OBERÖSTERREICH

Trusted Infrastructures for Identities

Virtual Goods, Koblenz 2007

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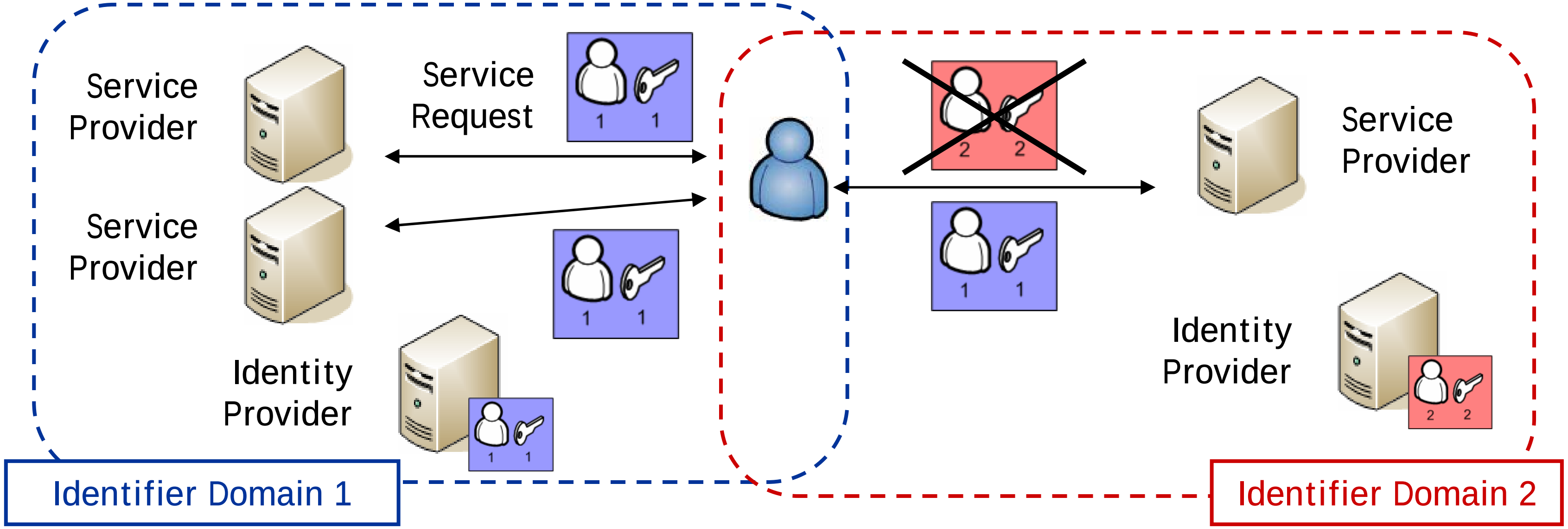
Agenda

- Problem description
- Basics
  - Trusted Computing
  - Identity Management
- Trusted Infrastructures for Identities
  - Requirements
  - Protocol sequence
  - Protocol messages
- Analysis

Problem description

- Increasing importance of Identity Management
- Identity Management Architectures

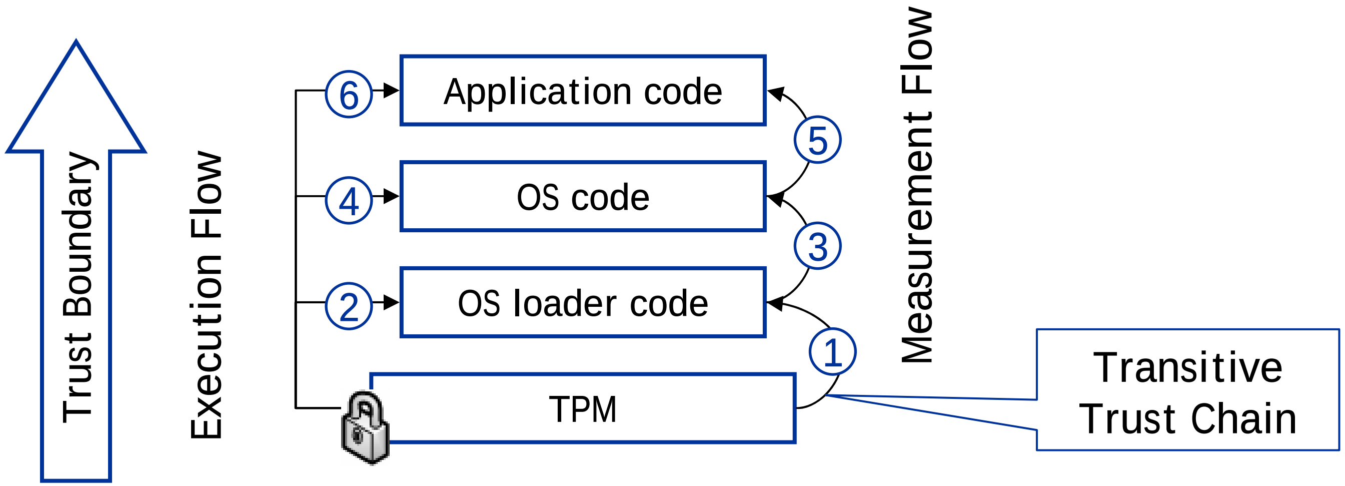


Problem description

- Trust relationships between the identifier domains
  - Traditional solutions
    - Cross certification
    - Spanning Certificate Authorities
    - Mirroring of user databases
  - Usage of already existing architectures:
    - Trusted Computing Group
- Identity provider
  - Authorization to issue tickets
  - Current system status during the authentication and authorization process

Trusted Computing

- Concept for attesting the trustworthiness of a platform
- Foundation of trust
  - Hardware chip: Trusted Platform Module (TPM)
- Transitive Trust



Trusted Computing

- Trusted Platform Module (TPM)
  - Integrity Measurement (Platform Configuration Register)
  - Cryptographic functions
  - Secure memory
- Cryptographic keys and credentials (certificates)
  - Endorsement Key (EK) und Credential
  - Attestation Identitiy Key (AIK) und Credential
  - Signing Keys

Identity Management - SAML

- Security Assertion Markup Language (SAML)
- XML-based security standard
- Transport of authentication- and authorization information
- Assertions
  - Authentication Statement
  - Authorization Decision Statement
  - Attribute Statement

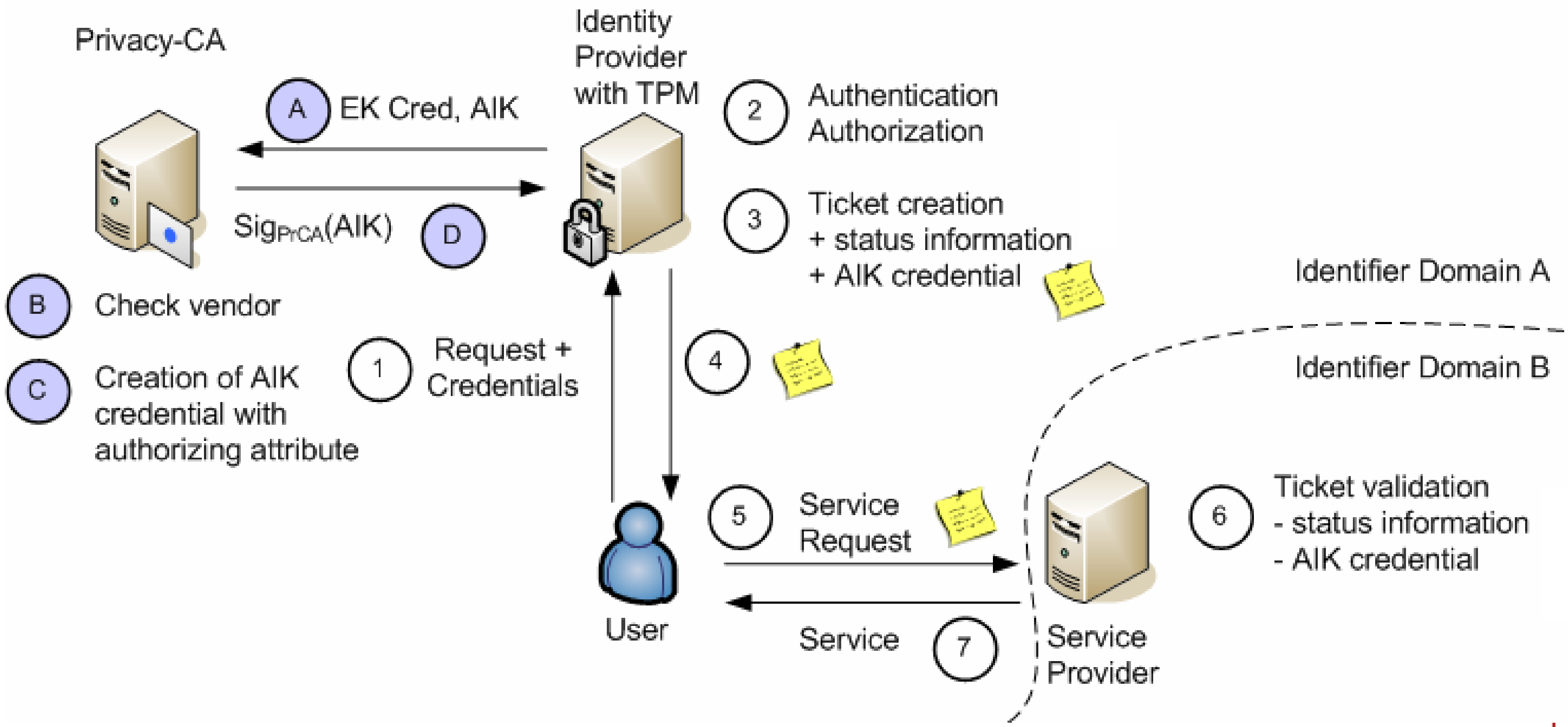
Trusted Infrastructures for Identities

- Goal
  - Service providers trust decisions of identity providers in foreign identifier domains
- Prerequisites
  - Identity providers have to be equipped with a TPM
  - Adaptable infrastructure offered by the Trusted Computing Group
- Tasks of the identity provider
  - Authentication and authorization
  - Issuance of a trusted ticket
- Tasks of the service provider
  - Was the identity provider trustworthy at the moment of ticket issuing?
  - Is the identity provider authorized to issue tickets for the domain?

Trusted Infrastructures for Identities

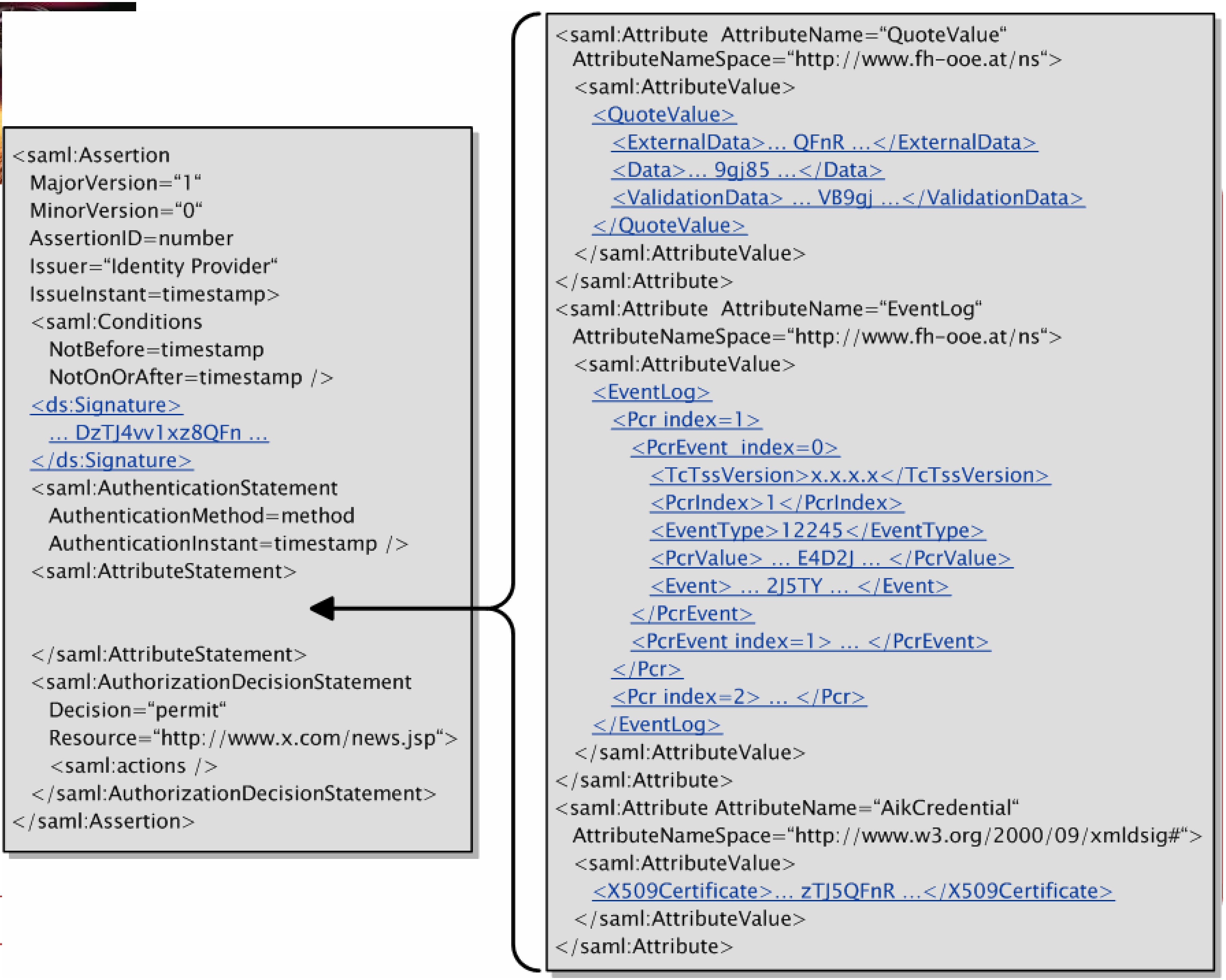
- Trustworthy status of the identity provider
  - Integration of status information in the tickets
  - Measurements are compared with reference values
- Authorization of the identity provider to issue tickets
  - Adaptation of the request of identity credentials from the Privacy-CA
  - Privacy-CA decides based on the Endorsement Credential
    - Vendor certificate, Public Endorsement key
  - Creation of a special Attestation Identity Credential

Protocol sequence



Protocol messages

- AIK Credential
  - Format specified based on X.509 certificates
  - Extended key usage attribute (trustedTicketIssuing)
- Trusted ticket
  - SAML Assertion
  - Attribute statement for the transport of status information
  - Special XML structure
    - Values of the Platform Configuration Registers
    - Measurement log
    - AIK Credential (used to sign the status information)
  - Assertion is signed with a signing key
    - Signing key is certified with the Attestation Identity Key



```
<saml:Assertion
  MajorVersion=“1“
  MinorVersion=“0“
  AssertionID=number
  Issuer=“Identity Provider“
  IssueInstant=timestamp>
  <saml:Conditions
    NotBefore=timestamp
    NotOnOrAfter=timestamp />
  <ds:Signature>
    ... DzTJ4vv1xz8QFn ...
  </ds:Signature>
  <saml:AuthenticationStatement
    AuthenticationMethod=method
    AuthenticationInstant=timestamp />
  <saml:AttributeStatement>


  </saml:AttributeStatement>
  <saml:AuthorizationDecisionStatement
    Decision=“permit“
    Resource=“http://www.x.com/news.jsp“>
    <saml:actions />
  </saml:AuthorizationDecisionStatement>
</saml:Assertion>
```

```
<saml:Attribute  AttributeName=“QuoteValue“
  AttributeNameSpace=“http://www.fh-ooe.at/ns“>
  <saml:AttributeValue>
    <QuoteValue>
      <ExternalData>... QFnR ...</ExternalData>
      <Data>... 9gj85 ...</Data>
      <ValidationData> ... VB9gj ...</ValidationData>
    </QuoteValue>
  </saml:AttributeValue>
</saml:Attribute>
<saml:Attribute  AttributeName=“EventLog“
  AttributeNameSpace=“http://www.fh-ooe.at/ns“>
  <saml:AttributeValue>
    <EventLog>
      <Pcr index=1>
        <PcrEvent  index=0>
          <TcTssVersion>x.x.x.x</TcTssVersion>
          <PcrIndex>1</PcrIndex>
          <EventType>12245</EventType>
          <PcrValue> ... E4D2J ... </PcrValue>
          <Event> ... 2J5TY ... </Event>
        </PcrEvent>
        <PcrEvent index=1> ... </PcrEvent>
      </Pcr>
      <Pcr index=2> ... </Pcr>
    </EventLog>
  </saml:AttributeValue>
</saml:Attribute>
<saml:Attribute AttributeName=“AikCredential“
  AttributeNameSpace=“http://www.w3.org/2000/09/xmldsig#“>
  <saml:AttributeValue>
    <X509Certificate>... zTJ5QFnR ...</X509Certificate>
  </saml:AttributeValue>
</saml:Attribute>
```

Analysis

- Advantages
  - Usage of the infrastructure provided by the Trusted Computing Group
  - Significant reduction of the initial implementation costs
  - No additional PKI is required
  - Embedding of status information in the tickets
- Problems
  - Scalability of the trust relationships between the identifier domains
  - Adaptions of the original Trusted Computing architecture
  - Size of the event log

Conclusion

- Results
  - Establishment of trust relationships with Trusted Computing technology is possible
  - Successful reference implementation
- Use cases in addition to the identity management area
  - Anonymous usage of the tickets
  - Combination with a payment system
- Future research topics
  - Verification of the service provider’s system status by the user
  - Formulation of generic access-control policies
  - Message replay attacks
  - Implementation of integrity-measurement mechanisms in current operating systems

Questions?