The Globus Authorization Processing Framework

New Challenges for Access Control Workshop

April 27, 2005, Ottawa, Canada

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Outline

- The Globus Toolkit (GT)
- (Grid) Use Cases
  - Virtual Orgs (VOs), multiple admin realms, delegation
- Policy, Policy, Policy....
  - Attributes
    - Shibboleth, SAML, X509-ACs, VOMS, etc.
  - Authorization
    - Call-out, SAML Authz, XACML, PC, PERMIS, AAA-tk, Delegation...
- Authorization Processing Framework
  - Attribute collection, generic PDP-abstraction, Master-PDP, Delegation/Rights-Admin
- Big Picture & Futures
  - Proto-type=>real-thing, XACML-3, job/agreement-language integration
Globus Toolkit (GT-4.0)

- WS, WS-I & WSRF compliant toolkit
- WSS, WS-I, X509/(GGF-)SAML Identity/Attribute Certificates, X509 Proxy-Certificate, XACML, PERMIS, VOMS compliant toolkit
  - Message Level Security & TLS support
- Different platform support
  - Java, C/C++, Python, .Net/C#
- (Security-)Integrated with higher-level Svcs
  - GridFTP, GRAM, MDS, MyProxy, PURSE, OGSA-DAI...
- Many, many parties involved
  - Customer-requirements driven
  - ... with commercial “versions”...
- Open Source
  - Apache-style license
Leverage (Open Source) Security Service Implementations

- **OpenSSL**
  - “native” Proxy Certificate support coming...
    (thanks to OpenSSL hacker Richard Levitte and KTH!)

- **Internet2’s OpenSAML**
  - Part of GT - used by CAS/GridShib/AuthzCallout/...

- **Internet2’s Shibboleth**
  - NSF funded GridShib project to “Grid-enable” Shibboleth

- **Sun’s open source XACML effort**
  - Integrate sophisticated policy decision engine in the GT

- **Futures: Permis, Handle System, XKMS, XrML, …**
Security of Grid Brokering Services

- Brokers/Schedulers handle resource discovery, reservation, coordination, and usage on behalf of users.
- Each Organization enforces its own access policy.
- User needs to delegate rights to broker which may need to delegate to services.
Security Services Objectives

- It’s all about “Policy”
  - (Virtual) Organization’s Security Policy
  - Security Services facilitate the enforcement

- Security Policy to facilitate “Business Objectives”
  - Related to higher level “agreement”

- Security Policy often delicate balance
  - More security ⇔ Higher costs
  - Less security ⇔ Higher exposure to loss
  - Risk versus Rewards
  - Legislation sometimes mandates minimum security
Agreement ⇔ VO Security Policy

(Business) Agreement

- Price
- Cost
- Obligations
- QoS
- T&Cs
- Security

Dynamic VO Security Policy

- members
- resources
- roles
- Attribute mgmt
- Authz mgmt

Static Initial VO Security Policy

- trust anchors
- (initial) members
- (initial) resources
- (initial) roles

- Access rules
- Privacy rules
Virtual Organization Concept
Propagation of Requester’s Rights through Job Scheduling and Submission Process

Virtualization complicates Least Privilege Delegation of Rights

Dynamically limit the Delegated Rights more as Job specifics become clear

Trust parties downstream to limit rights for you... or let them come back with job specifics such that you can limit them

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Security Services with VO
GT’s Attribute Assertion Support

- VOMS/Permis/X509/Shibboleth/SAML identity/attribute assertions
- Assertions can be pushed by client, pulled from a service, or are made locally available

GT-runtime has to mix and match all Attribute information a consistent manner, and present it to the subsequent Authz stage...
GT’s GGF’s Authorization Call-Out Support

- GGF’s OGSA-Authz WG:
  "Use of SAML for OGSA Authorization"
  - Authorization service specification
  - Extends SAML spec for use in WS-Grid
  - Recently standardized by GGF

- Conformant call-out integrated in GT
  - Transparently called through configuration

- Permis interoperability
  - Ready for GT4!

- Futures...
  - SAML2.0 compliance ... XACML2.0-SAML2.0 profile
GT-XACML Integration

- eXtensible Access Control Markup Language (XACML)
  - OASIS standard
  - Open source implementations
- XACML: sophisticated policy language
- Globus Toolkit will ship with XACML runtime
  - Integrated in every client and server build on GT
  - Turned-on through configuration

...and we’re using the XACML-“model” for our Authz Processing Framework...

...can be called transparently from runtime and/or explicitly from application...
GT’s Assertion Processing “Problem”

- VOMS/Permis/X509/Shibboleth/SAML/Kerberos identity/attribute assertions
- XACML/SAML/CAS/XCAP/Permis/ProxyCert authorization assertions
- Assertions can be pushed by client, pulled from service, or locally available
- Policy decision engines can be local and/or remote
- Delegation of Rights is required “feature” implemented through many different means

**GT-runtime has to mix and match all policy information and decisions in a consistent manner...**
Basic Access Control Policy

Bob’s policy:
Alice is my friend and I’ll share my lemonade with her
Mallory is not my friend and he can go #$%^&

Can I have glass of lemonade?
Sure, here is a glass

Can I have glass of lemonade?
No way, I don’t like you
Basic Access Control Policy (2)

Bob’s policy:
Alice is my friend and I’ll share my lemonade with her
Mallory is not my friend and he can go #$%^&

Can I have glass of lemonade?
Sure, here is a glass

Resource Owner decides!
(ultimate source of authority for access)
Delegation of Rights (1)

Ivan’s policy:
Carol is my friend and I’ll share my lemonade with her
I’ll share my lemonade with any friend of Carol
I don’t know any Bob... (?)

Can I have glass of lemonade?
Sure, here is a glass

Can Bob have glass of lemonade?
Sure, Bob is my friend

Carol’s policy:
Bob is my friend and I’ll share my lemonade with him
Delegation of Rights (2)

Ivan’s policy:
Carol is my friend and I’ll share my lemonade with her
I’ll share my lemonade with any friend of Carol
I don’t know any Bob... (?)

Can I have glass of lemonade?

Ivan likes Carol + Carol likes Bob
=> Ivan likes Bob
(non-normative delegation logic ;-) )

Sure, Bob is my friend

Carol’s policy:
Bob is my friend and I’ll share my lemonade with him

Sure, Bob is my friend

Ivan
Delegation of Rights (3)

Ivan’s PermitPolicy: Subject.vo-role == “administrator”
Ivan’s Attribute Assertion: Carol.vo-role = “administrator”
Ivan has no policy applicable to Bob => NotApplicable

Ivan’s local XACML PDP

Request to invoke porttype/operation on ws-resource

Application Reply

Can Bob’s request context invoke porttype/operation on my ws-resource?

Carol’s SAML-XACML Authz Svc EPR = Ext-PDP

Permit

Ivan delegates the rights to administrate access to Carol

Carol’s PermitPolicy: Subject.name == “Bob”

Bob

Carol

Ivan
Authz Processing Assumptions (1)

- All Policy Statements, PDPs and Authz-Decisions have Issuer associated with them
  - “someone” has to take responsibility for statements and associated decisions
- Resource Owner is the Ultimate Authority
  - Any statement/decision that can not be directly traced back to the owner is NotApplicable
    - “traced back”: delegation chain that starts with owner
- Two different Policy Statements and Queries
  - Admin Policy Statements
    - Issuer states that certain admin-subject are allowed to administer the rights of certain access-subjects to invoke certain operations on certain resources.
  - Access Policy Statements
    - Issuer states that certain access-subject are allowed to invoke certain operations on certain resources.
Authz Processing Assumptions (2)

- “Push-Pull” Equivalence
  - Pushing authz-assertion and evaluating it locally renders same decision as evaluating the same policy statements remotely behind an external PDP
- Authz-Decisions are Policy Statements
  - Folded over the request context
  - Could optimize by only considering the attributes used to render a decision...
  - If attributes don’t specify a “invocation context”, then only the invoker’s identity would suffice...
  - Conservative: mandate that all request context’s attributes values are equal to the ones that rendered the decision.
Attribute Collection Framework

Attributes

Services

Untrusted Attribute Svc

Trusted Attribute Svc

Attribute Authority Svc

Untrusted Attribute Svc

Signed Assertion Issuer \neq Signer

Trusted Attribute Svc

Unsigned Assertion Issuer \neq Sender

Message/Transport validation => AuthN Sender

SAML/IC/AC/PC DSig validation => AuthN Signer

Authorize Assertion Issuer \neq Sender

GT-Runtime

Local AttrSvs EPRs

Collected AttrSvs EPRs

Collected Id & Attr Assertions

Local SAML Id&Attr Assertions

Attribute Set per Actor

Normalized Attributes

(access)-subject-0

subject-1

subject-2

subject-n

mapping

grouping

AuthZ... PEP/PDP

Request

SOAP Header + AttrSvc-EPR

X509 Proxy-Certificate + AttrSvc-EPR

X509 Proxy-Certificate + X509 Attr Cert

SOAP Header + X509 Attr Cert

SOAP Header + SAML Assertion

X509 Proxy-Certificate + SAML Assertion

X509 Proxy Certificate X509 Identity Certificate
GT’s Authorization Processing Model (1)

- Use of a Policy Decision Point (PDP) abstraction that conceptually resembles the one defined for XACML.
  - Normalized request context and decision format
  - Modeled PDP as black box authorization decision oracle
- After validation, map all attribute assertions to XACML Request Context Attribute format
- Create mechanism-specific PDP instances for each authorization assertion and call-out service
- The end result is a set of PDP instances where the different mechanisms are abstracted behind the common PDP interface.
GT’s Authorization Processing Model (2)

- The Master-PDP orchestrates the querying of each applicable PDP instance for authorization decisions.
- Pre-defined combination rules determine how the different results from the PDP instances are to be combined to yield a single decision.
- The Master-PDP is to find delegation decision chains by asking the individual PDP instances whether the issuer has delegated administrative rights to other subjects.
- the Master-PDP can determine authorization decisions based on delegated rights without explicit support from the native policy language evaluators.
GT Authorization Framework (1)
GT Authorization Framework (2)
GT Authorization Framework (3)

- Master-PDP accessed all mechanism-specific PDPs through same Authz Query Interface
  - SAML-XACML-2 profile
- Master PDP acts like XACML “Combinator”
  - “Permit-Overrides” rules
    - Negative permissions are evil...
- Delegation-chains found through exhaustive search
  - ...with optimization to evaluate cheap decisions first...
- “Blacklist-PDPs” are consulted separately
  - Statically configured, call-out only PDPs
  - Deny-Overrides only for the blacklist-PDPs...
    - Pragmatic compromise to keep admin simple
**GT-Authz Summary & Futures**

- **Generic Authz Processing Framework**
  - Mix, match and combine different authz mechanism
  - Supports delegation as “side-effect”
- **Proto-type => GT-4.2 integration**
  - Both Attribute Collection & Authz Processing
  - Java, Python, C/C++ (.Net) ... WS & GridFTP & httpd
- **XACML-3 (?)**
  - May be able to incorporate “all” our processing requirements
- **Focus on higher-level Policy Integration**
  - (Security) Policy Negotiation/Publishing/Discovery
  - Job Execution & Agreement Language Integration (?Semantic Web?)
  - Infrastructure Svc Integration to enable the “5-min VO”
  - ... stay requirement driven - listen to our “customers” ...