Institute for Applied Information Processing and Communications

Graz University of Technology

IAIK TUG

Pure Java Server Signature Modules

Modules for Creating and Verifying Digital Signatures

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Concept „Citizen Card“

Any Device can be a Citizen Card

- Digital Signature according to Law
- Identify the Person
- Conforms to the Security-Layer Specification

Signature Requirements

Given by the Austrian Law for Electronic Signatures

- Algorithms (until End of 2005)
  - RSA (≥1023), DSA (1024), ECDSA (≥160)
  - RIPEMD-160, SHA-1
- Certified Signature Creation Device (Smart Card)

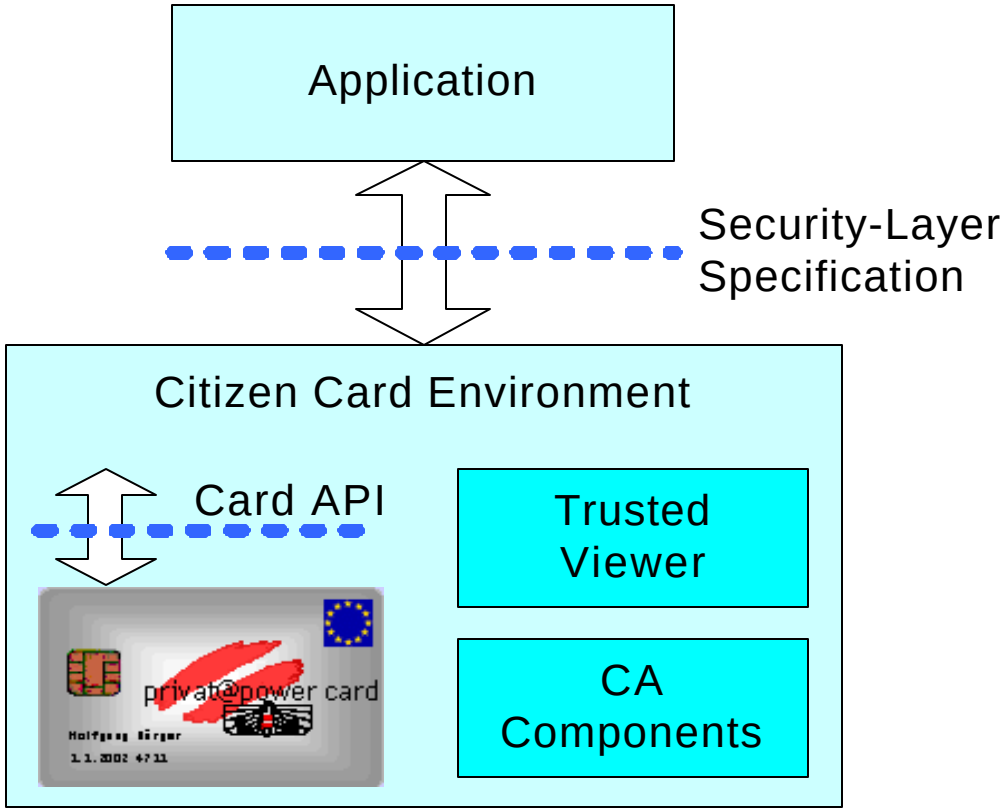
Identity of the Person

- Through a unique ID
- ID is bound to the Public Key with a Signature
- Used to Identify Persons in e-Government Processes

Security-Layer Specification

- XML based Request-Response Protocol
- TCP or HTTP as Transport (Port 3495)
- Specifies Commands for
  - Creation and Verification of XML Signatures
  - Creation and Verification of CMS Signatures
  - Access to Info-Boxes
  - Key Agreement (DH)
  - Query Properties

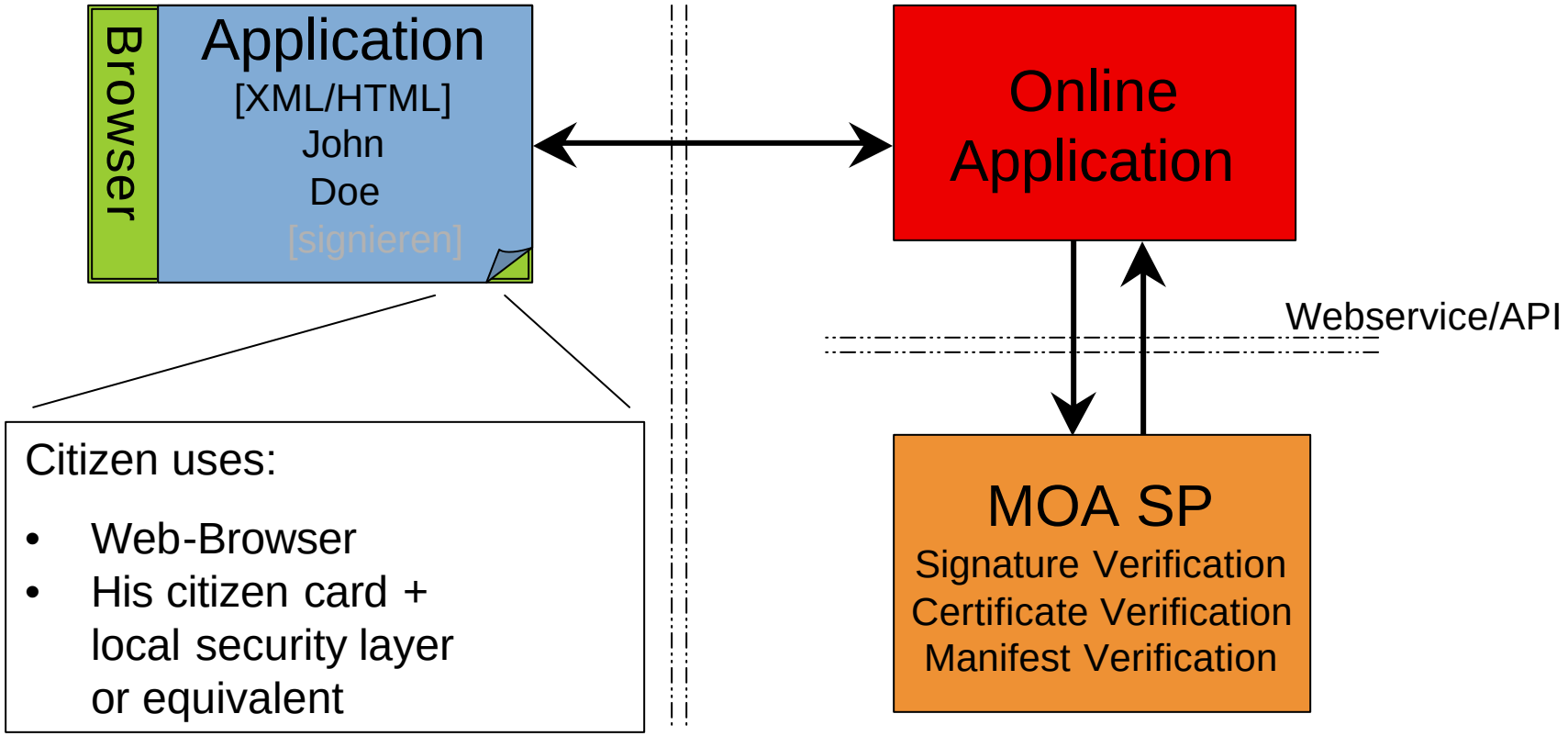
Security-Layer



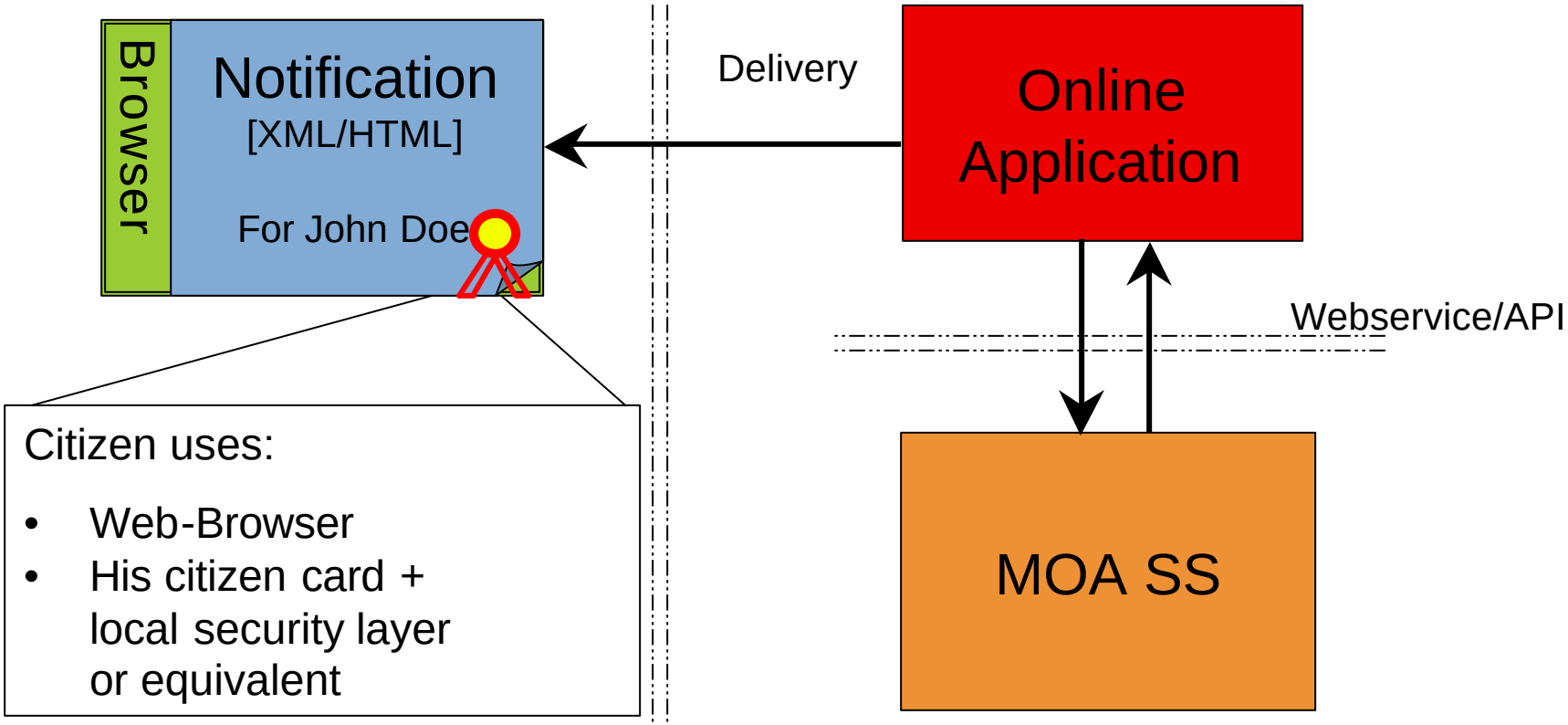
The Server Side

- Signature Cards enable Users to sign Documents, Identify themselves, ...
- The Systems of Official Bodies and Companies also need to process Signatures
- Signature Creation and Verification is often similar in different workflows

MOA SP – checking Signatures



MOA SS – signing



Server Modules

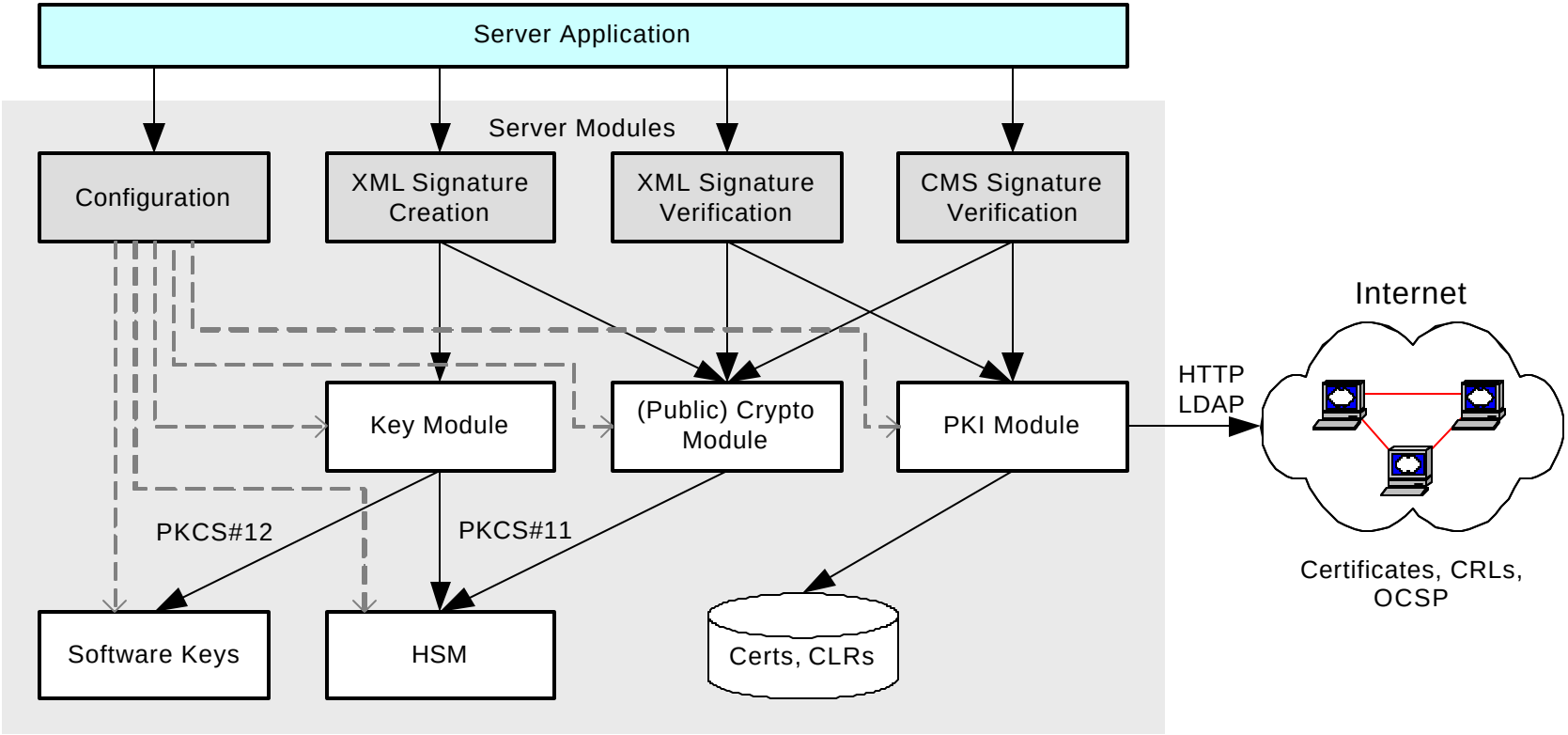
Java Library for Server Application

- XML Signature Creation/Verification
- CMS Signature Verification
- Designed to fit the Security-Layer Specification (but **not** restricted to it)
- Configurable Certificate Chain Building and Verification (PKIX and Chain Model)
- Support for Crypto Hardware (HSMs) via PKCS#11

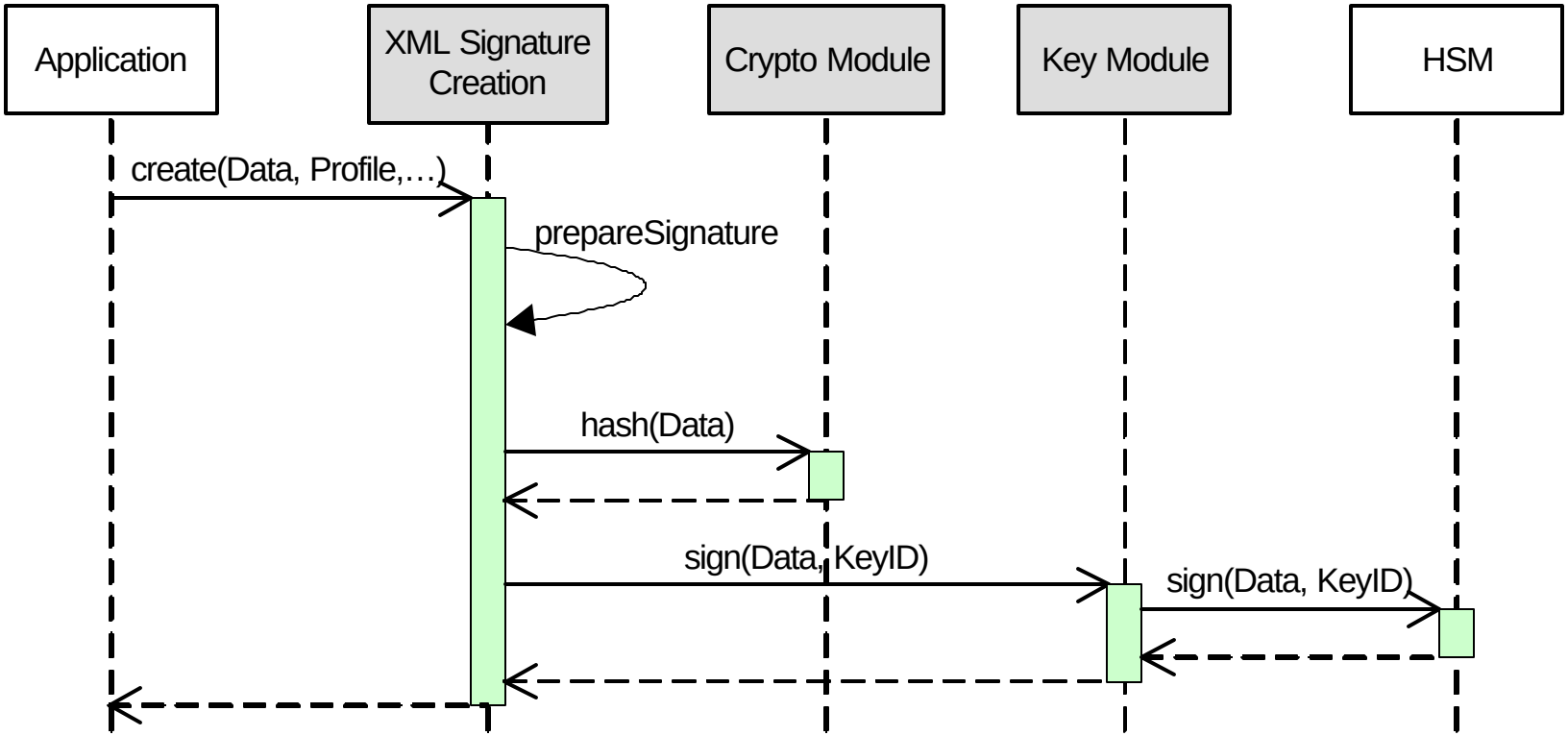
Additional Requirements

- Stability and Robustness
- Run 24 by 7
  - Reconfiguration at Runtime
    - Change Keys, Modify Trust Settings
- At least 10 Signatures per Second Throughput
- Based on International Standards
  - XML Signature, CMS, PKCS, PKIX

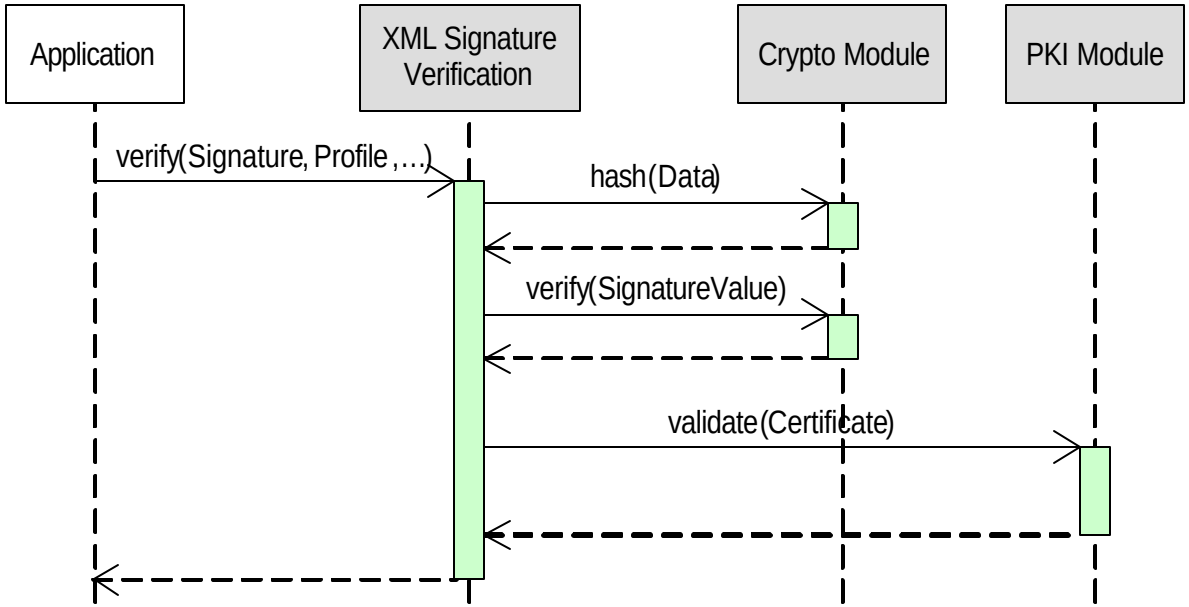
Basic Architecture



Signature Creation



Signature Verification



Key Management

- Multiple Keystores in Key Module
  - PKCS#12 (File)
  - PKCS#11 (HSM)
    - Access to any PKCS#11 compliant Hardware through JNI
- No direct Access to Keys
- Reference Keys by ID

Configuration

- Key Module
  - PKCS#12 Files, PKCS#11 Modules
- Crypto Module
  - Software only, Hardware Acceleration
- PKI Configuration
  - Certificate Stores, Revocation Checking, ...
- Logging
  - Default - Log4J

Profiles

Specified as Java Interfaces

- XML Signature Creation
  - Keys, Algorithms, Transformations, Structure,..
- PKI
  - Trusted Roots, Validation Model, Revocation,...
- XML Signature Verification
  - PKI Profile, Manifest Check, Return Data,...
- CMS Signature Verification
  - PKI Profile

XML Signature Features

- Algorithms
  - RSA, DSA, ECDSA
  - SHA-1, SHA-256, RIPEMD-160, RIPEMD-128, MD5, MD2
- Transformations
  - (Exclusive) Canonicalization, Base-64, Enveloped-Signature, XPath Filter, XPath Filter 2, XSLT
- Manifests
- ETSI Signed Properties

Crypto Performance

- Asymmetric Crypto is the Slowest
  - Software
    - 50-100 Signatures/Second (RSA 1024, P IV 2G)
    - RSA, DSA, ECDSA are available (simple to add)
  - Hardware
    - up to ~1000 Signatures/Second (RSA 1024)
    - decreases with increasing Security Level
    - often only RSA, sometimes DSA, hardly ECDSA

XML Performance

- XML often slower than Crypto
  - Transformations are Critical
  - XSLT Stylesheet Transformations
  - XPath Filter
- Use Transformations Carefully

PKI Performance

- Dynamic In-Memory Cache
  - Certificates, CRLs
  - Verifies Certificate Signature only once
- Permanent Store
  - Database (SQL) or File System
  - Stores Certificates
  - Stores CRLs (sometimes >700k)

Outlook

- Implement a Web-Service Layer
- Support for Long-Term Signatures (ETSI – XAdES)
- Complete OCSP support
- Complete Support for XKMS
- Add Support for Timestamping
- Release Server Modules as a Product (http://jce.iaik.tugraz.at)

References

- IAIK, Graz University of Technology
  - http://jce.iaik.tugraz.at, http://www.iaik.tugraz.at
- Austrian Citizen Card (Buergerkarte)
  - http://www.buergerkarte.at/ (German)
- Chief Information Office, Austria
  - http://www.cio.gv.at/ (German)
- XML Signature
  - http://www.w3.org/Signature/

Questions and Answers

Questions?