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CICS Web Service Security

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CICS Development

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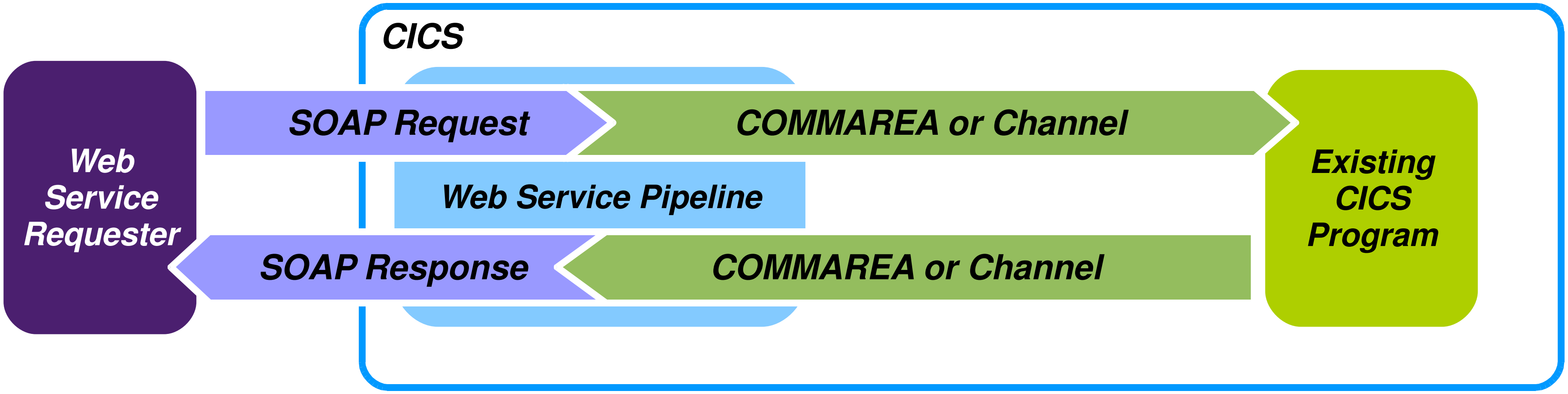
Agenda

- CICS Web Service Support Overview
- Security Basics and Terminology
- Pipeline Security Overview
- Identity
- Encryption
- Signature
- DataPower
- Identity Propagation

CICS Web Service Support Overview

CICS as a Web Service Provider



CICS

Web Service Requester

SOAP Request

COMMAREA or Channel

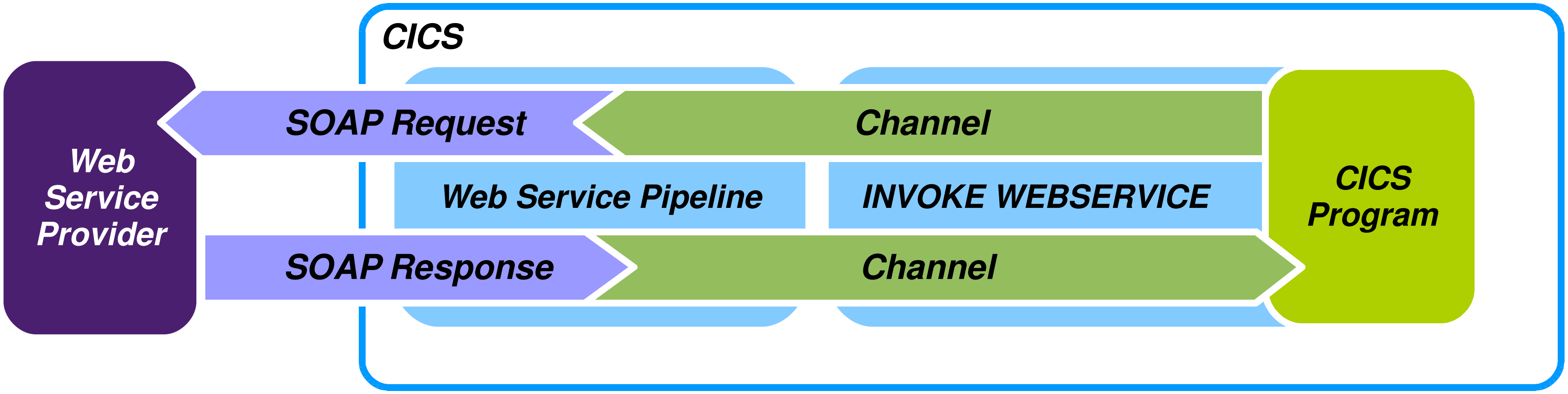
Web Service Pipeline

SOAP Response

COMMAREA or Channel

Existing CICS Program

CICS as a Web Service Requester



CICS

Web Service Provider

SOAP Request

Channel

Web Service Pipeline

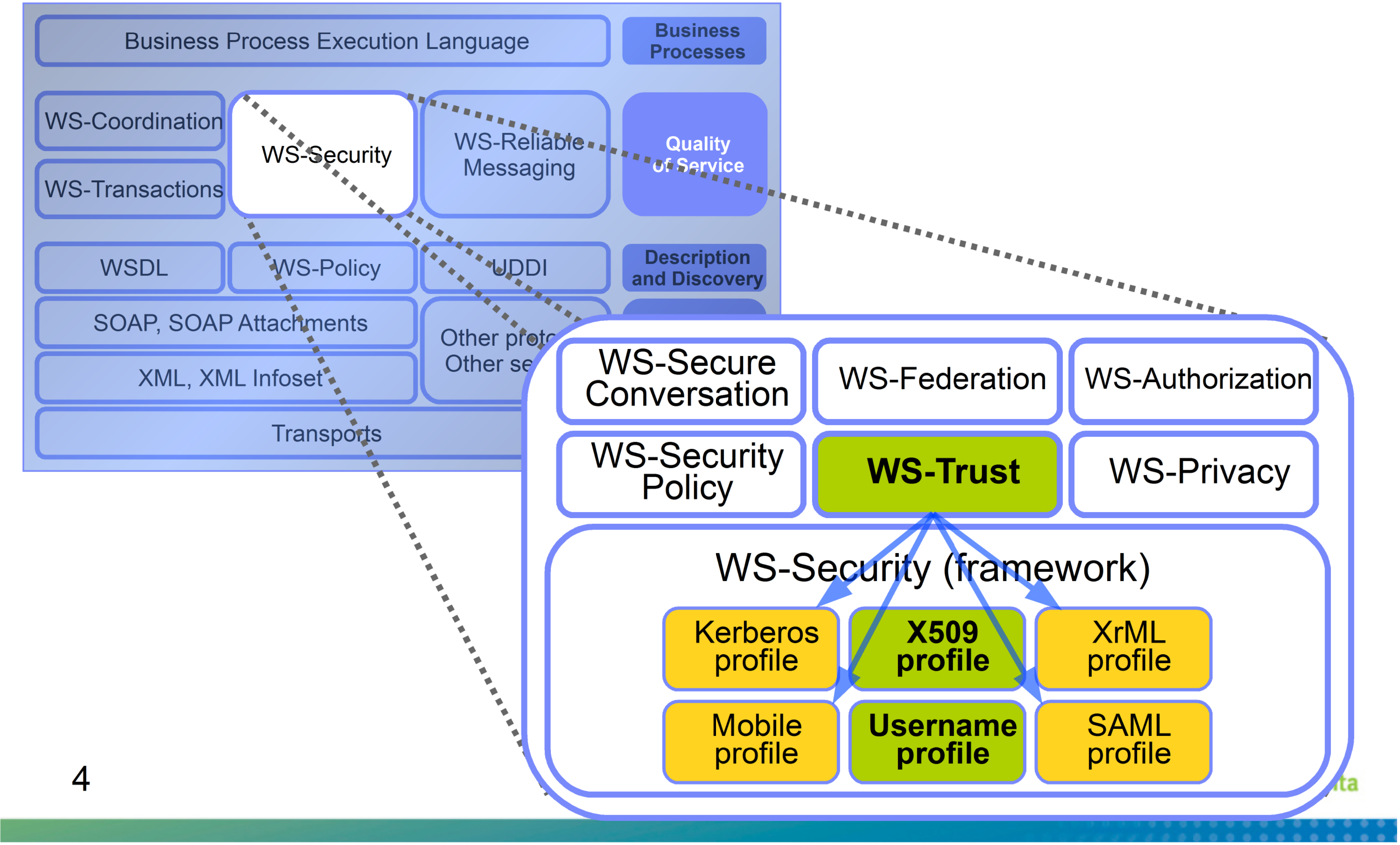
INVOKE WEBSERVICE

SOAP Response

Channel

CICS Program

CICS Web Service Security Support Overview



Security Basics and Terminology

- CICS Security is based of User ID
  - Command Level Security
  - Resource Level Security
  - etc.

- The various options for securing Web Services in CICS are aimed at addressing three common needs:
  - Identity
  - Confidentiality
  - Integrity

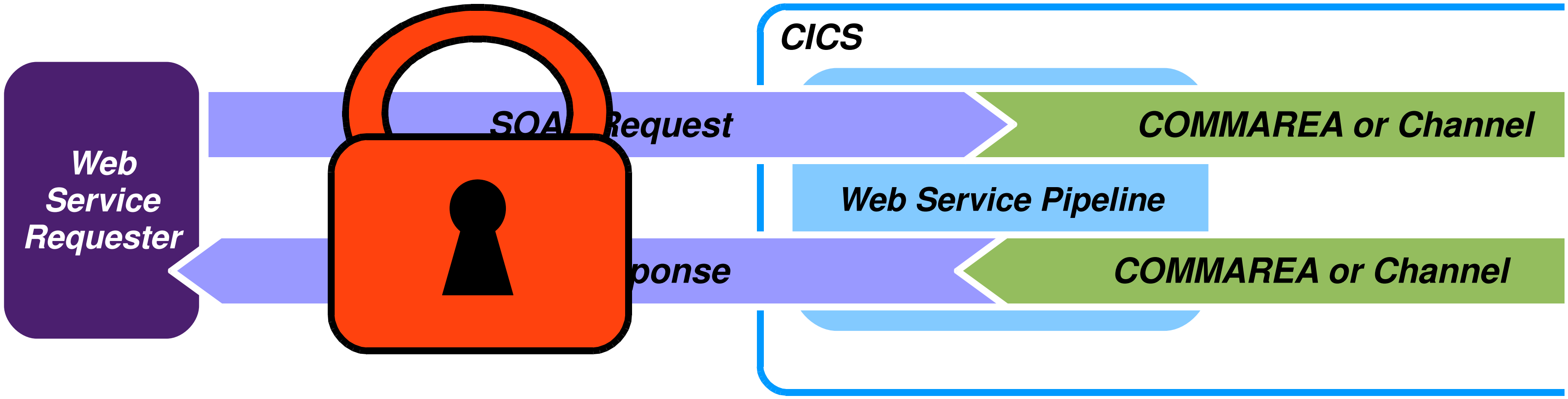
Identity

- As a Web Service Provider:
  - Need to know who the requester is so that we know what User ID we should run the business logic under so that CICS Security is maintained
  - Authentication – Need to prove that the requester is who they say they are.

- As a Web Service Requester:
  - Need to know what credentials we should provide to the Web Service Provider

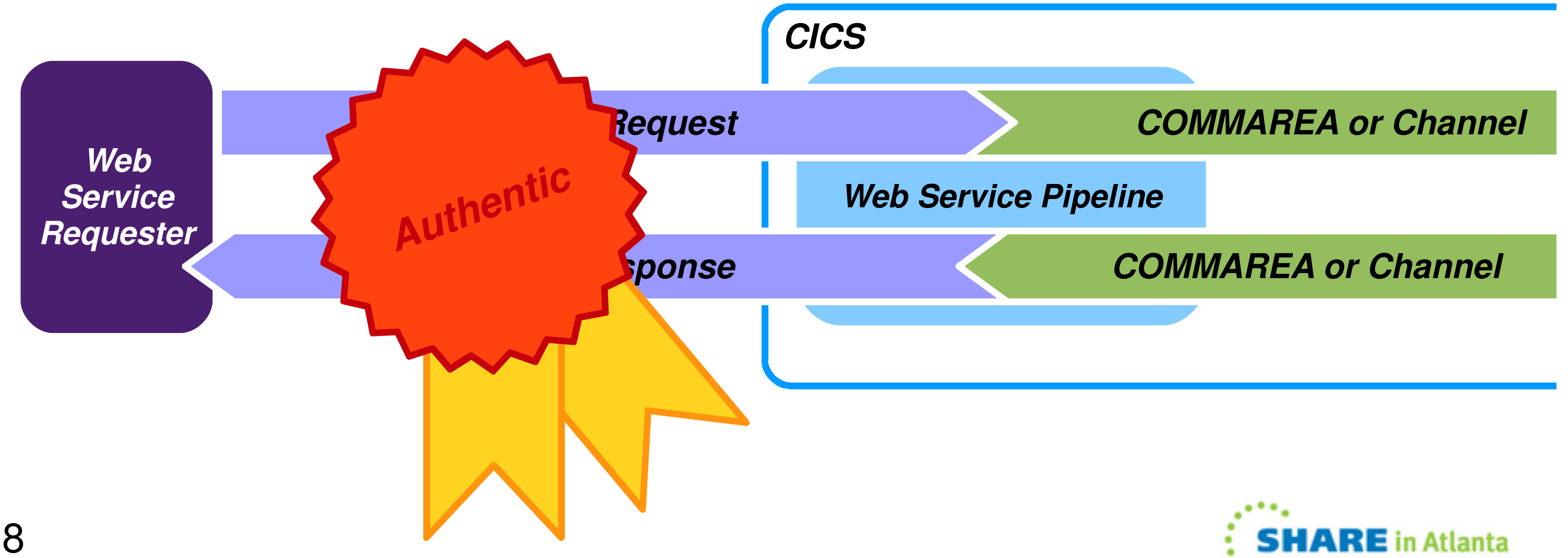
Confidentiality

- Web Services allow data in COMMAREAs or Channels to travel outside of CICS via SOAP Messages
- Need to ensure that the data in our SOAP messages can only be read by the intended recipient



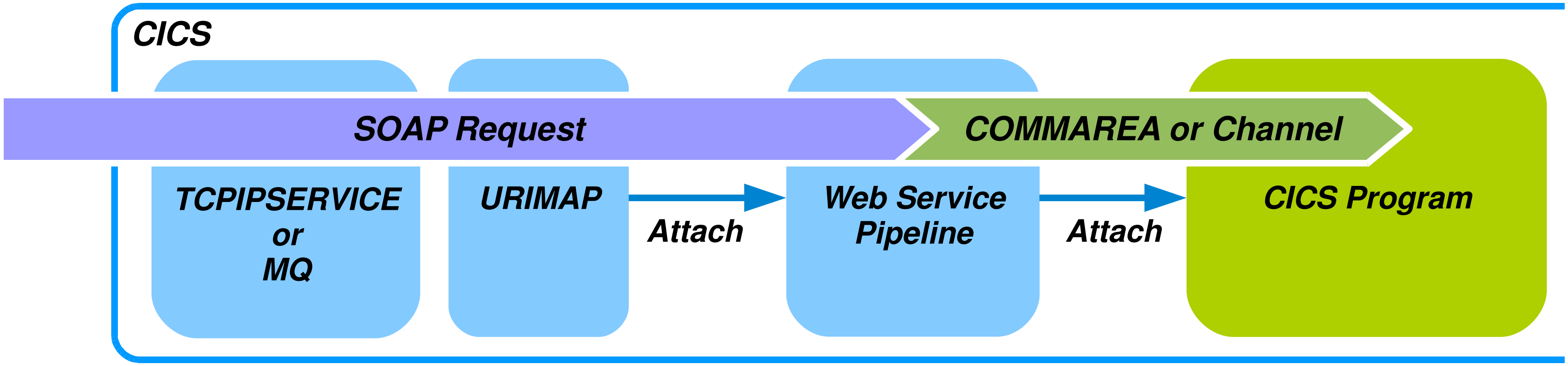
Integrity

- Web Services allow instructions to business logic to travel outside of CICS via SOAP messages
- Need to ensure that the data in our SOAP messages cannot be tampered with without us knowing

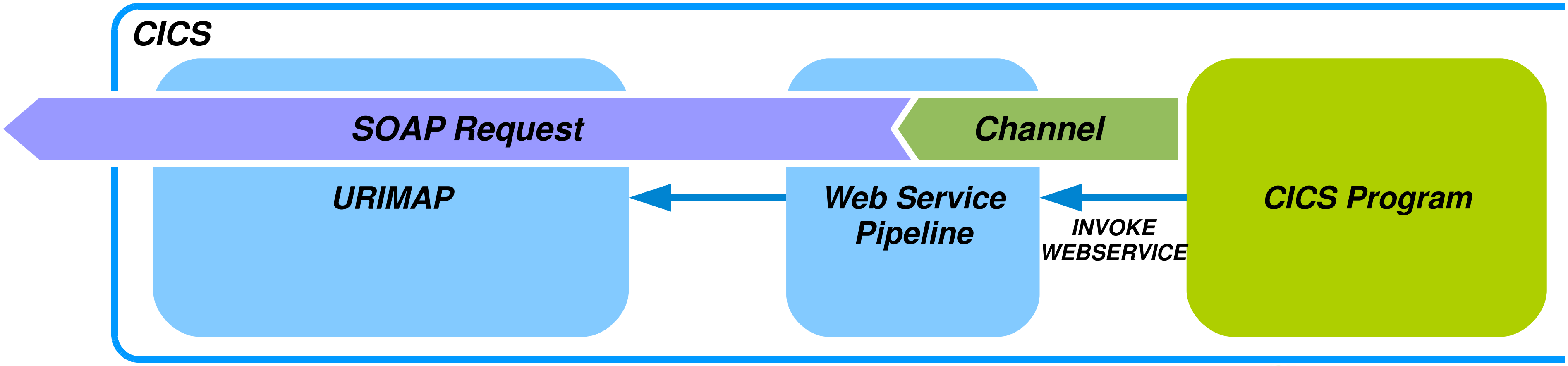


Pipeline Security Overview

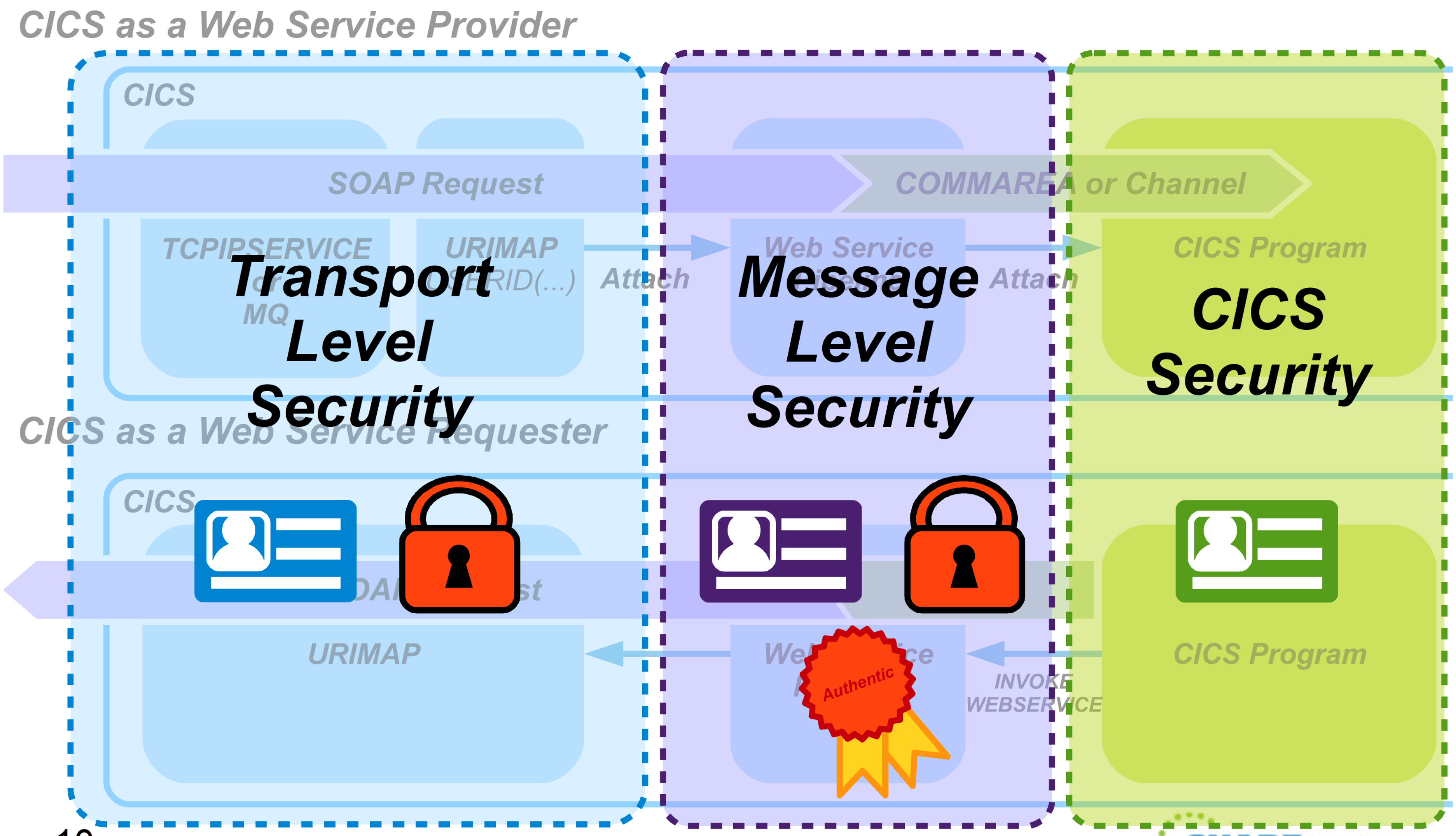
CICS as a Web Service Provider



CICS as a Web Service Requester



Pipeline Security Overview



CICS as a Web Service Provider

CICS

SOAP Request

COMMAREA or Channel

TCPIPSERVICE or MQ

URIMAP USERID(...)

Attach

Web Service Pipeline

Attach

CICS Program

CICS as a Web Service Requester

CICS

SOAP Request

URIMAP

Web Service Pipeline

INVOKE WEBSERVICE

CICS Program

Transport Level Security

Message Level Security

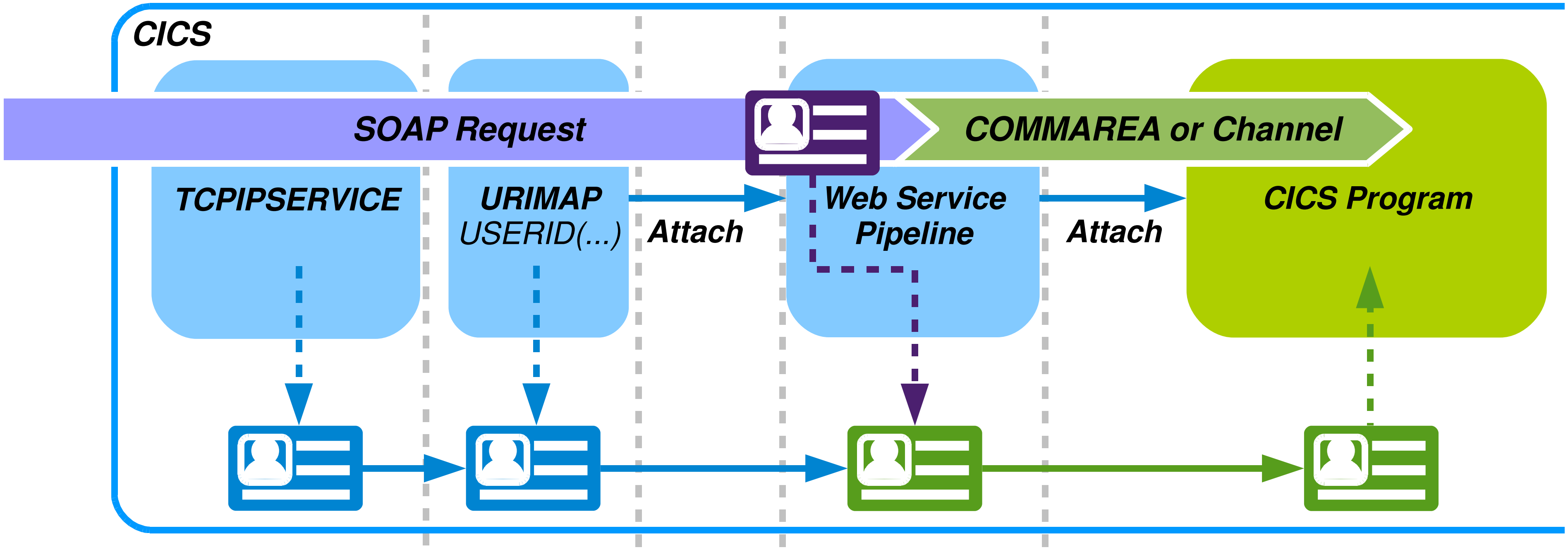
CICS Security

Identity

Identity Overview

“Where we get the User ID from…”

CICS as a Web Service Provider



CICS

SOAP Request

COMMAREA or Channel

TCPIPSERVICE

URIMAP
USERID(...)

Attach

Web Service Pipeline

Attach

CICS Program

Determine User ID from HTTP Basic Authentication
or
SSL Certificate

(CICS Default user if neither is present)

If User ID is still CICS Default then override this with USERID(...) on URIMAP if present

Attach CPIH with the User ID (Context Switch)

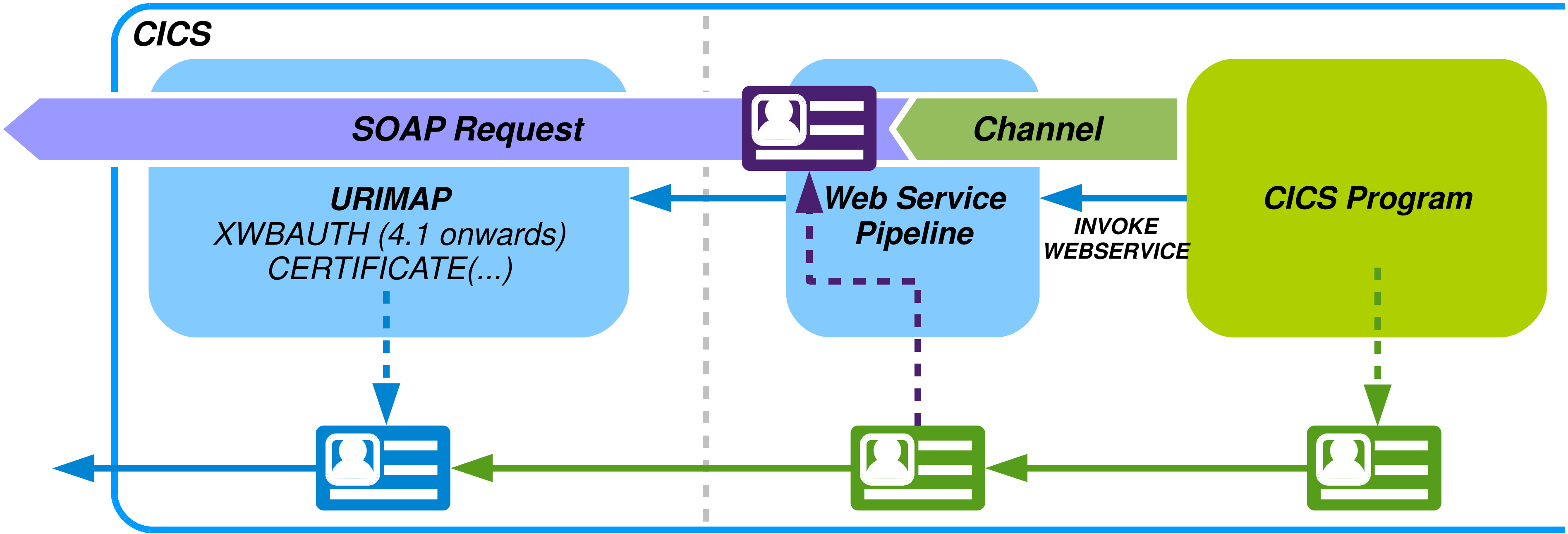
Security handler determines User ID from credentials in the SOAP header

Perform an Attach using the User ID in the DFHWS-USERID container if the User ID was updated during pipeline processing (Context Switch)

Identity Overview

"What credentials to send..."

CICS as a Web Service Requester



For CICS TS V4.1 and above, the XWBAUTH user exit is called to determine username and password for basic authentication credentials given the current CICS User ID and the URI that is being access

Can also use the CERTIFICATE(...) attribute if using SSL

Security handler determines Identity Credentials from Pipeline Configuration and adds them to the header of the SOAP message.

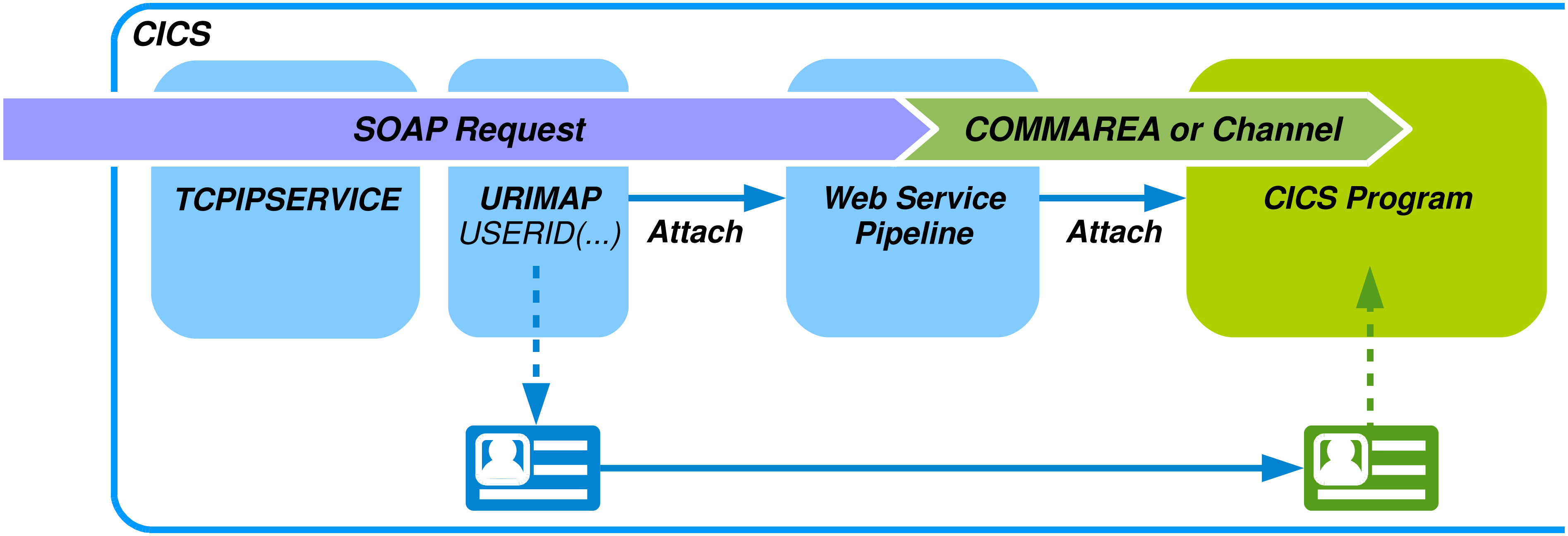
This may or may not be dependant on the current CICS User ID

Identity Scenarios

- Identity assigned on a per service basis
- Identity assigned on a per requester basis (basic)
- Identity assigned on a per requester basis (advanced)
- Identity from external credentials
- Identity from X.509 certificates

Identity Per Service

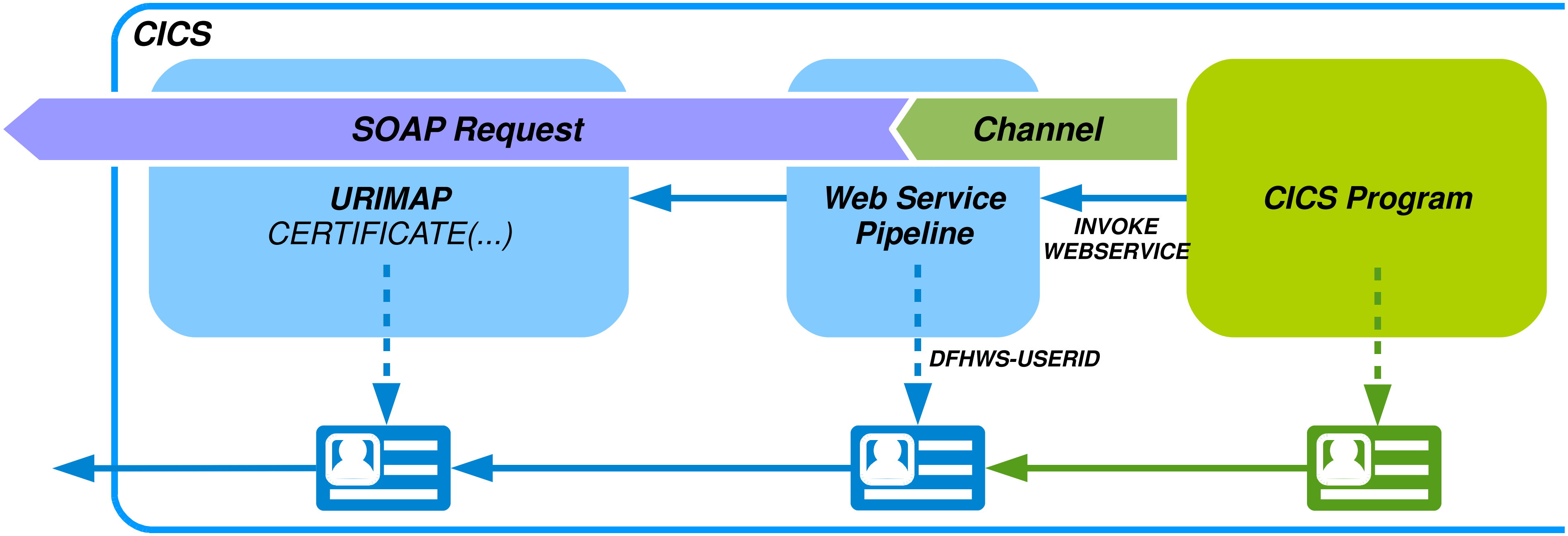
CICS as a Web Service Provider



- URIMAP can be used to assign a User ID for the pipeline task. If the User ID (or indeed Tran ID) can be derived directly from the URI of the Service this is the most efficient option.
- Custom handler could be used, per pipeline, but if this makes a static per pipeline decision then URIMAP is more efficient.

Identity Per Service

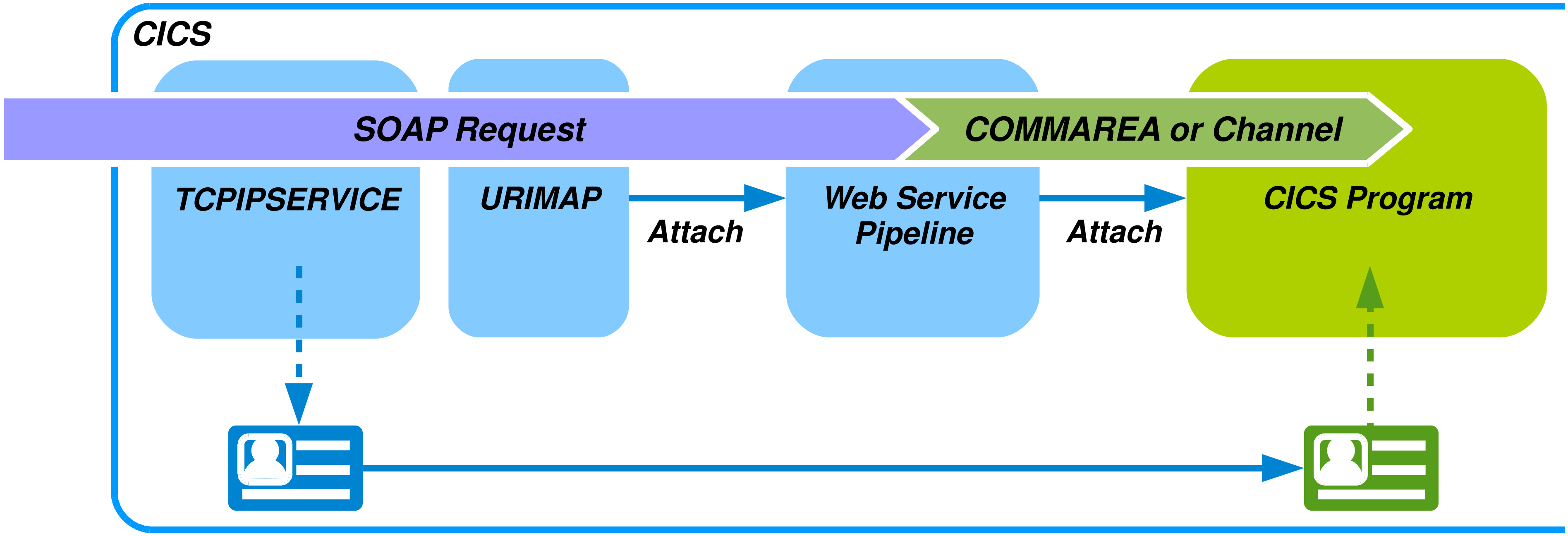
CICS as a Web Service Requester



- As of CICS TS V3.2 for HTTP a check will be made for a Client Mode URIMAP when making an outbound connection. The properties of this URIMAP will be used including Certificate and Ciphers if SSL.
- Can be achieved with a user handler that updates DFHWS-USERID

Identity Per Requester (basic)

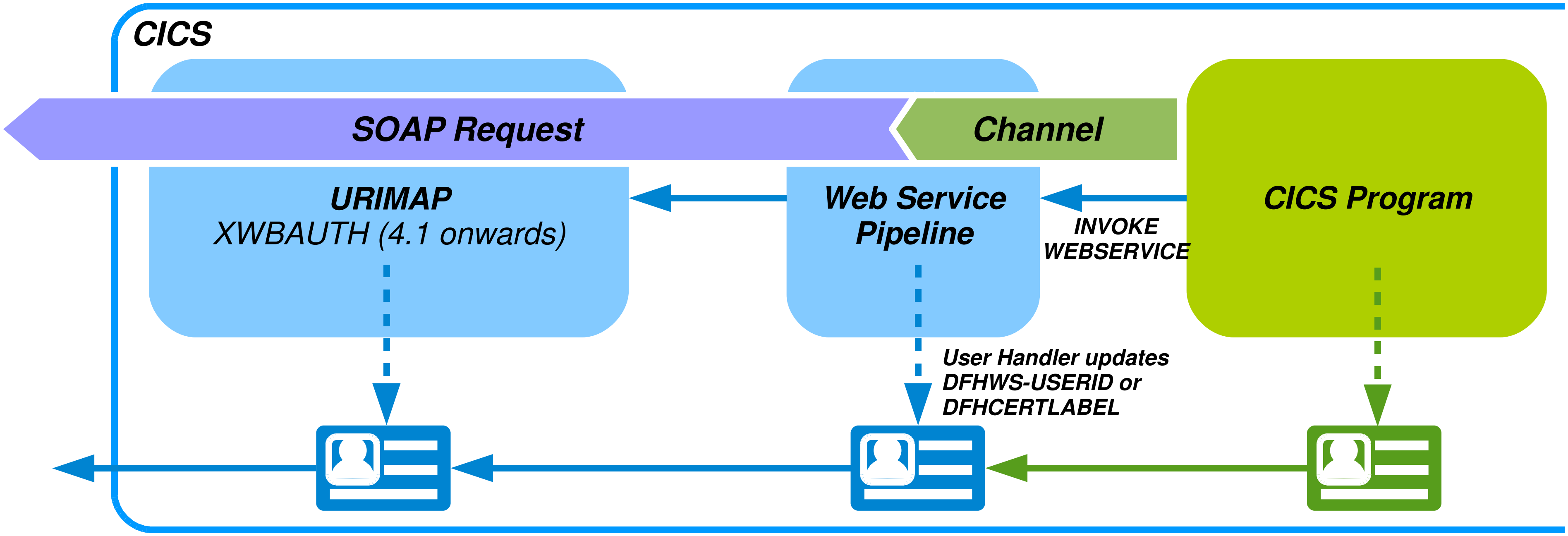
CICS as a Web Service Provider



- HTTP Basic Auth
- SSL Client Certificate Authentication
- Both configured on TCPIPService

Identity Per Requester (basic)

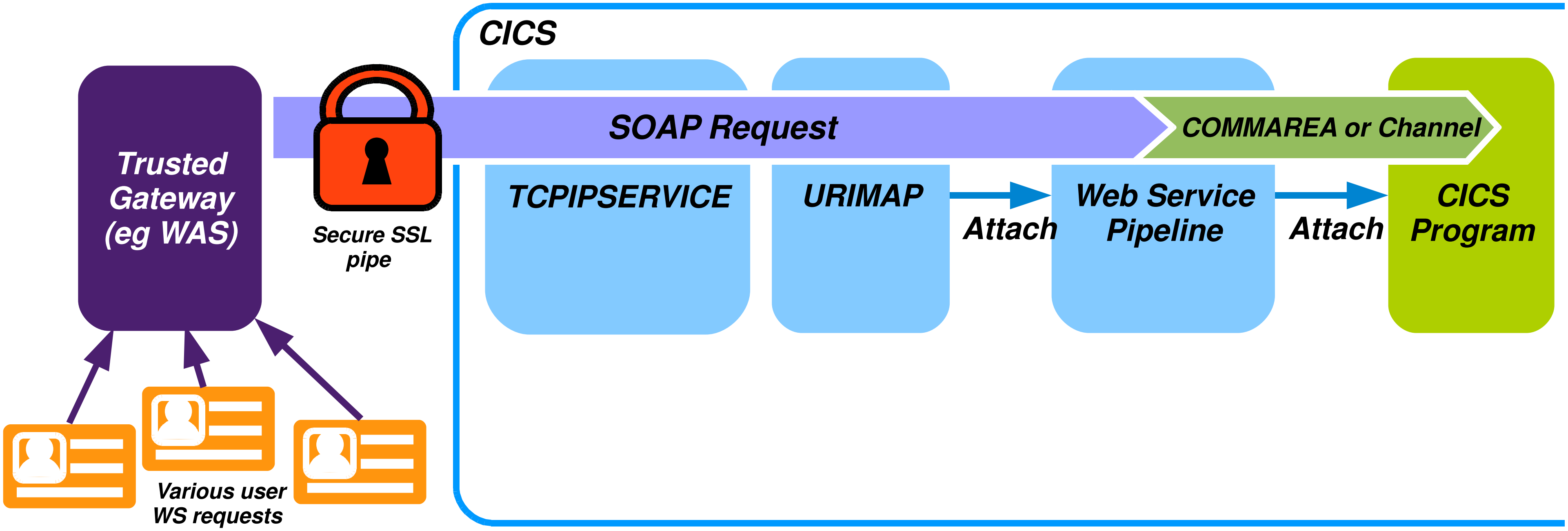
CICS as a Web Service Requester



- As of CICS TS V4.1 the XWBAUTH exit is called
- Can be achieved with a user handler

Identity Per Requester (advanced)

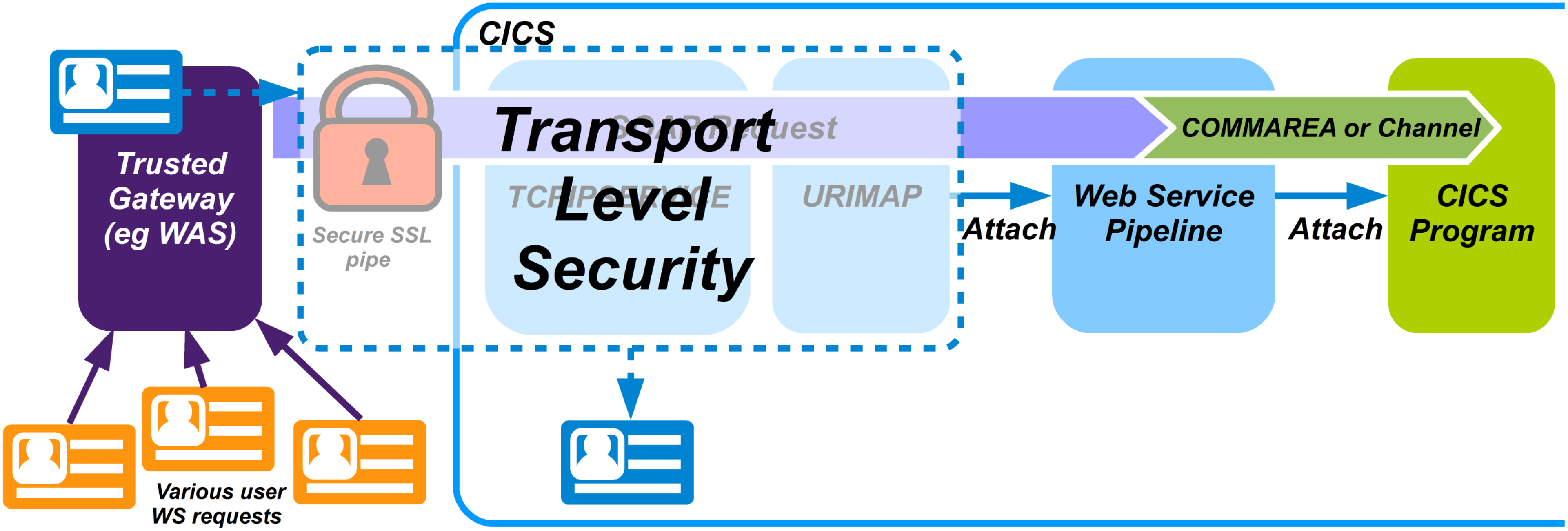
CICS as a Web Service Provider



- A typical pattern is to have a trusted gateway that sends Web Service requests into CICS on behalf of various users
- This means that users of a service only need security permissions to run the business logic (eg file/program access) but not to connect to CICS
- For this scenario you need CICS Web service security support

Identity Per Requester (advanced)

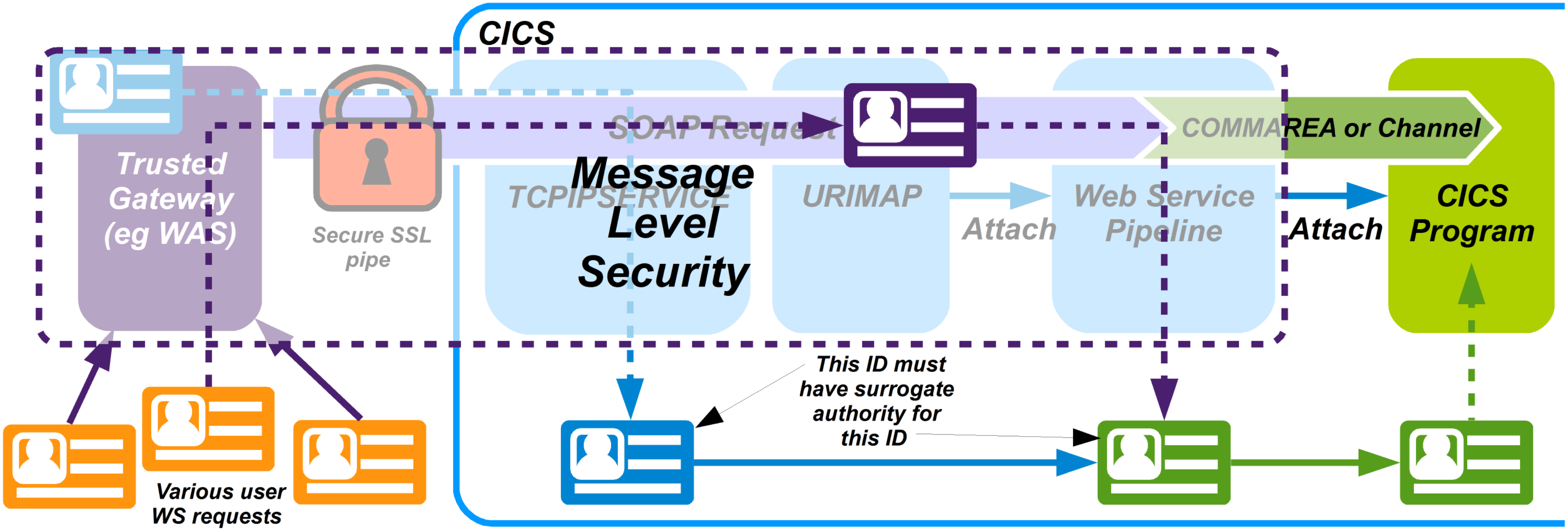
CICS as a Web Service Provider



- Transport level security is used to identify the trusted server
- So we cannot use this to identify the actual requester

Identity Per Requester (advanced)

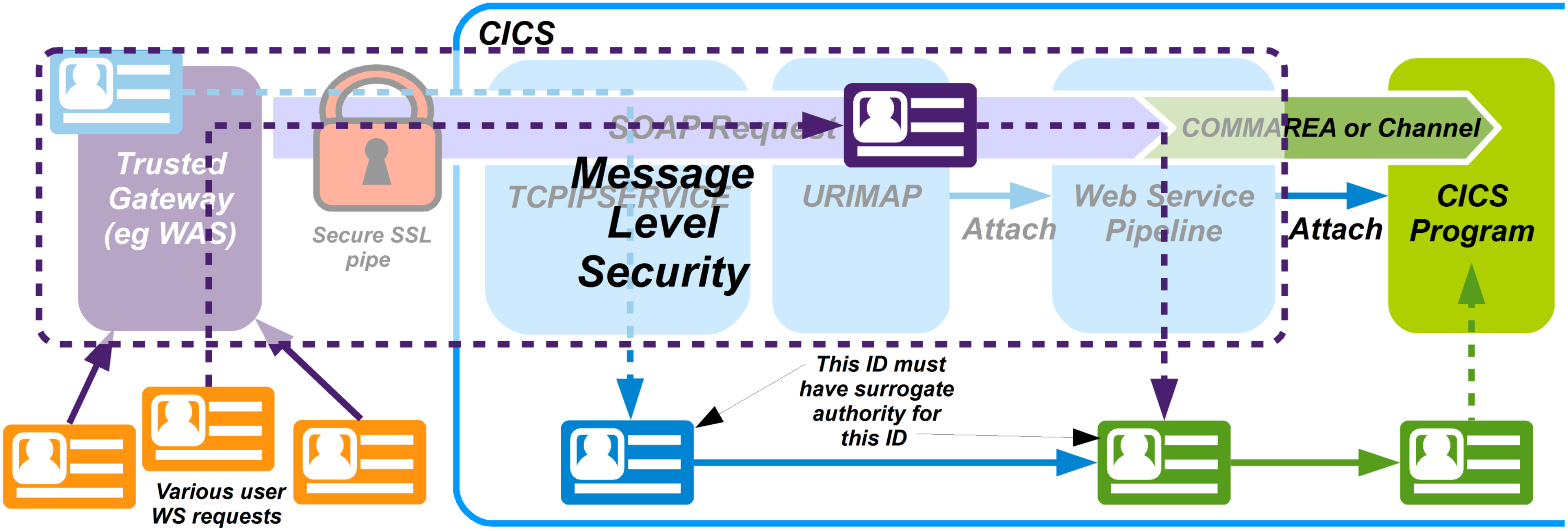
CICS as a Web Service Provider



- The Trusted Portal puts the credentials of the requester into the SOAP request header
- The Web Service Security handler extracts these credentials and assigns the appropriate CICS User ID
- NOTE: The Trusted Portal's ID must have surrogate authority for the requester's User ID

Identity Per Requester (advanced)

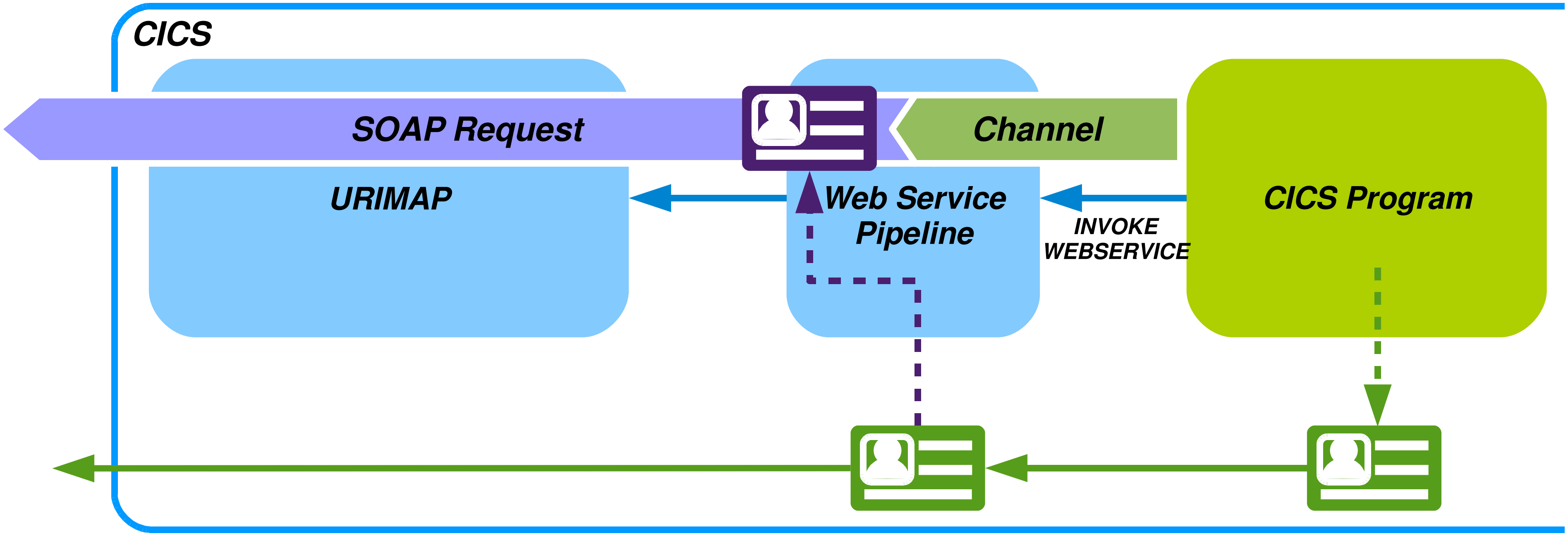
CICS as a Web Service Provider



- CICS supplied security handler
  - Simple case - CICS User ID in SOAP header
  - With password/passticket: Mode = Basic – Authenticate actual requester in CICS
  - Without password: Mode= Basic , Trust = Blind. - Authenticate actual requester in trusted portal
- Custom Handler can be used
  - Makes sense in CICS TS 3.1

Identity Per Requester (advanced)

CICS as a Web Service Requester



- CICS supplied security handler
  - Can add a User ID from DFHWS-USERID (defaults to task user id) into SOAP Header as a User ID without password
  - Mode= Basic , Trust = Blind.
- To add password WS-Trust or Custom handler would be needed
  - WS-Trust is used by configuring sts_authentication rather than native authentication in the pipeline configuration file

Example Pipeline Configuration

CICS User ID in SOAP Header

```
<wsse_handler>
  <dfhwsse_configuration version="1">
  <authentication mode="basic" trust="blind">
  </authentication>
  </dfhwsse_configuration>
</wsse_handler>
```

CICS User ID in WS Security header

Without password

Identity from External Credentials

- External Credentials are ones that cannot be handled natively by CICS
  - External user id / passwords
  - SAML, LPTA, Kerberos
  - Home grown etc.
- CICS as Requester and Provider
  - WS-Trust support to call and external Secure Token Service
  - Custom Handler

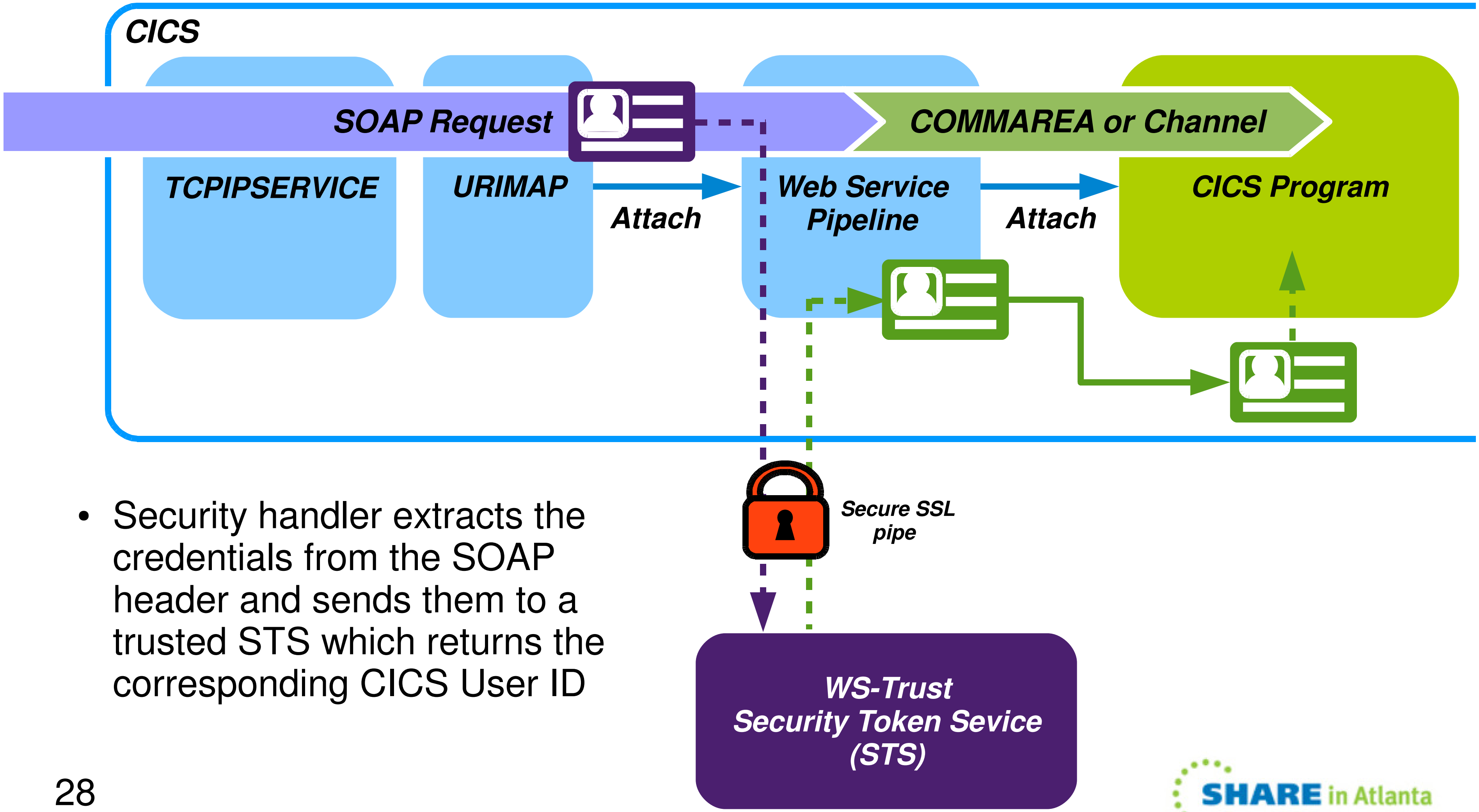
WS-Trust Specification

- WS-Trust
  - Published as specification 25 February 2005
  - Submitted to OASIS standardization process
  - Provides a framework for building trust relationships
    - Sender and Receiver in different security domains
    - Security tokens must be vouched for by trusted third party
    - Trusted third party is called the Security Token Service (STS)
  - WS-Trust defines standard protocols and standard WSDL interfaces to communicate with an STS

CICS Support of WS-Trust Options

- Interoperates with a Security Token Server
  - CICS supplied security handler
    - CICS as a Web Service provider
      - *Validate the security token in the WS-Security header*
      - *Exchange the security token in the WS-Security header*
    - CICS as a Web Service requester
      - *Exchange the security token to be used in the WS-Security header*
  - Custom interaction with an STS
    - *CICS Provides a Channel Linkable interface to allow user programs to easy call an STS, without understanding WS-Trust*
    - *Via DFHPIRT*
    - *CICS Builds and parsers the WS-Trust messages to and from containers*

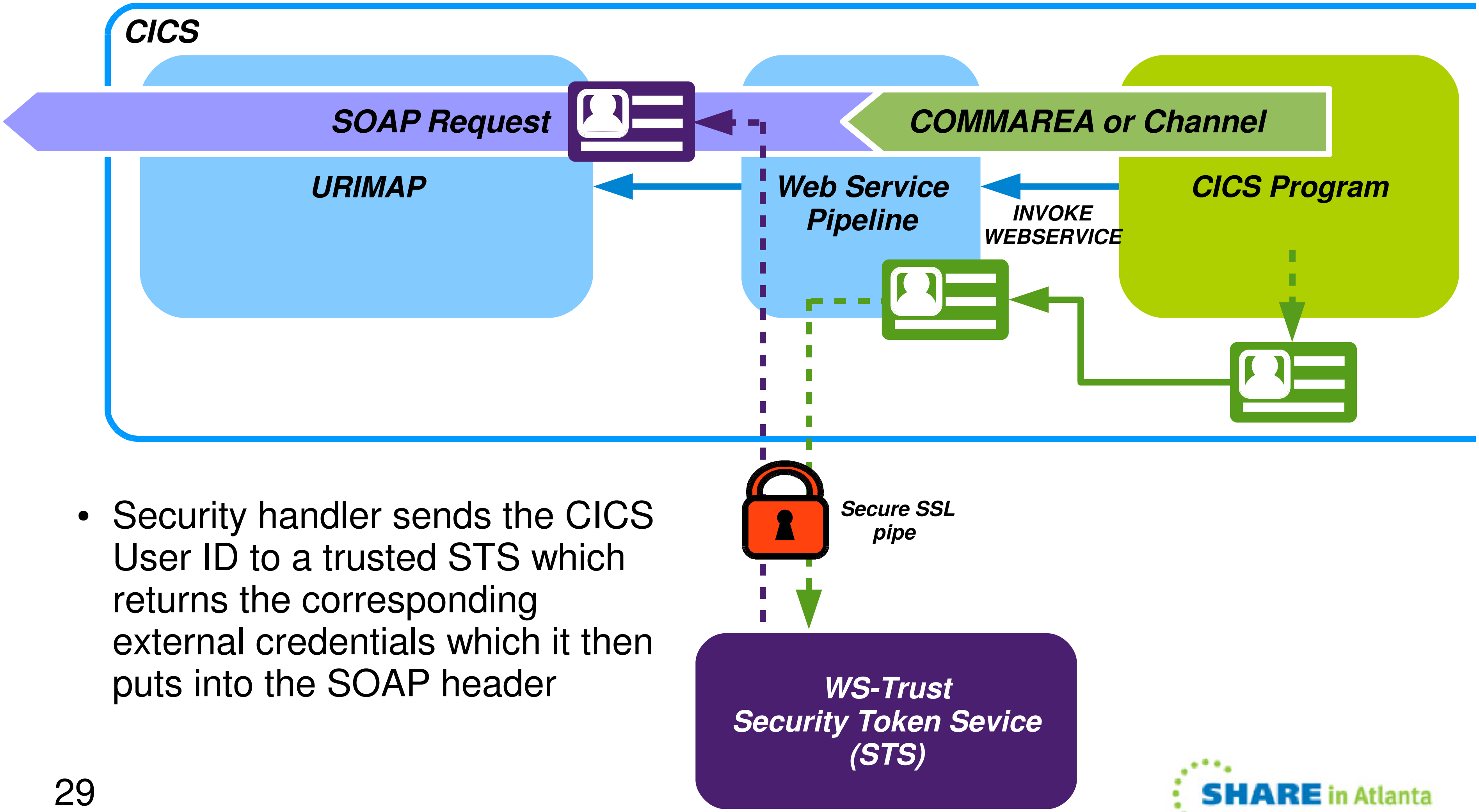
Identity from External Credentials
WS-Trust
CICS as a Web Service Provider



- Security handler extracts the credentials from the SOAP header and sends them to a trusted STS which returns the corresponding CICS User ID

Identity from External Credentials *WS-Trust*

CICS as a Web Service Requester



- Security handler sends the CICS User ID to a trusted STS which returns the corresponding external credentials which it then puts into the SOAP header

Example Pipeline Configuration

```
<wsse_handler>
  <dfhwsse_configuration version="1">
  <sts_authentication action="issue">
        <auth_token_type>
        <namespace>http://...</namespace>
        <element>MyToken</element>
        </auth_token_type>
  </sts_authentication>
  <sts_endpoint>
        <endpoint>https://...</endpoint>
  </sts_endpoint>
  </dfhwsse_configuration>
</wsse_handler>
```

Give us back the corresponding token

Namespace and tag name of the SOAP header that contains our security token

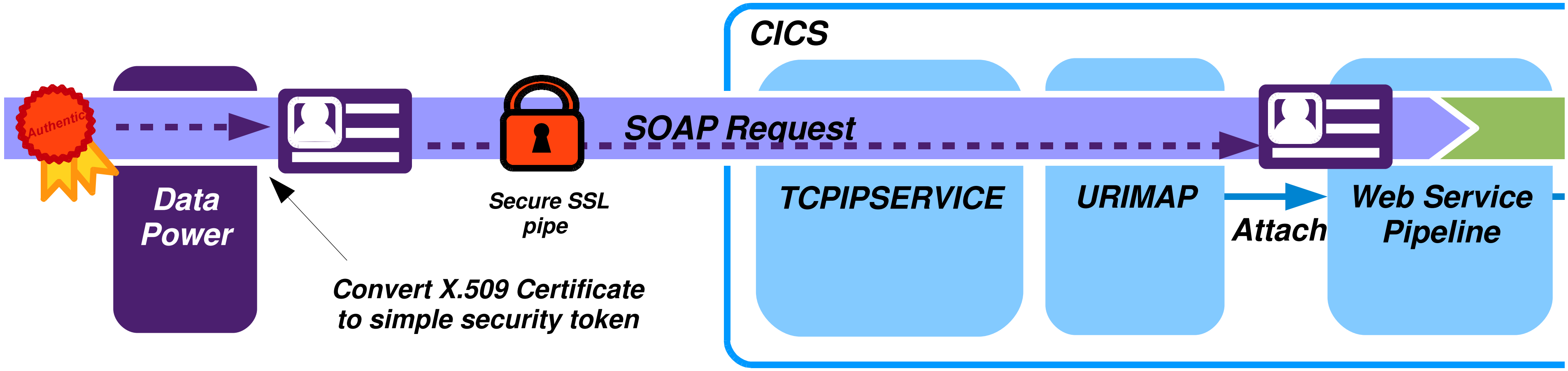
Location of our STS

Identity from X.509 Certificates

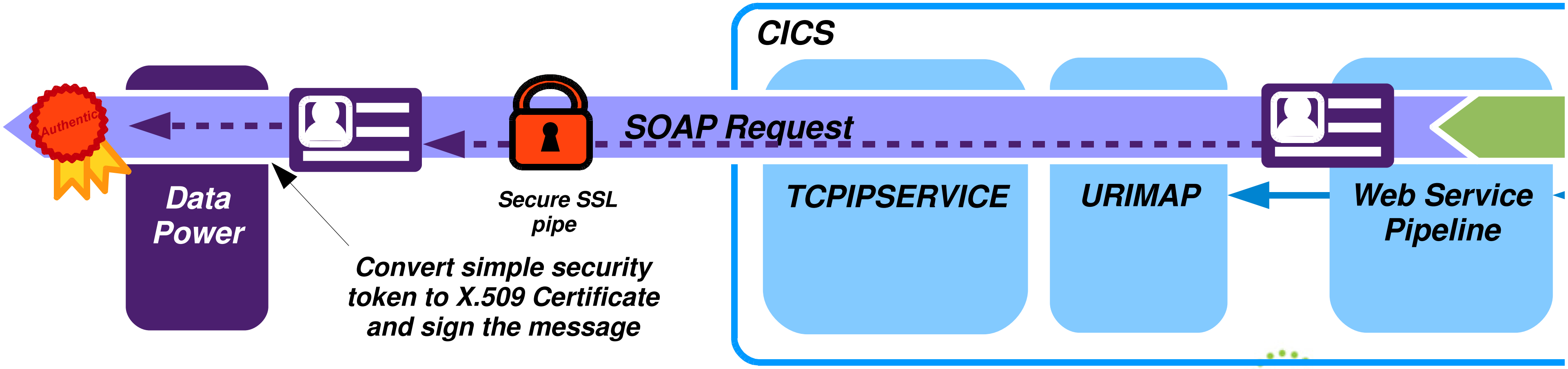
- Datapower
  - Transform to simple identity token in Data Power and use mode = basic, trust=blind
  - Optionally with SSL
- CICS Supplied security handler
  - Will use the Identity associated with the X.509 certificate used to sign the message body (i.e. Via RACF Keyring)
  - Very CPU heavy, so should only be used as a last resort or for low volume transactions

Identity from X.509 Certificates

CICS as a Web Service Provider with Data Power

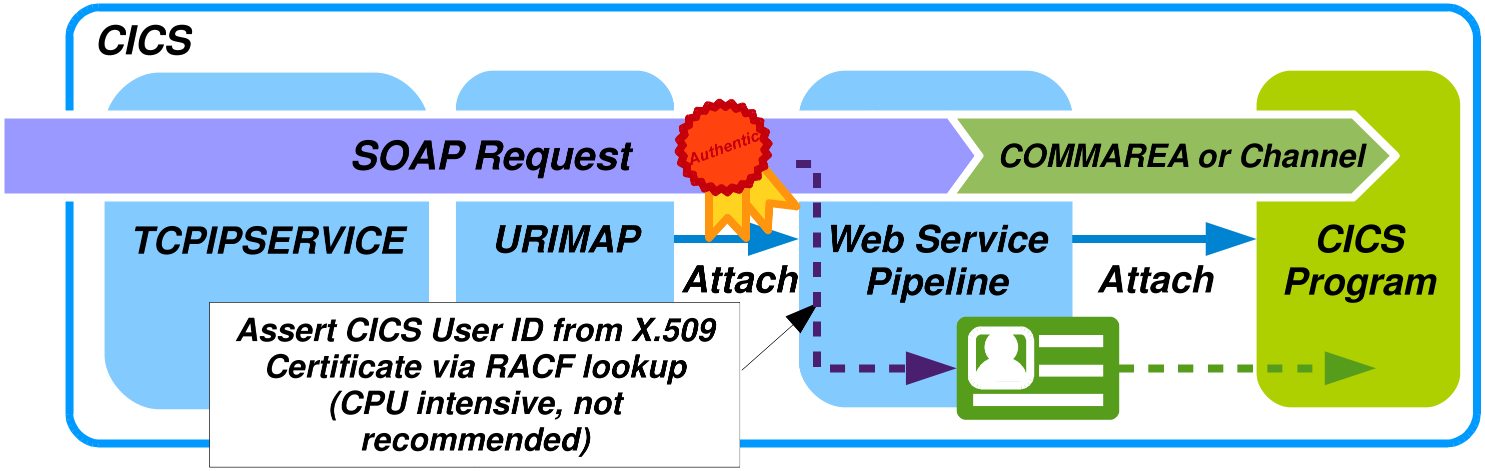


CICS as a Web Service Requester with Data Power



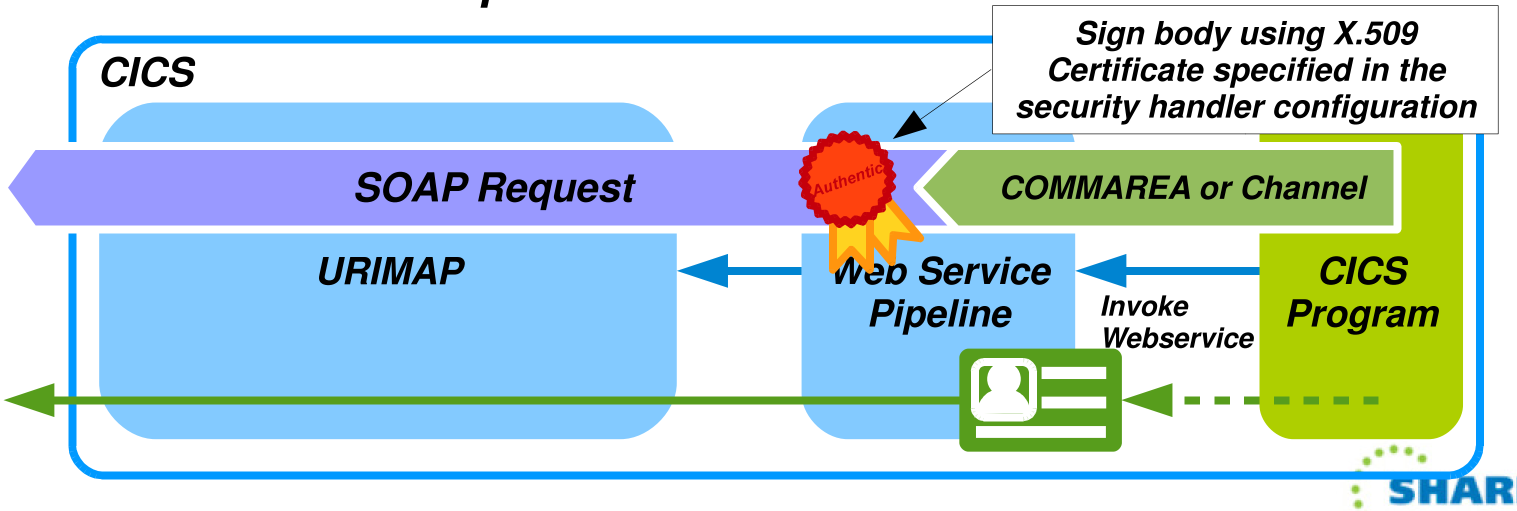
Identity from X.509 Certificates

CICS as a Web Service Provider without Data Power



Assert CICS User ID from X.509 Certificate via RACF lookup (CPU intensive, not recommended)

CICS as a Web Service Requester without Data Power



Sign body using X.509 Certificate specified in the security handler configuration

Example Pipeline Configuration

```
<wsse_handler>
  <dfhwsse_configuration version="1">
   <authentication mode="signature">

   <algorithm>
  http://www.w3.org/2000/09/xmldsig#dsa-sha1
   </algorithm>
   <certificate_label>
      MY_CERTIFCATE_LABEL
   </certificate_label>

   </authentication>
  </dfhwsse_configuration>
</wsse_handler>
```

Get Identity from the XML digital signature

For outbound:
The hashing algorithm to use to sign

For outbound:
The certificate to use to sign

More Advanced Identity Scenarios

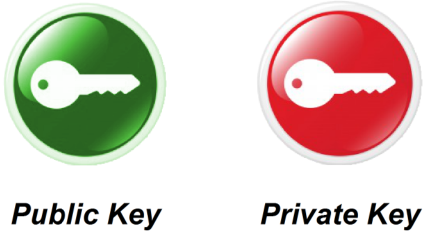
- Multiple Identity Tokens
  - Asserted Identity
  - CICS can natively handle X.509 and user name tokens
  - Trust = basic/blind/signature can be used to specify asserting (checked) ID.
  - Mode = basic/signature can be used to specify asserted (unchecked) ID.
  - Surrogate Security checks are use to ensure that the Asserting ID has authority to start work for target asserted user ID.

Encryption

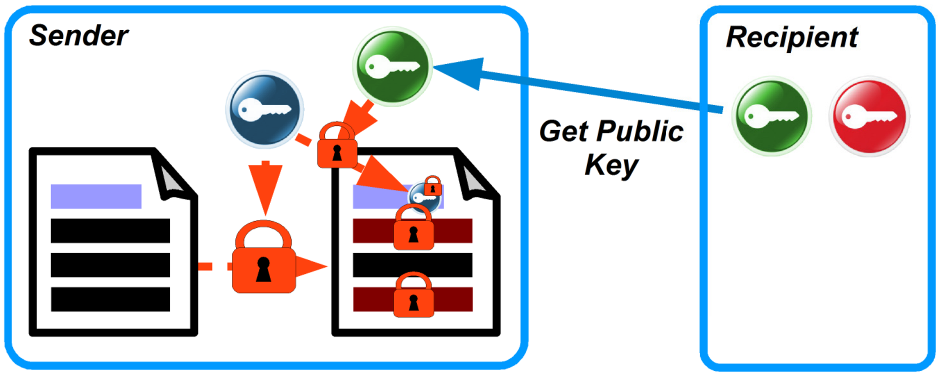
Encryption

- Data must be encrypted between Requester and Provider, provides Confidentiality
  - If calls are point to point then use transport encryption (SSL)
  - If service requires WS-Security XML Encryption then you can use DataPower
  - If WS-Security XML Encryption is required and DataPower is not available then the CICS supplied security handler can be used
    - *Can decrypt any elements in an inbound message*
    - *Can only encrypt the body on an outbound message*

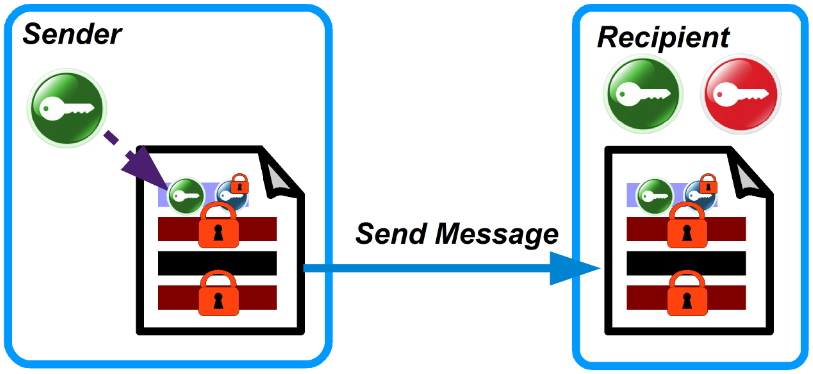
Encryption
XML Encryption with a Public/Private Key pair



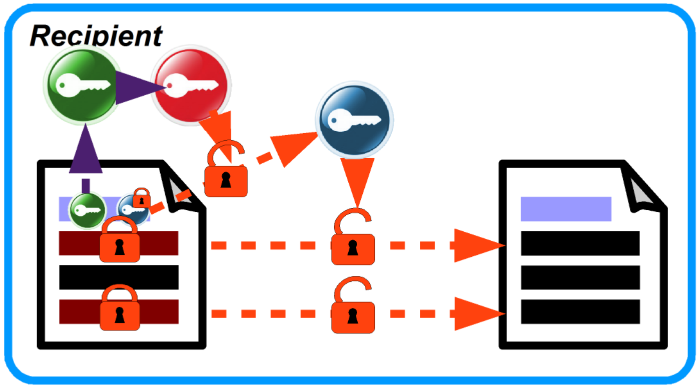
Message level (XML) encryption uses public/private key cryptography



Elements are encrypted using a symmetric key and the public key of the intended recipient's public/private key pair is used to encrypt the symmetric key



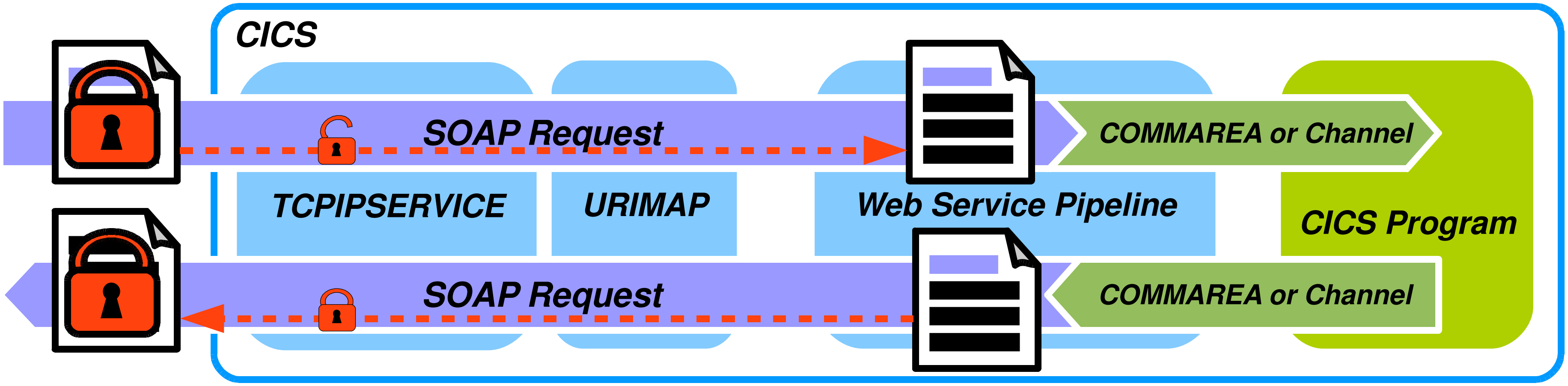
A certificate containing the public key is included in the message header



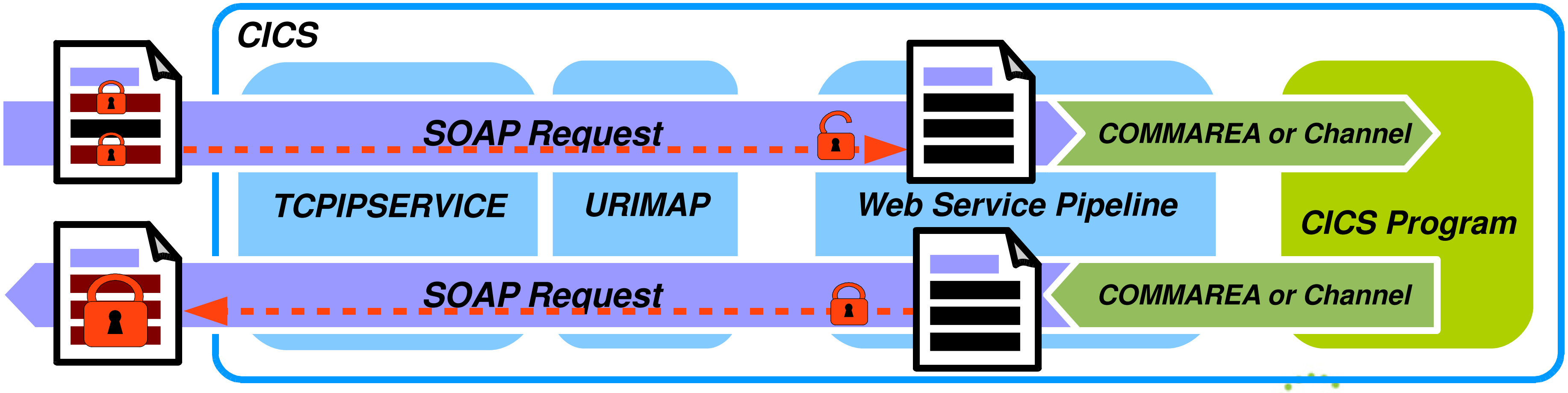
The recipient decrypts the symmetric key using their private key corresponding to the public certificate included in the message header. The symmetric key is then used to decrypt the elements.

Encryption
"How we keep our data secret..."

Transport Level (SSL)

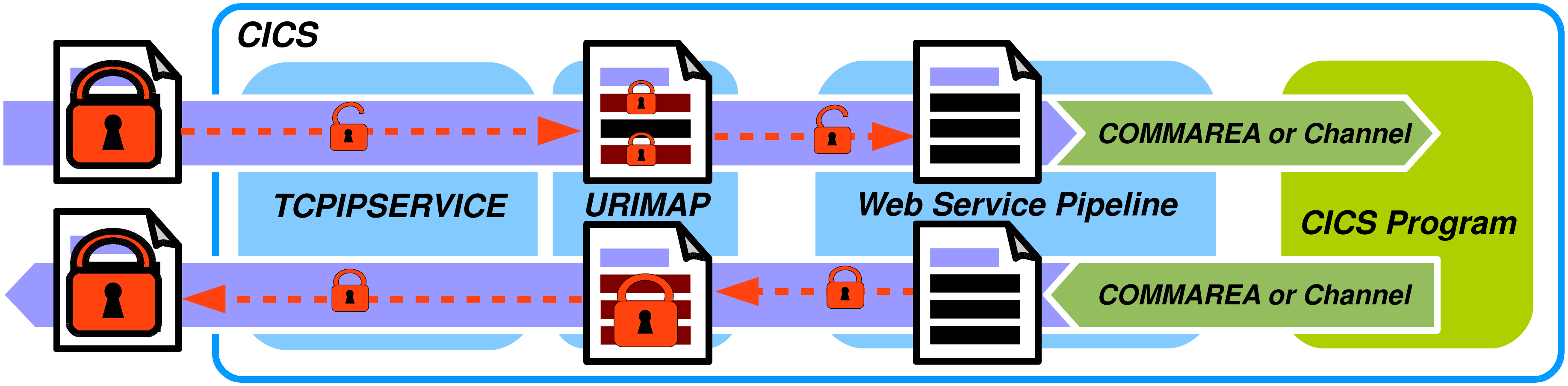


Message Level (XML encryption)

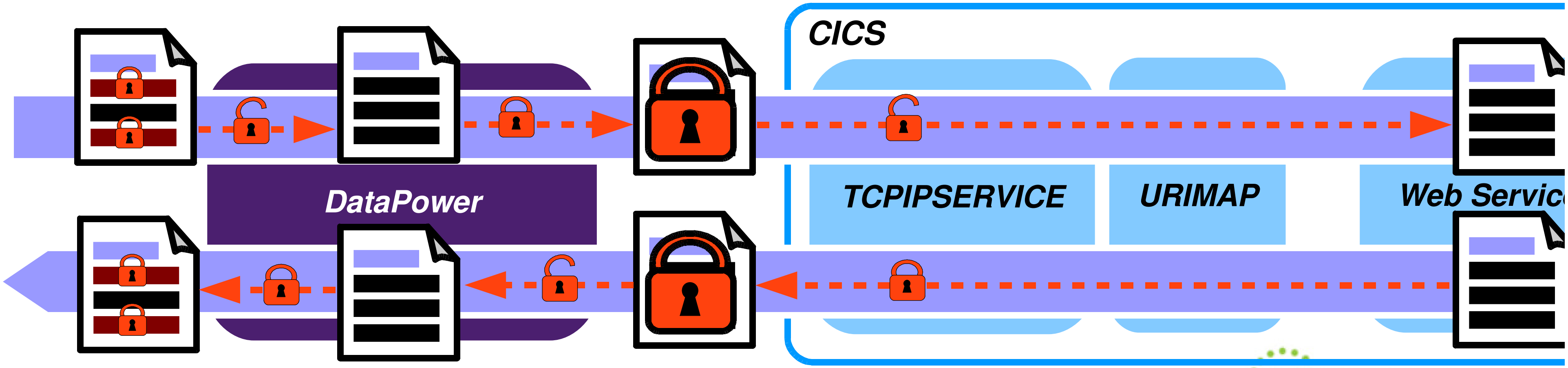


Encryption
“How we keep our data secret...”

Combination (XML encryption with SSL)

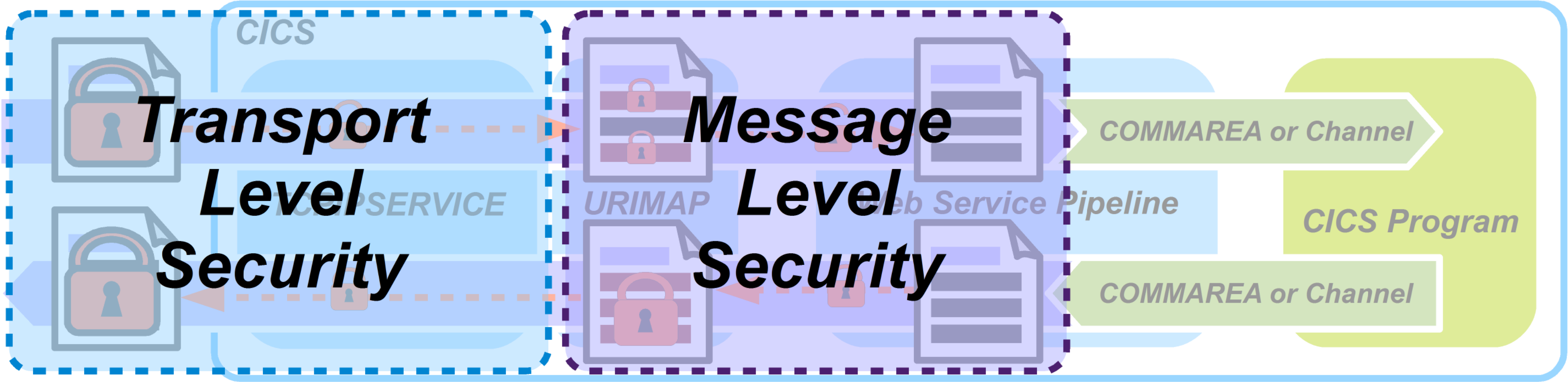


Data Power

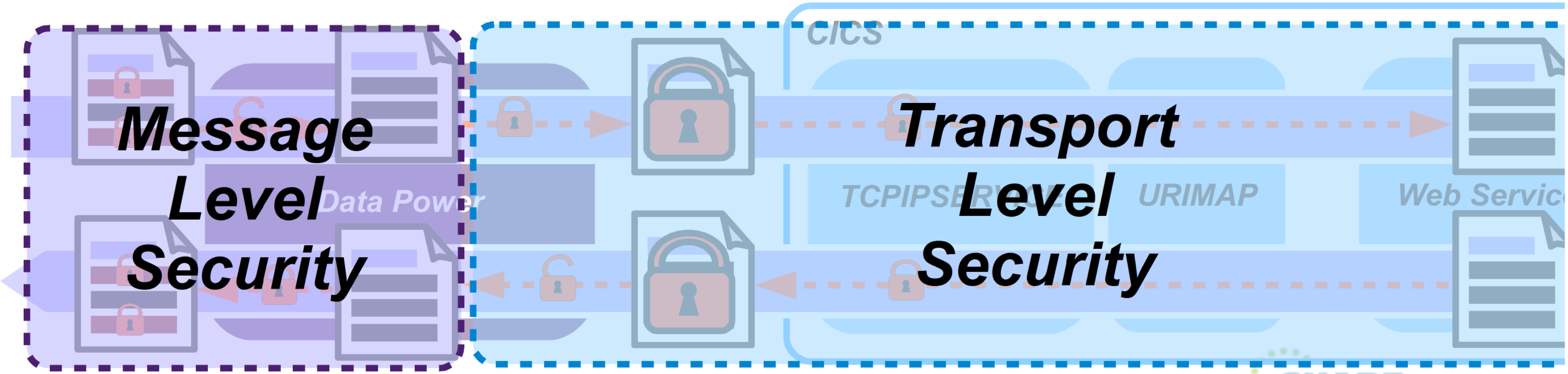


Encryption
"How we keep our data secret…"

Combination (XML encryption with SSL)



Data Power



Example Pipeline Configuration

```
<wsse_handler>
  <dfhwsse_configuration version="1">

  <encrypt_body>
    <algorithm>
http://www.w3.org/2001/04/xmlenc#tripledes-cbc
    </algorithm>
    <certificate_label>ENCCERT02</certificate_label>
  </encrypt_body>

  <expect_encrypted_body/>

  </dfhwsse_configuration>
</wsse_handler>
```

For Outbound:
The algorithm with which to encrypt the message body

For Outbound:
The Certificate with which to encrypt the message body (recipients public certificate)

For Inbound:
Flag to reject messages which don't have an encrypted body

Sample XML

```
<PaymentInfo xmlns='http://example.org/paymentv2'>
    <Name>John Smith</Name>
    <CreditCard Limit='5,000' Currency='USD'>
      <Number>4019 2445 0277 5567</Number>
      <Issuer>Example Bank</Issuer>
      <Expiration>04/02</Expiration>
    </CreditCard>
 </PaymentInfo>
```

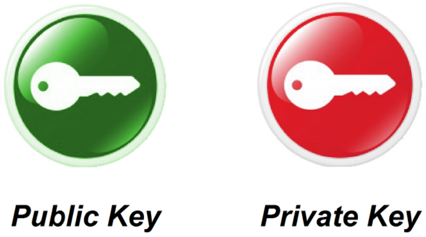
```
<PaymentInfo xmlns='http://example.org/paymentv2'>
    <Name>John Smith</Name>
    <EncryptedData
       Type='http://www.w3.org/2001/04/xmlenc#Element'
       xmlns='http://www.w3.org/2001/04/xmlenc#'>
      <CipherData>
        <CipherValue>A23B45C56...</CipherValue>
      </CipherData>
    </EncryptedData>
  </PaymentInfo>
```

Signature

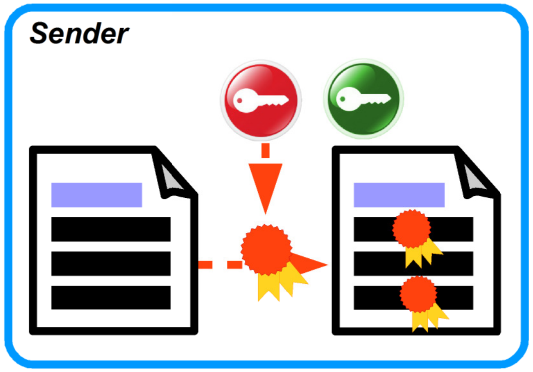
Signature

- Data must not have changed since it was sent, Integrity.
  - If encryption is used then a weak form on Integrity is implied
    - *It is hard to make meaningful changes to encrypted data*
    - *In such cases again SSL may be enough*
  - If service requires XML Digital Signature then you can use DataPower
  - If DataPower is not available you can use the CICS supplied Security Handler
    - *Can verify signature on any elements in an inbound message*
    - *Can only sign the body on an outbound message*

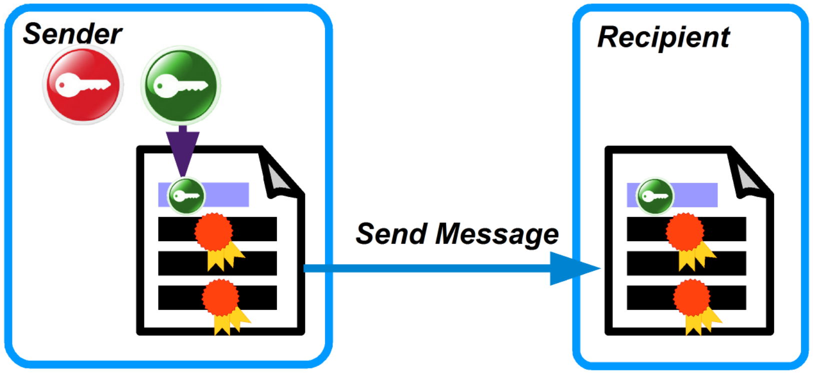
Signature
Signing with *Public/Private key pair*



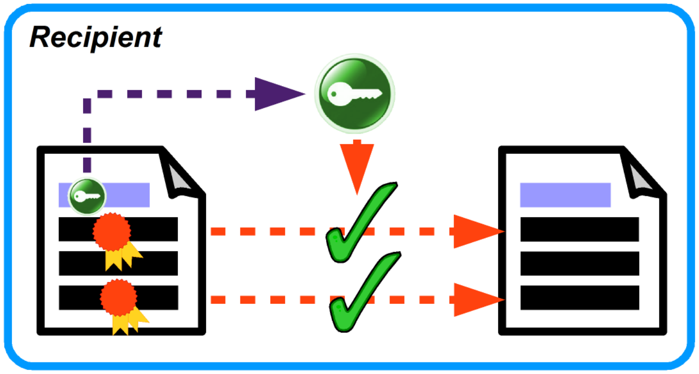
XML Digital Signature uses a public/private key pair



Elements are signed using the private key of the sender's public/private key pair



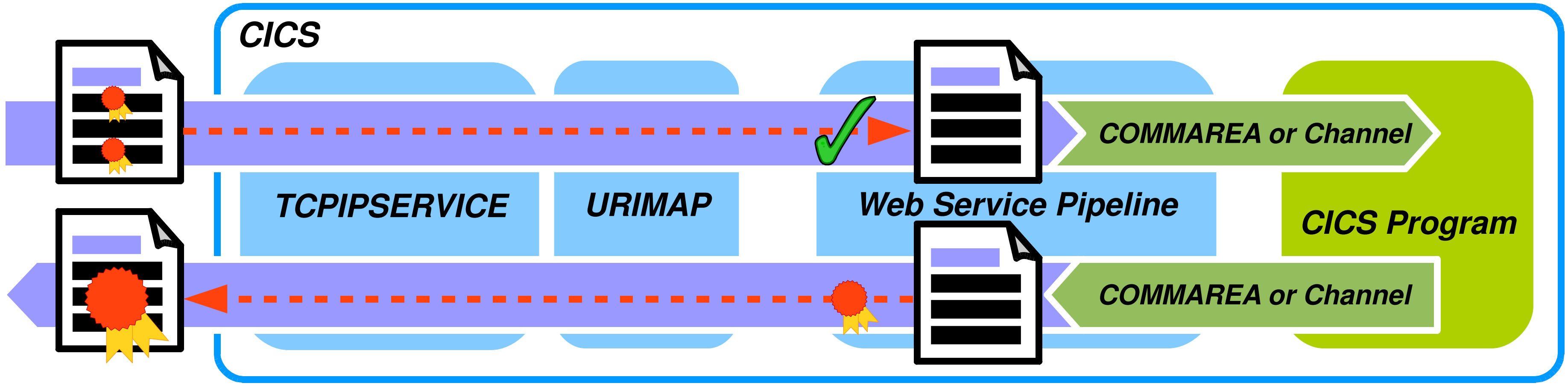
A certificate containing the public key is included in the message header



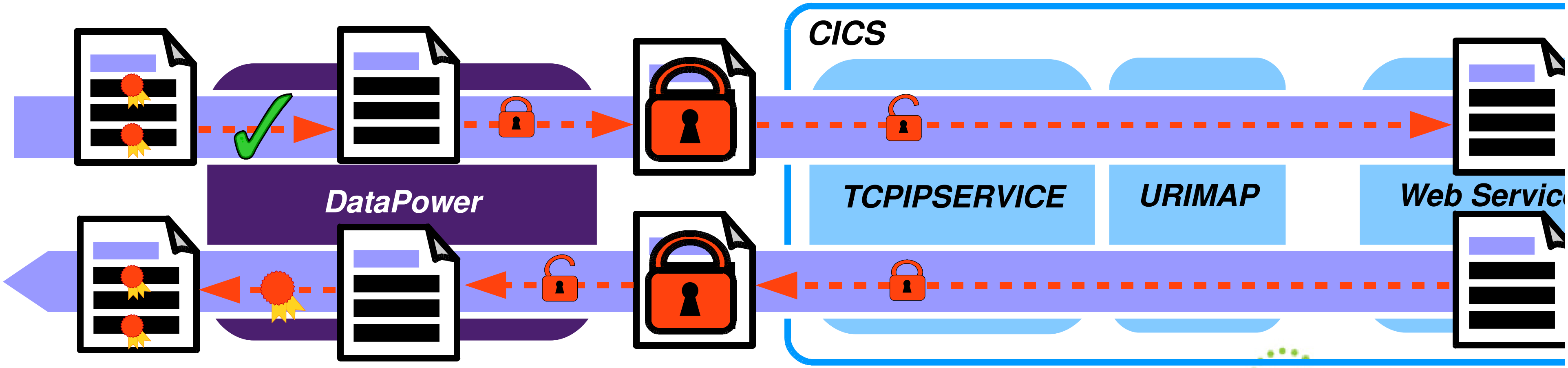
The recipient verifies the signed elements using the sender's public key from the message header

Signature
"How we stop our data changing..."

CICS only



Data Power



Example Pipeline Configuration

```
<wsse_handler>
  <dfhwsse_configuration version="1">

    <sign_body>
      <algorithm>
        http://www.w3.org/2000/09/xmldsig#rsa-sha1
      </algorithm>
      <certificate_label>SIGCERT01</certificate_label>
    </sign_body>

    <expect_signed_body/>

  </dfhwsse_configuration>
</wsse_handler>
```

For Outbound:
The algorithm with which to sign the message body

For Outbound:
The certificate with which to sign the message body

For Inbound:
Flag to reject messages which don't have a signed body

Signature

```
<S:Envelope>
  <S:Header>
    <wsse:Security S:mustUnderstand="1"
       xmlns:wsse="http://schemas.xmlsoap.org/ws/2002/07/secext">
      <wsse:BinarySecurityToken EncodingType="wsse:Base64Binary">
        MIIDQTCC4ZzO7tIgerPlaid1q ... [truncated]
      </wsse:BinarySecurityToken>
      <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
      ....signature data....
      </ds:Signature>
    </wsse:Security>
 </S:Header>

 <S:Body>
    <m:OrderAircraft quantity="1" type="777" config="Atlantic"
       xmlns:m="http://www.boeing.com/AircraftOrderSubmission"/>
 </S:Body>
<S:Envelope>
```

Header contains the signature for OrderAircraft tag in the body

Note: Data is not encrypted in the body

DataPower
"Some more use cases..."

Monitoring and control

- Example: centralized ingress management for all Web Services using ITCAM SOA

Deep-content routing and data aggregation

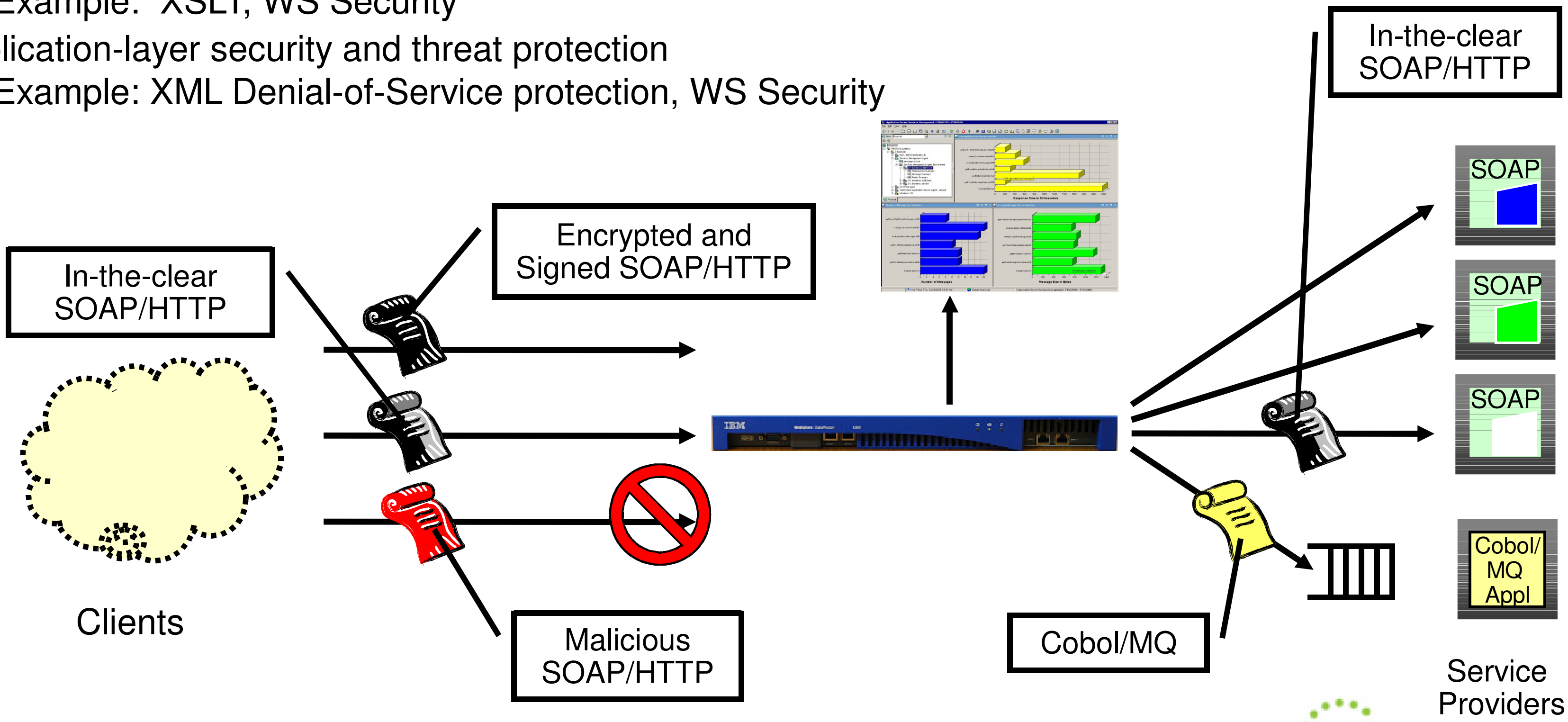
- Example: XPath (content) routing on Web Service parameters

Functional acceleration

- Example: XSLT, WS Security

Application-layer security and threat protection

- Example: XML Denial-of-Service protection, WS Security



DataPower
Integration Appliance XI50

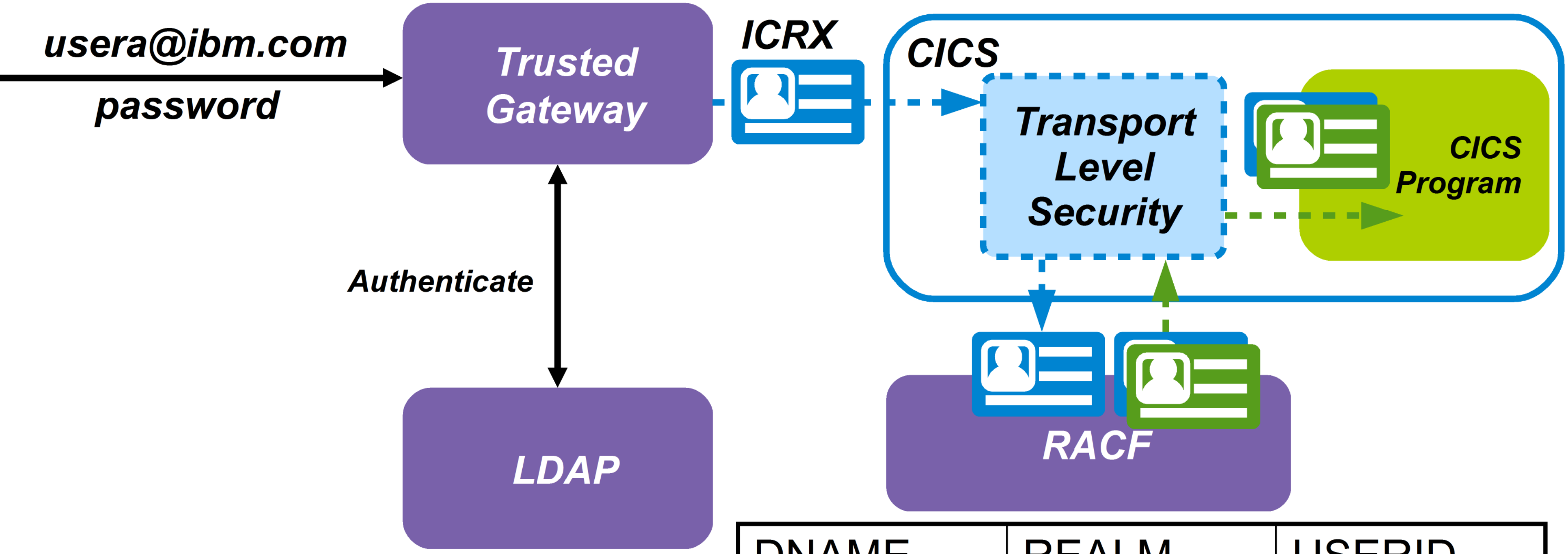
- **DataGlue “Any-to-Any” Transformation Engine**
- **Content-based Message Routing:** Message Enrichment
- **Protocol Bridging (HTTP, MQ, JMS, FTP, IMS Connect, etc.):** Request-response and sync-async matching
- **Direct to Database:** Communicate directly with remote Database instances
- **XML/SOAP Firewall:** Filter on any content, metadata or network variables
- **Data Validation:** Approve incoming/outgoing XML and SOAP at wirespeed
- **Field Level Security:** WS-Security, encrypt & sign individual fields, non-repudiation
- **XML Web Services Access Control/AAA:** AML, LDAP, RADIUS, etc.
- **MultiStep:** Sophisticated multi-stage pipeline
- **Web Services Management:** Centralized Service Level Management, Service Virtualization, Policy Management
- **Easy Configuration & Management:** WebGUI, CLI, IDE and Eclipse configuration to address broad organizational needs

Middleware Appliance Purpose-Built for Application Integration

Identity Propagation

- New in CICS TS V4.1
  - z/OS 1r11
  - PK95579, PK83741 & PK98426
- Enables two way mapping between dname@realm userid and RACF user ID
- Allows task association data to include BOTH RACF user and ICRX data
- Map an identity through the entire enterprise

Identity Propagation



```
<authentication mode="basic-ICRX">
```

DNAME	REALM	USERID
USER*	Ibm.com	FRED
Super	Ibm.com	SUPER

Summary

- CICS Web Service Security Support Overview
- Identity – Transport and Message Level
    - Native (CICS User ID) Security tokens
    - WS – Trust for non native security tokens
    - X.509 Certificates
- Encryption – Transport and Message Level
    - SSL for Transport level
    - Inbound: XML element encryption for message level
    - Outbound: Whole body encryption for outbound (XML element with data power)
    - Recommend using Data Power
- Signature – Message Level only
    - Inbound: XML element level signing
    - Outbound: Whole body signing for outbound (XML element level with data power)
    - Recommend using Data Power
- Identity Propagation
    - Propagate originating identity though CICS with ICRX

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Thank you, Any Questions?

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