APRICOT
BALI 2007

Progress Report on Resource Certification

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APNIC

Objective

- To create a robust framework that allows validation of assertions relating to IP addresses and ASNs and their use

and

- To make it easier for anyone to see if someone is lying about actual control over addresses and/or routing!

Uses

- Signing of IRR entries

  “Yes, I am the right-of-use holder and that’s *precisely* the information I entered into the IRR.”

- Signing of Routing Origination

  “Yes, I am the right-of-use holder for this address prefix and I am permitting ASx to originate a route to this address prefix.”

- Signing of Route Requests

  “Please route address prefix a.b.c.d/x through customer interface xxx.”

Resources for this work

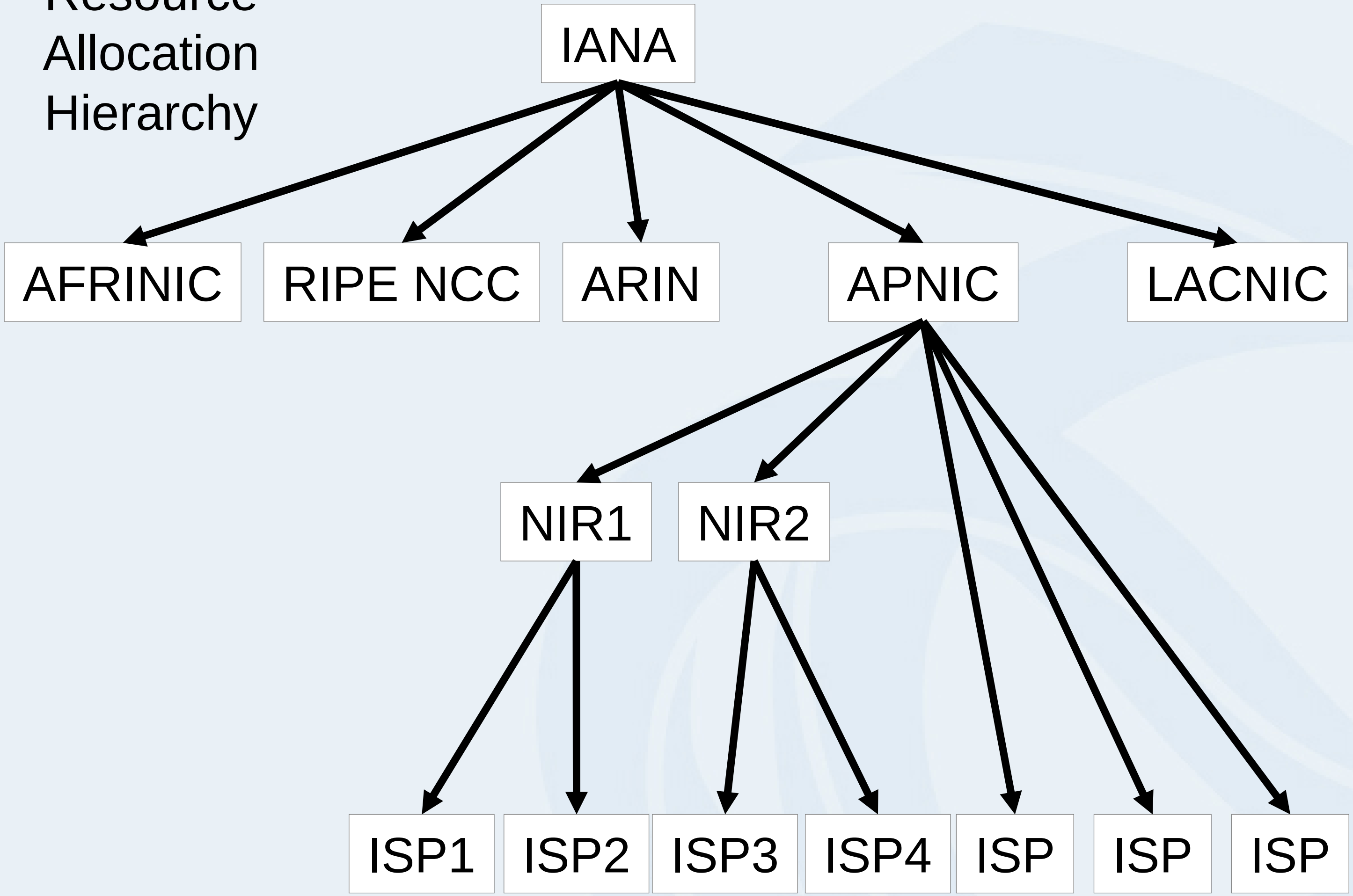
- APNIC's allocation database
- Public / Private key technology
- X.509 v3 certificate technology
- IP resource extensions to X.509 v3 certificates
- PKI models and trust relationships

The Overall Objective

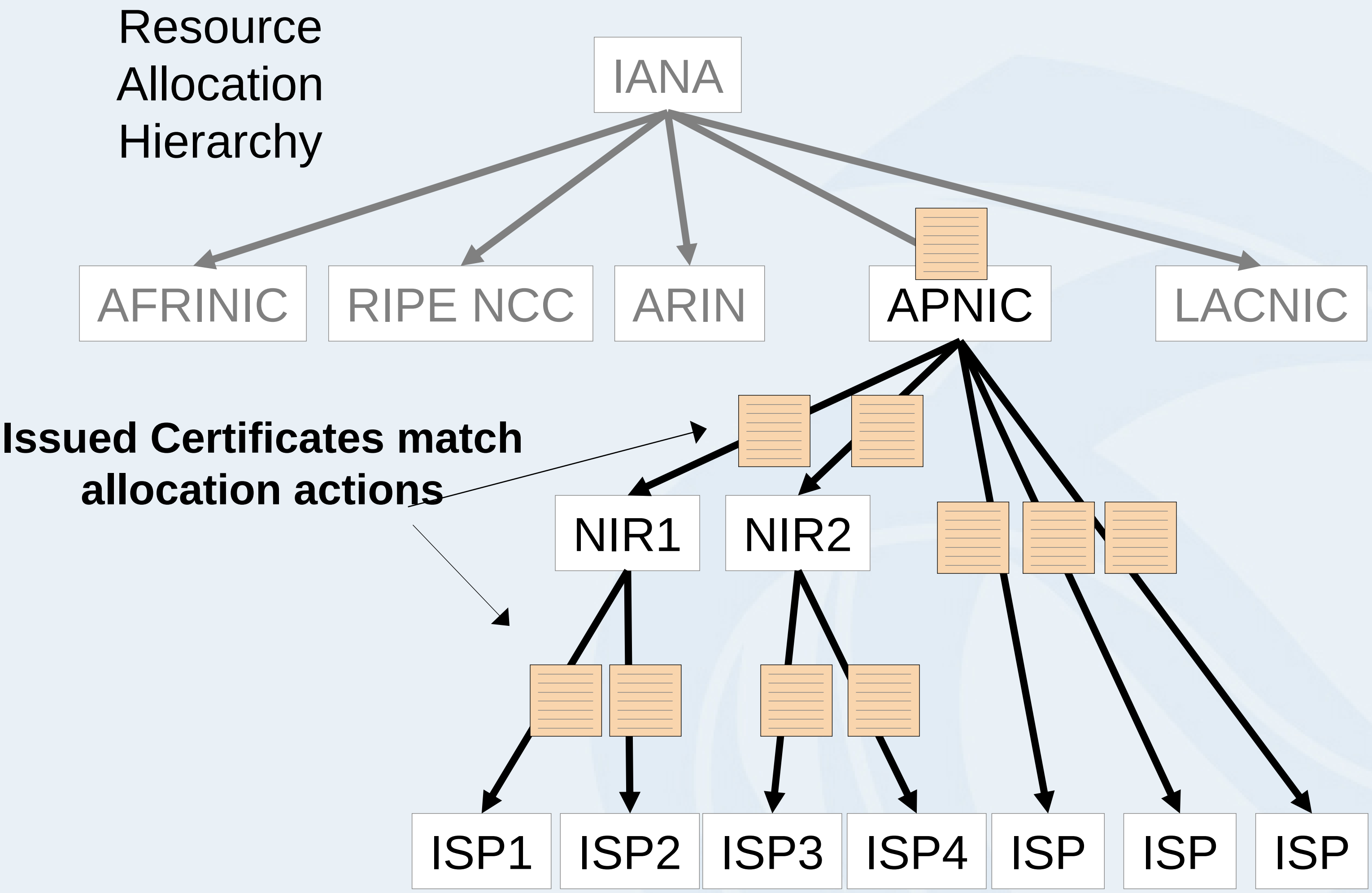
- To support a PKI that mirrors the existing resource allocation state
  - Every resource allocation can be attested by a matching certificate that binds the allocated resource with the resource issuer and recipient
- To use these resource certificates to make signed assertions that can be validated through this PKI

Resource Certificates

Resource Allocation Hierarchy

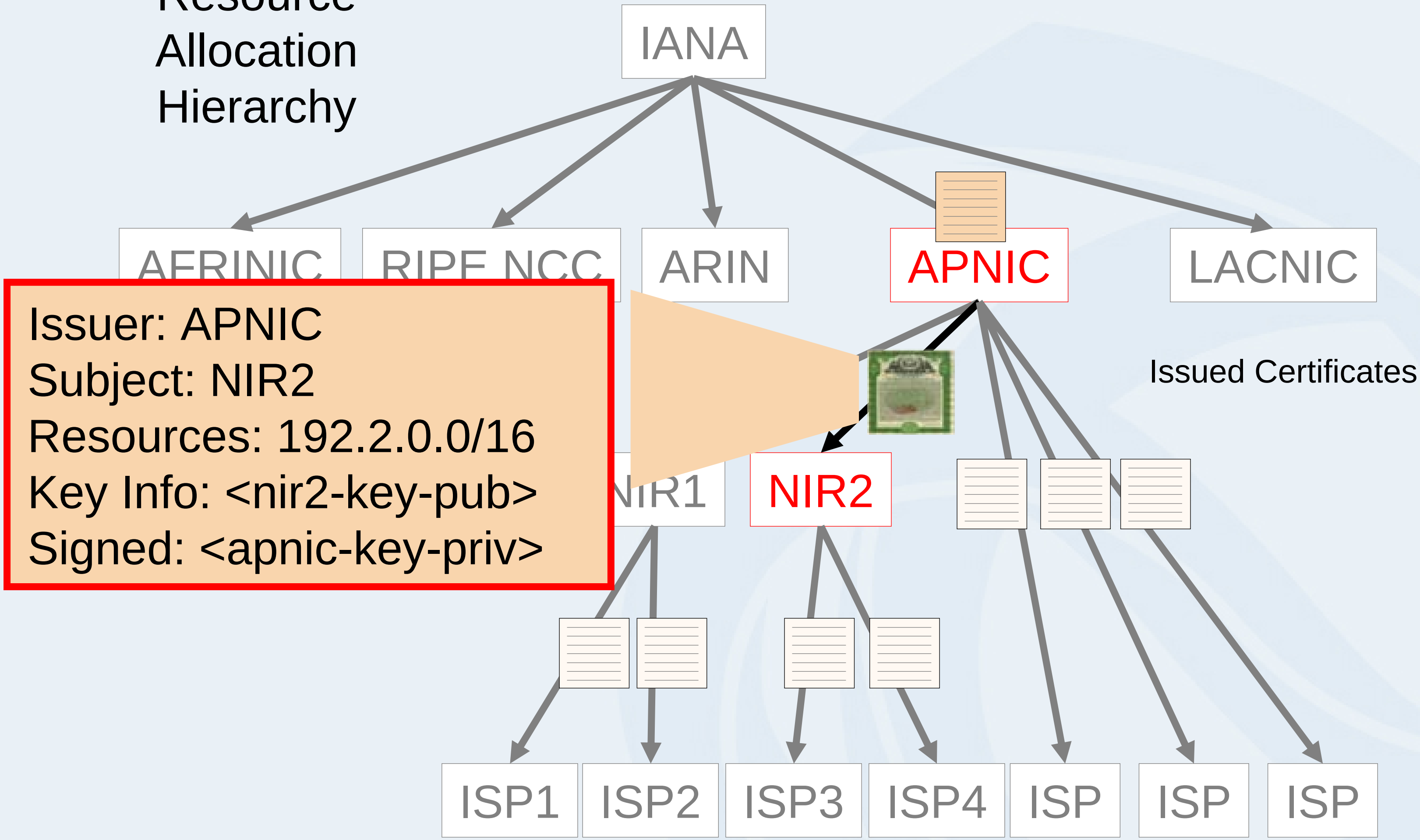


Resource Certificates



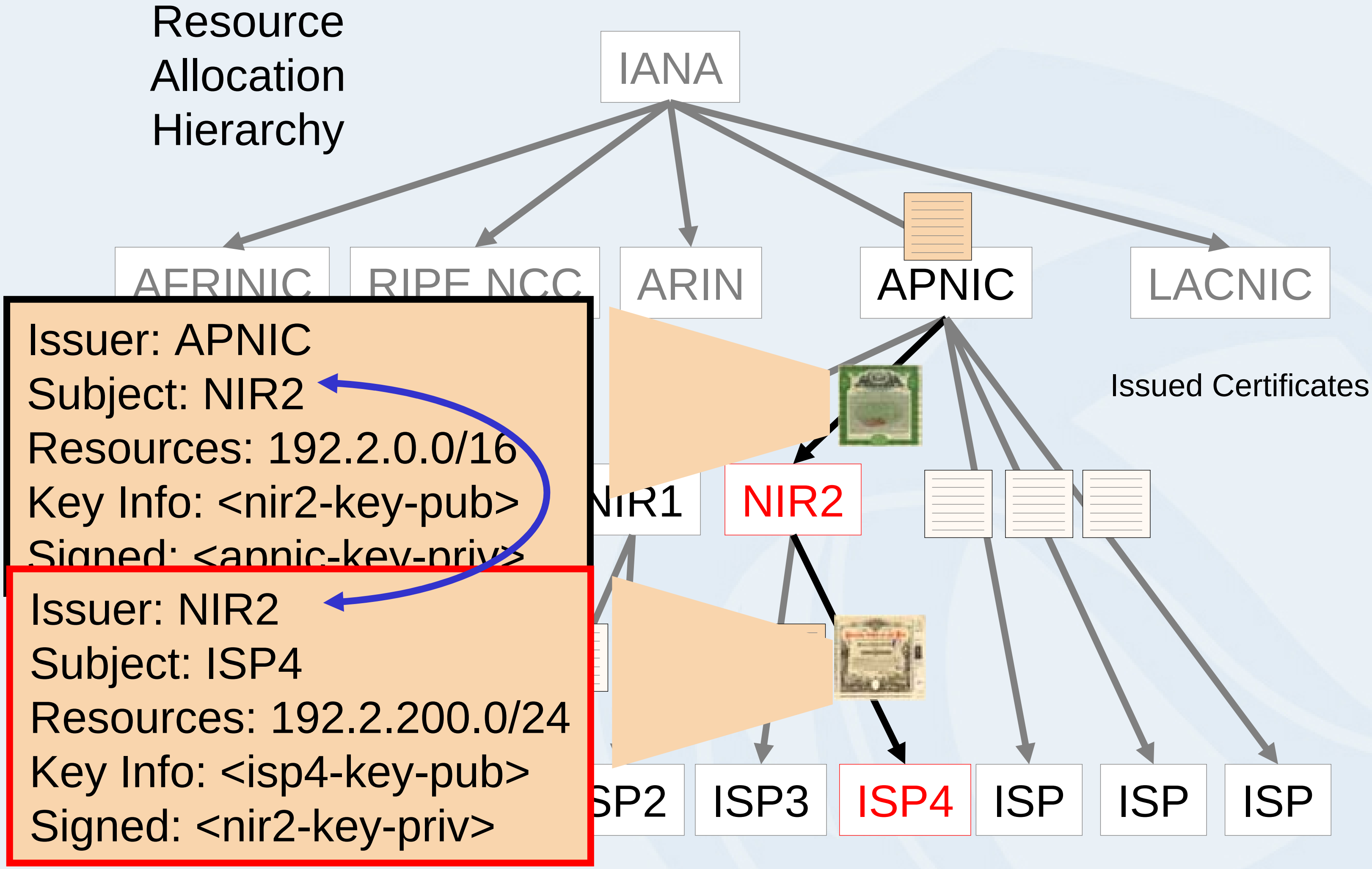
Resource Certificates

Resource
Allocation
Hierarchy



Issuer: APNIC
Subject: NIR2
Resources: 192.2.0.0/16
Key Info: <nir2-key-pub>
Signed: <apnic-key-priv>

Resource Certificates

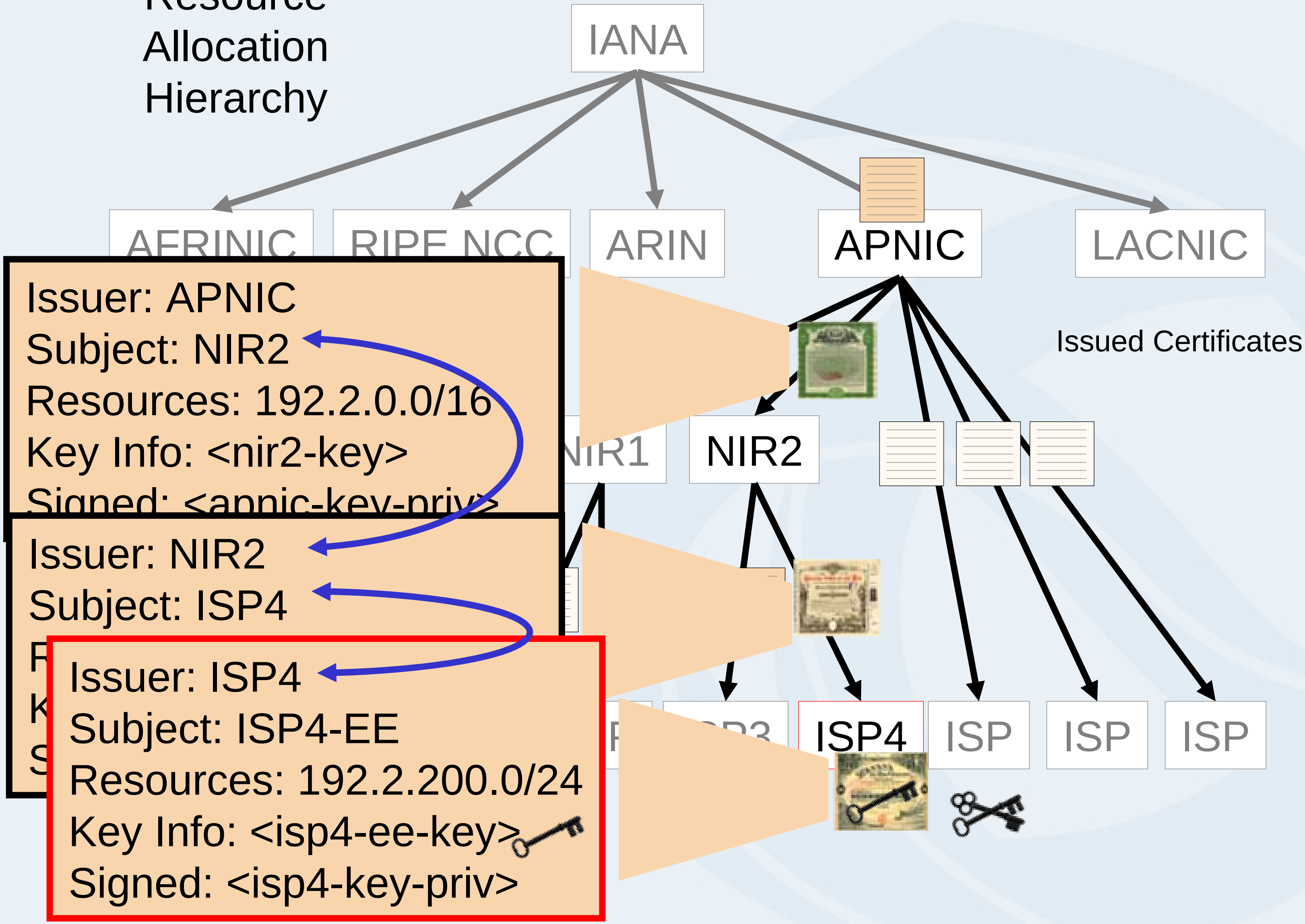


Issuer: APNIC
Subject: NIR2
Resources: 192.2.0.0/16
Key Info: <nir2-key-pub>
Signed: <apnic-key-priv>

Issuer: NIR2
Subject: ISP4
Resources: 192.2.200.0/24
Key Info: <isp4-key-pub>
Signed: <nir2-key-priv>

Resource Certificates

Resource
Allocation
Hierarchy

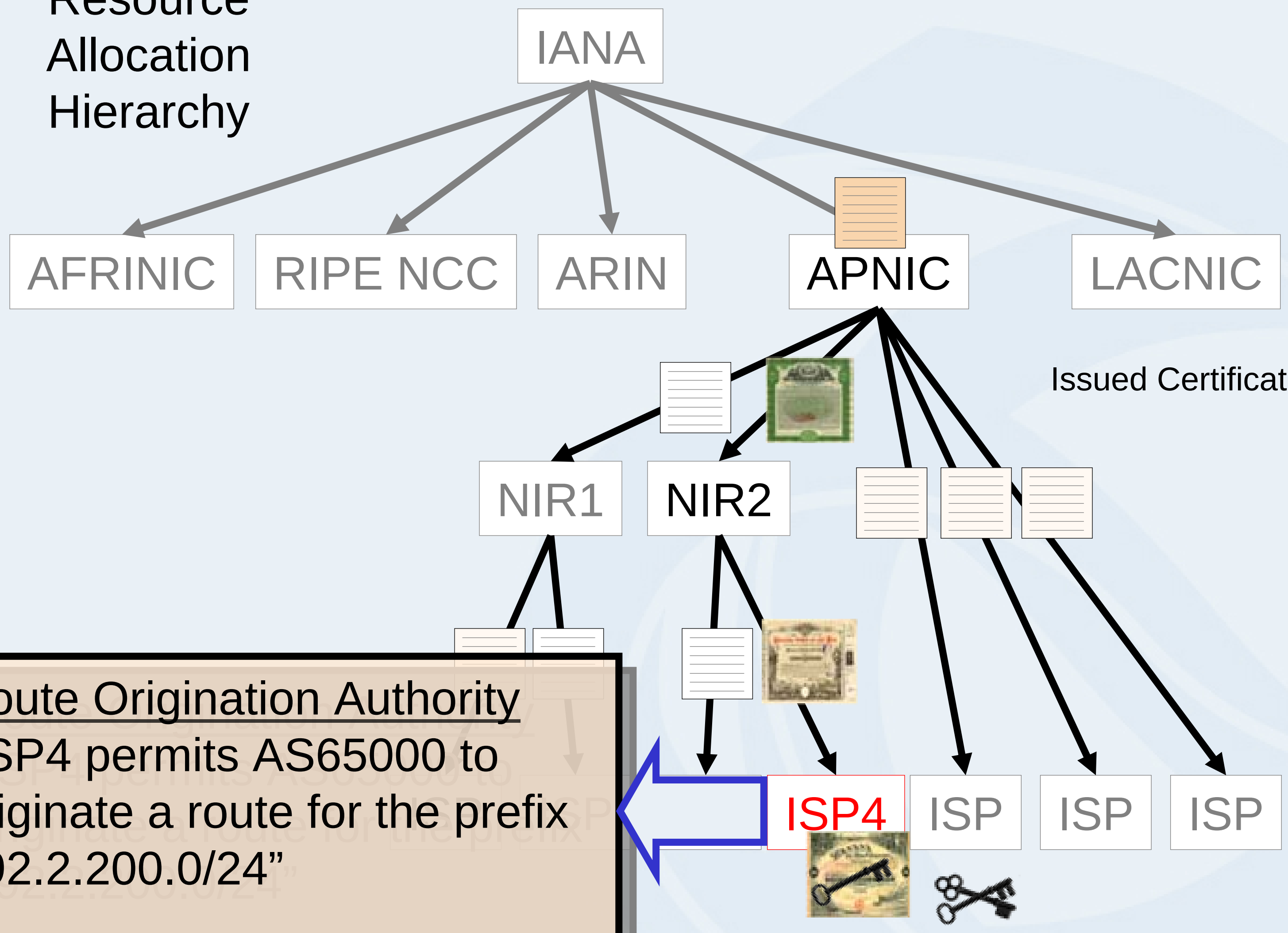


Issuer: APNIC
Subject: NIR2
Resources: 192.2.0.0/16
Key Info: <nir2-key>
Signed: <apnic-key-priv>

Issuer: NIR2
Subject: ISP4
R
K
S

Issuer: ISP4
Subject: ISP4-EE
Resources: 192.2.200.0/24
Key Info: <isp4-ee-key>
Signed: <isp4-key-priv>

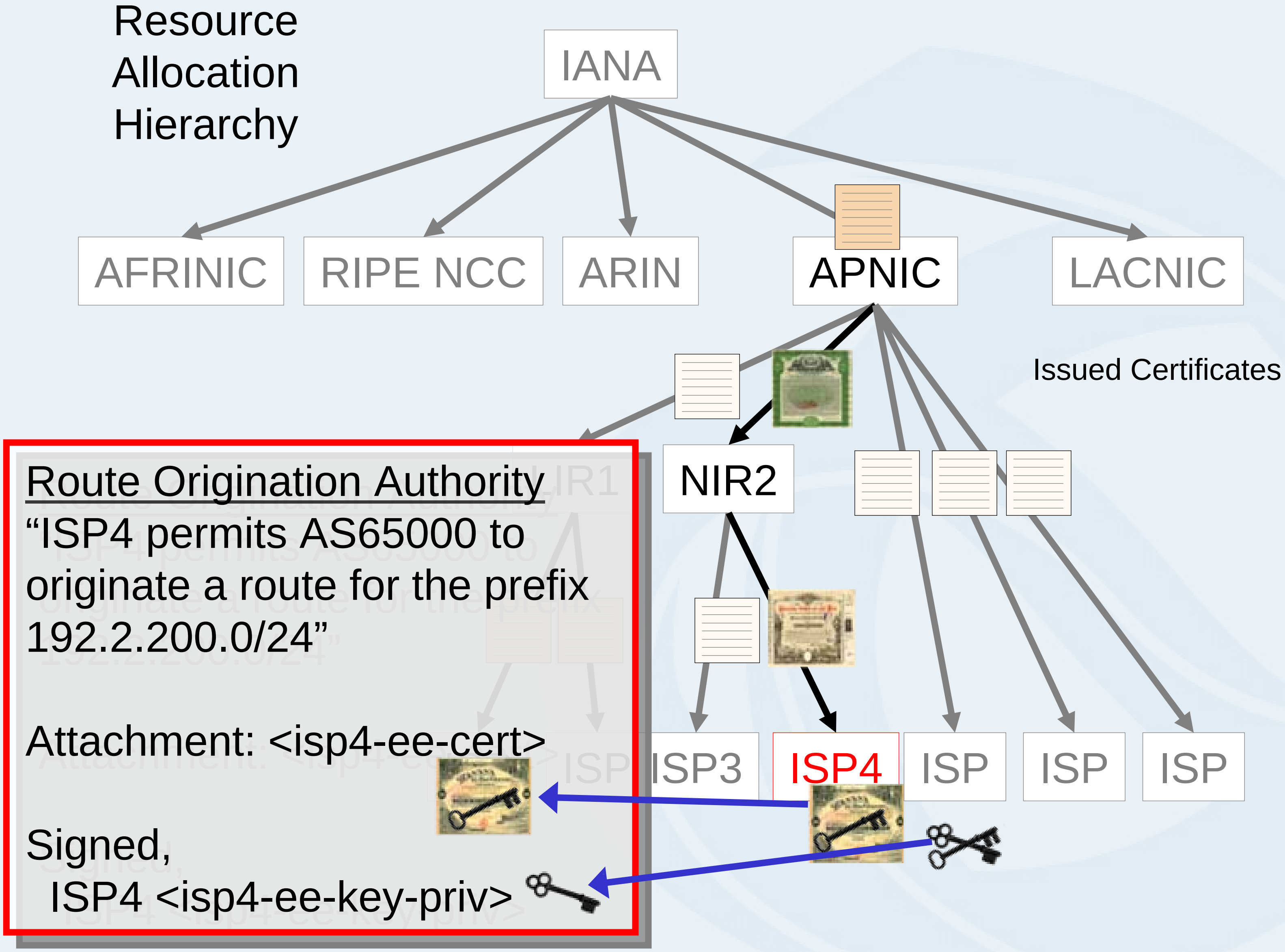
Use: Routing Authority



Route Origination Authority

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

Signed Objects



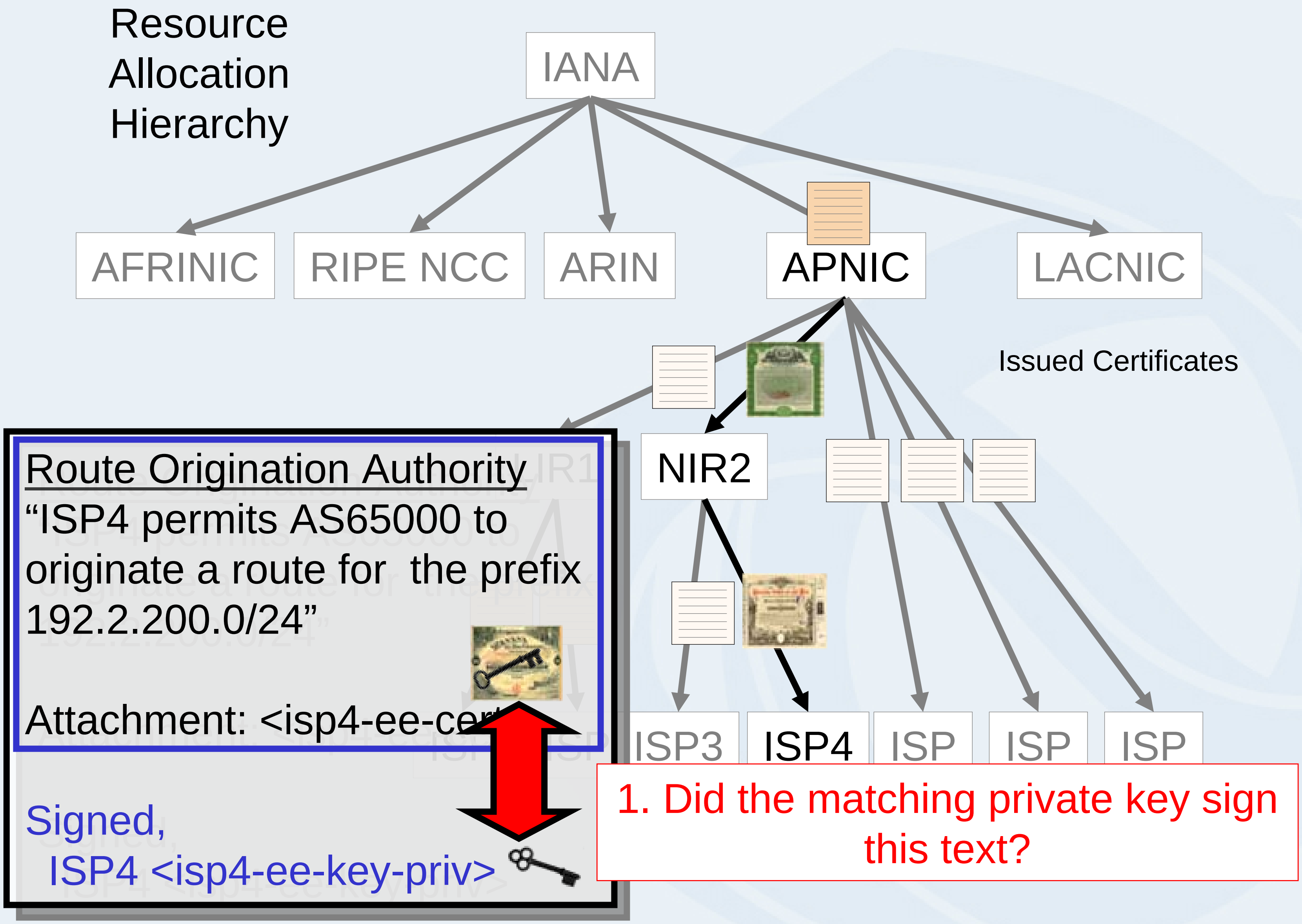
Route Origination Authority

"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>

Signed Object Validation



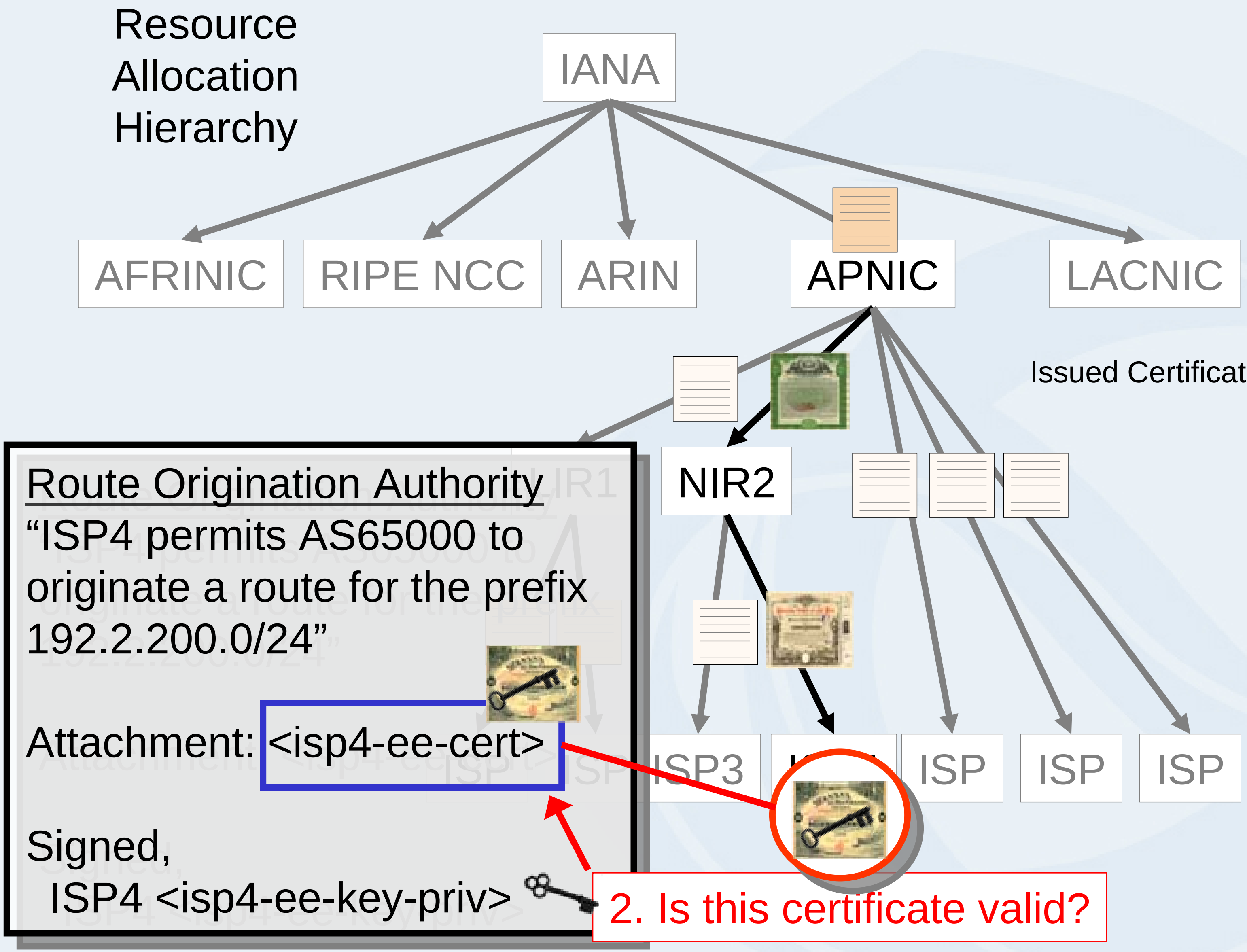
Route Origination Authority
"ISP4 permits AS65000 to originate a route for the prefix 192.2.200.0/24"

Attachment: <isp4-ee-cert>

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

1. Did the matching private key sign this text?

Signed Object Validation



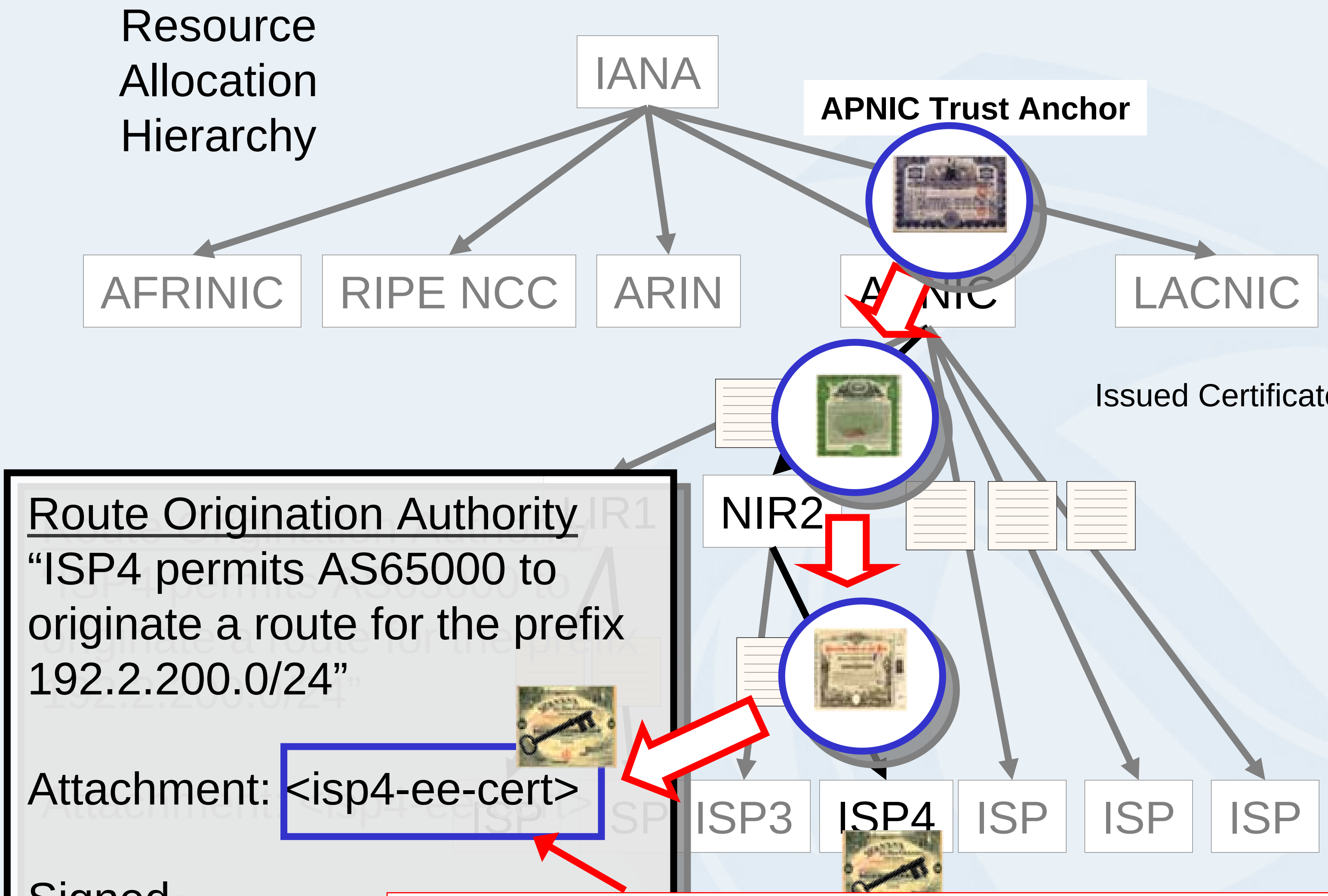
Route Origination Authority
“ISP4 permits AS65000 to originate a route for the prefix 192.2.200.0/24”

Attachment: <isp4-ee-cert>

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

2. Is this certificate valid?

Signed Object Validation



Route Origination Authority

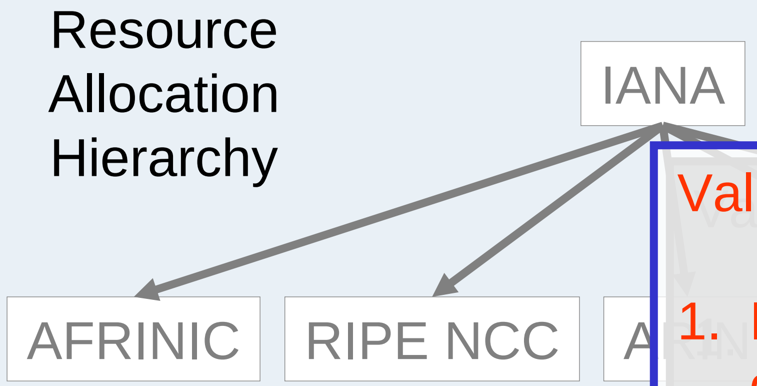
"ISP4 permits AS65000 to originate a route for the prefix 192.2.200.0/24"

Attachment: <isp4-ee-cert>

Signed,
ISP4 <isp4-ee-k

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

Signed Object Validation



<u>Route Origination Authority</u>
"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>

Validation Outcomes

1. ISP4 authorized this Authority document
2. 192.2.200.0/24 is a **valid** address, derived from an APNIC allocation
3. ISP4 holds a current right-of-use of 192.2 200.0/24
4. A route object, where AS65000 originates an advertisement for the address prefix 192.2.200.0/24, has the explicit authority of ISP4, who is the current holder of this address prefix

Example of a Signed Object

```
netnum-set: RS-TELSTRA-AU-EX1
descr:      Example routes for customer with space under apnic
members:    58.160.1.0-58.160.16.255,203.34.33.0/24
tech-c:     GM85-AP
admin-c:    GM85-AP
notify:     test@telstra.net
mnt-by:     MAINT-AU-TELSTRA-AP
sigcert:    rsync://repository.apnic.net/TELSTRA-AU-IANA/cbh3Sk-iwj8Yd8uqaB5
            Ck010p5Q/Hc4yxwhTamNXW-cDWtQcmvOVGjU.cer
sigblk:     -----BEGIN PKCS7-----
            MIIBdQYJKoZIhvcNAQcCoIIBZjCCAWICAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3
            DQEHATGCAUEwggE9AgEBMBowFTETMBEGA1UEAxMKdGVsc3RyYS1hdQIBATAJBgUr
            DgMCGgUAMA0GCSqGSIb3DQEBAQUABIIBAEZGI2dAG3lAAGi+mAK/S5bsNrgEHOmN
            1leJF9aqM+jVO+tiCvRHyPMeBMiP6yoCm2h5RCR/avP40U4CC3QMhU98tw2Bq0TY
            HZvqXfAOVhjD4Apx4KjiAyr8tfeC7ZDhO+fpvsydV2XXtHIvjwjcL4GvM/gES6dJ
            KJYFWWlrPqQnfTFMm5oLWBUhNjuX2E89qyQf2YZVizITTNg3ly1nwqBoAqmmDhDy
            +nsRVAxax7II2iQDTr/pjI2VWfe4R36gbT8oxyvJ9xz7I9IKpB8RTvPVO2I2HbMI
            1SvRXMx5nQOXyYG3Pcxo/PAhbBkVkgfudLki/IzB3j+4M8KemrnVMRo=
            -----END PKCS7-----
changed:    test@telstra.net 20060822
source:     APNIC
```

Signer’s Resource Certificate

```
Version:   3
Serial:    1
Issuer:    CN=telstra-au
Validity:  Not Before: Fri Aug 18 04:46:18 2006 GMT
Validity:  Not After:  Sat Aug 18 04:46:18 2007 GMT
Subject:   CN=An example sub-space from Telstra IANA, E=apnic-ca@apnic.net
Subject Key Identifier g(SKI): Hc4yxwhTamNXW-cDWtQcmvOVGjU
Subject Info Access: caRepository –
           rsync://repository.apnic.net/TELSTRA-AU-IANA/cbh3Sk-iwj8Yd8uqaB5
           Ck010p5Q/Hc4yxwhTamNXW-cDWtQcmvOVGjU
Key Usage: DigitalSignature, nonRepudiation
CRL Distribution Points:
           rsync://repository.apnic.net/TELSTRA-AU-IANA/cbh3Sk-iwj8Yd8uqaB5
           Ck010p5Q.crl
Authority Info Access: caIssuers –
           rsync://repository.apnic.net/TELSTRA-AU-IANA/cbh3Sk-iwj8Yd8uqaB5
           Ck010p5Q.cer
Authority Key Identifier:
           Key Identifier g(AKI): cbh3Sk-iwj8Yd8uqaB5Ck010p5Q
Certificate Policies: 1.3.6.1.5.5.7.14.2
IPv4:       58.160.1.0-58.160.16.255, 203.34.33.0/24
```

Trial Activity Status

- ✓ Specification of X.509 Resource Certificates
- ✓ Generation of resource certificate repositories aligned with existing resource allocations and assignments
- ✓ Tools for Registration Authority / Certificate Authority interaction (undertaken by RIPE NCC)
- ✓ Tools to perform validation of resource certificatesExtensions to OpenSSL for Resource Certificates (open source development activity, supported by ARIN)

Current Activities

- ✸ Tools for resource collection management, object signing and signed object validation (APNIC, and also open source development activity, supported by ARIN)
- ✸ LIR / ISP Tools for certificate management
- ✸ Testing, Testing, Testing
- ✸ Operational service profile specification

Working notes and related material we've been working on in this trial activity:

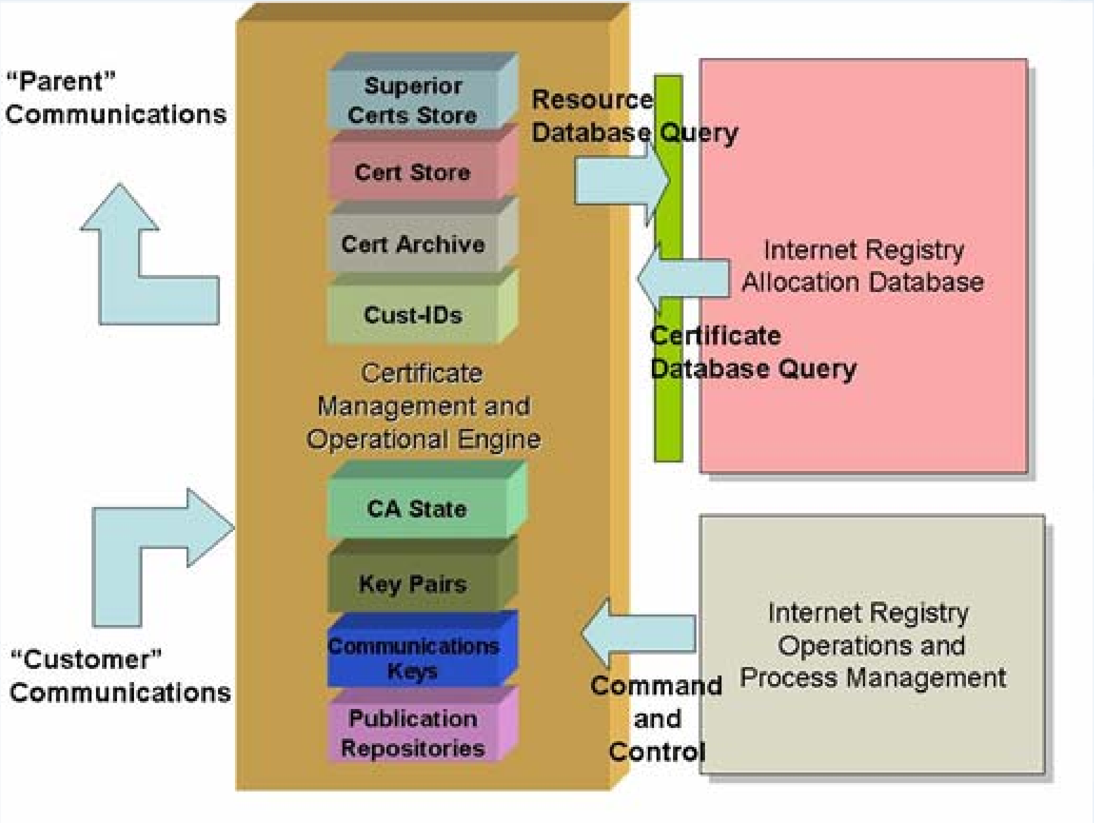
http://mirin.apnic.net/resourcecerts

Focus points for Q1 2007

- Can we design the certificate management subsystem to be an largely automated “slave” of the resource allocation function?
- Provide a toolset to allow IRs to manage certificate issuance
- Use the same toolset to provide “hosted” certificate services

Focus points for Q1 2007

- Defining the components and interactions of a “certificate engine”


“Parent” Communications
Superior Certs Store
Cert Store
Cert Archive
Cust-IDs
Certificate Management and Operational Engine
CA State
Key Pairs
Communications Keys
Publication Repositories
“Customer” Communications
Resource Database Query
Internet Registry Allocation Database
Certificate Database Query
Internet Registry Operations and Process Management
Command and Control

Focus points for Q1 2007

- Automated certificate issuance
  - Query / Response interaction between registry and registry clients:
    - **List**: What resources have been allocated to me and what’s the corresponding state of issued certificates?
    - **Issue**: Here is a certificate request – please issue me with a certificate that matches my allocated resource set
    - **Remove**: Please revoke certificates issued with this public key

Next Steps

- Development of the Certificate Engine
- End Entity Certificates
- Tools for Relying Parties
- Evaluation of Progress

Thank You

http://mirin.apnic.net/resourcecerts

Questions?