Competencies, Tools and Languages
Agenda

- An introduction to modelling and little history
- Are we the first to struggle with modelling concepts
- Language and its importance
- What can we learn from Henry Ford
- Instance based modelling
- Meta modelling
- Meta-meta modelling
- Putting it all together
Introduction

- **Modelling**
  - *a standard or example for imitation or comparison*
  - *a representation, generally in miniature, to show the construction or appearance of something*
  - *a style or design of a particular product*
  - *a pattern or mode of structure or formation*
  - to form or plan according to a model
  - to give shape or form to; fashion
  - to simulate (a process, concept, or the operation of a system), commonly with the aid of a computer

*The above courtesy of dictionary.com*
“Only fools go to war without a plan…”
- *The Art of War* by Sun Tzu

“if the design of a product has been sufficiently studied, then changes in it will come very slowly”
- *My life and work*, by Henry Ford

“I draw a plan and work out every detail on the plan before starting to build”
- *My life and work*, by Henry Ford
Modelling or Planning

- Is there a difference between modelling and planning?

Planning

- To form a delineation of; to draught; to represent, as by a diagram
- To scheme; to devise; to contrive; to form in design; as, to plan the conquest of a country
Are we the first...

- As a species we have been modelling for years
  - Henry Ford is a great example
  - The Egyptians needed a language to convey their ideas for the construction of the pyramids etc.
  - My mother used pattern to create dresses, the pattern was expressed in a form that she could understand
  - My brother who was a chef, he would use cookie type cutters to produce consumables
  - Biologist have been modeling for many years, as have chemist. Biologist used concept called classification
  - Building architects use a language to convey ideas
  - Einstein and Newton with their mathematical models
Importance of the language

- Models require a language and models are used to communicate ideas.
- For a language to be effective it must have a grammar, the grammar defines how the components of the language can be assembled for different specifications.
  - This is known as the meta-language (or meta model).
An instance/unclassified model

- An example: the parts of a car

  - “can we classify these parts?”
Moving to a classification model

- The previous model can be redrawn using classification, nothing new here!
The classification model

- Henry Ford spent many years creating the individual parts he needed for his visionary car.
- He later spent many years creating the tools that he would use to create the parts he needed for his visionary car i.e. a cookie cutter.

There was a gradual change in his thinking.
Moving to meta-models

- But our example is too fixated on the specific type of part
  - Henry Ford found himself spending a lot of time creating tools to create parts
  - A concept known as tool-setting
  - A mechanism to create tools for different situations

So maybe, I could create a cookie cutter for cookie cutters
Moving to meta-models

- A meta-model describes how a model may be constructed
  - It specifies a notation that can be used in many situations i.e. meta-language
Moving to meta-models

- It specifies a notation that can be used in many situations i.e. meta-language.

- The typical role of a meta-model is to define the semantics for how model elements in a model get instantiated.
IP realization

The more economical methods of production did not begin all at once. They began gradually, just as we began gradually to make our own parts…

The great economies began in assembling and then extended to other sections so that, while today we have skilled mechanics in plenty, they do not produce automobiles, they make it easy for others to produce them. Our skilled men are tool makers, machinists and pattern makers.
Moving to meta-meta models

- I still have a problem in that given each type of view, there are specifics elements available
- What if we could define the elements in a view independent manner so that they can be reused across multiple views {meta meta specification}
  - Each view could then utilise these elements in a manner that is constrained by the view {the meta-language}
Putting it together – the UML approach

MOF elements

M0
instances
A snapshot of the language of the problem domain

M1
The model
A more complete specification of the language of the problem domain

M2
Metamodel
The language for specifying models

M3
Meta-metamodel
The language for specifying the meta-model

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Summary

- We have seen that modern 21st century man isn’t the first to attempt modelling.
- We can learn a lot from people like Henry Ford.
- The importance of language and modelling.
- Moving from instance to class to meta-class to meta meta-class based modelling is where the IP is held and realised.