Access Control in the Era of Active Artefacts
A Generic Theory of Authorization to Support IS Practice and Research

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ACIS #34 – 8 December 2023

http://rogerclarke.com/ID/PGTAz {.html, .pdf}

Dictionary Definitions

- **Authorization**

  "The action of authorizing a person or thing ..." (OED 1)

- **Authorize**

  "To **give** official **permission** for **or** formal **approval**
  to (an action, undertaking, etc.);
  to **approve**, sanction" (OED 3a)

  "To **give** (a person or agent) legal or formal **authority**
  (to do something);
  to **give** formal **permission** to; to **empower**" (OED 3b)

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ICT Standards Definitions

- ***Authorization*** *is* ***a process*** *for granting approval to a system entity to access a system resource (RFC4949 2007, at 1b(I), p.29)*
- ***Access control or authorization*** *... is* ***the decision*** *to permit or deny a subject access to system objects (network, data, application, service, etc.) (NIST800-162 2014, p.2)*
- Ambiguities in other important sources, e.g. ISO/IEC 27000, X.800 Security Architecture, the NIST Guide (Josang 2017)

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- So Josang (2017) proposed:
  - **Authorization** as specification of access policies
  - **Access control** as application/enforcement thereof

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Access Control Models and Their Foci

- **Identity** of the Actor
  - Discretionary Access Control (DAC)
  - Identity-Based Access Control (**IBAC**)
- **Role** performed by the Actor
  - Role-Based Access Control (**RBAC**)
- **Attribute**(s) of the Actor, of the IS Resource, and/or of environmental variables
  - Attribute-Based Access Control (**ABAC**)
- **Task** being performed by the Actor
  - Task-Based Access Control (**TBAC**)

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Context

- **The crisis in Data Insecurity**
- Ongoing misconceptions inherent in **Id Management**

Motivation

- **Effective representation of relevant phenomena** to overcome Id Management inadequacies, past and present
- **A framework** that:
  - Reflects the intellectual complexities
  - Identifies the proponent's 'metatheoretic assumptions'
  - Is pragmatic, and supports instrumentalism

==>> A Pragmatic Metatheoretic Model

(a) for IS Practice and Practice-Relevant Research

(b) to underpin improvements to Id Management

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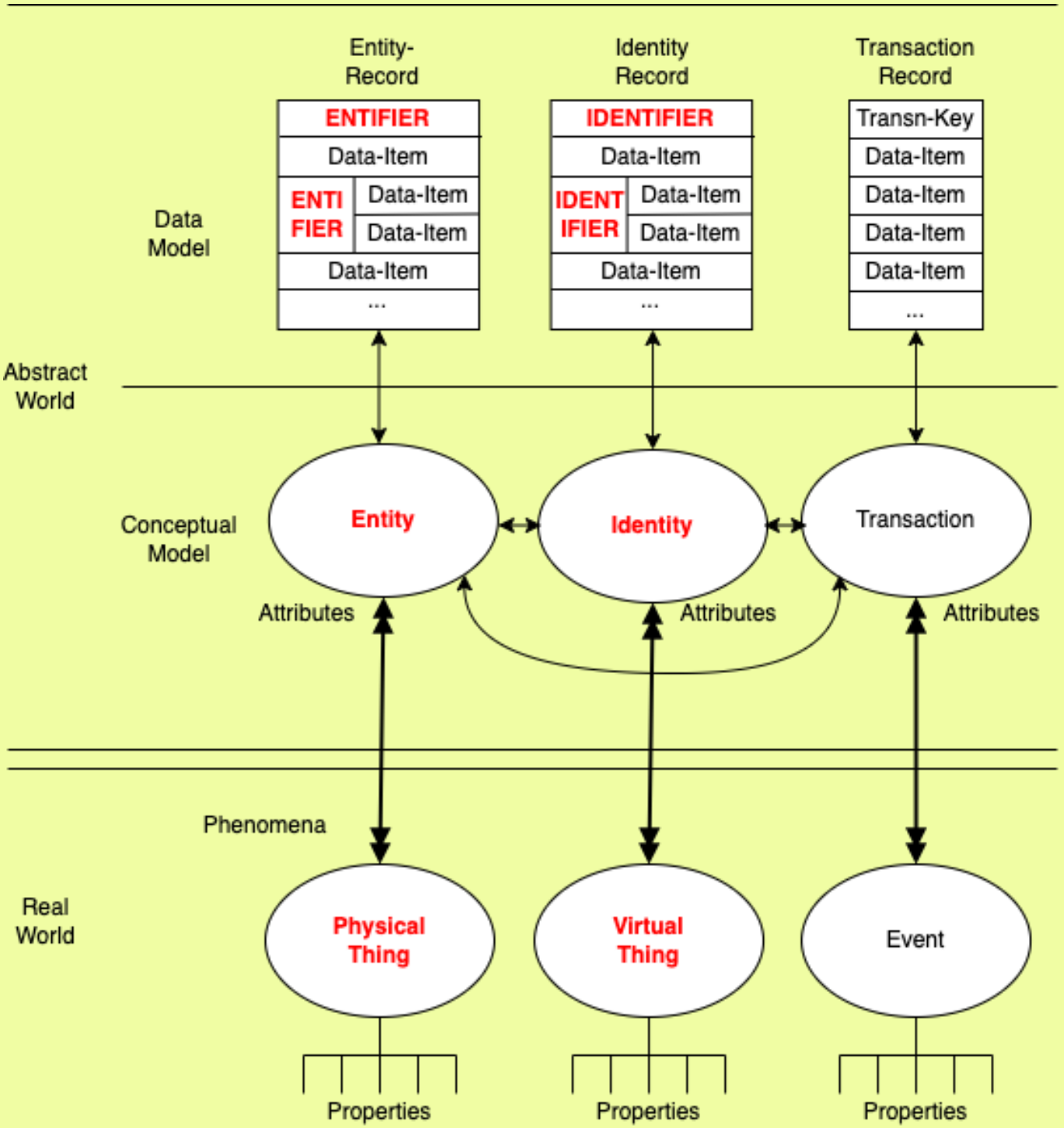
Key Differences about the Pragmatic Metatheoretic Model

Clarke (2021)
at ACIS #32
http://www.rogerclarke.com
/ID/PMM.html



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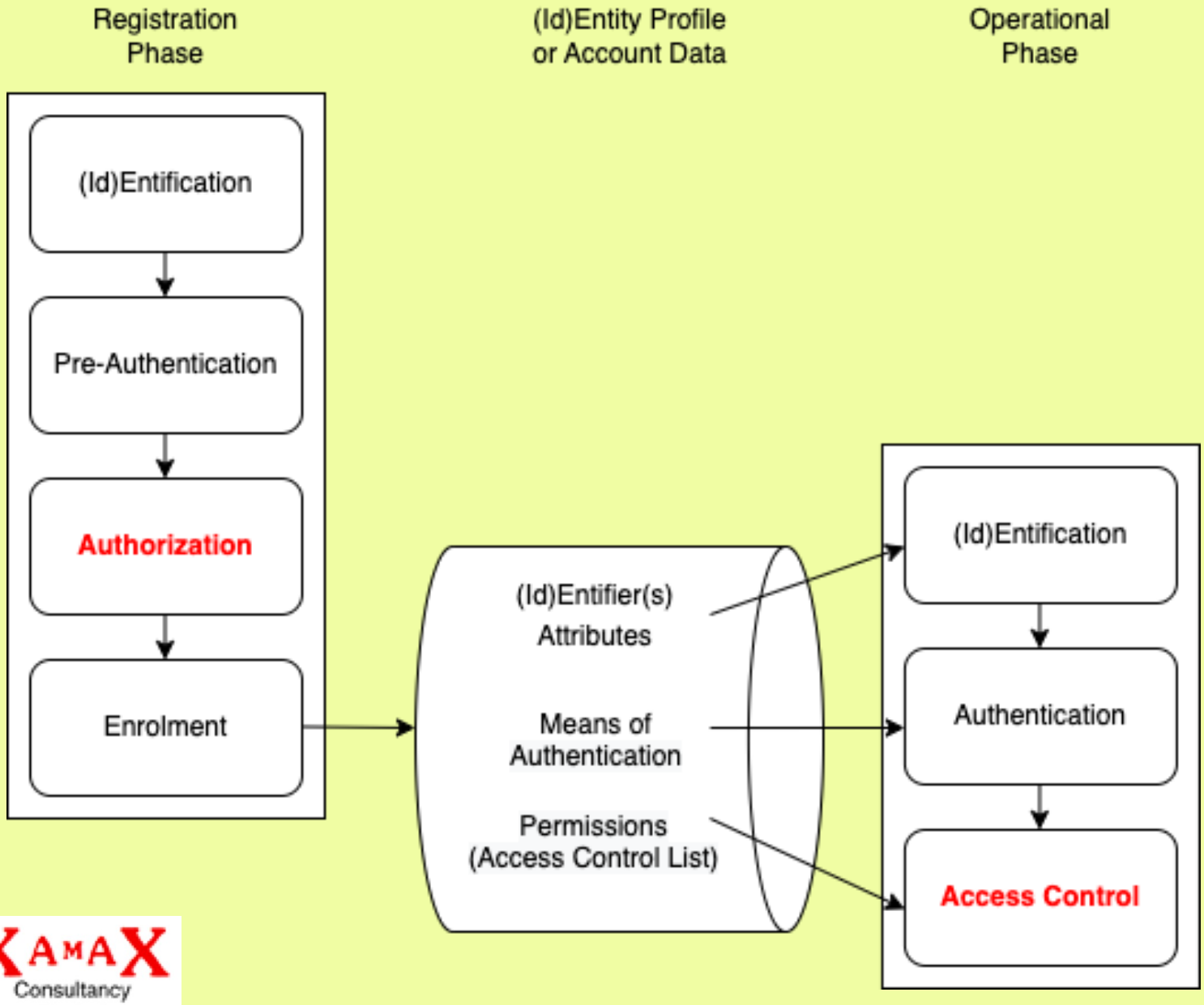
Physical Things and **Virtual Things**

- **Inanimate Objects** (Inventory-Items, Equipment)
  - Containers ⊃ Pallet-Loads ⊃ Boxes ⊃ Cartons
- **Active Objects**
  - Mobile-Phone/Handy/Cellulare ⊃ **SIM-Cards**
  - Computer ⊃ **Processes**
  - Car ⊃ **Convoy-Lead, Get-Away Car, Speed-Check,** ...
- **Organisations** (Companies, Associations, Govt Agencies, ...)
- **Humans and The Roles Humans Play**

  Seller, buyer, supplier, receiver, debtor, creditor, payer, payee, principal, agent, franchisor, franchisee, lessor, lessee, copyright licensor, copyright licensee, employer, employee, contractor, contractee, trustee, beneficiary, tax-assessor, tax-assessee, business licensor, business licensee, plaintiff, respondent, investigator, investigatee, defendant, ...

Generic Process Model of (Id)Entity Management (IdEM)



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(Id)EM Terminology

- **Actor:** A Real-World Thing capable of action on an IS Resource, including humans and some categories of artefact. Real-World Actors may be Physical or Virtual Actors
- **Entity**: An Abstract-World representation of a Physical Actor
- **Identity**: An Abstract-World representation of a Virtual Actor

- **IS Resource:** Data or a Process in the Abstract World, that an IS is capable of acting upon
- **Permission:** An entitlement or authority to be provided with the capability to perform a particular act (typically Read, Create, Amend, Delete) in relation to a particular IS Resource

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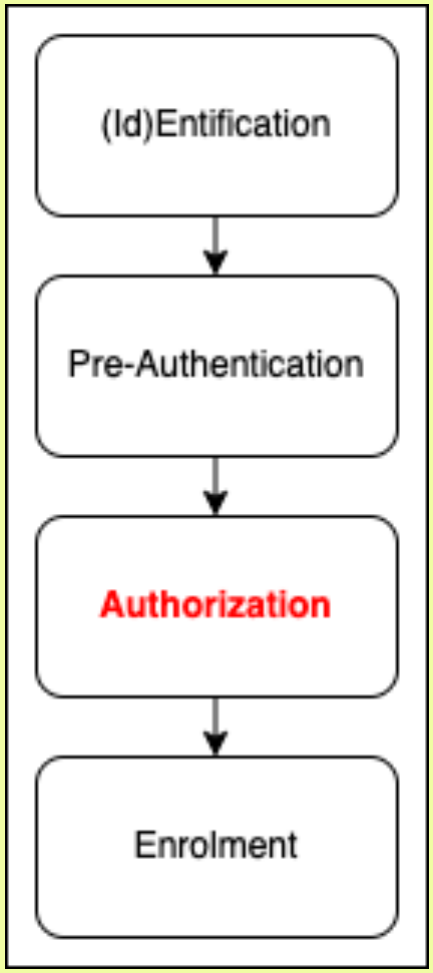
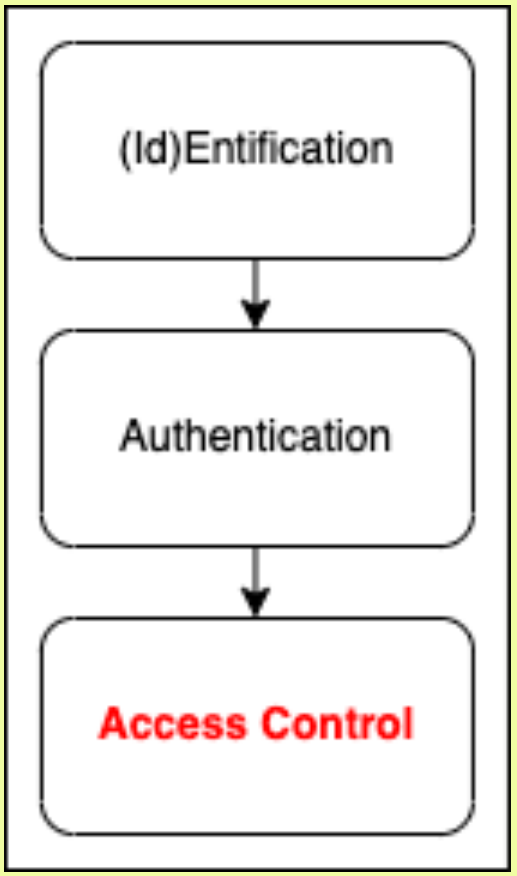
The Registration Phase



- **(Id)Entification**: Make an Assertion that a particular (Id)Entity should be given some kind of access to particular IS Resources
- **Pre-Authentication**: Acquire and evaluate Evidence, to assess the degree of confidence in the reliability of the Assertion
- **Authorization**: Apply decision criteria to determine what Permissions an (Id)Entity is to be given in respect of what IS Resources
- **Enrolment**: Record Data to enable the Operational Phase to be conducted in an effective and efficient manner

The Operational Phase

- **(Id)Entification**: Make an Assertion that the presenting (Id)Entity is the or an appropriate one to operate as that (Id)Entity
- **Authentication**: Use the previously-recorded Means of Authentication to assess the degree of confidence in the reliability of that Assertion
- **Access Control**: Use the previously-recorded Permissions to establish a Session that enables an authorized (Id)Entity to exercise the appropriate Permissions



Actor ===>>> IS Resource

A Real-World Thing capable of action on an IS Resource

- **Physical Things**
  - Humans
  - Some Artefacts
- **Virtual Things**
  - Human Identities
  - Computer Processes

A Thing not capable of action needs a capable Thing as Agent

Data or a Process, in the Abstract World, that an IS is capable of acting upon

Data
Database
File
Record
Item
Document

Process
Service
Application
Function
Program
Transaction
Action-Capability

Basic Proposal:

This is a Coherent Model of (Id)Entity Management (IdEM)

The architecture,
the infrastructure
and the processes

whereby Access to IS Resources
is enabled for appropriate Users,
and otherwise denied

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Enhanced Proposal:

This is a Coherent Model of (Id)Entity Management (IdEM)

The architecture,
the infrastructure
and the processes

whereby Access to ~~IS~~ **Resources**
is enabled for appropriate Users,
and otherwise denied

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Access Control to Resources (= Real-World Things and Events)

- The focus of IS has been on Abstract-World IS Resources
- **But ICT also acts in the Real-World, on Phenomena**
  - Supervisory Control and Data Acquisition (SCADA)
  - Industrial Control Systems (ICS)
  - Mechatronics
  - Robotics
  - The Internet of Things (IoT)

The Era of Active Artefacts

Actor ===>>> ~~IS~~ Resource

A Real-World Thing capable of action on a Resource

- **Physical Things**
  - Humans
  - Some Artefacts
- **Virtual Things**
  - Human Identities
  - Computer Processes

A Real-World Thing

Physical Things

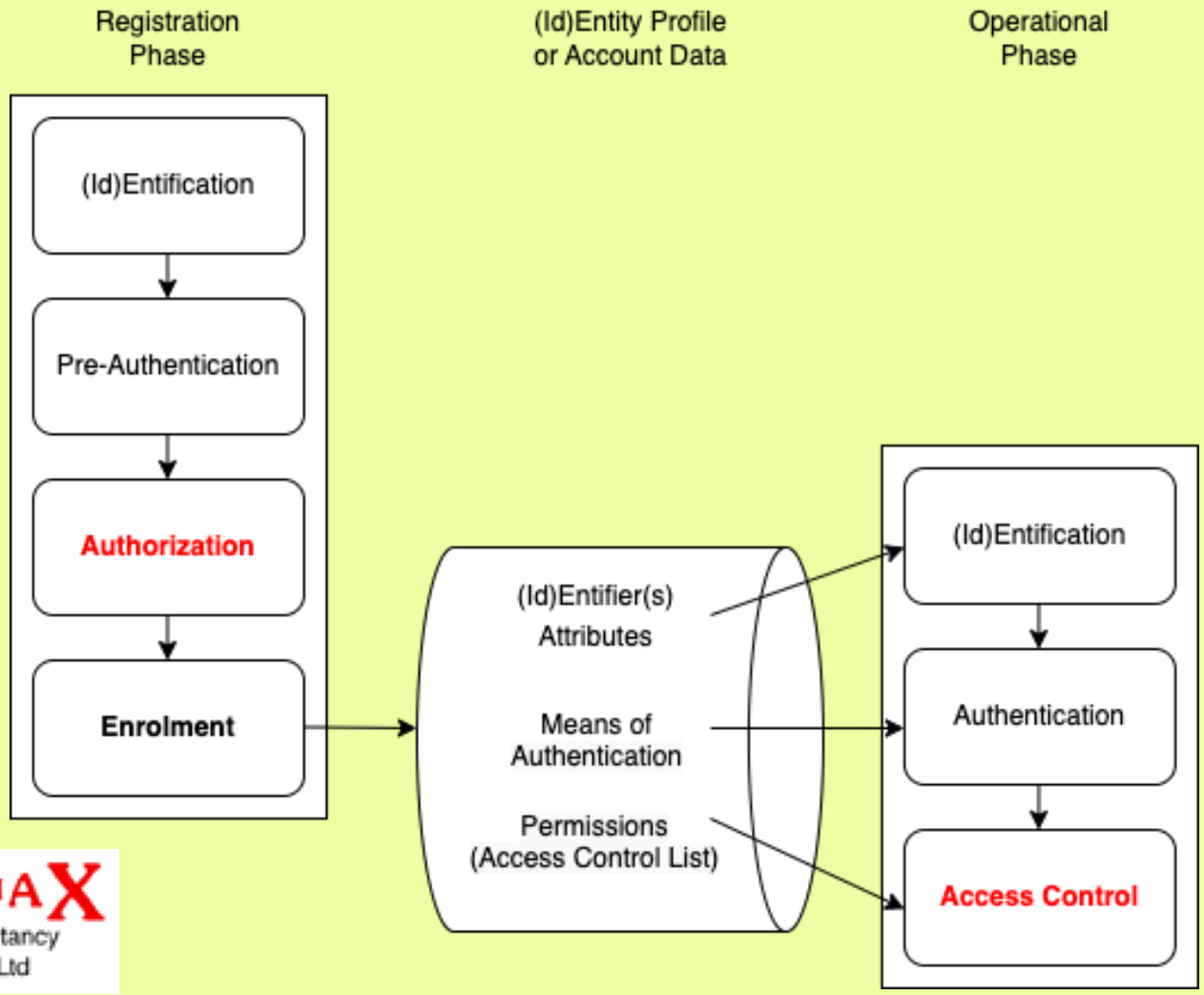
- Humans
- Artefacts

Virtual Things

- Human Identities
- Organisational Identities
- Computer Processes

Implications of (Id)Entity Management (IdEM)

The Pragmatic Metatheoretic Model enables clarity about weaknesses in conventional Identity Management (IdM), and the development of **a robust replacement model** referred to as (Id)Entity Management



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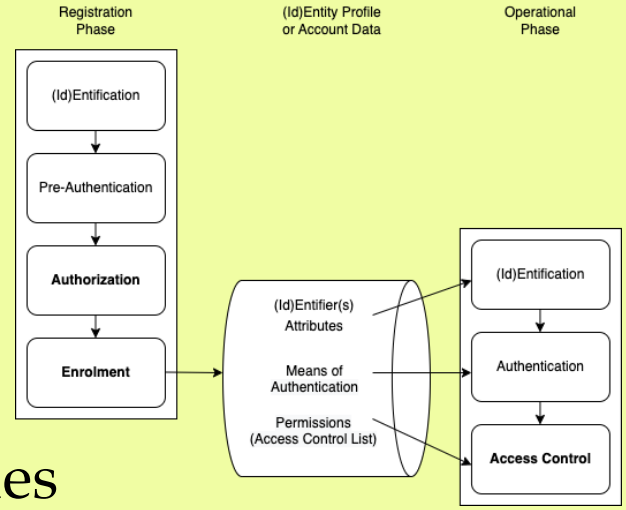
Implications for IS Practice and Theory



- **Standards** need to be revised to reflect the (Id)EM model
- **Entities are distinct from Identities** (Distinguish Physical and Virtual Things)
- The (Id)EM model defines an **orderly set of phases** and steps, uses **intuitive terms**, provides **coherent definitions**, and identifies relevant data
- Roles and associated Identities are **plural**, and **relative to an IS, not organisational positions**
- The (Id)EM model recognises the cost and intrusiveness of (Id)Entity Authentication, and **encourages careful choice of which Assertions really require Authentication**
- The model is **readily extended to Active Artefacts**

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