Distributed Application Development Technology Project

Shared Services Group
Applied Research & Technology

- **Objective**
  - Identify, investigate, prototype, and demonstrate how emerging standard technologies can be used to build distributed applications with authentication and role-based authorization using CORBA services and a Public Key Infrastructure (LDAP and X.509 certificates).

- **Technology**
  - Combines technology from several projects: security, Java, components, objects.

- **Constraints**
  - Pure Java solution, X.509v3 certificates, integration into corporate LDAP schema.
Situation

• Applications
  • Each application does its own access management in its own application specific manner
  • Currently four major COTS applications
    – Number of applications is growing

• Users
  • User base will increase from 20,000 to 50,000+ Users

• Performance
  • Role changes ripple through the system
  • Distribution of access information into new releases or builds requires between 24 and 72 hours of downtime
  • User updates require a minimum of 24 hour turnaround
  • Quick fixes to user privileges made in the application are often not updated within SSA
Target

- Central management and visibility of user account and privileges using Secure System Access (SSA)
- Reduce the complexity of managing user privilege associations using Role Based Access Control (RBAC)
- Externalize user privilege associations
- Externalize the definition of roles
- Data is centrally managed and replicated
- Management interfaces used to manage data in the store
- Application interfaces used to retrieve the user’s authorization policy (via CORBA, Java, DCOM)
- User’s authorization policy cached on the local device for the duration of the user’s session
- Take advantage of emerging technology
Prototype Summary

- Authentication
  - Used Netscape Certificate Server to generate and e-mail X509v3 certificates
  - Used the JDK 1.2 (and JCE) to read DN in certificate
- Authorization
  - Used LDAP to store and retrieve roles, capabilities and access contexts
  - Used a component based object service to access the LDAP data and make authorization decisions
LDAP Schema

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Attributes

<table>
<thead>
<tr>
<th>application</th>
<th>capability</th>
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<tbody>
<tr>
<td>appname</td>
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<tr>
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<tr>
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<table>
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<tr>
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<tbody>
<tr>
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<tr>
<td>appcap</td>
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<tr>
<td>description</td>
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<tr>
<td>o</td>
</tr>
<tr>
<td>ou</td>
</tr>
<tr>
<td>owner</td>
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<tr>
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<td>owner</td>
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<table>
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<tr>
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<tr>
<td>dataset</td>
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<tr>
<td>partitioningname</td>
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<tr>
<td>description</td>
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<tr>
<td>ou</td>
</tr>
<tr>
<td>owner</td>
</tr>
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</table>

notation: attributes above the box’s internal line are required, those below the line are optional. All objects require objectClass which is not shown to reduce clutter.
Authorization Service Prototype Software Subsystems

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SERVICES
- distributed object platform
- security service
- authorization service
- relational database interface

PRESENTATION
- HTML
- applet
- stand-alone GUI app

DOMAIN
- COTS1 (pdm)
- COTS2 (erp)
- STAC

FRAMEWORKS
- component framework
- LDAP sdk
- JDK

Notes:
- not implemented in prototype
- denotes dependency
Prototype: Security Abstractions-1

- Abstractions based on CORBA Security model (we provisionally defined simplified interfaces).
- CORBA Security model probably the most flexible and extensible; mapping to Java, WWW, Microsoft models should be possible, if not straightforward. (We have not proved this.)
- (Note: security model mappings at this level will not solve security service interoperability issues.)
- Use of CORBA Security abstractions does not require underlying CORBA Security services or CORBA ORB. Two prototype implementations so far:
  - single-VM, no ORB.
  - CORBA ORB (OrbixWeb), no CORBA-based security.
  - (OrbixSSL, Orbix Security and web-based prototypes envisioned, but not implemented.)
CORBA Security:

- Users are associated with Security Attributes, including identity (e.g., user’s DN name) and privilege attributes (e.g., DCAC “context”).
- Credentials contain set of Security Attributes which will determine user’s effective rights (e.g., DCAC “capabilities?”).
- Credentials are passed between client and target via Current object (representing current invocation thread).
- Credentials may be delegated, if there are multiple hops to target.
- Security Policies may be defined for a set of objects. (E.g., Access Policy answers the question: what are user’s rights on an object given Security Attributes set in Credentials?)
Prototype: Platform Abstractions

• Platform abstractions provide applications’ view of distributed object services.
• Support retrieval of Current and Policy objects by applications.
• Interceptors inserted in invocation path enable communication of authorization data where underlying security services do not support it. (E.g., SSL supports communication of identity, not other attributes.)
• Interceptors must be implemented differently depending on infrastructure (e.g., Orbix Filters). OMG is working on standard.
• Access control may be performed in Interceptors (not addressed in prototype).
Prototype: Component Model

Supports assembly from pre-built, distributed components.
Prototype Scenario

- User interacts with “OURSTAC” via a remote client. (Presumed to have logged on to system prior to OURSTAC startup. No further login required.)
- OURSTAC presents user with choice of Contexts for which the user is authorized. *(Authorization required.)*
- User selects a Context for the session.
- OURSTAC presents all the Applications for which the user is authorized in this Context. *(Authorization required.)*
- User selects the COTS1 application.
- OURSTAC connects to a remote instance of COTS1 on the user’s behalf. *(Security context and delegation required.)*
- COTS1 presents user with choice of authorized Capabilities. *(Authorization required.)*
- User selects Capability ...
Prototype APIs

Application Programming Interfaces:
• UserAuthorizationPolicy
  - What contexts are authorized to user?
  - What applications are authorized to user in current context?
• ApplicationAccessPolicy
  - What capabilities are authorized to user for this application?

Service Provider Interfaces:
• AuthorizationDataAccess
  - Retrieves attribute and policy data from directory.
• CredentialsCache
  - Retrievals user’s authenticated credentials (e.g. X.509).