INFS 767 Fall 2000

Engineering Authority and Trust in Cyberspace: The OM-AM and RBAC Way

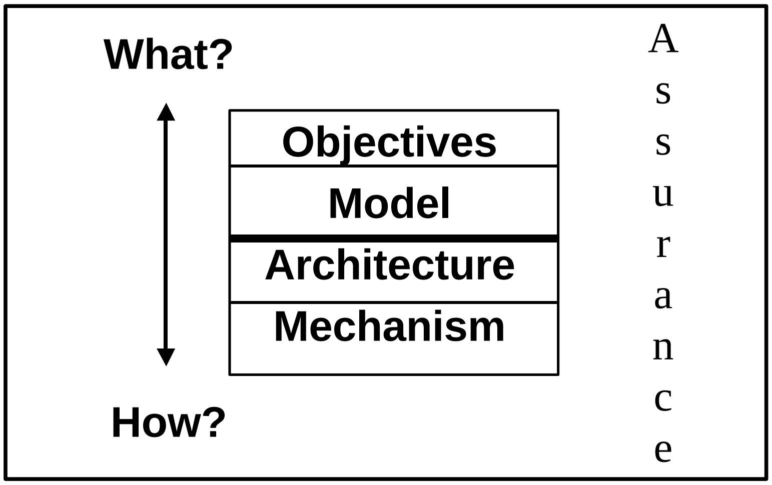
Prof. Ravi Sandhu

AUTHORIZATION, TRUST AND RISK

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

  so as to manage risk

THE OM-AM WAY



What?

Objectives

Model

Architecture

Mechanism

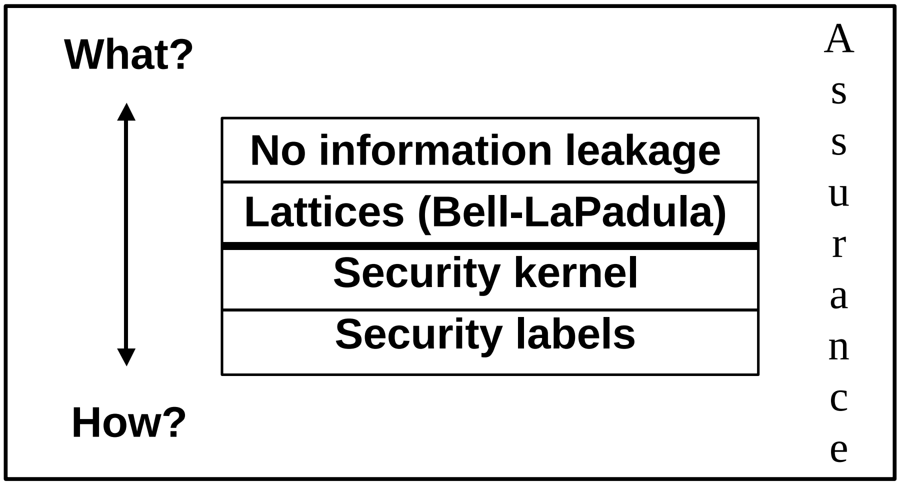
How?

Assurance

LAYERS AND LAYERS

- **Multics rings**
- **Layered abstractions**
- **Waterfall model**
- **Network protocol stacks**
- **Napolean layers**
- **RoFi layers**
- **OM-AM**
- **etcetera**

OM-AM AND MANDATORY ACCESS CONTROL (MAC)



What?

No information leakage

Lattices (Bell-LaPadula)

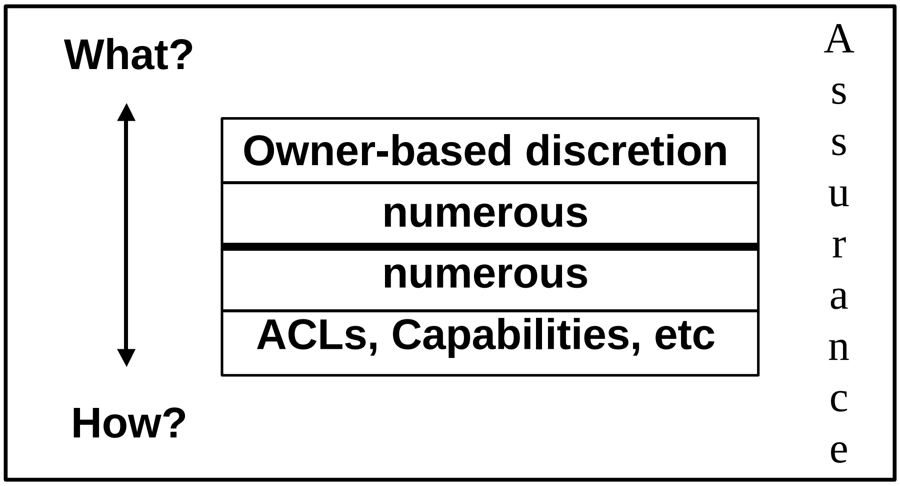
Security kernel

Security labels

How?

Assurance

OM-AM AND DISCRETIONARY ACCESS CONTROL (DAC)



What?

Owner-based discretion

numerous

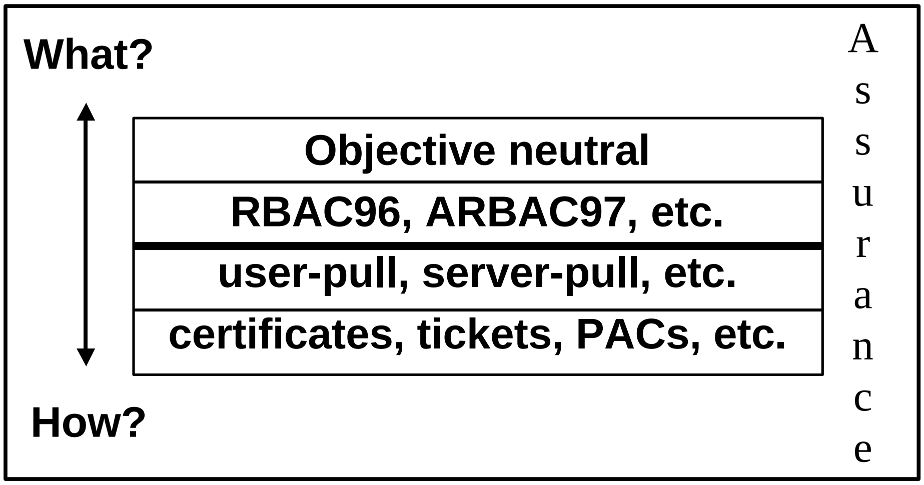
numerous

ACLs, Capabilities, etc

How?

Assurance

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



What?

Objective neutral

RBAC96, ARBAC97, etc.

user-pull, server-pull, etc.

certificates, tickets, PACs, etc.

How?

Assurance

DISTRIBUTED RBAC (DRBAC) CASE STUDY

- **Approximately a dozen physical sites**
- **Approximately 2-3 simulation models/site**
- **Fewer than 100 roles structured in a very shallow hierarchy**
  - **A subset of roles is used in any single simulation model**
- **Fewer than 100 users**
- **A user uses only one role at a time**
  - **Convenient but not critical**
- **Moderate rate of change**

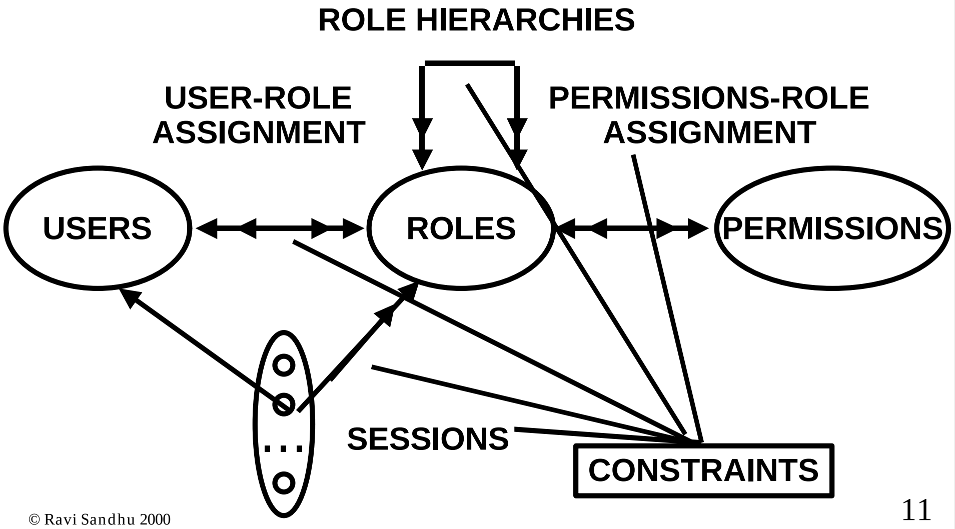
DISTRIBUTED RBAC (DRBAC) CASE STUDY

- Permission-role assignment
  - Locally determined at each simulation model
- User-role assignment
  - A user can be assigned to a role if and only if all simulation models using that role agree
  - A user is revoked from a role if and only if any simulation model using that role revokes the user

DISTRIBUTED RBAC (DRBAC) CASE STUDY

- Each simulation model has a security administrator role authorized to carry out these administrative tasks
- A simulation model can assign permissions to a role X at any time
  - even if X is previously unused in that simulation model
- Consequently any simulation model can revoke any user from any role!

RBAC3



ROLE HIERARCHIES

USER-ROLE ASSIGNMENT

PERMISSIONS-ROLE ASSIGNMENT

USERS

ROLES

PERMISSIONS

SESSIONS

CONSTRAINTS

MODEL CUSTOMIZATION

- Each session has a single role
- SM = {sm1, …, smk}, simulation models
- OP = {op1, …, opl}, operations
- P= SM X OP, permissions
- SMA = {sma1, …, smk}, administrative roles
- R ∩ SMA = ∅
- Admin: SM ↔ SMA

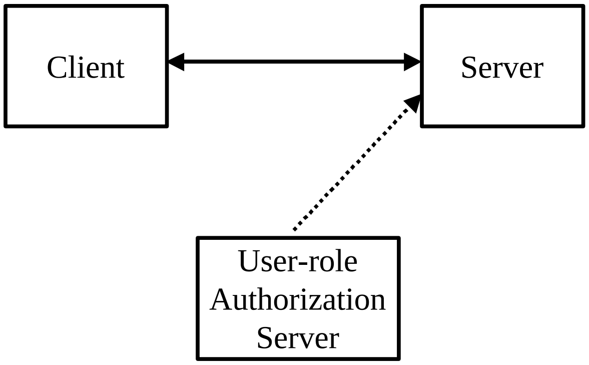
MODEL CUSTOMIZATION

- **Can formalize the administrative rules given earlier**
- **For each simulation model designate a unique user to be the chief security administrator who is authorized to assign and revoke users from the security administrator role for that model**

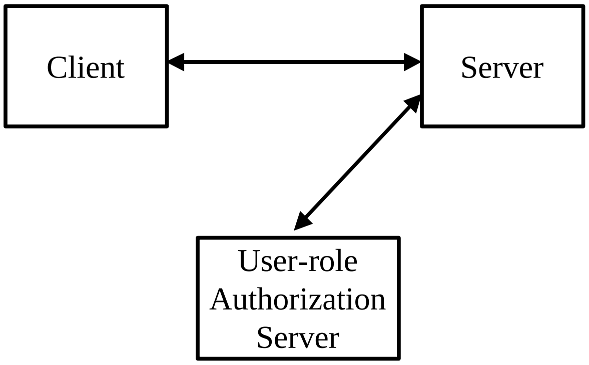
DRBAC ARCHITECTURES

- **Permission-role**
  - **Enforced locally at each simulation model**
- **Permission-role administration**
  - **Enforced locally at each simulation model**
  - **May need to communicate to other simulation models**
- **User-role**
  - **See following slides**
- **User-role administration**
  - **Centralized or decentralized**

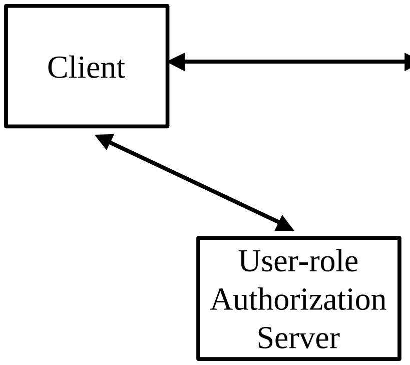
SERVER MIRROR



SERVER-PULL



USER-PULL

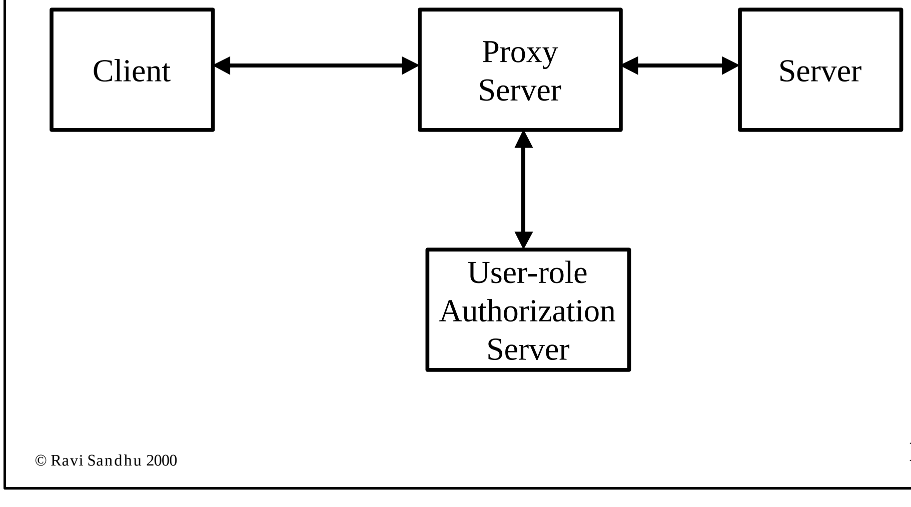


Client

Server

User-role Authorization Server

PROXY-BASED



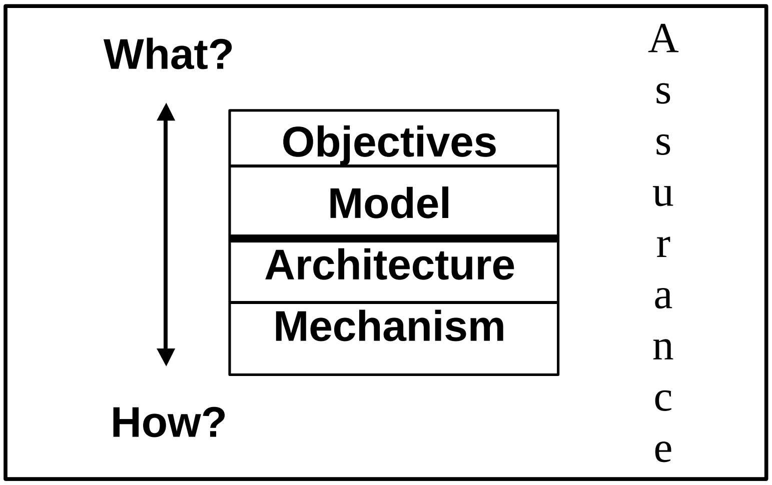
Client

Proxy Server

Server

User-role Authorization Server

THE OM-AM WAY



What?

Objectives

Model

Architecture

Mechanism

How?

Assurance