Progress Report on APNIC Trial of Certification of IP Addresses and ASes

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Geoff Huston
Motivation: Address and Routing Security

What we have today is a relatively insecure system that is highly vulnerable to various forms of deliberate disruption and subversion.

And it appears that bogon filters and routing policy databases are not, in and of themselves, entirely robust forms of defence against these vulnerabilities.
Motivation: Address and Routing Security

The (very) basic routing security questions that need to be answered are:

- Is this a valid address prefix?
- Who injected this address prefix into the network?
- Did they have the necessary credentials to inject this address prefix?

Can these questions be answered reliably, quickly and cheaply?
What would be good …

To be able to use a public infrastructure to validate assertions about addresses and their use:

– Allow third parties to authenticate that an address or routing assertion was made by the holder of the address resource

– Confirm that the asserted information is complete and unaltered from the original

– Convey routing authorities from the resource holder to a nominated party that cannot be altered or forged
General Approach

- Use existing technologies as much as possible
- Leverage on existing open source software tools and deployed systems
- Develop open source solutions
- Contribute to open standards

- Use X.509 Public Key Certificates with IP address extensions, with OpenSSL as the tool foundation
Resource Public Key Certificates

The certificate’s Issuer certifies that:

- the certificate’s Subject
  
  *whose public key is contained in the certificate*

  is the current controller of a collection of IP address and AS resources

  *that are listed in the certificate’s resource extension*

- The certificate issuer is NOT certifying here the identity of the subject, nor their good (or evil) intentions!

- This is a simple mechanism of using certificates as a means of validation of a “right-of-use” of a resource collection
What could you do with Resource Certificates?

• Sign routing authorities, routing requests, or WHOIS objects or IR objects with your private key
  – The recipient (relying party) can authenticate the signed object, and then validate this signature against the matching certificate’s public key, and can validate the certificate in the context of the Resource PKI

• Issue signed subordinate resource certificates for any sub-allocations of resources, such as may be seen in a LIR context

• Validate signed objects
  
  Authentication: Did the resource holder really produce this document or object?

  Authenticity: Is the document or object in exactly the same state as it was when originally signed?

  Validity: Is the document valid today?
Potential Use Scenario

Service interface via APNIC web portal:
  - Generate and Sign routing-related objects
  - Validate signed objects against the PKI
  - Manage subordinate certificate issuance

Local Tools – LIR Use
  - Local repository management
  - Resource object signing
  - Generate and lodge certificate objects
Example of a signed object

route-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
technical-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-iwj8Yd8uqaB5Ck010p5Q/Hc4yxwhTamNXW-cDwtQcmvOVGjU.cer
sigblk: ----BEGIN PKCS7-----

MIIBdQYJKoZIhvcNAQcCoIBZjCCAWICAQExCzAJBgUrDgMCGgUAMAsGCSqGSIb3DQEhATGCAUEwggE9AgEBMBowFTETMBEGA1UEAxMKdGVsc3RyYS1hdQIBATAJBgUrDgMCGgUAMAsGCSqGSIb3DQEBAQUAIBAIIBAEZGI2dAG31AAGi+mAK/S5bsNrgEHOmN1leJF9aqM+jVO+tiCvRHypMeBmIp6yoCm2h5RCR/avP4U4CC3QMhU98tw2Bq0TYHZvqXfAOVhjD4ApkMaYr8tfeC7ZDhO+fpvsydV2XXtHIjwjcL4GvM/gESdJ

KJYFWt1PqQnTFm5oLWBUHnjUZ2X89qYqF2YZVizITTNg3ly1nwqBoAqmmDhDy+nsRVAxax7II2iQDT/rpjI2VWe4R36gbT8oxyvJ9xz7I9IKpB8RTvPVO2I2HbMl1SvrXMx5Q0xyY3Pcxo/PAbhBkVkgfudLki/IzB3j+4M8KemrnVMRo=

-----END PKCS7-----

changed:    test@telstra.net 20060822
source:     APNIC
Signer’s certificate

Version: 3 (0x3)
Serial: 1 (0x1)
Issuer: CN=telstra-au
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
Resource Signing Tool

Resources can be subdivided into “collections” and each collection can be named. This section of the portal provides tools to manage resource collections.

A resource collection is used to sign a document (or any other digital object).
Resource Signing Tool

Documents can be signed with a resource collection, and associated validity dates. Signed objects can also be reissued and deleted.

The underlying resource certificate generation and management tasks are not directly exposed in this form of the signing tool.
Resource Certificate Trial Program

- 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 certificates

Current Activities
- Extensions to OpenSSL for Resource Certificates (activity supported by ARIN)
- Tools for resource collection management, object signing and signed object validation
- LIR / ISP Tools for certificate management
- Operational service profile specification
Next Steps

• Complete current trial activities

• Review
  – Does this approach meet the objectives?
  – What are the implications of this form of certification of resources?
  – Impact assessment
    • Service infrastructure, operational procedures
    • Utility of the authentication model

• Reporting
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