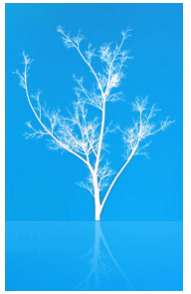
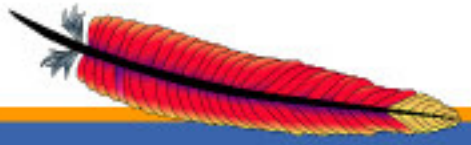


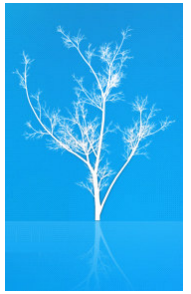
ApacheDS
Access Control Administration; The X.500 Way

- Originally presented at ***ApacheCon US 2006*** in Austin
- Latest presentation materials are at ***http://people.apache.org/~ersiner***
- Presented by ***Ersin Er***, ***ersiner@apache.org***



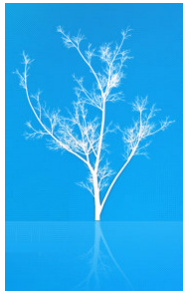
ApacheCon US 2006

Agenda

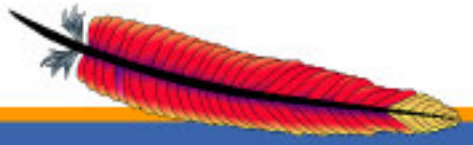


- Access Control
- X.500 Access Control Model
- ACI Items
- Directory Access Control Domains
- Some Principals
- Access Control Administrative Areas
- Delegation of Authority
- Demos

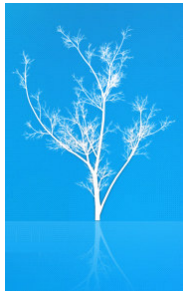
Access Control



- Access: Performing an operation on a resource and getting back some result
- Control: Defining
  - **Who** can
  - access **How**
  - to **What**

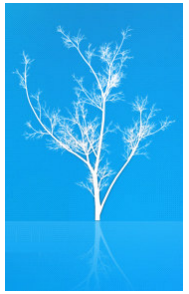


X.500 Access Control



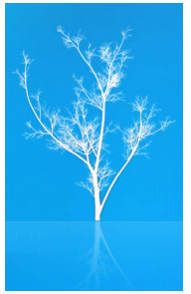
- Defined in terms of Access Control Information (ACI) Items
  - Who can: *User Classes*
  - access How: *Grants and Denials*
  - to What: *Protected Items*

ACI items are powerful



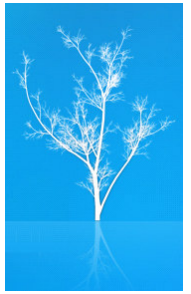
- Fine grained access control
  - Various options with different semantics and capabilities to specify User Classes and Protected Items
- Matter of style - different ways to define access control
  - Who can – (access How, to What)*
  - to What – (Who can, access How)*

Exploring ACIItem components: User Classes



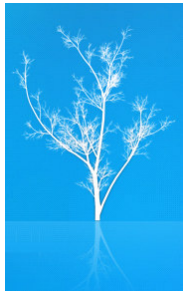
- All users
- A specific user
- A user group
- The user who accesses his/her own (user) entry
- Users (entries) falling under a *subtree*

Exploring ACIItem components: Protected Items



- An entry itself (but not any attribute types or values)
- All user attribute types and values
- All user attribute types (but not any values)
- All attribute values (of a type)
- An attribute type (but not any values)
- Attribute value (of a type)
- User's DN as an attribute value (of a type)

Exploring ACIItem components: Grants and Denials

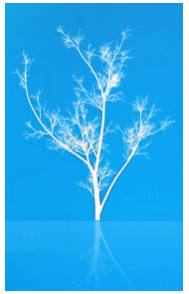


- Some *Grants and Denials* that can be associated with an *Entry*:
  - Read
  - Browse
  - ReturnDN

  } Search
  - Add
  - Modify
  - Remove
  - Rename
  - Export
  - Import

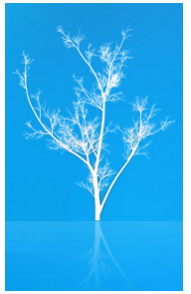
  } ModifyDN

Exploring ACIItem components: Grants and Denials

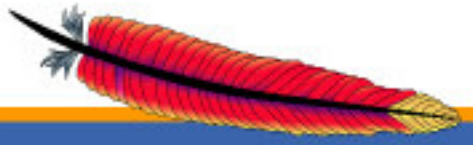


- Some *Grants and Denials* that can be associated with both an *Attribute Type* and an *Attribute Value*:
  - Read
  - Compare
  - FilterMatch
  - Add
  - Remove

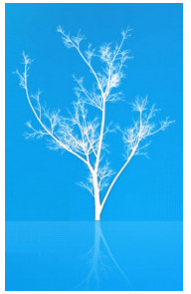
DEMO 1



- Grant read access to an attribute for a user
  - Allow John to read his name!



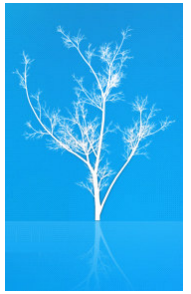
DEMO 1 - entryACI



```
{ identificationTag  "allowJohnToReadHisName_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses {
      name { "cn=John,ou=users,ou=system" }
    },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantRead }
      },
      { protectedItems {
          attributeType { commonName },
          allAttributeValues { commonName }
        },
        grantsAndDenials { grantRead }
      }
    }
  }
}
```

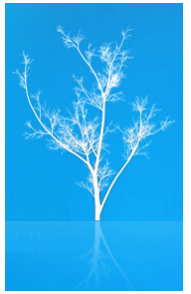
Put this in John's user entry

DEMO 2



- Grant modify access to an attribute for a user
  - Allow Jane to change her password!

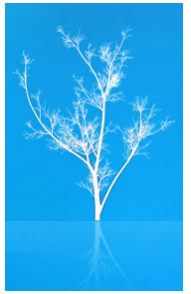
DEMO 2 - entryACI



```
{ identificationTag  "allowJaneToChangeHerPassword_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses {
      name { "cn=Jane,ou=users,ou=system" }
    },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantRead, grantModify }
      },
      { protectedItems {
          allAttributeValues { userPassword }
        },
        grantsAndDenials { grantRemove, grantAdd }
      }
    }
  }
}
```

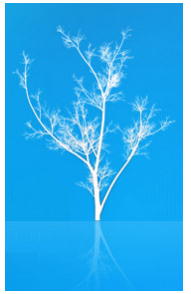
Put this in Jane's user entry

DEMO 3



- Grant read and modify access of a specific value to an attribute for a user
  - Allow Jim to subscribe to/unsubscribe from a mail list!

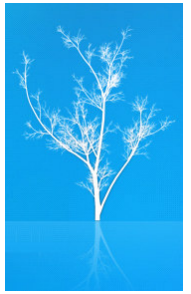
DEMO3 - entryACI



```
{ identificationTag "allowJimToSubsToUnsubsFromAMailList_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses { name { "cn=Jim,ou=users,ou=system" } },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantRead, grantModify }
      },
      { protectedItems {
          attributeValue {
            { type uniqueMember, value "cn=Jim,ou=users,ou=system" }
          }
        },
        grantsAndDenials { grantRead, grantRemove, grantAdd }
      }
    }
  }
}
```

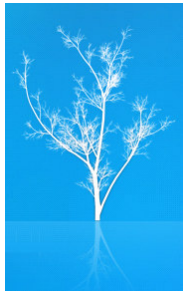
Put this in mail list entry

Questions



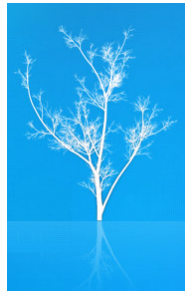
- Are we going to create
  - each of these entryACI values
  - for each user entry
  - if we want them all have same permissions?
- Changes from user to user seem to be few, don't they?

(Unsatisfactory) Answer



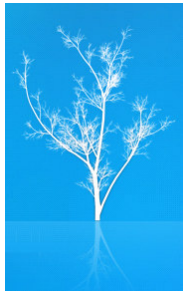
- We can replace user specific parts in each entryACI with generic components:
  - For 1st and 2nd cases:
    - UserClass *thisEntry*
      - Not for the 3rd case, because the accessed entry is not the user's entry
  - For 3rd case:
    - UserClass *allUsers*
    - ProtectedItem *selfValue*
  - can be used.

DEMO 4



- Grant read and modify access to an attribute for a user
  - Allow user to read/change his or her password!

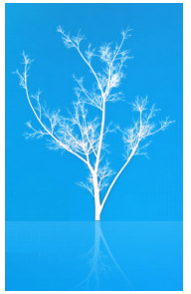
DEMO 4 - entryACI



```
{ identificationTag  "allowUserToChangeHisOrHerPassword_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses {
      thisEntry
    },
    userPermissions {
      { protectedItems {
          entry
        },
        grantsAndDenials {
          grantRead, grantModify
        }
      },
      { protectedItems {
          allAttributeValues { userPassword }
        },
        grantsAndDenials {
          grantRemove, grantAdd
        }
      }
    }
  }
}
```

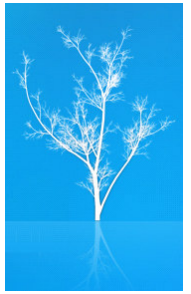
Put this in a user's entry

DEMO 5



- Grant read and modify access of a specific value to an attribute for a user
  - Allow users to subscribe to/unsubscribe from a mailing list!

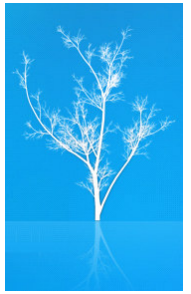
DEMO 5 - entryACI



```
{ identificationTag  "allowAllUsersToSubscribeToUnsubscribeFromAMailingList_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses {
      allUsers
    },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantRead, grantModify }
      },
      { protectedItems {
        selfValue
        },
        grantsAndDenials {
          grantRead, grantRemove, grantAdd
        }
      }
    }
  }
}
```

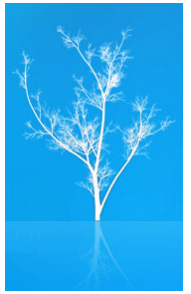
Put this in a mail list entry

Why was the answer unsatisfactory? New Questions



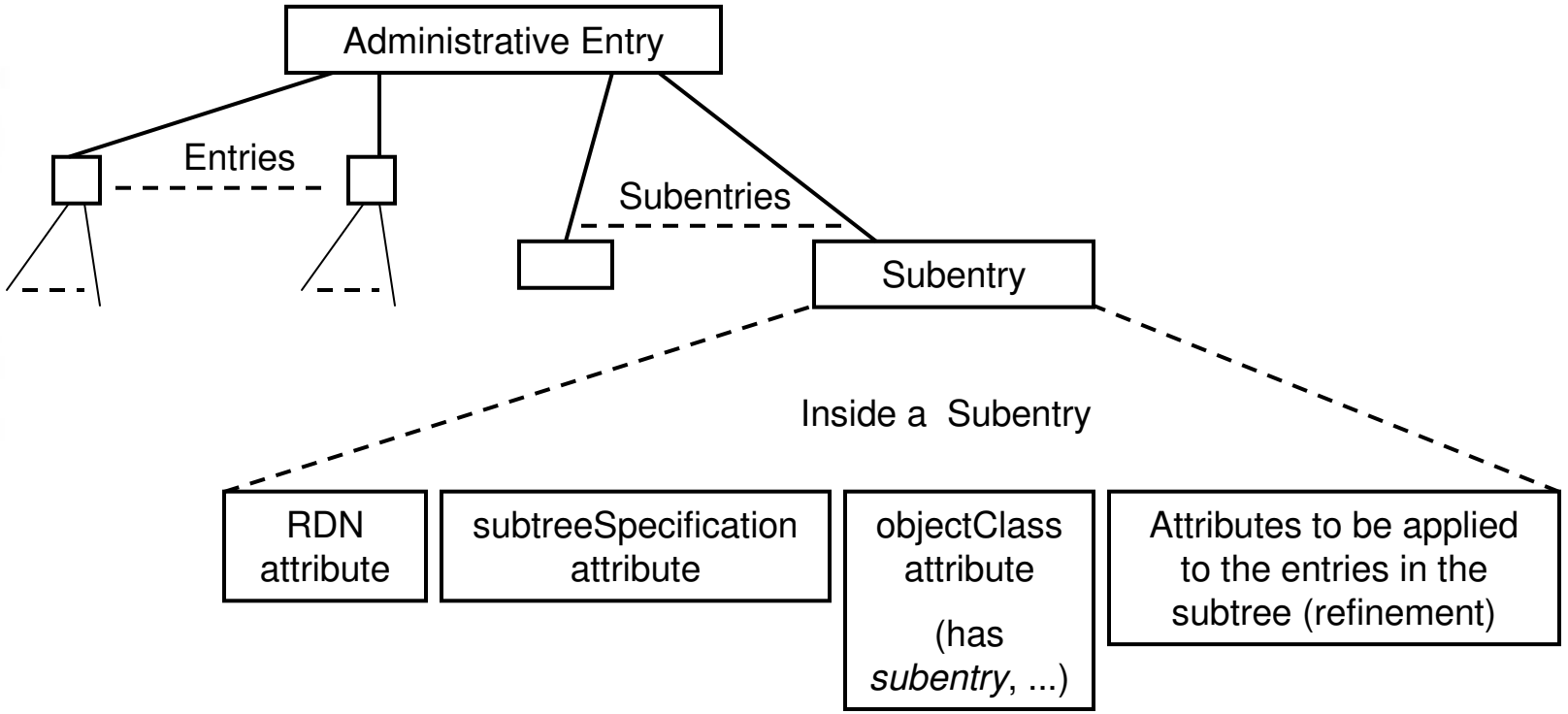
- Solutions for the 3rd case seemed good but,
- For 1st and 2nd cases,
  - What if we have hundreds of thousands of users that need the same permissions?
  - What if we need much more access control for each user?
  - Will we have to add each generic entryACI value to all users' entries?
- *So, do we always have to define access control information on a single entry only? What about a set of entries?*

Satisfactory Answer: Directory Access Control Domains (DACD)

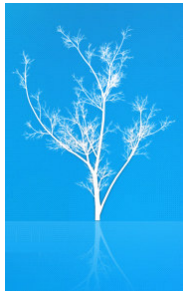


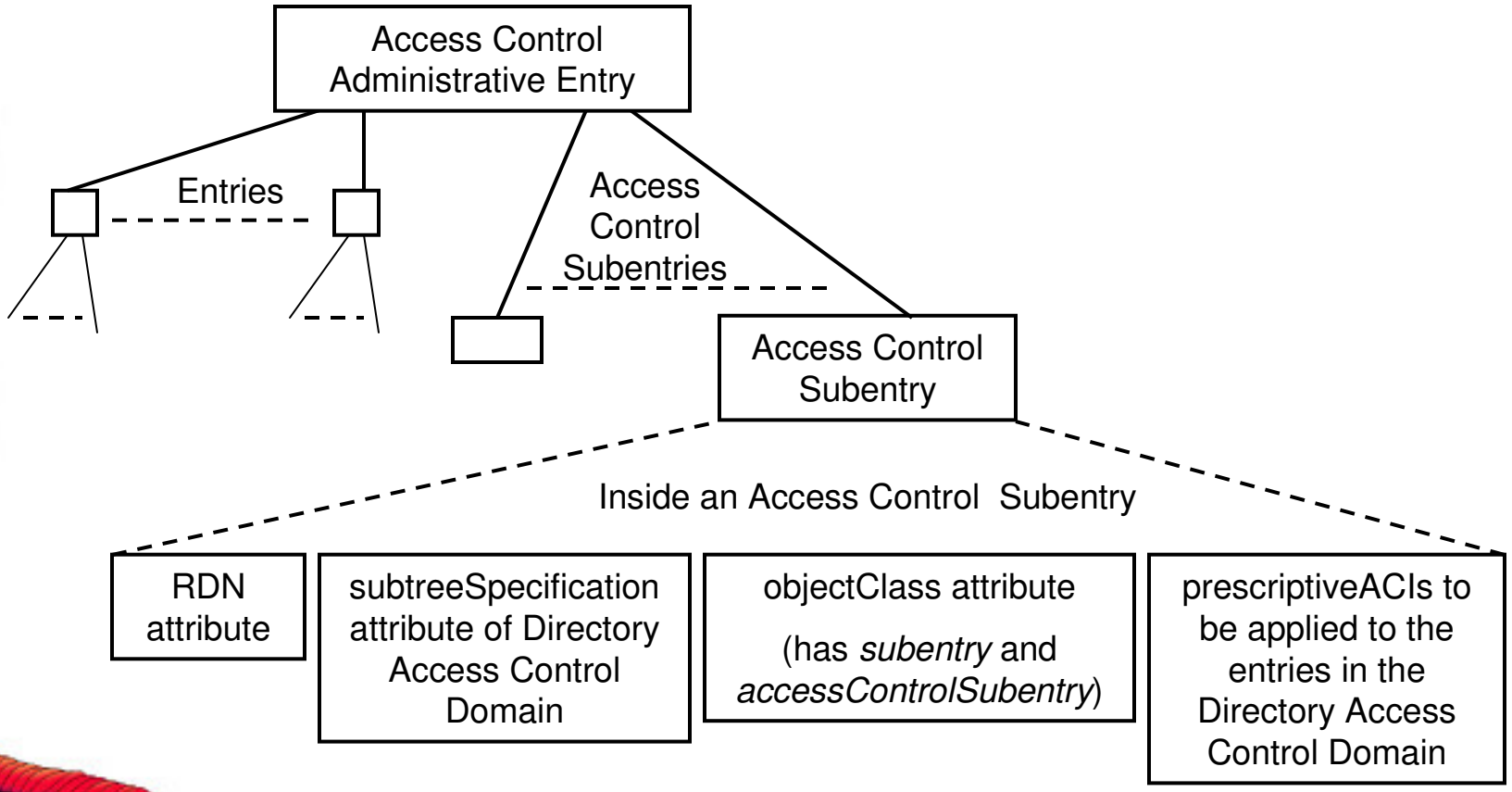
- X.500 Subentries and subtreeSpecification
  - A Subentry holds a subtreeSpecification attribute
  - subtreeSpecification allows specifying a *subtree of entries with chop specifications and refinements*
  - Other attributes in the Subentry are *applied* to the selection of entries
  - A building block of X.500 Administrative Model
  - RFC 3672 - Subentries in the Lightweight Directory Access Protocol
- Directory Access Control Domains
  - Instead of entryACI,
  - use *prescriptiveACI* in *accessControlSubentry*
  - to define access control rules on a set of entries

X.500 Administrative Model

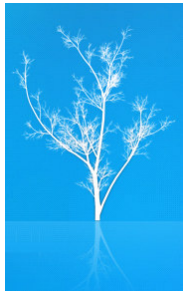


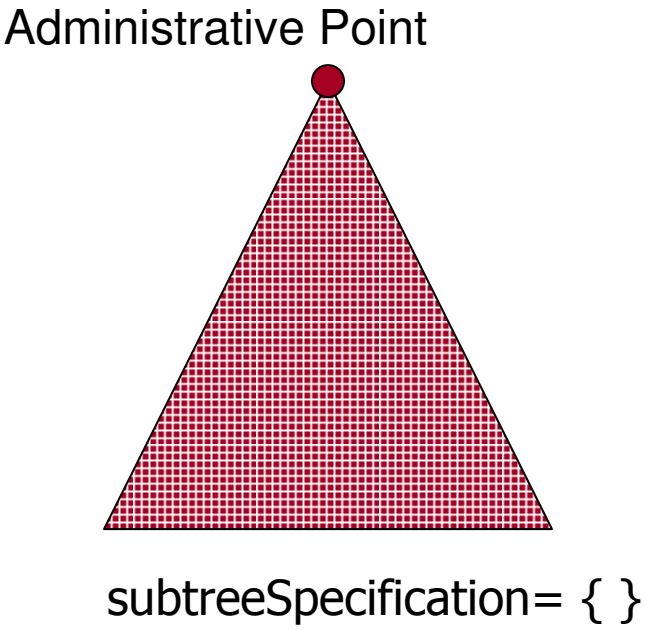
X.500 Administrative Model – Access Control Aspect



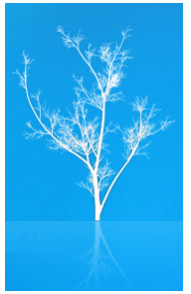


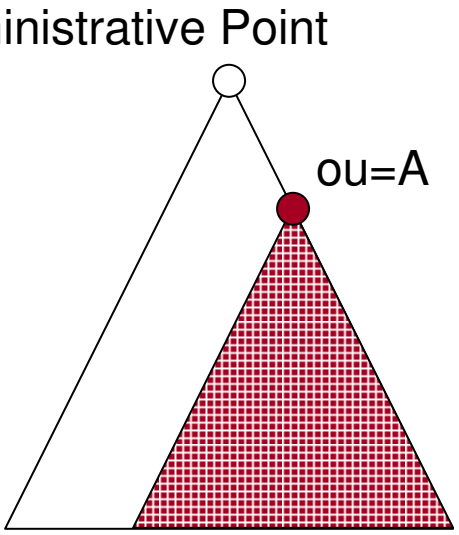
What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (1)





What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (2)

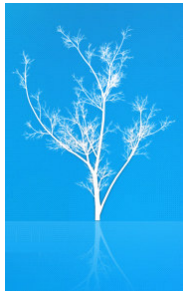


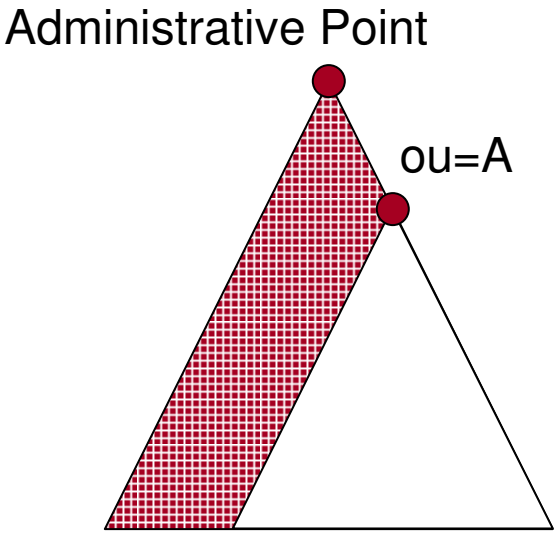


subtreeSpecification=

{ base "ou=A" }

What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (3)

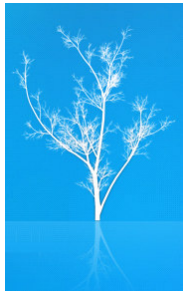


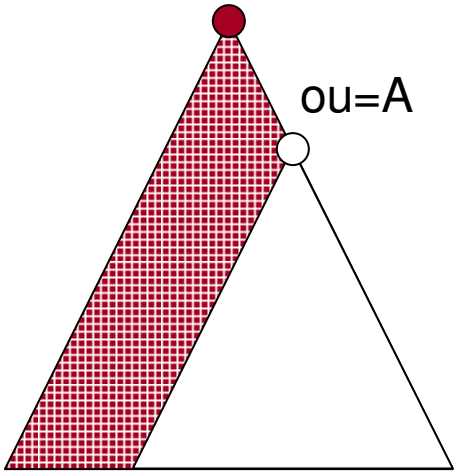


subtreeSpecification=

{ specificExclusions { chopAfter: "ou=A" } }

What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (4)

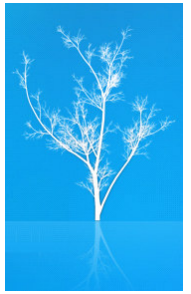


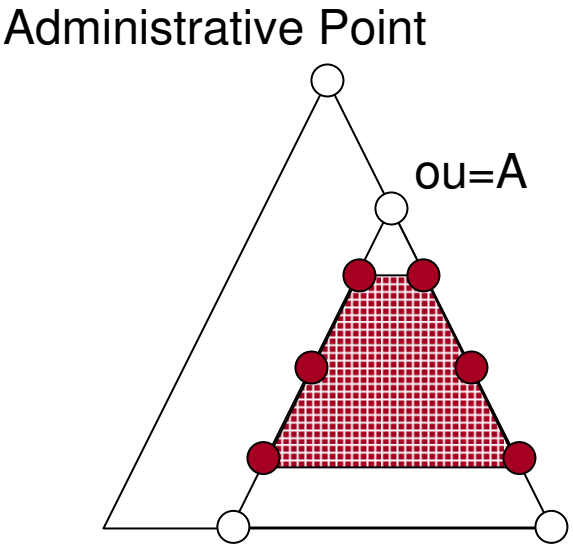


subtreeSpecification=

{ specificExclusions { chopBefore: "ou=A" } }

What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (5)

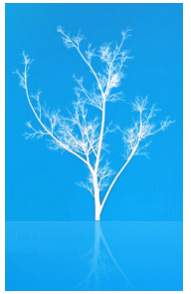


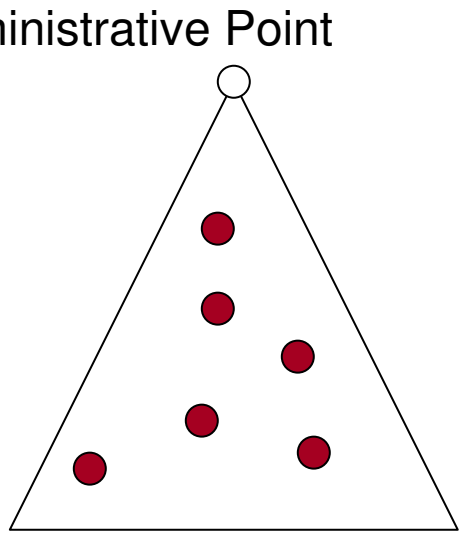


subtreeSpecification=

{ base “ou=A”, minimum 1, maximum 3 }

What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (6)

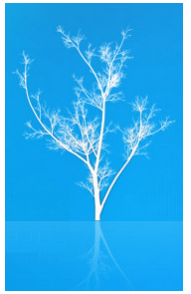


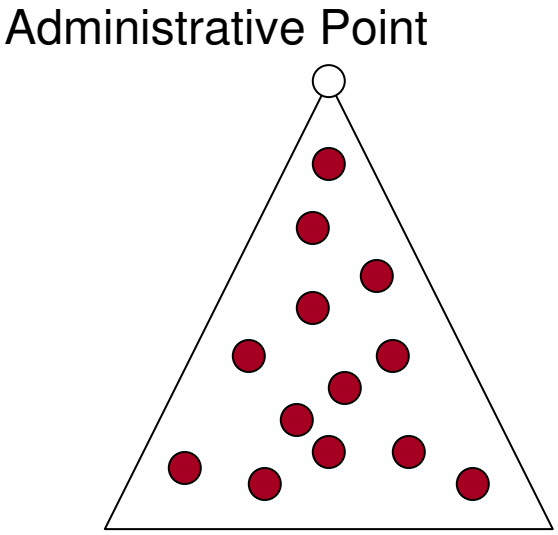


subtreeSpecification=

{ specificationFilter item:student }

What can be specified
(How a DACD can be specified)
with a subtreeSpecification ? (7)

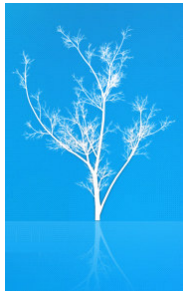




subtreeSpecification=

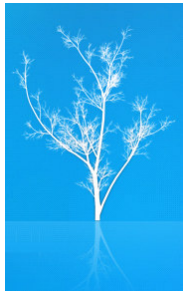
{ specificationFilter or: { item:student, item:faculty } }

DEMO 6



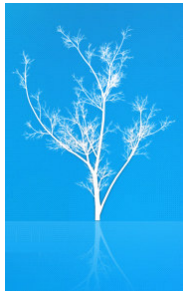
- Allow all users on the whole domain
  - to do search operations by commonName attribute
  - read (as search result) and compare commonName and telephoneNumber attributes

DEMO 6 - subtreeSpecification



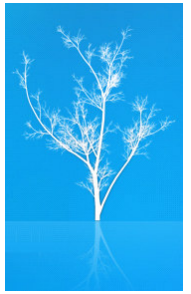
- subtreeSpecification: { }
- All entries in the domain will be subject to access control by prescriptiveACIs defined in the accessControlSubentry

DEMO 6 - prescriptiveACI

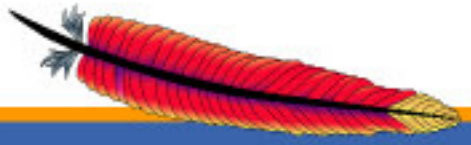


```
{ identificationTag  "demo6_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses { allUsers },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantBrowse, grantRead, grantReturnDN }
      },
      { protectedItems {
          attributeType {
            commonName, telephoneNumber, objectClass }
          allAttributeValues {
            commonName, telephoneNumber, objectClass }
        },
        grantsAndDenials {
          grantRead, grantCompare, grantFilterMatch }
      }
    }
  }
}
```

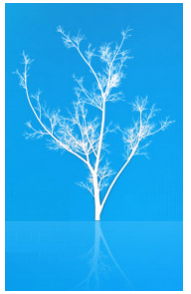
DEMO 7



- Allow a group of user administrators on the whole domain
  - to do all operations on only “person” entries
  - to do all operations related to entryACIs in users’ entries



DEMO 7 - subtreeSpecification

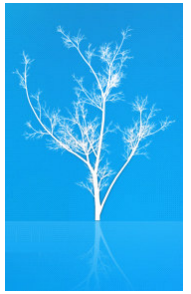


- subtreeSpecification:

  { specificationFilter item:person }

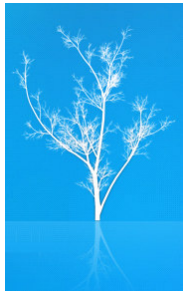
- All “person” entries in the domain will be subject to access control by prescriptiveACIs defined in the accessControlSubentry

DEMO 7 - prescriptiveACI



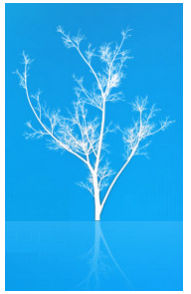
```
{ identificationTag  "demo7_ACI",
  precedence 10, authenticationLevel simple,
  itemOrUserFirst userFirst: {
    userClasses { userGroup { "ou=User Administrators,..." } },
    userPermissions {
      { protectedItems { entry },
        grantsAndDenials { grantBrowse, grantRead, grantModify }
      },
      { protectedItems {
          allUserAttributeTypesAndValues,
          attributeType { entryACI },
          allAttributeValues { entryACI }
        },
        grantsAndDenials {
          grantRead, grantCompare, grantFilterMatch, grantAdd, grantRemove
        }
      }
    }
  }
}
```

Some Principals



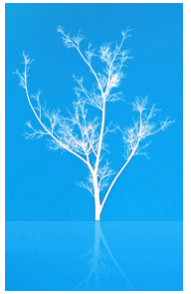
- Least privilige by default
  - Information is not present unless it's allowed to access it
- Precedence
  - Highers override Lowers
- Specificity
  - If precedences are the same
  - For User Classes and Protected Items
  - High overrides Low
- Denials vs. Grants
  - If precedences and specificities are same
  - Denials override Grants

Application of Principals - Precedence



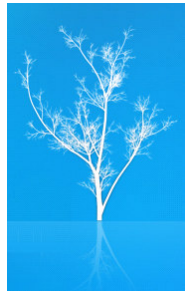
- Two ACIItems
- 1st one is of precedence 10 defines rules to deny search for all users
- 2nd one is of precedence 20 and defines rules to grant search for all users
- Result: Search is allowed for users

Application of Principals - Specificity



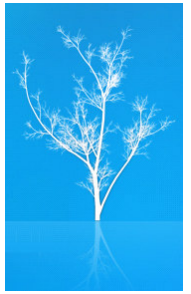
- Two ACIItems with the same precedence
- 1st one defines rules to deny search for all users
- 2nd one defines rules to grant search for user Jimmy
- Result: Search is allowed for Jimmy

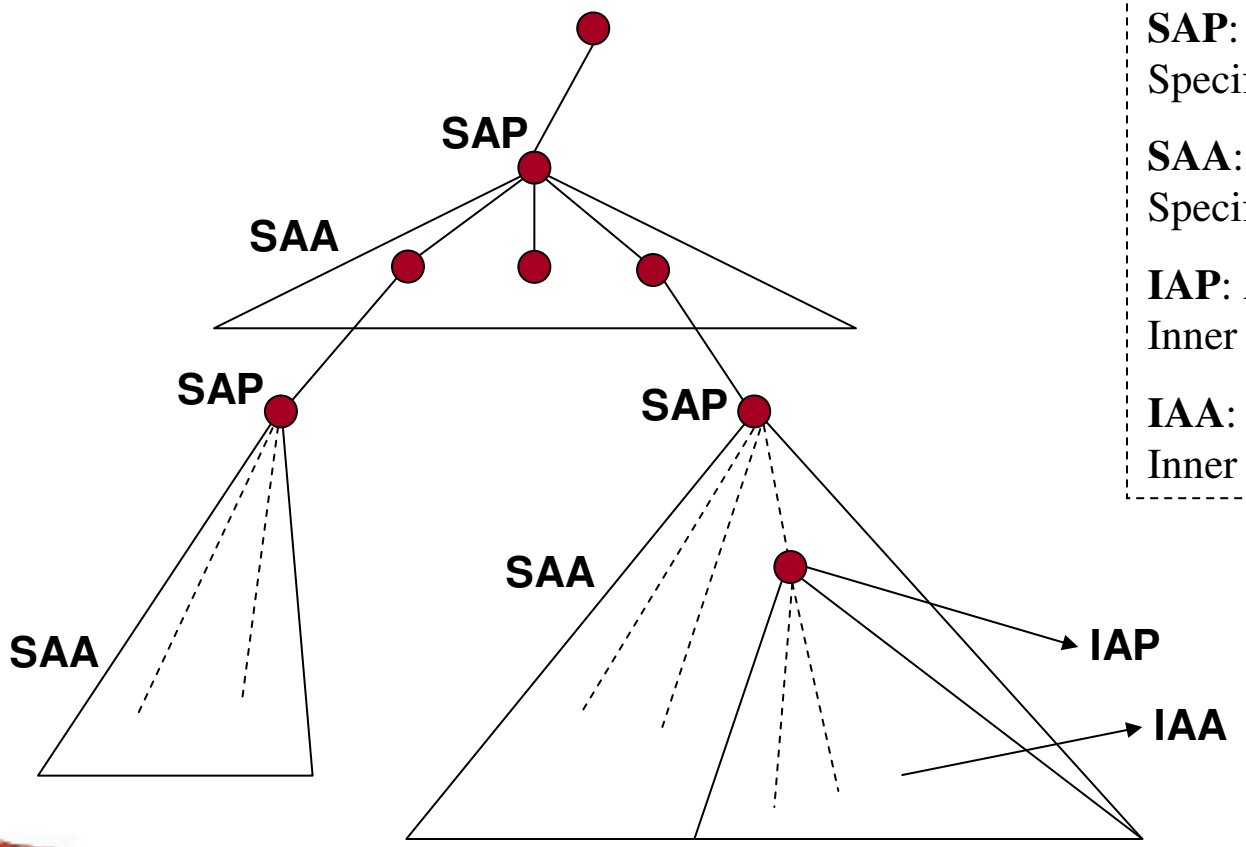
Application of Principals – Grants vs. Denials



- Two ACIItems with the same precedence
- 1st one defines rules to deny search for all users
- 2nd one defines rules to grant search for all users
- Result: Search is now allowed for users

Access Control Administrative Areas





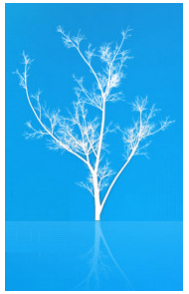
SAP: Access Control Specific Admin. Point

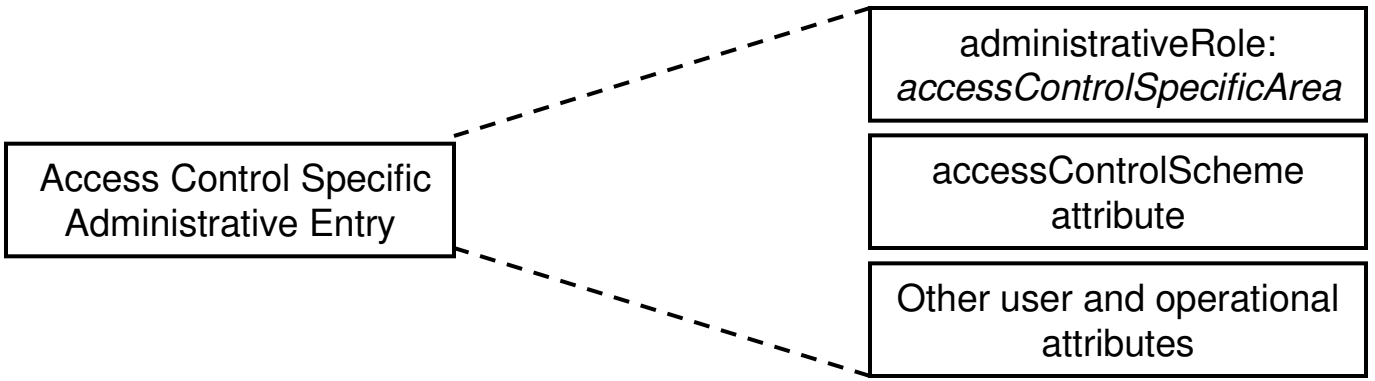
SAA: Access Control Specific Admin. Area

IAP: Access Control Inner Admin. Point

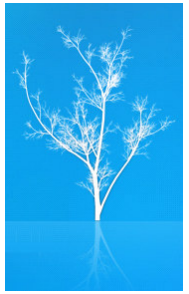
IAA: Access Control Inner Admin. Area

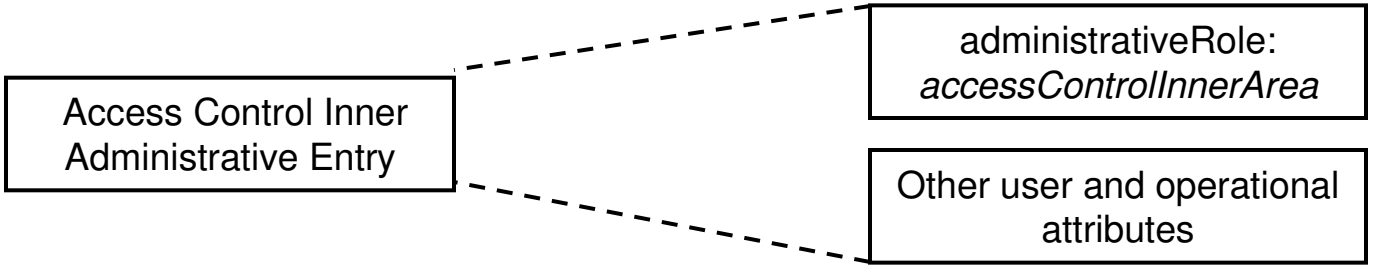
Inside an Access Control *Specific* Administrative Point (Entry)



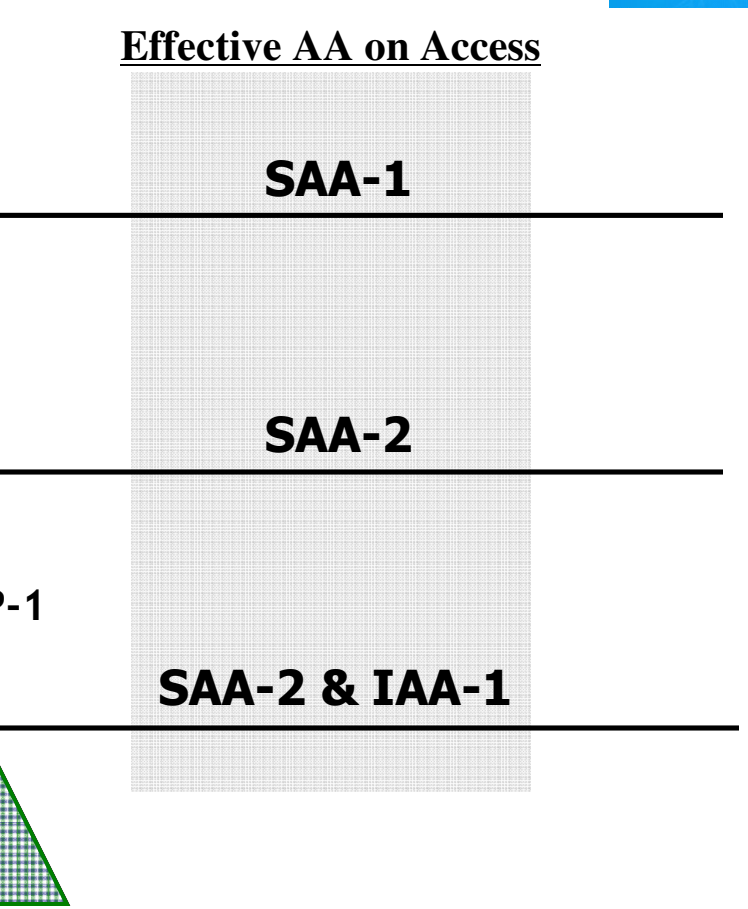


Inside an Access Control *Inner* Administrative Point (Entry)

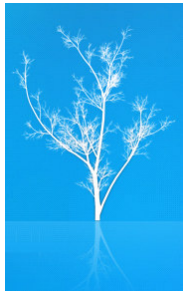




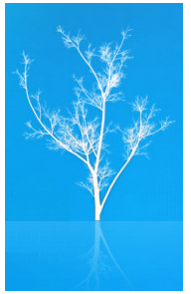
Effects of Administrative Areas on Access Control



Delegation of Authority

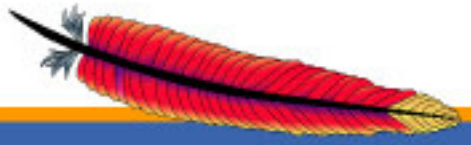


- Complete Delegation of Authority
  - Access Control Specific Areas
- Partial Delegation of Authority
  - Access Control Inner Areas
  - ACI precedence



ApacheDS
Access Control Administration; The X.500 Way

- Originally presented at ***ApacheCon US 2006*** in Austin
- Latest presentation materials are at ***http://people.apache.org/~ersiner***
- Presented by ***Ersin Er***, ***ersiner@apache.org***



ApacheCon US 2006