Grand Challenges in Authorization Systems

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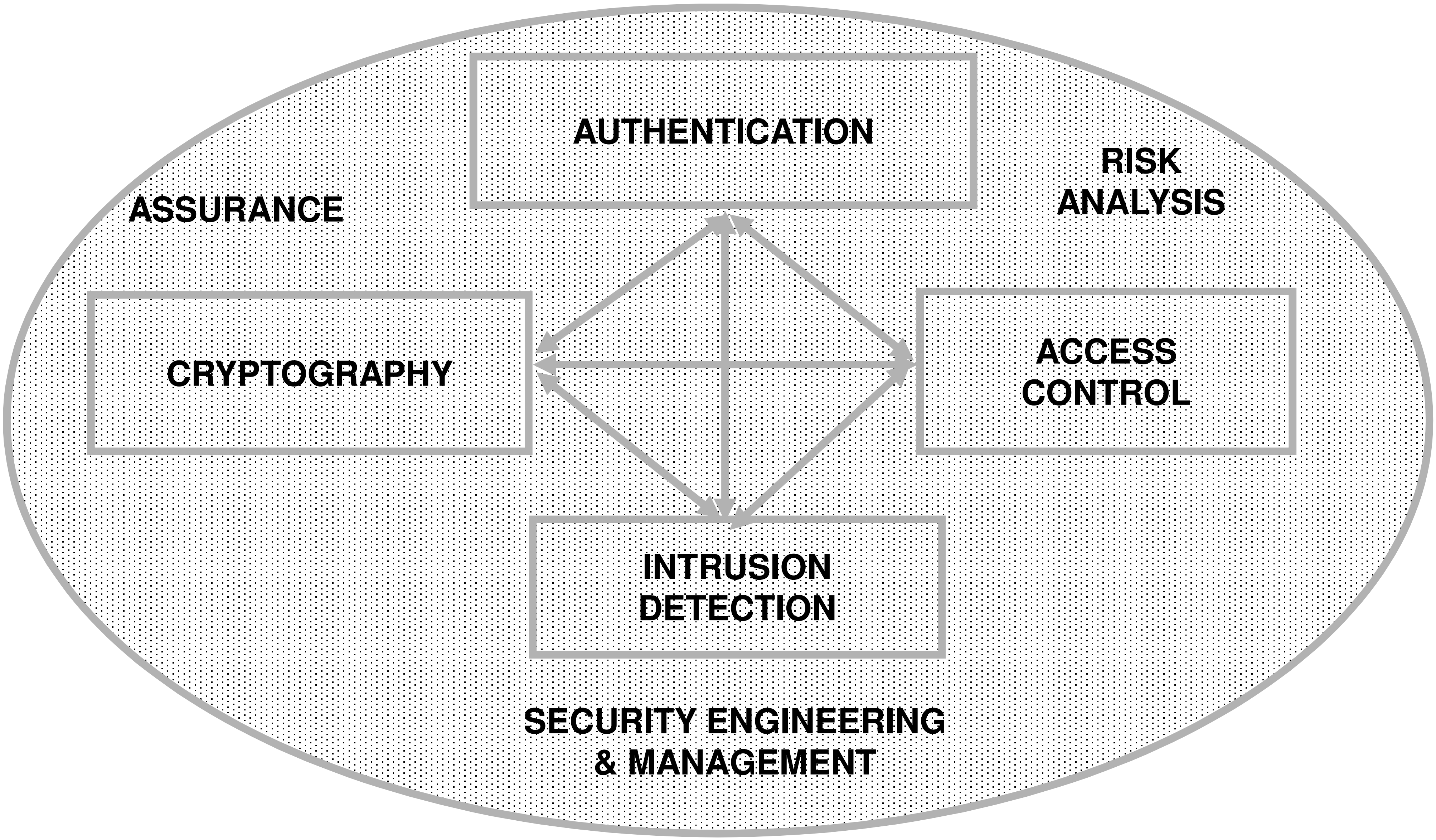
Mutually Supportive Technologies



AUTHENTICATION

ASSURANCE

RISK ANALYSIS

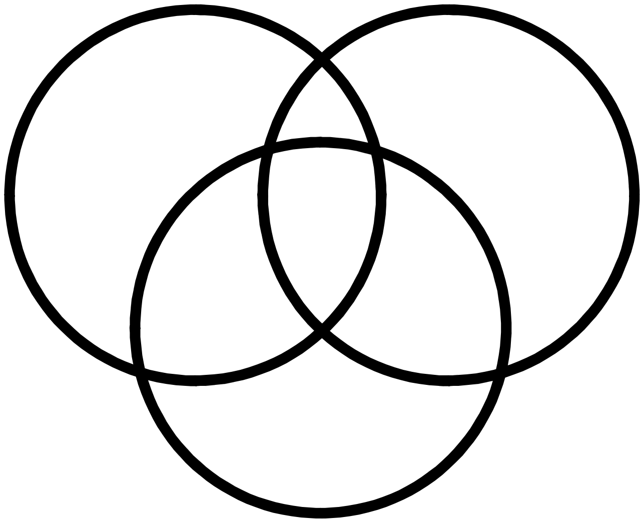
CRYPTOGRAPHY

ACCESS CONTROL

INTRUSION DETECTION

SECURITY ENGINEERING & MANAGEMENT

Cyber Security Objectives

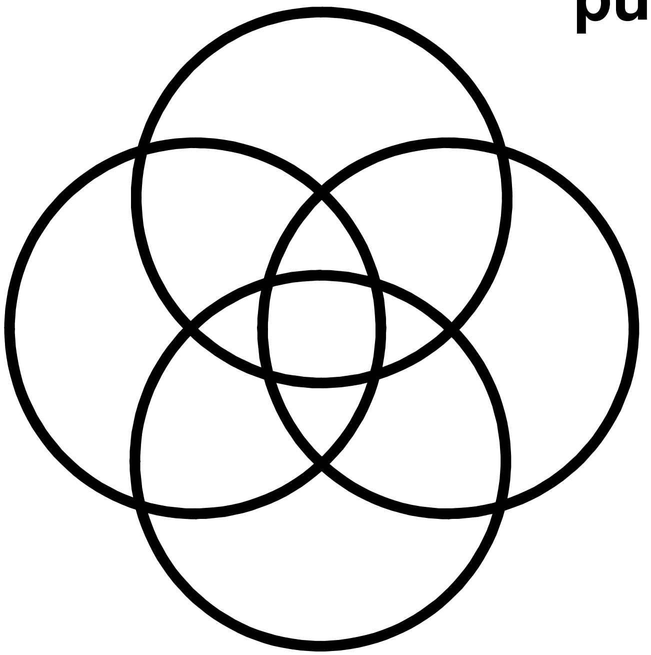


INTEGRITY
modification

AVAILABILITY
access

CONFIDENTIALITY
disclosure

Cyber Security Objectives



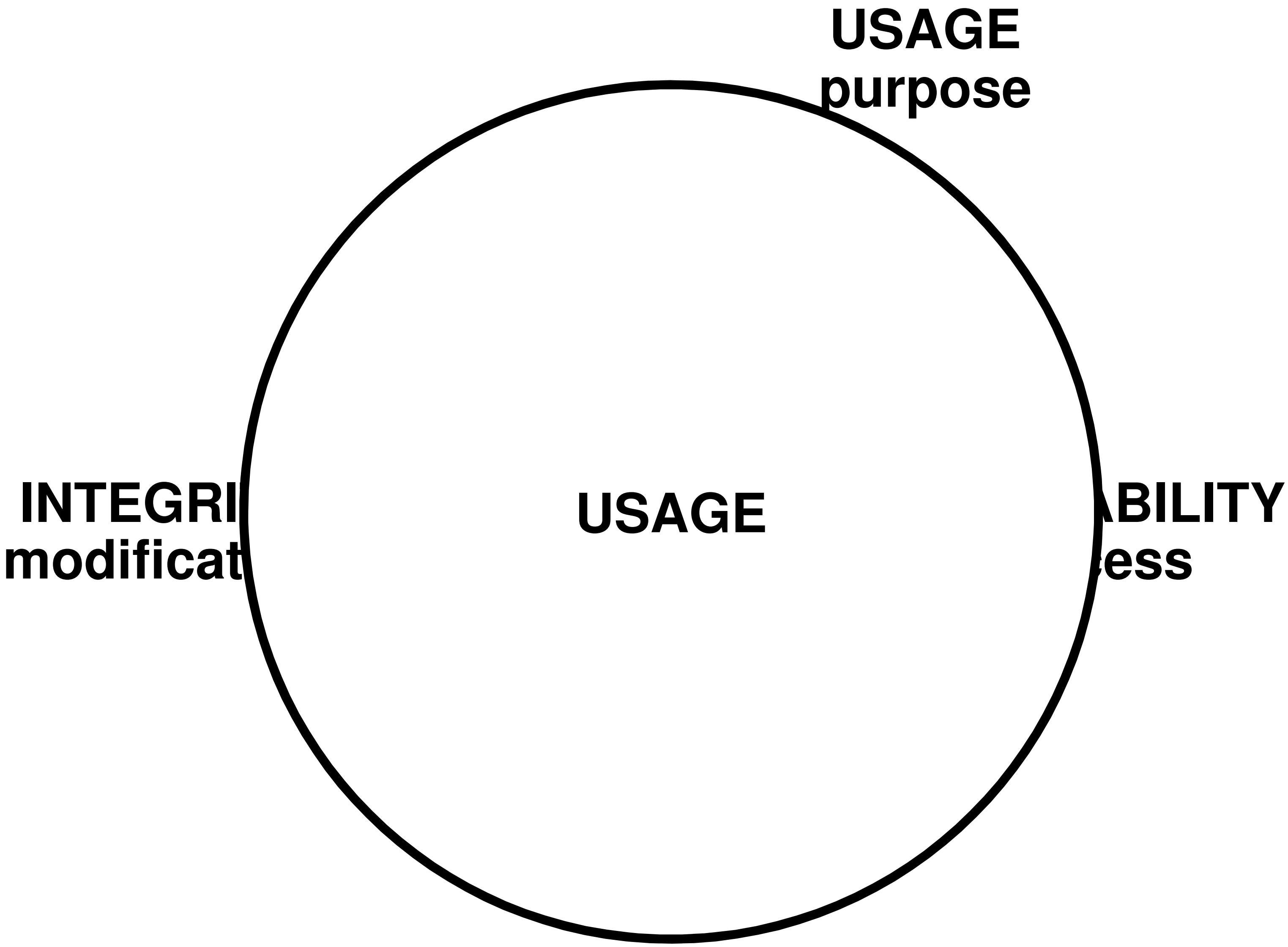
USAGE
purpose

INTEGRITY
modification

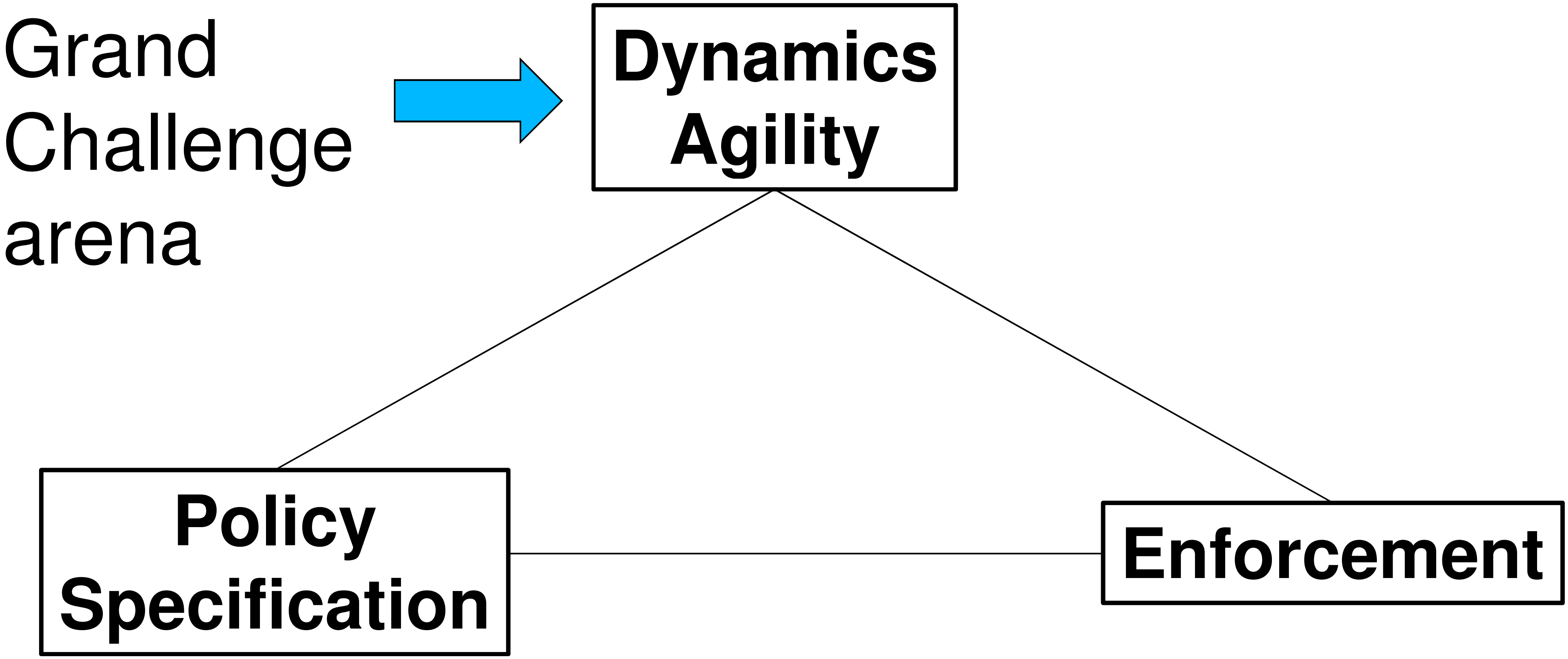
AVAILABILITY
access

CONFIDENTIALITY
disclosure

Cyber Security Objectives



Authorization Systems



Grand Challenge arena

Dynamics Agility

Policy Specification

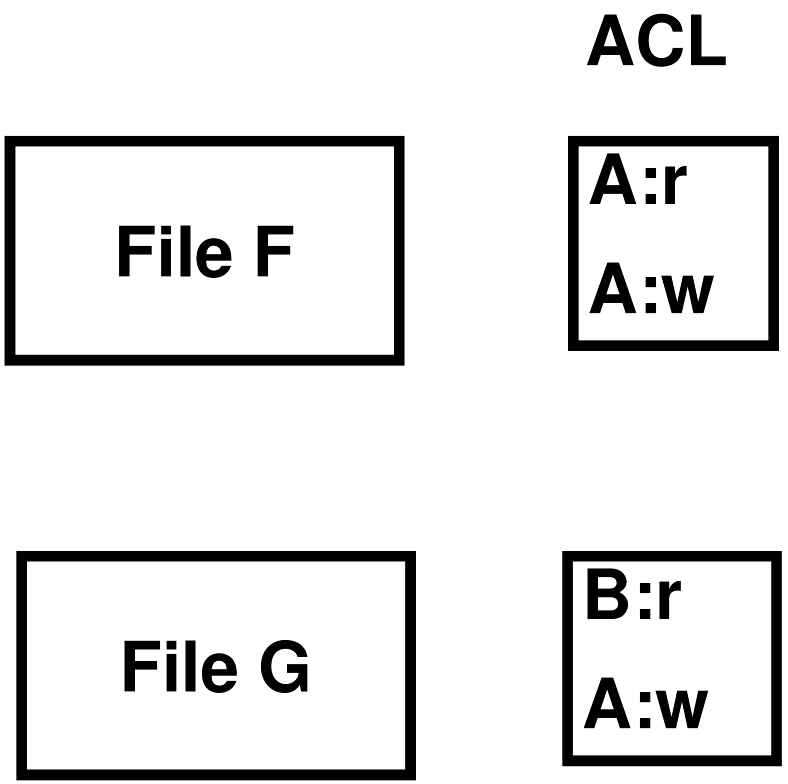
Enforcement

Access Control Models

- Discretionary Access Control (DAC)
  - Owner controls access
  - But only to the original, not to copies
- Mandatory Access Control (MAC)
  - Same as Lattice-Based Access Control (LBAC)
  - Access based on security labels
  - Labels propagate to copies
- Role-Based Access Control (RBAC)
  - Access based on roles
  - Can be configured to do DAC or MAC
  - Generalizes to Attribute-Based Access Control (ABAC)

Numerous other models but only 3 successes: SO FAR

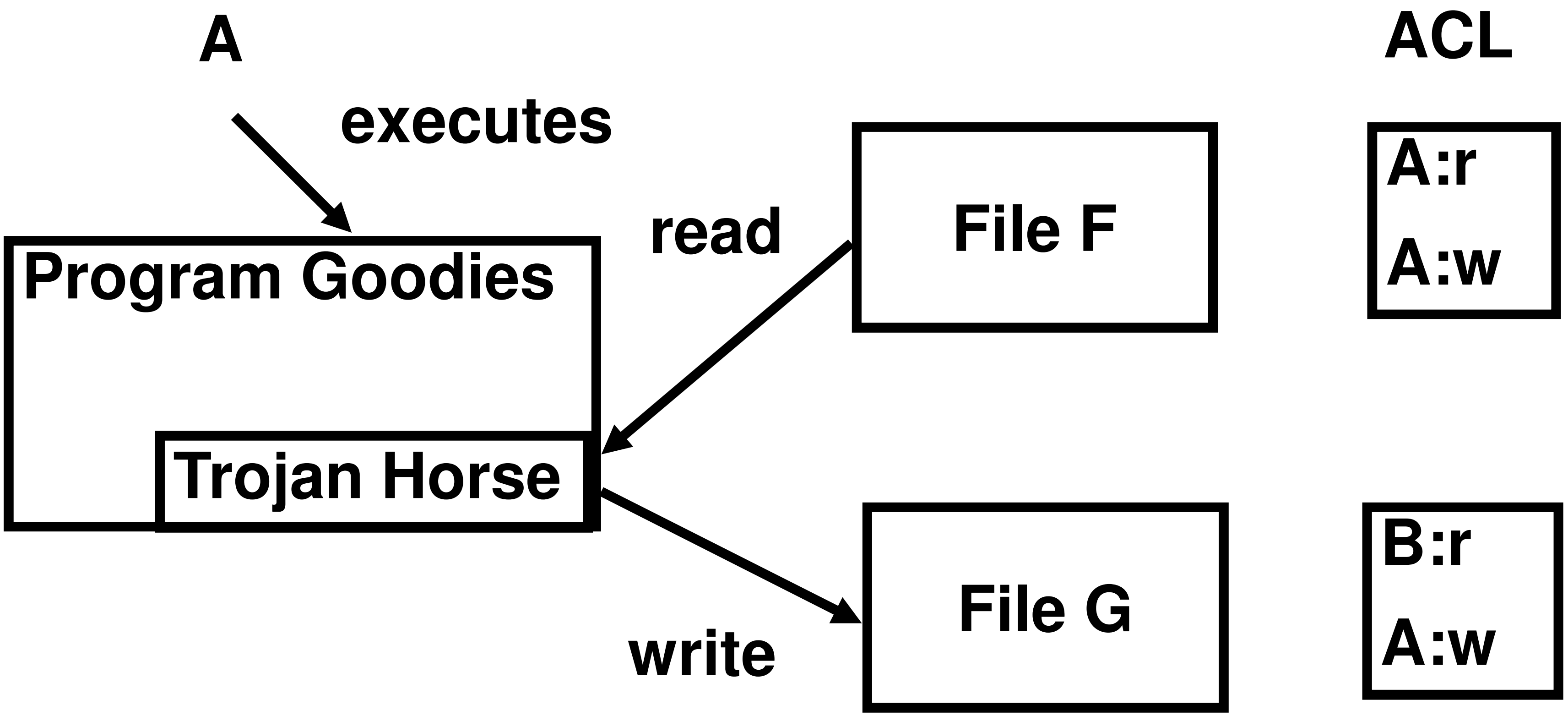
Discretionary Access Control



B cannot read file F

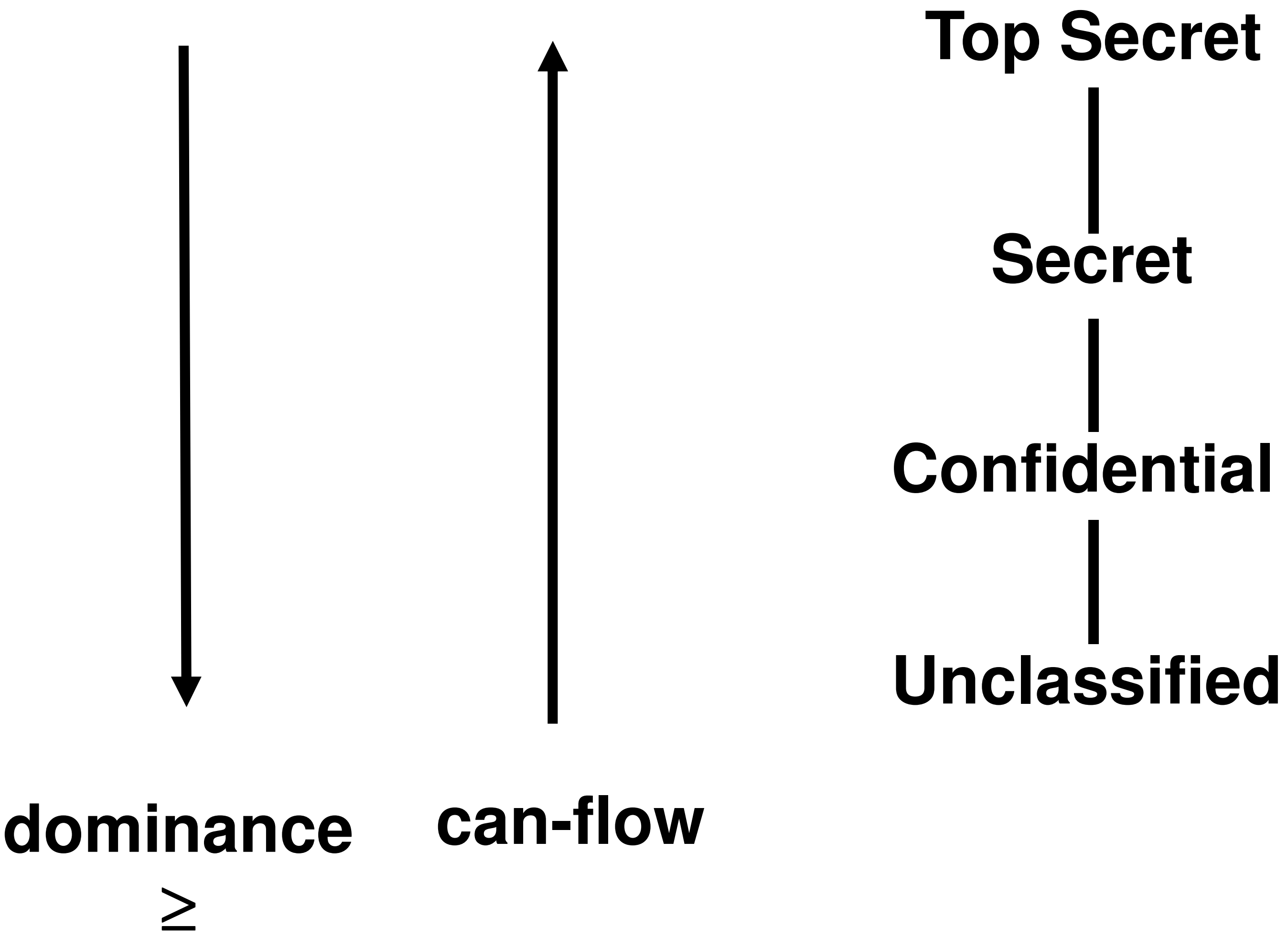
A trusted not to copy F to G

Discretionary Access Control



But trusting A does not stop Trojan Horses

Mandatory Access Control



Top Secret

Secret

Confidential

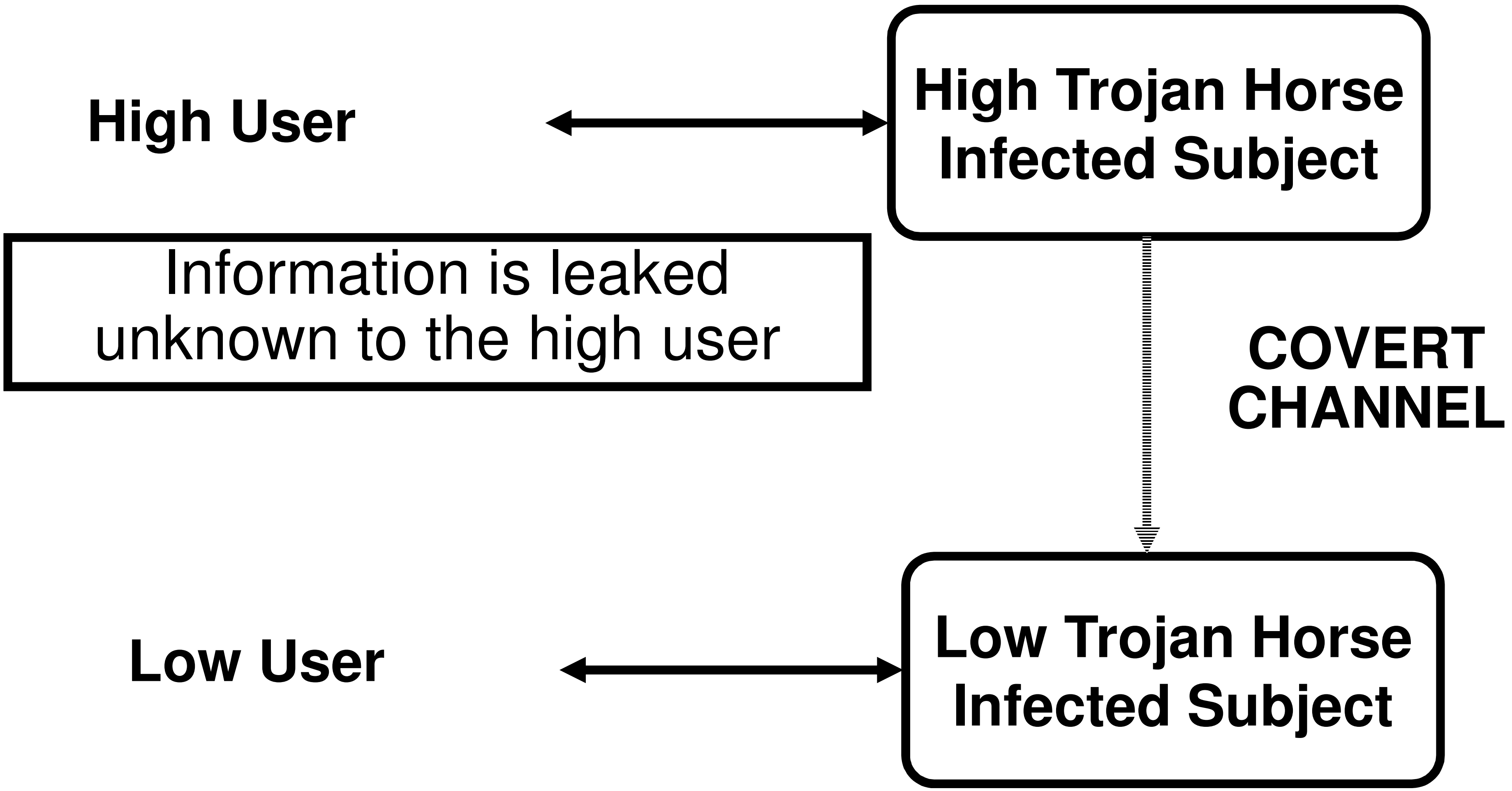
Unclassified

dominance

≥

can-flow

Mandatory Access Control



High User

High Trojan Horse Infected Subject

Information is leaked unknown to the high user

COVERT CHANNEL

Low User

Low Trojan Horse Infected Subject

Role-Based Access Control

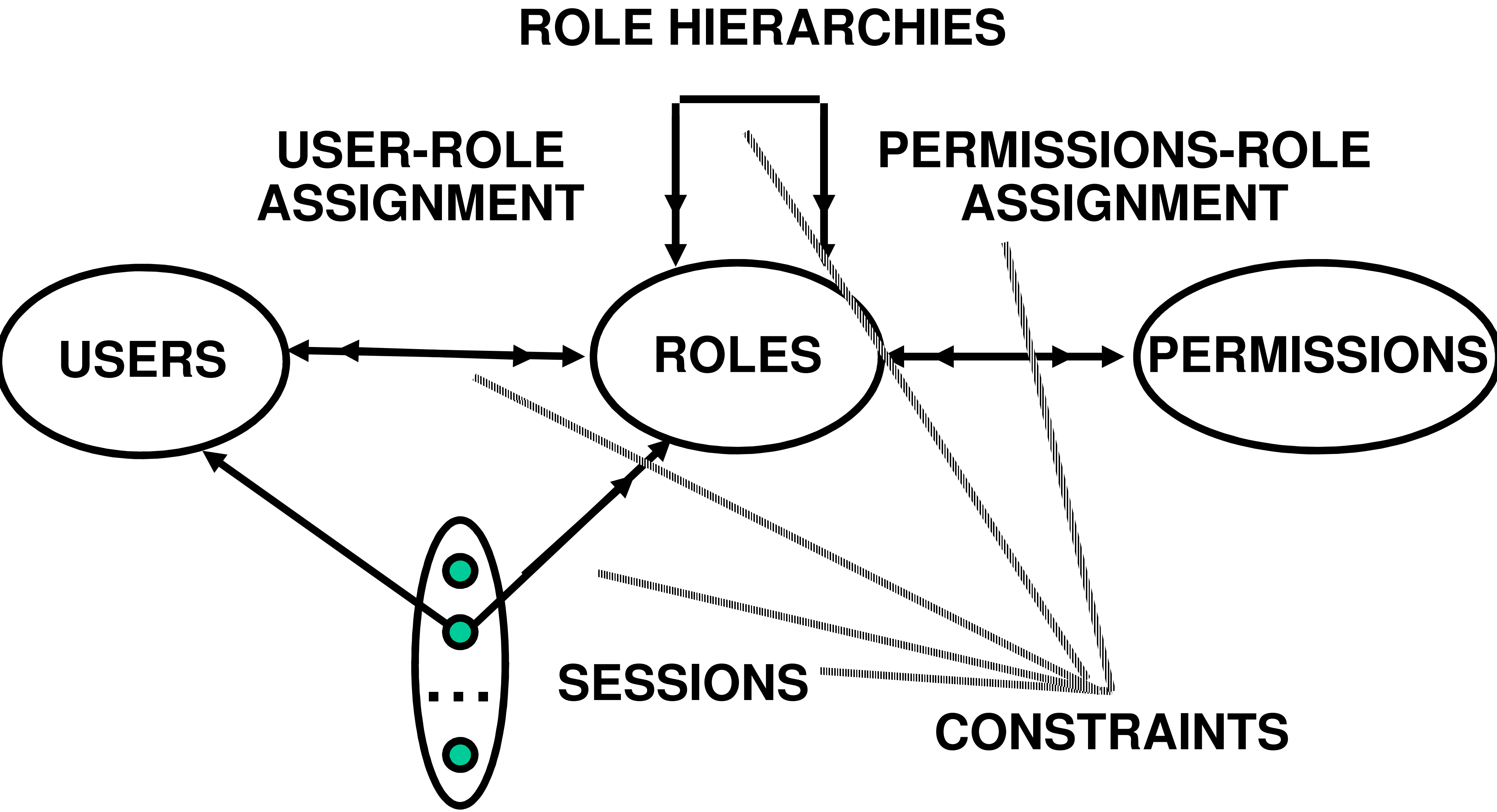
- Access is determined by roles
- A user’s roles are assigned by security administrators
- A role’s permissions are assigned by security administrators

Is RBAC MAC or DAC or neither?

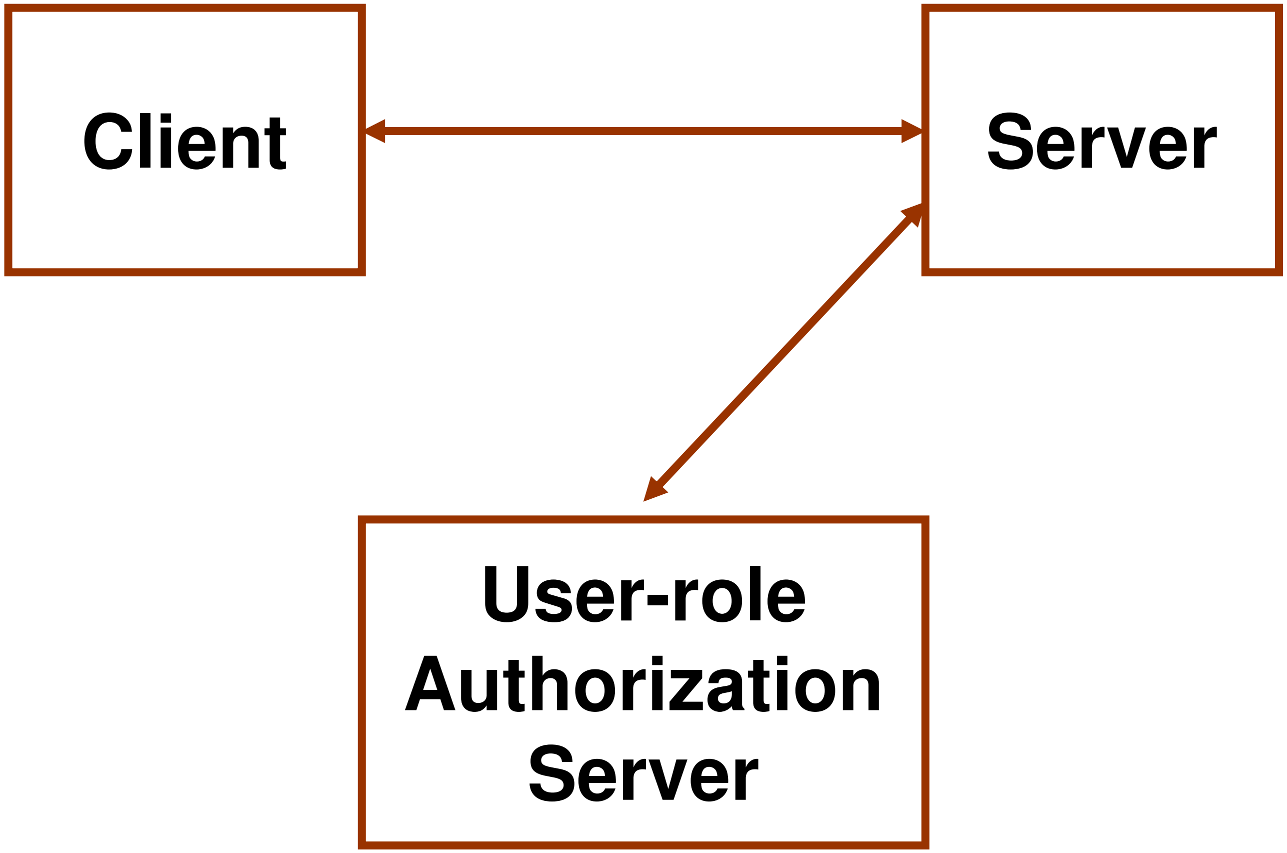
- RBAC can be configured to do MAC
- RBAC can be configured to do DAC
- RBAC is policy neutral

RBAC is neither MAC nor DAC!

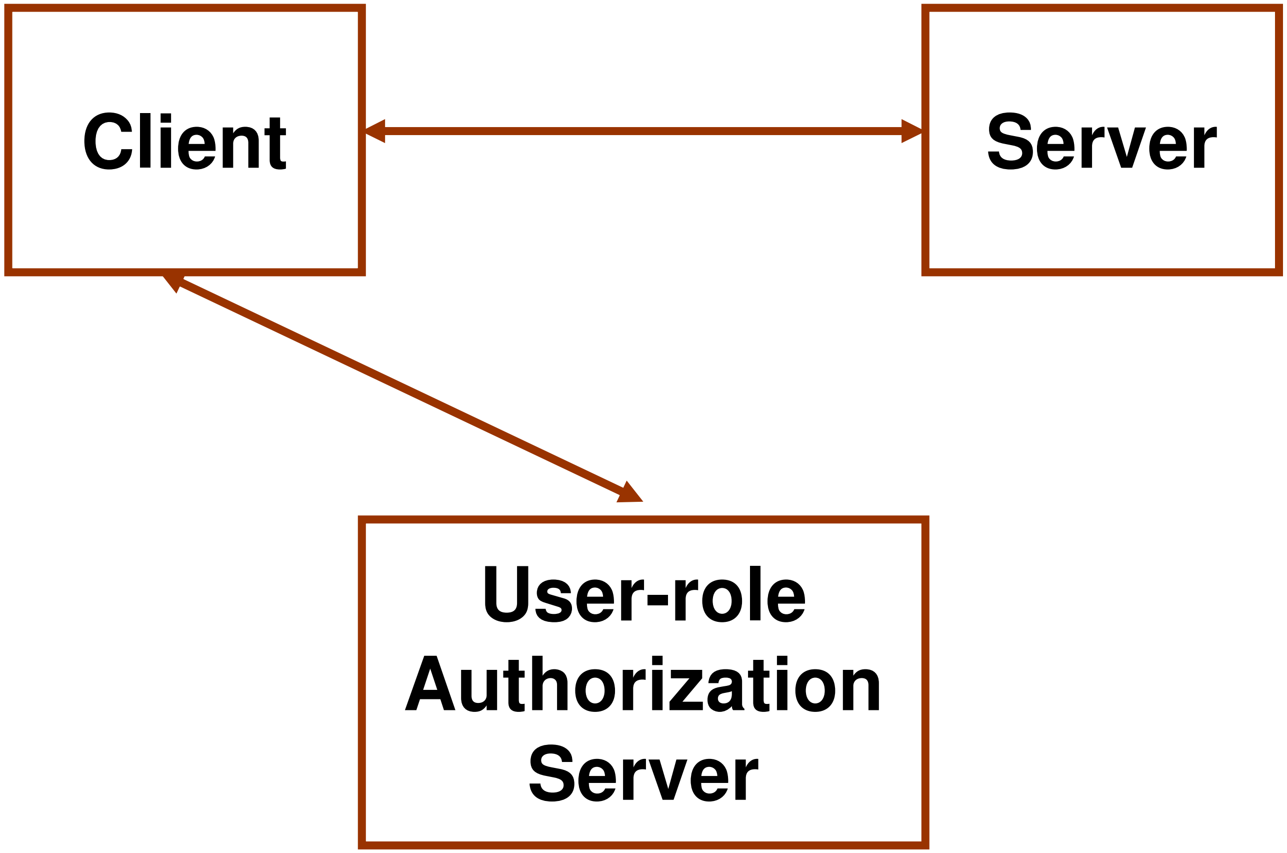
Role-Based Access Control



Server Pull Enforcement Model



Client Pull Enforcement Model



Tough Challenges

- Trojan Horse
- Covert Channels
- Inference
- Analog Hole
- Assured Enforcement
- Privelege Escalation
- Policy Comprehension and Analysis

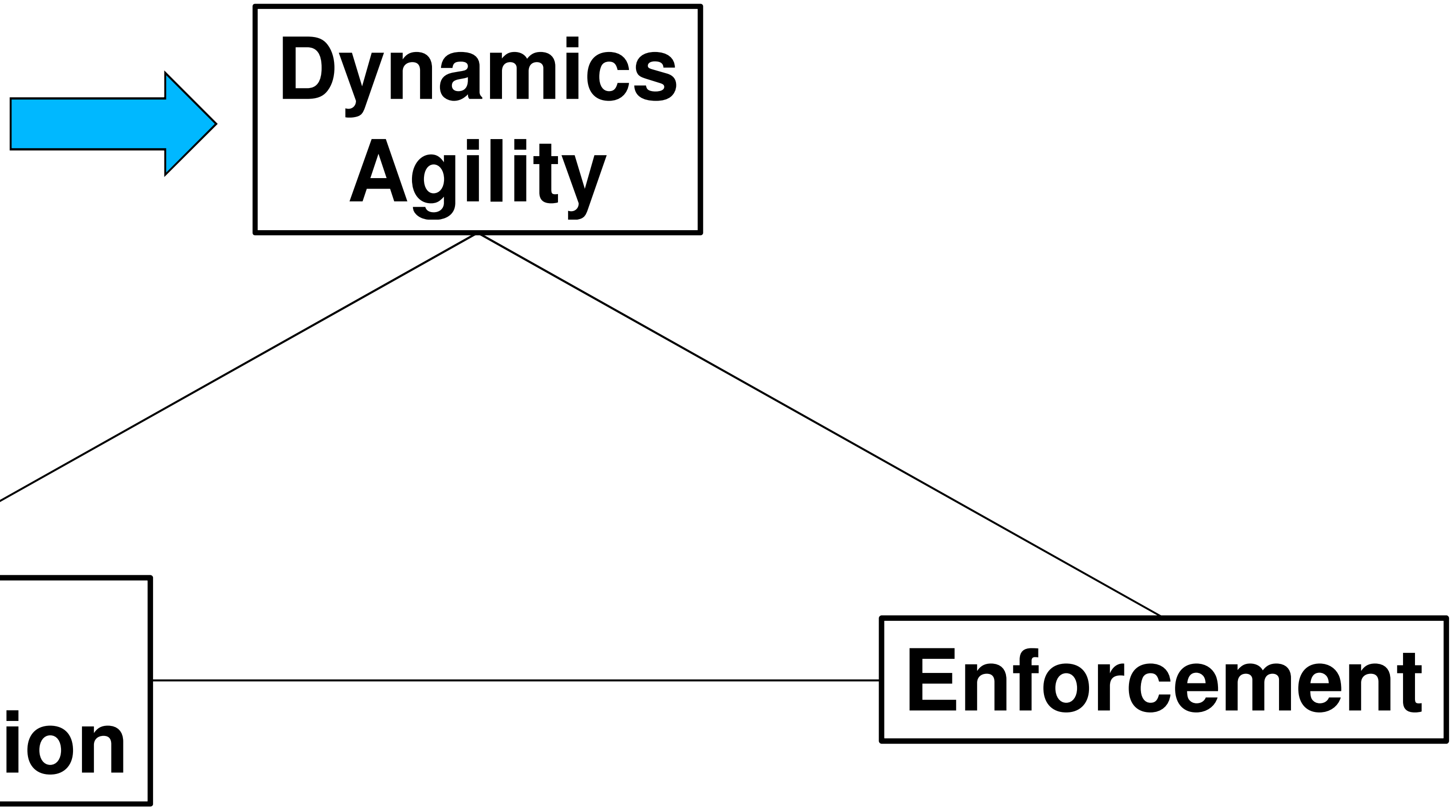
Tough Challenges NOT EQUAL TO Grand Challenges

Grandest Challenge

- How can we be “secure” while being “insecure”?
- What is the value of access control when we know that ultimately it can be bypassed?

Authorization Systems

Grand Challenge arena



Dynamics Agility

Policy Specification

Enforcement

Grand Challenges

- How do we determine the balance between too much and too little?
- How do we enforce policies across multiple layers of the software stack?
- How do we build dynamics into policy specifications and enforcement mechanisms?
- How do we understand and control what we have done?

Butler Lampson Paraphrased

- Computer scientists could never have designed the web because they would have tried to make it work.
  - But the Web does "work."
  - What does it mean for the Web to "work"?