# Deploying MBSE

Overview & Techniques
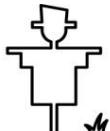
Why, hello there…

Prof Jon Holt

PhD, BEng, CEng FIET, FBCS CITP, FINCOSE

Director, Scarecrow Consultants Ltd
Professor of Systems Engineering, Cranfield University
Technical Director, INCOSE UK

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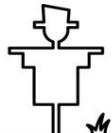
Overview

1. Introduction

2. The reason – why MBSE?

3. MBSE Evolution

4. MBSE Capability

5. Some techniques

6. Summary
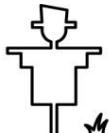
Interlude

*the origin of this presentation...*
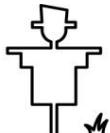
1996
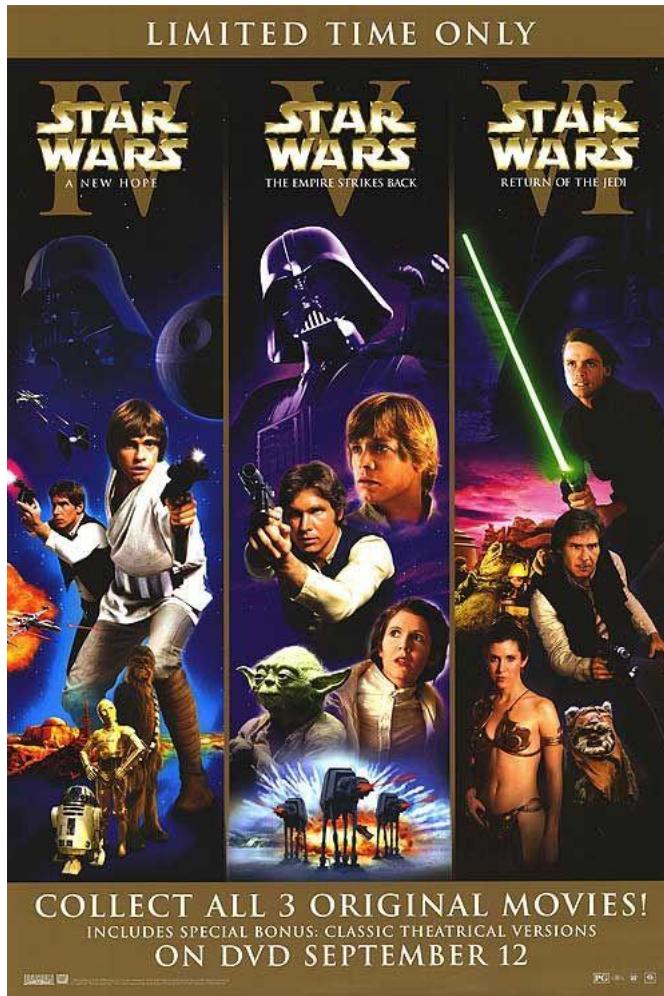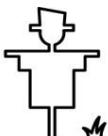
Star Wars Tazos!

Star Wars Tazos!

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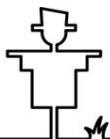
Star Wars Tazos!
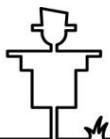
Limited Edition Collectors' Force Pack!

The Quiz

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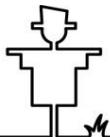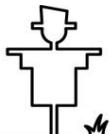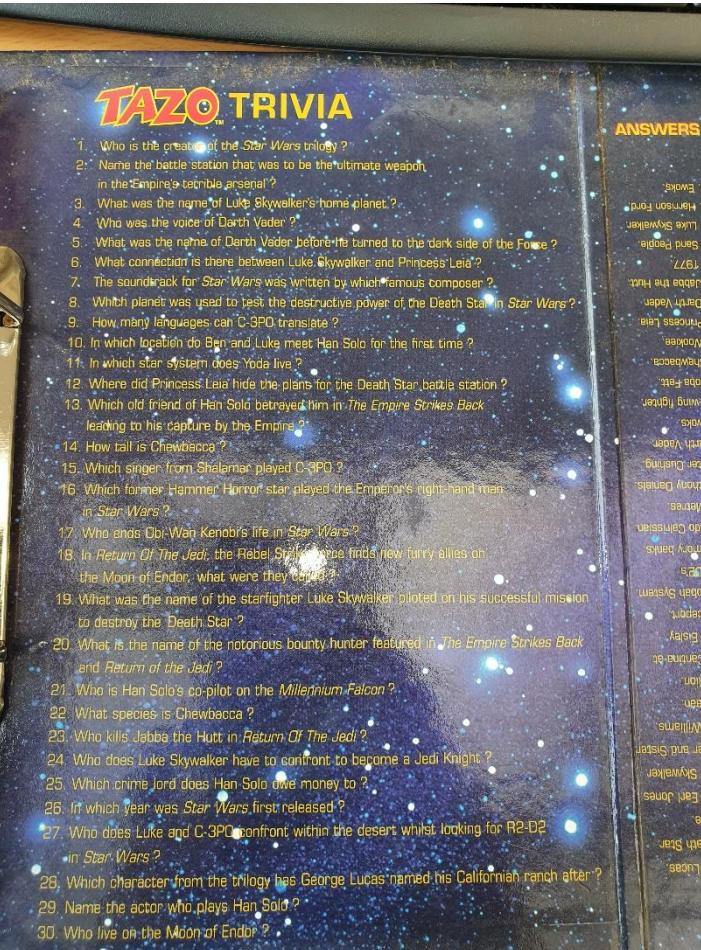
The Quiz
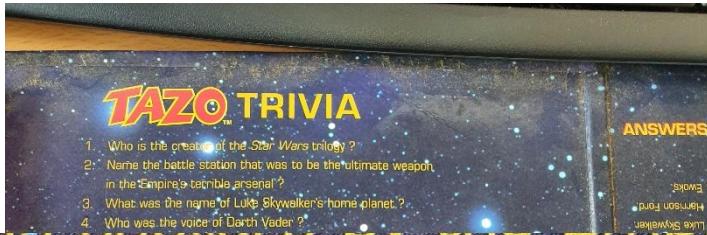
14. How tall is Chewbacca ?

15. Which singer from Shalamar played C-3PO ?

16. Which former Hammer Horror star played the Emper...
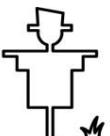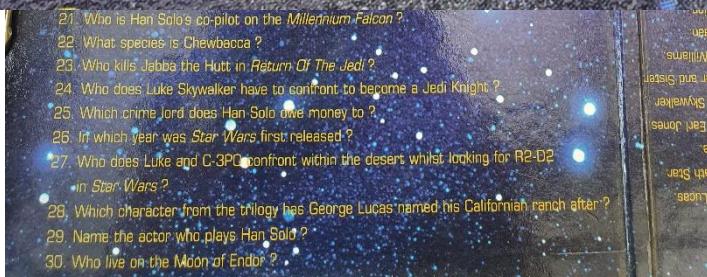
Fast forward ….. Tenby 2011!
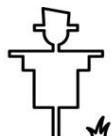
The Las Vegas of Wales!

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Tenby culture

The Coach and Horses

The voice in my head

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The voice in my head

The voice in my head

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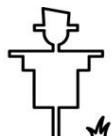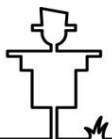
Will the real Mr Daniel(s) please stand up?
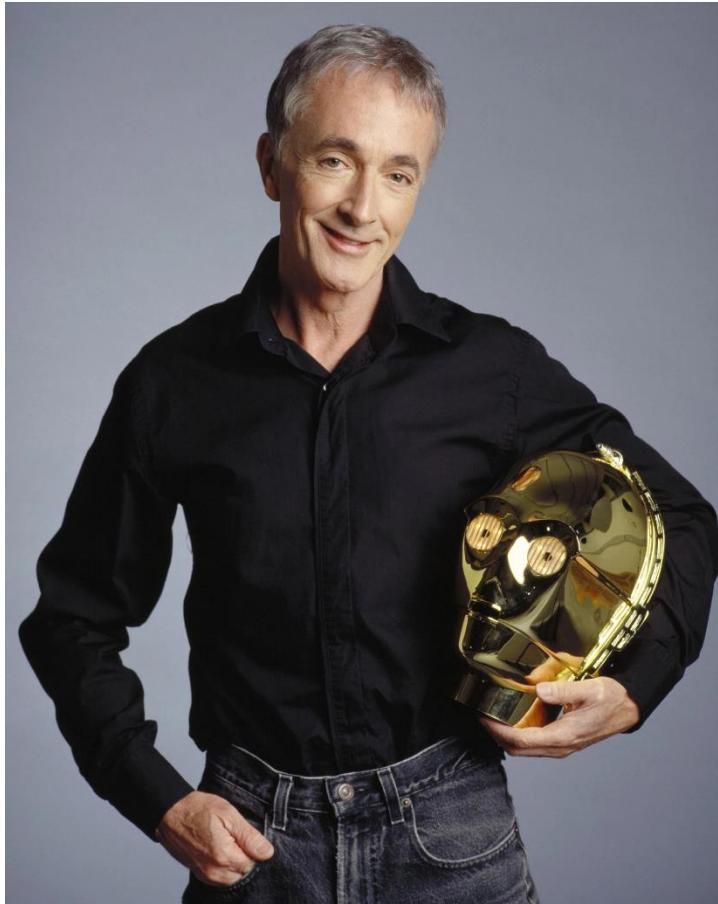
Anthony Daniels (C3PO)

Will the real Mr Daniel(s) please stand up?
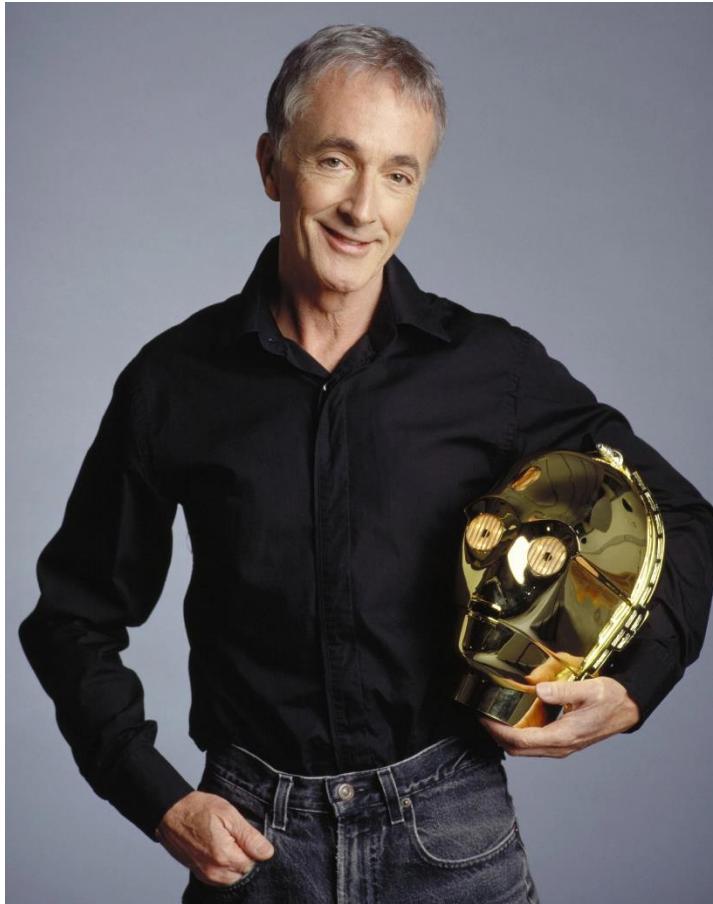
Anthony Daniels (C3PO)
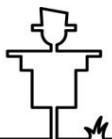
Jeffrey Daniel (Shalamar)

Just because you read it somewhere, doesn't make it true!
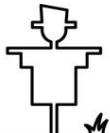
1. Introduction

- Deploying MBSE is increasingly more important
  - MBSE becoming more established
  - MBSE being widely adopted
- Trinity is a model-based approach for MBSE deployment
  - Based around exploring three key Considerations
  - Answers then form an evolutionary path on how to implement the MBSE deployment strategy
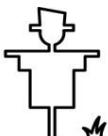
The Trinity of Considerations
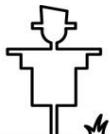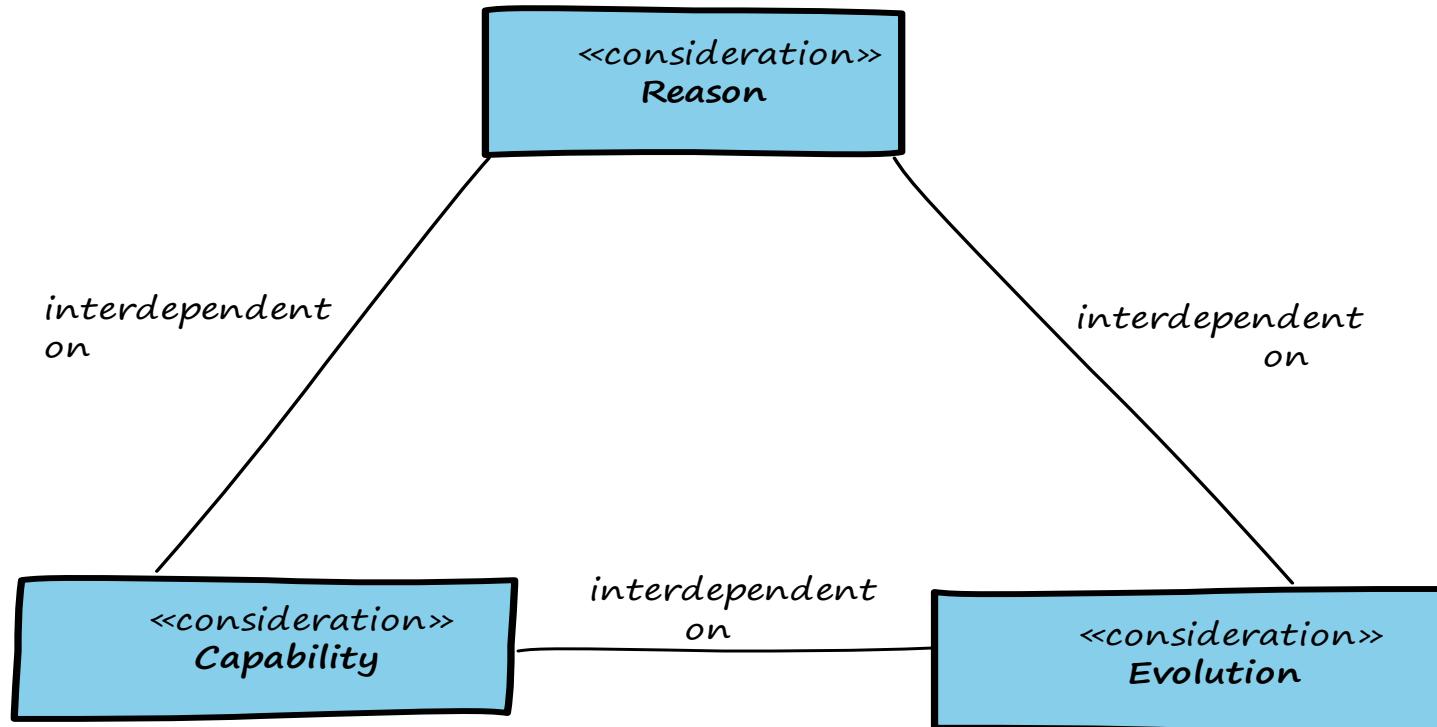
2. Reason – why MBSE?

- *Why* does the organisation want to implement MBSE?
- Knowing 'why' is essential
- 'Why' will depend on context
  – Different stakeholders have different needs
  – Different stakeholders want different benefits
- If you don't know why, then don't do it!
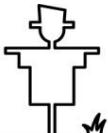
Realising MBSE
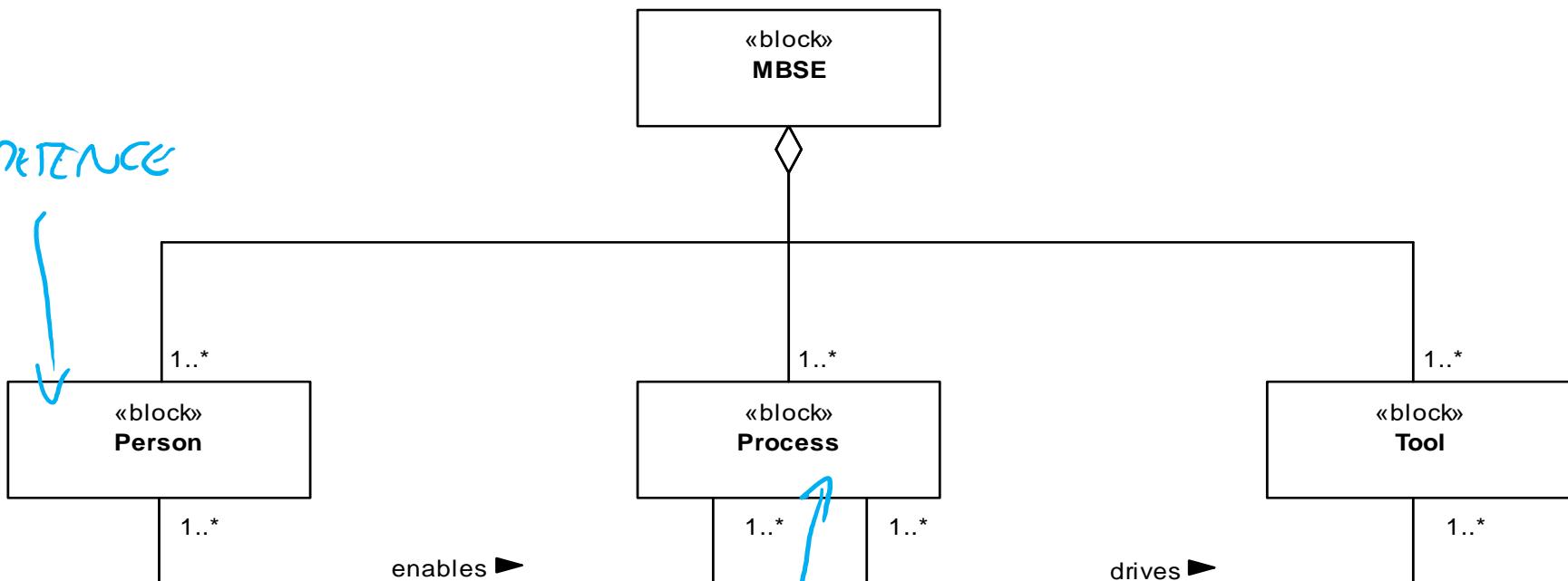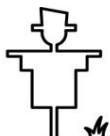
Realising MBSE Benefits
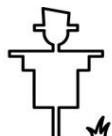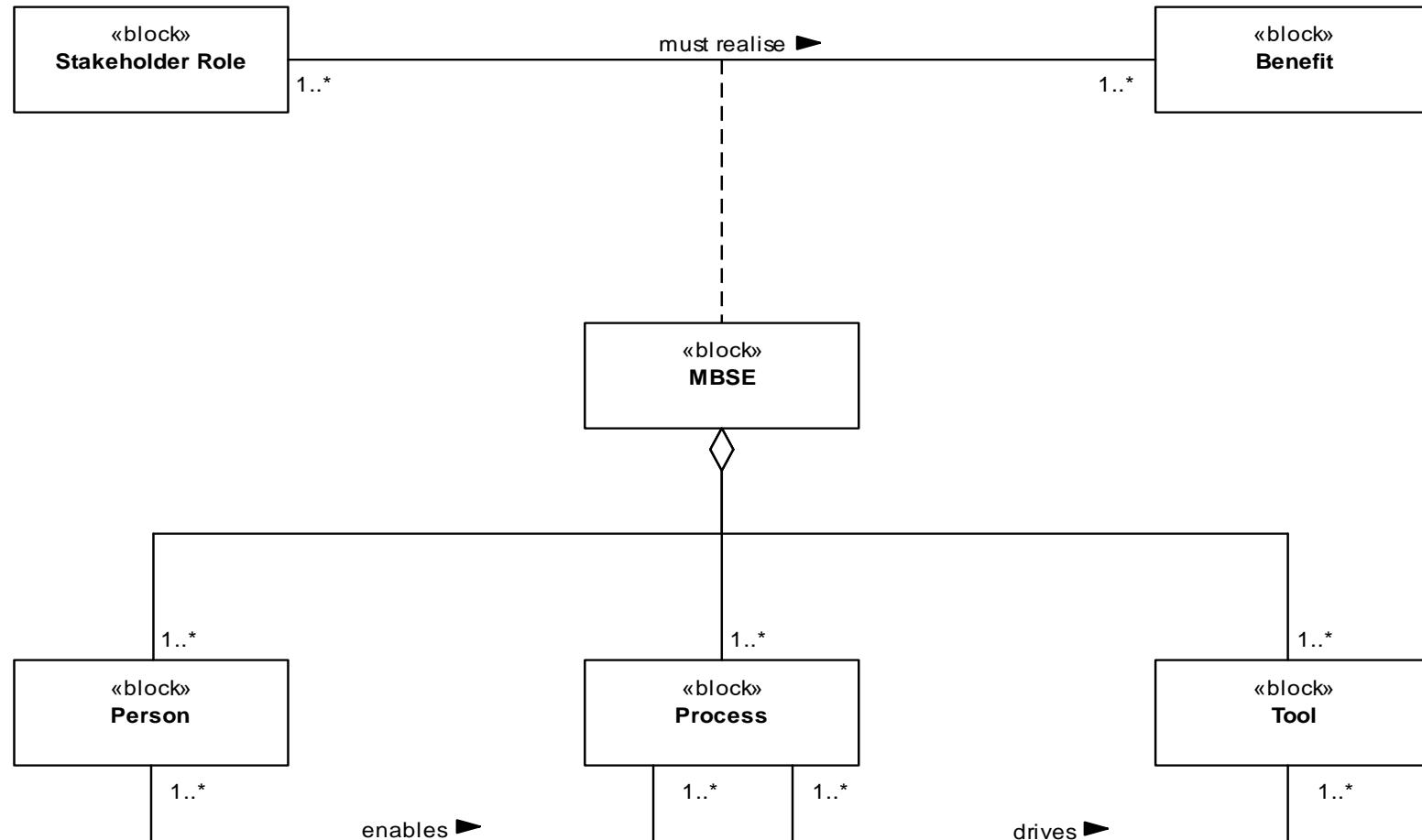
Typical MBSE Stakeholder Roles
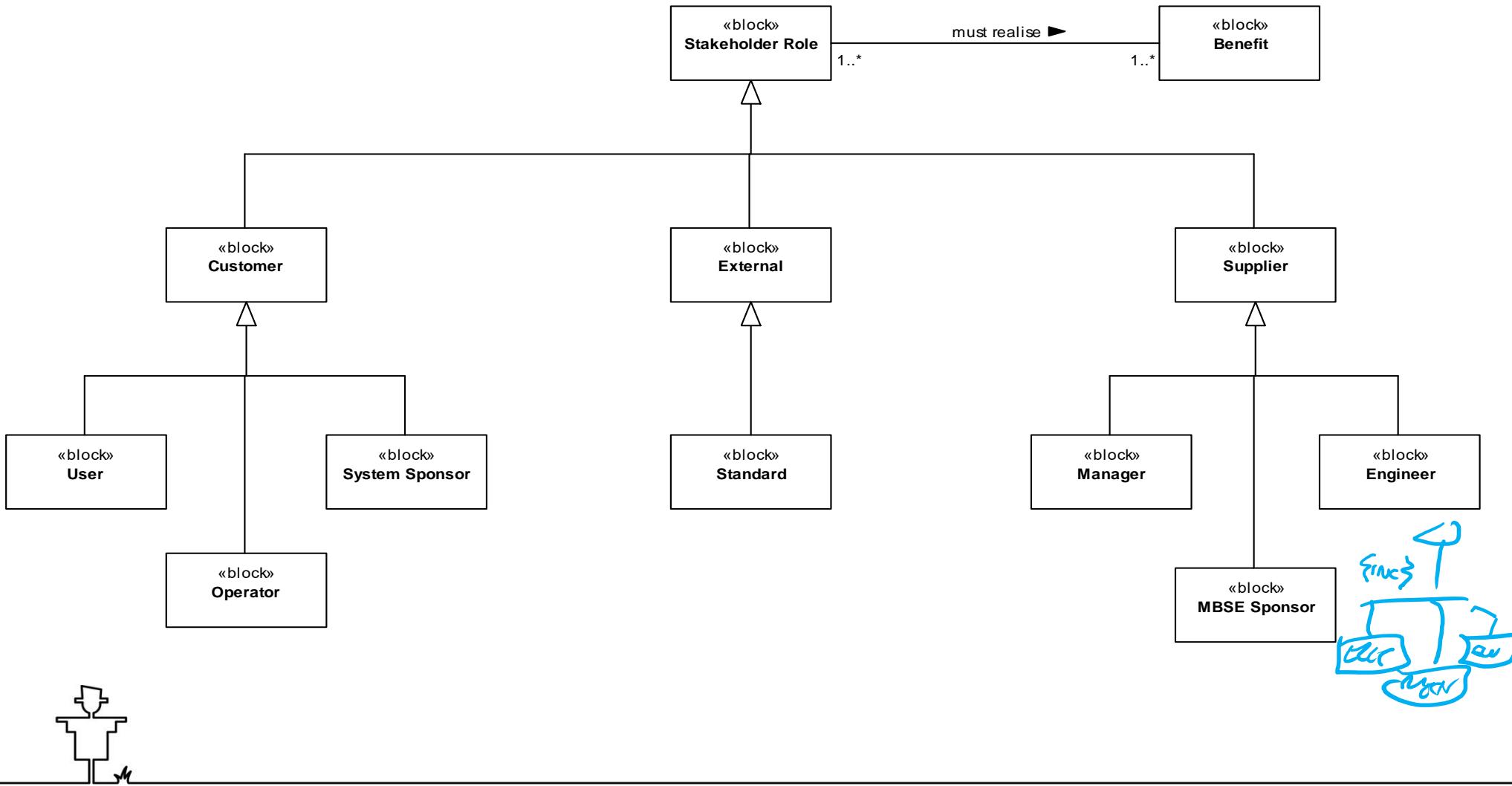
Engineer Context
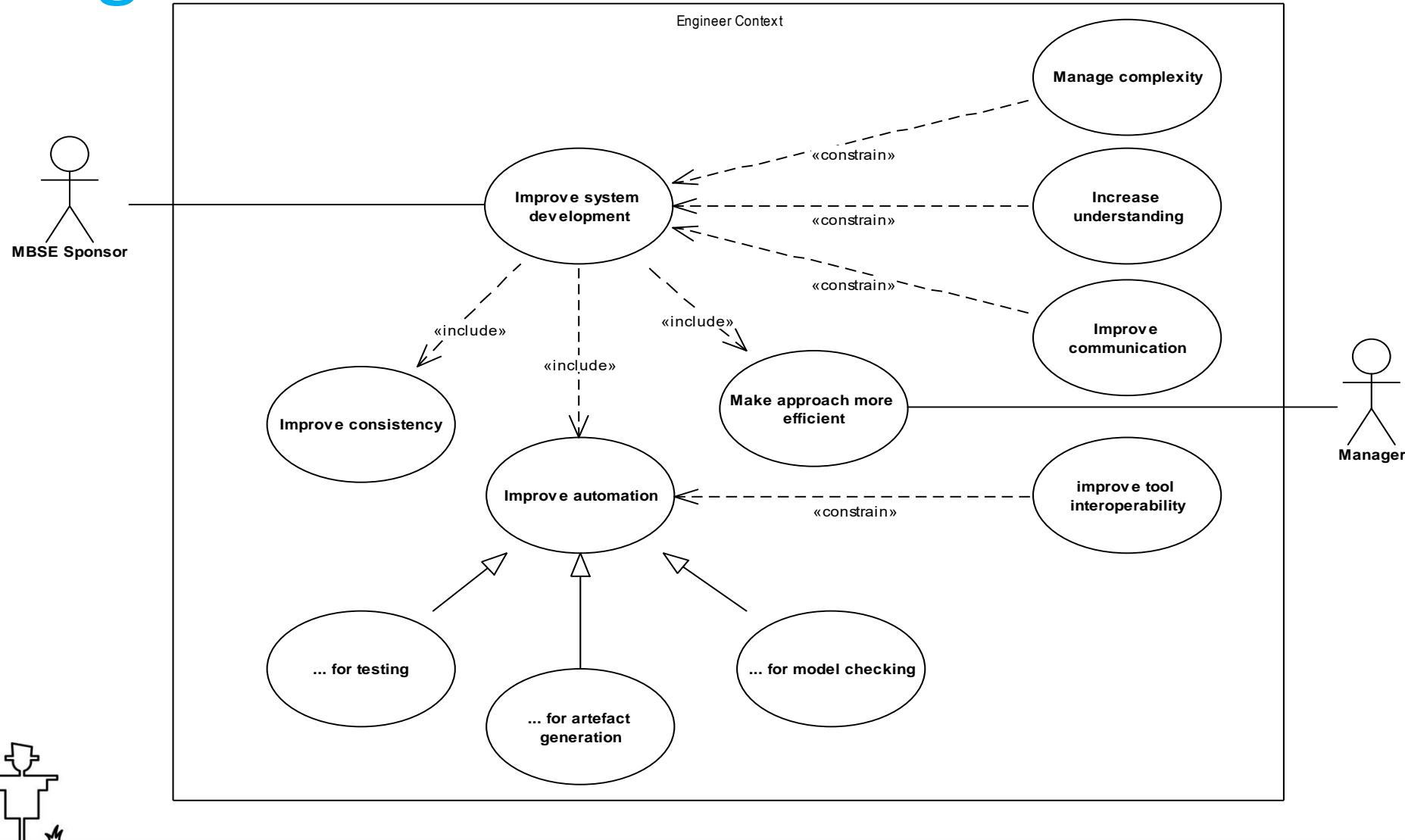
MBSE Sponsor Context
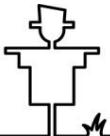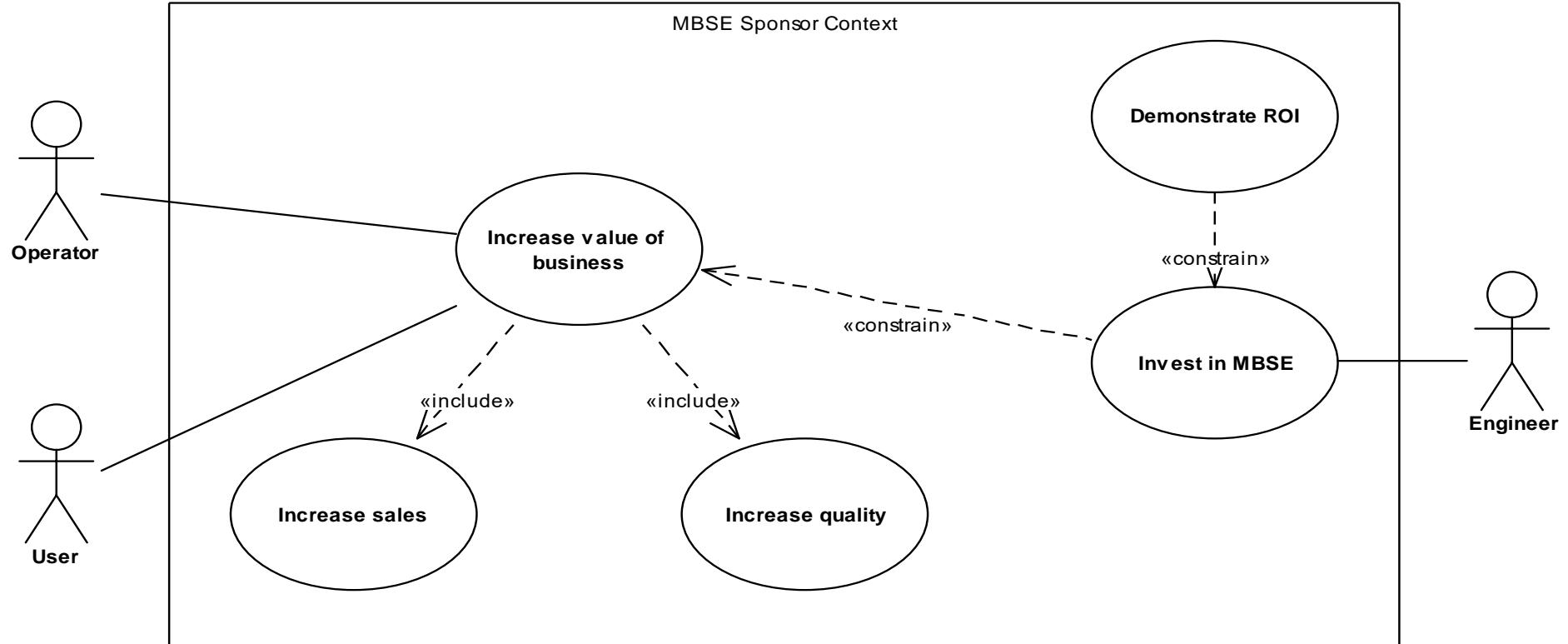
Identified Benefits of MBSE

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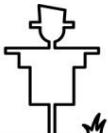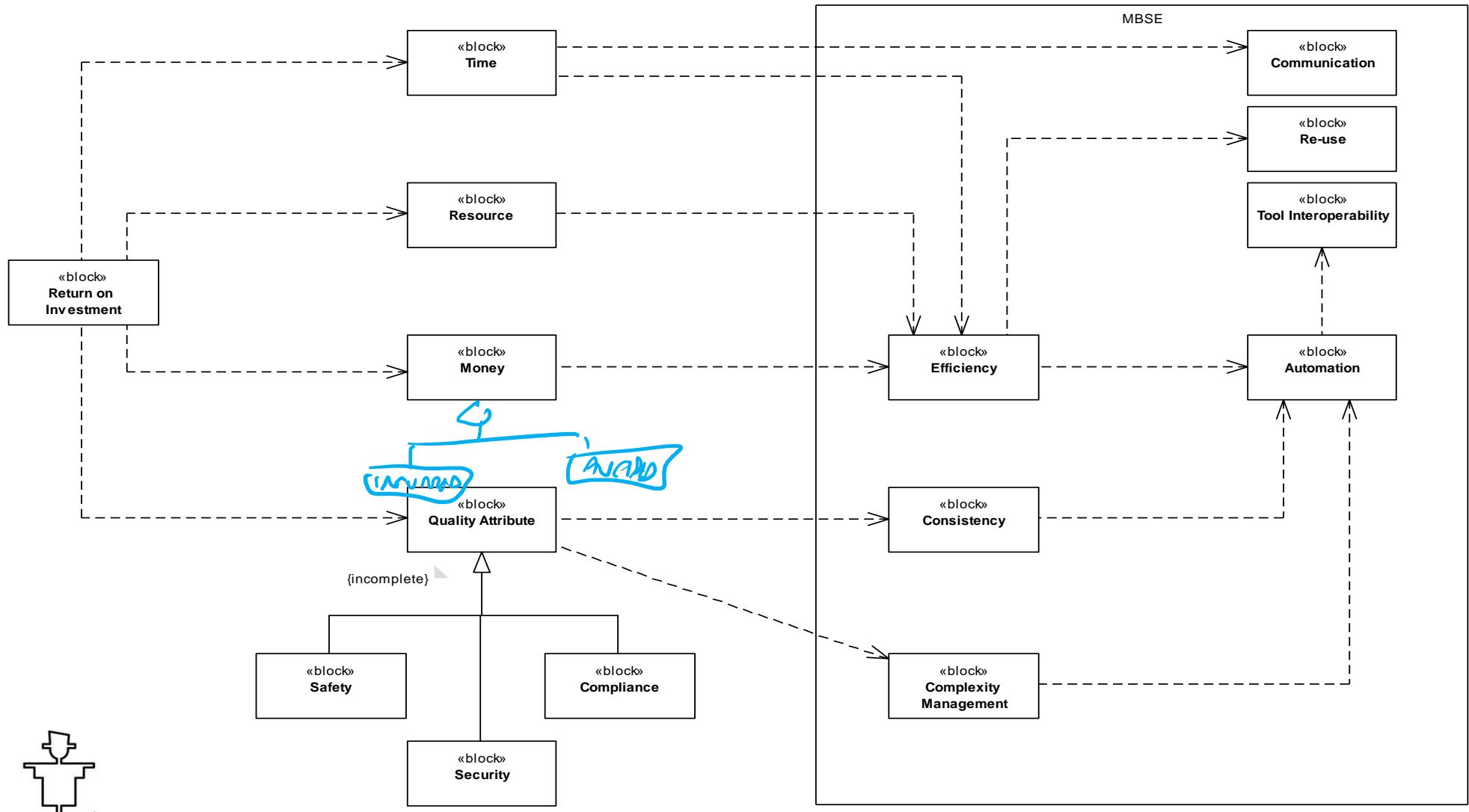
3. MBSE Evolution

- *How* does the organisation need to evolve in terms of its People, Processes and Tools to be able to do what they want to do in the future?

- In other words:
  - Where are you now?
  - Where do you want to be?

- See presentation number 1!
  - https://www.youtube.com/watch?v=bcvWf4pGTz4
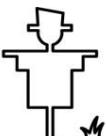
Complexity - Consider a car

Complexity evolves over last 50 years

- System elements and interfaces (mechanical, electrical, electronic, software, networks, etc)
- Constraints (standards, legislation, stakeholder expectations, safety, security, etc)
- Systems of systems (part of a wider, connected world)
- Complexity shift (technology, responsibility of system, etc)
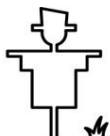
Evolution of MBSE

As the complexity of our Systems evolves over time….

….so must our approach to Systems Engineering….

….MBSE is the natural evolution of Systems Engineering
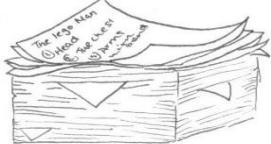
Stage 1:
Document-based
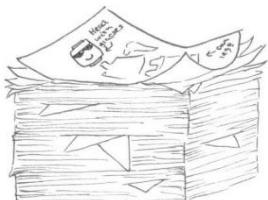
Stage 2:
Document-centric
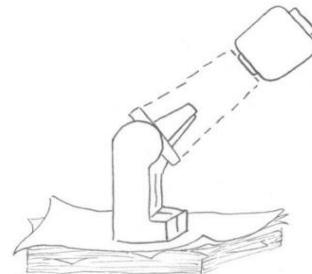
Stage 3:
Model-enhanced
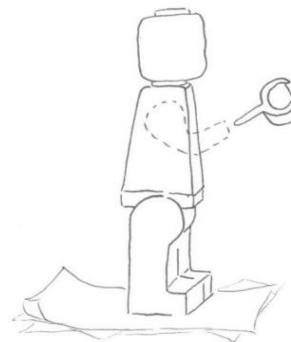
Stage 4:
Model-centric

Stage 5:
Model-based

4. MBSE Capability

- *What,* with regards to MBSE, can the organisation already do and what do they want to be able to do in the future?

- In other words:
  - Where are you now?
  - Where do you want to be?

- See Presentation number 2!
  - https://www.youtube.com/watch?v=rctS5cpqjsc
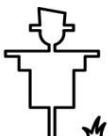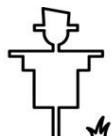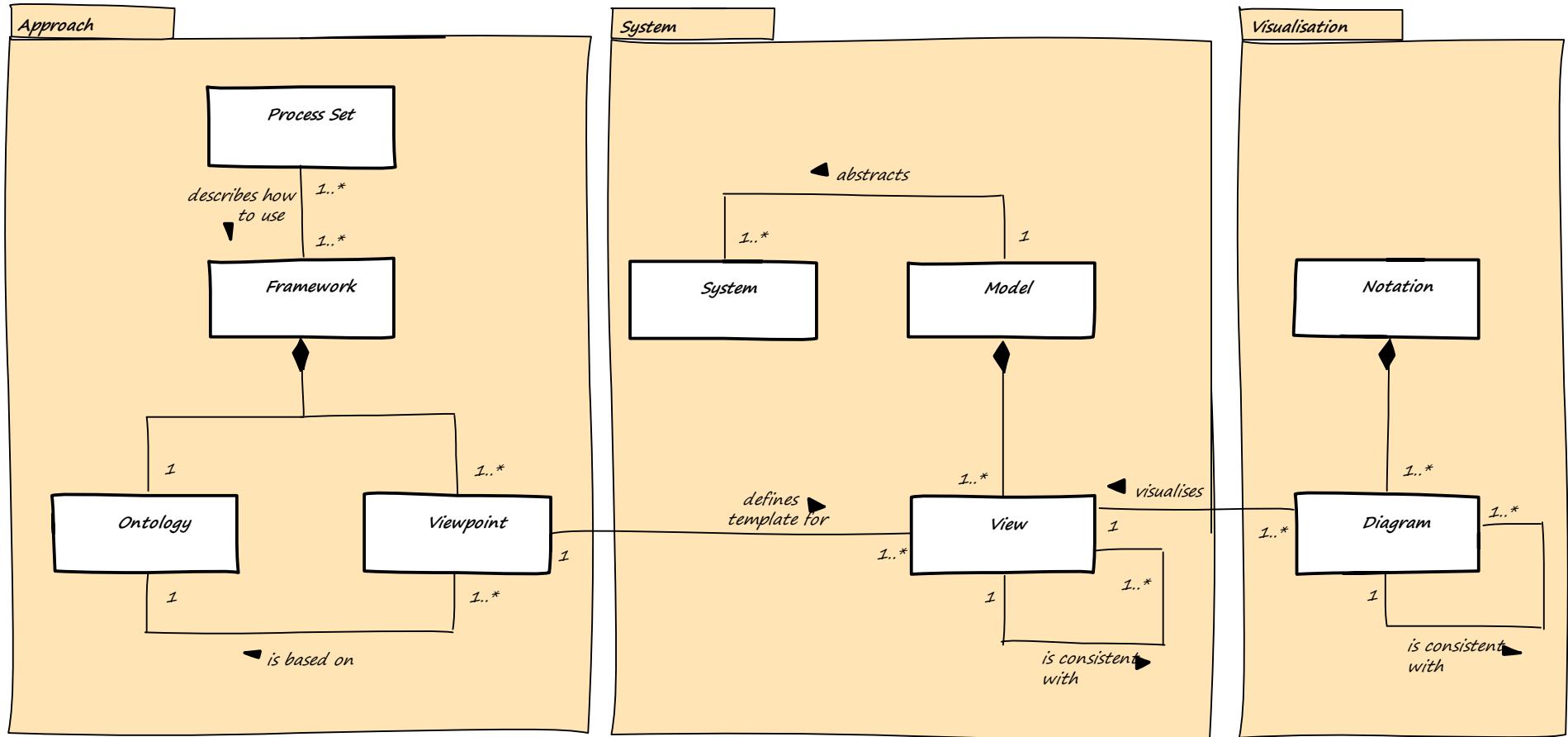
MBSE in a Slide

MBSE in a Slide (and a bit)
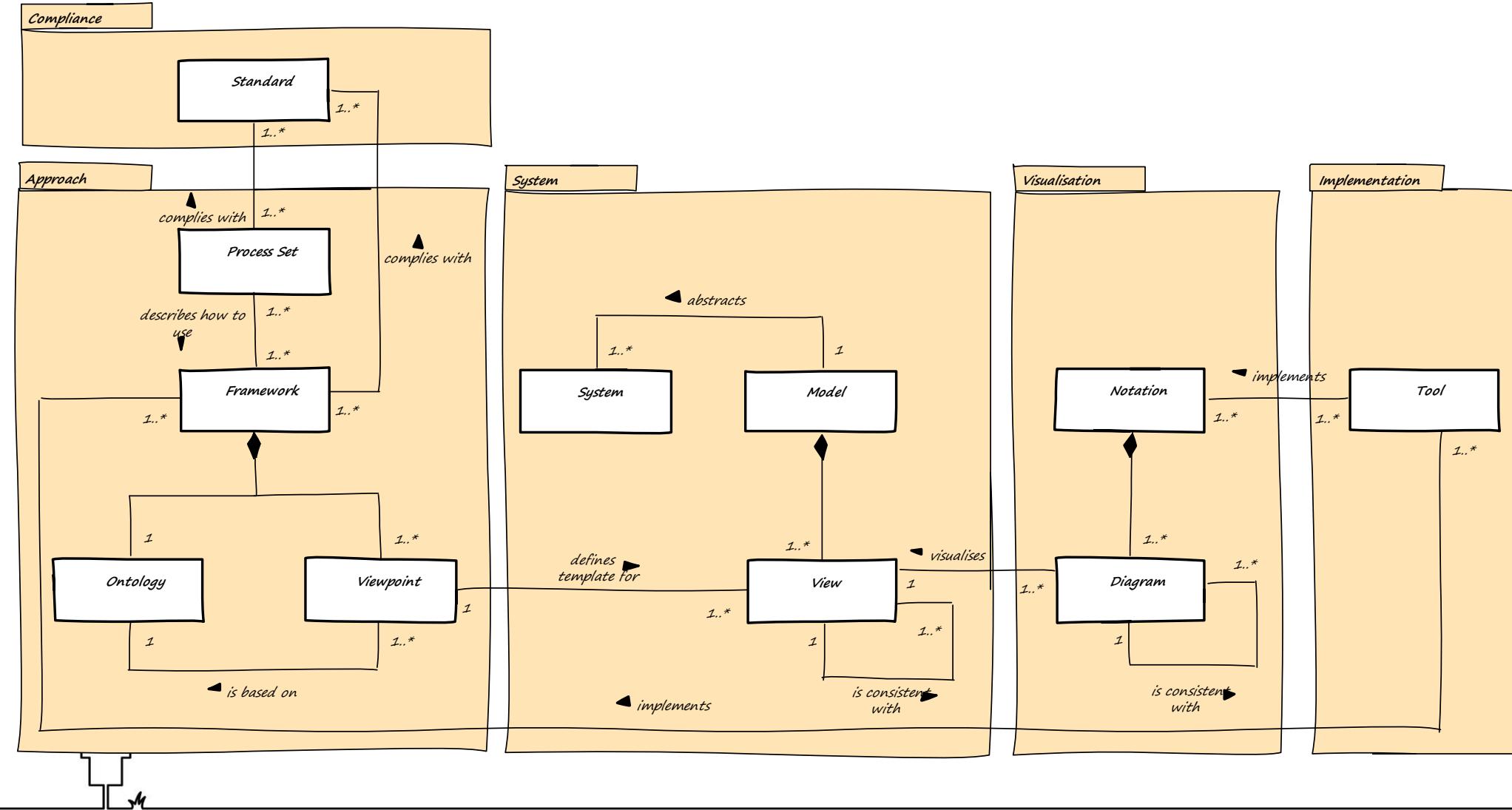
MBSE in a Slide

The thing we are trying to realise

Single source of truth

Spoken language (SysML, text, maths, etc)

How we use the Model (agile, iterative, linear, etc)

Blueprint for the Model

Approach

Process Set

describes how to use

1..*

1..*

Framework

1

1..*

Ontology

Viewpoint

1

1

1..*

is based on

System

abstracts

1..*

1

System

Model

defines template for

1..*

1

View

1..*

1

1..*

is consistent with

visualises

Visualisation

Notation

1..*

1

Diagram

1..*

1..*

1

is consistent with

Domain-specific language

Templates for Views

Focused set of information

How we communicate with stakeholders

MBSE in a Slide (and a bit)

How we demonstrate compliance (standards, legislation, certification, etc)

How we implement the model (SysML tools, mathematical tools, simulations, CAD, management tools, etc

Compliance

Standard

Approach

complies with 1..*
1..*

Process Set

complies with

describes how to use 1..*
1..*

Framework

1..* 1..*

1

Ontology

1 1..*

Viewpoint

is based on

1 1..*

System

abstracts

1..* 1

System   Model

1..*

defines template for

View

1 1..* 1..*

implements

is consistent with

Visualisation

visualises

Notation

1..*

1..*

Diagram

1 1..*

is consistent with

Implementation

implements 1..*

Tool

1..*

1..*
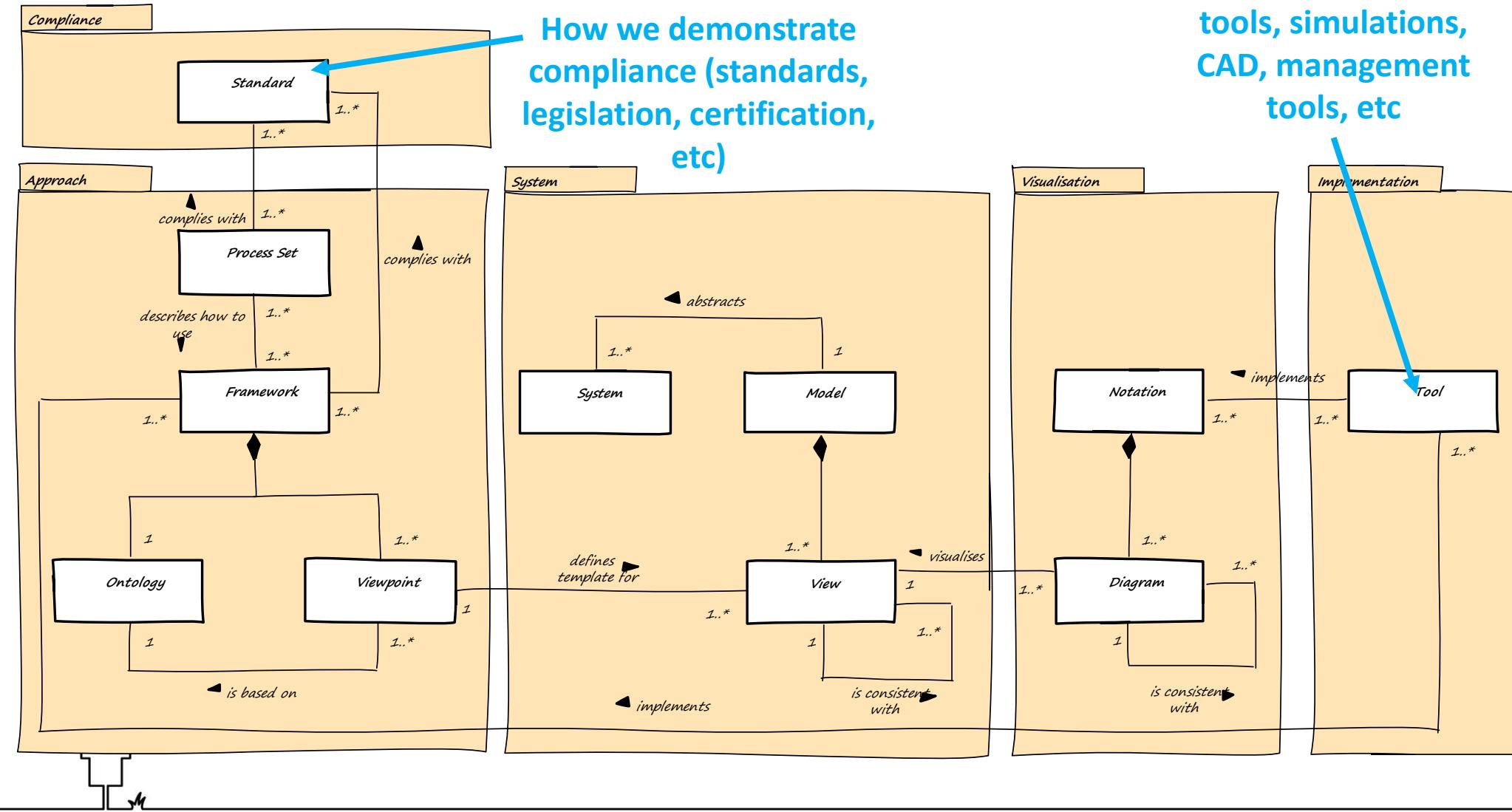
5. Some techniques

- This is all well and good, but….

How on earth do we do this?

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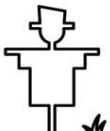
Reason - Why do you want MBSE?
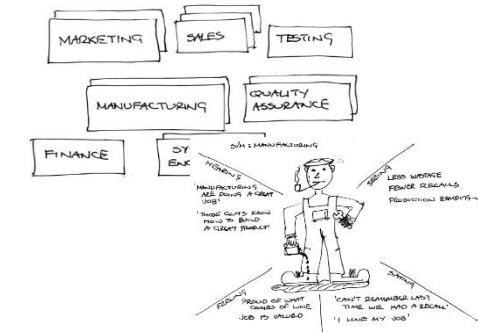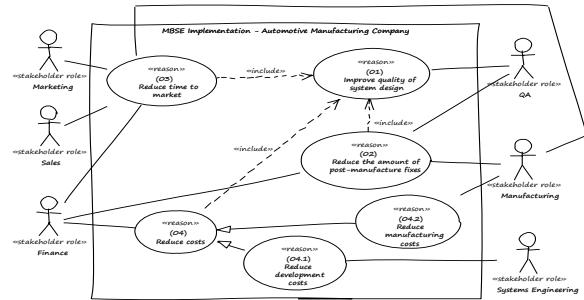
Context modelling
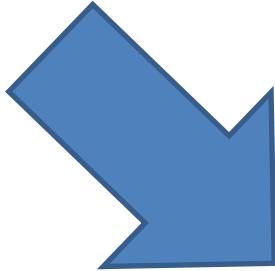
TeamStorming

Reason

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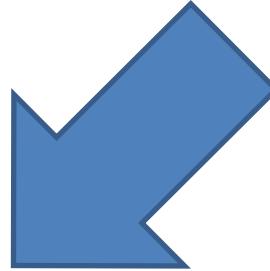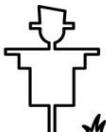
TeamStorming – How it Works

- Can be run at two levels:
  - Over a day or more – standard TeamStorming
  - Over a few hours – TeamStorming Lite
- TeamStorming consists of a number of Games
  - Group of 12 to 40 people
 - Answer a specific key question
- In this case:

   ***Why do we want to implement MBSE in our business?***
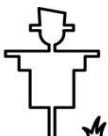
The Big Picture
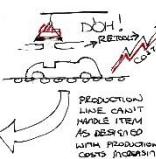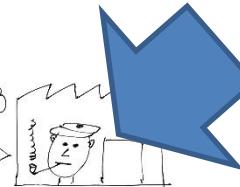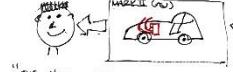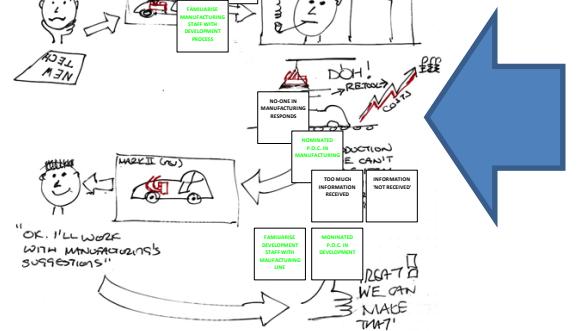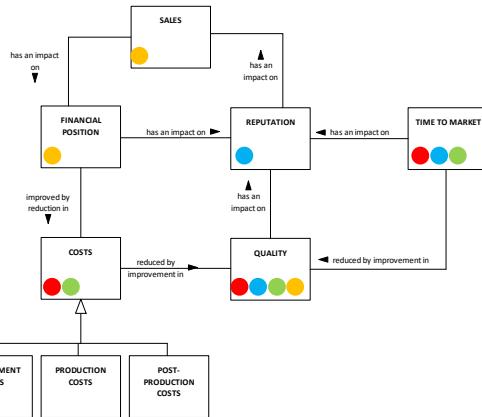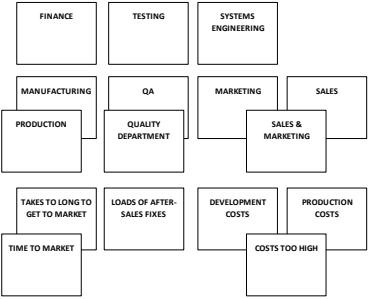
Capturing Capability & Evolution – RAVEnS
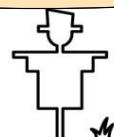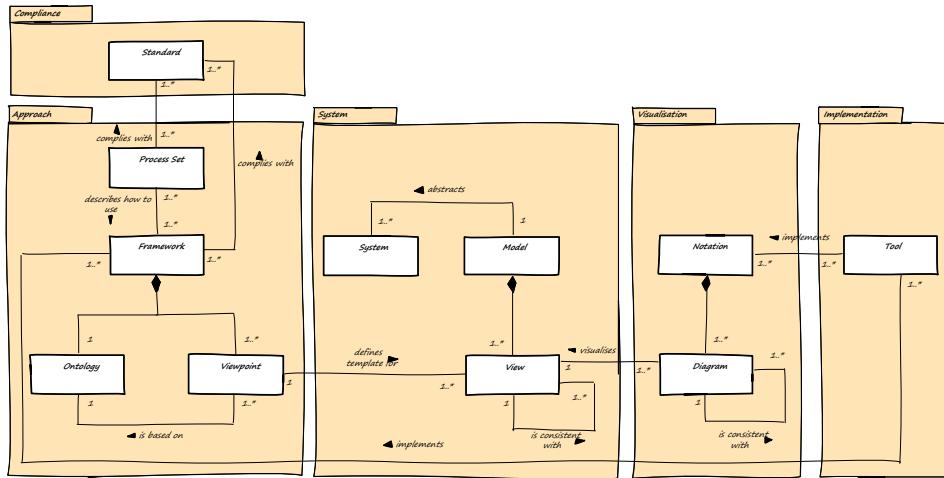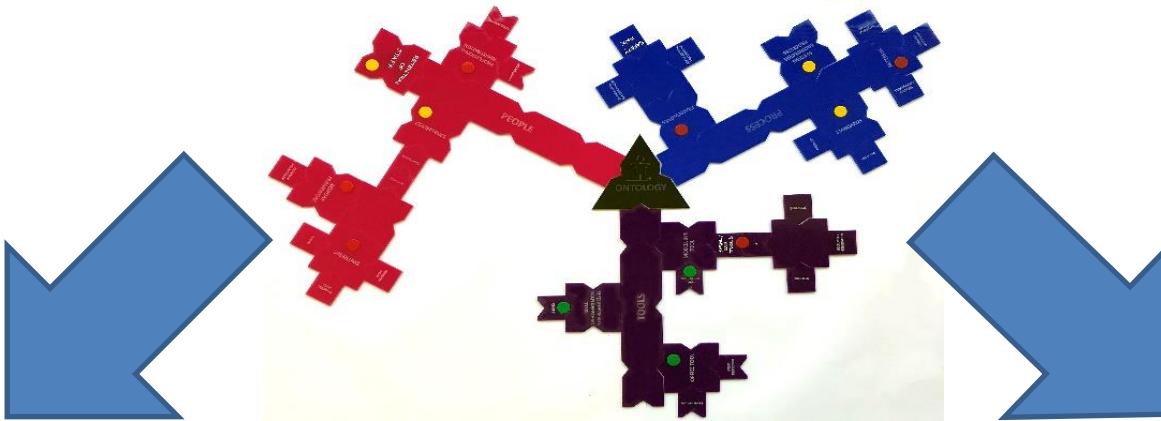
Capability
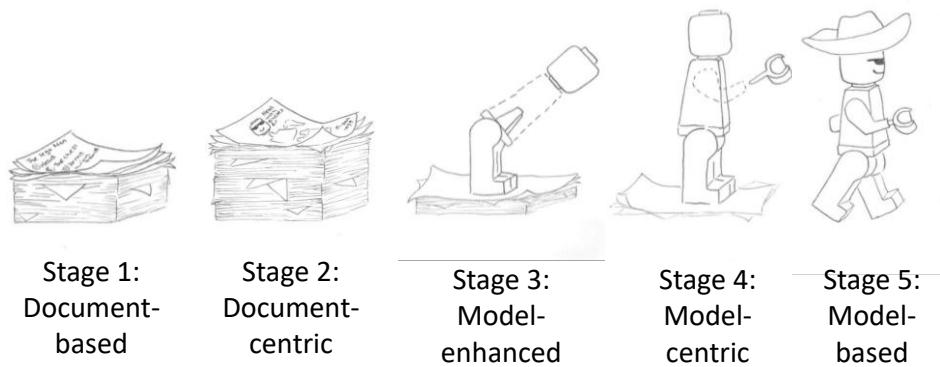
Evolution

Stage 1: Document-based

Stage 2: Document-centric

Stage 3: Model-enhanced

Stage 4: Model-centric

Stage 5: Model-based

Applying RAVEnS

- Review and Visualization of Enabling Strategy
- Used to determine current & future
  - Capability
  - Evolution
- Determine the scope
  - Group, project, organisation?
  - Identify key stakeholders
- Consider
 - People
  - Process
  - Tools

Overview – Current Capability
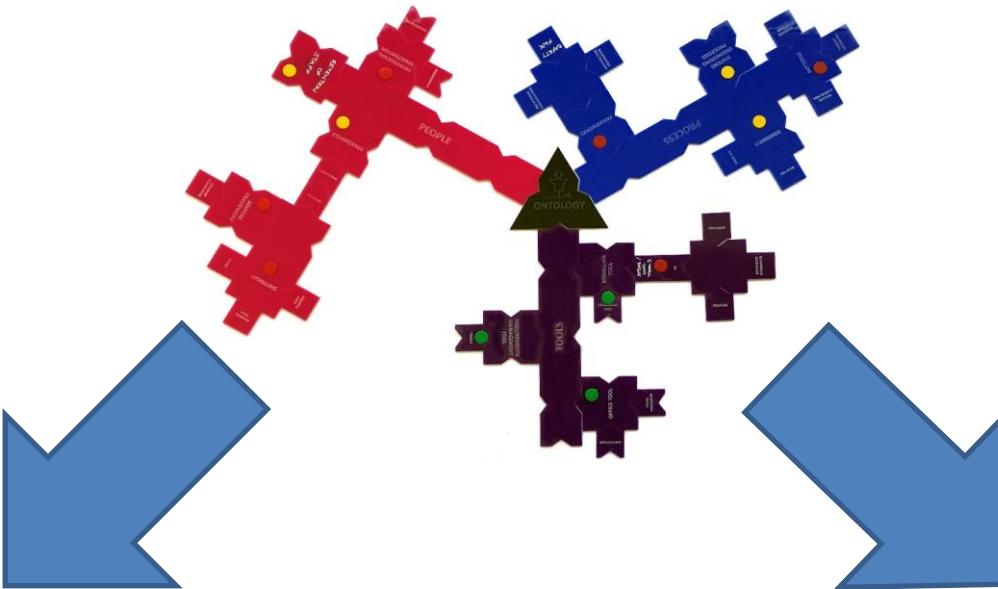
Red = no capability
Yellow = some capability
Green = capability

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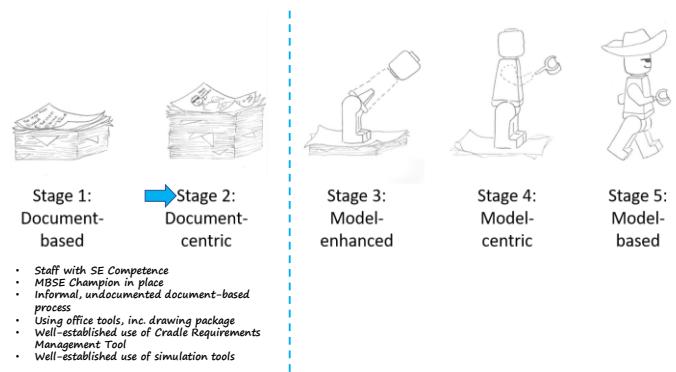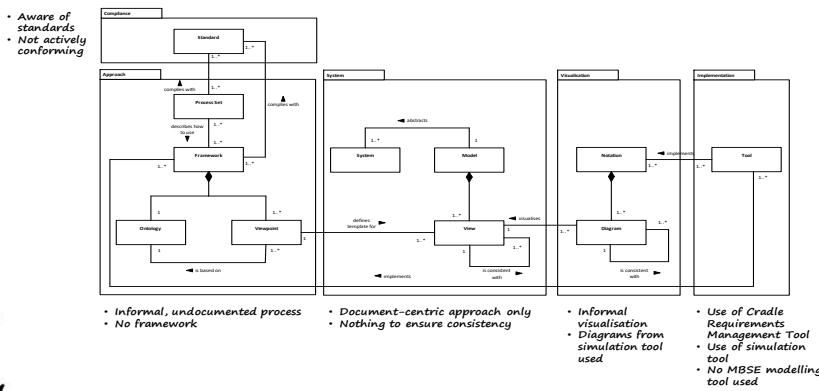
Overview – Desired Capability

White = not considered
Blue = considered
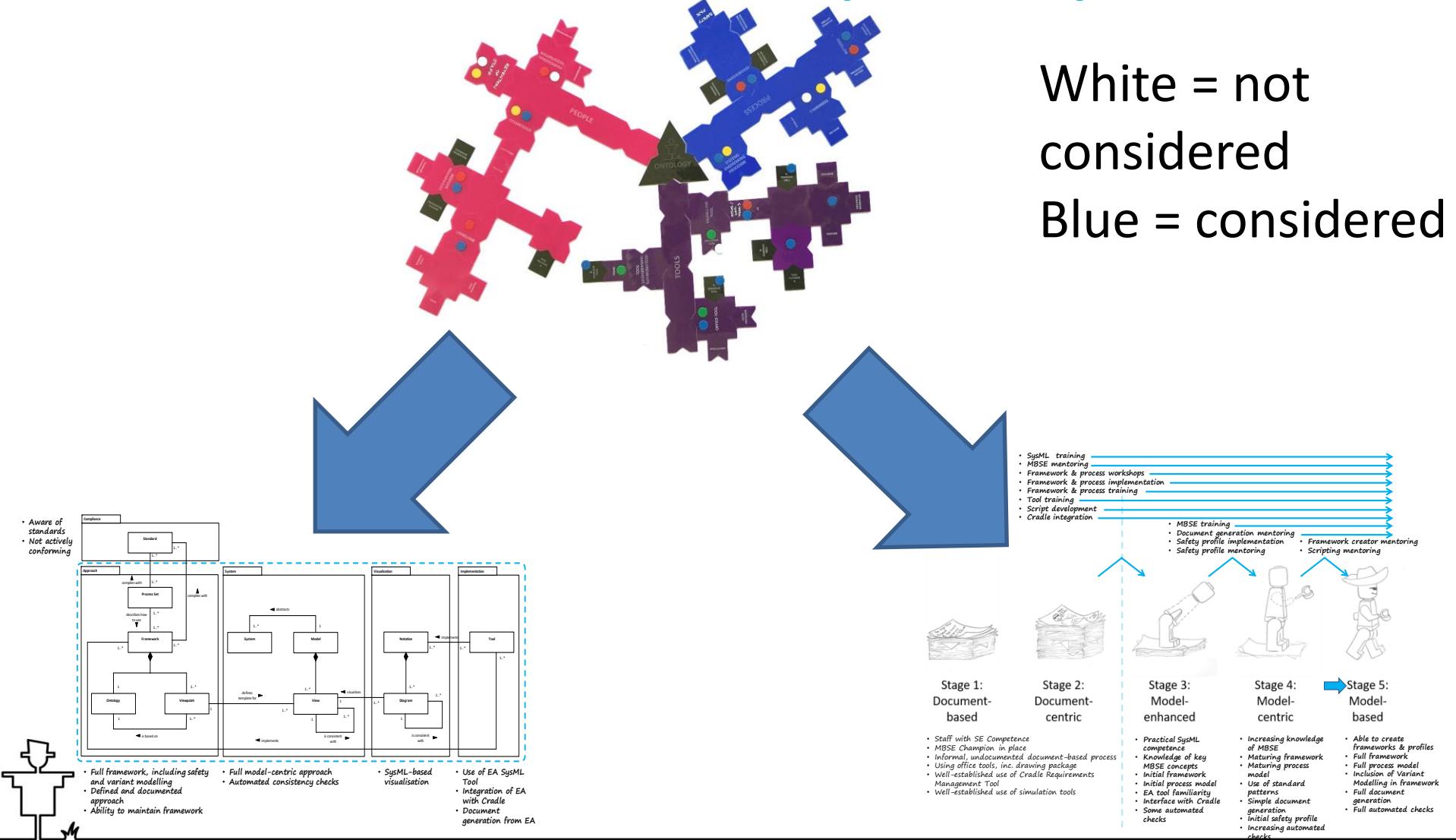
Defining the strategy - the Evolutionary Path

- Information captured on Reason, Capability and Evolution (via Worksheets) is brought together
  - Forms Evolutionary Path
- Capture in 'MBSE Implementation Strategy'
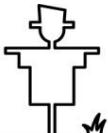
The Evolutionary Path
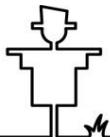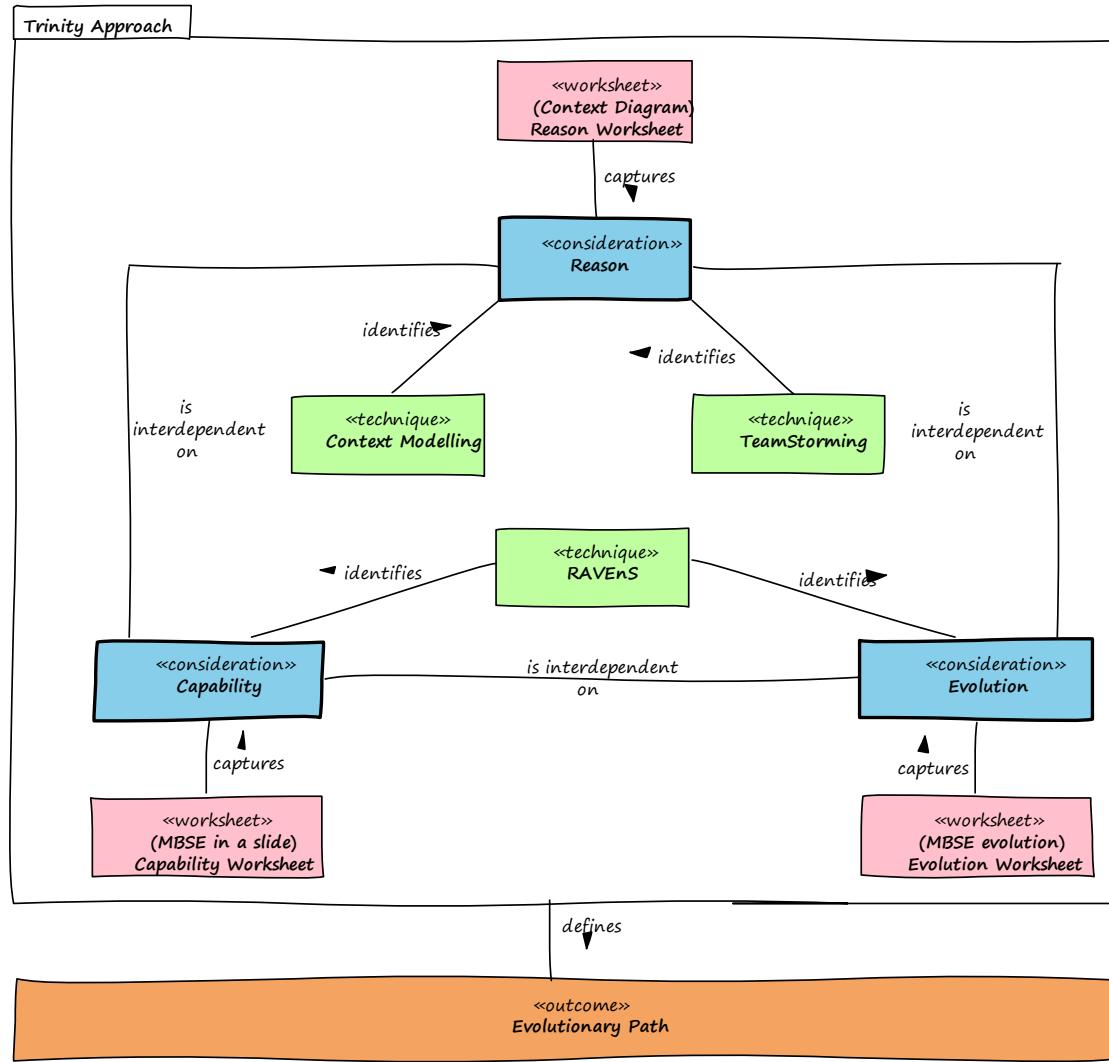
Evolutionary Path – Timescale

| Starting Stage: Stage 2: Document-centric			
Target Stage	**Timescale (from start)**	**Capabilities to Achieve in Stage**	**Activities Needed to Achieve Stage & Capabilities**
Stage 3: Model-enhanced	3 months	▪ Practical SysML competence ▪ Knowledge of key MBSE concepts ▪ Initial framework ▪ Initial process model ▪ EA tool familiarity ▪ Interface with Cradle ▪ Some automated checks	▪ SysML training ▪ MBSE mentoring ▪ Framework & process workshops ▪ Framework & process implementation ▪ Framework & process training ▪ Tool training ▪ Script development ▪ Cradle integration
Stage 4: Model-centric	6 – 9 months	▪ Increasing knowledge of MBSE ▪ Maturing framework ▪ Maturing process model ▪ Use of standard patterns ▪ Simple document generation ▪ Initial safety profile ▪ Increasing automated checks	▪ As for Stage 2 to 3 plus: ▪ MBSE training ▪ Document generation mentoring ▪ Safety profile implementation ▪ Safety profile mentoring
Stage 5: Model-based	12 – 18 months	▪ Able to create frameworks & profiles ▪ Full framework ▪ Full process model ▪ Inclusion of Variant Modelling in framework ▪ Full document generation ▪ Full automated checks	▪ As for Stage 2 to 3 plus: ▪ MBSE training ▪ Document generation mentoring ▪ Framework creator mentoring ▪ Scripting mentoring
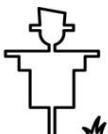
Evolutionary Path – Meeting the Reasons

| ID	Reason	Met by (Capabilities & Activities)
0	Implement MBSE	*Met by 1 to 6*
1	Develop MBSE competence of staff	• Knowledge of key MBSE concepts • Increasing knowledge of MBSE • MBSE training • MBSE mentoring
1.1	Develop staff's competence with SysML	• Practical SysML competence • SysML training
2	Carry out model-based requirements engineering	• Initial framework • Initial process model • Interface with Cradle • Framework & process workshops • Framework & process implementation • Framework & process training • Cradle integration
2.1	Conform to industry best-practice	• Initial to Full framework • Initial to Full process model • Use of standard patterns
3	Use Sparx EA tool	• EA tool familiarity • Able to create frameworks & profiles • Tool training • Framework & process implementation • Document generation mentoring • Scripting mentoring • Framework creator mentoring
4	Reduce time to market	• Inclusion of Variant Modelling in framework • Initial safety profile • Safety profile mentoring
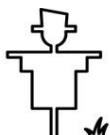
6. Summary

- Trinity has three Considerations
  - Reason
  - Capability
  - Evolution
- Explored using different techniques
- Results feed into Evolutionary Path
  - Part of the MBSE Implementation Strategy

Shameless self-promotion
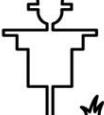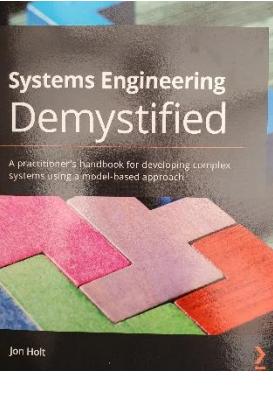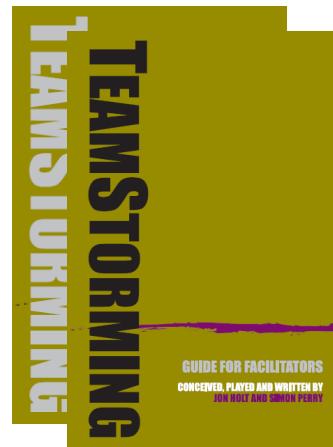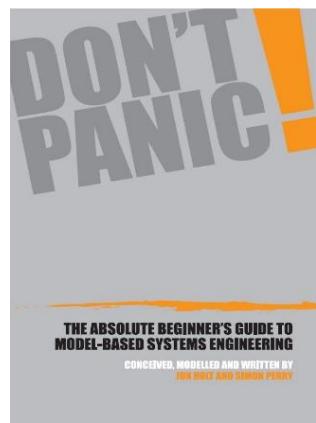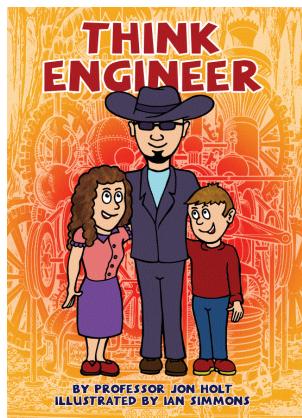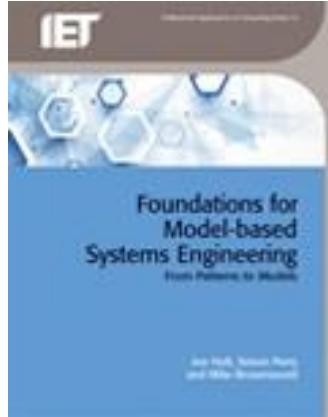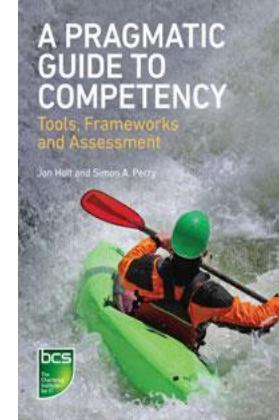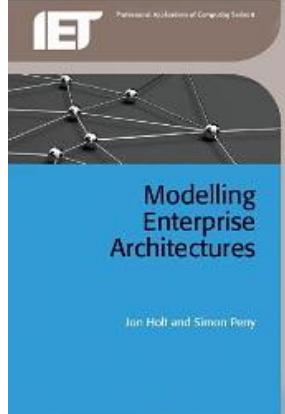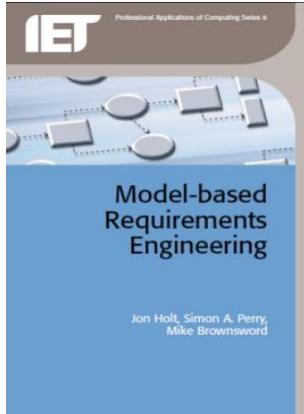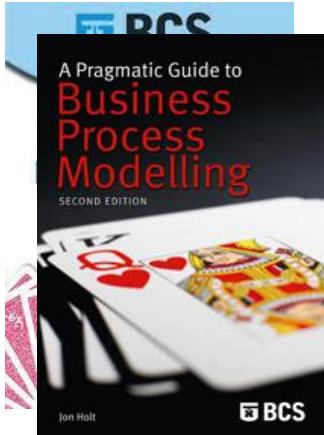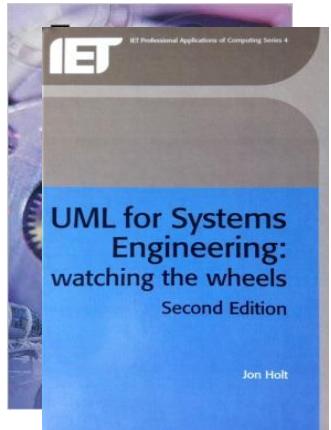
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