XML
Emerging Authorization and Authentication Standards

About the speaker

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Topics of the Presentation

1. XML

2. Brief description for main emerging protocols

    a. SAML
    b. XACML
    c. XKMS
    d. XML signature

XML
(Extensible Markup Language)

XML in brief

- XML is **subset** of the Standard Generalized Markup Language (SGML)
- It is designed to make it easy to interchange structured documents over the Internet.
- Structured documents contain:
  1. Content (words, pictures, etc.) and
  2. Some indication of what role that content plays
- A markup language is a mechanism to identify structures in a document.

XML and HTML

- In HTML, both the **tag semantics and the tag set are fixed**:
  - New changes are confined by:
    1. Browser implementions
    2. Backward compatibility is paramount.
- XML specifies **neither semantics nor a tag set**.
- XML is really a meta-language for describing markup languages:
  - Provides a facility to define tags and the structural relationships between them.
  - No predefined tag set means there can't be any preconceived semantics.
  - All of the semantics of an XML document will either be defined by the applications that process them or by stylesheets.

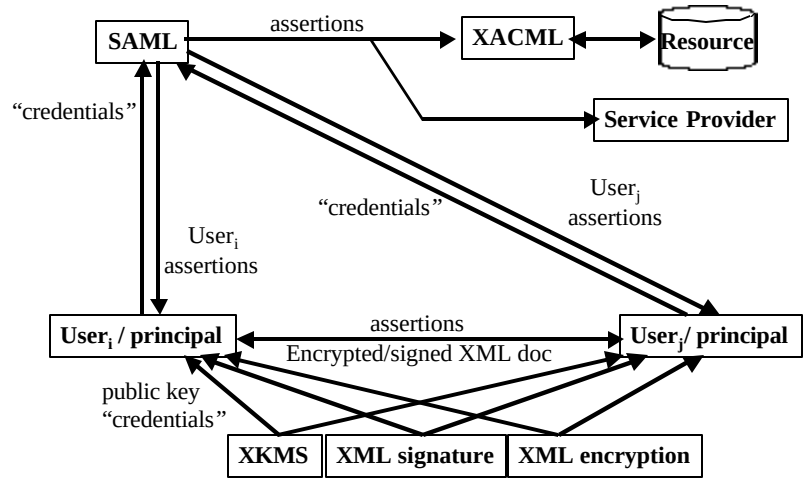
Why XML?

- XML was created so that **richly structured documents** could be used over the web.
- The only viable alternatives, HTML and SGML, are **not** practical for this purpose:
  1. HTML comes bound with a set of semantics and does **not** provide arbitrary structure.
  2. SGML provides arbitrary structure, but is **too difficult to implement** just for a web browser.

An XML example

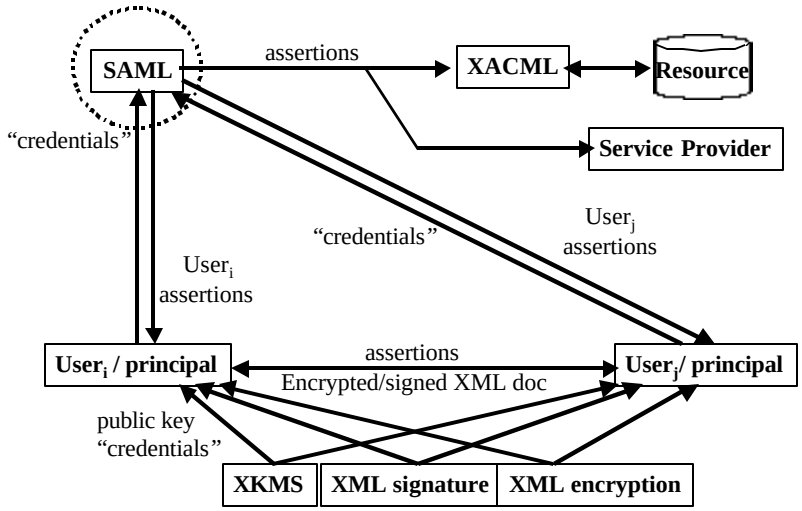
```
<?xml version="1.0"?>
<Country>
    <Summary>
        <Georgraphical_Location>
                Arabian Penansula
        </Georgraphical_Location>

        <Population>
                14 Million
        </Population>

        <Religion>
                Islam
        </ Religion>
    </ Summary>

    <body>
     - - - - - - - - - - - - - - -
    </body>
</Country>
```

Main XML security protocols



SAML
(Secure Assertion Markup Language)

SAML



What is SAML

- A proposed standard for the exchange of **authentication** and **authorization** information between trust domains.
- SAML enables Single Sign On across trust domains

SAML Assertions

The **basic data objects** of the SAML protocol model are "**Assertions**" and "References" (to Assertions).

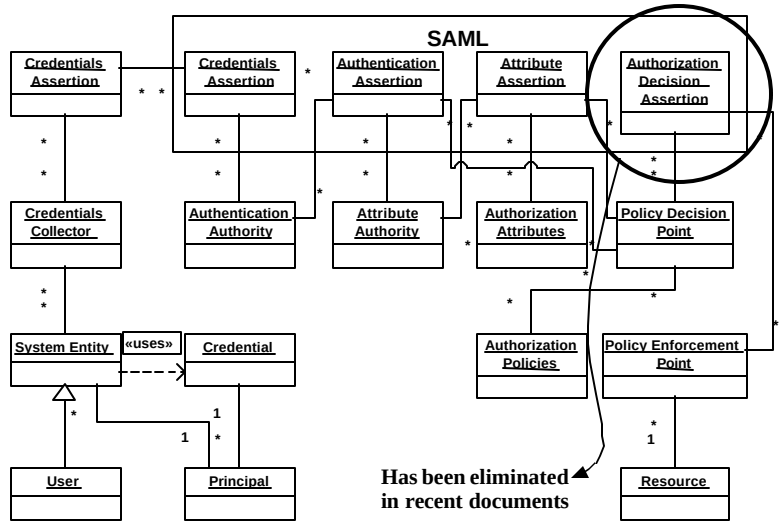
1. **Authentication** Assertion: Asserts that the issuer has authenticated the specified subject
2. **Attribute** Assertion: Asserts that the specified subject has the specified attribute(s).
3. **Authorization** Assertion: Asserts that a subject has been granted specific permissions to access one or more resources.

SAML

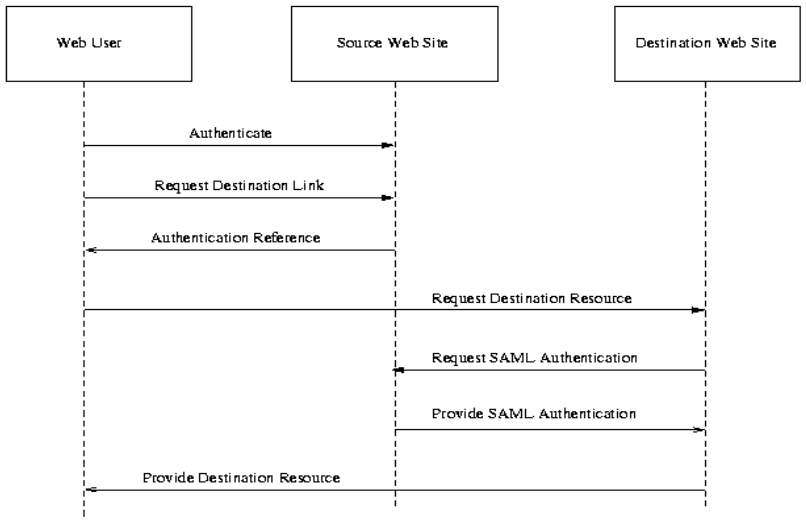
SAML Assertions may be exchanged using a variety of protocols:

1. The request protocol
   (defined by the <SAMLQuery> and <SAMLQueryResponse> elements)
2. HTTP
3. SMTP
4. MIME
5. ebXML
6. SOAP/XP
7. BEEP

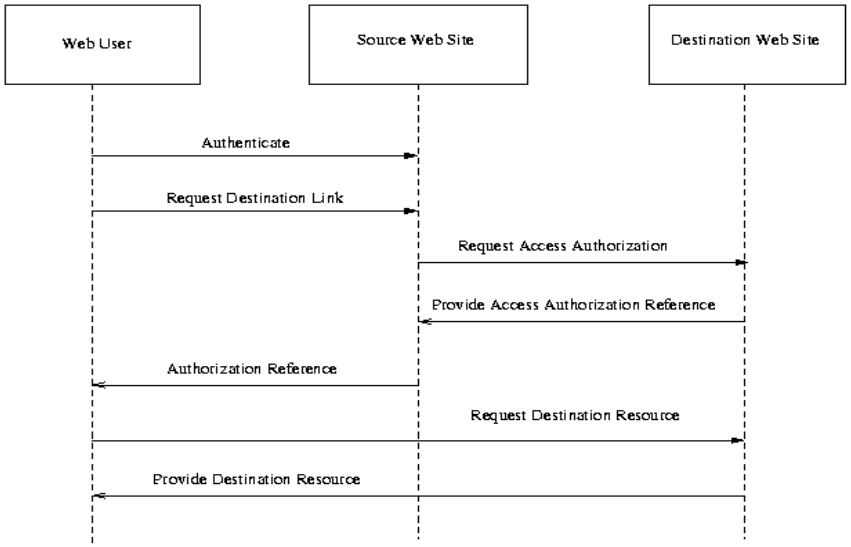
SAML Static Domain Model



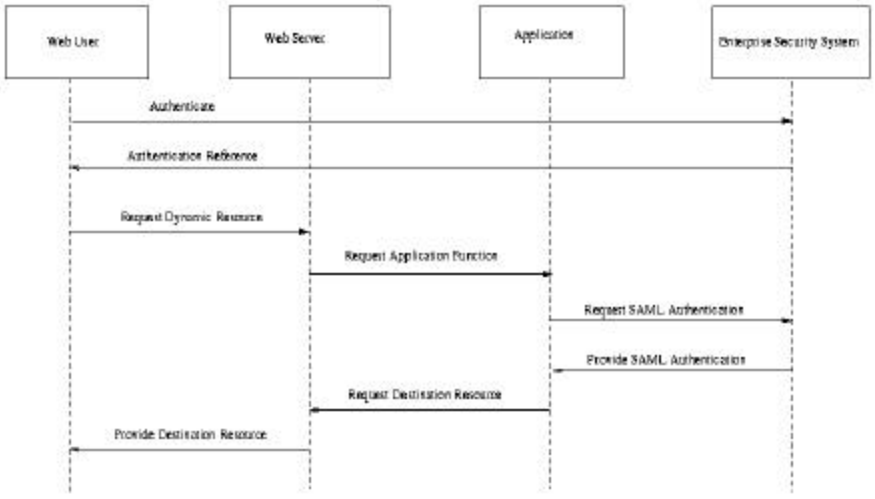
SAML: Scenario #1: Single Sign-On (Pull Model)



SAML: Scenario #1: Single Sign-On (Push Model)



SAML: Scenario #2: Authorization Service

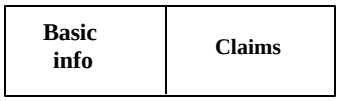


SAML assertion: *Basic Info*

The different types of SAML assertion are encoded in a common XML package, which consists of:

Basic Information:

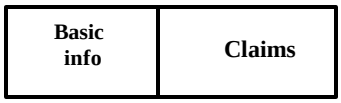
- A **unique identifier**: Serves as a name for the assertion.
- SAML version no.
- Date and time of issue: Optional
- Time interval for which the assertion is valid: Optional



SAML assertion: *Claims*

Describe the **use** of assertions to make claims for **Authorization**

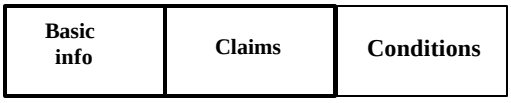
1. "DecisionClaim": Access permissions specified in the request identified by the corresponding RequestID were either permitted, denied or could not be determined
2. "AuthenticationClaim": Specified subject has been authenticated
3. "AttributeClaim" element: Specified subject has the specified attribute(s) specified by a URI
4. "AuthorizationClaim" : Specified subject is authorized to perform the specified operation(s) on the specified resource(s).



SAML assertion : *Conditions*

(**Optional**): The assertion status may be dependent on:

- Additional information from a validation service.
- Other assertions being valid.

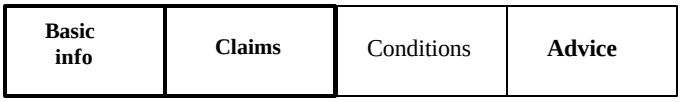


SAML assertion package

SAML assertion : *Advice*

(**Optional**): Additional information that may be used to specify the assertions that were used to make a policy decision.

The Advice element is a **general container for any additional information** that does not affect the semantics or validity of the assertion itself.



SAML assertion package

SAML *AssertionPackage*

The <SAMLAssertionPackage> element is specified by the following schema:

```
<element name="SAMLAssertionPackage" type="S0:SAMLAssertionPackageType">

<complexType name="SAMLAssertionPackageType">
      <!-- Basic Information -->
   <attribute name="Version"           type="string"/>
   <attribute name="AssertionID"       type="uriReference"/>
   <attribute name="Issuer"            type="string"/>
   <attribute name="IssueInstant"      type="timeInstant"/>
   <attribute name="NotBefore"         type="timeInstant"/>
   <attribute name="NotOnOrAfter"      type="timeInstant"/>

   <element name="Claims"     type="s0:Claims"      minOccurs="0"/>
   <element name="Conditions" type="s0:Conditions"  minOccurs="0"/>
   <element name="Advice"     type="s0:Advice"      minOccurs="0"/>
</complexType>
```

Basic Info

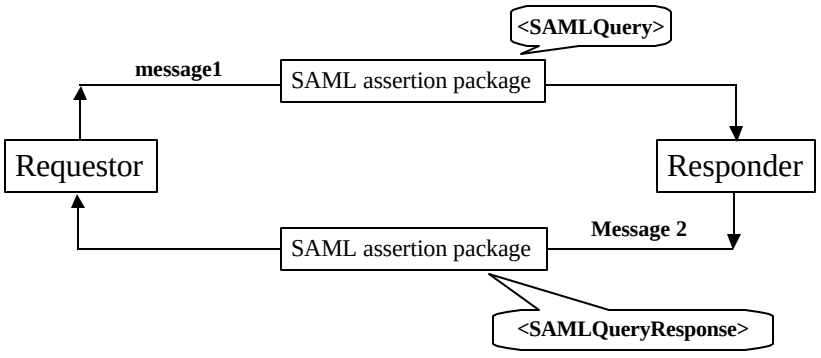
Conditions

Advice

Claims

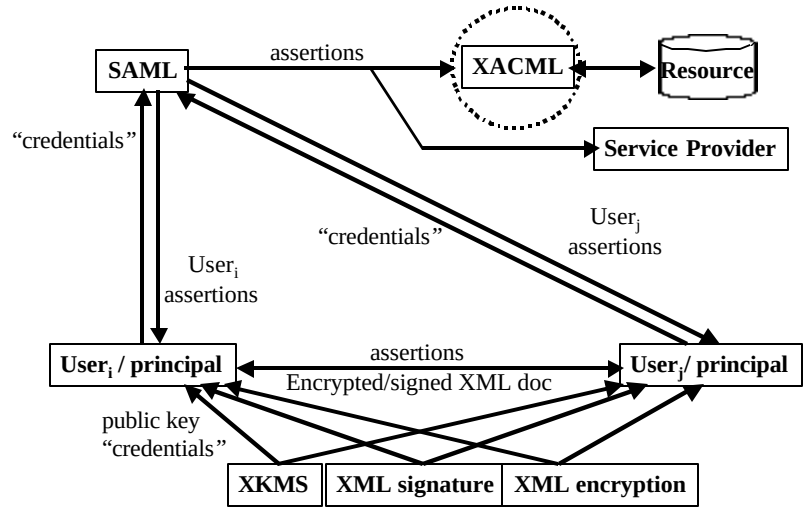
SAML *protocol*

If a suitable assertion already exists, then that assertion may be returned in response to the request, without the responder having to create a new one.



XACML
(Extensible Access Control Markup Language)

XACML

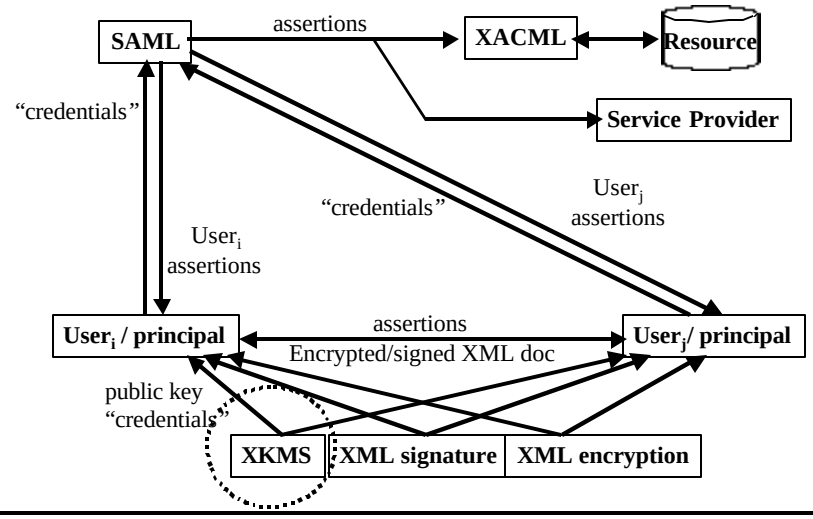


What is XACML

- It is an XML specification for expressing **policies** for **information access** over the Internet
- XACML targets any object that can be **referenced** using XML
- XACML allows the assignment of privileges **directly** to users
- XACML does **not** specify the action primitive at all
- XACML specifications document has not been released yet

XKMS
XML Key Management Specification

XKMS

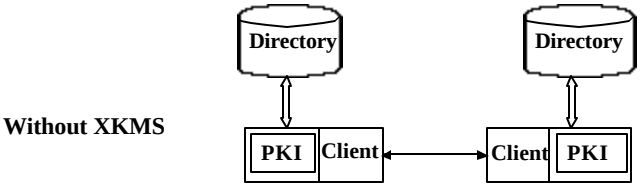


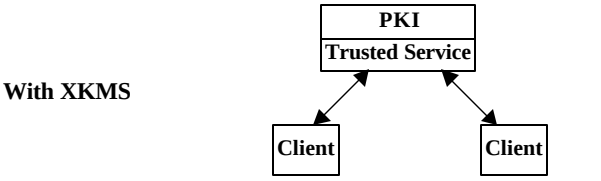
What is XKMS

A protocol for:

- Distributing
- Registering public keys

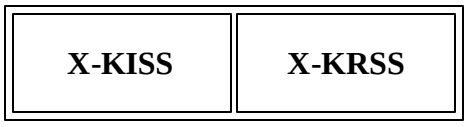
XKMS purpose





XKMS Components

- The XML Key Information Service Specification (X-KISS)
- The XML Key Registration Service Specification (X-KRSS).



XKMS sub-protocol: X-KISS

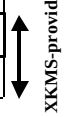
- Allows a client to delegate part or all of the tasks required to process XML Signature to a Trust service.
- The underlying PKI may be based upon a different specification such as X.509/PKIX, SPKI or PGP.

XKMS: Tiered Service Model

KeyInfo: Optional element that enables the recipient's to obtain the key needed to validate the signature.

- KeyInfo may contain:
  1. Keys
  2. Names
  3. Certificates

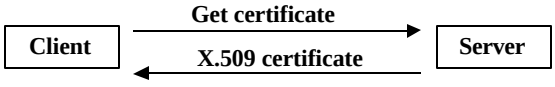
Tiers	<ds:keyinfo> processing	<ds:keyinfo> Validation
Tier 0	Done by Application	NA
Tier 1	Done by trust service	Done by Application
Tier 2	Done by trust service	Done by trust service



X-KISS : Tiered Service Model

Tier 0:

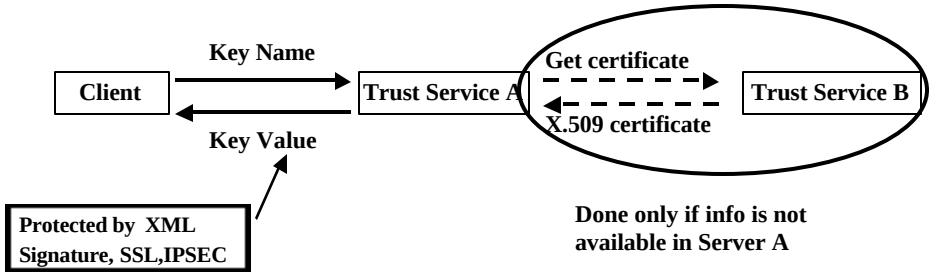
- XKMS is **not** deployed
- The client pulls PKI info from PKI server



X-KISS : Tiered Service Model

Tier 1: (Key **Locating** service)

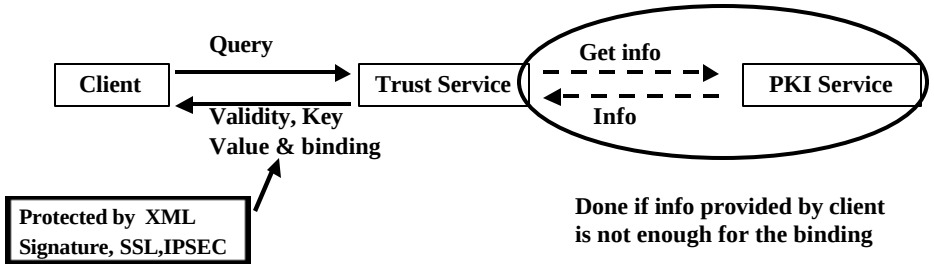
- A client receives a signed XML document
- The client requests the trust server to obtain the public key parameters



X-KISS : Tiered Service Model

Tier 2: (Key **Validating** service)

- A client receives a signed XML document
- The client queries the trust server to determine whether the signing key is trustworthy.
- The Trust Service builds a certificate trust path, then validates each certificate in the path against the relevant CRL



XKMS sub-protocol: X-KRSS

• X-KRSS permits management of information that is bound to a public key pair

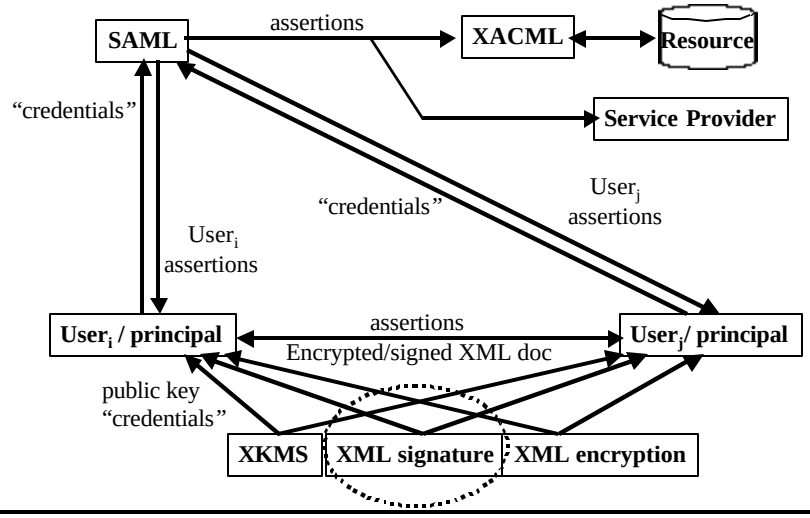
• 2 ways to generate a public key pair:
1. In advance by the client, or
2. On request by the service (to support key **recovery**)

• Services provided:

1. Registration
2. Revocation
3. Key Recovery

XML Signature

XML Signature



Scope

- XML signature is composed of:
    1. Syntax used for representing the signature of Web resources (anything referenceble by a URI)
    2. Procedures for computing and verifying such signatures.
- XML Signatures are generated from a hash over a signature manifest (a collection of references to the objects being signed)
- XML signature does not address mechanisms for making statements or assertions.

XML signature

- The XML Signature data structures must be based on the RDF data model
- XML Signatures apply to any resource addressable by a locator including non-XML content
- XML Signatures may apply to a part or totality of an XML document
- XML Signatures are first class objects themselves and consequently must be able to be referenced and signed

Signature "element"

XML digital signatures are represented by the **Signature element** which has the following structure

```
<Signature>
    <SignedInfo>
        (CanonicalizationMethod)
        (SignatureMethod)
        (<Reference (URI=)? >
            (Transforms)?
            (DigestMethod)
            (DigestValue)
         </Reference>)+
    </SignedInfo>

    (SignatureValue)
    (KeyInfo)?
    (Object)*
</Signature>
```


Signature element example

```
[s01] <Signature Id="MyFirstSignature" xmlns="http://www.w3.org/2000/09/xmldsig#">
[s02]   <SignedInfo>
        [s03]   <CanonicalizationMethod Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
        [s04]   <SignatureMethod Algorithm="http://www.w3.org/2000/09/xmldsig#dsa-sha1"/>
        [s05]   <Reference URI="http://www.w3.org/TR/2000/REC-xhtml1-20000126/">
        [s06]    <Transforms>
        [s07]       <Transform Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
        [s08]    </Transforms>
        [s09]    <DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>
        [s10]    <DigestValue>j6lwx3rvEPO0vKtMup4NbeVu8nk=</ DigestValue>
        [s11]   </Reference>
[s12] </SignedInfo>
[s13]   <SignatureValue>MC0CFFrVLtRlk=...</SignatureValue>
[s14]   <KeyInfo>
        [s15a]    <KeyValue>
                [s15b]      <DSAKeyValue>
                [s15c]      <P>...</P><Q>...</Q><G>...</G><Y>...</Y>
                [s15d]     </DSAKeyValue>
        [s15e]    </KeyValue>
[s16]   </KeyInfo>
[s17] </Signature>
```

The key to be used to validate the signature

info that is actually signed

Signature Process

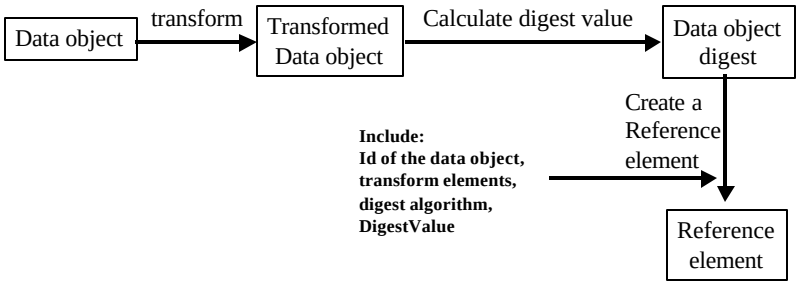
1. Core Generation
    - Reference Generation
    - Signature Generation
2. Core Validation
    - Reference Validation
    - Signature Validation

Signature Process: Core Generation

1. Core Generation

a) Reference Generation: Creating a Reference element for each data object to be signed

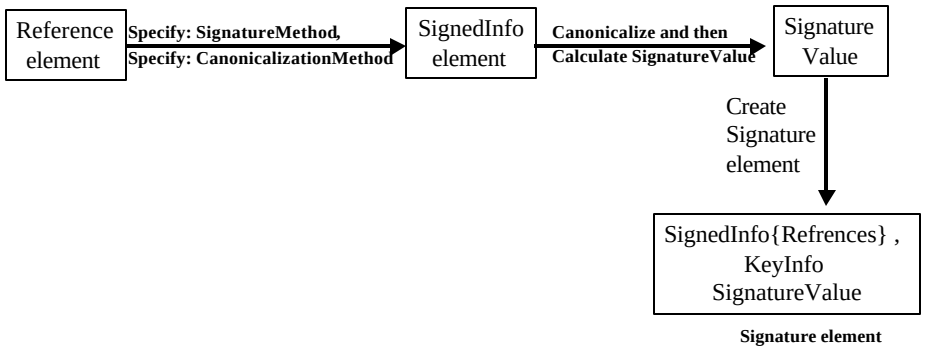
b) Signature Generation



Signature Process: Core Generation

1. Core Generation (continues)

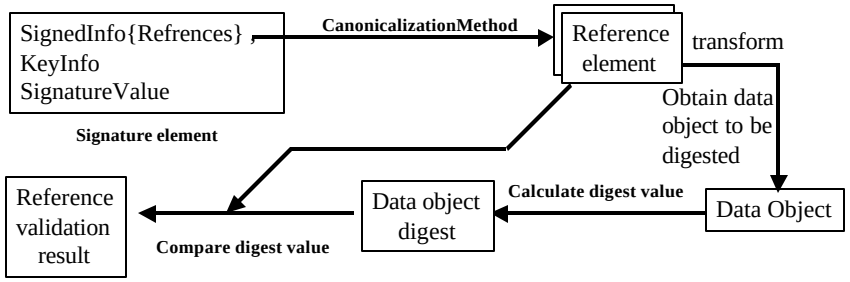
a) **Reference Generation**
b) **Signature Generation**



Signature Process: Core Validation

2.Core Validation

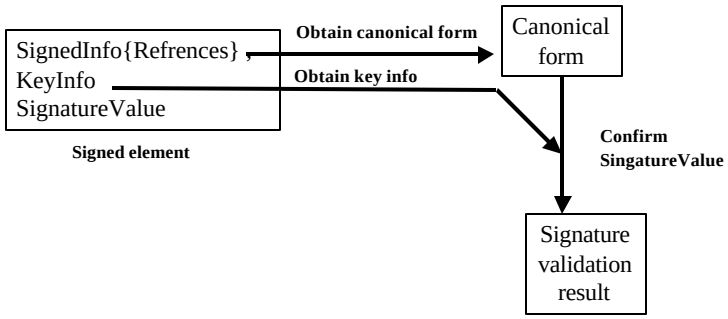
a) **Reference Validation: The verification of the digest contained in each Reference in SignedInfo**
b) **Signature Validation**



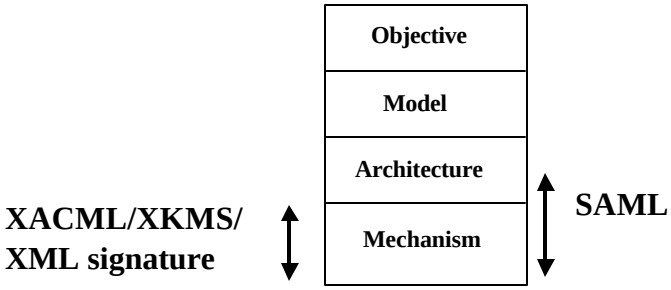
Topics of the Presentation

2.Core Validation

a) **Reference Validation**
b) **Signature Validation: Cryptographic signature validation of the signature calculated over SignedInfo**



XML security protocols and Framework for Security Engineering



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3. A Technical Introduction to XML by Norman Walsh (http://nwalsh.com/docs/articles/xml/)
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