# Using XML based security tickets and tokens

or

# SAML demystified

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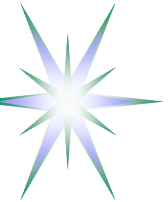


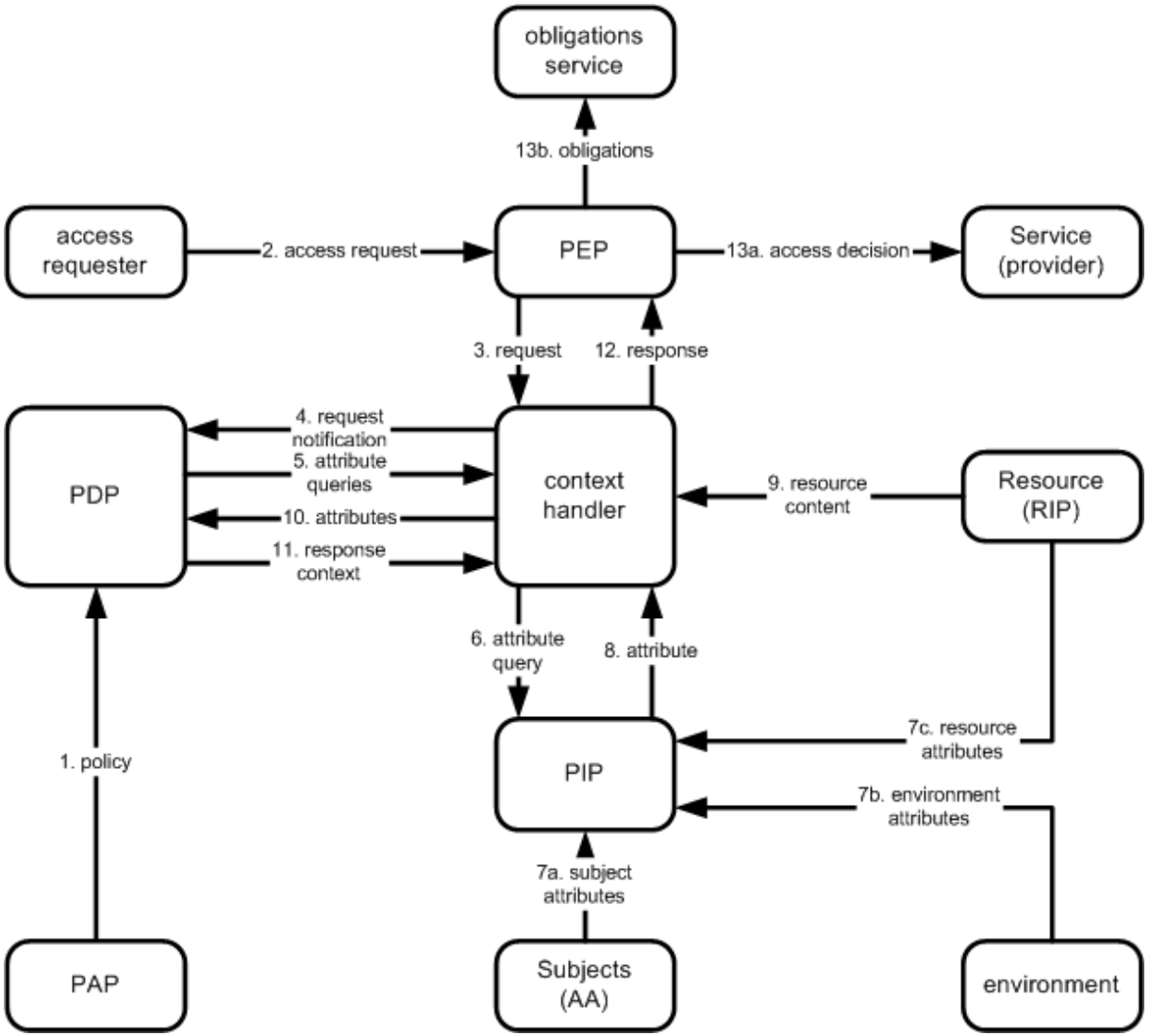
# Outline

- Fine grained access control with Generic AAA Authorisation framework and RBAC
  - Combined push-pull and agent-push models using AuthZ tickets and tokens
- GAAAPI implementation detail and ticket/token examples
  - Collaboratory.nl Authorisation service
- Prospective integration with GT4 and gLite Authorisation Frameworks

# Distributed Security Architecture for Open Collaborative Environment (OCE) and used technologies

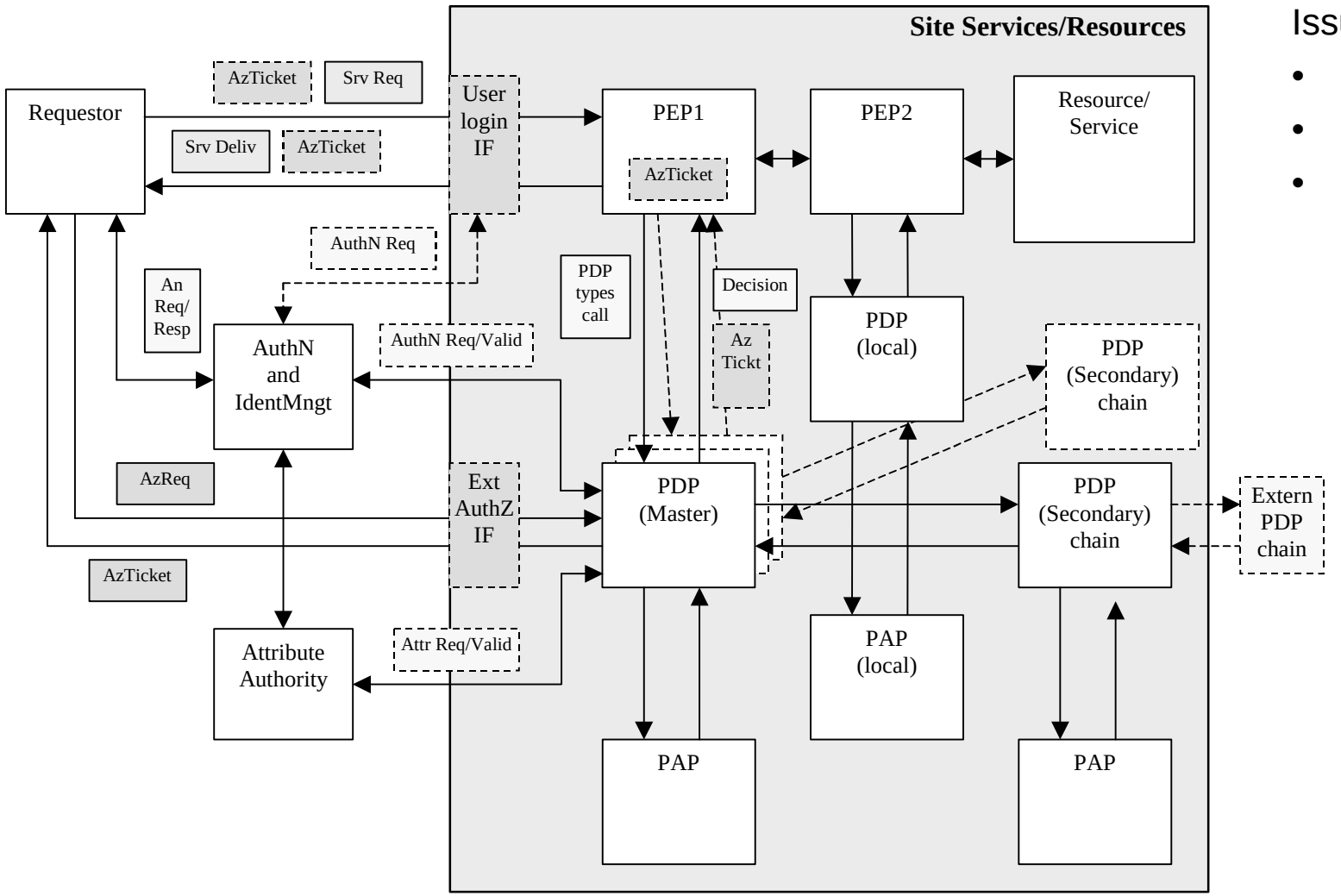
- Based on the Job-centric security model
  - Job description format – to be compatible with WS-Agreement and GGF JSDL (Job Submission Description Language)
- Extended RBAC functionality including RBAC administration tool (using GAAA Toolkits)
- GAAA RBE and AAA policy expression
  - XACML Request/Response messaging
  - Migration to XACML based policy exchange and combination
- SAML 2.0 based AuthzTicket format
- XML Signature and XML Encryption for JobDescription and AuthzTicket security
- Policy binding to WSDL and AuthZ portType definition
  - Using WS-Security Framework and OGSA/WSRF
- TODO: Adding VO and VOMS functionality - for user and resource attributes management

# RBAC: main components and dataflow – XACML model




- PEP/AEF - Policy Enforcement Point (authorisation enforcement function)
- PDP/ADF - Policy Decision Point (authorisation decision function)
- PIP - Policy Information Point
- AA - Attribute Authority
- PAP - Policy Authority Point

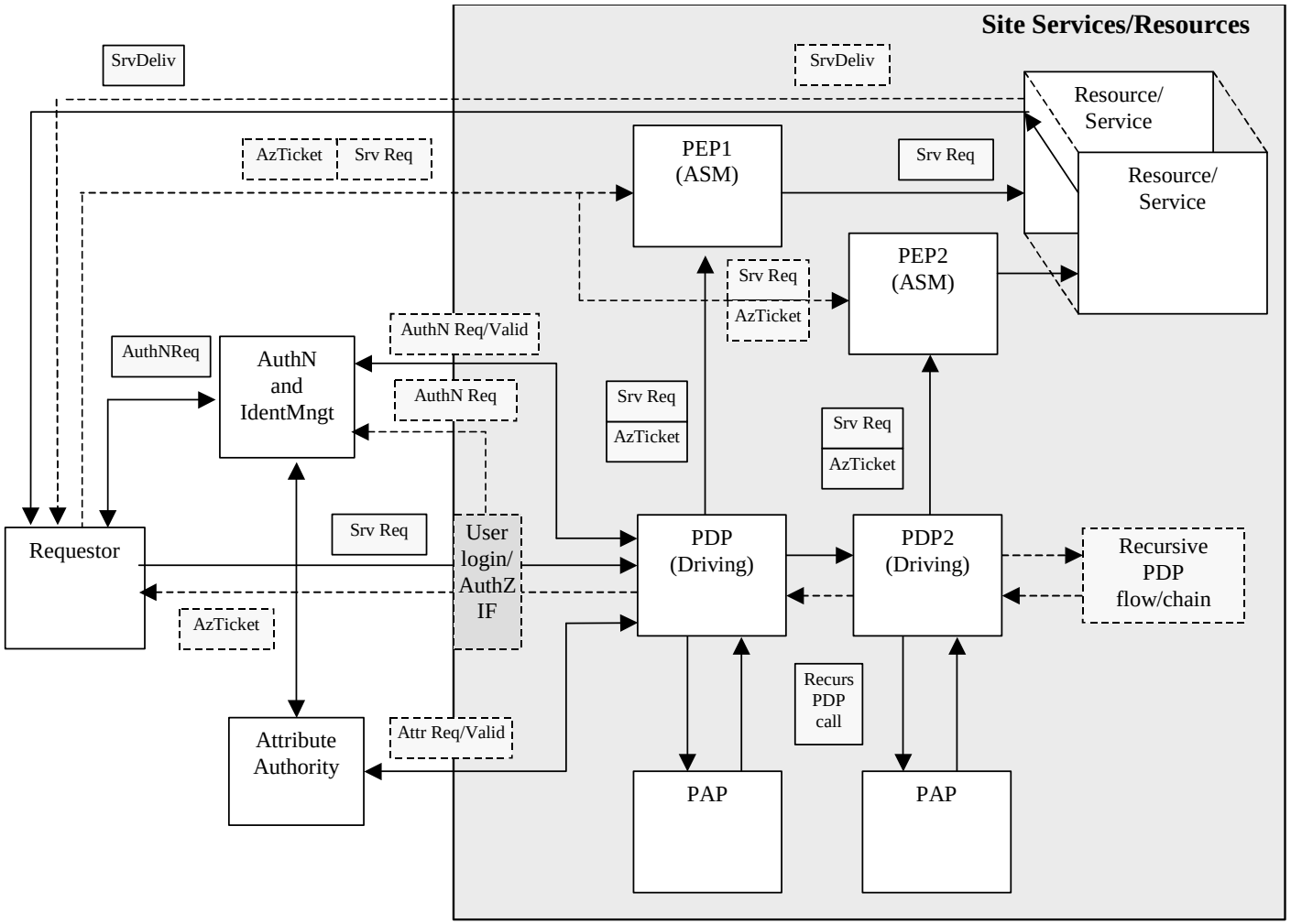
# Site AuthZ service implementing RBAC and combined pull-push model




Issues to be addressed:

- PEP and PDP chaining
- Policy combining
- Multiple domains

# Site AuthZ service implementing combined agent and push model for complex resource




Issues to be addressed:

- Multi-component and multidomain resources
- Policy push and/or token based access control

# Implementation suggestions for OCE

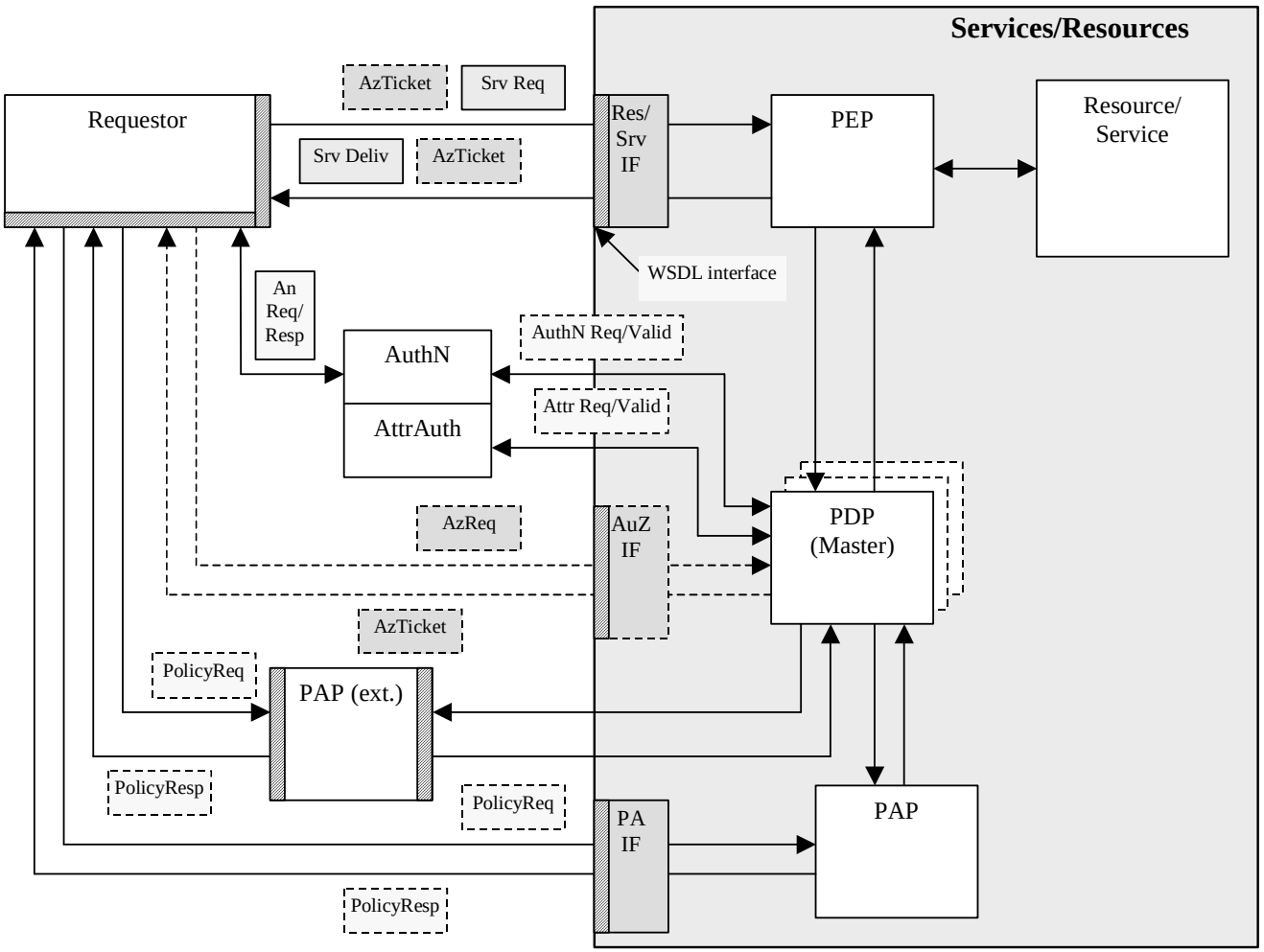
- PDP and PAP must share common namespace
- Policy and respectively PAP should be referenced in the request message explicitly or known to PEP and PDP a priory
- Every PEP in the chain of policy enforcement should take care of the whole request evaluation/enforcement by calling to a single (master) PDP. PEP should not do multiple decision combination.
- Only one PDP should provide a final decision on the whole request
- However, PEP may have a possibility to request different PDP types based on request semantics/namespace and referred policy
- When using ticket/token based access control model, the PEP should understand and have a possibility to validate the AuthZ ticket issued by trusted PDP
  - The AuthZ ticket should have validity and usage restriction and contain information about the decision and the resource.
- For the further validation of the AuthZ tickets/token, the PEP may cache the ticket locally to speed-up the validation procedure.

# Traditional Access Control model – setting up trust and authority relations

- Policy, attributes semantics and namespaces are known a priory to all participating parties
  - A requestor knows what information to present to adhere to a specific policy and in what format (although PEP may act as ASM)
- PEP and PDP locations are known and interacting parties are known
- Trust relations between PDP, AA and resource are established
  - Resource trusts PDP's decision that can be delivered to a Resource in a form of AuthzTicket or based on default trust between PEP and Resource
  - Root of policy enforcement hierarchy, like in real life, belongs to the resource owner

This approach is not sufficient for effective Service Oriented Architecture (SOA)

# Open policy enforcement model in WSA/SOA using WS-Policy attachment mechanisms




- Linking dynamically all components of the access control system
- Policy is attached to any component of the service description in WSDL format
- Interacting services will fetch policy document and apply restrictions/rules to elements, which declared policy compliance requirements
- Provides a basis for mutual authorisation

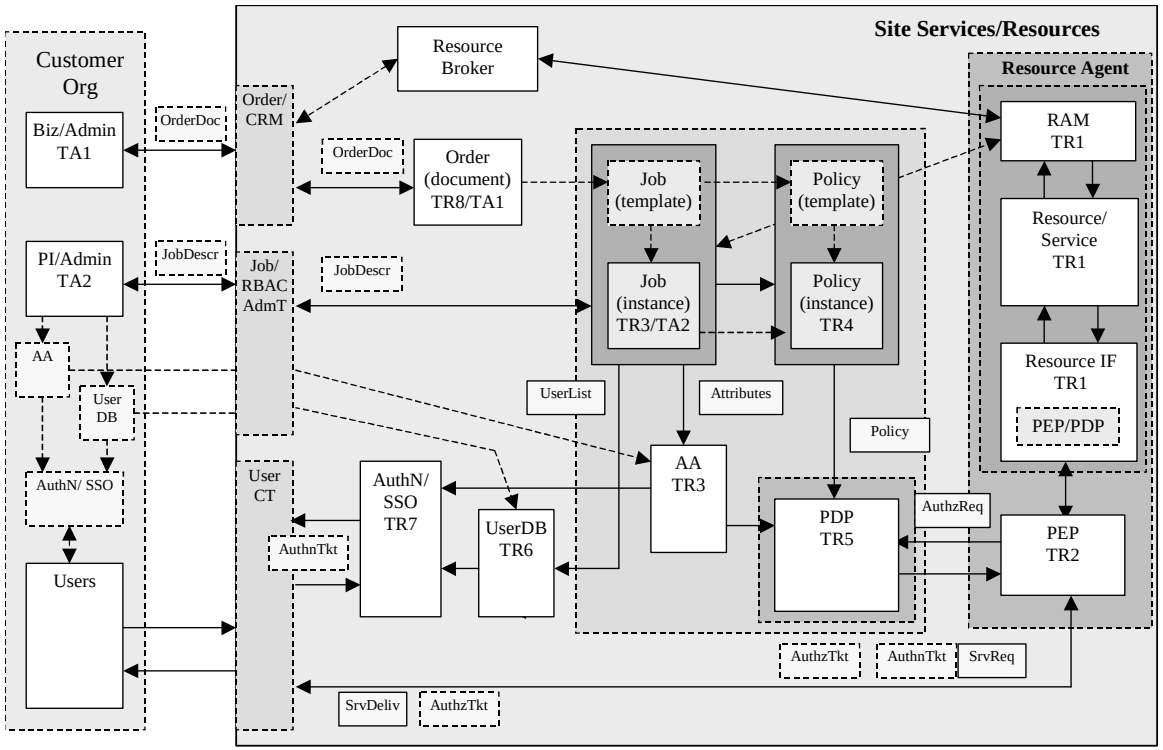
# Attaching policy to WSDL - Example

```
<definitions xmlns="http://schemas.xmlsoap.org/wsdl/"
        < …. snip long namespace declaration …. >
   xmlns:wsp="http://schemas.xmlsoap.org/ws/2002/12/policy"
   xmlns:cnl="http://cnl.telin.nl/cnl" xmlns:policy="cnl-policy-schema.xsd"
   targetNamespace="http://cnl.telin.nl/cnl">
    <message name="ViewExperimentRequest" wsp:PolicyURIs="cnl-policy-02example.xml">
        <part name="coordinateX" type="xs:string"/>
       <part name="coordinateY" type="xs:string"/>
       <part name="zoom" type="xs:int"/>
    </message>

   <<< snip >>>>
    <wsp:PolicyAttachment ... >
        <wsp:AppliesTo>
            <x:DomainExpression/> +
        </wsp:AppliesTo>
        ( <wsp:Policy>...</wsp:Policy> |
        <wsp:PolicyReference>...</wsp:PolicyReference> ) +
        <wsse:Security>...</wsse:Security> ?
        ...
    </wsp:PolicyAttachment>

    <wsp:UsingPolicy wsdl:Required="true"/>
   </definitions>
```

# Trust relations in distributed AAA infrastructure




Trust/credentials chain and delegation between major modules:

```
User =>
   => HomeOrg.staff(TA2) =>
      => Job.members =>
         => Member.roles =>
            => Role.permissions
```

The process of obtaining required permissions to perform requested action by the user:

```
User => AuthN(HomeOrg.staff, Job.members) =>
                => AuthZ(Member.roles, Policy.permissions) =>
                                   => Resource.permissions
```

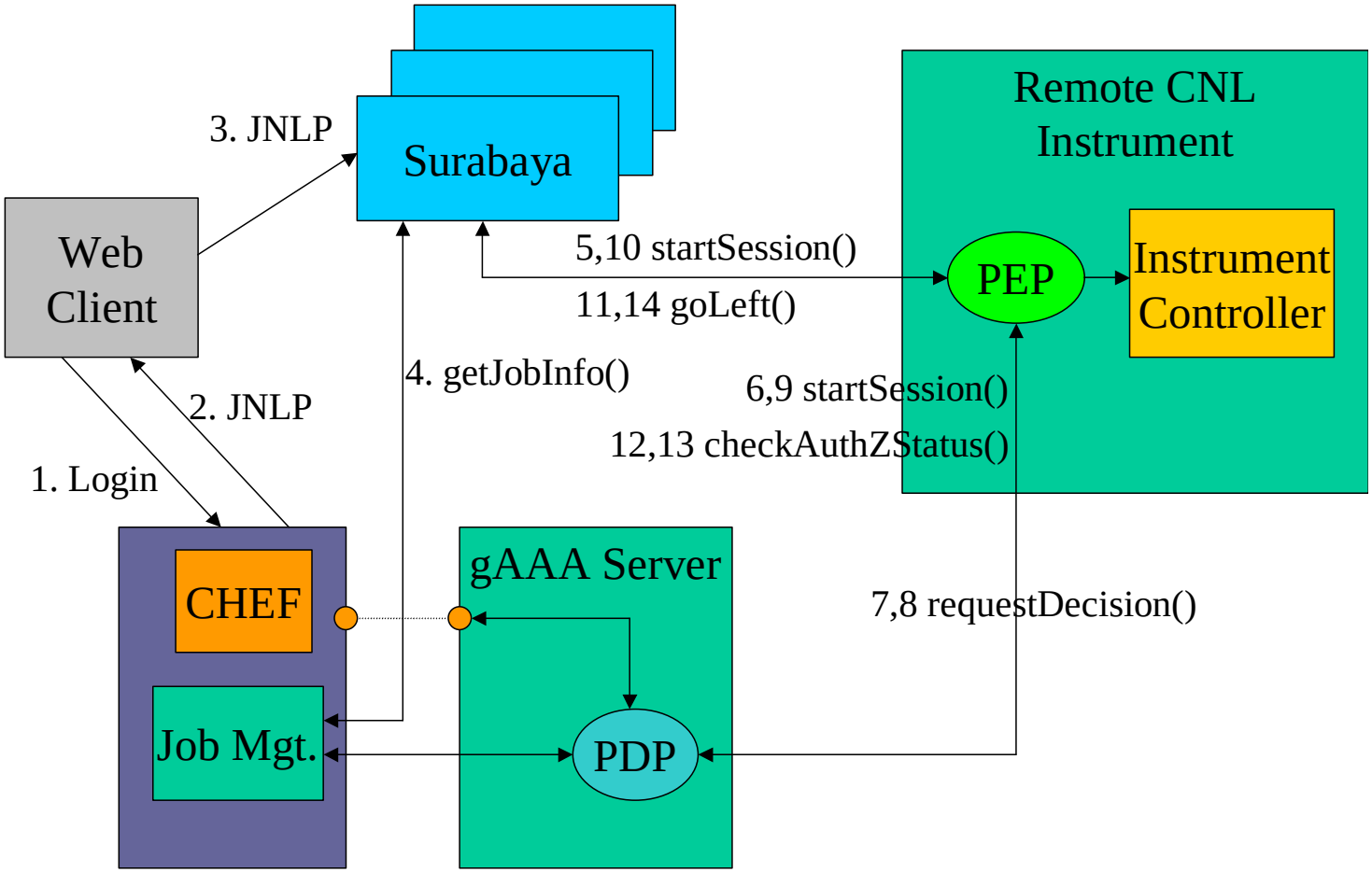
# Implementation suggestions for OCE Job-centric security model

- Root of trust and authority belong to the Resource
- Trust anchor TA2 embedded into the Job Description is the main trust anchor shared between the resource and the customer.
  - In more business integrated model the signed order may contain TA1
  - Both TA2 and TA1 may have the same trust path to the root/resource
- To become a shared trust anchor for the resource and the customer trust domains, the Order or JobDescription must contain mutually signed credentials/certificates
- Although the main PEP operation assumes authorisation decision request from the trusted PDP, in general PEP may accept an AuthzTicket from the trusted external PDP

# Before deploying security infrastructure

- Design conventions and agreements
  - Key distribution and trust establishing
    - In search of simple consistent model
  - Policy definition including subject, attributes, actions semantics and namespaces
    - Compatibility with existing, e.g. SAML, XACML
  - Security credentials format
    - Standard vs proprietary
  - Protocols and Messages format
    - SOAP + XACML Request/Response
      vs
    - SOAP + SAMLP + XACML

# Authorisation Service operation in a CNL2 Demo system



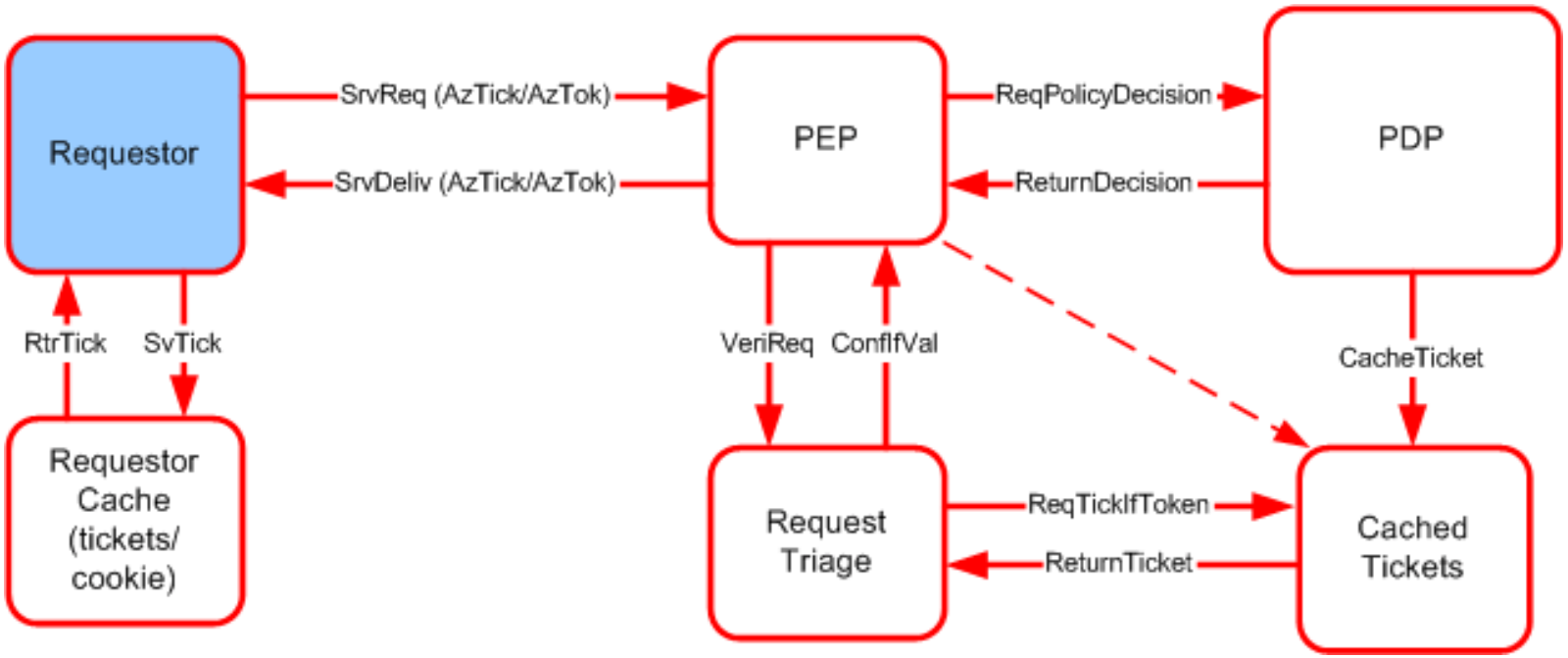

JNLP – Java Network Launch Protocol

CHEF – Collaborative tool

Surabaya – Collaborative Workspace environment

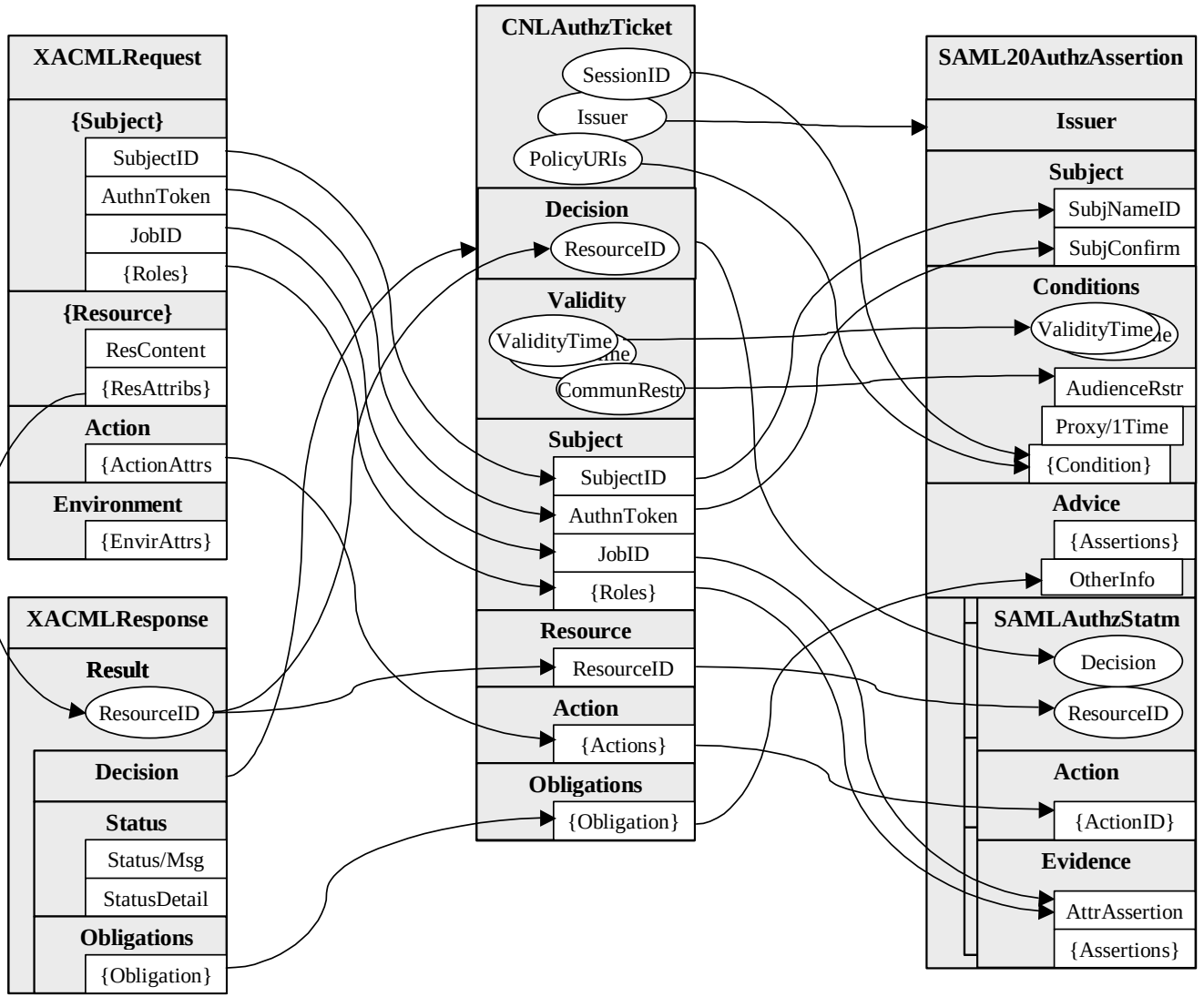
**Note:** we assume SSL TCP connections all over.

# Tickets/Tokens handling in AuthZ system




- AuthzTicket is issued by PDP and may be issued by PEP
- AuthzTicket must be signed
- AuthzTicket contains all necessary information to make local PEP-Triage Request verification
- When using AuthzTokens, AuthzTickets must be cached; Resolution mechanism from token to ticket must be provided

# Mapping between CNLAuthzTicket, XACML Request/Response and SAML2.0 Authorization Assertion




SAML 2.0 vs SAML 1.1

- Better security features
- Issuer and Subject are top level elements
- Encrypted elements for Subject, Attributes, Evidence
- Special profile for XACML

**General problems for AuthZ**

- Attributes can be placed only as deep as 5 level down: Assert/AzStm/Evid/AttrAsrt/Attr/AttrValue
- Ambiguous location for PolicyURIs and SessionID
- SAML1.1 ConfirmationData element is extensible type – compatibility problems

# CNLAuthzTicket example – 1011 bytes

```
<cnl:CNLAuthzTicket xmlns:AAA="http://www.AAAarch.org/ns/AAA_BoD"
   xmlns:cnl="http://www.aaauthreach.org/ns/#CNL" Issuer="http://www.AAAarch.org/servers/AAA"
   PolicyURIs="CNLpolicy01" SessionIndex="JobXPS1-2005-001"
   TicketID="c24d2c7dba476041b7853e63689193ad">
   <!-- Mandatory elements -->
   <cnl:Decision
   ResourceID="http://resources.collaboratory.nl/Philips_XPS1">Permit</cnl:Decision>
   <cnl:Validity NotBefore="2005-02-13T01:26:42.699Z" NotOnOrAfter="2005-02-
   14T01:26:42.699Z"/>
   <!-- Additional elements -->
   <cnl:Subject Id="subject">
         <cnl:SubjectID>WHO740@users.collaboratory.nl</cnl:SubjectID>
         <cnl:SubjectConfirmationData>SeDFGVHYTY83ZXxEdsweOP8Iok</cnl:SubjectConfirmationData>
         <cnl:JobID>CNL2-XPS1-2005-02-02</cnl:JobID>
         <cnl:Role>analyst@JobID;expert@JobID</cnl:Role>
   </cnl:Subject>
   <cnl:Resource>http://resources.collaboratory.nl/Philips_XPS1</cnl:Resource>
   <cnl:Actions>
         <cnl:Action>cnl:actions:CtrlInstr</cnl:Action>
         <cnl:Action>cnl:actions:CtrlExper</cnl:Action>
   </cnl:Actions>
<ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#"> ... </ds:Signature>
</cnl:CNLAuthzTicket>
```

# CNLAuthzTicket XML Signature element – 957 bytes (total signed ticket 1968 bytes)

```
<ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#">
   <ds:SignedInfo>
     <ds:CanonicalizationMethod Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315"/>
     <ds:SignatureMethod Algorithm="http://www.w3.org/2000/09/xmldsig#rsa-sha1"/>
     <ds:Reference URI="">
       <ds:Transforms>
         <ds:Transform Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
         <ds:Transform Algorithm="http://www.w3.org/TR/2001/REC-xml-c14n-20010315#WithComments"/>
       </ds:Transforms>
       <ds:DigestMethod Algorithm="http://www.w3.org/2000/09/xmldsig#sha1"/>
       <ds:DigestValue>nrNrZZDiw/2aDnKXFEHSeoixnsc=</ds:DigestValue>
     </ds:Reference>
   </ds:SignedInfo>
   <ds:SignatureValue>
0IZt9WsJT6an+tIxhhTPtiztDpZ+iynx7K7X2Cxd2iBwCUTQ0n61Szv81DKllWsq75IsHfusnm56
zT3fhKU1zEUsob7p6oMLM7hb42+vjfvNeJu2roknhIDzruMrr6hMDsIfaotURepu7QCT0sADm9If
X89Et55EkSE9oE9qBD8=
   </ds:SignatureValue>

   <ds:KeyInfo> << ... snip ... >> </ds:KeyInfo>

</ds:Signature>
```

# RSA <ds:KeyInfo> element – 1010 bytes (total signed ticket with KeyInfo - 3078 bytes)

```
<ds:KeyInfo>
  <ds:X509Data>
    <ds:X509Certificate>
     MIICADCCAWkCBEGX/FYwDQYJKoZIhvcNAQEEBQAwRzELMAkGA1UEBhMCTkwxGTAXBgNVBAoTEENv
     bGxhYm9yYXRvcnkubmwxHTAbBgNVBAMTFEFBQXV0aHJlYWNoIFNlY3VyaXR5MB4XDTA0MTExNTAw
     NDYxNFoXDTA1MDIxMzAwNDYxNFowRzELMAkGA1UEBhMCTkwxGTAXBgNVBAoTEENvbGxhYm9yYXRv
     cnkubmwxHTAbBgNVBAMTFEFBQXV0aHJlYWNoIFNlY3VyaXR5MIGfMA0GCSqGSIb3DQEBAQUAA4GN
     ADCBiQKBgQDdDrBhVmr1nD9eqi7U7m4yjIRxfvjAKv33EpuajvTKHpKUgLjbcBC3jNJ4F7a0GiXQ
     cVbuF/aDx/ydIUJXQktvFxK0Sm77WVeSel0cLc1hYfUSAg4mudtfsB7rAj+CzNnVdr6RLFpS9YFE
     lv5ptGaNGSbwHjU02HnArEGL2K+0AwIDAQABMA0GCSqGSIb3DQEBBAUAA4GBADHKqkOW4mP9DvOi
     bMvf4oqXTth7yv8o3Zol7+nqlB9Tqf/bVNLMk8vNo5fWRHbpnHIFFgTk31nrJf8kEZEofvwAeW9s
     1gQtYfs1oxvsMPKHxFjJDiZlLkHRViJl/slz5a7pkLqIXLRsPFRziTksemRXB/fT8KDzM14pzQZg
     HicO
    </ds:X509Certificate>
  </ds:X509Data>
  <ds:KeyValue>
    <ds:RSAKeyValue>
      <ds:Modulus>
     3Q6wYVZq9Zw/Xqou1O5uMoyEcX74wCr99xKbmo70yh6SlIC423AQt4zSeBe2tBol0HFW7hf2g8f8
     nSFCV0JLbxcStEpu+1lXknpdHC3NYWH1EgIOJrnbX7Ae6wI/gszZ1Xa+kSxaUvWBRJb+abRmjRkm
     8B41NNh5wKxBi9ivtAM=
      </ds:Modulus>
      <ds:Exponent>AQAB</ds:Exponent>
    </ds:RSAKeyValue>
  </ds:KeyValue>
</ds:KeyInfo>
```

# CNLAuthzToken example – 293 bytes

```
<cnl:CNLAuthzToken TokenID="ed9d969e1262ba1d3a7f33dbd670dd94">
<cnl:TokenValue>
0IZt9WsJT6an+tIxhhTPtiztDpZ+iynx7K7X2Cxd2iBwCUTQ0n61Szv81DKllWsq75IsHfusnm56
zT3fhKU1zEUsob7p6oMLM7hb42+vjfvNeJu2roknhIDzruMrr6hMDsIfaotURepu7QCT0sADm9If
X89Et55EkSE9oE9qBD8=
</cnl:TokenValue>
</cnl:CNLAuthzToken>
```

- CNLAuthzToken is constructed of the CNLAuthzTicket TicketID and SignatureValue
- CNLAuthzToken use suggests caching CNLAuthzTicket's

# CNLSAMLAuthzTicket example – 2254 bytes

```
<Assertion xmlns="urn:oasis:names:tc:SAML:1.0:assertion" xmlns:saml="urn:oasis:names:tc:SAML:1.0:assertion"
    xmlns:samlp="urn:oasis:names:tc:SAML:1.0:protocol" AssertionID="c236b047d62db5cecec6b240996bcb90" IssueInstant="2005-02-
    15T14:53:23.542Z" Issuer="cnl:subject:CNLAAAauthority" Version="1.1">
  <Conditions NotBefore="2005-02-16T14:32:12.506Z" NotOnOrAfter="2005-02-17T14:32:12.506Z">
    <Condition xsi:type="typens:cnl:session-id">JobXPS1-2005-001</Condition>
    <Condition xsi:type="typens:cnl:policy-uri">CNLpolicy01</Condition>
  </Conditions>
  <AuthorizationDecisionStatement Decision="Permit" Resource="http://resources.collaboratory.nl/Philips_XPS1">
    <Action Namespace="urn:oasis:names:tc:SAML:1.0:action:cnl:action">cnl:actions:CtrlInstr</Action>
    <Action Namespace="urn:oasis:names:tc:SAML:1.0:action:cnl:action">cnl:actions:CtrlExper</Action>
    <Evidence>
      <Assertion AssertionID="f3a7ea74e515ffe776b10a7eef0119d7" IssueInstant="2005-02-15T14:53:23.542Z"
    Issuer="cnl:subject:CNLAAAauthority" MajorVersion="1" MinorVersion="1">
        <Conditions NotBefore="2005-02-15T14:53:11.745Z" NotOnOrAfter="2005-02-16T14:53:11.745Z"/>
        <AttributeStatement>
          <Subject>
            <NameIdentifier Format="urn:oasis:names:tc:SAML:1.1:nameid-format:emailAddress"
    NameQualifier="cnl:subject">WHO740@users.collaboratory.nl</NameIdentifier>
            <SubjectConfirmation>
              <ConfirmationMethod>signed-subject-id</ConfirmationMethod>                    ===➔ moved to attr in SAML 2.0
              <ConfirmationData>
              PBLIR0aZRtdZmq979lj8eDpJ5VT6BxxWBtSApC5BPnIsfHRUcOOpWQowXBw2TmOZdJGNzFWhMinz
              XU3/wSdLjv+siO2JGfyZ7U9eqkM0GqY8VizMl5uRuUAsrr7AIHv9/DP1ksJMNDZ5DnGosMc+Zyqn
              KogfMqhK+DKqPwfHF6U=</ConfirmationData>
            </SubjectConfirmation>
          </Subject>
          <Attribute xmlns:typens="urn:cnl" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
    instance" AttributeName="AttributeSubject" AttributeNamespace="urn:cnl">
            <AttributeValue xsi:type="typens:cnl:job-id">CNL2-XPS1-2005-02-02</AttributeValue>          ===➔ level 5 of element
            <AttributeValue xsi:type="typens:cnl:role">analyst@JobID;expert@JobID</AttributeValue>
          </Attribute>
        </AttributeStatement>
      </Assertion>
    </Evidence>
  </AuthorizationDecisionStatement>
</Assertion>
```

# CNLAuthnTicket example – 1752 bytes

```
<cnl:CNLAuthnTicket xmlns:AAA="http://www.AAAarch.org/ns/AAA_BoD"
    xmlns:cnl="http://www.aaauthreach.org/ns/#CNL" Issuer="http://www.AAAarch.org/servers/AAA"
    TicketID="f35585dfb51edec48de0c7eadb11c17e">
  <!-- Mandatory elements -->
  <cnl:Validity NotBefore="2005-02-15T14:33:10.548Z" NotOnOrAfter="2005-02-16T14:33:10.548Z"/>
  <cnl:Subject Id="subject">
    <cnl:SubjectID>WHO740@users.collaboratory.nl</cnl:SubjectID>
    <cnl:SubjectConfirmationData>
    0+qQNAVuZW4txMi8DH6DFy7eLMGxSfKDJY6ZnY4UW5Dt0JFtatlEprUtgnjCkzrJUMvWk9qtUzna
    sDdUG+P4ZY7dgab+PHiU91ClusZbztu/ZIjNqCnw5su1BQLTumC8ZTtYKKJi4WWs+bMMbP8mFNQm
    +M7F4bJIPBfLcxf0bk4=
    </cnl:SubjectConfirmationData>
    <!--Optional elements -->
    <cnl:SubjectAttribute attrname="urn:cnl:subject:attribute:job-id">
     CNL2-XPS1-2005-02-02
    </cnl:SubjectAttribute>
    <cnl:SubjectAttribute attrname="urn:cnl:subject:attribute:role">
     analyst@JobID;expert@JobID
    </cnl:SubjectAttribute>
  </cnl:Subject>
</cnl:CNLAuthnTicket>
```

# CNLAuthnToken signed/encrypted – 401/269 bytes

```
<cnl:CNLAuthnToken xmlns:cnl="http://www.aaauthreach.org/ns/#CNL"
    TokenID="f35585dfb51edec48de0c7eadb11c17e">
  <cnl:SubjectID>WHO740@users.collaboratory.nl</cnl:SubjectID>
  <cnl:TokenValue>
   0+qQNAVuZW4txMi8DH6DFy7eLMGxSfKDJY6ZnY4UW5Dt0JFtatlEprUtgnjCkzrJUMvWk9qtUzna
   sDdUG+P4ZY7dgab+PHiU91ClusZbztu/ZIjNqCnw5su1BQLTumC8ZTtYKKJi4WWs+bMMbP8mFNQm
   +M7F4bJIPBfLcxf0bk4=</cnl:TokenValue>
</cnl:CNLAuthnToken>
```

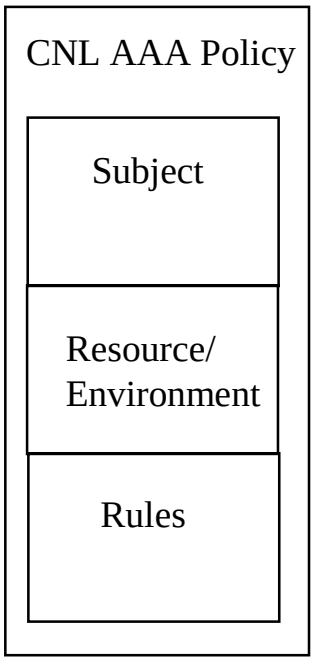
- CNLAuthnToken is constructed of the CNLAuthnTicket TicketID and SubjectConfirmationData which is encrypted SubjectID value
- CNLAuthzToken must be self-sufficient and doesn't require caching CNLAuthnTicket's

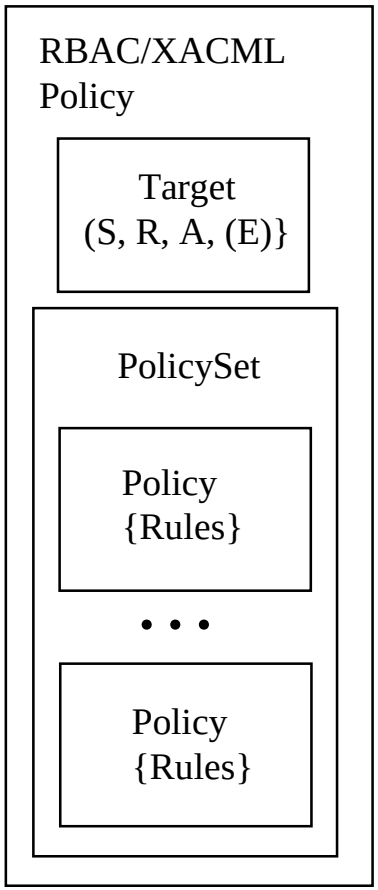
```
<cnl:CNLAuthnToken xmlns:cnl="http://www.aaauthreach.org/ns/#CNL"
    TokenID="a392a20157698d201d77b2c6e8e444ef">
<cnl:SubjectID>WHO740@users.collaboratory.nl</cnl:SubjectID>
<cnl:TokenValue>qij9zJgKZp9RiJxYN1QJAN0vhjLJSMGVLD/doQtmCsk=</cnl:TokenValue>
</cnl:CNLAuthnToken>
```

# Integrating with existing Access Control and other tools

- Policy mapping between XACML, AAA Policy Language and other formats
- GT4 Authorization Framework
- EGEE gLite Authorisation Framework

# AAA Policy and RBAC/XACML Policy



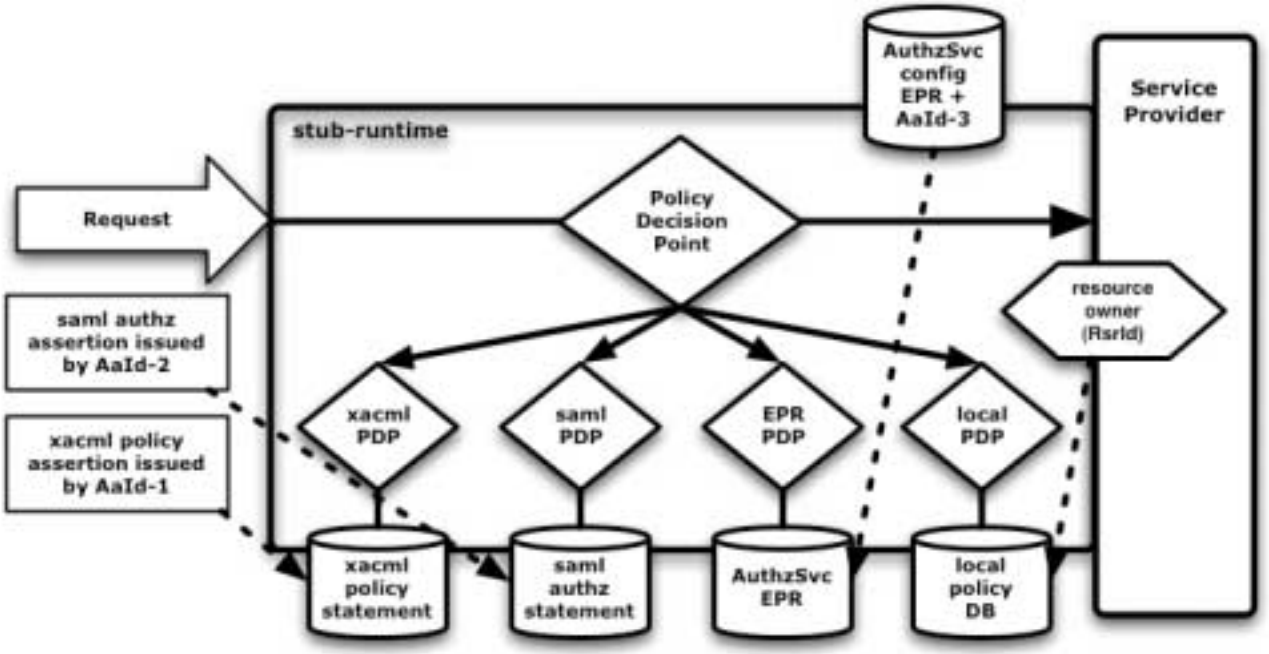



# GT4 AuthZ framework: Implementation details

- Source code tree

  org.globus.wsrf.impl.security.authorization
- Still using grid-map file as a major option
- Special interface for PDP and PIP to interact with Interceptor
- Very simple example provisioning for XACML
  - Simple policy format

# GT4 AuthZ framework: Multiple configured PDPs




GT4 implementation uses Interceptor concept

- Originated from POSIX AuthZ f/w
- Supported by Axis Handlers
- PEP function is (virtually) eliminated
- “Deny-override” vs “Permit-override” combination
- Configured by Interceptor PDP/PIP call-out list
- PDP are called directly or via PIP

# Acknowledgements

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