z/TPF V1.1

TPF Users Group - Fall 2009
Data Confidentiality for Web Services (WS-Security on z/TPF)

Direction

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Agenda

- **Brief introduction to WS-Security and XML Encryption**
- **Overview of existing SOAP support**
- **Planned data confidentiality support for Web Services on z/TPF**
- **Questions**

Web services security (WS-Security)

- **WS-Security is made up of a collection of specifications:**
  - WS-Security Core Specification 1.1 (link)
  - Username Token Profile 1.1 (link)
  - X.509 Token Profile 1.1 (link)
  - SAML Token Profile 1.1 (link)
  - Kerberos Token Profile 1.1 (link)
  - Rights Expression Language (REL) Token Profile 1.1 (link)
  - SOAP with Attachments (SwA) Profile 1.1 (link)
- **WS-Security also builds upon other specifications:**
  - XML encryption (XMLENC) (link)
  - XML digital signatures (XMLDSIG) (link)
  - Canonical XML Version 1.0 (XMLC14N) (link)
  - Exclusive XML Canonicalization Version 1.0 (EXCC14N) (link)
- **Web Services Interoperability Organization (WS-I) clarifies WS-Security:**
  - Basic Security Profile 1.0 (link)

XML encryption

- **Open standard developed by the World Wide Web Consortium (W3C)**
- **Standard specifies the following:**
  - Steps to encrypt data
  - Steps to decrypt encrypted data
  - Syntax to represent XML encrypted data, the information used to decrypt the data, and a list of encryption algorithms supported
- **Data being encrypted/decrypted in an XML document may be either:**
  - Arbitrary data (including an entire XML document)
  - An XML element (including child elements if any)
  - XML element content (which may be character data, or all child elements)
- **Result of encrypting data is an <EncryptedData> element which contains (via one of its children's content) or identifies (via a URI reference) the cipher data**
  - When encrypting an XML element or element content the <EncryptedData> element replaces the element or content in the encrypted version of the XML document
  - When encrypting arbitrary data (including entire XML documents), the <EncryptedData> element may become the root of a new XML document or become a child element in an application-chosen XML document

WS-Security usage of XML encryption standard

- **WS-Security Core Specification (WSSE) allows for encryption of any combination of body blocks, header blocks, and any of these sub-structures**
- **WS-Security defines a `<wsse:Security>` header block where all security related information should be inserted, including information about message encryption**
  - When a producer or active-intermediary encrypts portion(s) of a SOAP message it must prepend a sub-element to the `<wsse:Security>` header block
  - The sub-element MUST contain the information necessary for the recipient to identify the portions of the message that it is able to decrypt
- **WS-Security also defines a new element called `<wsse11:EncryptedHeader>` for containing encrypted header blocks (similar to `<EncryptedData>` element of XMLENC)**

Identifying encrypted data in SOAP messages

- **<ReferenceList> element usage in <wsse:Security> header block**
  - May be used to create a manifest of encrypted portions within the SOAP envelope
  - All <EncryptedData> elements created should be listed in <DataReference> elements inside one or more <ReferenceList> elements

```
<S11:Envelope xmlns:S11="..."
  xmlns:wsse="...
      xmlns:wsu="..." xmlns:ds="..."
  xmlns:xenc="...">
  <S11:Header>
     <wsse:Security>
        <xenc:ReferenceList>
           <xenc:DataReference
                 URI="#bodyID"/>
        </xenc:ReferenceList>
     </wsse:Security>
  </S11:Header>
  <S11:Body>
     <xenc:EncryptedData Id="bodyID">
        <ds:KeyInfo>
           <ds:KeyName>
           CN=Hiroshi Maruyama,C=JP
           </ds:KeyName>
        </ds:KeyInfo>
        <xenc:CipherData>
           <xenc:CipherValue>
           ...
           </xenc:CipherValue>
        </xenc:CipherData>
     </xenc:EncryptedData>
  </S11:Body>

</S11:Envelope>
```

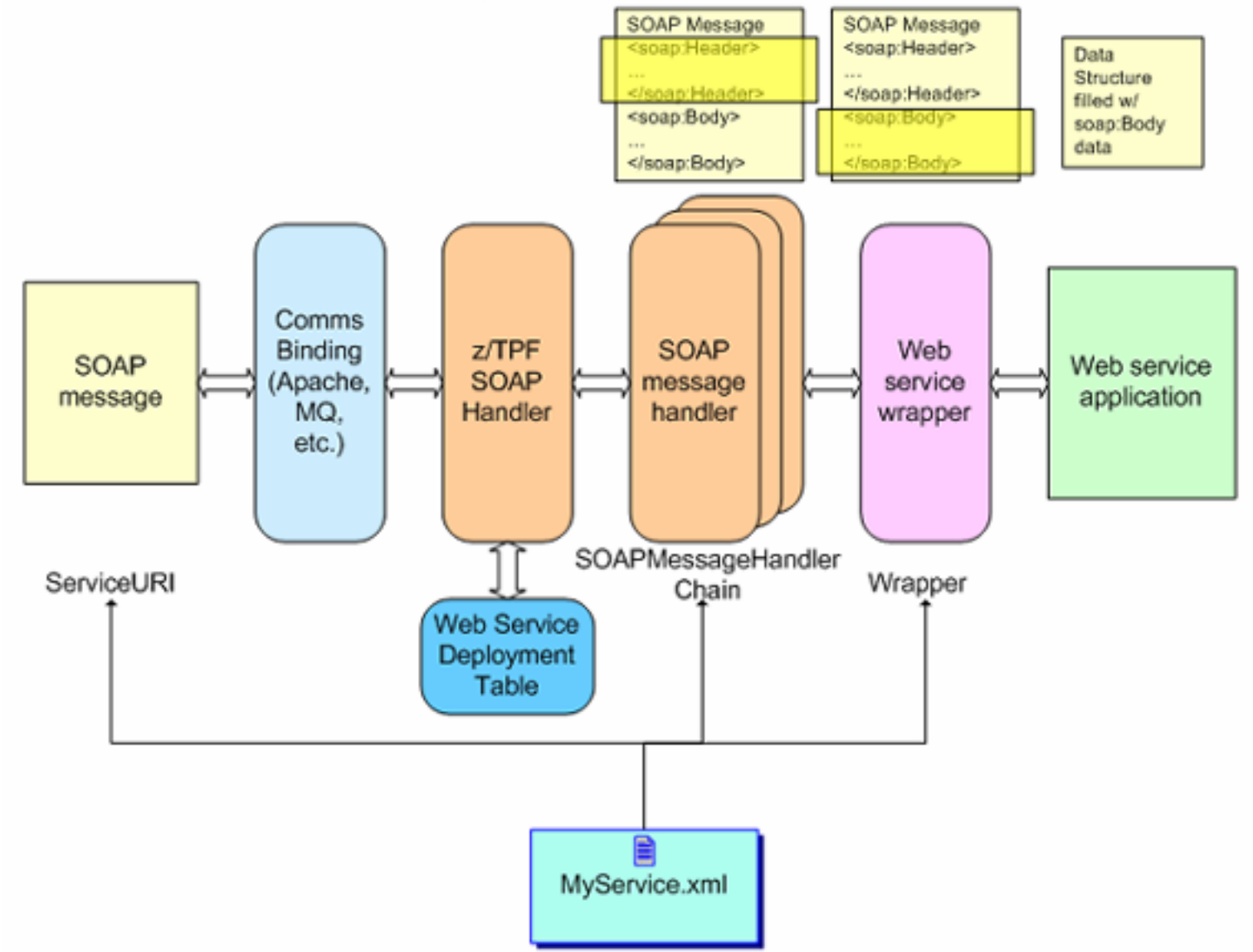
Identifying symmetric keys in SOAP messages

- **Use either a 'common' key (i.e., reference a key by name) or encrypt the key itself in the SOAP message**
- **Encrypted keys are carried in the `<EncryptedKey>` element**
  - This element may also contain a `<ReferenceList>` that identifies the portions of the message that are encrypted with this key
  - `<ReferenceList>` can occur outside of this element, as long as the `<EncryptedData>` in question has a `<KeyInfo>` element that references this key

Additional information about encryption with SOAP

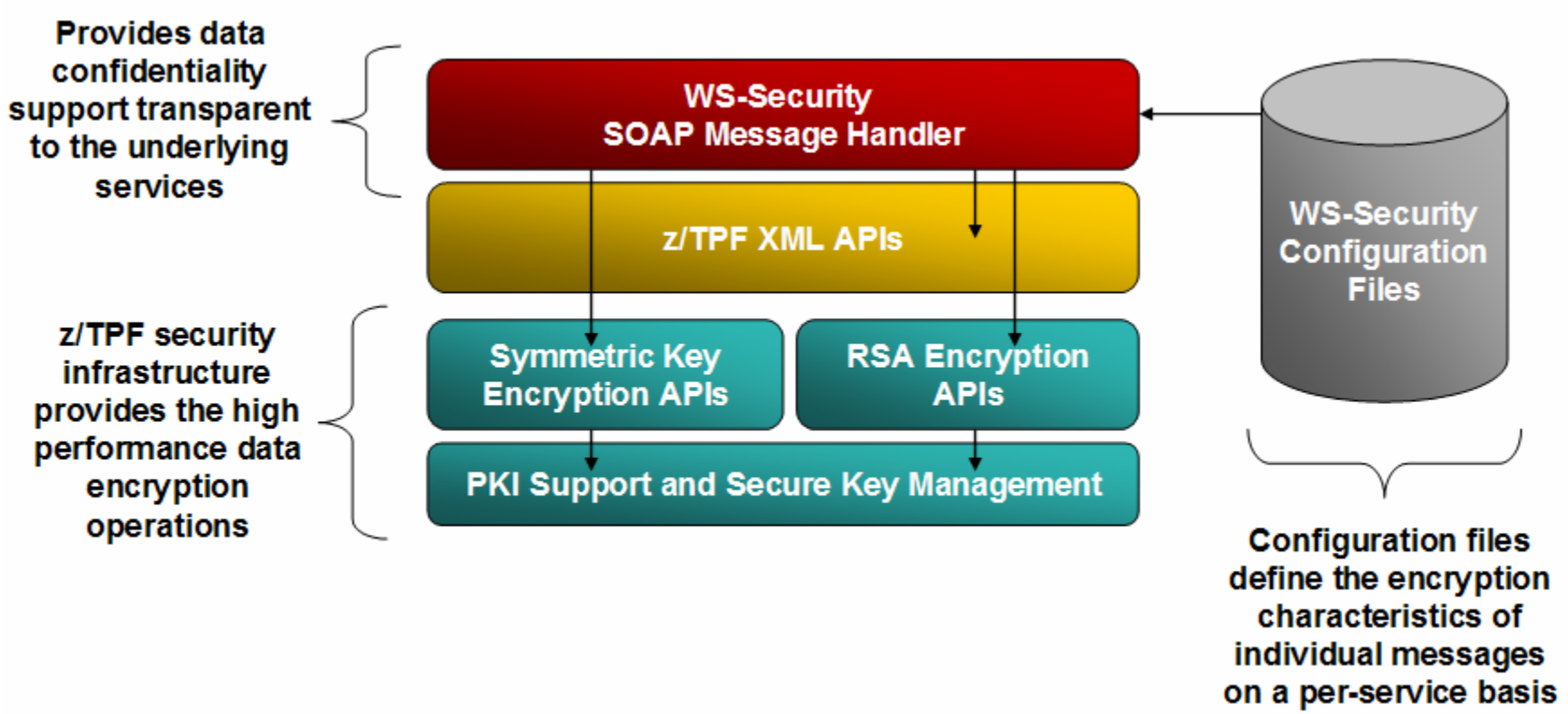
- **<Envelope>, <Header>, and <Body> elements must not be encrypted, although child elements may be encrypted**
- **Multiple steps of encryption may be added in a single <wsse:Security> header block if they are targeted for the same recipient**

Overview of existing SOAP support



WS-Security SOAP message handler for z/TPF

Direction



Planned Data Confidentiality Support for Web Services
Direction

- **Protected sensitive data**
  - Non-displayable storage for all decrypted information
  - Mechanism to specify sensitive data fields in unencrypted SOAP message
- **Field-level encryption configuration**
- **Super-encryption support**
  - Encrypting encrypted data
- **TPF Toolkit support**
  - Deployment descriptor updates
  - Configuration file wizard

Planned Data Confidentiality Support for Web Services - keys
Direction

- **Shared symmetric keys** — **work in progress**
- **Session-level key wrapping** — **future work**
- **Session-level key transport** — **future work**
- **User-specified keys** — **future work**
- **Key types:**
  - AES-128-CBC
  - AES-256-CBC
  - TDES
  - RSA v1.5

Data Confidentiality Support for Web Services – configuration

Direction

- **Inflow**
  - Which encrypted fields must be present in the request
- **Outflow and Faultflow**
  - Which fields need to be encrypted
    - Identified by a subset of XPath
  - Which keys need to be used
    - z/TPF keystore
    - Generated for the session
    - Specified in user exit
  - How keys are transported
    - Common alias specified in the message
    - Encrypted using shared symmetric key or public key and sent as part of the message

Data Confidentiality Support for Web Services – configuration (cont)

Direction

- **How to match keys used on both sides?**
  - Key alias on z/TPF
    - New Z-command
    - Actual key name in z/TPF keystore depends on the key alias AND the destination
    - Alternatively, use user exit to map alias to the key
  - Away from z/TPF
    - Maintain a mapping between actual key names and key aliases specified in SOAP messages
      - Similar to existing SOAP engines, like Apache Axis2

Data Confidentiality Support for Web Services on z/TPF – how to enable this support?

Direction

- **Changes to existing applications**
  - NONE
- **Deploy WS-Security SOAP message handler**
- **For each Web service that requires WS-Security**
  - Create an configuration file with encryption parameters
  - Add WS-Security to SOAP message handler chain and specify the configuration file name
  - Redeploy the service

Questions? Comments?

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