



Internet Initiative Japan

An Operational ISP & RIR PKI

AfriNIC / Nairobi

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<<http://psg.com/~randy/060516.afrinic-pki.pdf>>

Quicksand

- 'Unknown' quality of whois data
- 'Unknown' quality of IRR data
- No formal means of verifying if a new customer legitimately holds IP space X
- No formal means of verifying routing announcements

We Need To

- Verify that a customer has been allocated a resource they are asking an ISP or upstream to announce (manual)
- Verify the origin of announcements when debugging (manual)
- Verify IRR data when generating route filters (programmatic)
- Allow routers to formally verify BGP announcements as to origin and path

Routing Security Gap

- The big gap is the PKI -
certificate structure
 - Creating
 - Storing
 - Moving, and
 - Validating

Public Key Infrastructure

PKI DataBase

RIR Identity Certs
ISP Identity Certs
Site Identity Certs
IP Resource Certs
ASN Resource Certs
Rights to Route

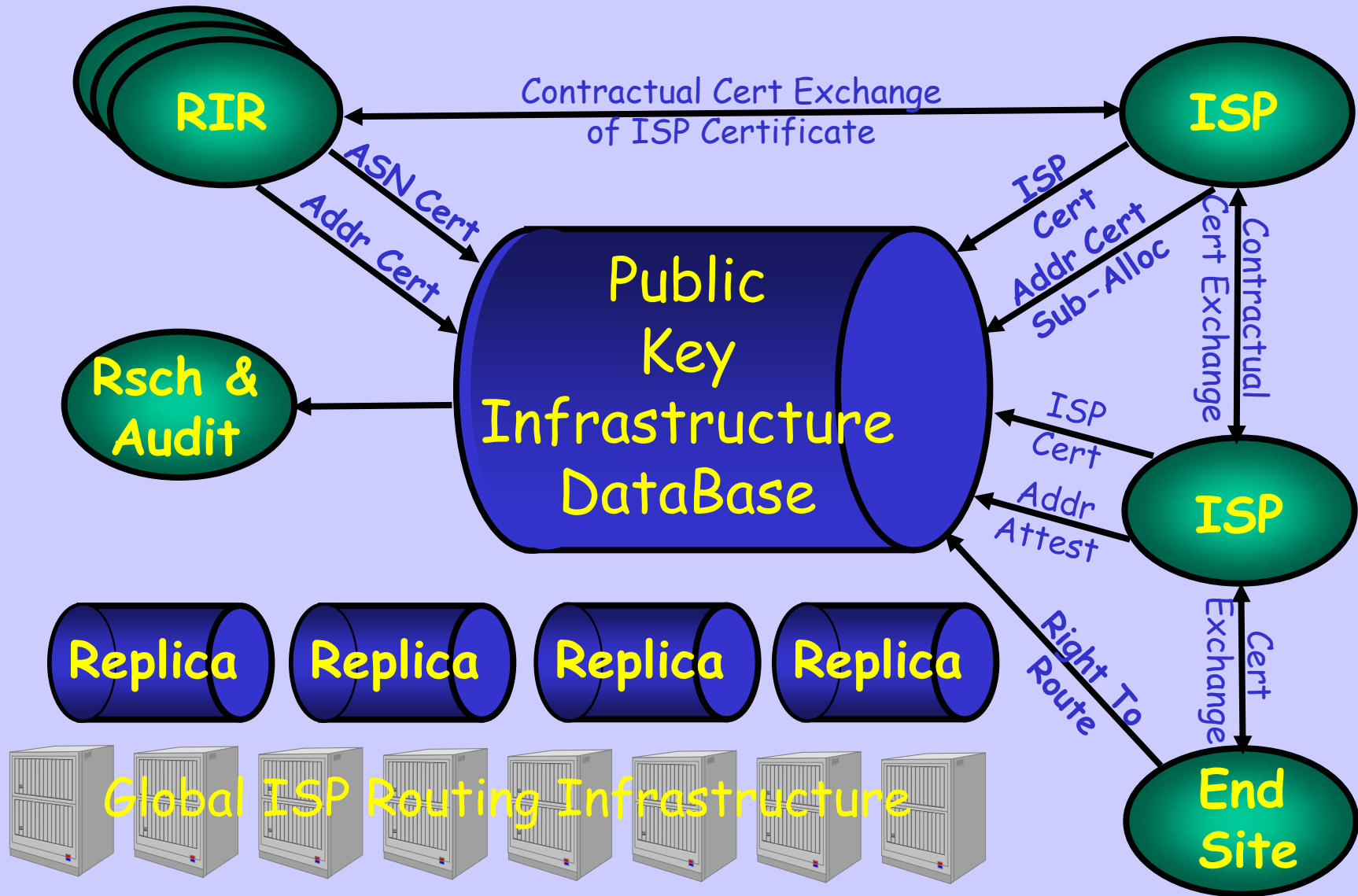
Application Range

- Handle both resource ownership
 - ASNs and IP space
- And certified transactions with RIR:
 - Allocation
 - Billing
 - DNS delegation

Operate Across RIRs

- With different kinds of IP/ASN allocations
 - Normal
 - Experimental
 - Legacy, ...
- And resources received from multiple RIRs

PKI Interfaces/Users



IP and AS Certificates

- Specifies identity == {name,public key} of recipient
- Specifies block to be delegated
- Signed by allocator's private key
- Follows allocation hierarchy
 - RIR to ISP
 - ISP to downstream ISP or end user enterprise

IP Delegation Chain

- RIR allocates to ISP
S.rir (192.168/16, *isp*)
- ISP allocates to Downstream
S.isp (192.168.128/17, *dstr*)
- Downstream allocates to User
S.dstr (192.168.142/24, *user*)
- Anyone can verify it all, because the public keys *rir*, *isp*, *dstr*, and *user* are in the public PKI

ISP / End-Site Certs

- RIRs generate identity certs for members
- Need only be reproducible, they are not formal identities, because are only used
 - In business transactions where they are exchanged and managed by contract, or
 - To create IP or ASN certs
- May be based on 'external', e.g. Thawte certs, used to generate an identity cert within the RIR PKI
- ISPs may use an ARIN identity for an APNIC allocation or business transaction

RIR Identity

- RIR identities are the root trust anchors for the system
- They can get their certificates from the NRO, IANA
- They can buy outside, or generate a self-signed cert, or ..., but
- The hard issues are key rollover, revocation, ...

Underlying Certificate PKI Architecture

- Allows one open implementation to be used by all
- Yet allows each RIR to have its own business processes and user front end
- And allows ISPs and end sites to build their own processes on top of the base tool-set

RIR Intrnl
Data

Web Prog Web Prog Web CLI

ISP
Tool Sets

RIR
Tool Set

User /
Query
Tools

PKI
API

Public Key Infrastructure
DataBase Management
Toolkit

Distributed PKI Store

PKI Management API

- Trans-RIR API for dealing with distributed repository
- Describes interfaces and transactions for creating, publishing, validating, ... certificates etc.
- The PKI is self-authenticating because it is just a bundle of certs
- So no need for transport security!

Tools for RIRs

- Create root ASN and IP space certificates
- Issue IP and ASN allocations to ISPs and End Sites
- Generate and lodge ISP certs
- Manage their own cert sets

Tools for ISPs

- Acquire identity certs from RIRs
- Generate IP and ASN requests to RIRs and Upstreams
- Generate certs for downstream ISPs and End-User sites
- Generate and manage role certs
- Validate resource certificates

State of Play

- APNIC has a trial implementation
- APNIC and friends have converged on multi-RIR and ISP/user-viewpoint requirements
- APNIC & RIPE finalizing the first API model, essentially a C/perl interface
- The sub-API work has started
- The result will be open source
- Soon, RIRs and LIRs can code above

BGP Routing Security

- Over 3-10 years, PKI system provides the basis for verifiable BGP routing
- S-BGP, or SOBGP, or ...
- But I am biased toward S-BGP
 - Is congruent with BGP, no weird baggage
 - Does not require publication of my policy
 - Does not rely on more external data

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