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The Institute for Cyber Security

C·SPECC
Center for Security and Privacy Enhanced Cloud Computing

Access Control Convergence: Challenges and Opportunities

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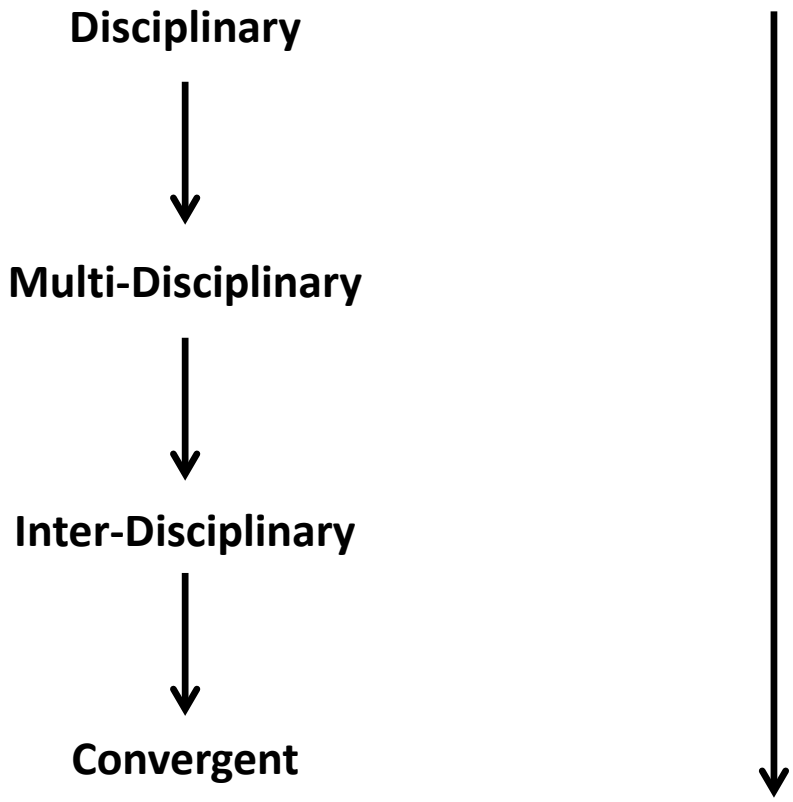
UTSA Computer Science

Convergent Research



INCREASED

Collaboration
Interaction
New paradigms
New concepts
New language
New disciplines

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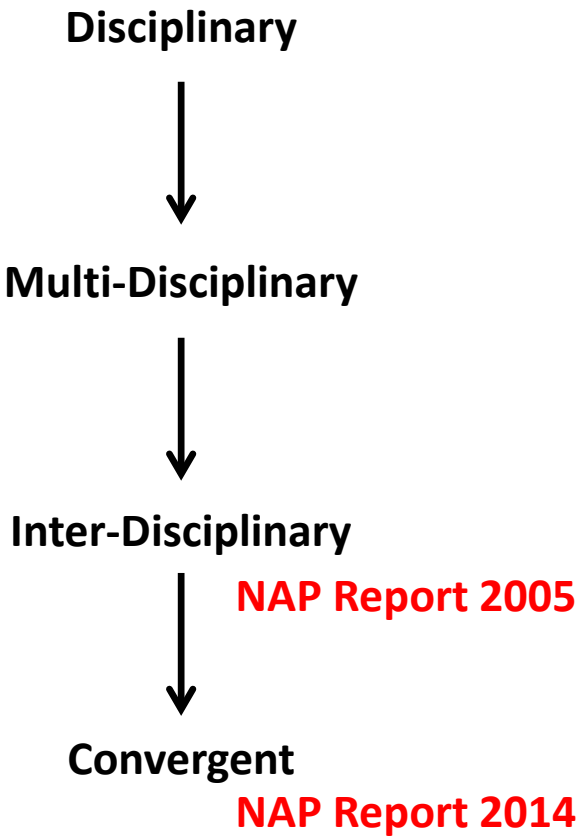
Convergent Research



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NAP = National Academies Press

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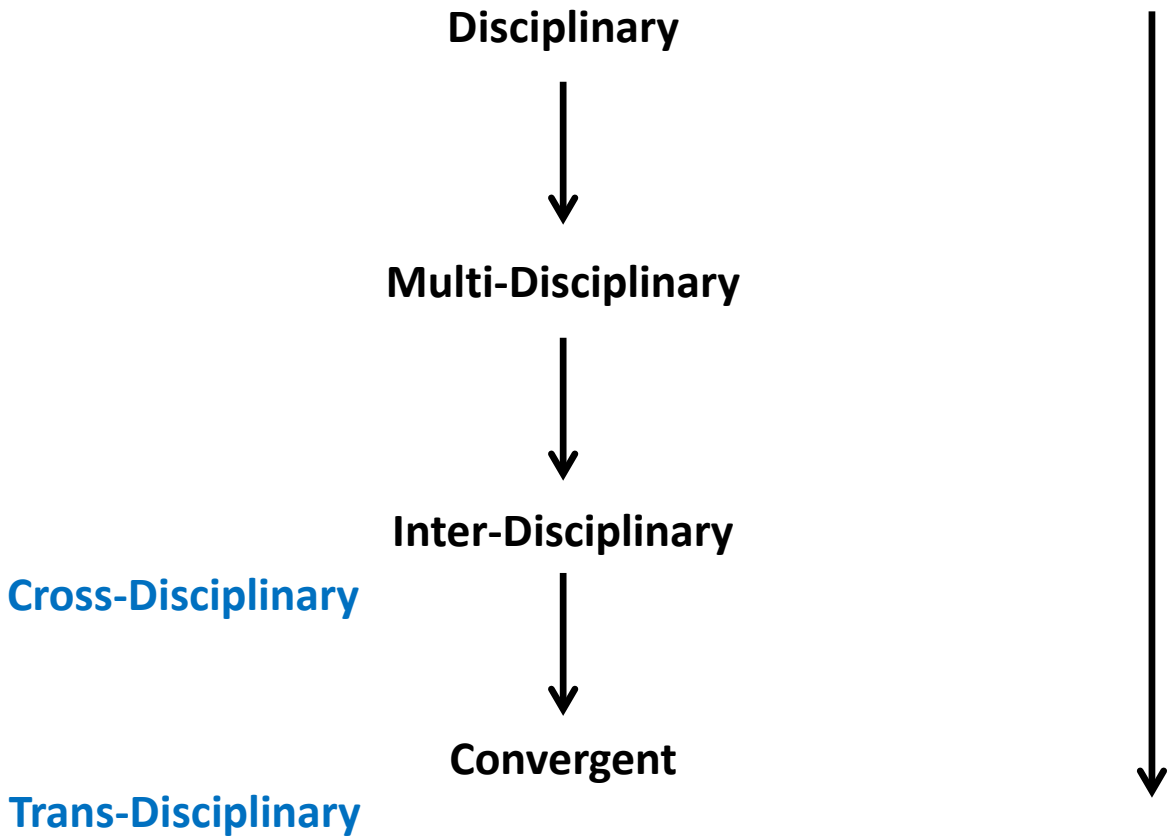

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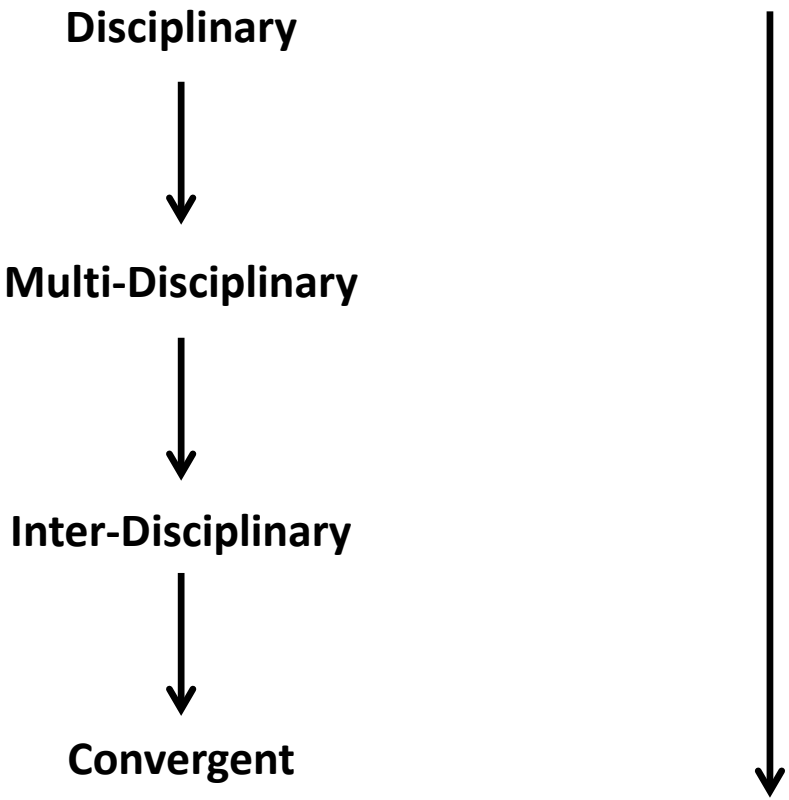

INCREASED

Collaboration
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DRIVERS
-- Deep scientific questions
-- Pressing societal needs

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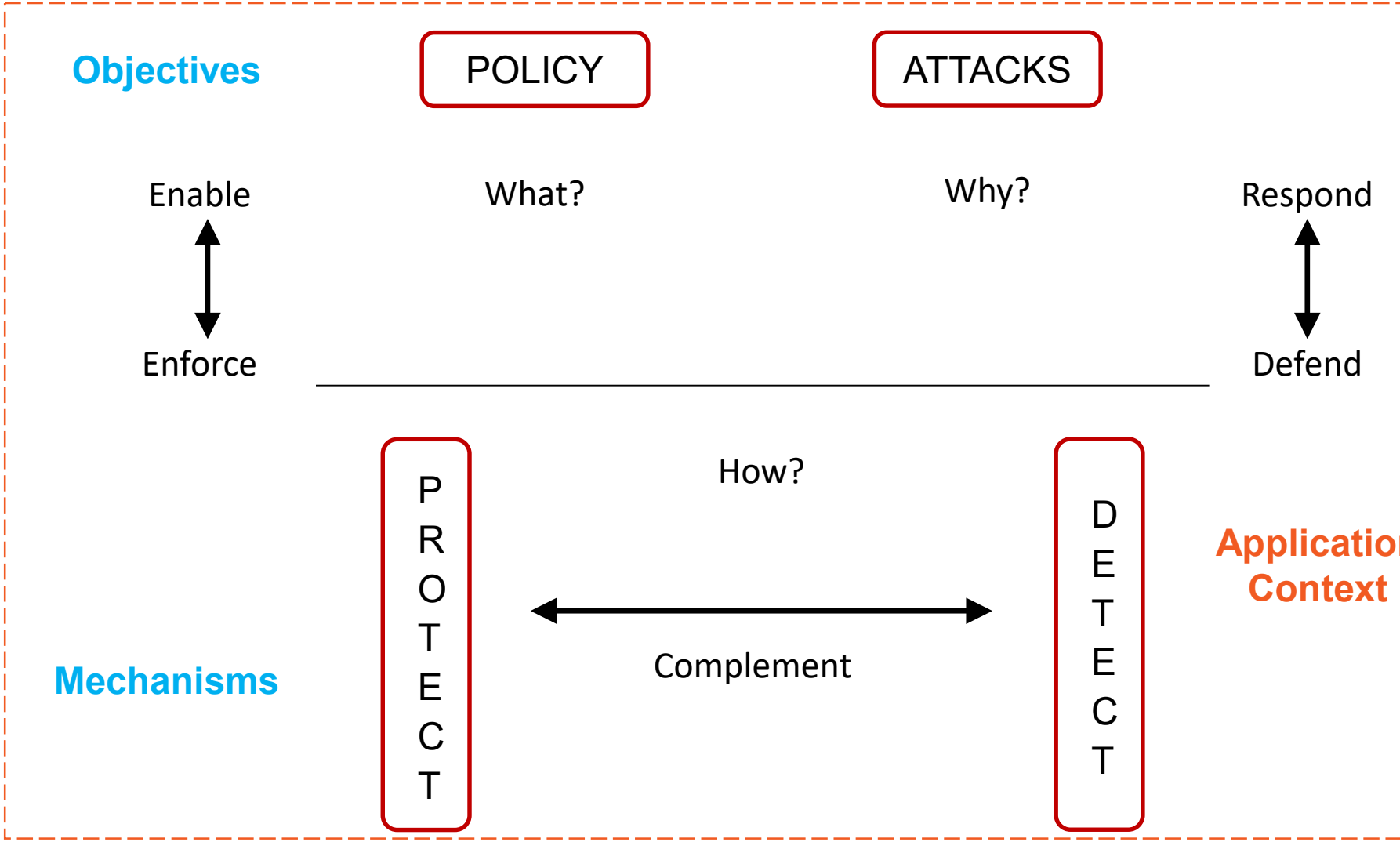

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Cyber Security Research Convergence

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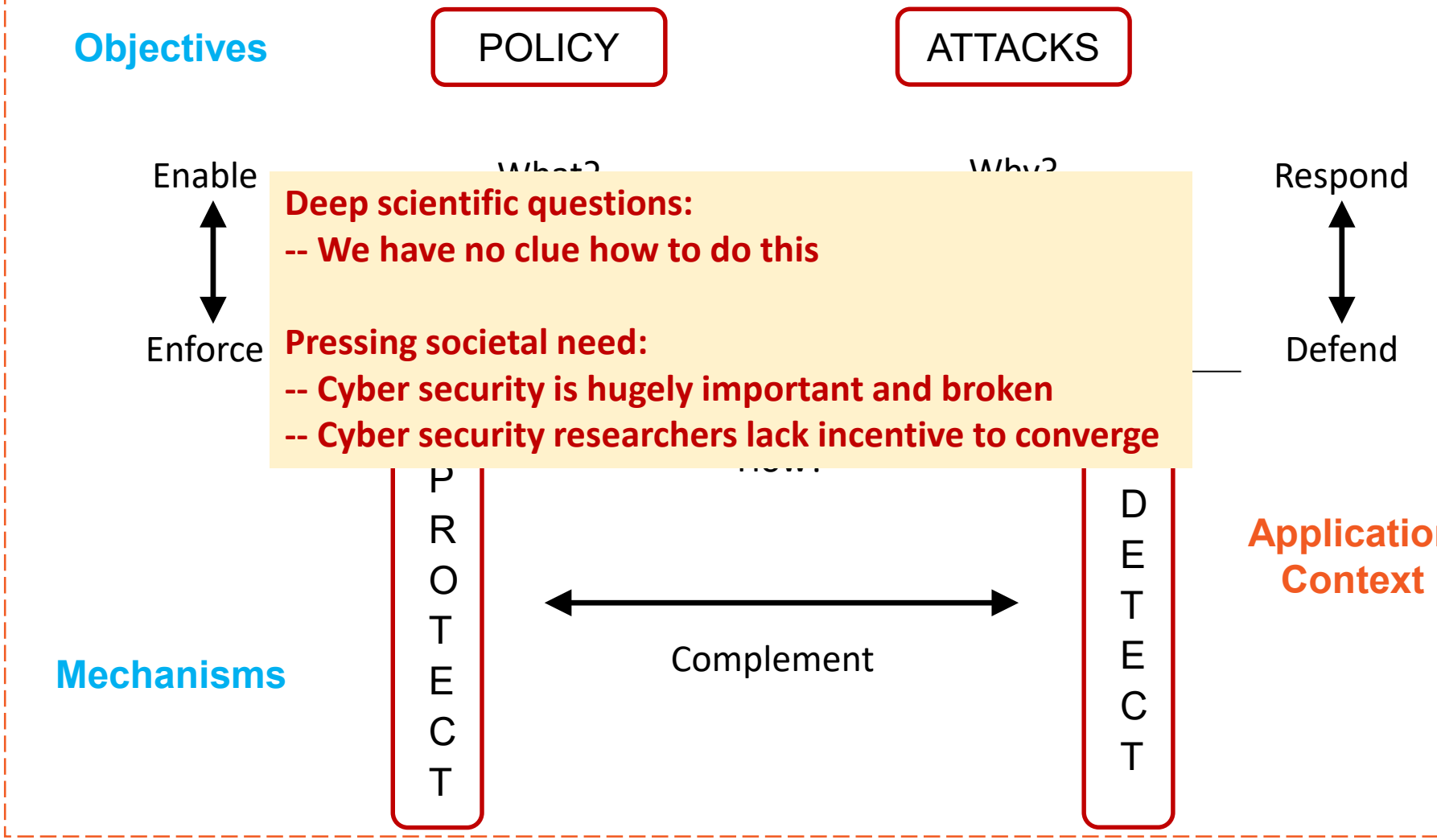

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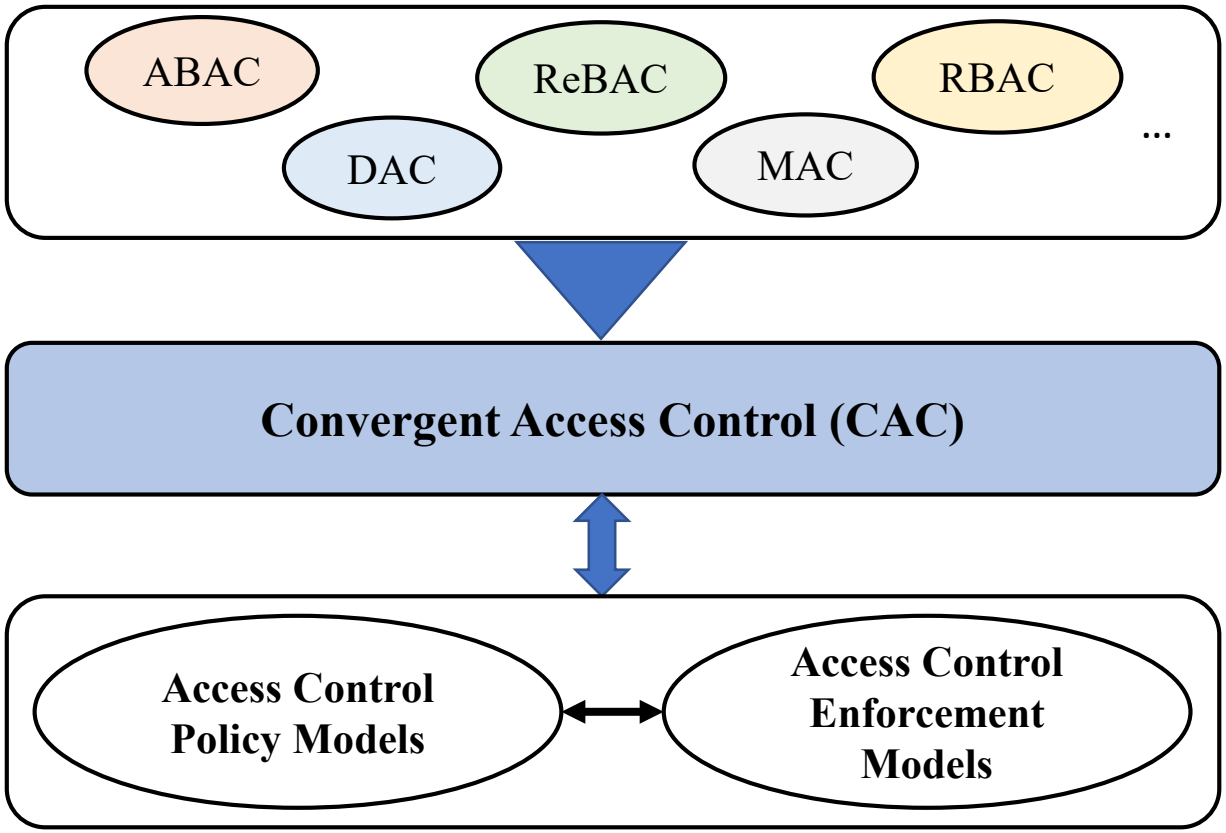
Access Control Research Convergence



Application Context

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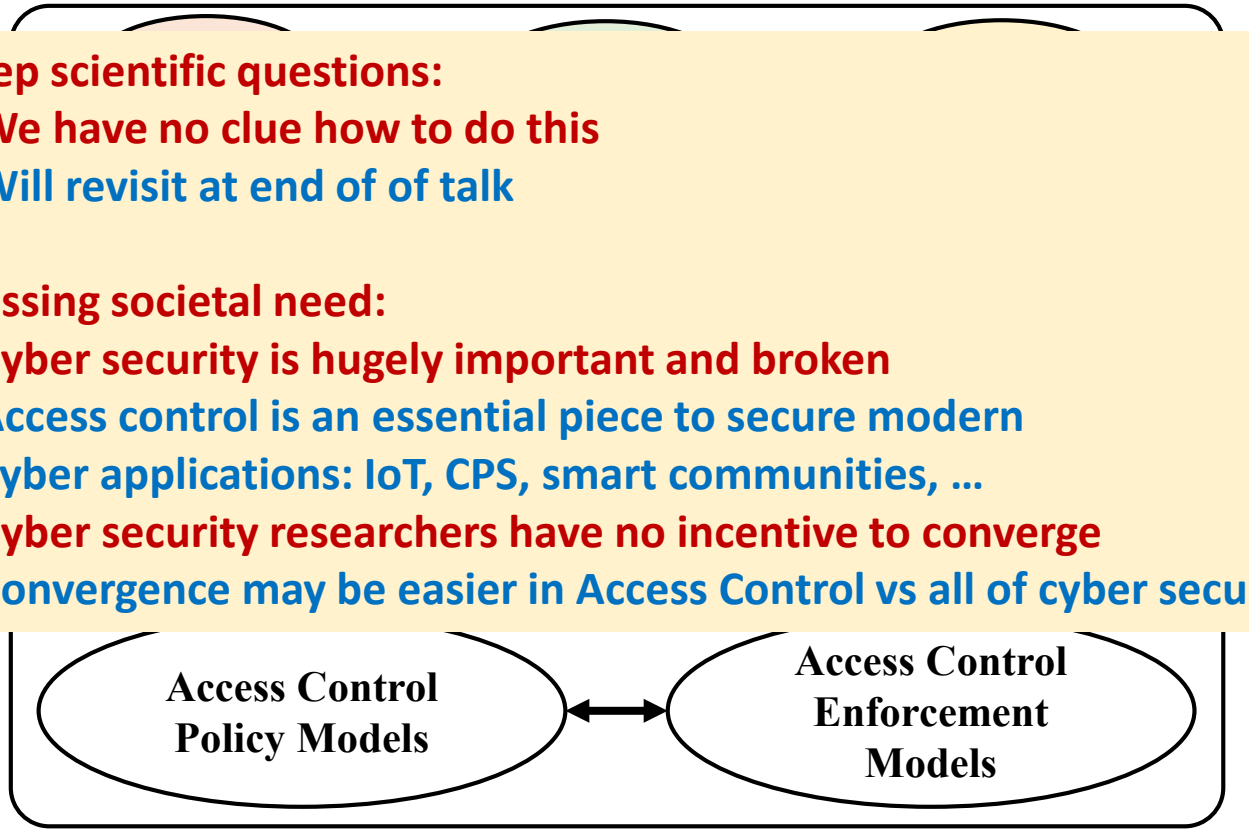
Access Control Research Convergence

Deep scientific questions:
-- We have no clue how to do this
-- Will revisit at end of of talk

Pressing societal need:
-- Cyber security is hugely important and broken
-- Access control is an essential piece to secure modern cyber applications: IoT, CPS, smart communities, …
-- Cyber security researchers have no incentive to converge
-- Convergence may be easier in Access Control vs all of cyber security



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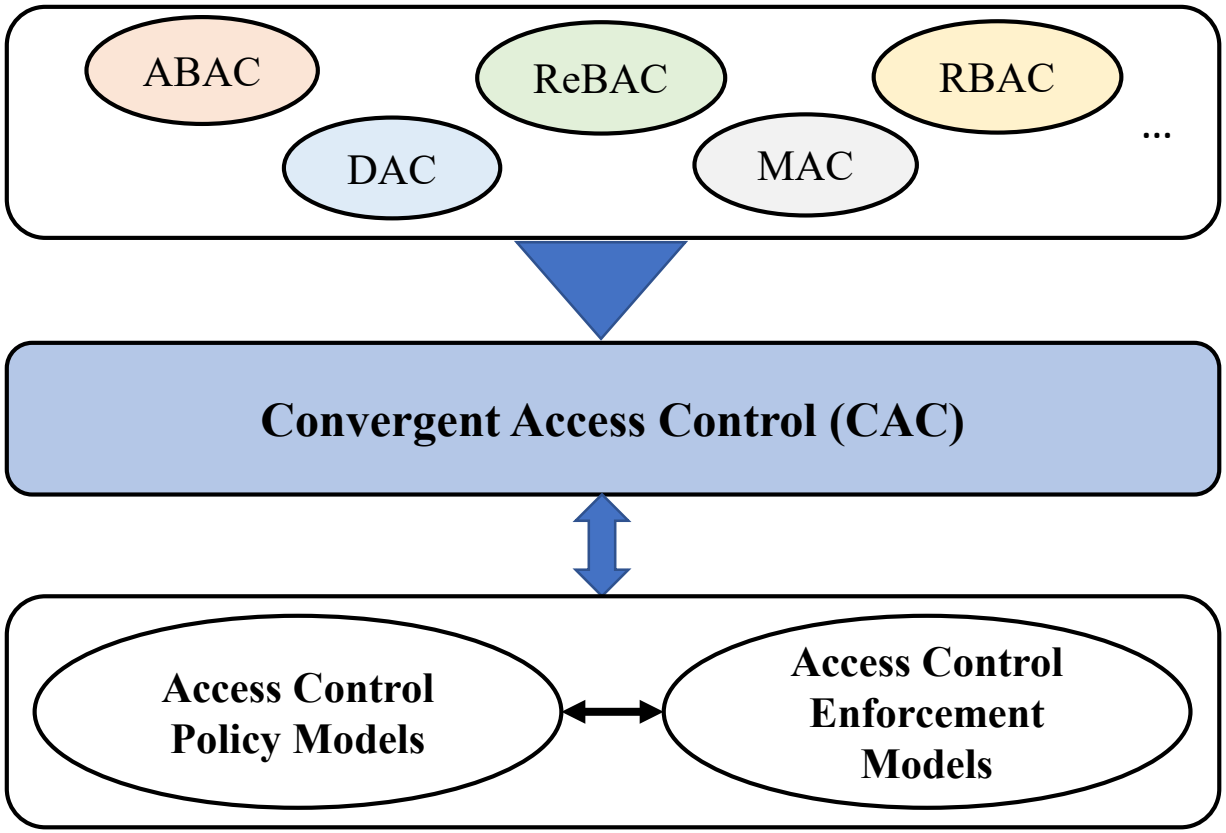

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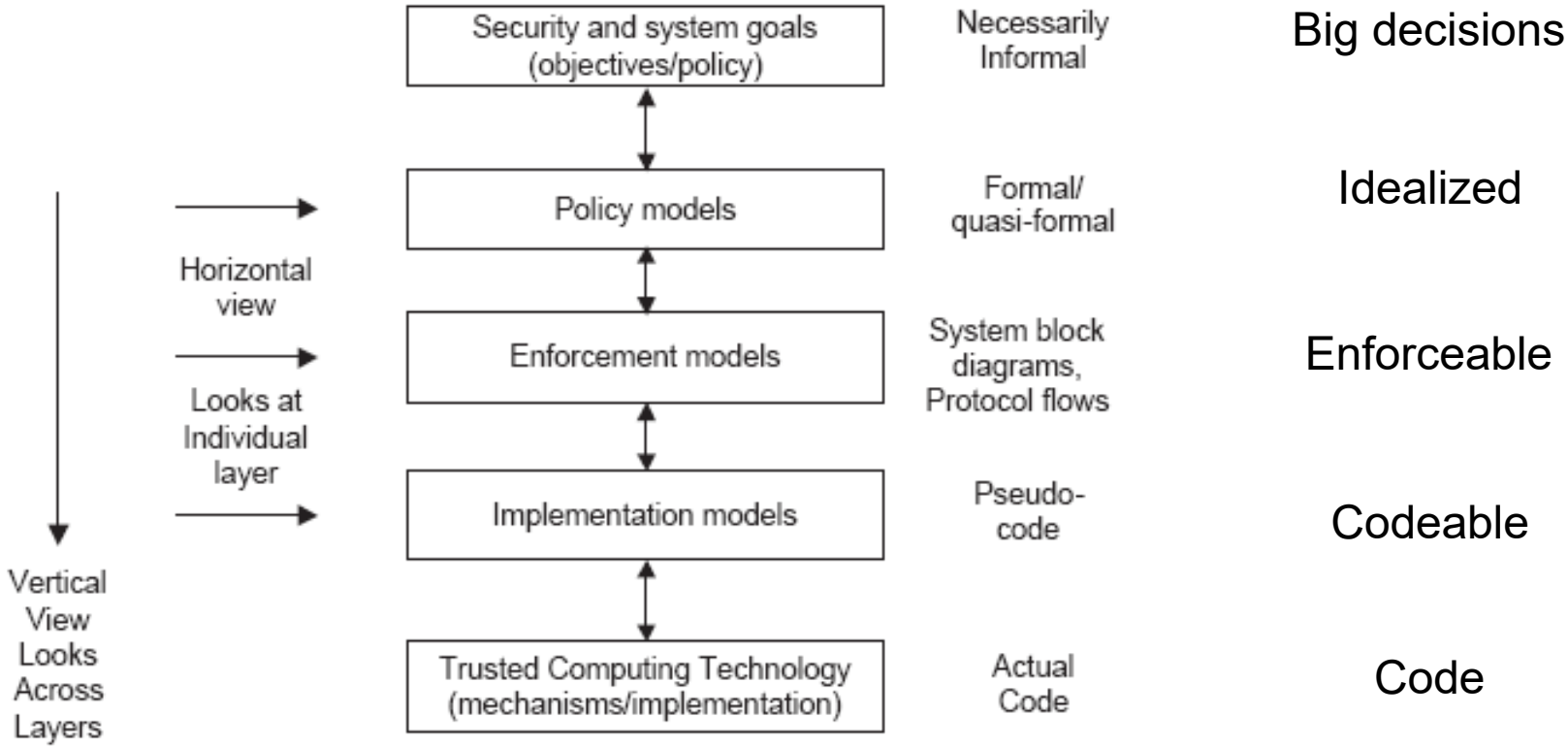
Access Control PEI Layers



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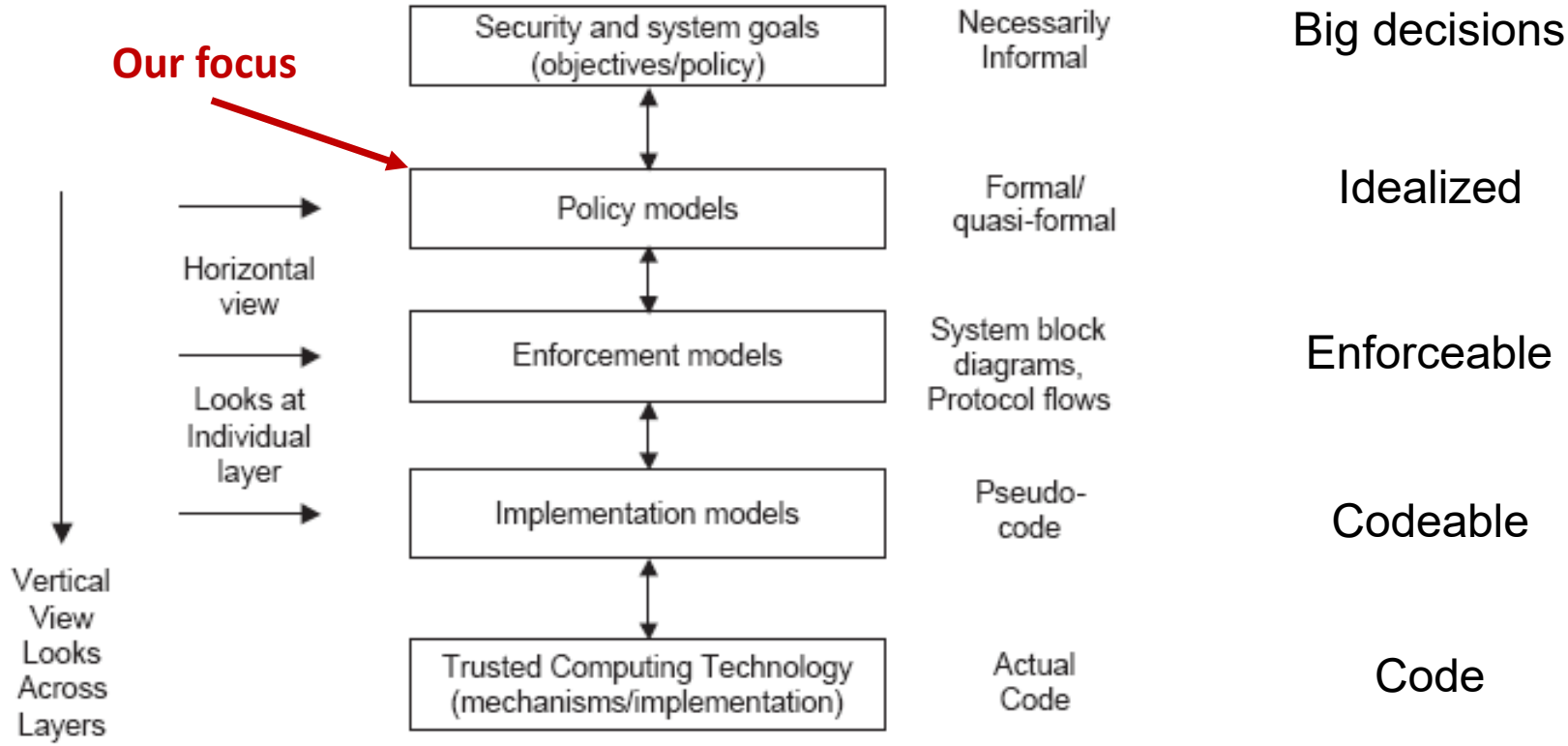
Access Control PEI Layers



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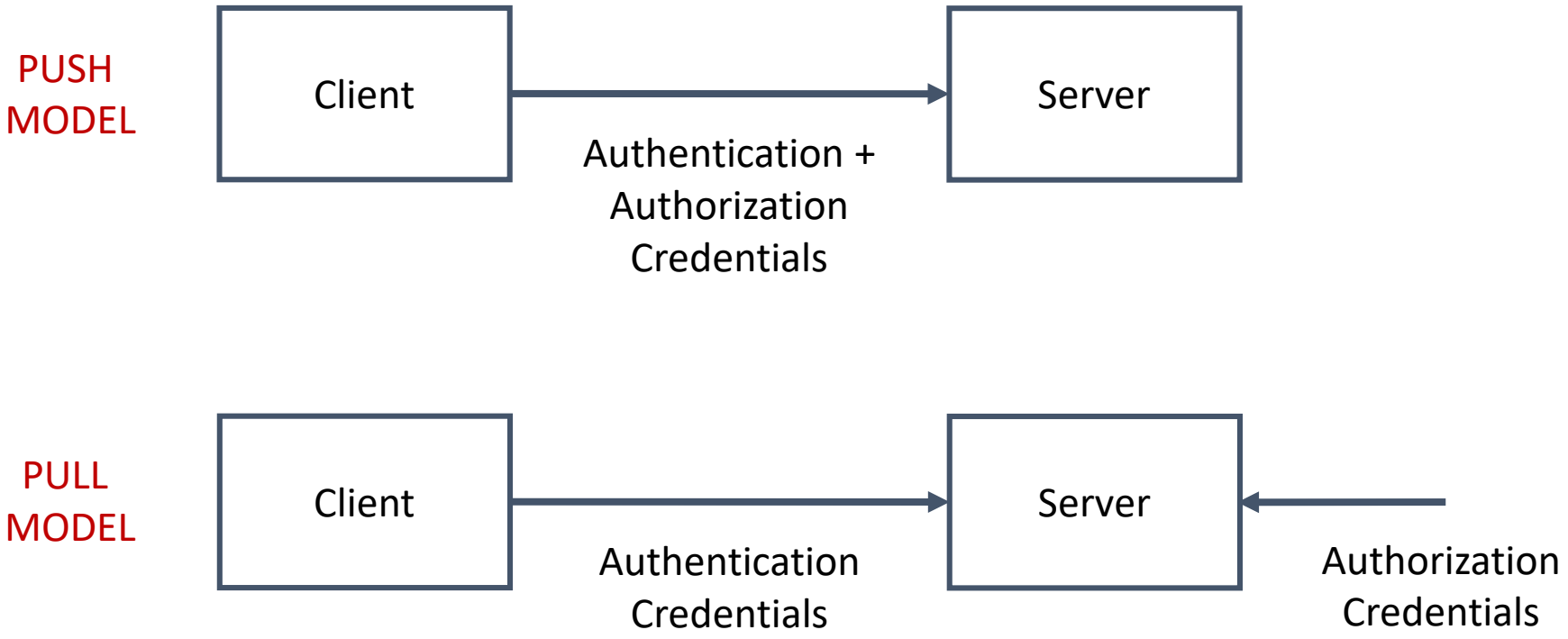
Enforcement Models



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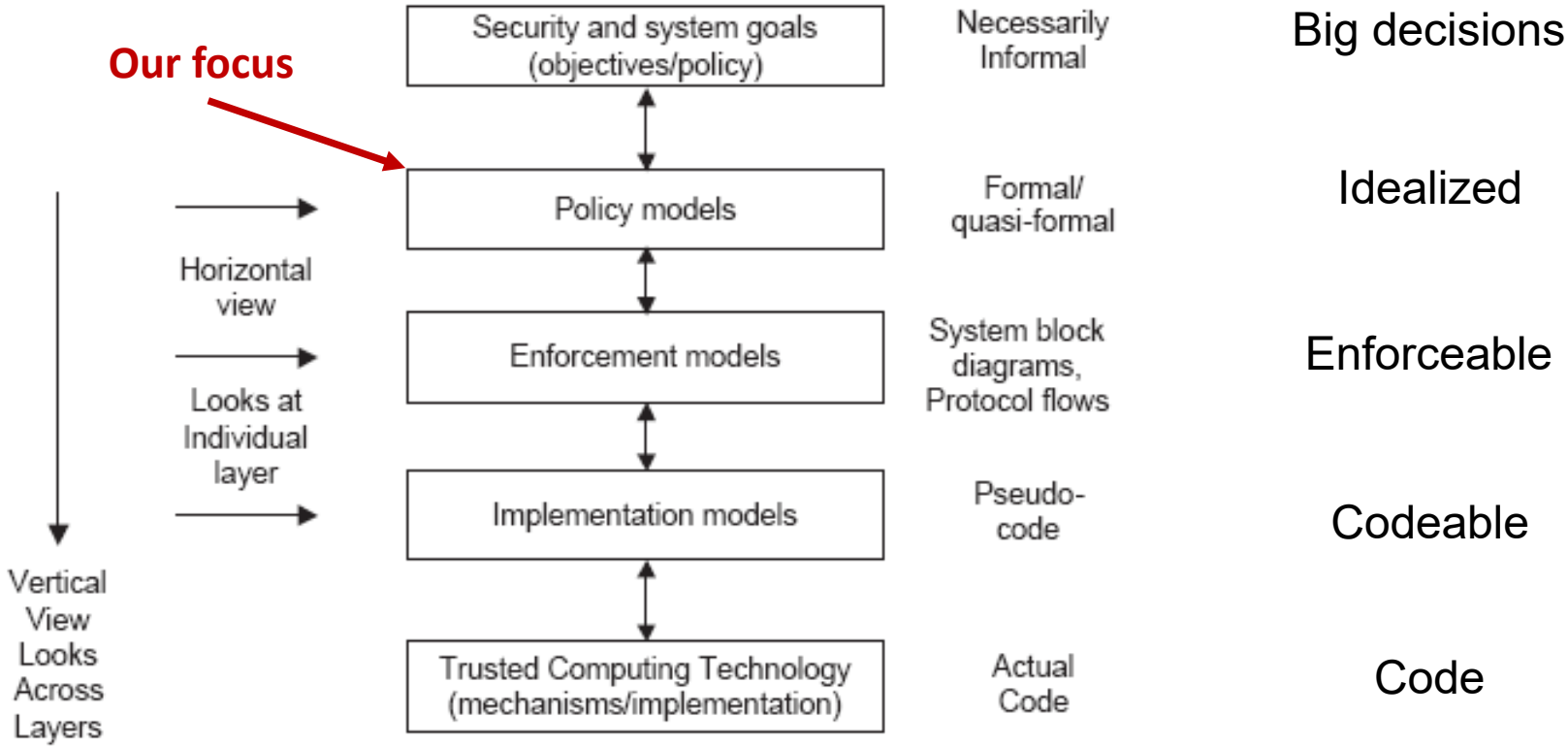

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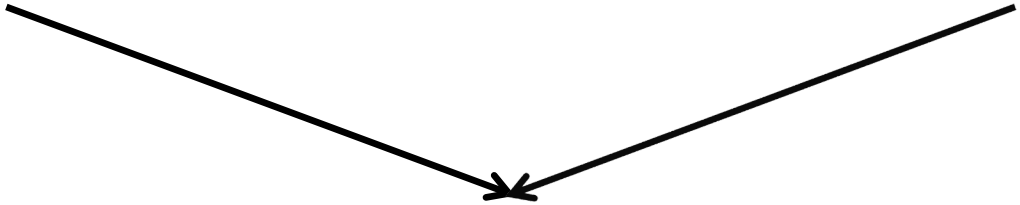
Access Control

Discretionary Access Control (DAC)
1970

Mandatory Access Control (MAC)
1970



Role Based Access Control (RBAC)
1995

Attribute Based Access Control (ABAC)
Relationship-Based Access Control (ReBAC)
Usage Control (UCON)
2020s (Hopefully)

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Discretionary Access Control (DAC)

- Core concept:

  Custodian of information determines access

- Core drawback:

  Does not protect copies
  Therefore OK for integrity but not for confidentiality

- Sophistication:

  Delegation of custody

  Denials or negative rights

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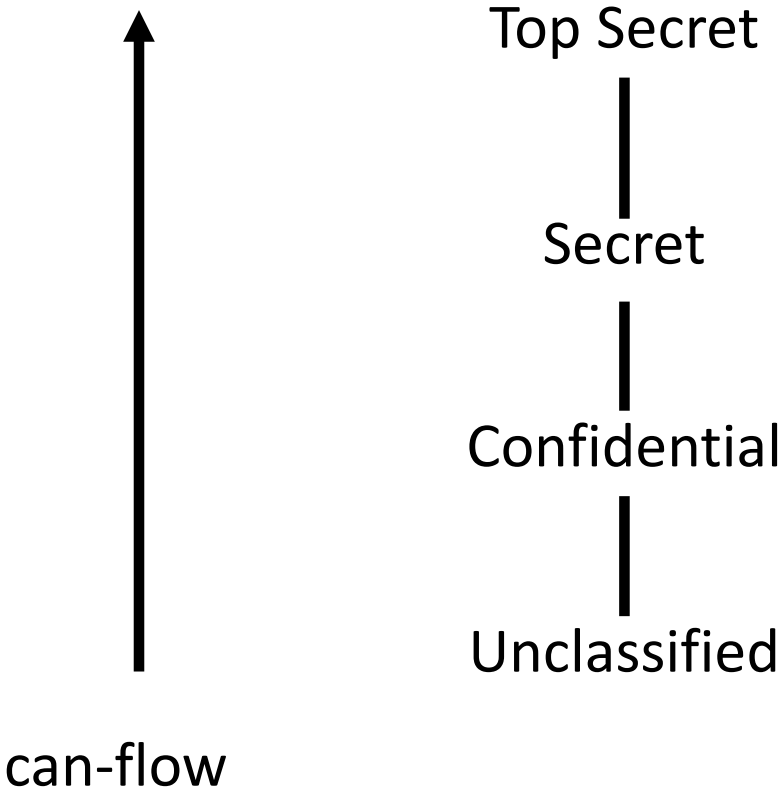
Mandatory Access Control (MAC)



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Mandatory Access Control (MAC)

- Core concept:
  - Extend control to copies by means of security labels
- Core drawback:
  - Covert/side channels bypass MAC
  - Inference not prevented
  - Too strict
  - Too reductionist
- Sophistication:
  - Dynamic labels

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Access Control

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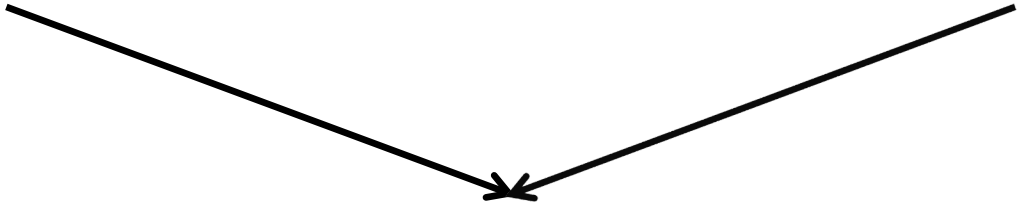

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Role-Based Access Control (RBAC)

- Core concept:
  - Roles determine everything
- Core drawback:
  - Roles are a natural concept for human users
  - But not so natural for:
  - Information objects
  - IoT things
  - Contextual attributes
- Sophistication:
  - Role hierarchies
  - Role constraints

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Access Control

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Mandatory Access Control (MAC)
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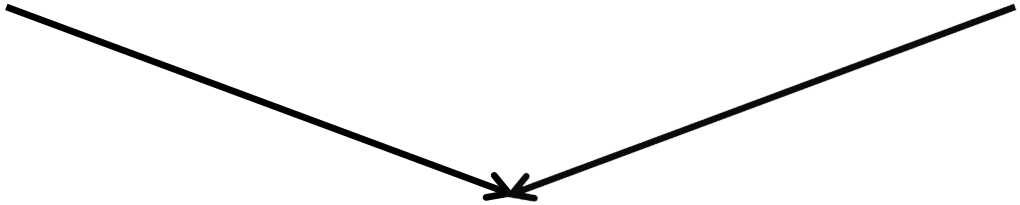

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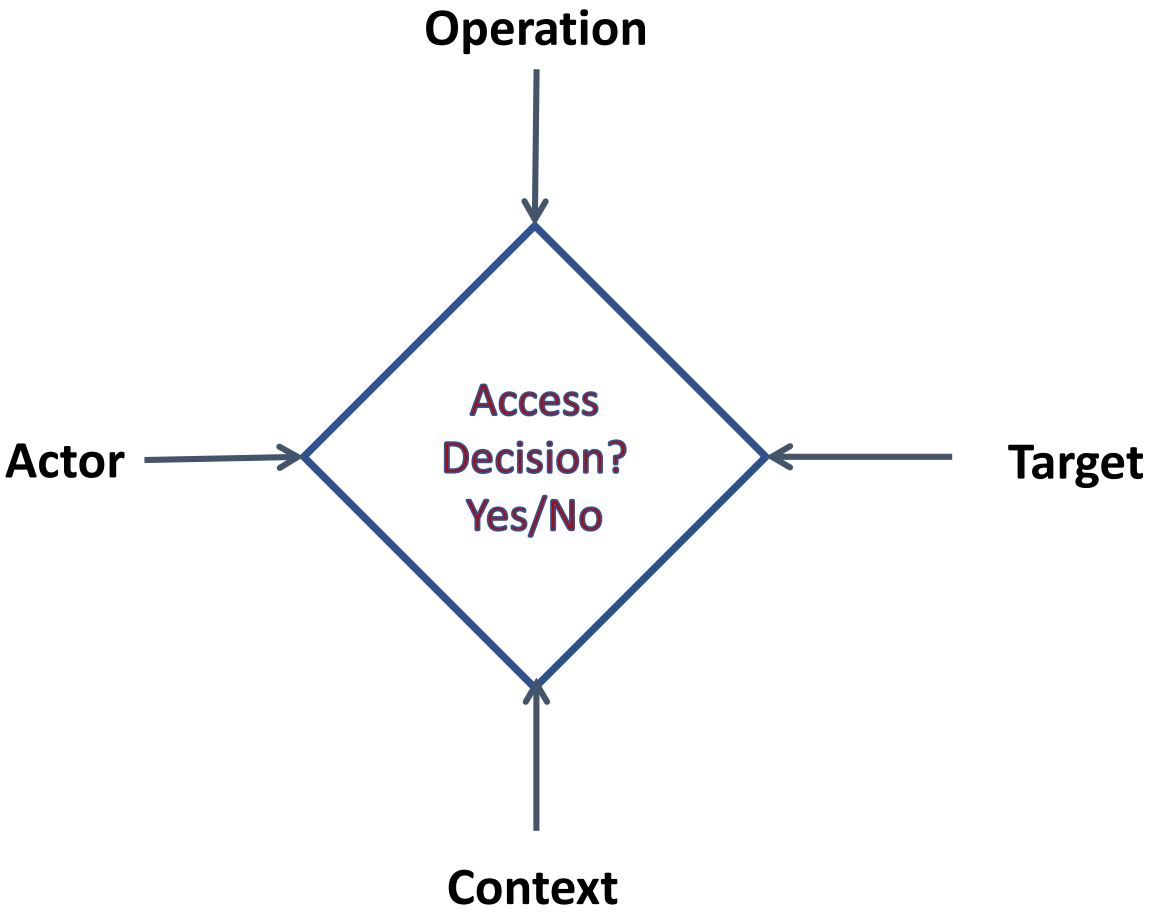
Attribute-Based Access Control (ABAC)



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Attribute-Based Access Control (ABAC)

- Core concept:
  - Attributes determine everything
  - No fixed access decision rule
- Core drawback:
  - Flexibility at the cost of complexity
- Sophistication:
  - Chained attributes
  - Group attributes
  - Distributed decision rules
  - Automation
  - Adaptation

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Access Control

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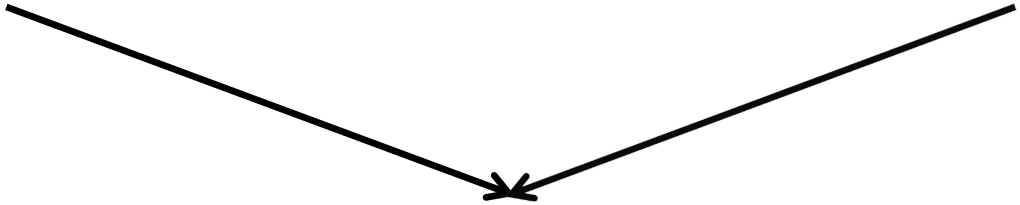

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Usage Control (UCON)
2020s (Hopefully)

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Access Control: Where Are We?

- Rich set of building blocks:

  DAC, MAC, RBAC, ABAC, ReBAC, UCON

- We have some understanding of the relationships amongst these

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Access Control: What Next?

- Rich set of building blocks:

  DAC, MAC, RBAC, ABAC, ReBAC, UCON

- We have some understanding of the relationships amongst these

- Do we need more building blocks?
- We have very little understanding of synergy amongst these

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Deep scientific question for convergent research

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Pressing societal need?

Deep scientific question for convergent research

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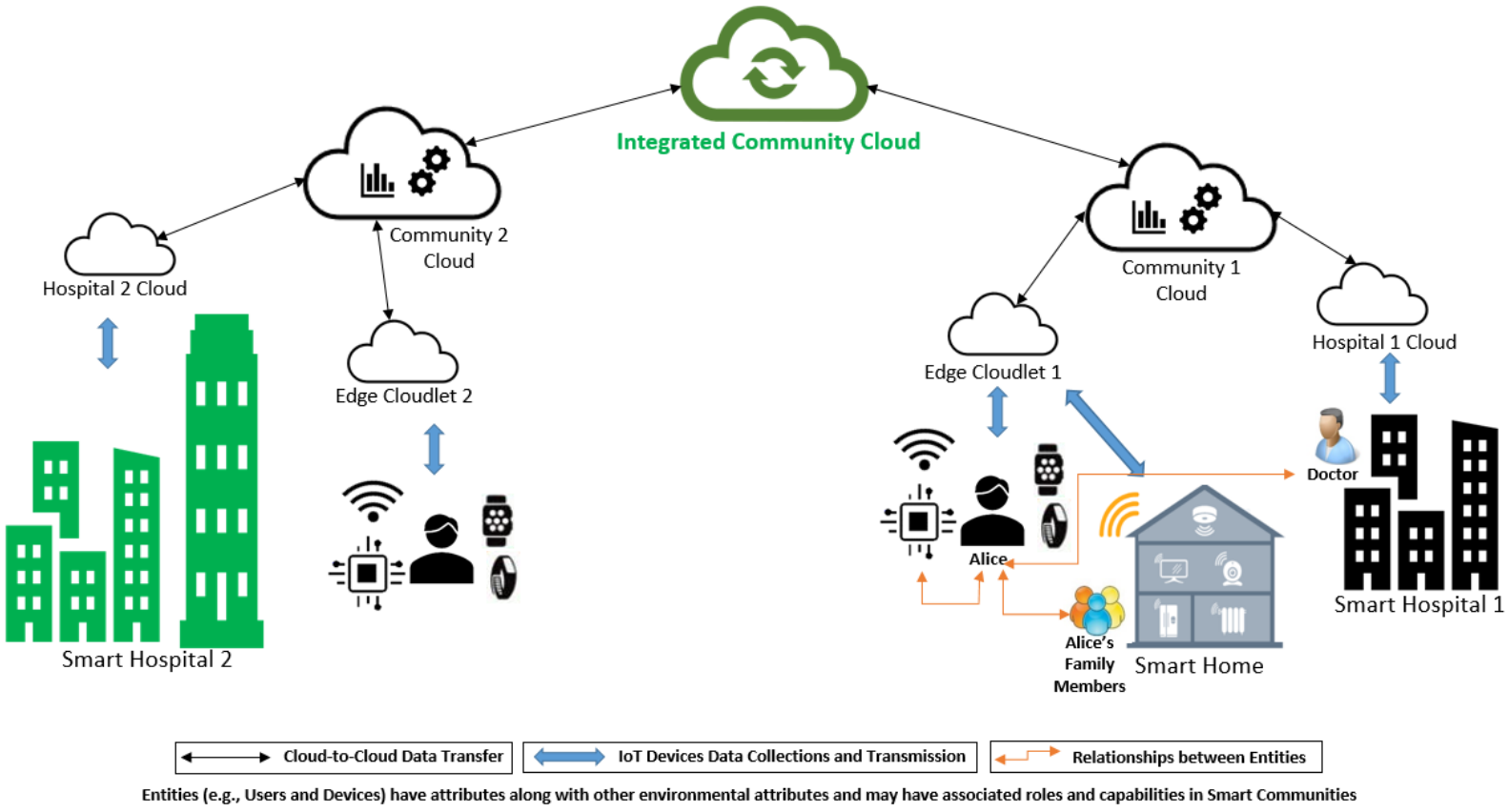
Smart Communities



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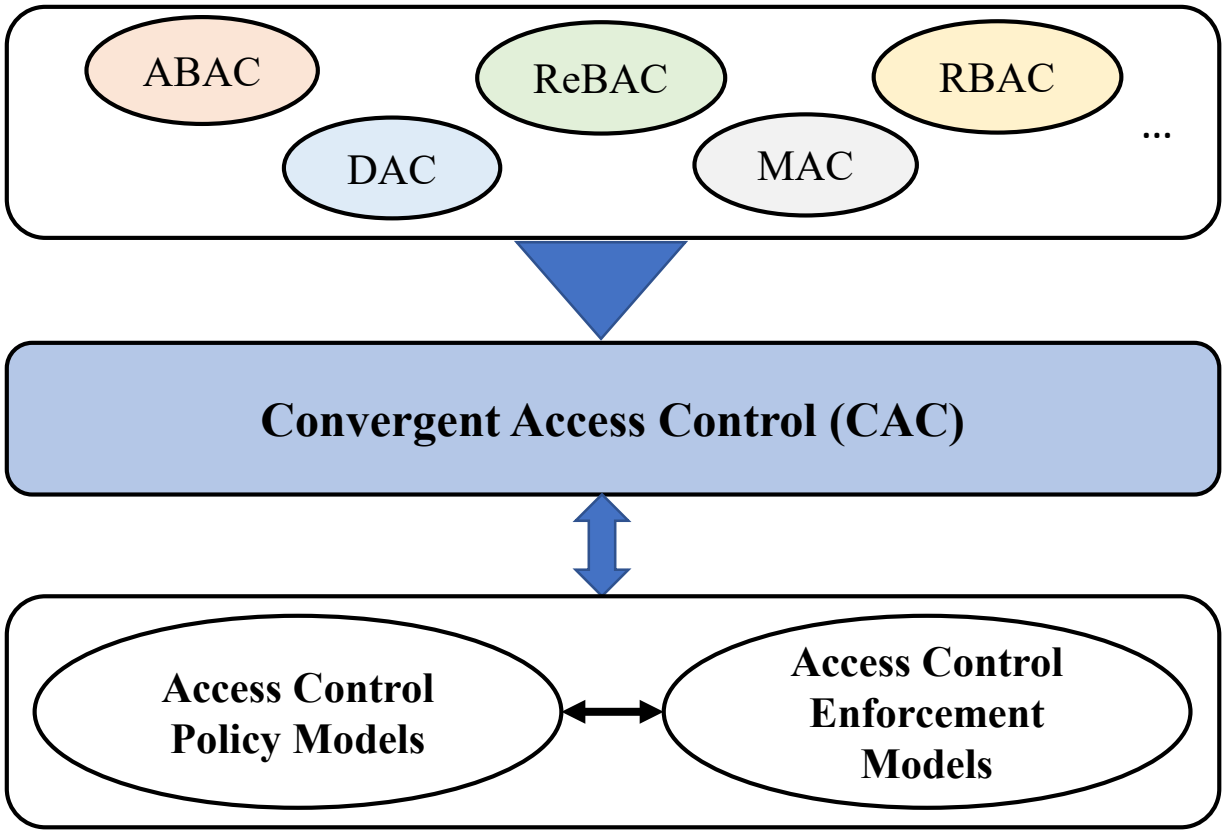

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