Higher Education National Certificate Authority

Enabling secure interoperation

Rodney McDuff, The University of QLD

Viviani Paz, AusCERT

THE UNIVERSITY OF QUEENSLAND AUSTRALIA
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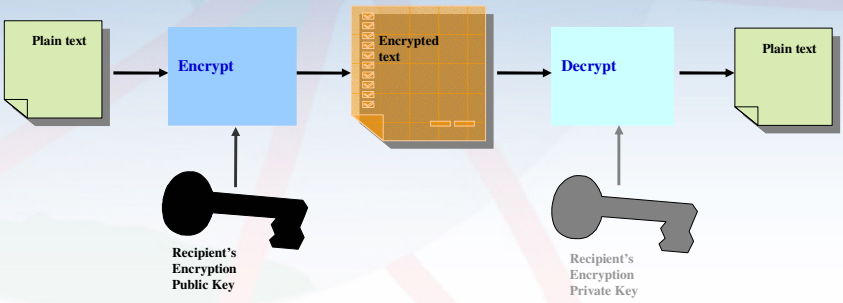
Outline

- Introduction to PKI
- Higher Education Sector PKI
  - CAUDIT PKI Pilot
  - Certificate Levels
  - Trust Model
  - Certificate Path Processing
- Conclusion

Introduction to PKI

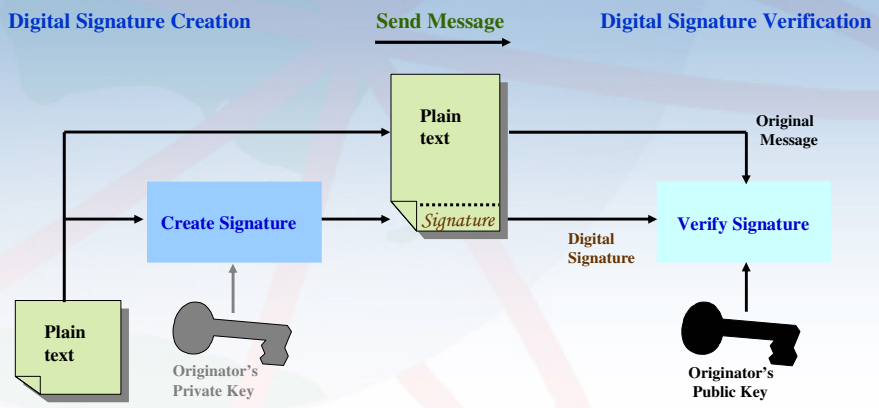
Introduction to PKI

- Reliable infrastructure for information/resource sharing.
- Public-key cryptography
  - 1976 Diffie and Hellman



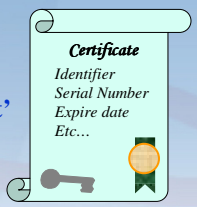
Introduction to PKI Cont.

- Digital Signature = Electronic Signature



Introduction to PKI Cont.

- Digital Certificate
  - Digitally signed data structure
  - 'Electronic "credit card" that establishes one's credentials when doing transactions on the Internet'
- Certification Authority (CA)
  - Issues and manages digital certificates
- Registration Authority (RA)
  - Supports the CA in the end-entity registration requirements
  - Verifies user requests for digital certificates and initiates the certificate process with CA
- Certificate Policy (CP)
  - High-level document that describes requirements/limitations associated with the proposed use of the certificates issued under such a policy.
- Certification Practice Statement (CPS)
  - Detailed document that describes internal operating procedures used by the CA when issuing certificates



X.509

Higher Education Sector PKI

Collaboration
and
Interoperation

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Higher Education Sector PKI

- **CAUDIT PKI Pilot -** ***September 2004***
- **Proposal**
  - **Pro-actively develop policies and standards to avoid retro-fitting implementations and ensure interoperability with overseas PKIs**
  - **Implement a proof of concept system**
- **Benefits**
  - **Enable a collaborative framework for implementation across sector**
  - **Ongoing governance mechanism to support the collaborative framework**
  - **Share lessons learned with the sector**
  - **Reduce the cost of implementation of PKI across the sector**
- **Funded by GrangeNet and DCITA**
  - **$ 171,000.00**

Higher Education Sector PKI Cont.

- Managed by the CAUDIT PKI SC

NZ Vice Chancellors Standing Committee on Information Technology

Higher Education Sector PKI Cont.

- Research
  - Policies, Technologies, Pros, Cons
  - Lack of Standards
  - Federated Approach
  - Certificate use
    - Strongly Identity based + Authentication
    - Authorisation via attribute certificates or Shibboleth
- Identify initial PKI requirements
- Services
  - Authentication
    - Entity identification
    - Data origin identification → Non repudiable evidence
  - Integrity
  - Confidentiality

Higher Education Sector PKI Cont.

- Participant Universities

- Technical Activities Group
  - Test and evaluate available technologies for certificate management systems
  - Input into CP and CPS

Higher Education Sector PKI Cont.

- Training
  - Induct CAs, RAs and other users
- Investigate additional requirements
  - PKI + Shibboleth
- Proposal for Production PKI and PKI/Shibboleth alignment project
  - Funding through Systemic Infrastructure Initiative (SII)
  - Supported by

Certification Levels

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Certification Levels

Certificate Level	Description
Level 1	No proactive identity check has been provided to the RA. However identity information has been provided by a body that the RA has a trust relationship. Example: A student being enrolled in at least one subject is sufficient for the certificate issuing however identity information has only been supplied by QTAC (or similar state body).
Level 2	Subject is required to provide proof of identity by an in-person appearance to the RA. However the individual for what ever reason can not provide the required 100 points of identification. Example: A contractor, who is at an institution for a short time but needs access to a system protected by PKI, may not have enough credentials on her person to meet the 100 points check but can provide some credentials like a drivers licence and/or credit card.
Level 3	Subject is required to provide proof of identity by an in-person appearance to the RA. That proof should accrue to at least 100 points of identity. Example: A foreign staff member that has a valid passport and has a written reference from an acceptable referee.
Level 4	Subject is required to provide the same information for Level 3 certification in addition to a positive check to be conducted by an appropriate external agency.

 Identification Record for a Signatory to an Account: http://www.austrac.gov.au/guidelines/forms/201.pdf

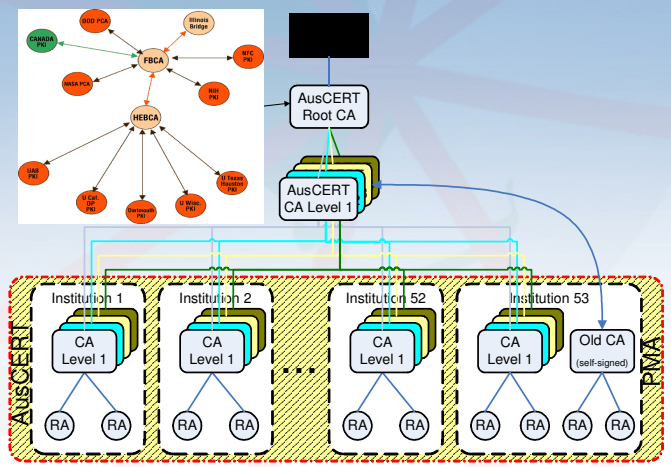
Trust Model

What is Trust?

Certificate Path Processing

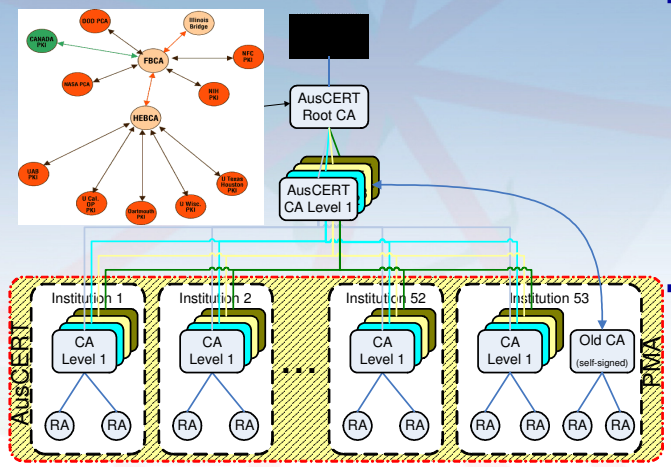
- Psychologically need to
  - Construct a "sense of trust" between a relying party and an end entity.
- Technologically need to
  - Construct a valid unbroken chain of CAs between a relying party's trust anchor and an end entity's certificate.
- Certificate Path Construction
- Certificate Path Validation
- Most common PKI enabled application disappoint here

Trust Model



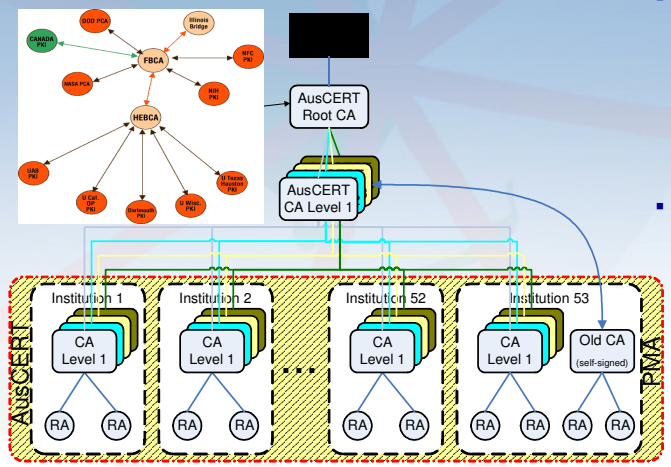
- AusCERT Root CA is trust anchor for CAUDIT PKI.
- Root CA signed subordinate AusCERT CA for each Certification Level.
  - Good for PKI networking.
- Each institution has CA for each Certification Level signed by appropriate AusCERT subordinate CA.

Trust Model Cont.



- Institutions with old PKI can deploy new CA but old CA cross-certify with appropriate sub CA.
  - Old certs will continue working and get access to CAUDIT PKI.
- AusCERT cross-certify with national, international and global PKIs.
  - Like HEBCA.

Trust Model Cont.



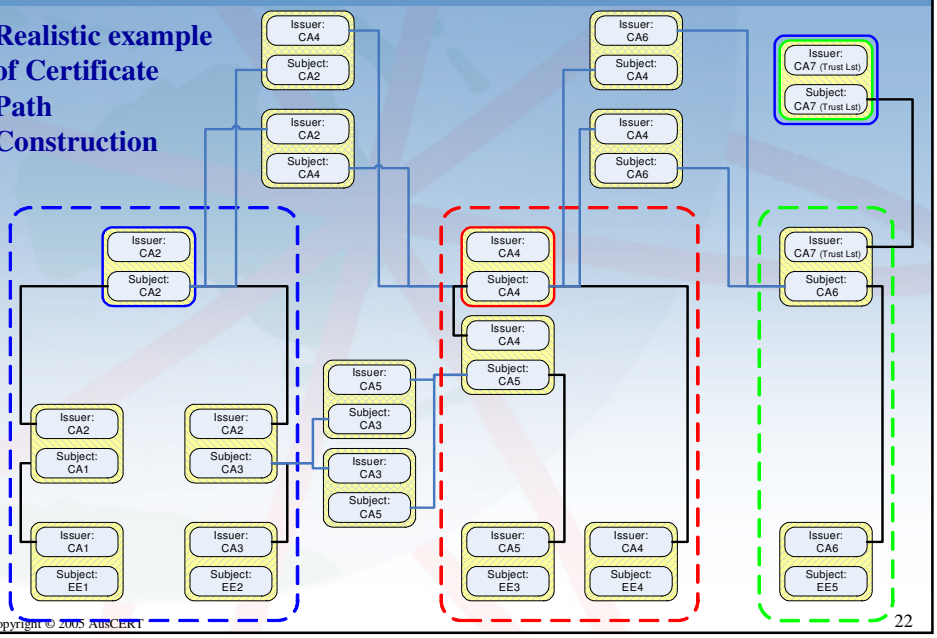
- **AusCERT to provide:**
  - **PMA**
  - **Directory of Directories**
  - **Single point Certificate Dissemination.**
  - **Single point CRL and OCSP.**
  - **Virtual CA for institutions that can't deploy own PKI.**
- **Pilot project needed to do extensive interoperability survey**
  - **Range of CMSs.**
    - **Microsoft**
    - **Sun One**
    - **Open CA**
  - **Common applications.**
    - **Browsers, mail clients.**
  - **Specialized applications**
    - **Access and Computation Grids.**
    - **Shibboleth.**

Certificate Path Construction and Validation

Certificate Path Construction

- Two CAs must have a trust relationship to form a link. Either:
  - One must be subordinate to other, or
  - Must be Cross-Certified. (Unilateral or Bilateral?)
  - Relationships should be forged due to common policies or procedures or interests. Otherwise there is a dilution of trust.
- Must be able to locate and retrieve candidate CAs for chain
  - Don't need end entity's certificate. Already have it.
  - Some protocols can provide them. SSLv3/TLSv1, S/MIME.
  - Some certificate attributes can hint at where to find them.
    - Authority Information Access Extension.
  - Some X.500 or LDAP directories can contain them.
- Can't construct path, can't construct "sense of trust".

Realistic example of Certificate Path Construction



Certificate Path Validation

- Once a path is constructed each link of chain must be checked
  - Is integrity of certificate sound?
    - Issuer signature must be verified.
  - Is the certificate being used within its validity period?
  - Has certificate been revoked?
    - Not trivial pursuit. Need external information. CRL. OCSP.
    - Where do I find these? Some X.509 extensions hint at locations.
  - Has it been used for its intended purpose?
  - Is the candidate path too long?
  - Does one of the CA certificates prohibit the candidate path?
  - Does one of the CA certificates prohibit the policy of another?
- Can't validate path, can't construct "sense of trust"
- If path doesn't validate sirens go off
- If path does validate (suddenly) nothing happens
  - But who does my application think is the trust anchor and how did it get there? Check the Padlock!!!

The Good, The Bad and The Ugly

- X.509 and RFC3280 imprecise about Certificate Path Processing.
  - Has lead to vendor inoperability problems
  - Common applications can't do dynamic path construction
    - Netscape/Mozilla/Firefox. (Hope on the horizon with SUN.)
  - Others do it but with varying degrees of success
    - Microsoft Windows CryptoAPI (IE, Outlook)
  - Can get third party CPP engines.
    - Entrust Entelligence.
  - CPP can be very intensive and untimely for relying party
- Delegated Path Construction and Validation. (DPP and DPV)
  - Certificate Authority Module (CAM)
    - Freely available
    - Used by HEBCA and FBCA
  - Simple Certificate Validation Protocol (SVCP)
    - Coming soon to a RFC near you
  - W3C XML Key Management Specification (XKMS)
    - Total refactoring of PKI way from ASN.1

Conclusion

- CAUDIT PKI Project
  - Infancy
  - Technology is not all it could be
  - Potential
  - Production
  - Participants Universities
    - Support
    - Feedback
  - Interoperability with other PKIs

Thank You!

Any Questions?