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The RBAC96 Model

Prof. Ravi Sandhu
George Mason University

AUTHORIZATION, TRUST AND RISK

- **Information security is fundamentally about managing**
  - **authorization and**
  - **trust**

  so as to manage risk

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SOLUTIONS

- **OM-AM**
- **RBAC**
- **PKI**
- **and others**

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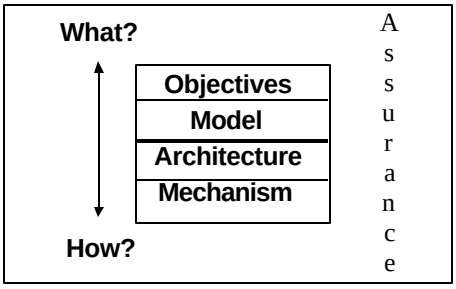
THE OM-AM WAY



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LAYERS AND LAYERS

- **Multics rings**
- **Layered abstractions**
- **Waterfall model**
- **Network protocol stacks**
- **OM-AM**

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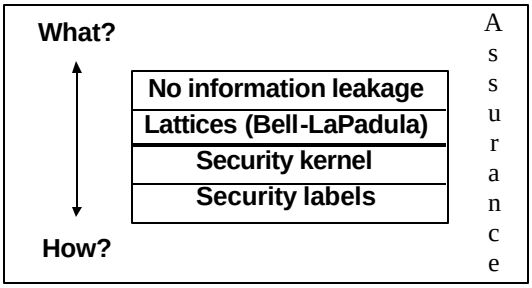
OM-AM AND MANDATORY ACCESS CONTROL (MAC)



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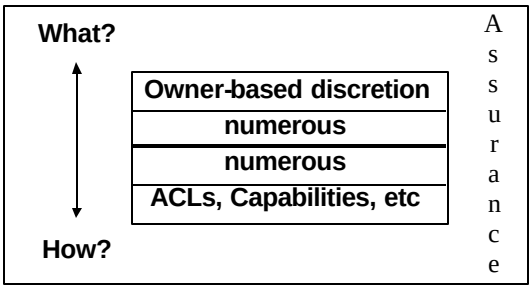
OM-AM AND DISCRETIONARY ACCESS CONTROL (DAC)



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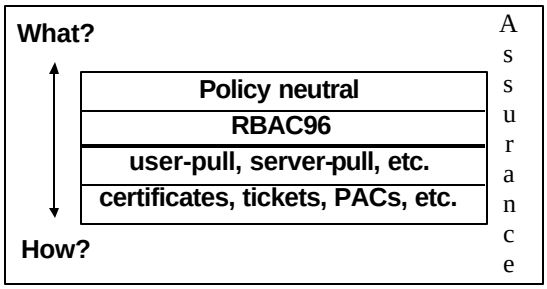
OM-AM AND ROLE-BASED ACCESS CONTROL (RBAC)



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ROLE-BASED ACCESS CONTROL (RBAC)

- **A user's permissions are determined by the user's roles**
  - **rather than identity or clearance**
  - **roles can encode arbitrary attributes**
- **multi-faceted**
- **ranges from very simple to very sophisticated**

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WHAT IS THE POLICY IN RBAC?

- **RBAC is a framework to help in articulating policy**
- **The main point of RBAC is to facilitate security management**

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RBAC SECURITY PRINCIPLES

- **least privilege**
- **separation of duties**
- **separation of administration and access**
- **abstract operations**

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RBAC96 IEEE Computer Feb. 1996

- **Policy neutral**
- **can be configured to do MAC**
  - **roles simulate clearances (ESORICS 96)**
- **can be configured to do DAC**
  - **roles simulate identity (RBAC98)**

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WHAT IS RBAC?

- **multidimensional**
- **open ended**
- **ranges from simple to sophisticated**

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RBAC CONUNDRUM

- **turn on all roles all the time**
- **turn on one role only at a time**
- **turn on a user-specified subset of roles**

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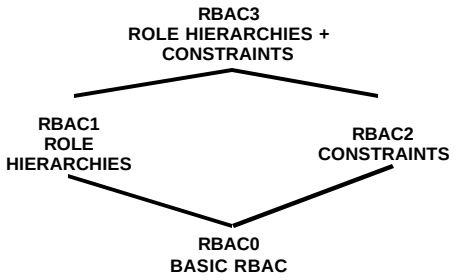
RBAC96 FAMILY OF MODELS



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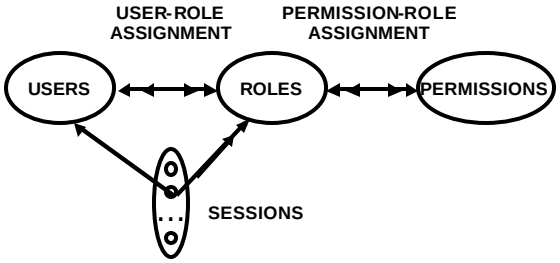
RBAC0



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PERMISSIONS

- **Primitive permissions**
  - **read, write, append, execute**
- **Abstract permissions**
  - **credit, debit, inquiry**

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PERMISSIONS

- **System permissions**
  - **Auditor**
- **Object permissions**
  - **read, write, append, execute, credit, debit, inquiry**

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PERMISSIONS

- Permissions are positive
- No negative permissions or denials
  - negative permissions and denials can be handled by constraints
- No duties or obligations
  - outside scope of access control

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ROLES AS POLICY

- A role brings together
  - a collection of users and
  - a collection of permissions
- These collections will vary over time
  - A role has significance and meaning beyond the particular users and permissions brought together at any moment

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ROLES VERSUS GROUPS

- Groups are often defined as
  - a collection of users
- A role is
  - a collection of users and
  - a collection of permissions
- Some authors define role as
  - a collection of permissions

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USERS

- Users are
  - human beings or
  - other active agents
- Each individual should be known as exactly one user

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USER-ROLE ASSIGNMENT

- A user can be a member of many roles
- Each role can have many users as members

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SESSIONS

- A user can invoke multiple sessions
- In each session a user can invoke any subset of roles that the user is a member of

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PERMISSION-ROLE ASSIGNMENT

- A permission can be assigned to many roles
- Each role can have many permissions

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MANAGEMENT OF RBAC

- Option 1:
  USER-ROLE-ASSIGNMENT and PERMISSION-ROLE ASSIGNMENT can be changed only by the chief security officer
- Option 2:
  Use RBAC to manage RBAC

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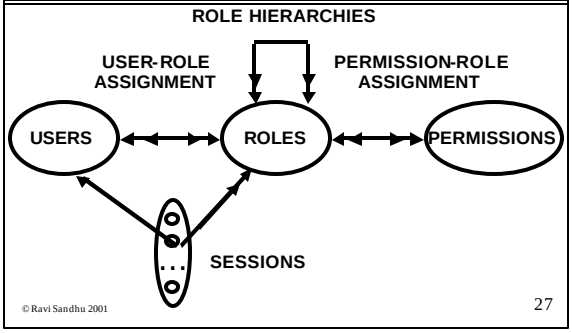
RBAC1



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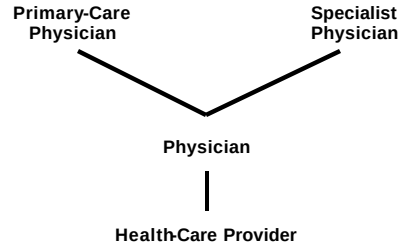
HIERARCHICAL ROLES



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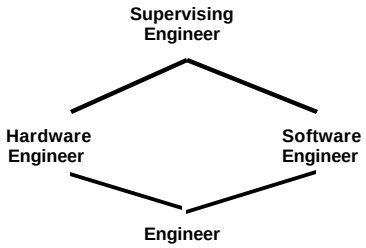
HIERARCHICAL ROLES



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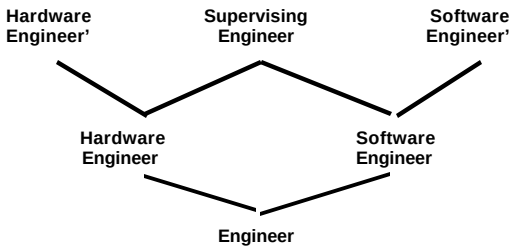
PRIVATE ROLES



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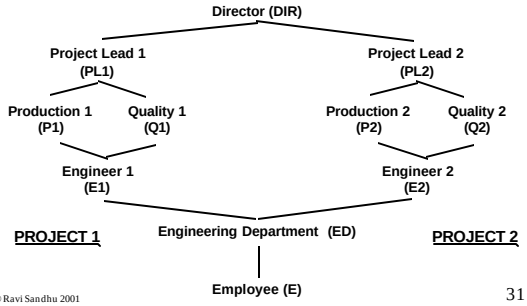
EXAMPLE ROLE HIERARCHY



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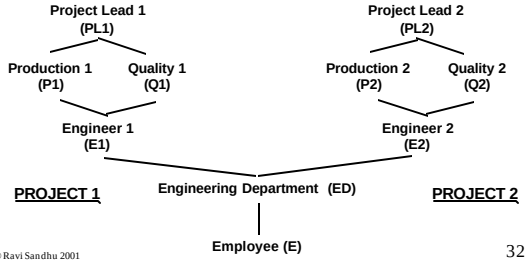
EXAMPLE ROLE HIERARCHY



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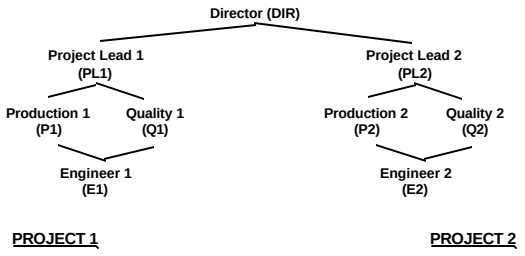
EXAMPLE ROLE HIERARCHY



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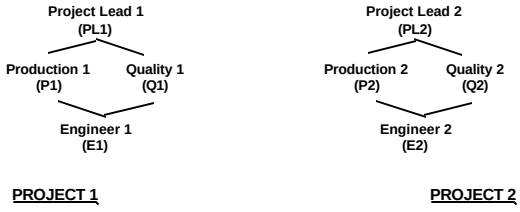
EXAMPLE ROLE HIERARCHY



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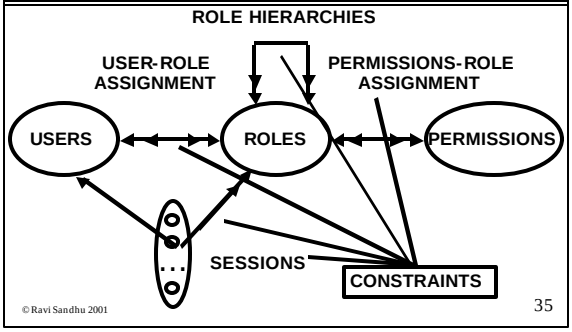
RBAC3



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CONSTRAINTS

- **Mutually Exclusive Roles**
  - **Static Exclusion: The same individual can never hold both roles**
  - **Dynamic Exclusion: The same individual can never hold both roles in the same context**

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CONSTRAINTS

- **Mutually Exclusive Permissions**
  - **Static Exclusion: The same role should never be assigned both permissions**
  - **Dynamic Exclusion: The same role can never hold both permissions in the same context**

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CONSTRAINTS

- **Cardinality Constraints on User-Role Assignment**
  - **At most k users can belong to the role**
  - **At least k users must belong to the role**
  - **Exactly k users must belong to the role**

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CONSTRAINTS

- **Cardinality Constraints on Permissions-Role Assignment**
  - **At most k roles can get the permission**
  - **At least k roles must get the permission**
  - **Exactly k roles must get the permission**

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