# Attribute-Based Access Control Models and Beyond

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v2.0

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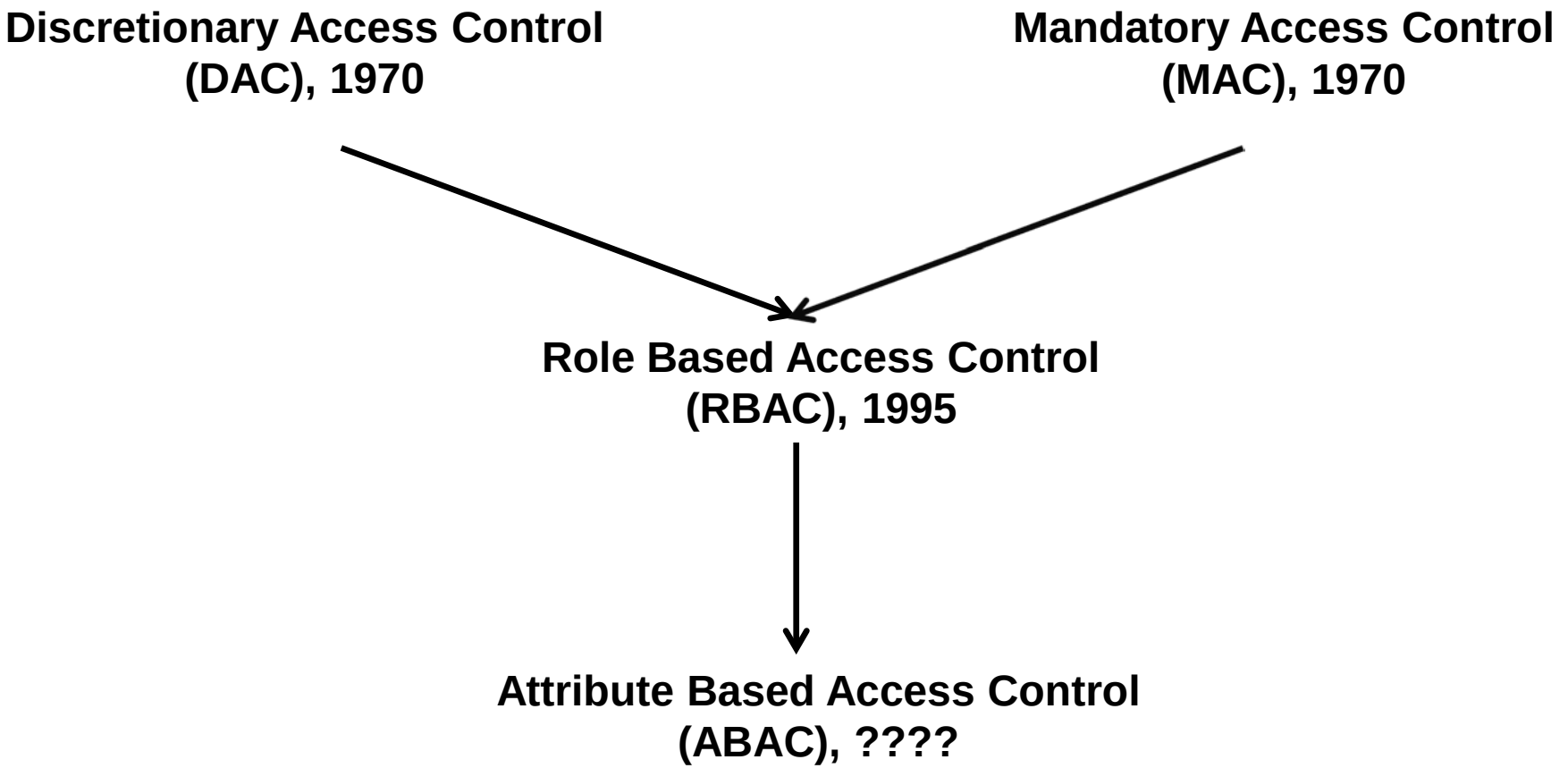
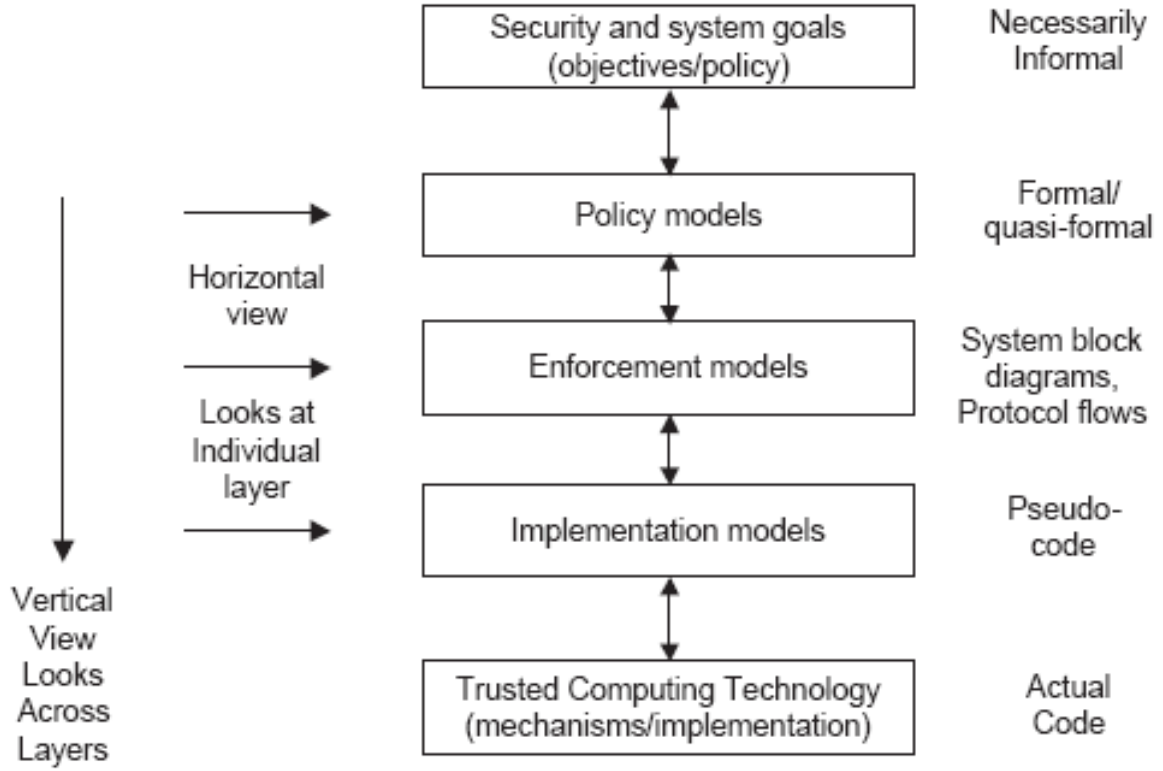
# Access Control





# PEI Models




Idealized

Enforceable (Approximate)

Codeable

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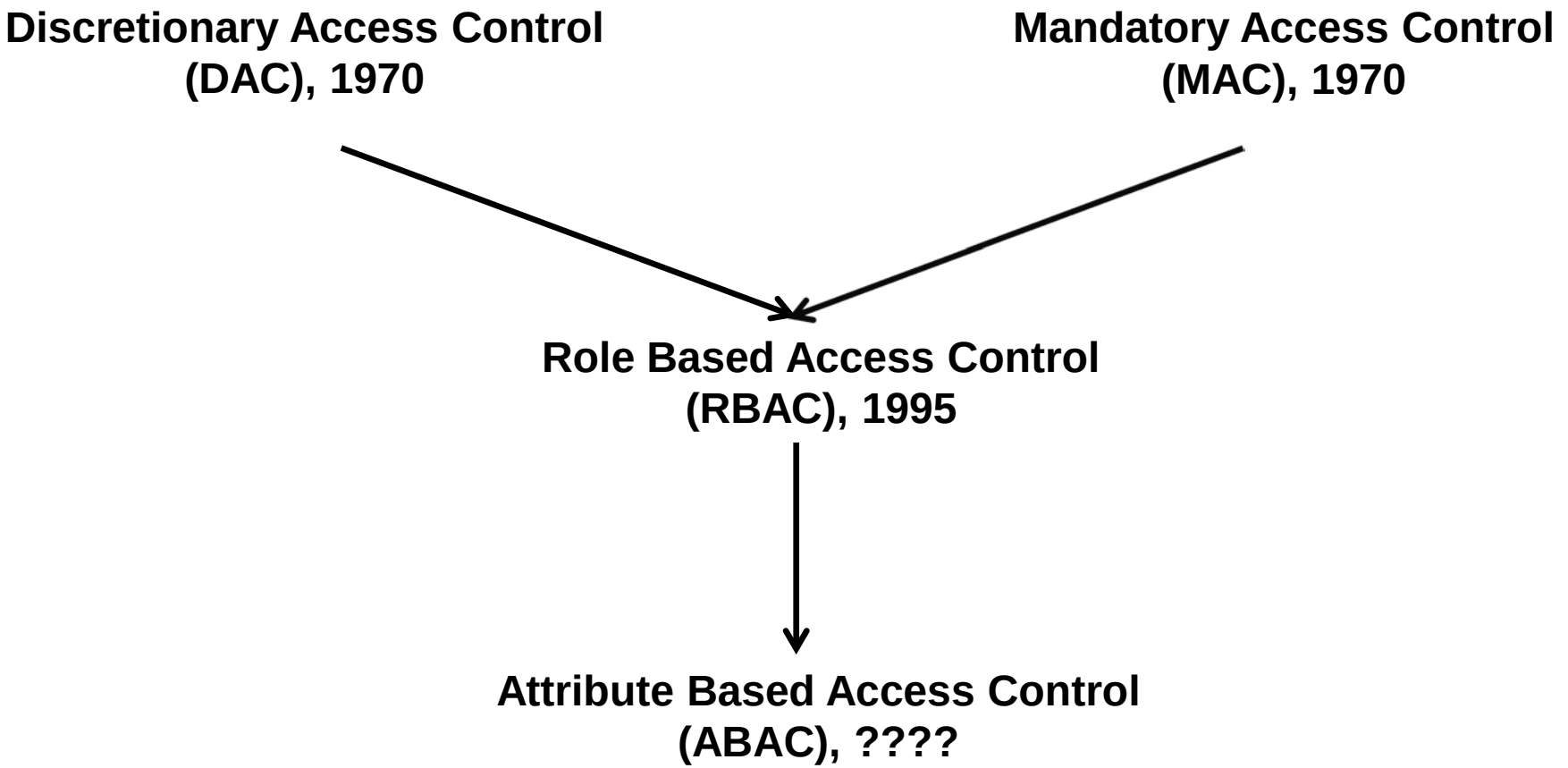

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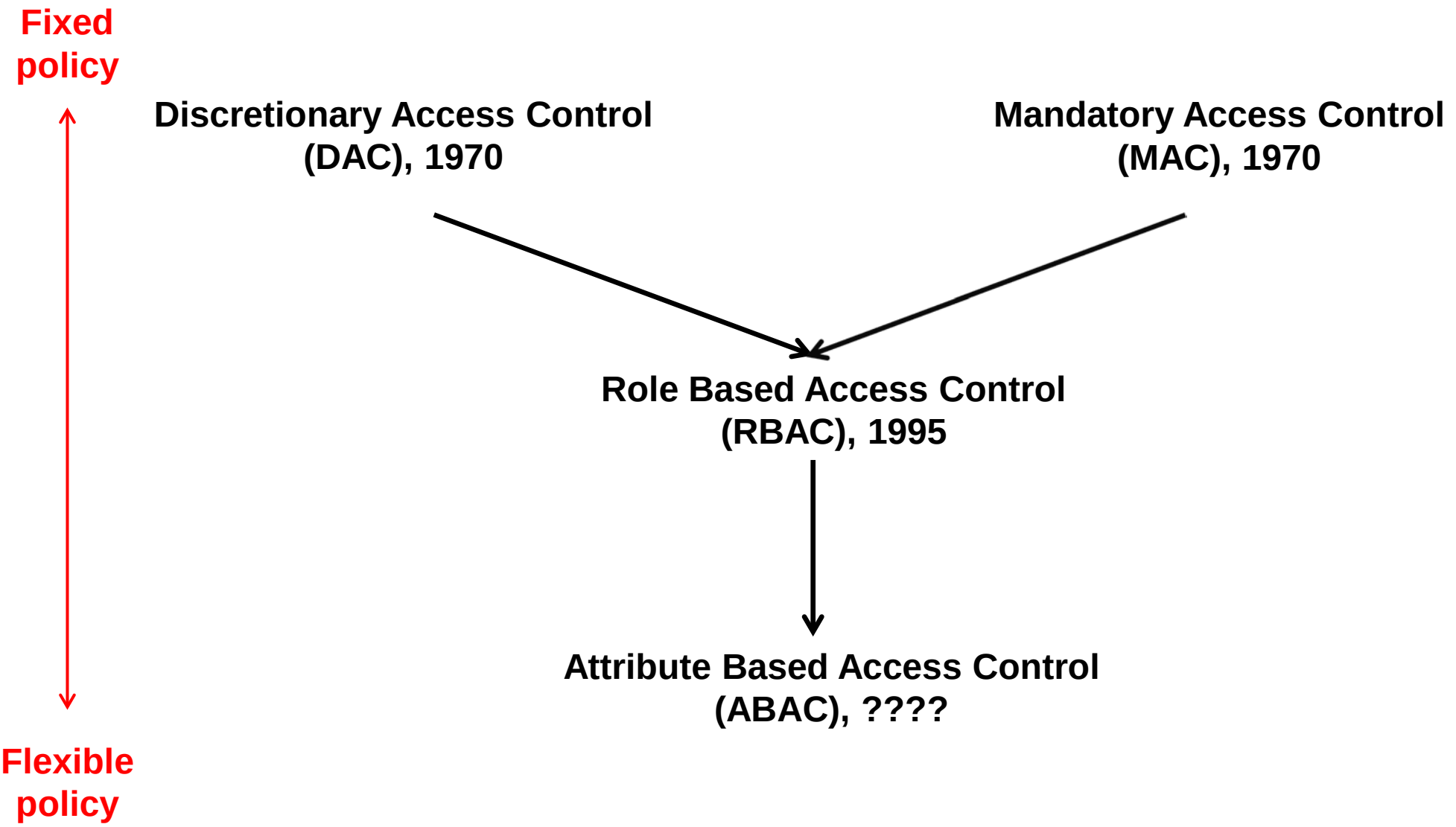

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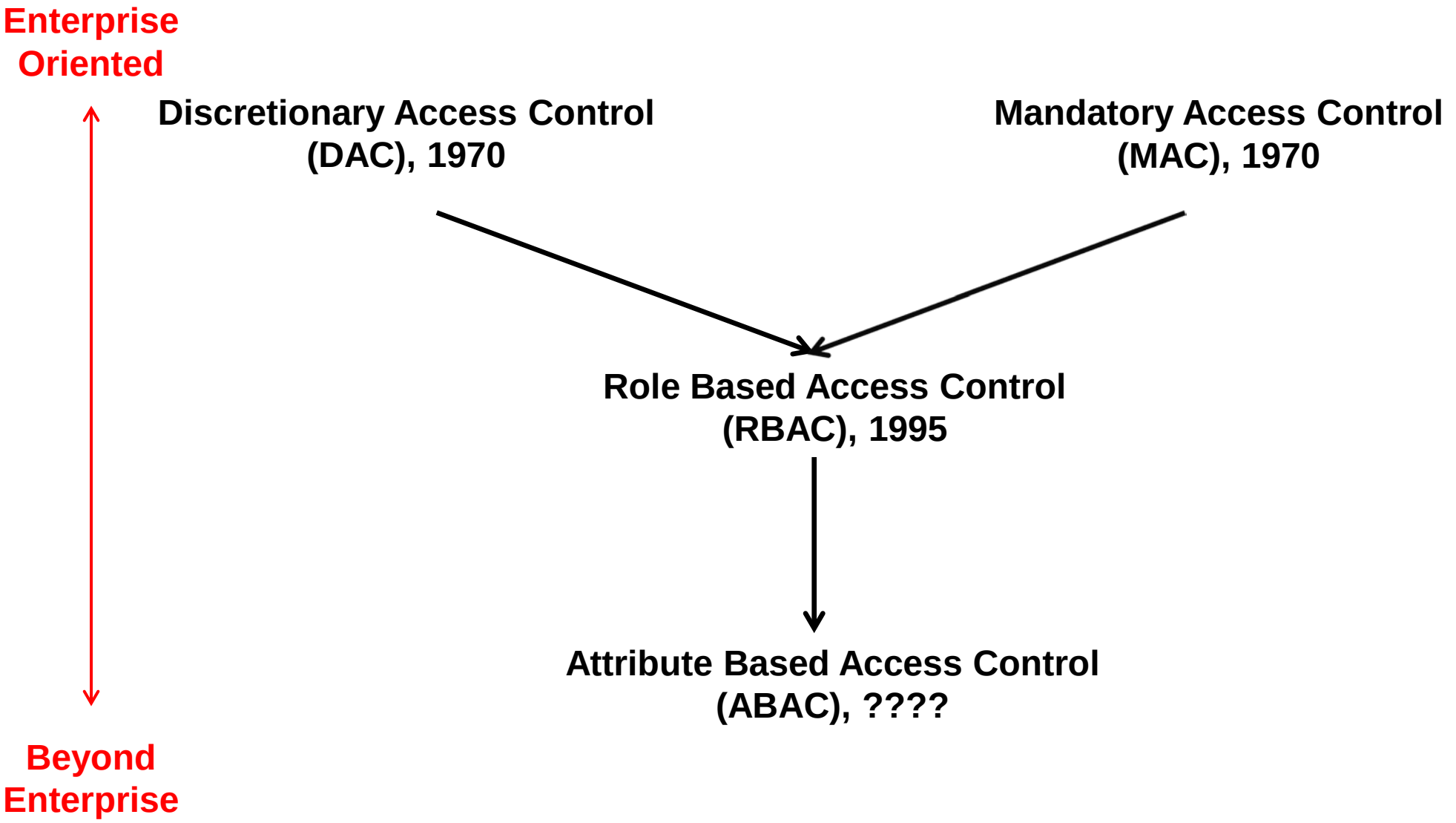

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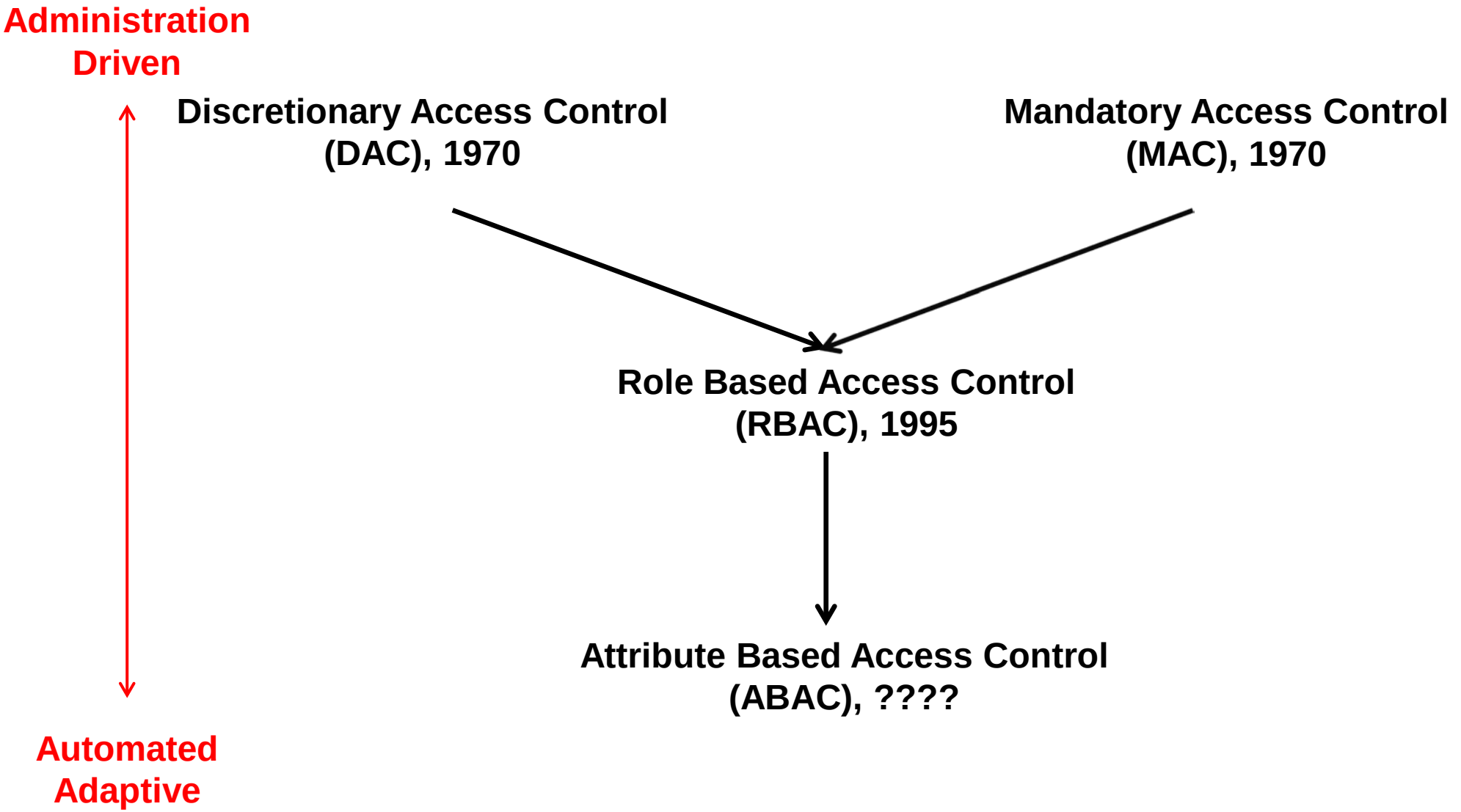
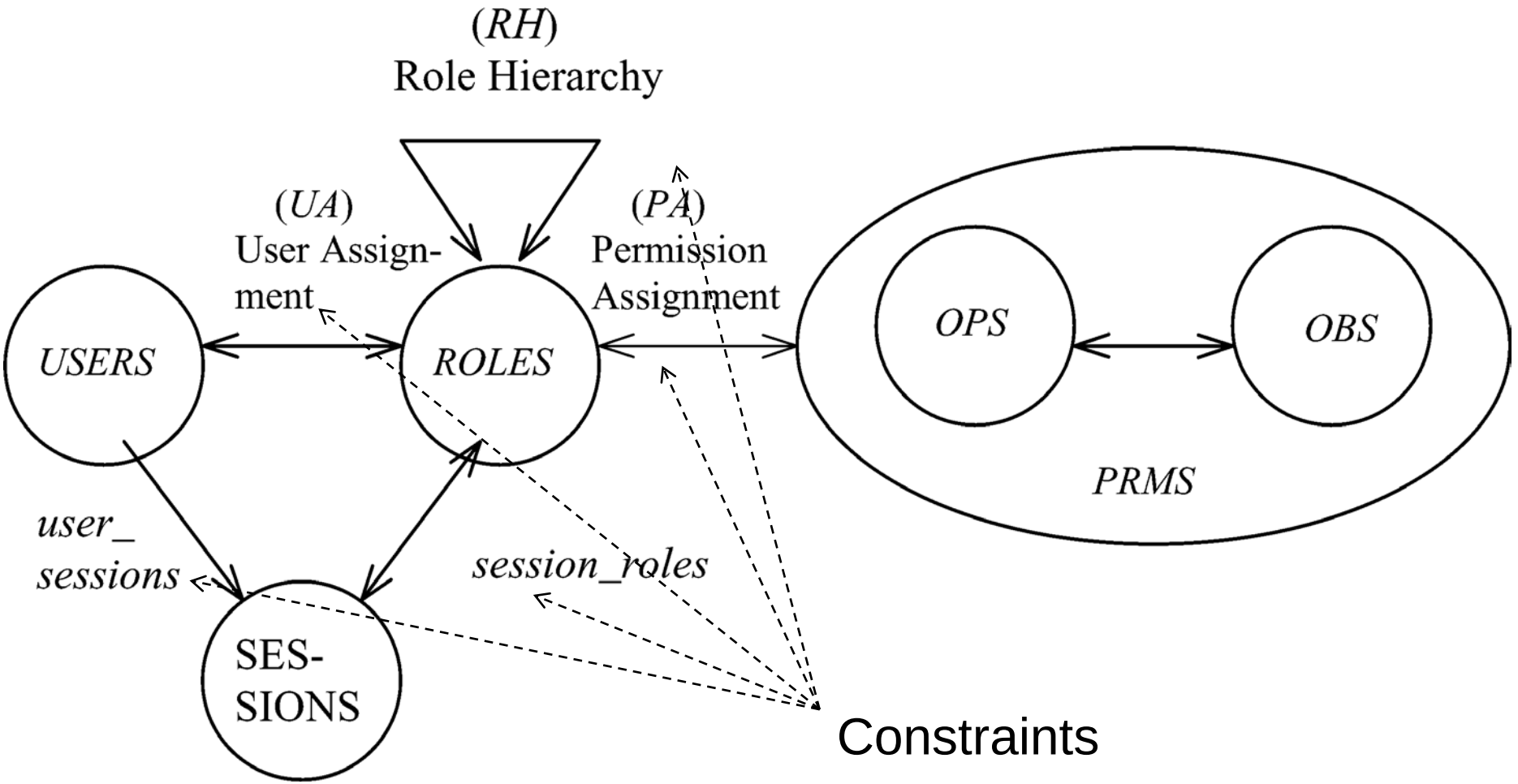


# RBAC96 Model





# Fundamental Theorem of RBAC



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

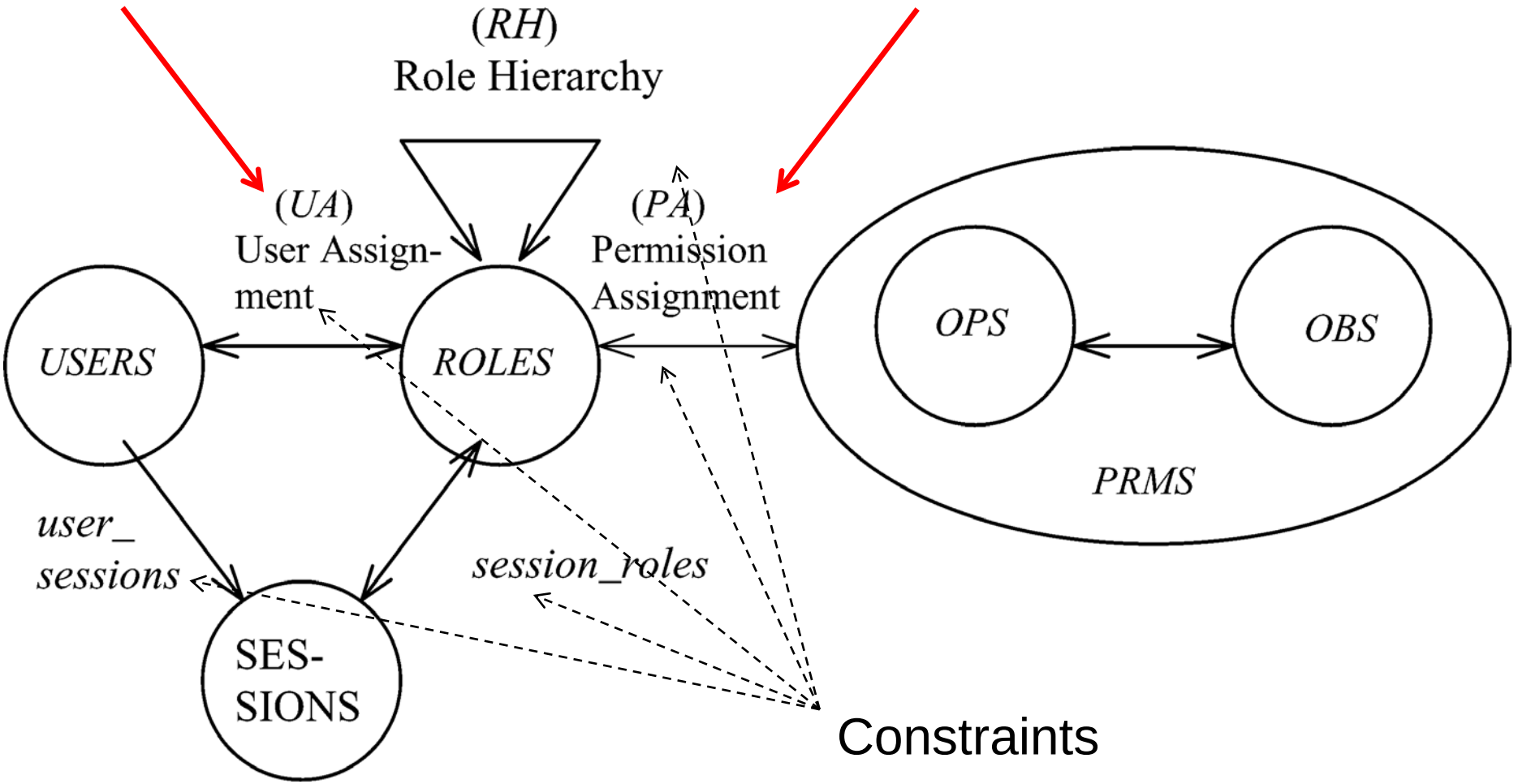
RBAC is neither MAC nor DAC!

# RBAC Shortcomings

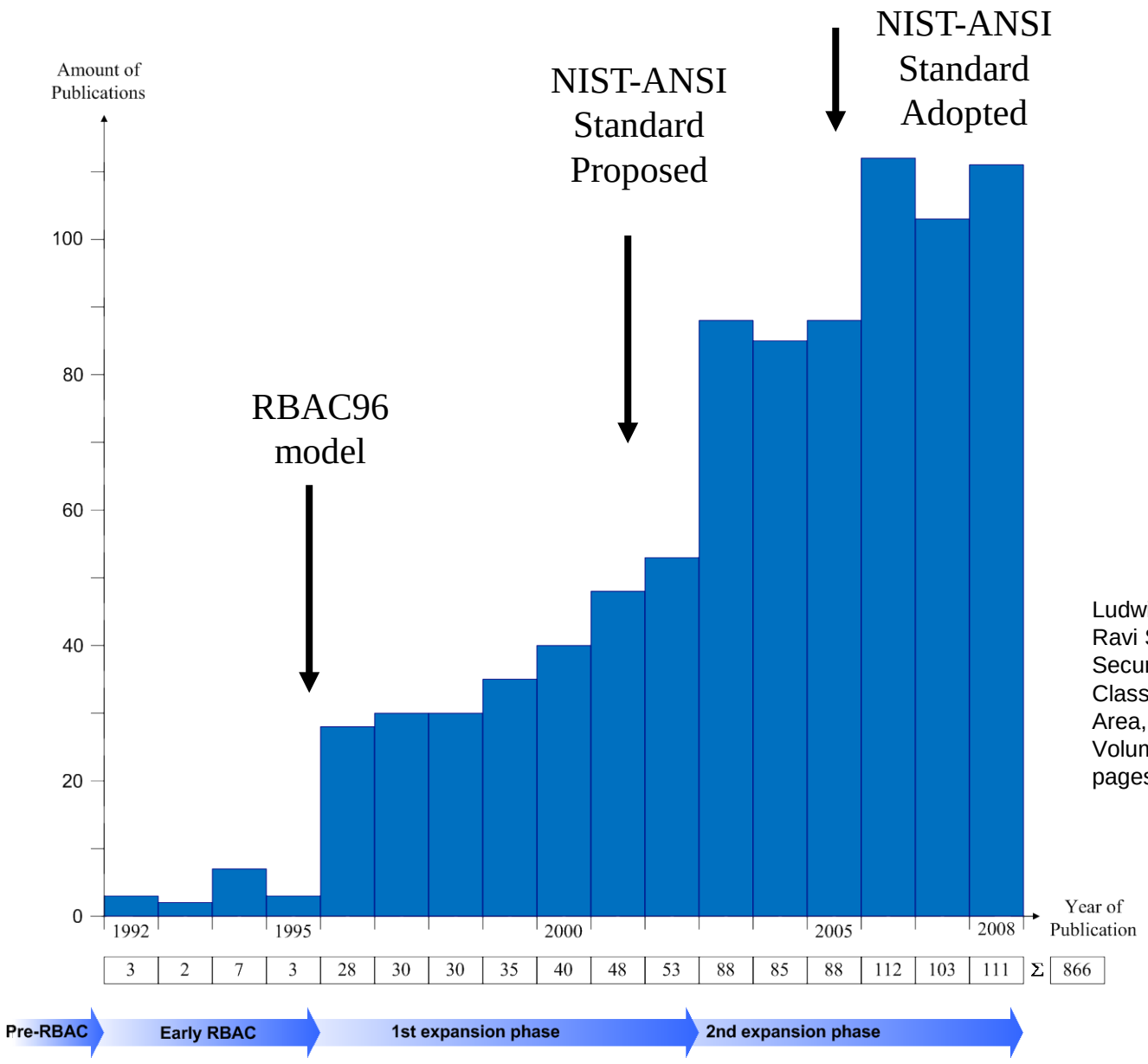


**Hard Enough**

**Impossible**

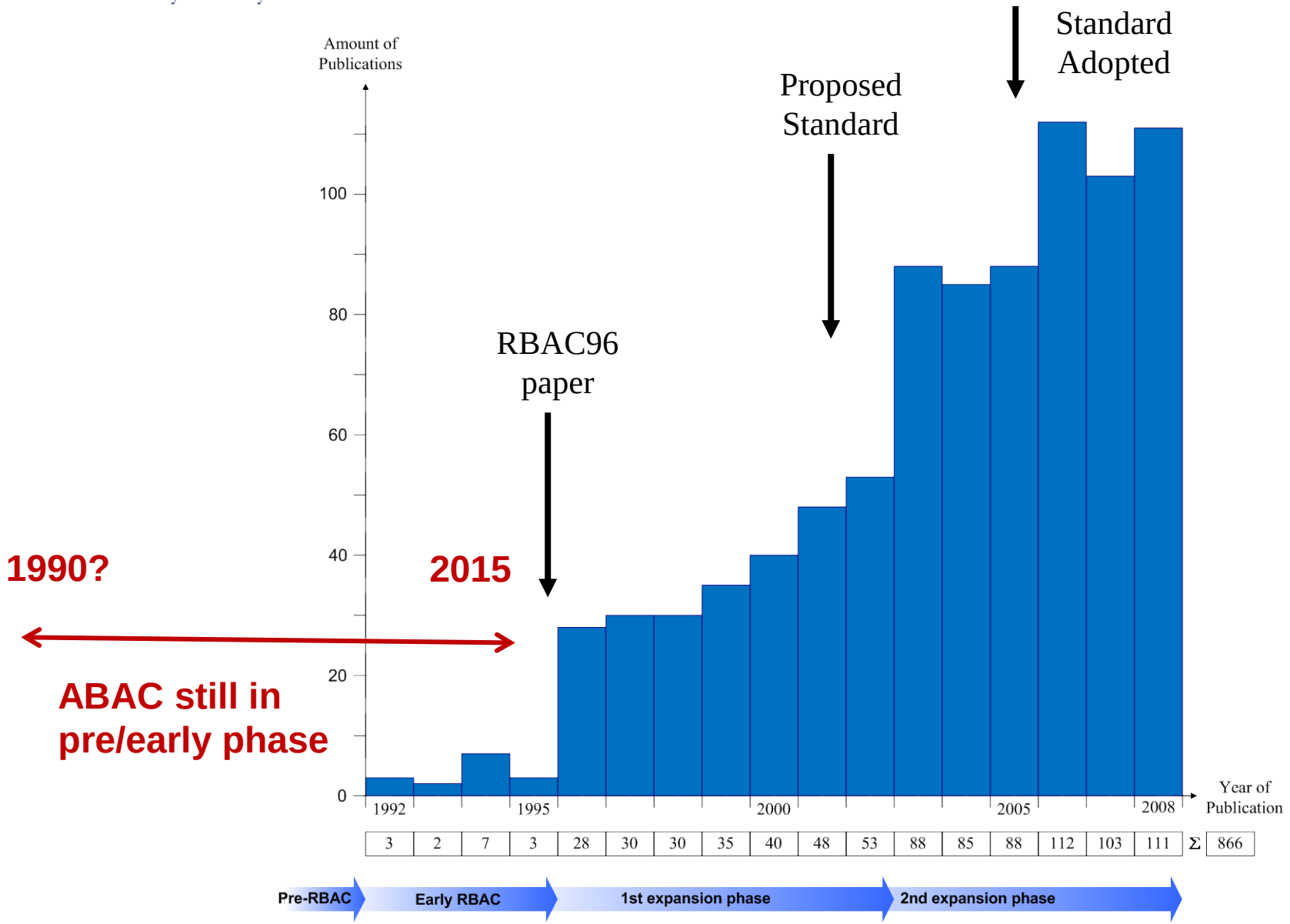


# The RBAC Story



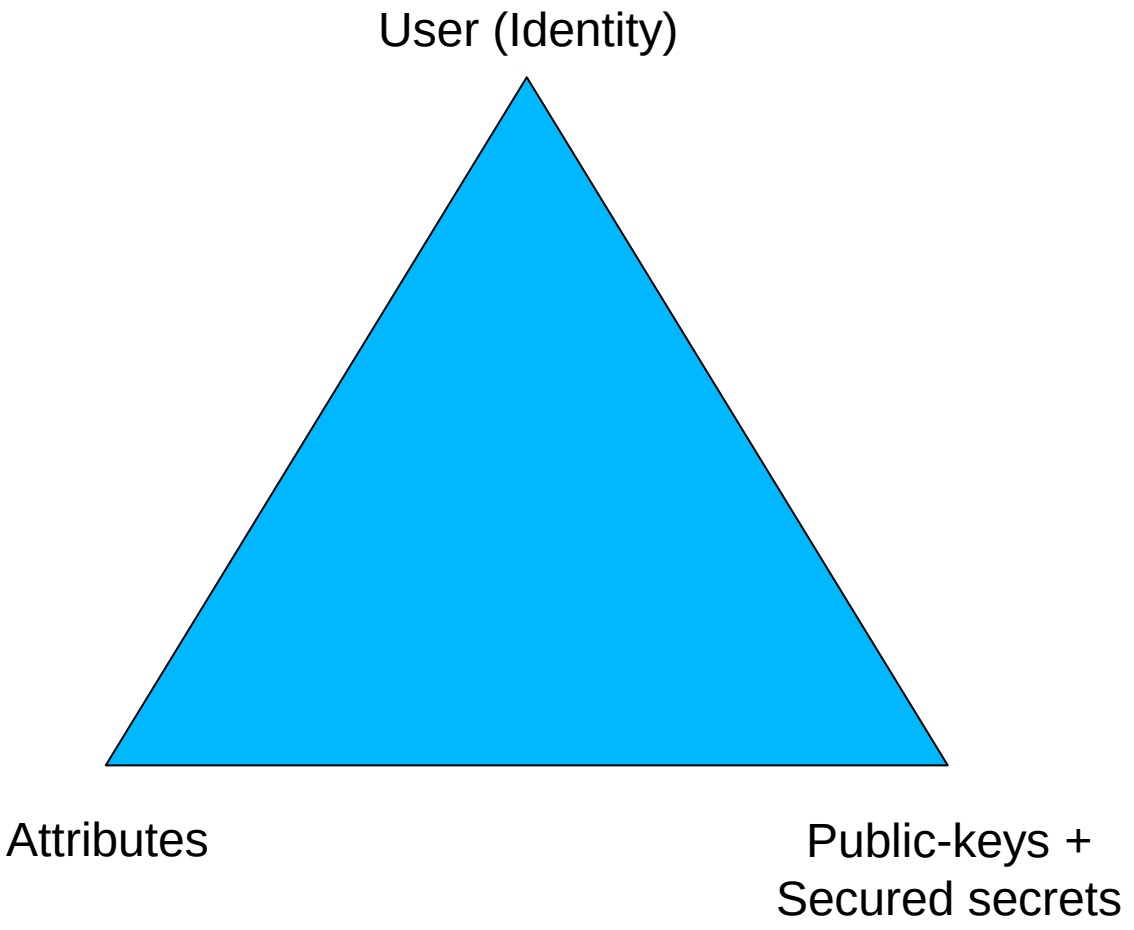

Ludwig Fuchs, Gunther Pernul and Ravi Sandhu, Roles in Information Security-A Survey and Classification of the Research Area, Computers & Security, Volume 30, Number 8, Nov. 2011, pages 748-76

# ABAC Status


Amount of Publications
Standard Adopted
Proposed Standard
RBAC96 paper
1990?
2015
ABAC still in pre/early phase
100
80
60
40
20
0
1992
1995
2000
2005
2008
Year of Publication
3 2 7 3 28 30 30 35 40 48 53 88 85 88 112 103 111 Σ 866
Pre-RBAC
Early RBAC
1st expansion phase
2nd expansion phase

# ABAC is not New



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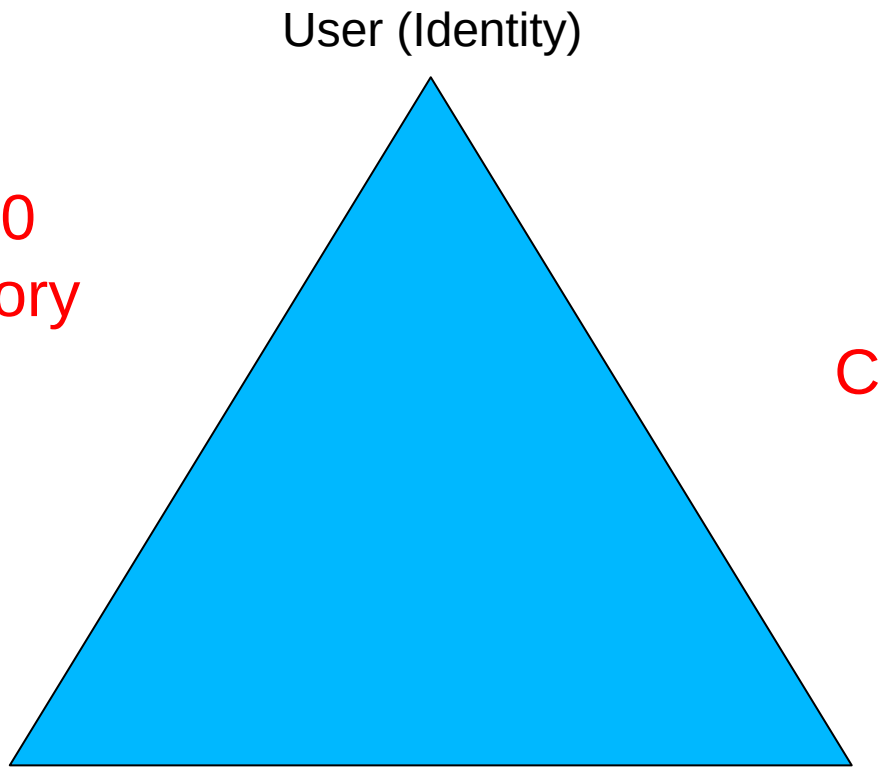


Pre Internet, early 1990s

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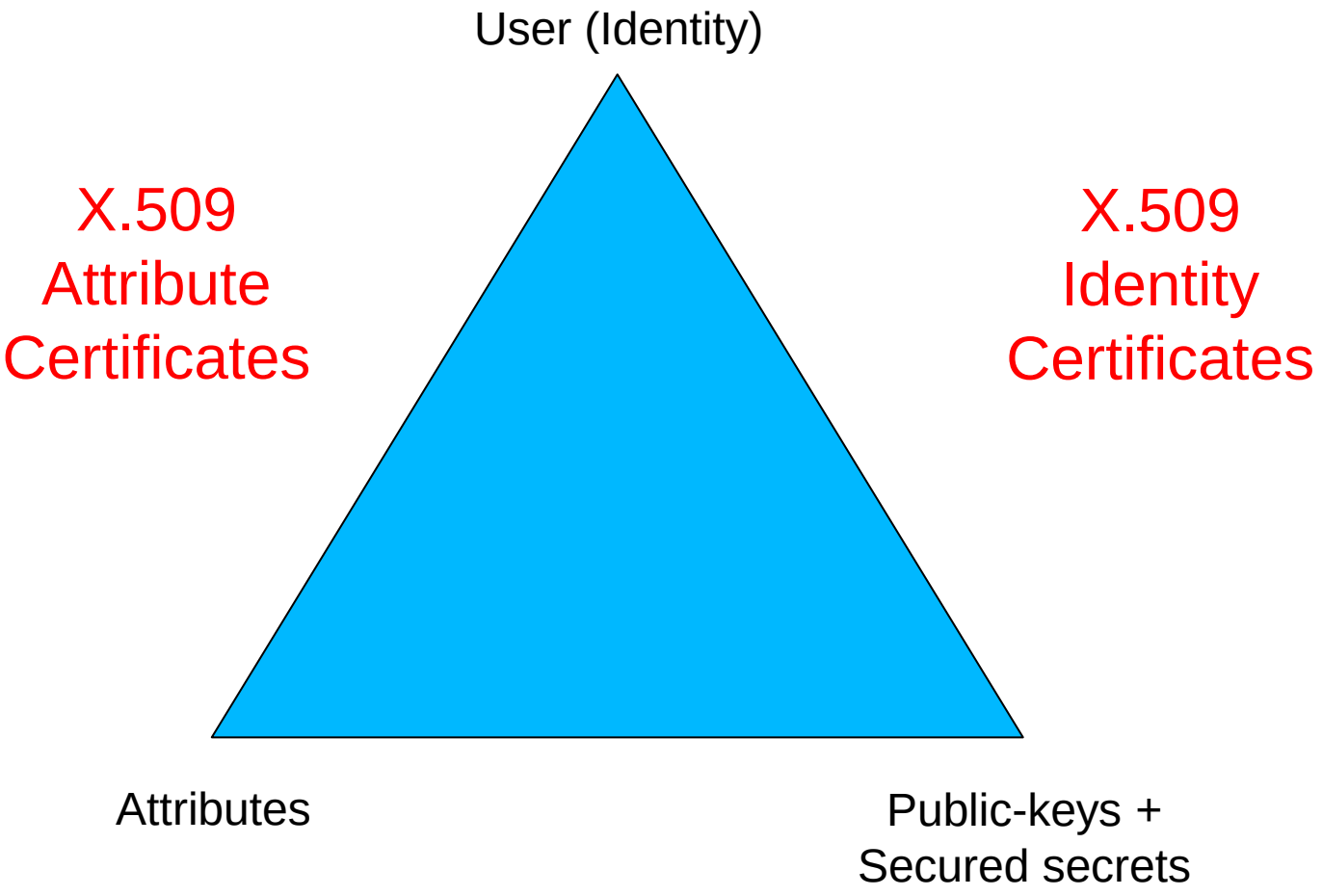


Post Internet, late 1990s

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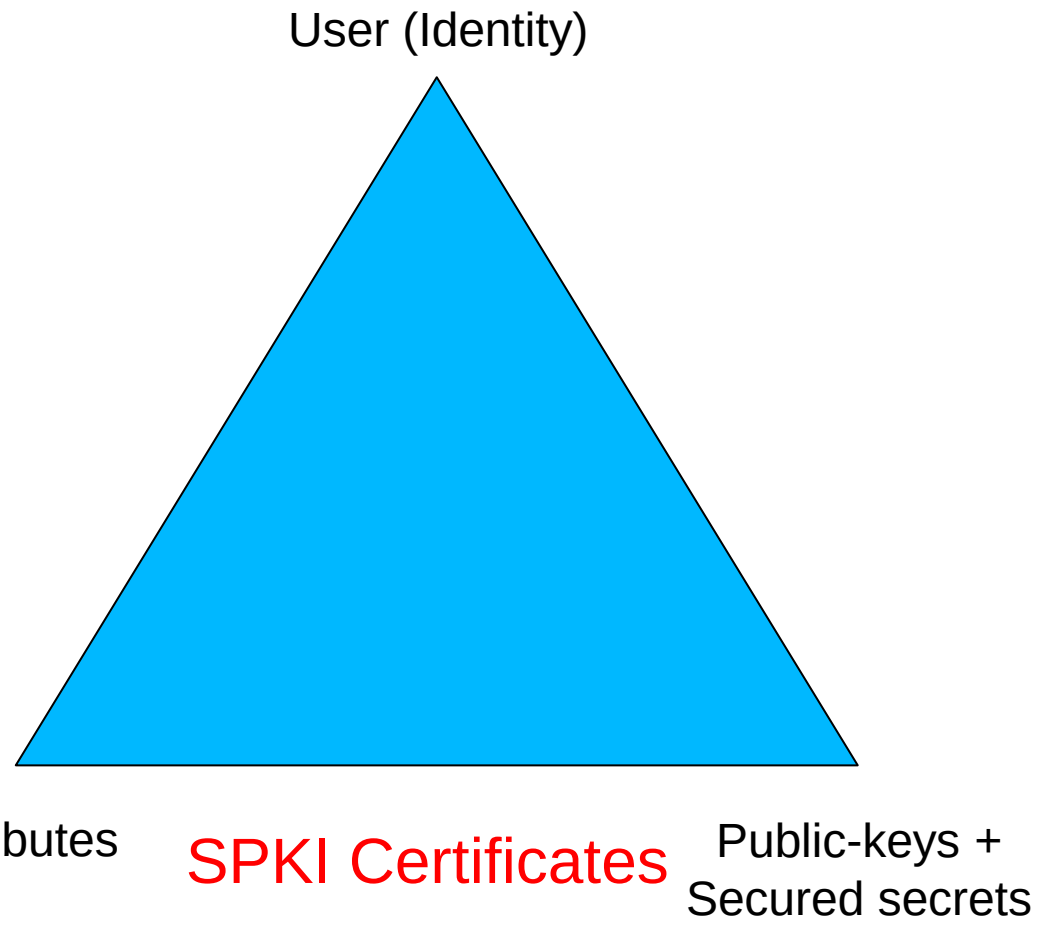


Post Internet, late 1990s

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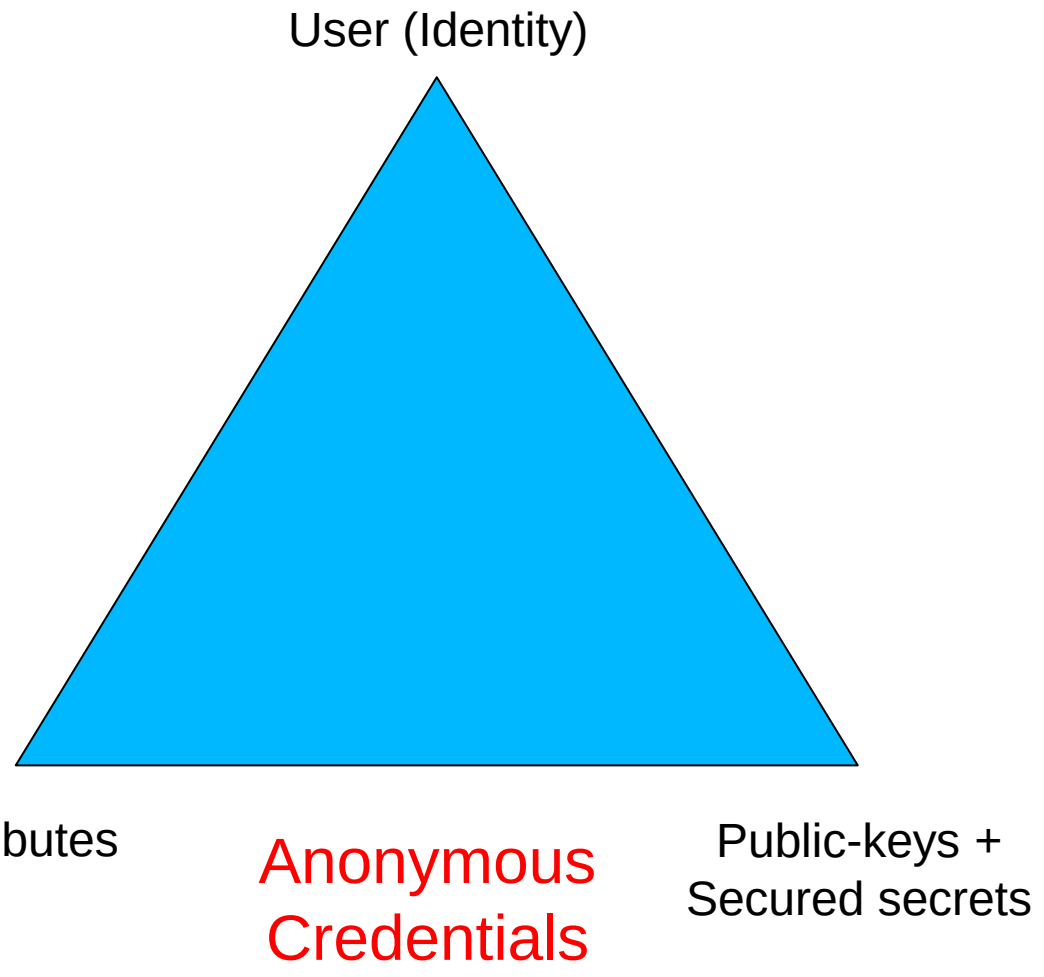
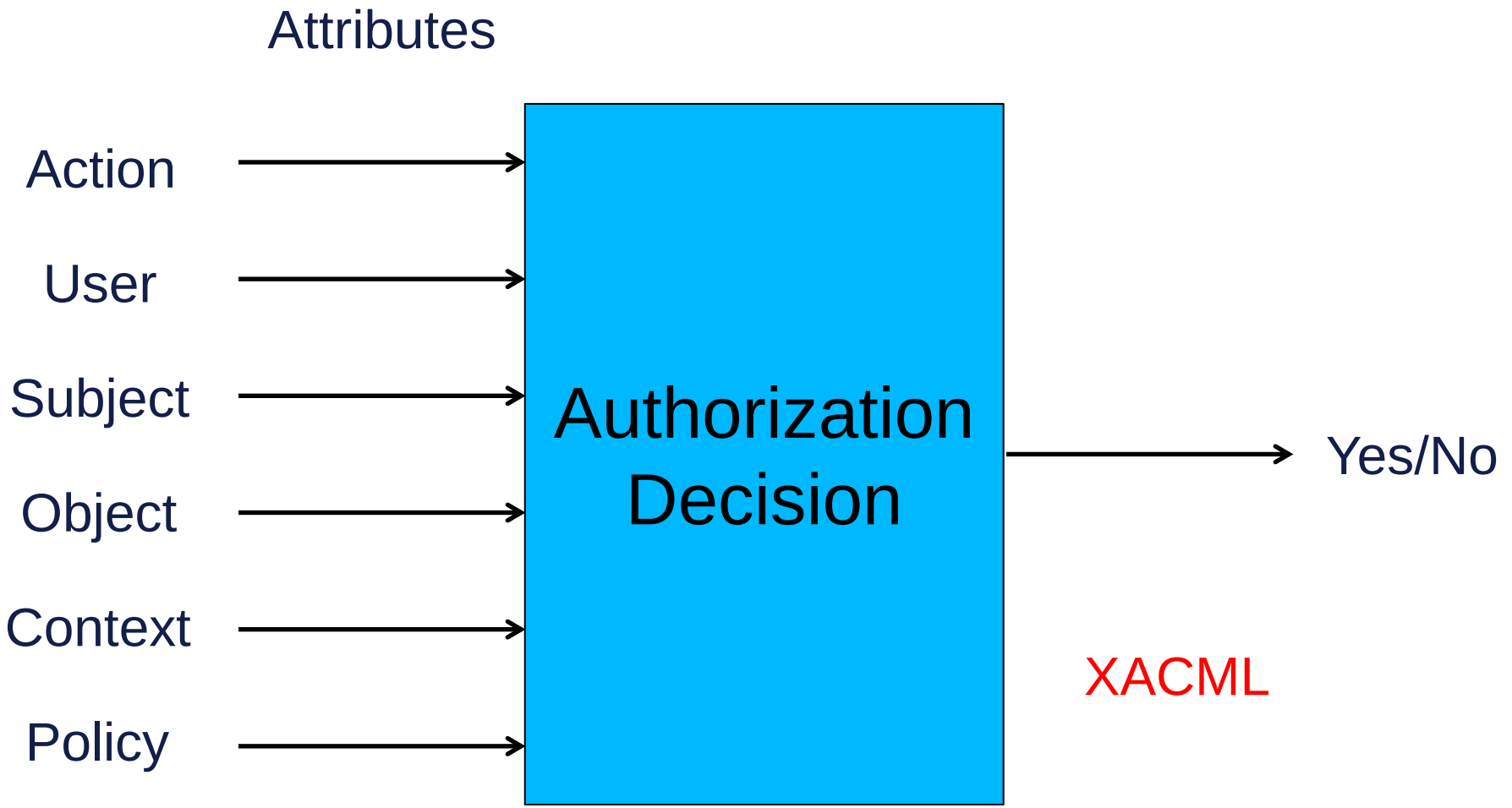



Mature Internet, 2000s

# ABAC is not New






Mature Internet, 2000s

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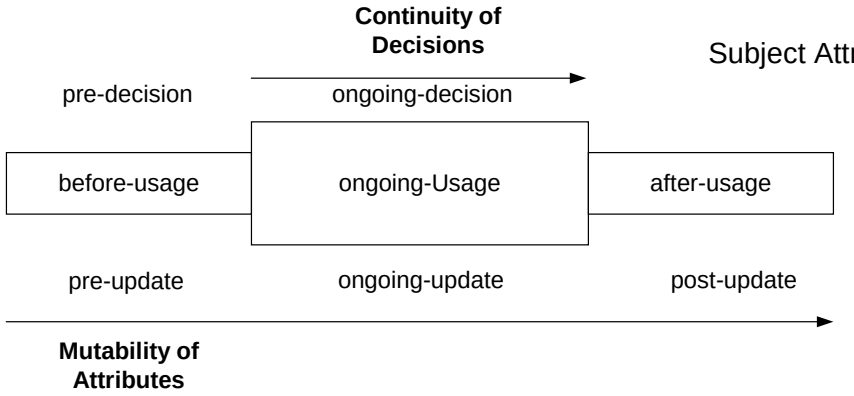
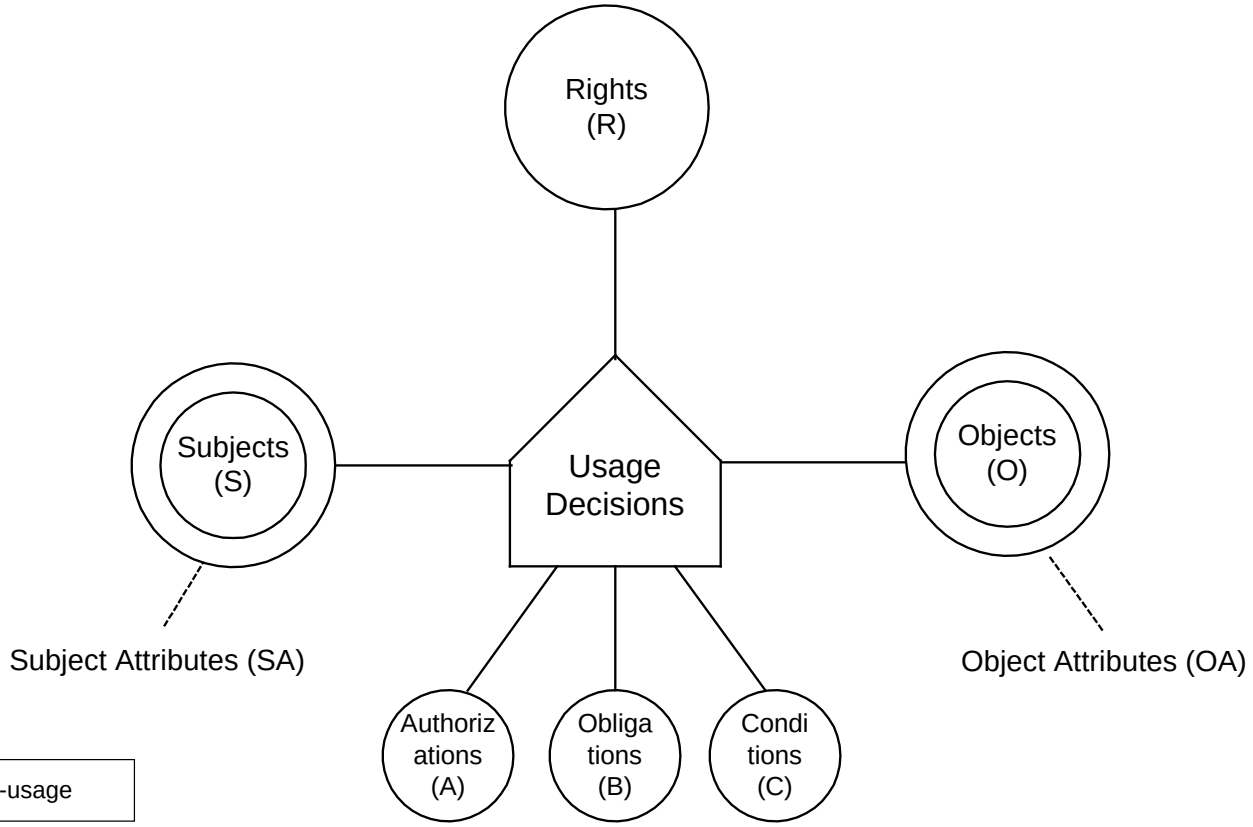
# ABAC is not New



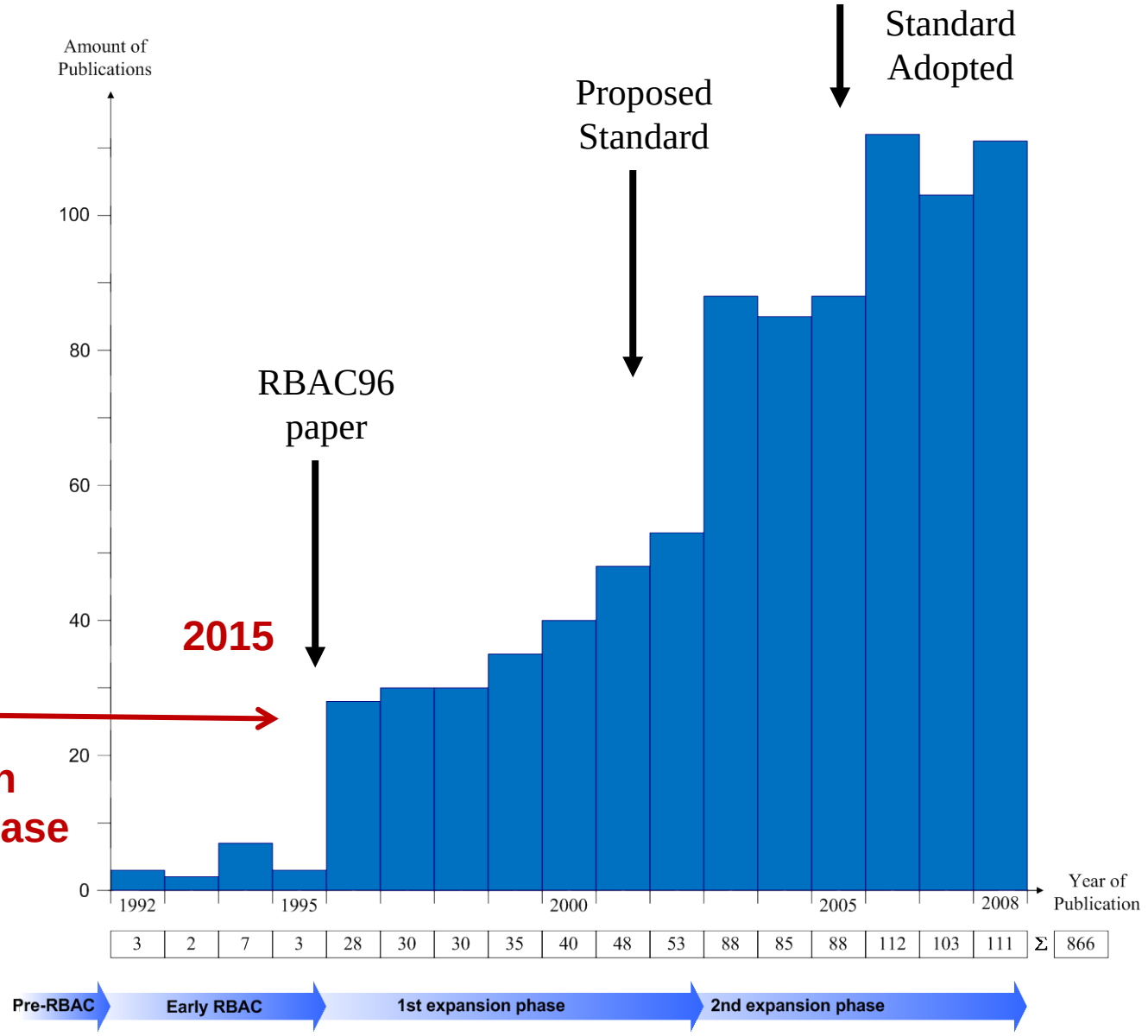
- unified model integrating
  - authorization
  - obligation
  - conditions
- and incorporating
  - continuity of decisions
  - mutability of attributes




Usage Control Models, early 2000s

# ABAC Status



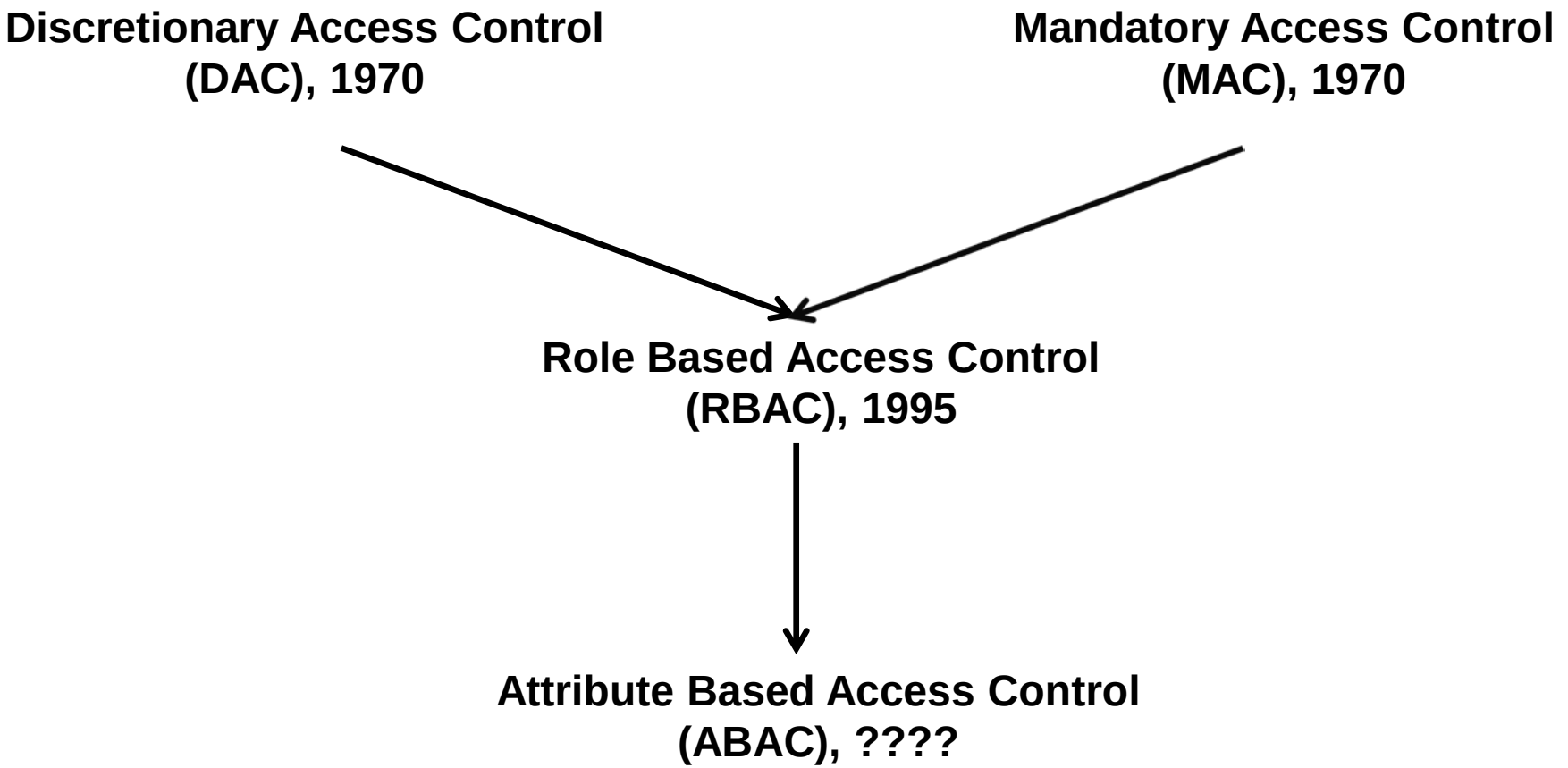

**1990?**

**2015**

**ABAC still in pre/early phase**

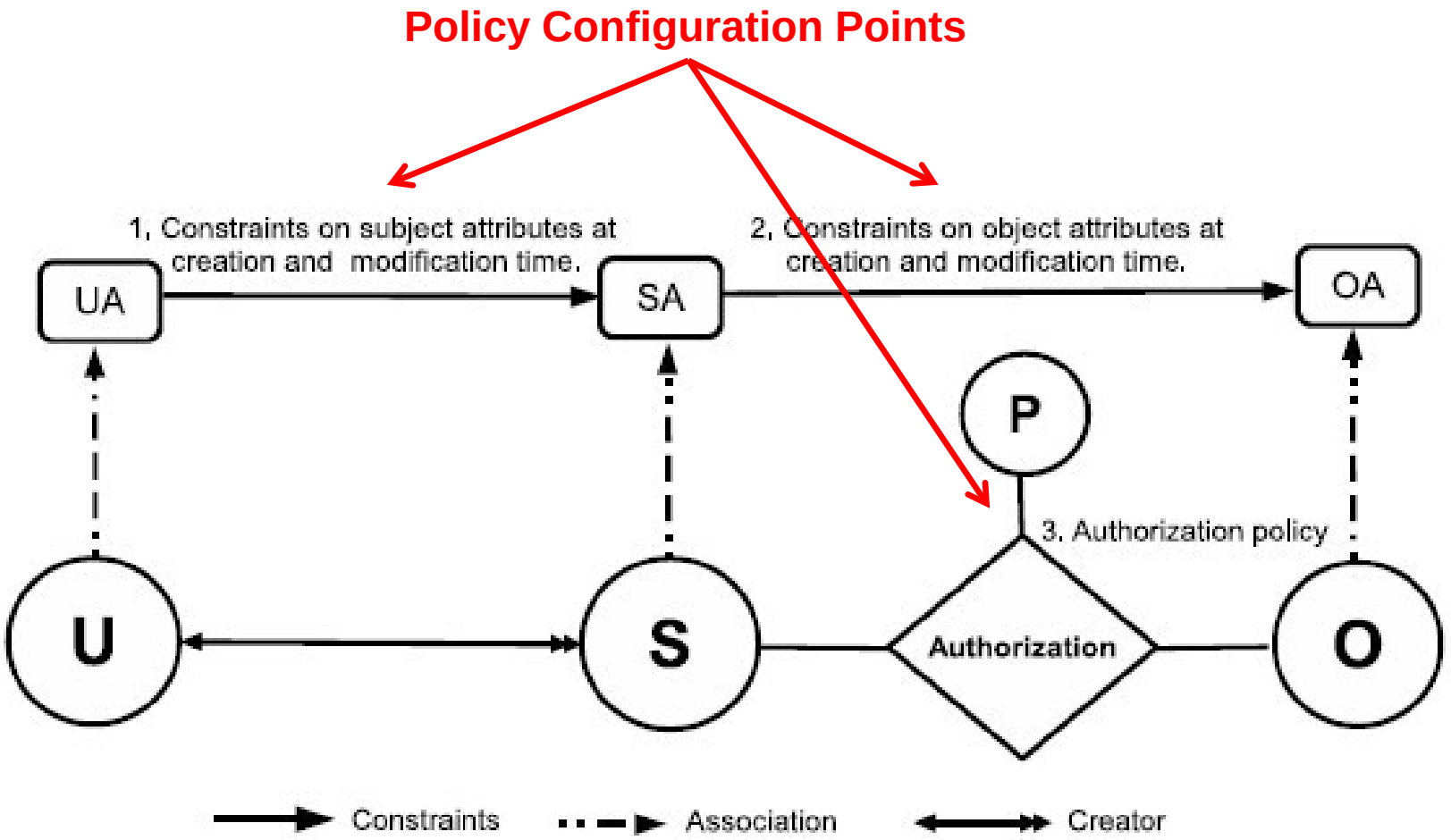
# Access Control





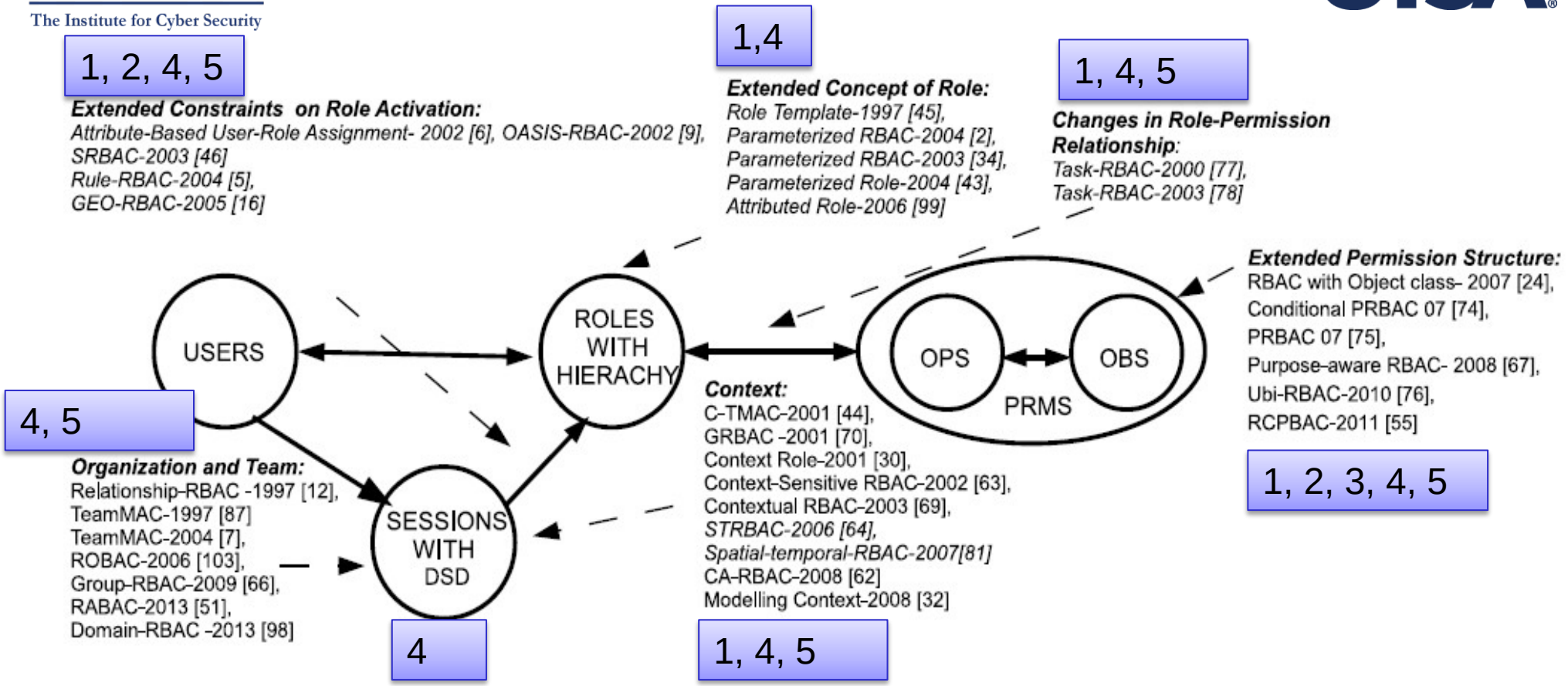
# ABACα Model Structure





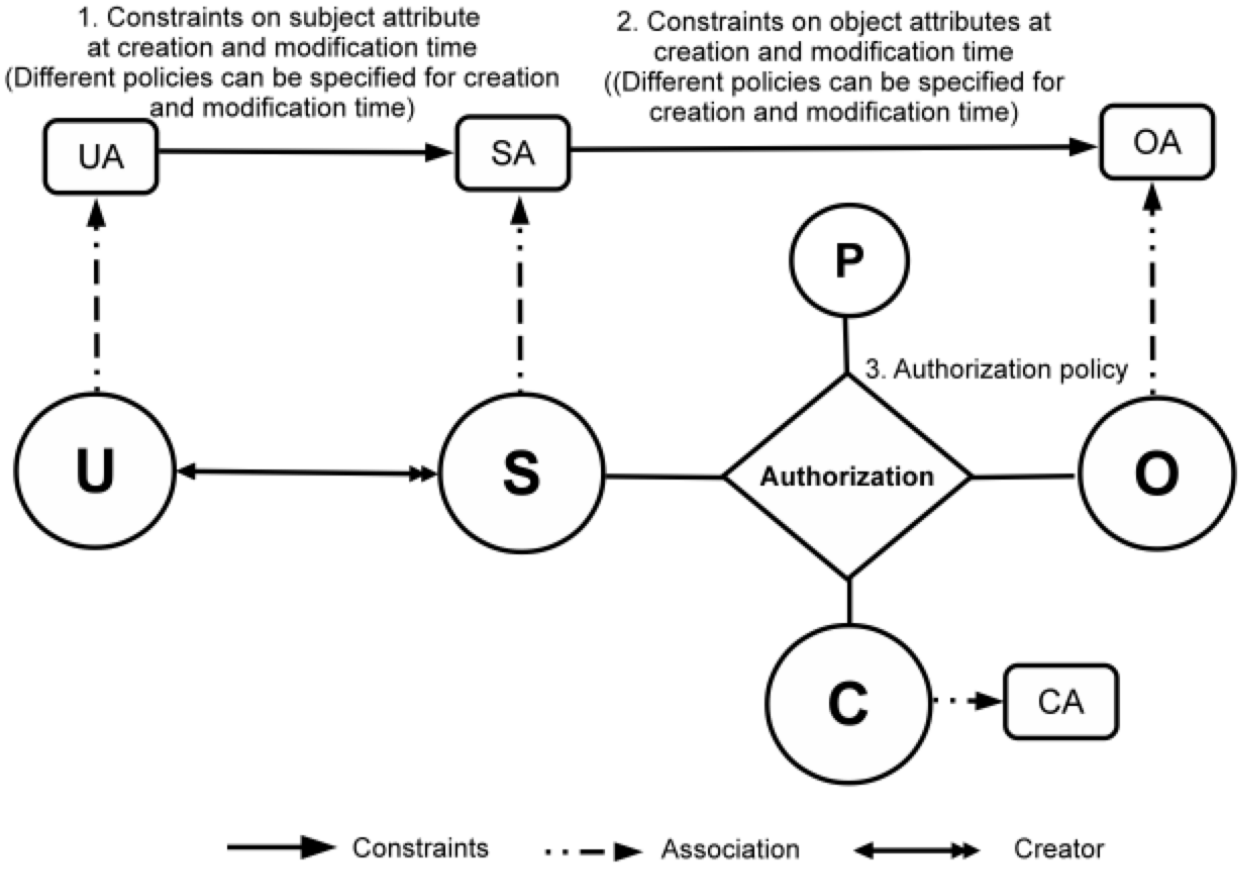

**Can be configured to do simple forms of DAC, MAC, RBAC**

# RBAC Extensions




1. Context Attributes
2. Subject attribute constraints policy are different at creation and modification time.
3. Subject attributes constrained by attributes of subjects created by the same user.
4. Policy Language
5. Meta-Attributes

# ABAC$_\beta$ Model

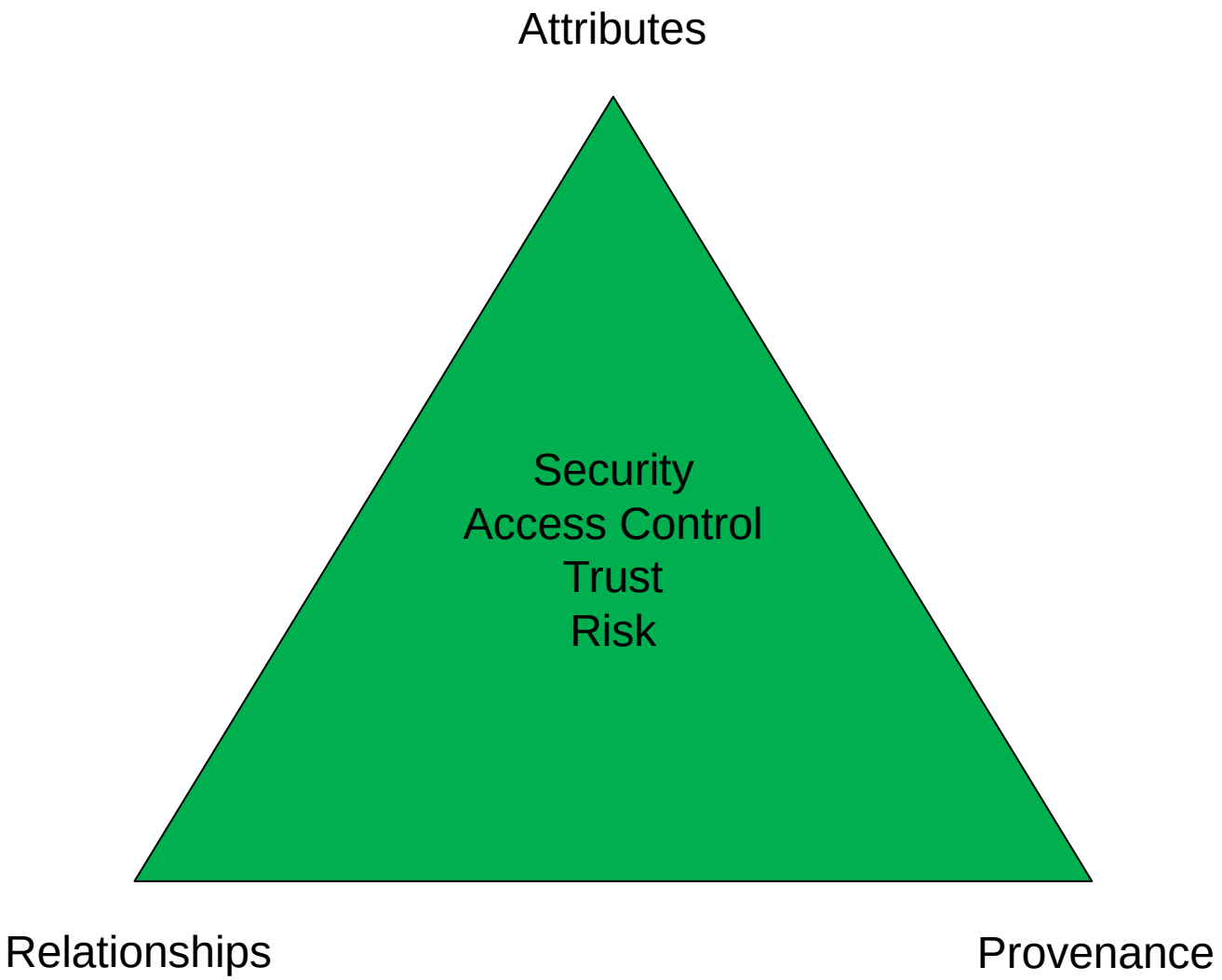



**Can be configured to do many RBAC extensions**

# SOME RESEARCH CHALLENGES

# Ultimate Unified Model



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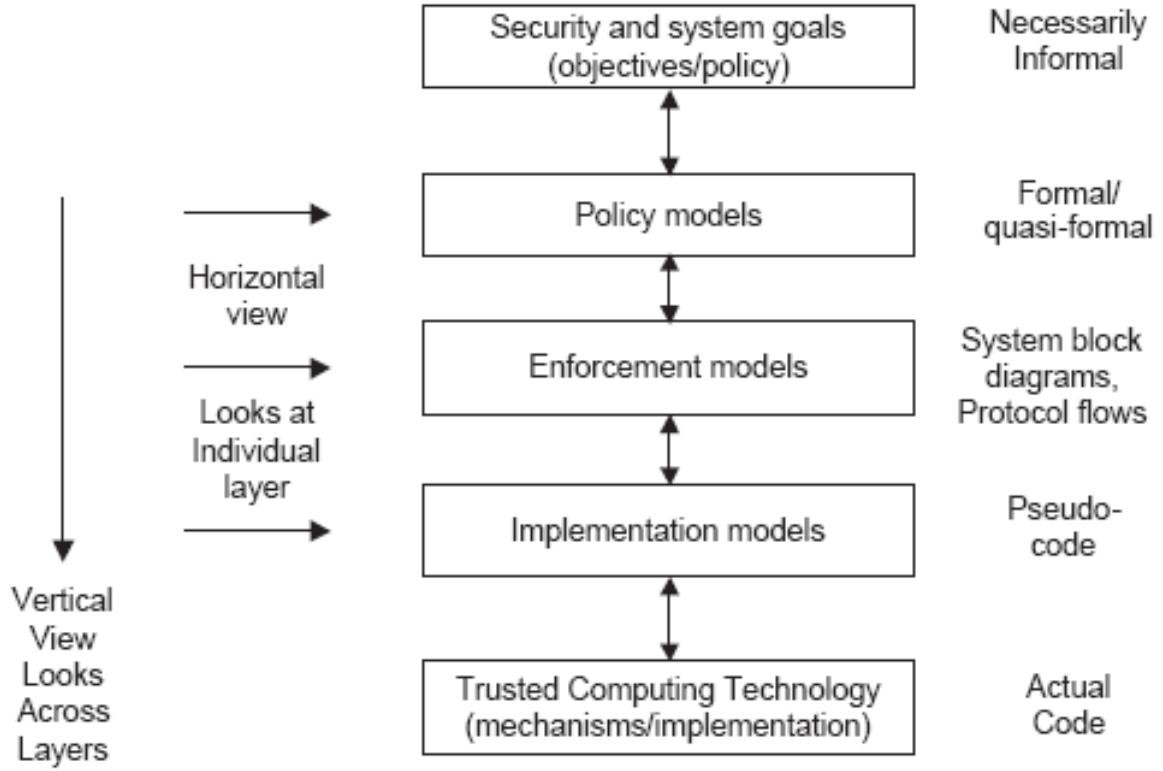
# Expressive Power





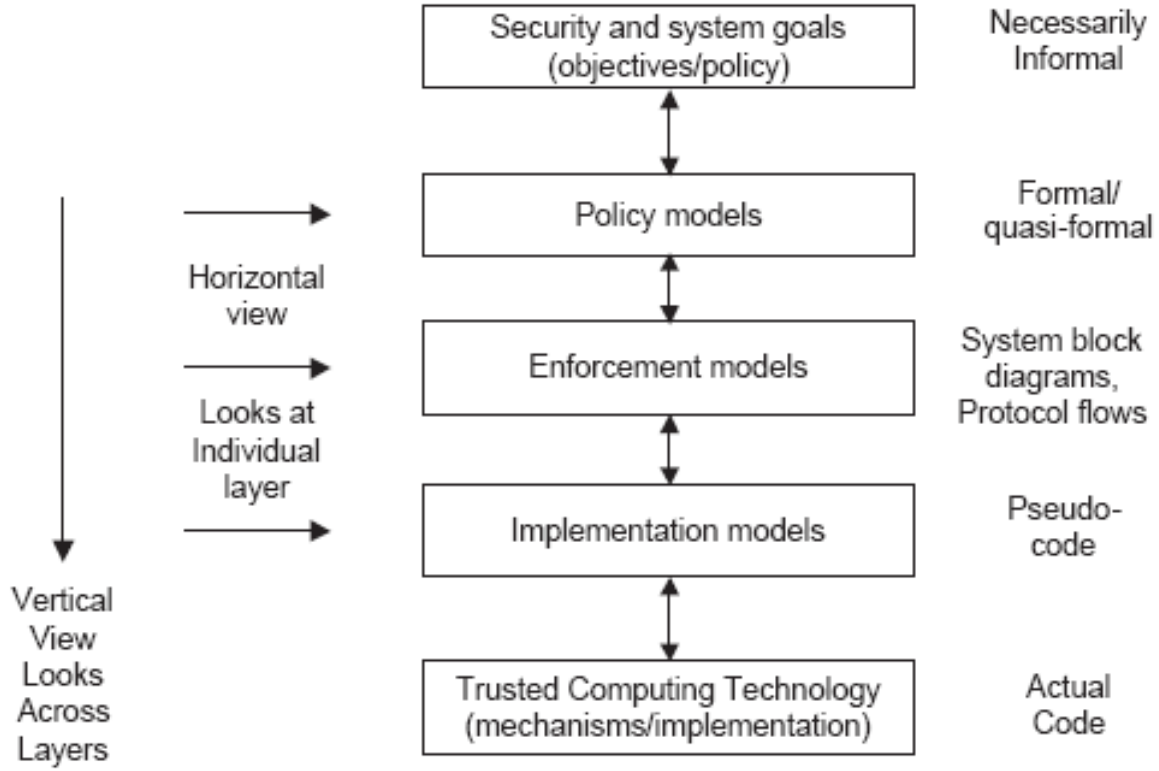

Idealized

Enforceable (Approximate)

Codeable

# Safety Analysis






Idealized

Enforceable (Approximate)

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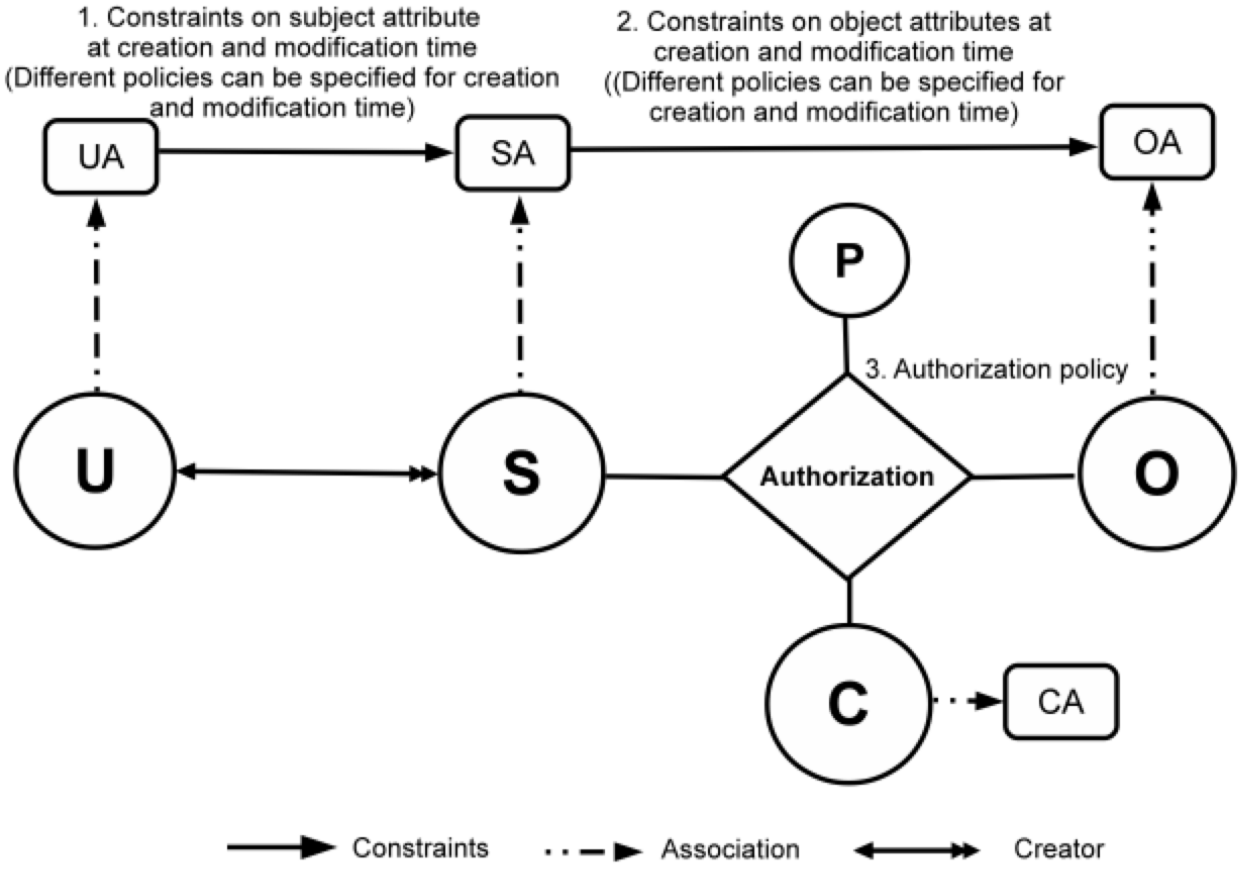
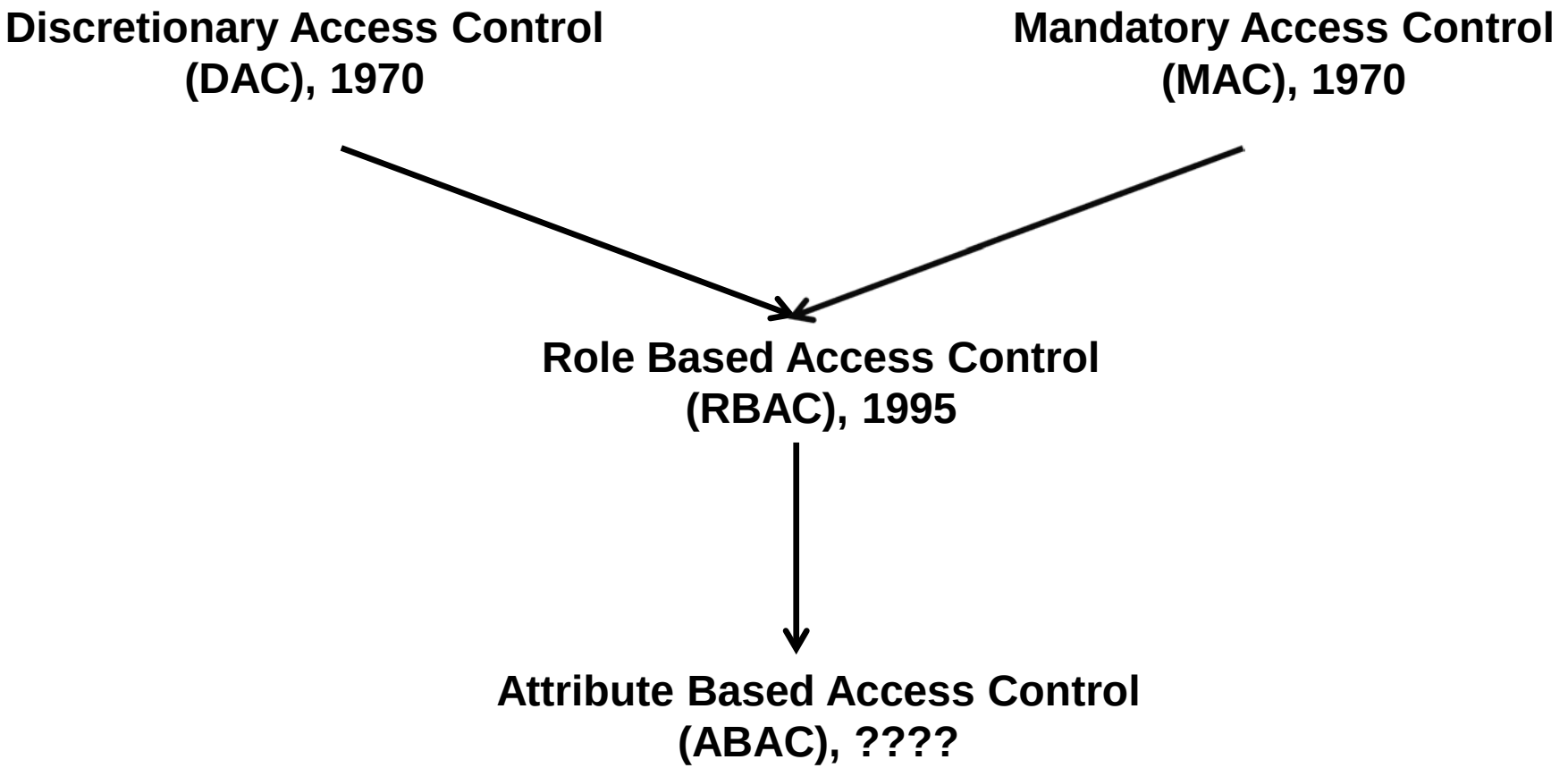
# Attribute and Policy Engineering



# Application Domains



- Cloud computing
- Internet of Things
- …….

# Access Control