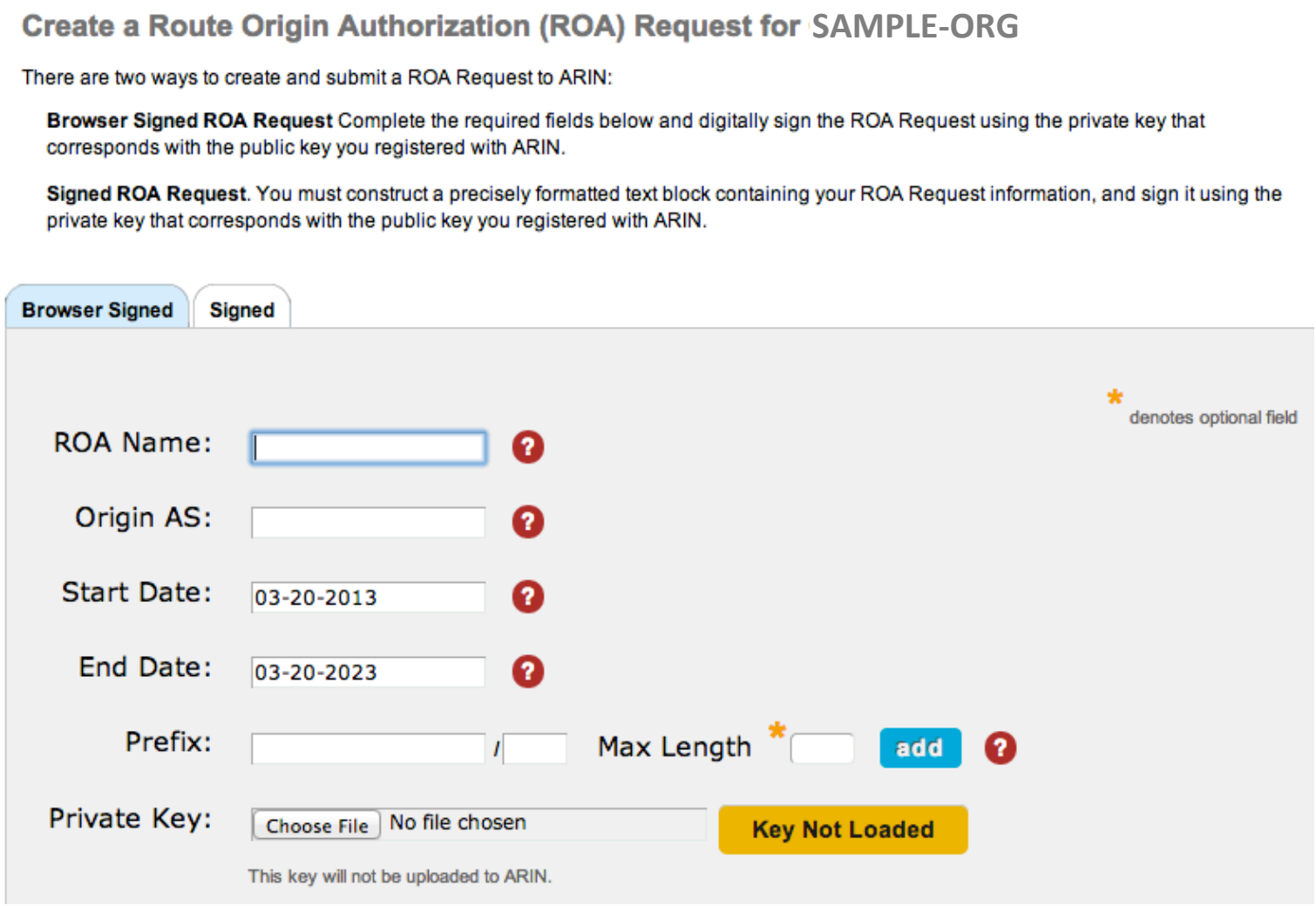
```
-----BEGIN PUBLIC KEY-----
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAvBhoSmbRQhbSpTIM2Pqn
hWcHL/6SHORJGCtuoMUS6tVamIqgdTZJw+8POFku+WIOLgUJOEw763rQVTsAq8WZ
vs6px2FNr6CJftKAr3fg/T083vHYiMtYJnJbVPKJjdSQSylyUWIeR2hYh/4LEOyK
MPr3zAuDS2QOI6778OY/kpTEsCrwzp+dM4KtLGOQbyrkfSVIHgux5pCMzsQP/8nP
son5vOIkWtkuFNmg8pXgLfEdBR6MC0Y7eKaTeYM6EEJ7rhUCY69SUq+SFmuwYFsg
7YNzRAErF9THpEWqOaOxaSu/4nwLVJ2oexksT6k4hsEWPadxJ0P3E0FHSb/YIfOS
fwIDAQAB
-----END PUBLIC KEY-----
```

Submit

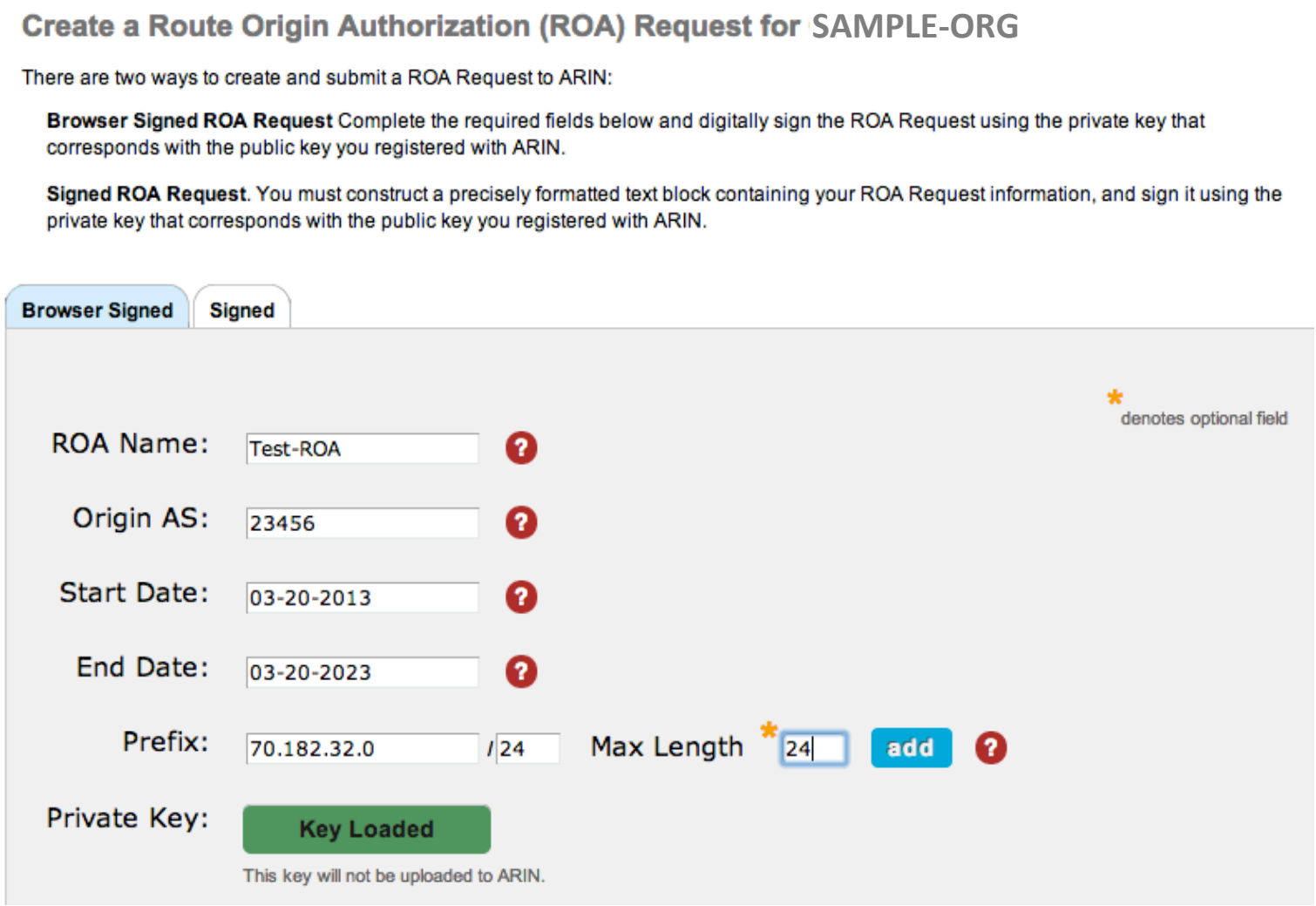
Hosted RPKI in ARIN Online



Hosted RPKI in ARIN Online



Hosted RPKI in ARIN Online



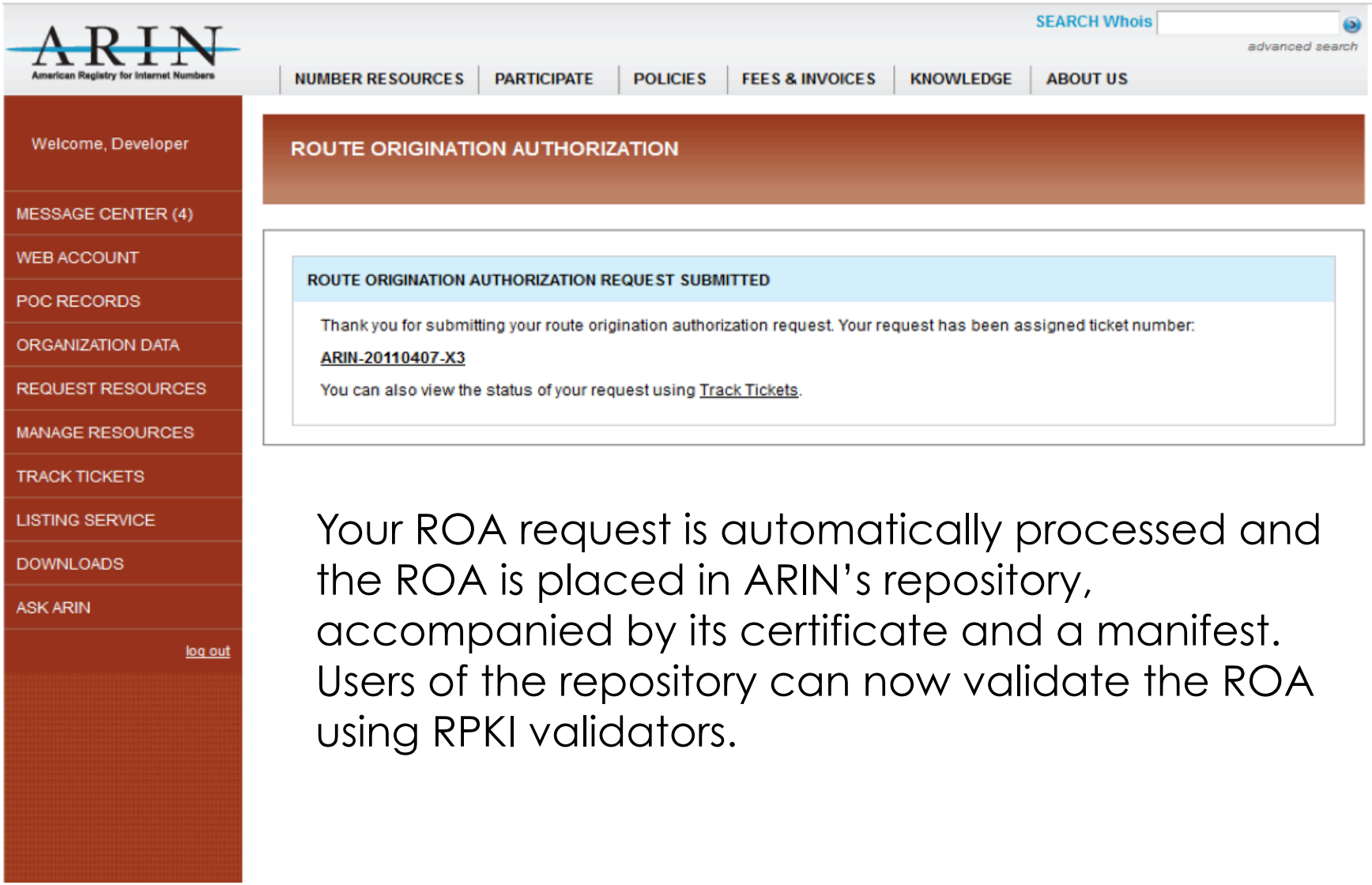
Hosted RPKI in ARIN Online

SUBMIT SIGNED ROUTE ORIGIN AUTHORIZATION

This information will not be saved until you click the **Submit** button below. Note that the signature is used by ARIN to ensure that the ROA Request was signed with your private key. Please verify that the information below is correct. Click **Submit** to send the request, or click **Back** to make changes.

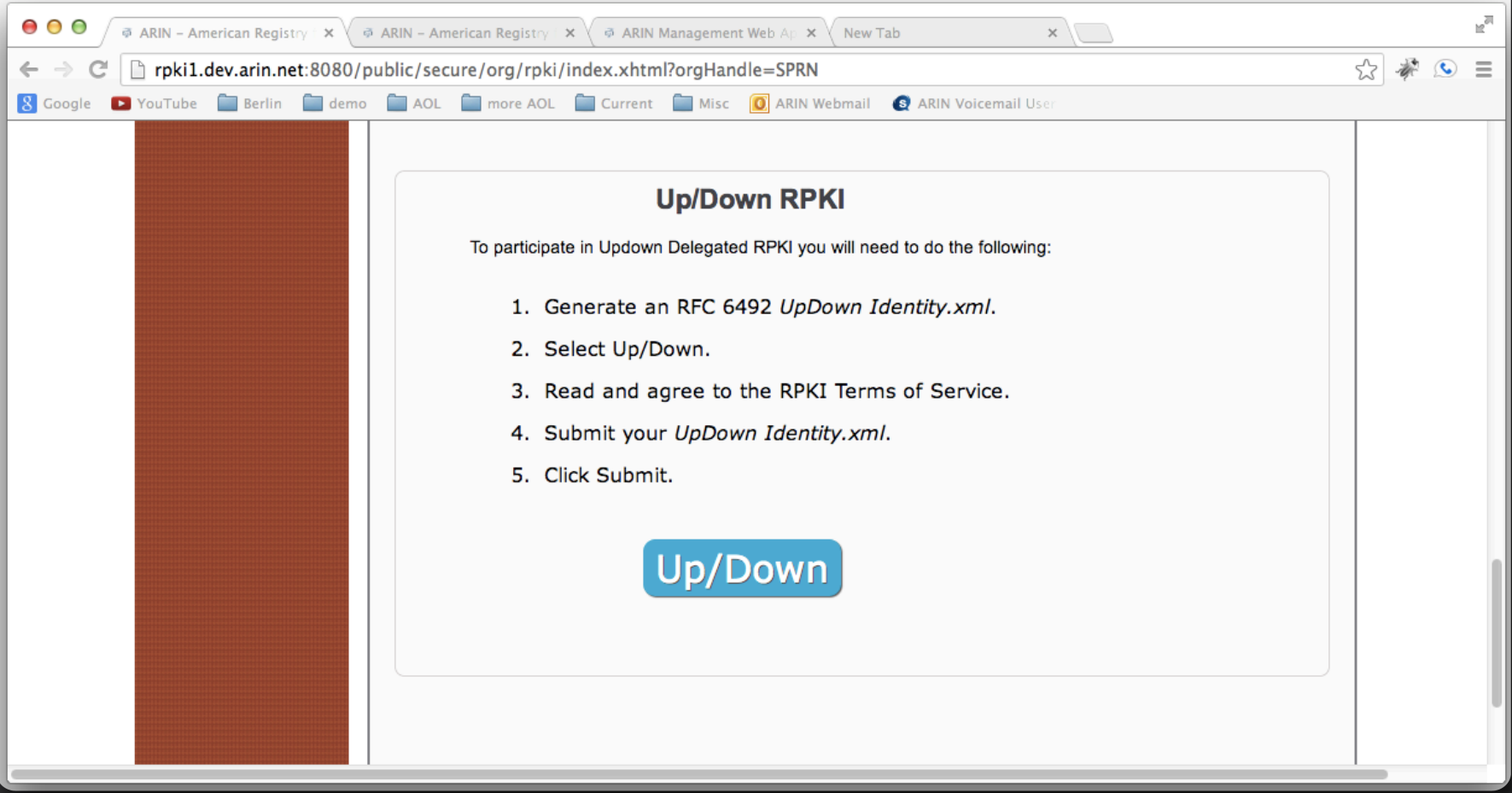
ROA Name:	**Test-ROA**
Origin AS:	**23456**
Validity Period:	**03-20-2013 to 03-20-2023**
Resources:	**70.182.32.0/24 max length 24**
Signature:	**Hjnse52POzaVFupNDGqYXZVylmr78wSd4A1XEMUpj4vVmpJWWH nKoZRupDvB2OBtwcJJEyx4KUWPgHUt8VhdCYroyuZGRxJkDtTe q8c0FT2QQdjuD+GmwUWlvtnSD26VZdYUrXM6WniTVwL96UV6sK bJGTx40GqD52tdJq6612QpC6K+Y+JEISgauVyy2htnAPI5rI1Z GY42Fb9c1CEoE8GmT/FWY+CX6UmKsxJ8LQ0NGR2XUeGKZyc2k5 gKiSCog976VnItt88/z5jOm1GkYQoQvk6uyy+yYUKreC+GyNqP YyPAvGAq61jYIDXMhDTSjWdGRiV2dNQ8zMmoDOgm9A==**

BACK | Submit Signed ROA Request

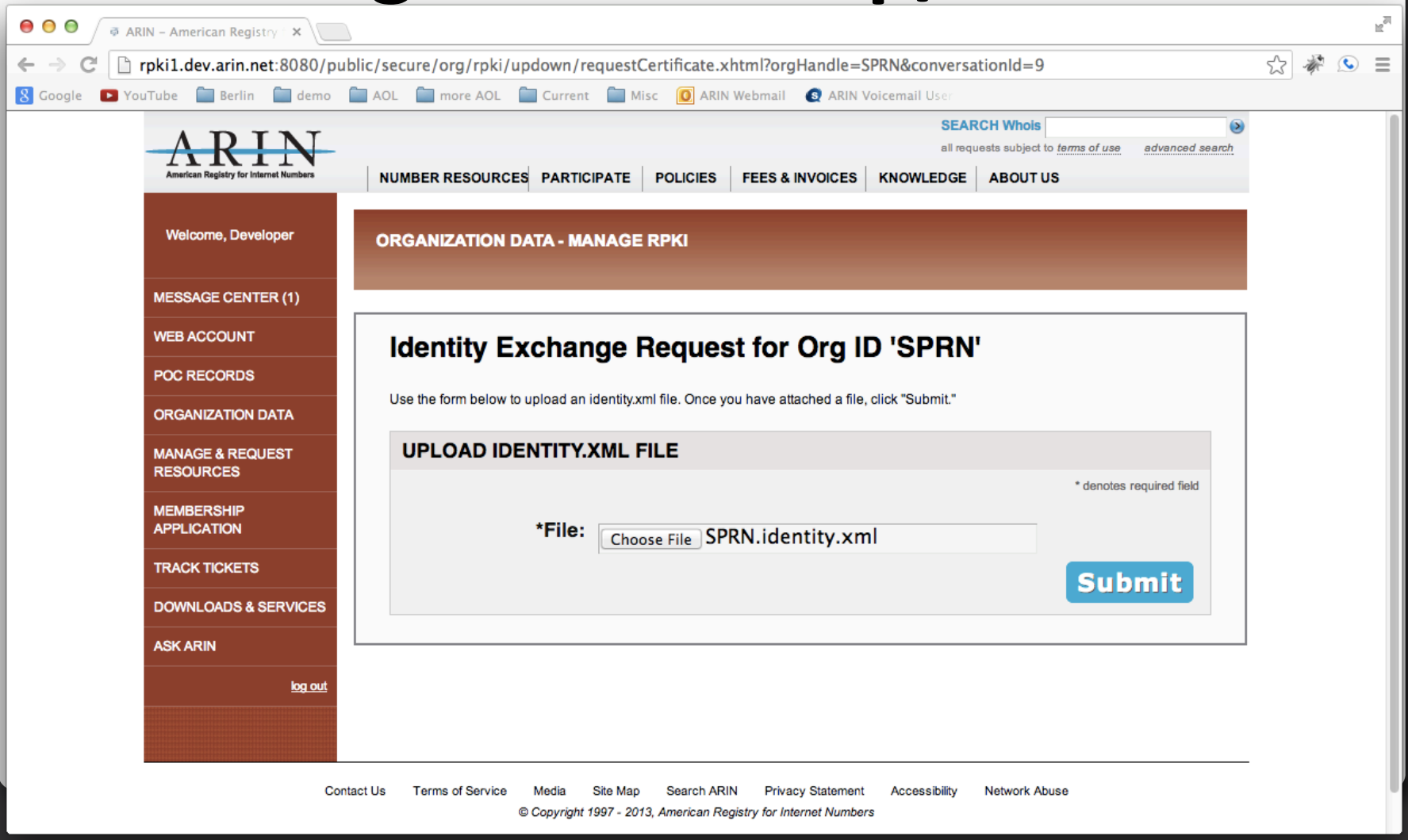


Your ROA request is automatically processed and the ROA is placed in ARIN's repository, accompanied by its certificate and a manifest. Users of the repository can now validate the ROA using RPKI validators.

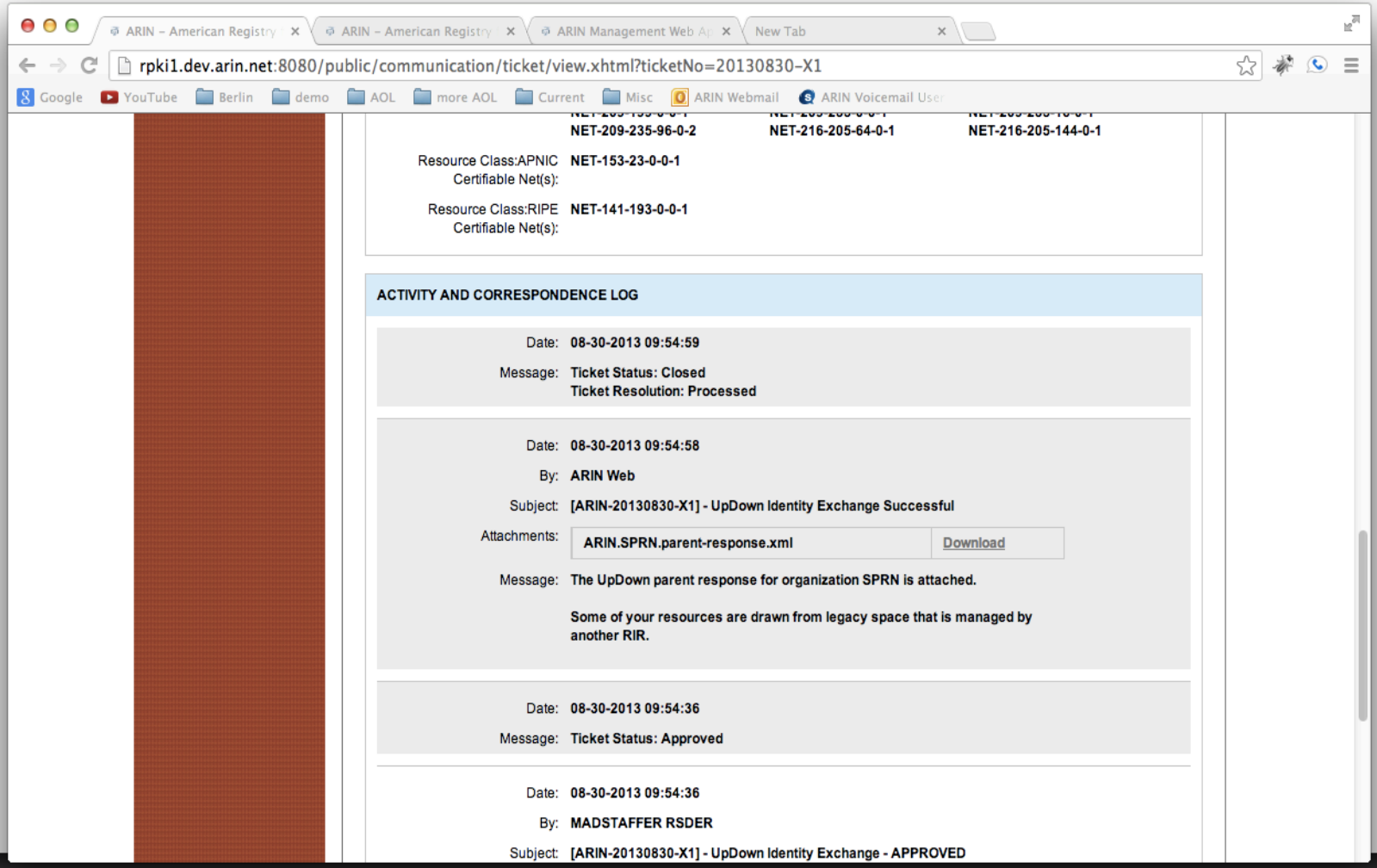
Delegated with Up/Down



Delegated with Up/Down



Delegated with Up/Down



Delegated with Up/Down

- You have to do all the ROA creation
- Need to setup a CA
- Have a highly available repository
- Create a CPS

Updates within RPKI outside of ARIN

- The four other RIRs are in production with Hosted CA services
- ARIN and APNIC have delegated working for the public
- Major routing vendor support being tested
- Announcement of public domain routing code support

ARIN Status

- Hosted CA deployed 15 Sept 2012
- Web Delegated CA deployed 16 Feb 2013
- Delegated using “Up/Down” protocol deployed 7 Sept 2013

Why is this important?

- Provides more credibility to identify resource holders
- Leads to better routing security

Q&A