INFS 767 Fall 2001

Administrative RBAC ARBAC97

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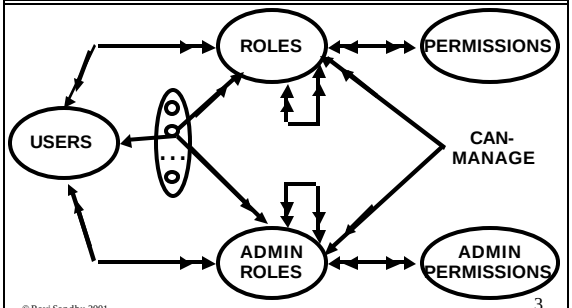
SCALE AND RATE OF CHANGE

- roles: 100s or 1000s
- users: 1000s or 10,000s or more
- Frequent changes to
  - user-role assignment
  - permission-role assignment
- Less frequent changes for
  - role hierarchy

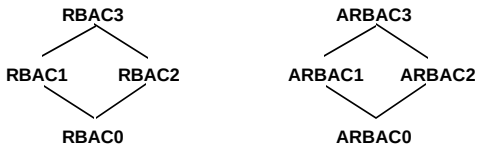
ADMINISTRATIVE RBAC



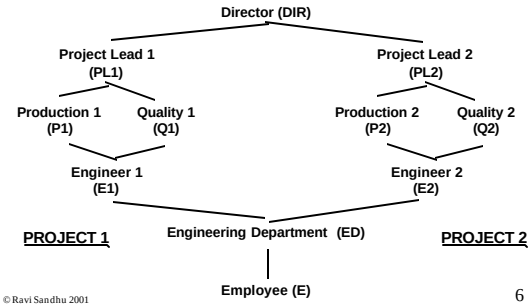
ARBAC97 DECENTRALIZES

- user-role assignment (URA97)
- permission-role assignment (PRA97)
- role-role hierarchy
  - groups or user-only roles (extend URA97)
  - abilities or permission-only roles (extend PRA97)
  - UP-roles or user-and-permission roles (RRA97)

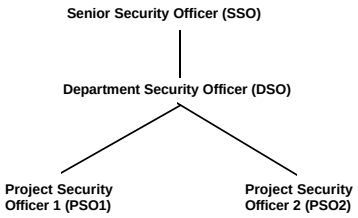
ADMINISTRATIVE RBAC



EXAMPLE ROLE HIERARCHY



EXAMPLE ADMINISTRATIVE ROLE HIERARCHY



URA97 GRANT MODEL: can-assign

ARole	Prereq Role	Role Range
PSO1	ED	[E1,PL1)
PSO2	ED	[E2,PL2)
DSO	ED	(ED,DIR)
SSO	E	[ED,ED]
SSO	ED	(ED,DIR]

URA97 GRANT MODEL : can-assign

ARole	Prereq Cond	Role Range
PSO1	ED	[E1,E1]
PSO1	ED & ¬ P1	[Q1,Q1]
PSO1	ED & ¬ Q1	[P1,P1]
PSO2	ED	[E2,E2]
PSO2	ED & ¬ P2	[Q2,Q2]
PSO2	ED & ¬ Q2	[P2,P2]

URA97 GRANT MODEL

- **"redundant" assignments to senior and junior roles**
  - **are allowed**
  - **are useful**

URA97 REVOKE MODEL

- **WEAK REVOCATION**
  - **revokes explicit membership in a role**
  - **independent of who did the assignment**

URA97 REVOKE MODEL

- **STRONG REVOCATION**
  - **revokes explicit membership in a role and its seniors**
  - **authorized only if corresponding weak revokes are authorized**
  - **alternatives**
    - **all-or-nothing**
    - **revoke within range**

URA97 REVOKE MODEL : can-revoke

ARole	Role Range
PSO1	[E1,PL1)
PSO2	[E2,PL2)
DSO	(ED,DIR)
SSO	[ED,DIR]

PERMISSION-ROLE ASSIGNMENT

- dual of user-role assignment
- can-assign-permission
  can-revoke-permission
- weak revoke
  strong revoke (propagates down)

PERMISSION-ROLE ASSIGNMENT CAN-ASSIGN-PERMISSION

ARole	Prereq Cond	Role Range
PSO1	PL1	[E1,PL1)
PSO2	PL2	[E2,PL2)
DSO	E1 Ú E2	[ED,ED]
SSO	PL1 Ú PL2	[ED,ED]
SSO	ED	[E,E]

PERMISSION-ROLE ASSIGNMENT CAN-REVOKE-PERMISSION

ARole	Role Range
PSO1	[E1,PL1]
PSO2	[E2,PL2]
DSO	(ED,DIR)
SSO	[ED,DIR]

ARBAC97 DECENTRALIZES

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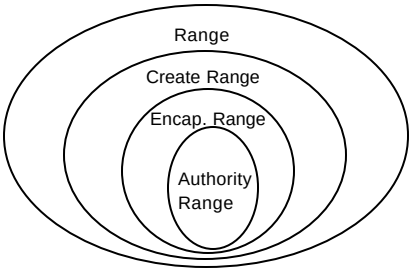
Range Definitions



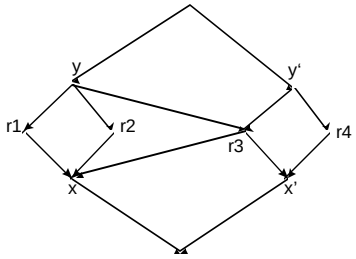
Authority Range

- **Range:**
  - **(x, y) = {r : Roles | x < r < y}**
- **Authority Range:**
  - **A range referenced in *can-modify* relation**
- **Partial Overlap of Ranges:**
  - **The ranges Y and Y' partially overlap if**
    - **Y Ç Y' ¹ f and**
    - **Y Ë Y' Ù Y' Ë Y**
- **Partial Overlap of Authority Ranges is forbidden**

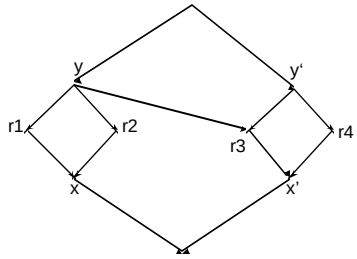
Authority Range

- **Encapsulated Authority Range:**
  - **The authority range (x, y) is said to be encapsulated if**
    - **" r1 Î (x, y) and " r2 Î (x, y)**
      - r2 > r1 ⇔ r2 > y ∧
      - r2 < r1 ⇔ r2 < x

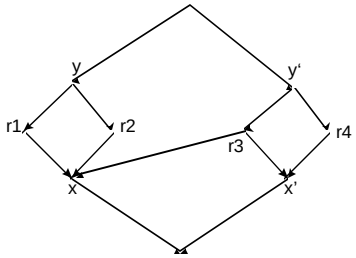
Non-encapsulated Range (x, y)



Encapsulated Range (x, y)



Encapsulated Range (x, y)



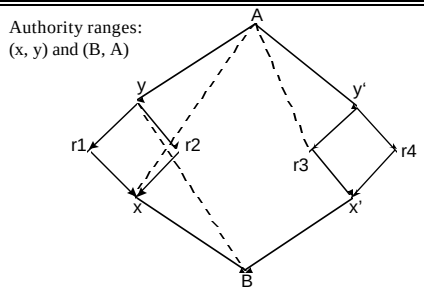
ROLE CREATION

- **New roles are created one at a time**
- **Creation of a role requires specification of immediate parent and child**
  - **immediate parent and child must be a create range**

Role Creation

- **Create Range:**
  - **The range (x, y) is a create range if**
    - **(a) $AR_{immediate}(x) = AR_{immediate}(y)$ Ú**
    - **(b) x = End point of $AR_{immediate}(y)$ Ú**
    - **(c) y = End point of $AR_{immediate}(x)$**
  - **Note: only comparable roles constitute a create range.**

Create Range



Role Deletion

- **Roles in the authority range can be deleted by administrator of that range.**
- **End points of authority ranges cannot be deleted.**

Inactive Roles

- **End points of authority ranges can be made inactive.**
- **Inactive Roles:**
  - **A user associated to it cannot use it.**
  - **Inheritance of permissions is not affected.**
  - **Permissions and users can be revoked.**

Other Restrictions on deletion of roles

- **Roles can be deleted only when they are empty.**
- **Delete the role and at the same time:**
  - **assign permissions to immediate senior roles.**
  - **Assign the users to immediate junior roles.**

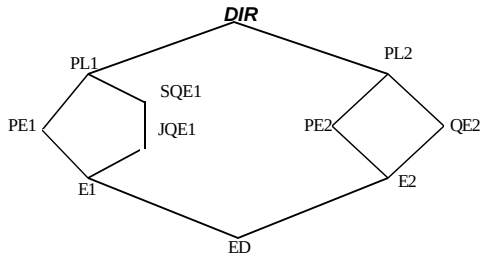
INSERTION OF AN EDGE

- **Inserted only between incomparable roles (No Cycles)**
- **Inserted one at a time.**
- **The edge AB is inserted if**
  - **(a) $AR_{immediate}(A) = AR_{immediate}(B)$ and**
  - **(b) For a junior authority range (x, y):**
    - **(A = y Ù B > x) or (B = x Ù A < y) must ensure encapsulation of (x, y).**

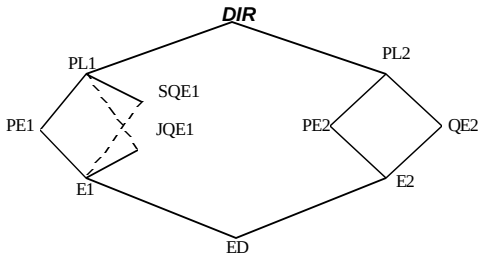
DELETION OF AN EDGE

- **Deleted one at a time.**
- **The edges in transitive reduction are candidates for deletion.**
- **Edges connecting the end points of an authority range cannot be deleted.**
- **Implied edges are not deleted**

Example : Before deletion (SQE1, JQE1)



Example : After deletion (SQE1, JQE1)



Conclusion

- **RRA97 completes ARBAC97**
- **RRA97 provides decentralized administration of role hierarchies.**
- **Gives administrative role autonomy within a range but only so far as the side effects of the resulting actions are acceptable.**