Software Service Engineering

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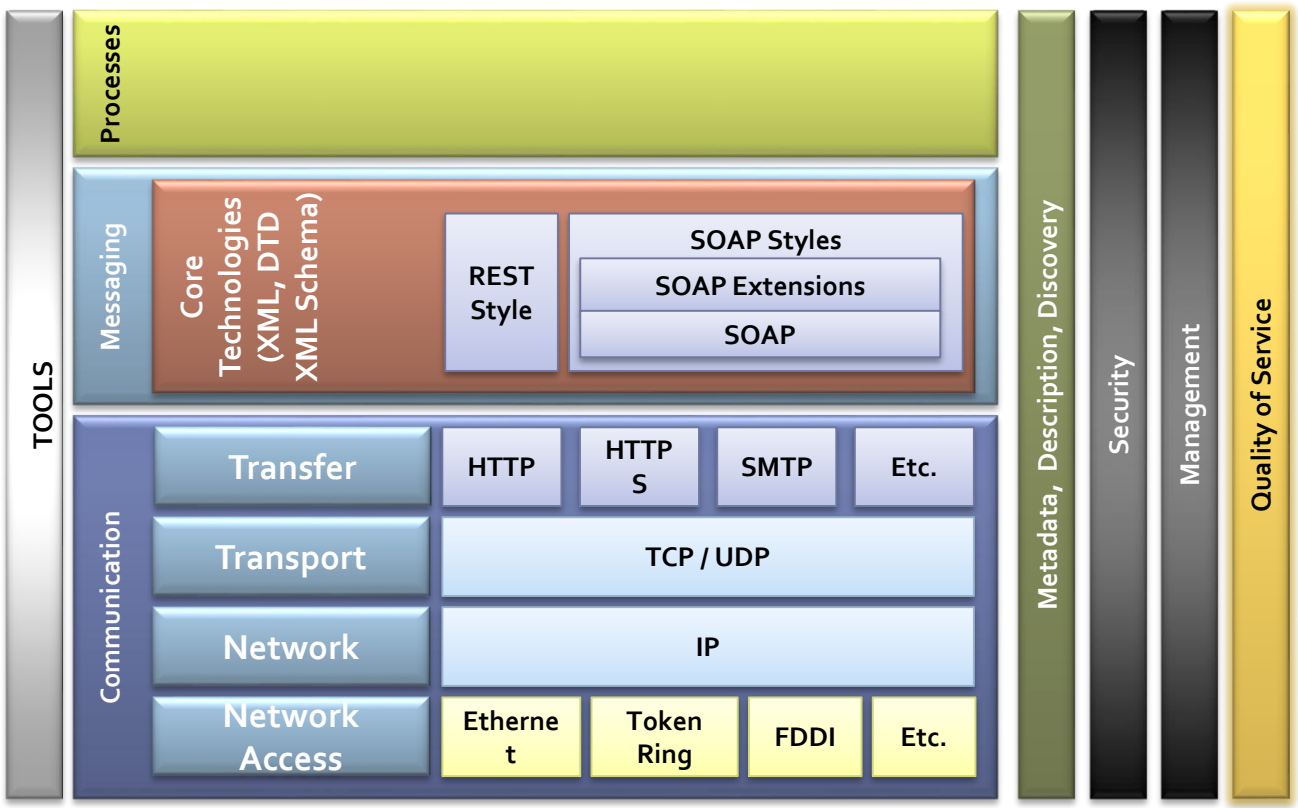
Chapter 4

WEB SERVICES STACK

Basic Technologies and Extensions



Messaging (1)

- Basic Technology
  - SOAP
- Routing/Addressing
  - Transport technology-independent transfer of messages
  - Examples: *WS-Addressing*, WS-MessageDelivery
- Multiple Message Sessions
  - Transport technology-independent processing of XML resources using Web services
  - Examples: WS-Enumeration, *WS-Transfer*

Messaging (2)

- Events and Notification
  - Event-based architecture implementation independent of transport technology
  - Example: WS-Eventing, WS-Notification
- Reliable Messaging
  - Secure message exchange implementation independent of transport technology
  - Example: WS-Reliable Messaging, WS-Reliability (obsolete)
- Message Packaging
  - Message Transmission Optimization Mechanism (W3C Recommendation 25 January 2005) – for efficient transfer of binary data to and from Web Services. The focus is on transmission optimization of base64 encoded data.
  - Data is transferred as MIME Multipart/Related XML-binary Optimized Package (XOP Package)
  - Example: MTOM (Attachments)

WS-Addressing

- Web Services Addressing (WS-Addressing)
  - W3C Member Submission 10 August 2004
  - http://www.w3.org/Submission/ws-addressing/
  - WS Addressing provides a transport technology neutral mechanism of addressing Web Services and their messages

WS-Addressing – Example (1)

- Specified Request structure

```
<?xml version="1.0" encoding="utf-8" ?>
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
            xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing">
  <S:Header>
    <wsa:MessageID>
      uuid:12345678-1234-5678-ABCD-123456789ABC
    </wsa:MessageID>
    <wsa:ReplyTo>
      <wsa:Address>http://FromCompanyA.example.org/Buyer</wsa:Address>
    </wsa:ReplyTo>
    <wsa:To S:mustUnderstand="1">http://ToComapnyB.example.org/Purchasing</wsa:To>
    <wsa:Action>http://comapnyB.example.org/SubmitOrder</wsa:Action>
  </S:Header>
  <S:Body>
    <!--XML-Code for Order-->
  </S:Body>
</S:Envelope>
```


WS-Addressing – Example (2)

- Specified Reply structure

```
<?xml version="1.0" encoding="utf-8" ?>
<S:Envelope xmlns:S="http://www.w3.org/2003/05/soap-envelope"
            xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing"
            xmlns:example="http://Schemas.ToComapnyB.example.org/Purchasing">
  <S:Header>
    <wsa:MessageID>
      uuid:aaaabbbb-cccc-dddd-eeee-wwwwwwwwwww
    </wsa:MessageID>
    <wsa:RelatesTo>
      uuid:12345678-1234-5678-ABCD-123456789ABC
    </wsa:RelatesTo>
    <wsa:To S:mustUnderstand="1">
      http://FromCompanyA.example.org/Buyer
    </wsa:To>
    <wsa:Action>http://ToComapnyB.example.org/OrderReceived</wsa:Action>
  </S:Header>
  <S:Body>
    <example:OrderReceived/>
  </S:Body>
</S:Envelope>
```


WS-Transfer

- Web Services Transfer (WS-Transfer)
  - W3C Member Submission 27 September 2006
  - http://www.w3.org/Submission/WS-Transfer/
  - Specification describes a generic SOAP-based protocol to process any XML-based representation of a Web Service-based resource
  - Idea: provide Create, Read, Update and Delete as a Web Service to enable processing of any XML resource independently of communication mechanisms
  - Uses WS Addressing
- Implementation of the idea
  - Resource Operations: Get, Put, Delete
  - Resource Factory Operation: Create
  - Faults

WS-Transfer – Get

- Resource Operation Get

```
<s:Envelope …="">
  <s:Header …="">
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/Get
    </wsa:Action>
    <wsa:MessageID>xs:anyURI</wsa:MessageID>
    <wsa:To>xs:anyURI</wsa:To>
    …
  </s:Header>
  <s:Body …..="">
    ...
  </s:Body>
</s:Envelope>
```

```
<s:Envelope …="">
  <s:Header …="">
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/GetResponse
    </wsa:Action>
    <wsa:RelatesTo>xs:anyURI</wsa:RelatesTo>
    <wsa:To>xs:anyURI</wsa:To>
    …
  </s:Header>
  <s:Body …="">
    xs:any
    ...
  </s:Body>
</s:Envelope>
```

Resource operations behaving accordingly:
Put – PutResponse
Delete – DeleteResponse

WS-Transfer – Create

- Resource Factory Operation: Create

```
<s:Envelope …="">
  <s:Header …="">
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/Create
    </wsa:Action>
    <wsa:MessageID>xs:anyURI</wsa:MessageID>
    <wsa:To>xs:anyURI</wsa:To>
    …
  </s:Header>
  <s:Body …="">
    xs:any
    ...
  </s:Body>
</s:Envelope>
```

```
<s:Envelope …="">
  <s:Header …="">
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/CreateResponse
    </wsa:Action>
    <wsa:RelatesTo>xs:anyURI</wsa:RelatesTo>
    <wsa:To>xs:anyURI</wsa:To>
    …
  </s:Header>
  <s:Body …="">
    <wxf:ResourceCreated>endpoint-reference</wxf:ResourceCreated>
    xs:any ?
  </s:Body>
</s:Envelope>
```


WS-Transfer – Example: Create

```
<s:Envelope
    xmlns:s="http://www.w3.org/2003/05/soap-envelope"
    xmlns:wsa="http://schemas.xmlsoap.org/ws/2004/08/addressing"
    xmlns:example="http://schemas.example.com/resource-model" >
  <s:Header>
    <wsa:ReplyTo>
      <wsa:Address>
        soap://sender.example.org/
      </wsa:Address>
    </wsa:ReplyTo>
    <wsa:To>soap://www.example.org/websvc/</wsa:To>
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/transfer/Create
    </wsa:Action>
    <wsa:MessageID>
      uuid:12345678-abcd-1234-eeff-123456781234
    </wsa:MessageID>
  </s:Header>
  <s:Body>
    <example:Product>
      <example:title>Seife</example:title>
      <example:price>1.22</example:price>
    </example:Product>
  </s:Body>
</s:Envelope>
```


Metadata, Description, Discovery (1)

- Basic technology
  - WSDL and semantic extension
  - UDDI
- Policy
  - Specification to enable Web Services to describe their respective usage rules or to allow consumers to describe such requirements
  - Policies can apply to security, quality, etc
  - Examples: WS-Policy, WS-PolicyAssertions, WS-PolicyAttachment

- WS Policy Example
  - wsp:ExactlyOne, wsp:All

```
<wsp:Policy
    xmlns:sp="http://schemas.xmlsoap.org/ws/2005/07/securitypolicy"
    xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy" >
  <wsp:ExactlyOne>
    <sp:Basic256Rsa15 />
    <sp:TripleDesRsa15 />
  </wsp:ExactlyOne>
</wsp:Policy>
```


Metadata, Description, Discovery (2)

- Discovery
  - Describes specification of Service discovery independent of communication technology
  - Example: WS-Discovery
    - Defines a Multicast Discovery Protocol for Web Services localization
- Metadata Retrieval
  - Describes specification of obtaining Web Services' metadata independent of communication technology
  - Example: WS-MetadataExchange

WS-MetadataExchange

- Web Services Metadata Exchange (WS MetadataExchange / WS-Mex)
  - Specification http://schemas.xmlsoap.org/ws/2004/09/mex/
  - Web Service offers various metadata to let the other endpoints (consumers) know how one can communicate with it, for example, WSDL, Policy etc.
    - Example: http://ws.example.org/service?WSDL
    - Problem (1): Convention for WSDL does not allow end-to-end communication at the message level
    - Problem (2): Convention for WSDL, what about other metadata?
- Idea: Protocol for metadata exchange independent of communication mechanisms
  - Solution: Metadata is resource of a Web Service.
  - Resource is made available over WS-Transfer in terms of Request/Response

WS-MetadataExchange – Example

- http://schemas.xmlsoap.org/ws/2004/09/mex/GetMetadata/Request

```
<s:Envelope
    xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:wsa="http://www.w3.org/2005/08/addressing"
    xmlns:mex="http://schemas.xmlsoap.org/ws/2004/09/mex" >
  <s:Header>
    <wsa:To>http://ws.example.org/webservice</wsa:To>
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/mex/GetMetadata/Request
    </wsa:Action>
    <wsa:MessageID>
      urn:uuid:12345678-4321-dddd-cccc-abcdef6543212
    </wsa:MessageID>
    <wsa:ReplyTo>
      <wsa:Address>http://consumer.example.org</wsa:Address>
    </wsa:ReplyTo>
  </s:Header>
  <s:Body>
    <mex:GetMetadata>
      <mex:Dialect>http://schemas.xmlsoap.org/ws/2004/09/policy</mex:Dialect>
      <mex:Identifier>http://ws.example.org/webservice/policy</mex:Identifier>
    </mex:GetMetadata>
  </s:Body>
</s:Envelope>
```


WS-MetadataExchange – Example

- http://schemas.xmlsoap.org/ws/2004/09/mex/GetMetadata/Response

```
<s:Envelope
       xmlns:s="http://schemas.xmlsoap.org/soap/envelope/"
       xmlns:wsa="http://www.w3.org/2005/08/addressing"
       xmlns:wsp="http://schemas.xmlsoap.org/ws/2004/09/policy"
       xmlns:mex="http://schemas.xmlsoap.org/ws/2004/09/mex">
  <s:Header>
    <wsa:To>http://consumer.example.org</wsa:To>
    <wsa:Action>
      http://schemas.xmlsoap.org/ws/2004/09/mex/GetMetadata/Response
    </wsa:Action>
    <wsa:RelatesTo>
      urn:uuid:12345678-4321-dddd-cccc-abcdef6543212
    </wsa:RelatesTo>
  </s:Header>
  <s:Body>
    <mex:Metadata>
      <mex:MetadataSection
         Dialect="http://schemas.xmlsoap.org/ws/2004/09/policy"
         Identifier="http://ws.example.org/webservice/policy">
        <wsp:Policy>
            <!-- Policy description-->
        </wsp:Policy>
      </mex:MetadataSection>
    </mex:Metadata>
  </s:Body>

</s:Envelope>
```


Processes

- Business Domain
  - Different approaches, e.g. OASIS
  - Portal and Presentation: WSRP
- Transactions and Business Processes
  - WS-BusinessActivity
  - WS-AtomicTransaction
  - BPEL4WS
  - WS-Humantask, BPEL4People
- Aggregation, Choreography, Composition and Coordination
  - WS-Coordination
  - WS-Choreography / WS-CDL

Management

- Distributed Management
  - Web Services Distributed Management (WSDM)
    - Management of Web Services (MOWS)
    - Management using Web Services (MUWS)
    - WS-Resource Framework (WS-RF)
  - WS-Manageability
- Provisioning
  - OASIS: "Provisioning is the automation of all the steps required to manage (setup, amend & revoke) user or system access entitlements or data relative to electronically published services".
  - Specification of mechanisms (APIs and schemas) to realize interoperability of provisioning systems based on SOAP message exchange
  - Example: WS-Provisioning

Security & Co.

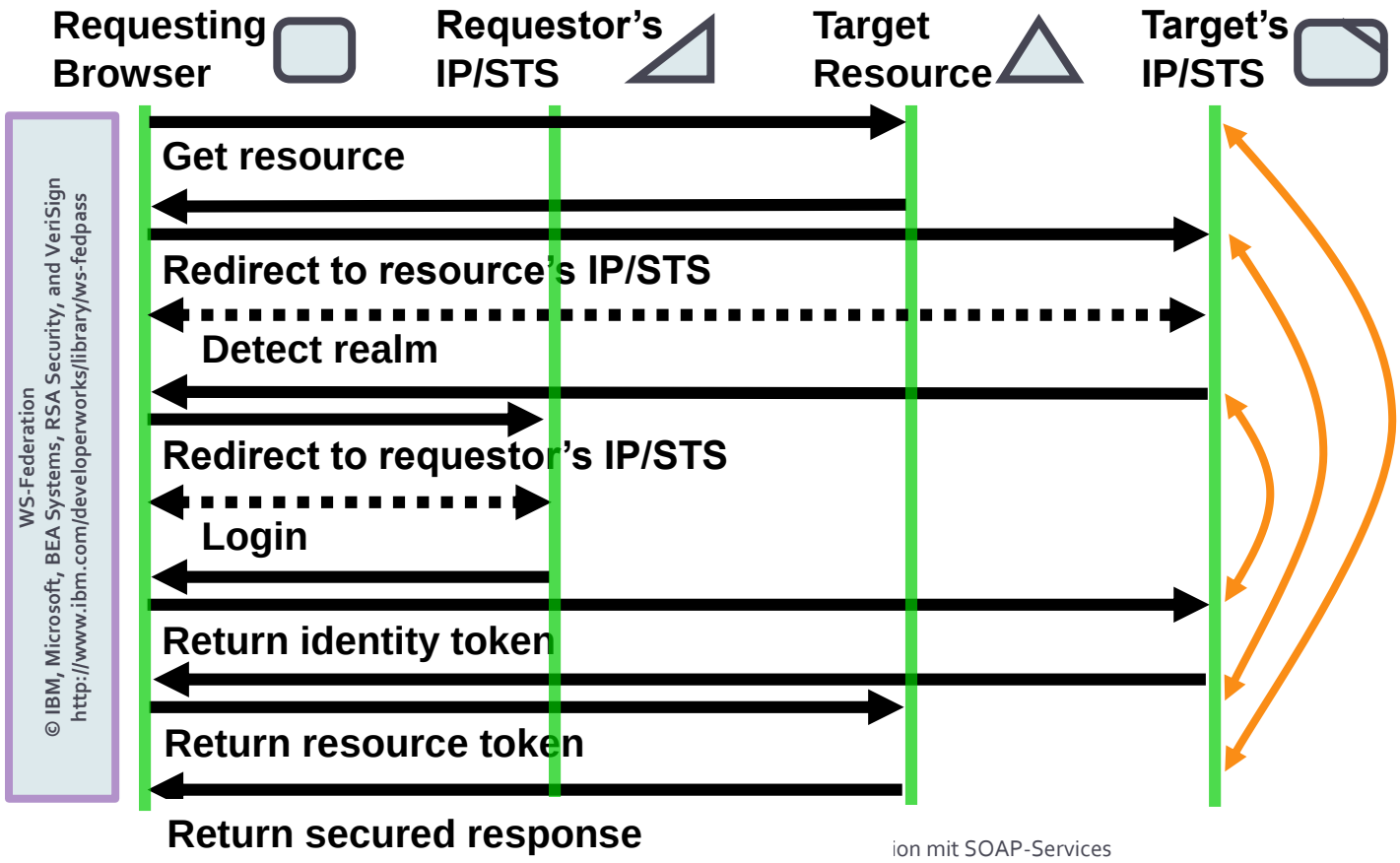
- Security
  - Specifies a protocol for secure end-to-end communication. SOAP messages are get signed and encrypted. WS-Security provides a framework for securing SOAP messages using the W3C recommendations regarding XML-Signature Syntax and Processing (XML Encryption, XML Signature)
  - Example: WS-Security
- Security Policy and Secure Conversation
  - Extend the capabilities of WS-Security accordingly
  - Examples: WS-SecurityPolicy, WS-SecureConversation
- Trusted Message
  - SOAP-based mechanisms for mediation of trust relationships as well as request / invalidation of security tokens
  - Example: WS-Trust
- Further approaches
  - Examples: Privacy (WS-Privacy), Authorization (WS-Authorization)

- Current trend: Federated Identity
  - Example: WS-Federation
  - Example: http://webcomposition.net/idfs

Section

FEDERATION MIT SOAP-SERVICES

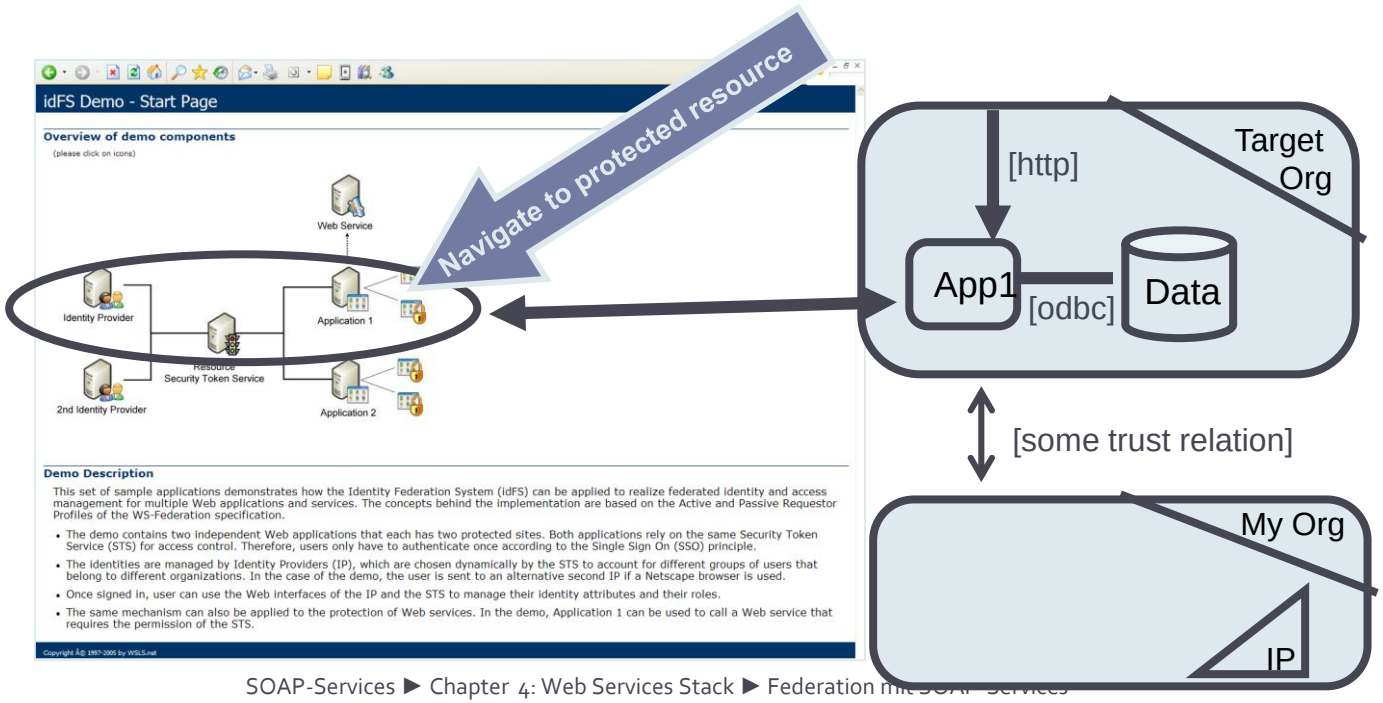
WS-Federation PRP Sample



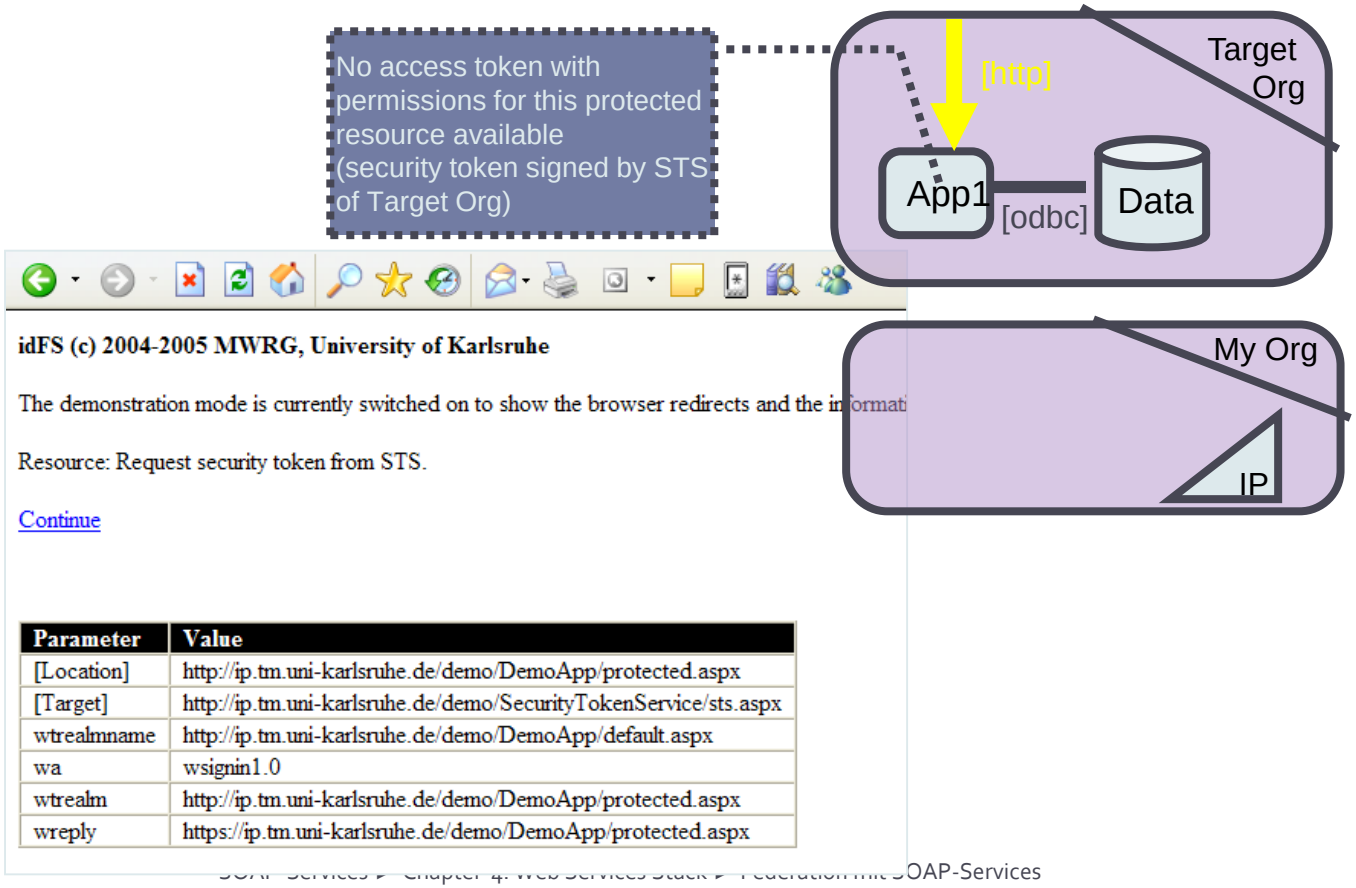
ion mit SOAP-Services

Example – WAM Applied

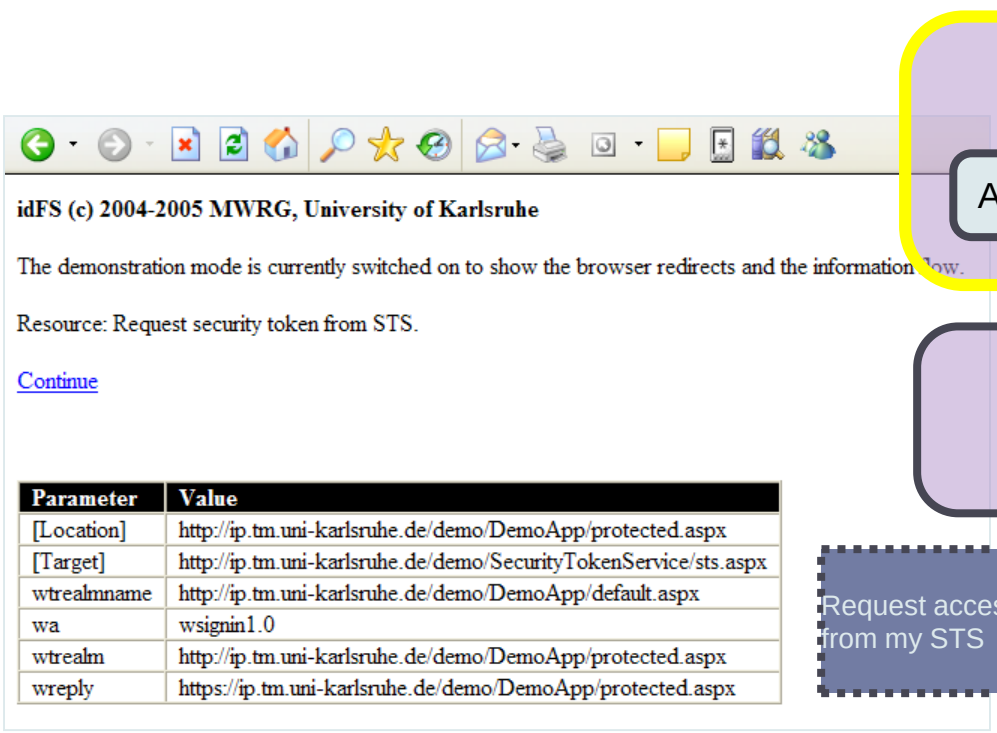
- http://webcomposition.net/idfs/demo/
- SSO with WS-Federation (PRP)



Call Protected Resource



Protected Resource → STS



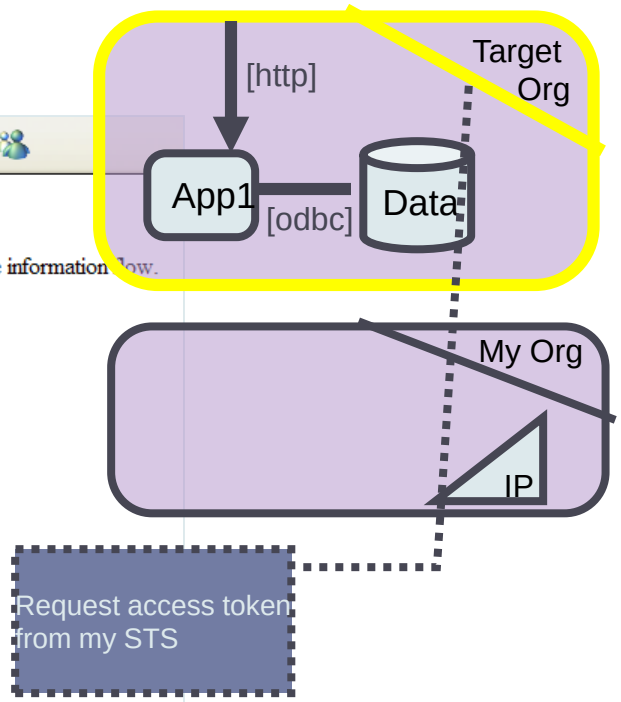
idFS (c) 2004-2005 MWRG, University of Karlsruhe

The demonstration mode is currently switched on to show the browser redirects and the information flow.

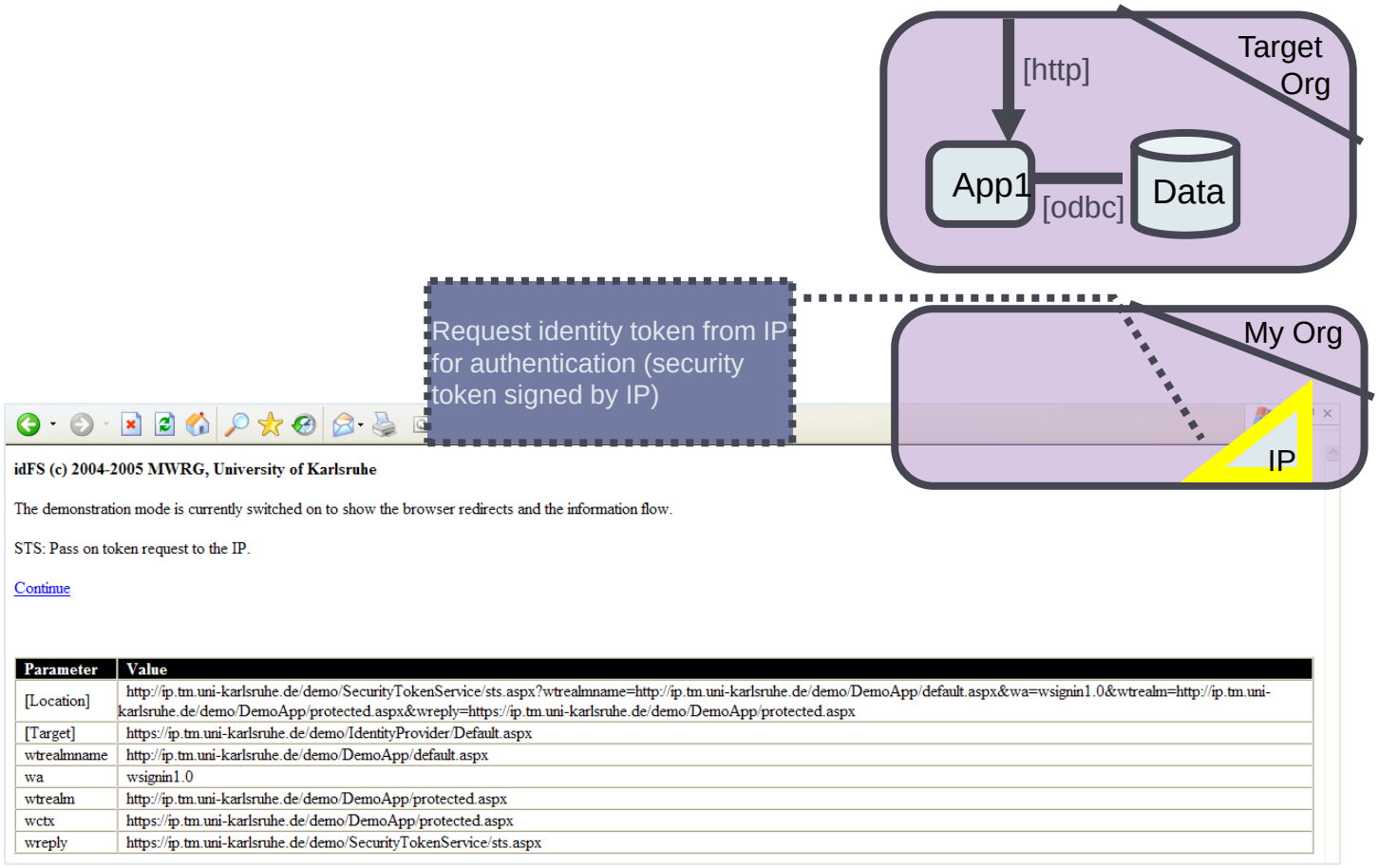
Resource: Request security token from STS.

Continue

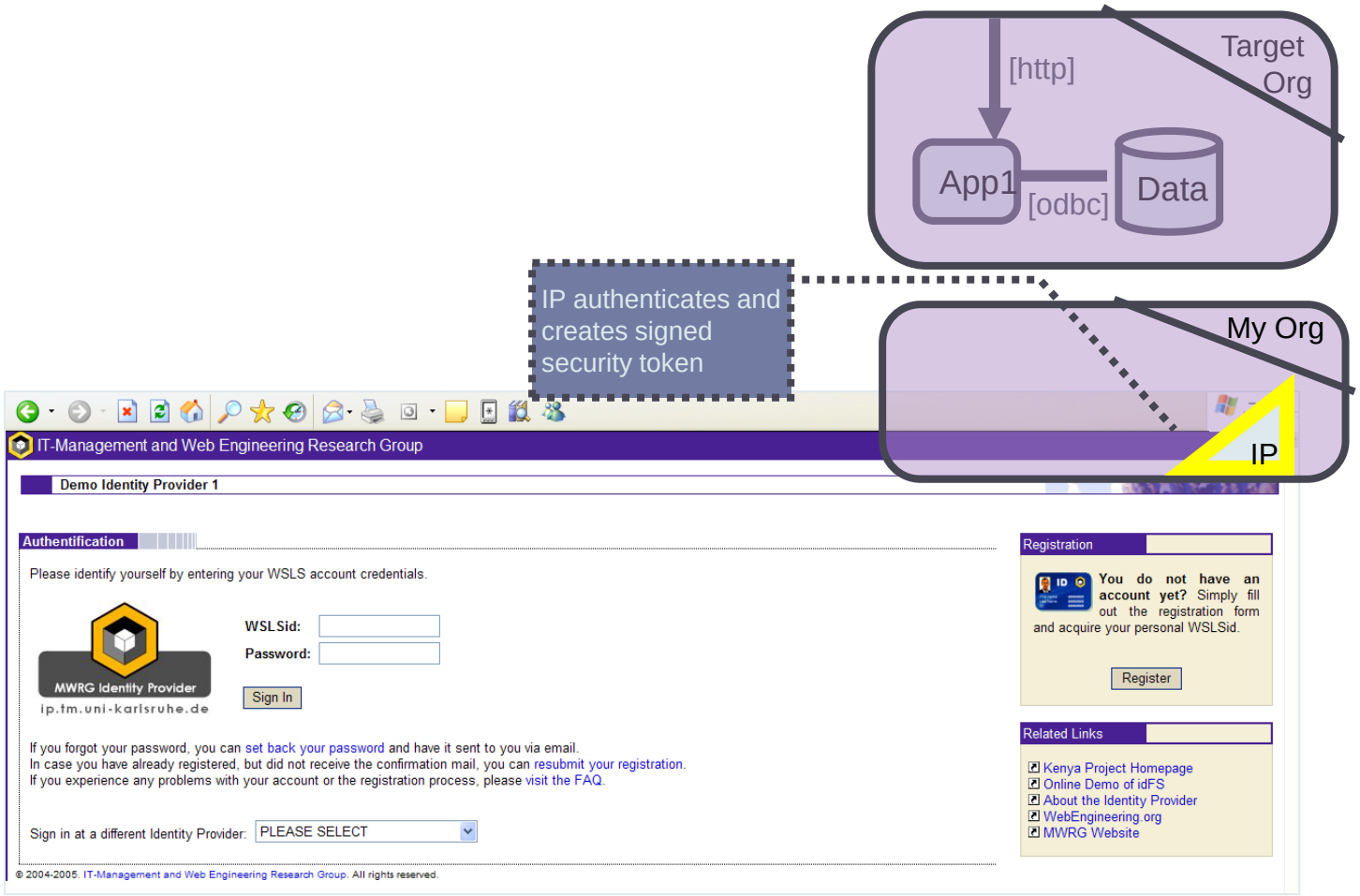
Parameter	Value
[Location]	http://ip.tm.uni-karlsruhe.de/demo/DemoApp/protected.aspx
[Target]	http://ip.tm.uni-karlsruhe.de/demo/SecurityTokenService/sts.aspx
wtrealmname	http://ip.tm.uni-karlsruhe.de/demo/DemoApp/default.aspx
wa	wsignin1.0
wtrealm	http://ip.tm.uni-karlsruhe.de/demo/DemoApp/protected.aspx
wreply	https://ip.tm.uni-karlsruhe.de/demo/DemoApp/protected.aspx



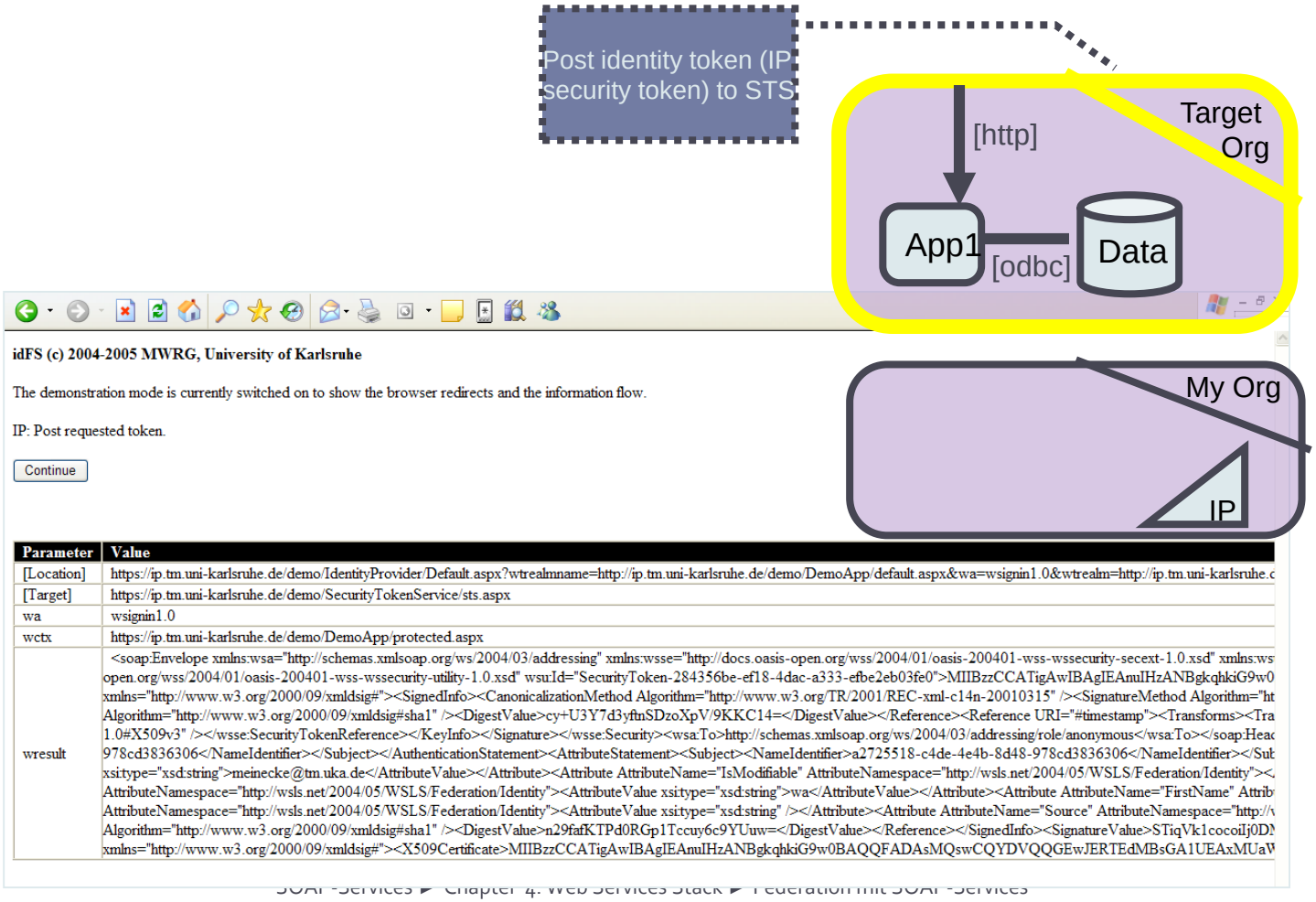
STS→IP



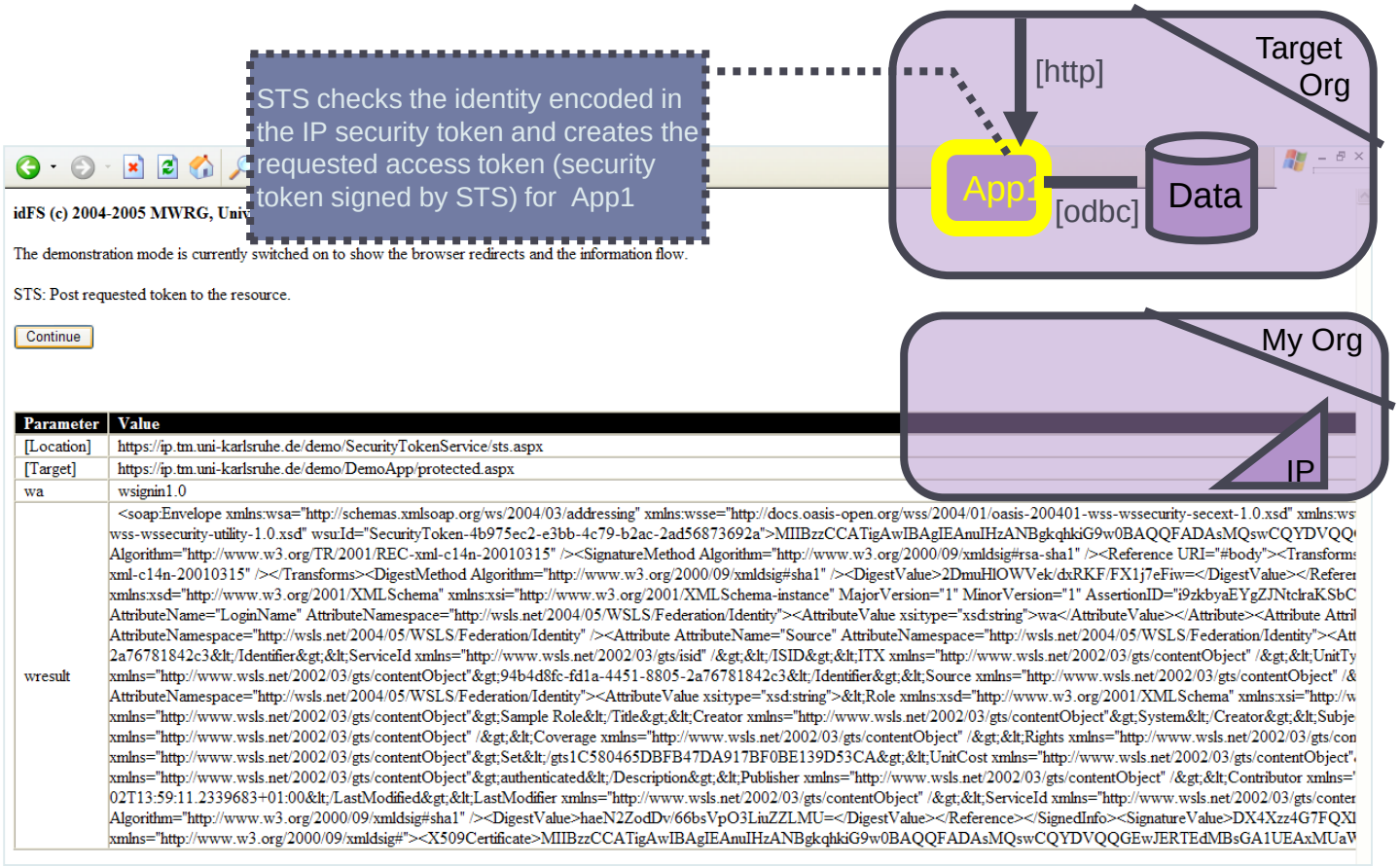
IP - Authenticate



IP→STS



STS→Protected Resource



Show Protected Resource