INFS 767 Fall 2003

The RBAC96 Model

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AUTHORIZATION, TRUST AND RISK

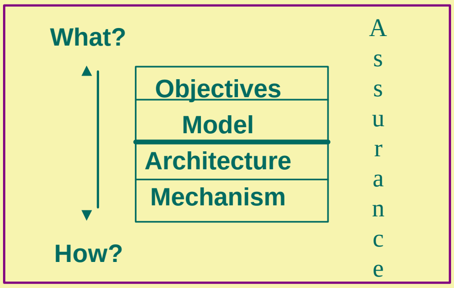
- Information security is fundamentally about managing
  - authorization and
  - trust

so as to manage risk

SOLUTIONS

- OM-AM
- RBAC
- PKI
- and others

THE OM-AM WAY



What?

Objectives
Model
Architecture
Mechanism

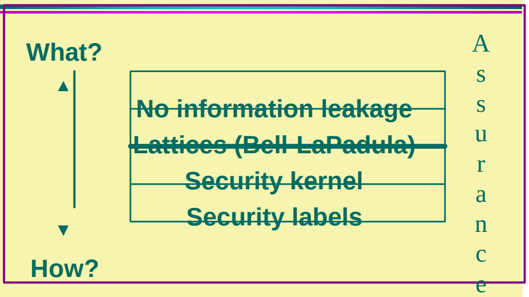
How?

Assurance

LAYERS AND LAYERS

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

OM-AM AND MANDATORY ACCESS CONTROL (MAC)



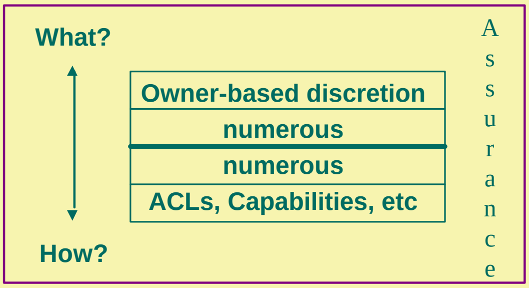
What?

No information leakage
Lattices (Bell-LaPadula)
Security kernel
Security labels

How?

Assurance

OM-AM AND DISCRETIONARY ACCESS CONTROL (DAC)



What?

Owner-based discretion

numerous

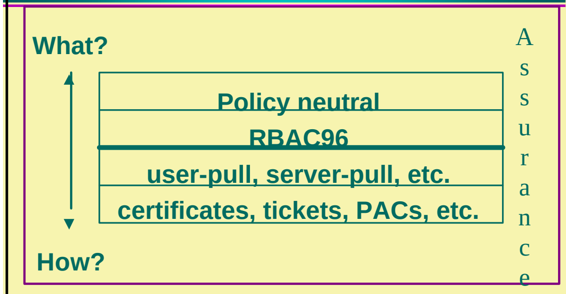
numerous

ACLs, Capabilities, etc

How?

Assurance

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



What?

Policy neutral

RBAC96

user-pull, server-pull, etc.

certificates, tickets, PACs, etc.

How?

Assurance

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

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

RBAC SECURITY PRINCIPLES

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

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)

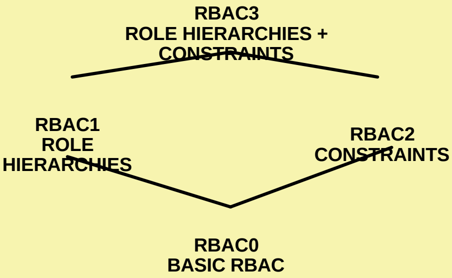
WHAT IS RBAC?

- multidimensional
- open ended
- ranges from simple to sophisticated

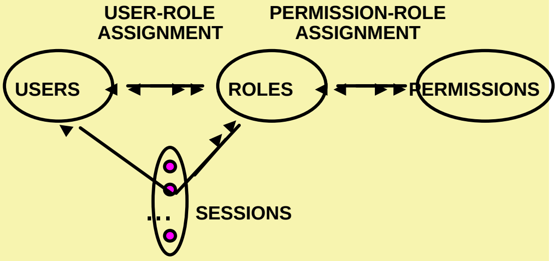
RBAC CONUNDRUM

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

RBAC96 FAMILY OF MODELS



RBAC0



PERMISSIONS

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

PERMISSIONS

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

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

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

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

USERS

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

USER-ROLE ASSIGNMENT

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

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

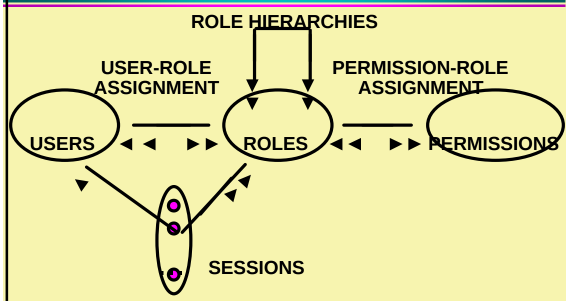
PERMISSION-ROLE ASSIGNMENT

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

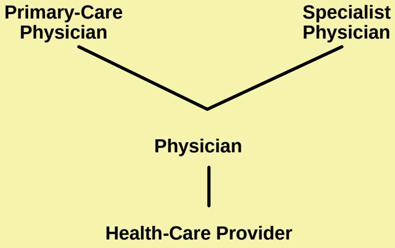
MANAGEMENT OF RBAC

- 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

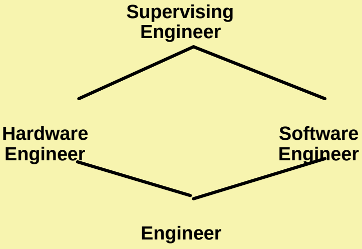
RBAC1



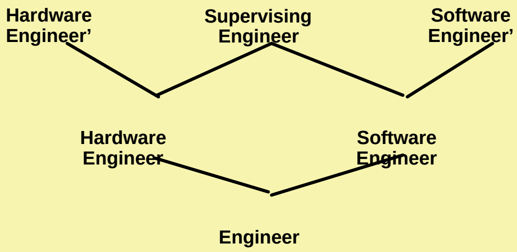
HIERARCHICAL ROLES



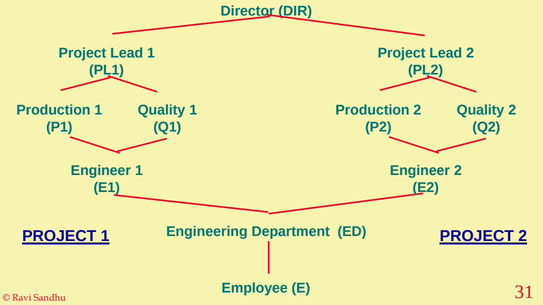
HIERARCHICAL ROLES



PRIVATE ROLES



EXAMPLE ROLE HIERARCHY



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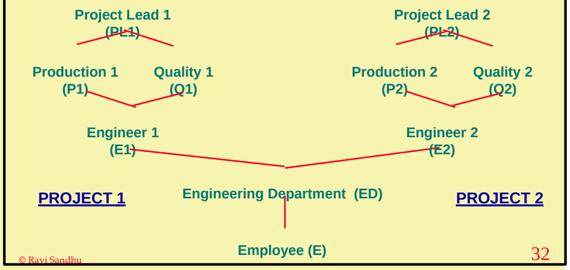

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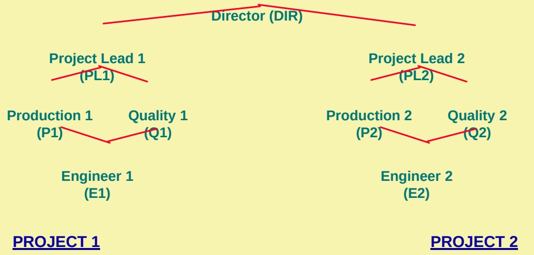

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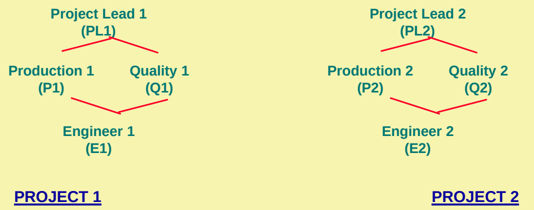
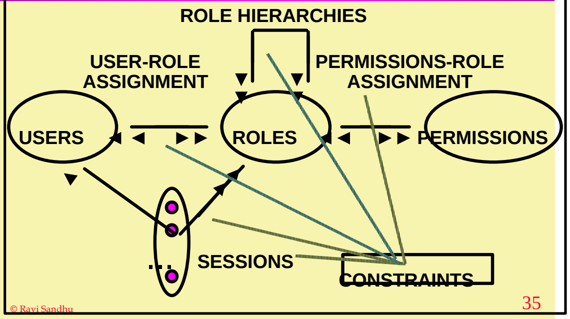


RBAC3



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

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

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

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