Ontology & Enterprise Architecture

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model futures

Introduction

- Semantic issues with Enterprise Architecture
  - Examine some of these issues
- Ontology can be a difficult subject
  - Especially for those immersed in information theory
  - Basic introduction to some of the concepts
- The IDEAS Group
- The BORO Methodology

Enterprise Architecture

- Multi-Disciplinary
  - Policy, Process Modelling, Information, Data, Apps, Networks, etc.

- Different levels of abstraction
  - Types of people (posts), types of organization, types of systems, etc.
  - Actual systems, locations, etc.

- Need a way to
  - ...say what exists, or what could exist
  - ...tie it all together

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Terminology

- Large Enterprises have specialist groups and departments.
  - The specialists tend to develop their own terminology and processes
 - ..and these can differ...

Terminology - 2

"tank"
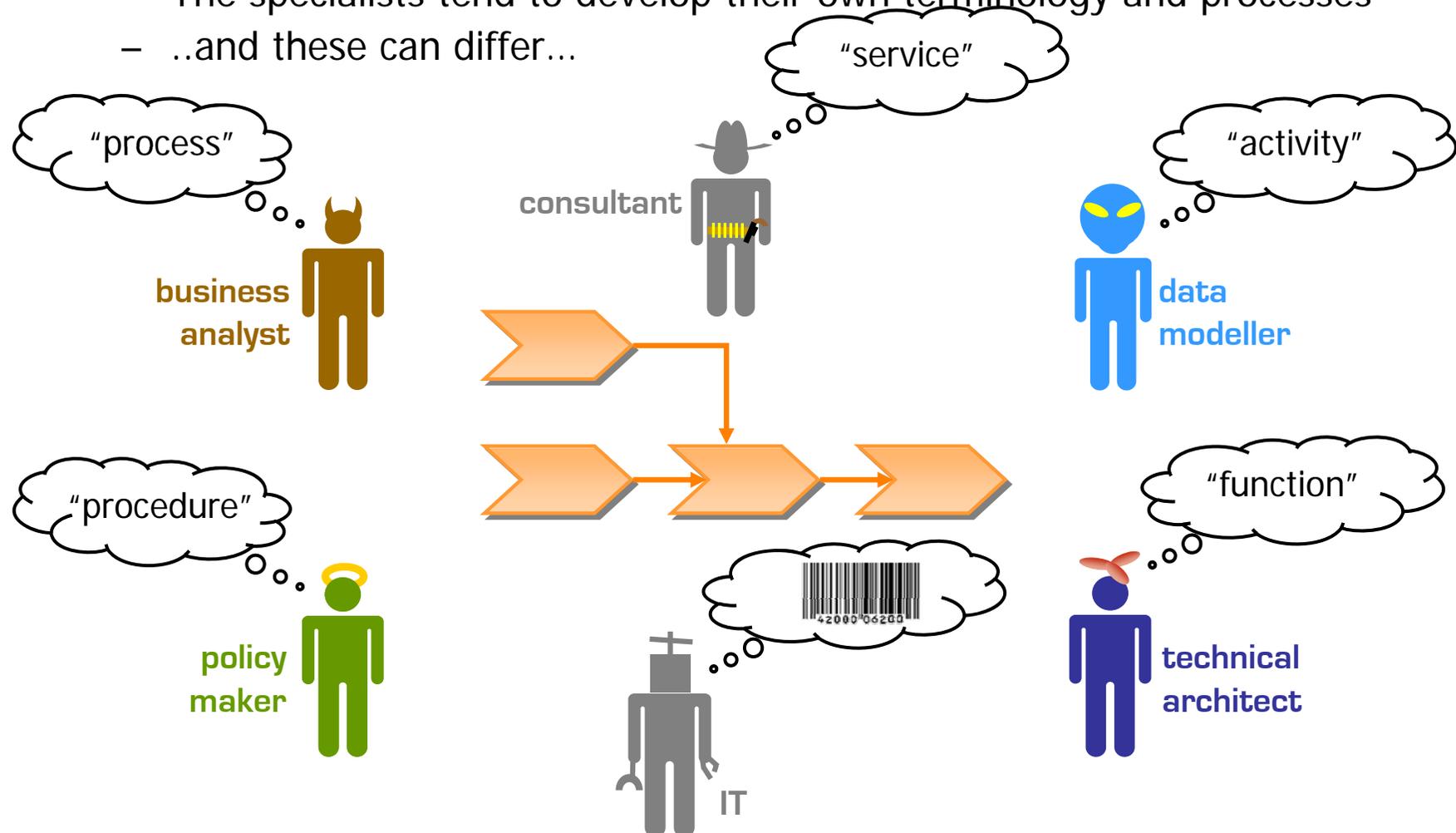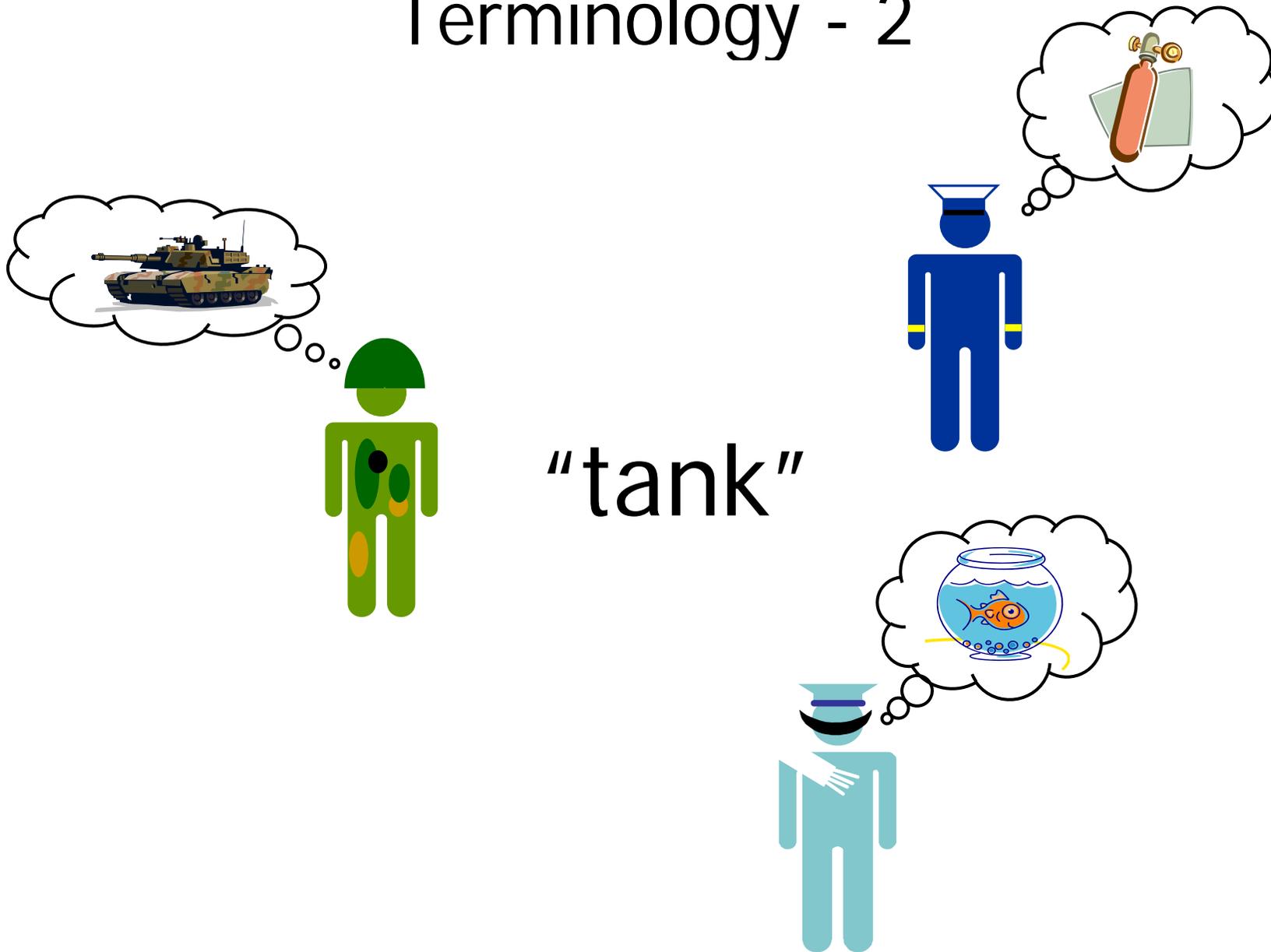
EA & The Real World

- Very easy to say that EA is just about modelling
  - But, the models tend to describe actual systems, processes, etc.
  - Some aspects of an EA are "live" data – e.g. site data is business data to the facility managers
- Even models have impact on the daily business
  - Data models (which are usually part of the EA) are partial representations of the real world
  - Those same real world things may also be represented in other model – e.g. org structures, system deployments that are also part of the EA
- In other words, stratification of model and data is too simplistic an approach for EA

Business Architecture

IT

Technical Architecture

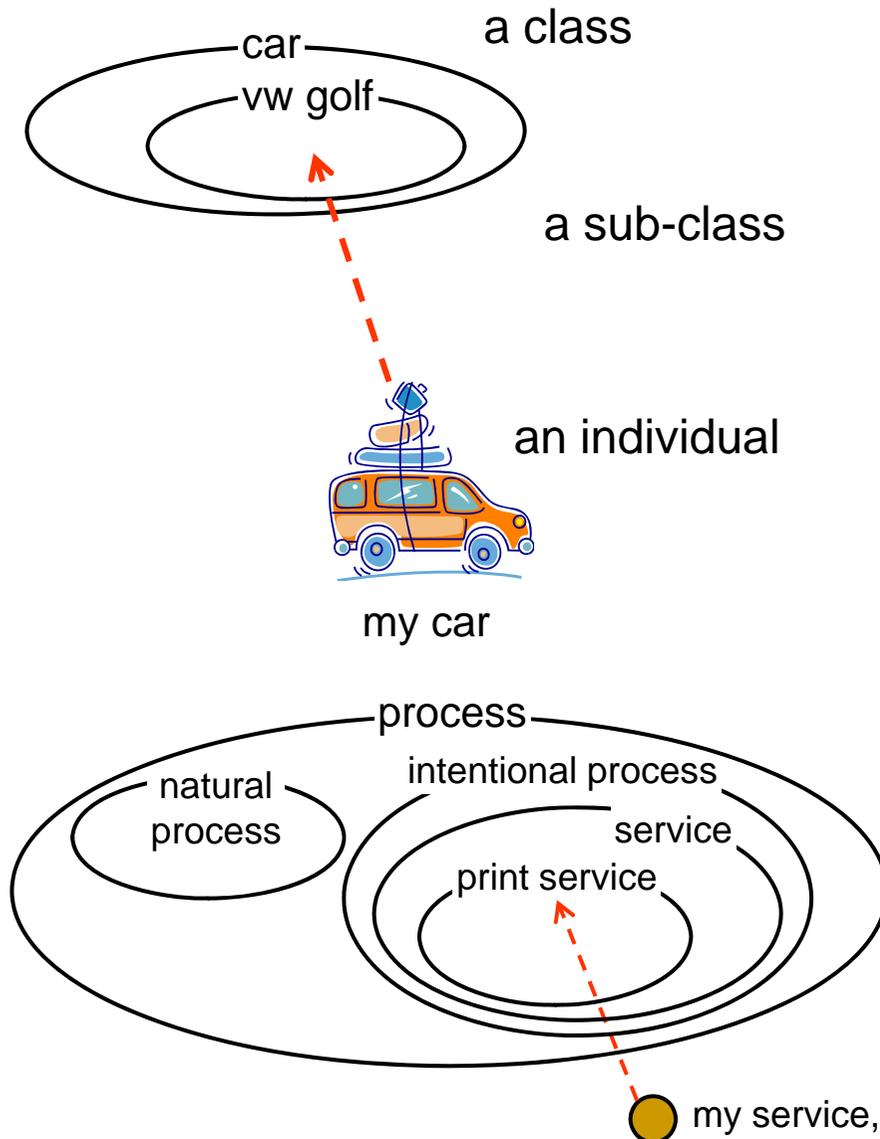EA
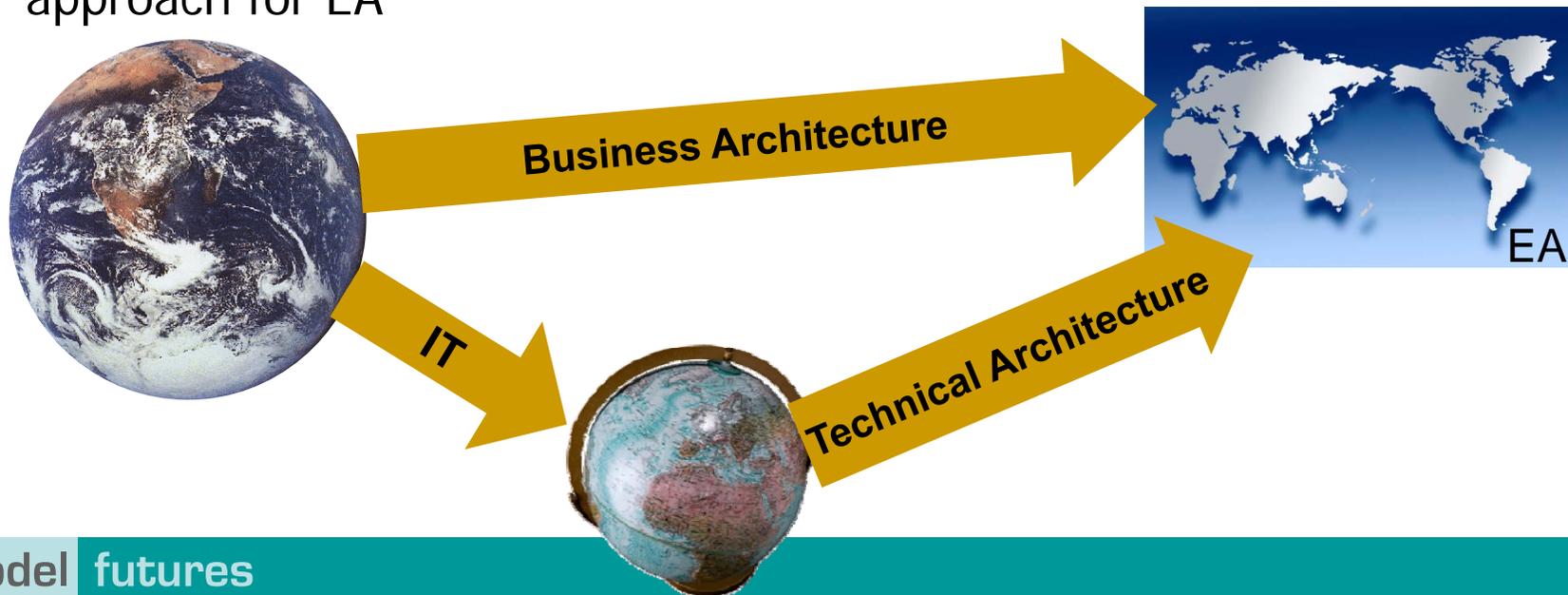
Ontology & Information Conflict
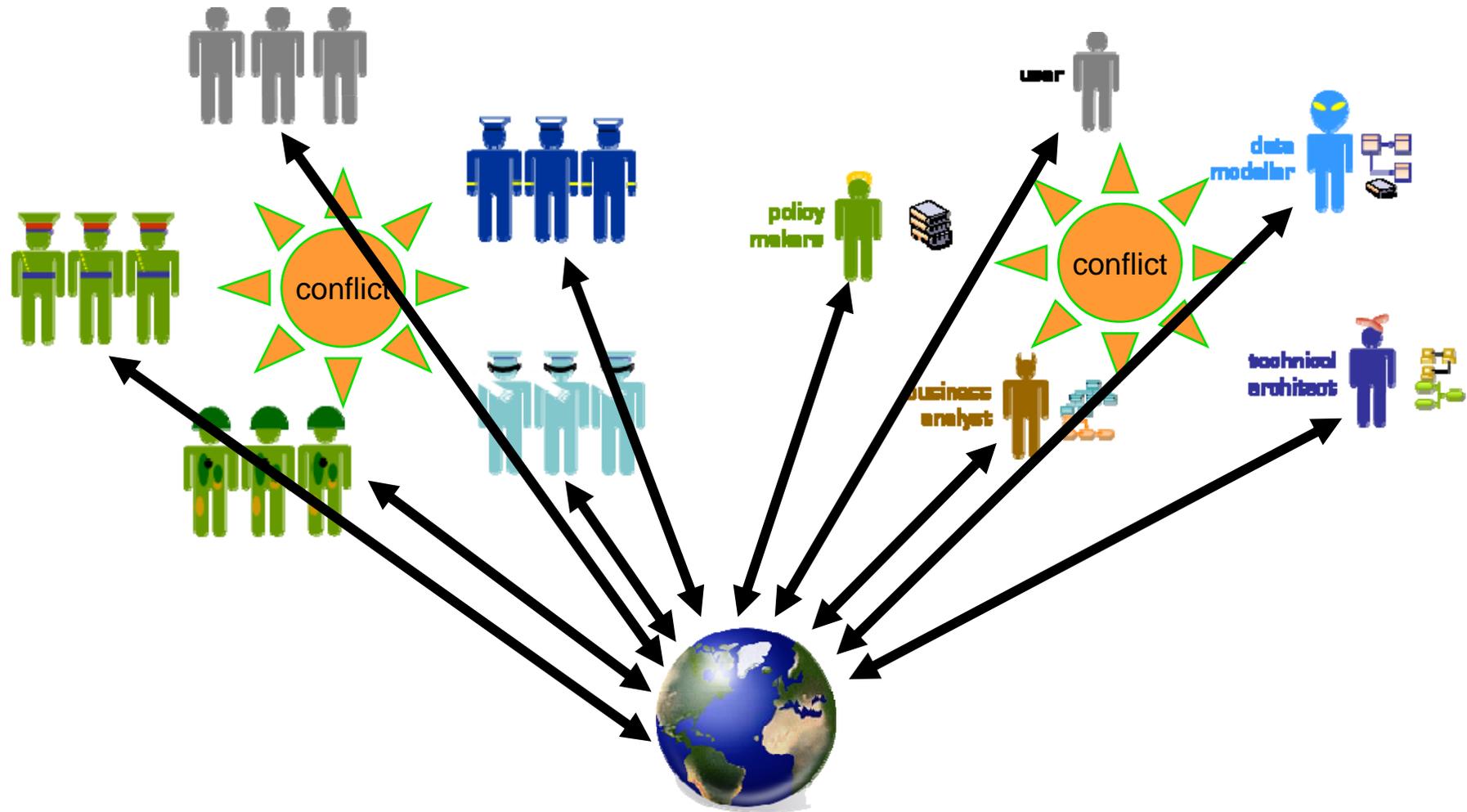
Ontology

- Currently much hype about ontology
  - But how much do people really understand about it ?
- There are two main types of ontology that appear in IT:
  - Formal ontology – usually based on AI concepts of machine "reasoning". Built for a purpose to enable a machine to make "decisions".
  - Philosophical ontology – using the best discoveries of mathematics and philosophy to create a model which best describes the things we're interested in
- The interest for EA is the latter, as we're seeking to have a common understanding

Key Ontological Concepts

a class

car

vw golf

a sub-class

an individual

my car

process

natural process

intentional process

service

print service

my service, performed 13/11/06

- Useful to know a few terms before explaining more...

- Where would the service reference model fit ?
  - Classes of service
  - Specialise from process

Taxonomy

- But surely if we just need common understanding, all we need is a taxonomy ?
  - True up to a point, but all we then have are names, with no idea about their true meaning
  - A traditional taxonomy – e.g. IPSV or the UK Defence Taxonomy is a structure of broader and narrower terms:

class (i.e. type of thing)

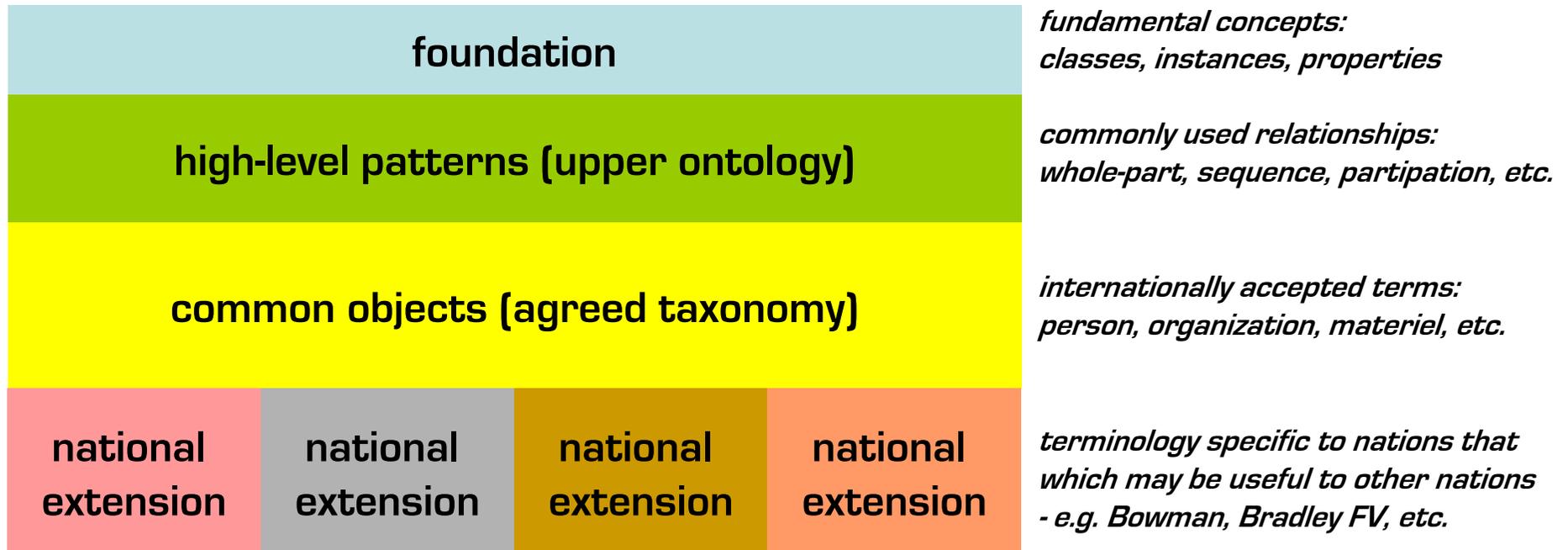*individual (i.e. specific thing)*
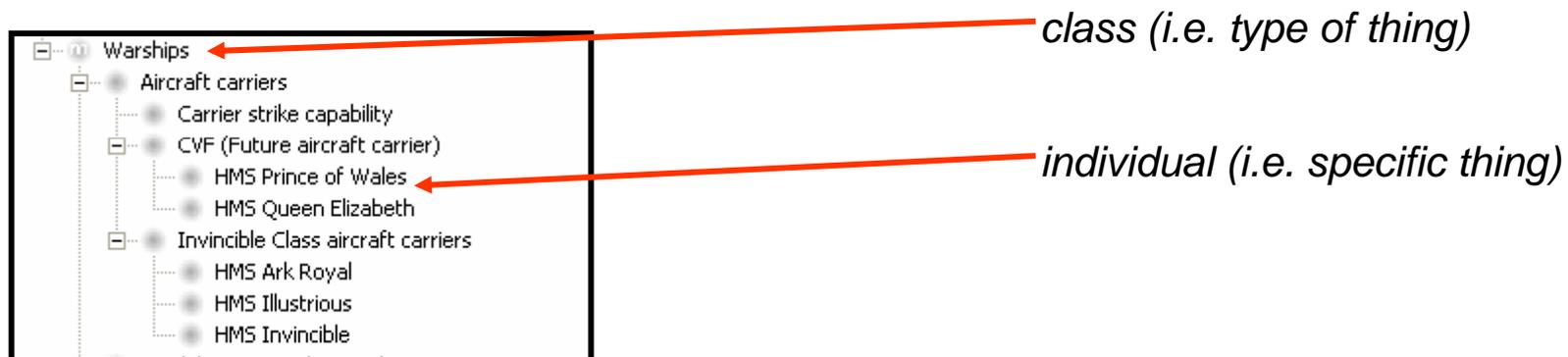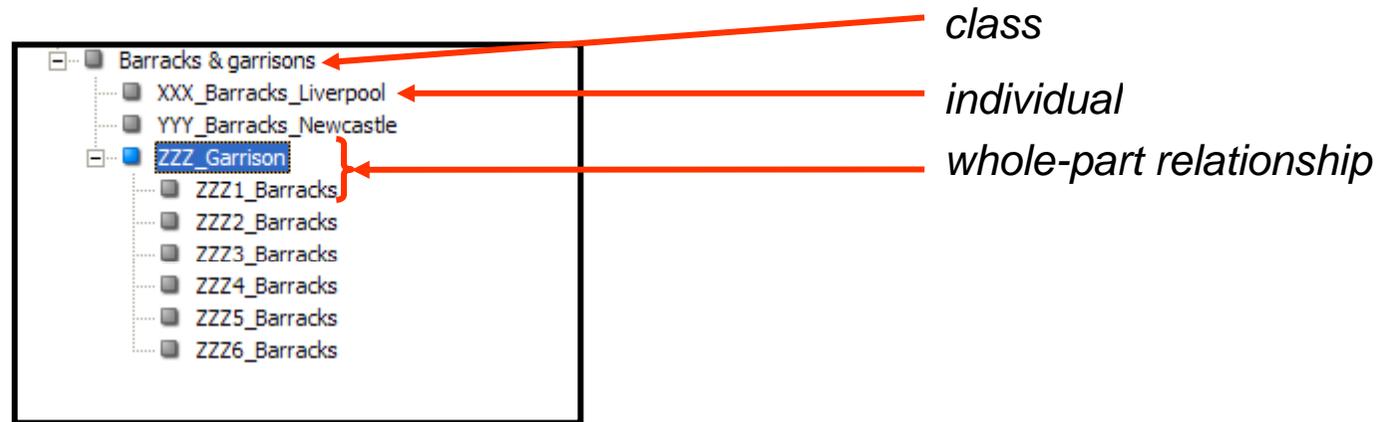
Taxonomy & Ontology

- Above shows a typical taxonomy short-cut
- An ontology would distinguish between all of these.
- In addition, a well-founded ontology can provide a good deal more functionality

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IDEAS Group

- Consisting of representatives from the defence departments of four countries:
  - Australia, Canada, UK, USA
  - + Sweden and NATO as observers
- Goal is to develop a common model for interoperability of defence enterprise architecture
- Adopted the BORO Methodology

Structure

- Layered approach
  - Starting from first principles to ensure common understanding at the most fundamental level
  - Reaching down to country-specific definitions whose meaning may need to be understood by other nations

|	
foundation	*fundamental concepts: classes, instances, properties*
high-level patterns (upper ontology)	*commonly used relationships: whole-part, sequence, partipation, etc.*
common objects (agreed taxonomy)	*internationally accepted terms: person, organization, materiel, etc.*
national extension / **national extension** / **national extension** / **national extension**	*terminology specific to nations that which may be useful to other nations - e.g. Bowman, Bradley FV, etc.*

Foundation

- The nations involved were using different modelling paradigms:
  - Entity-Relationship
  - Object-Oriented (inc. UML Meta-Models)
  - Ontology
- All of these modelling approaches are based on formal logic and set theory, but each is subtly different – especially as users tend to adopt a given "style"
  - These differences were making it hard to establish a common approach between the nations – there was too much scope for misunderstanding between parties
- To mitigate these problems, the IDEAS Model defines a foundational layer (based on IEEE Candidate Upper Ontologies such as SUMO & ISO15926)

The Language of Ontology

- Before we can begin the training, it is important that everyone has a common understanding of the tools and language of the ontologist
- Founded in Set Theory and Formal Logic
  - *Types* (also known as "classes", "categories", "sets")
  - *Elements* (also known as "individuals")
  - *Tuples* (also known as "relationships" or "associations")
- Tips:
  - Always try to ground your thinking by taking it back to concrete examples – esp. when dealing with types, work with example individuals that are instances of those types.
  - Draw it as a Venn Diagram (notation to follow)

Venn Diagram Notation

- The typical Venn diagram is slightly enhanced to deal with the case of types that are instances of types
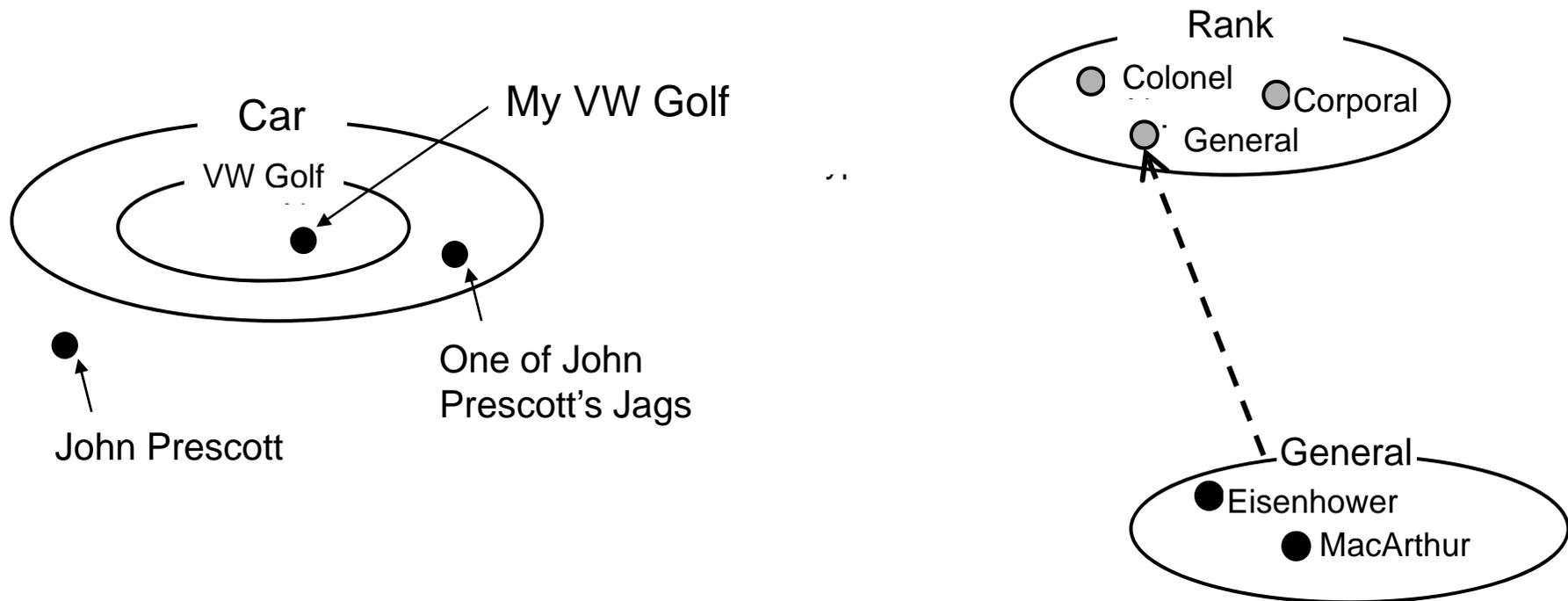
The BORO Methodology

- BORO
  - "Business Object Reference Ontology"
  - A methodology for developing business models
- *Ontology* is the study of what exists
  - BORO provides a formal, step-by-step method to develop an ontology
  - Ensures that there is no scope-creep due to modelling alone (can't prevent stakeholders from widening the scope though)
  - Provides a way of de-conflicting several stakeholder views (cf Soft Systems)
  - Aims to get at the essence of the information requirements
  - Results in a formal ontology
  - Tends towards simplification – establishes high-level patterns that repeat throughout the model

The BORO Process

- Does it exist in space & time ?
  - i.e. can you kick it (now, in the past or in the future)
  - INDIVIDUAL
  - This is the crucial BORO criteria for identity that ensures there can be no debate about semantics.

- If not, is it a type of Individual, or a type of type of individual ?
  - TYPE
  - What is it a type of ? Always trace back down to individuals – again, this de-conflicts semantics for types.

- If not, does it relate other Types or Individuals ?
  - TUPLE

Generalisation

- The basic BORO process establishes the ontic categories
  - This is the first essential stage
  - However, this has not built us an ontology
- Need to establish the hierarchy – i.e. a taxonomy
  - ...and this is where the difference with BORO becomes apparent
  - Because the basic ontic categories have been established, the hierarchy that is built is clean.
  - ...and strange things start to happen – high level patterns start to emerge
  - ..some of them are quite surprising

What does BORO let us do ?

- Compare systems
  - BORO works best with real (legacy) data.
  - The dirtier the data the better – works on the assumption that most data quality problems stem from the fact that systems do not do what the users want, so they shoe-horn in the data they actually need.
  - Comparison is guaranteed accurate provided the BORO method and criteria for identity are rigidly followed.
- Integrate systems
  - Once we know how the systems' data is related, we can automate the conversion between them
- Build the next generation of systems
  - Implement the high-level patterns – everything else is data
  - Universal applications

BORO Example - Standards

- ## What is a standard ?
  - A document ?
  - The act of ratifying an agreement ?
  - The class of acts which conform to a standard ?

- ## Deal with each of these cases one by one
  - Take each back to the criteria of identity
  - Work out the types
  - Work out the tuples

- ## Pattern starts to emerge
  - As more business data from other subject areas is analysed, it becomes apparent that Standard is just a special case of a more general end-to-end agreement pattern.
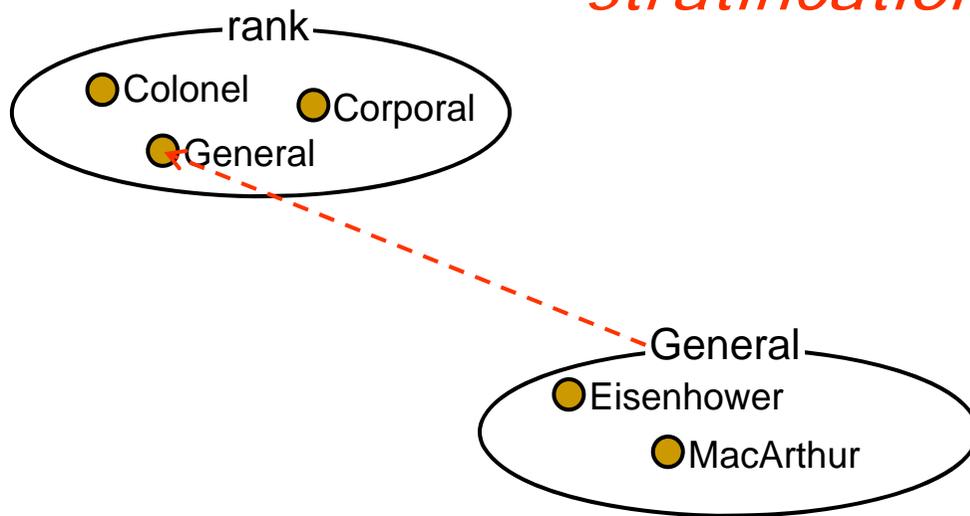
Unlearning-1

- IT professionals have a lot to "unlearn" before they can work with ontologies

1 - Need to stop thinking about the representation of the thing, and think about the actual thing

Unlearning-2

- IT professionals have a lot to "unlearn" before they can work with ontologies
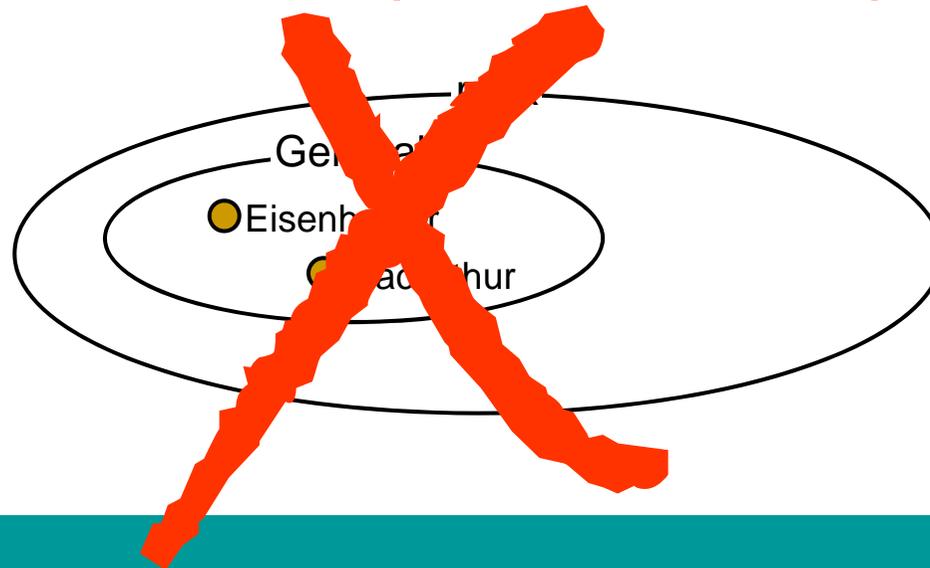
2 – Need to forget the type-instance (class-object) stratification

Unlearning-3

- IT professionals have a lot to "unlearn" before they can work with ontologies

3 – Need to be careful not to mix type-instance relationships with sub-super

Unlearning-4

- IT professionals have a lot to "unlearn" before they can work with ontologies

4 – Need to let go of obsessions about names – the elements position in the ontology defines what it is, not its name
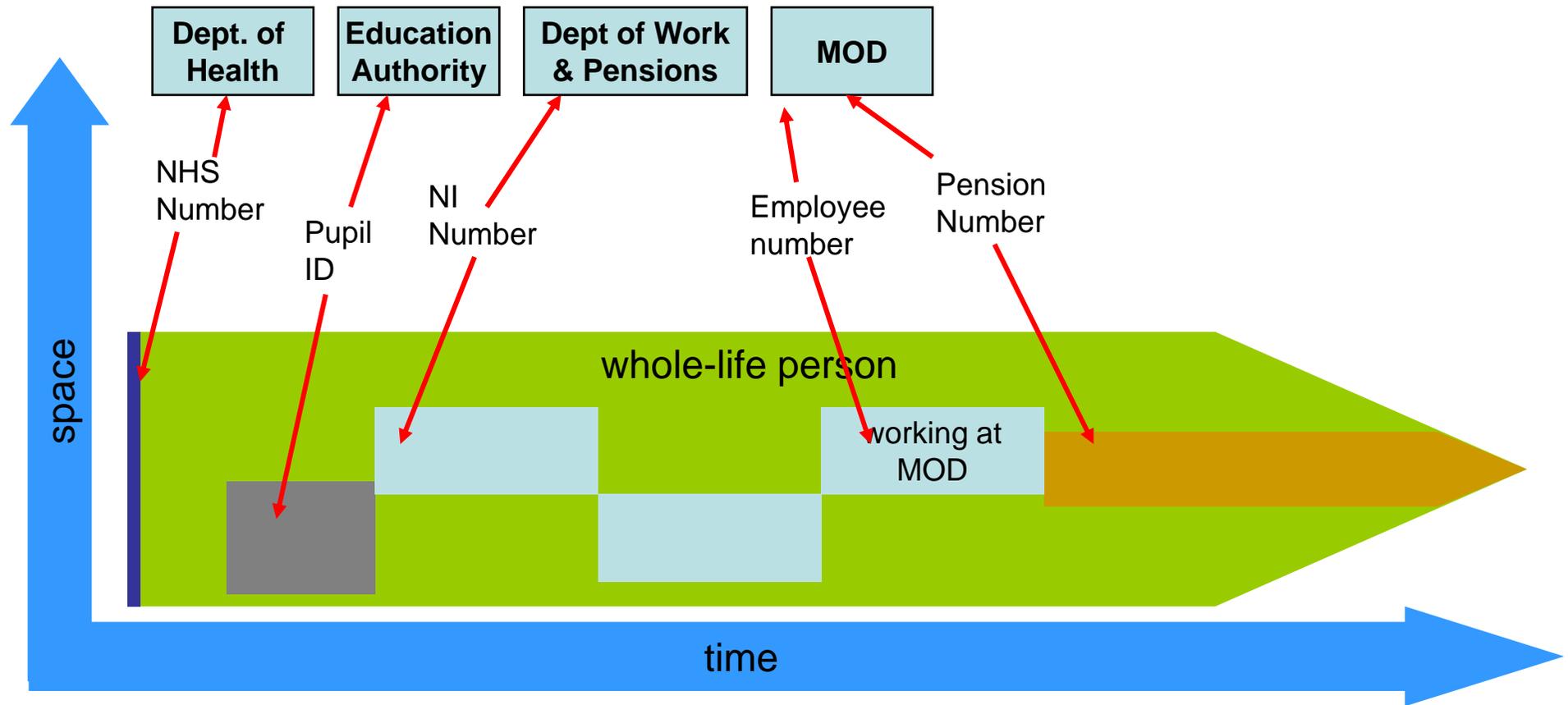
Managing Change Over Time

- One type of ontology approach deals particularly well with the tricky subject of time – the 4D ontology
- Distinguished between whole life things and the states they have throughout time – e.g. a person
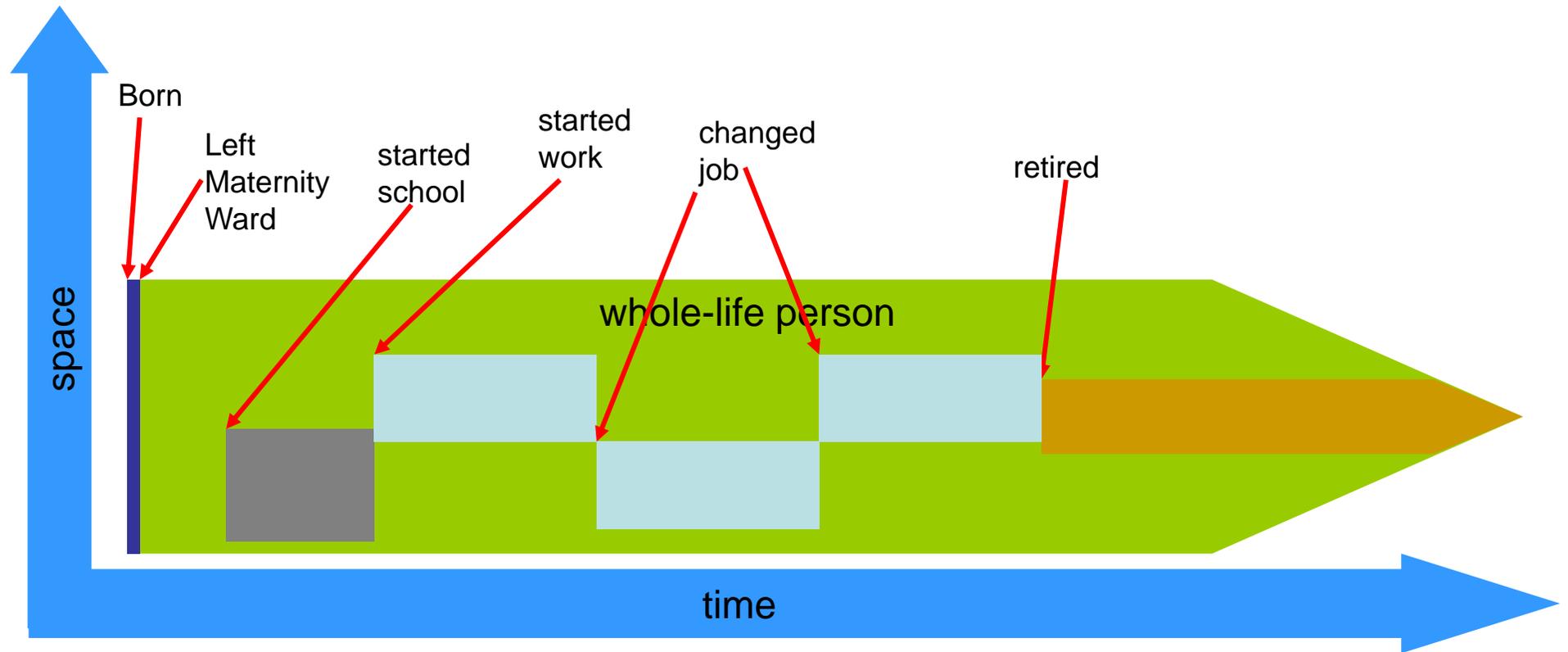
Managing Identity

- A good ontology will identify the states of the individual
- It will also say who owns the identification scheme used

Last Slide

- What does ontology do for me ?
  - Provides a single coherent <u>reference</u> model for the whole enterprise
  - Supports the enterprise architect
  - Supports the applications and data
- What do I require ?
  - Need to decide type of ontology to use
  - Can I re-use anything out there – e.g. IDEAS, ISO15926, SUMO
- More than taxonomy
  - Ontology is not about words
  - It's about identifying the nature of things – the relationships between elements do more to identify them than the names do
- What Next ?
  - Try it !
  - Choose a subject area and model it
- Links
  - http://www.boroprogram.org/ http://www.ideasgroup.org