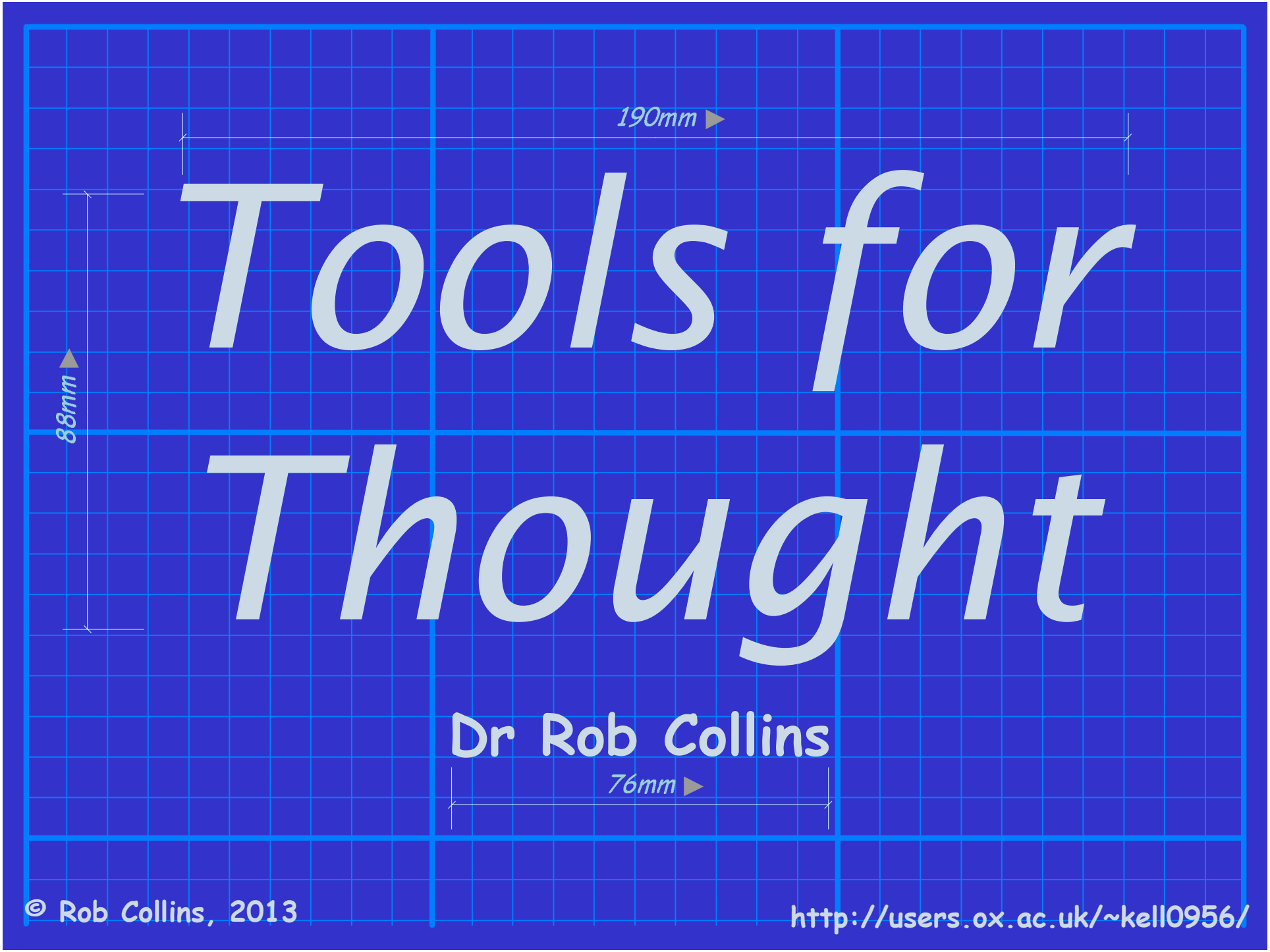

190mm
88mm
Tools for Thought
Dr Rob Collins
76mm
© Rob Collins, 2013
http://users.ox.ac.uk/~kell0956/

Tools to Enable ..

- Collaboration and Consensus building between diverse teams
- Documentation of Rationale and Explanation
- Alignment from Enterprise Strategy to Systems Design

Proof!

To show:

$\mu.X.F(X) = F(\mu.X.F(X))$

Establish an ordering relationship:

$(A,S) \subseteq (B,T) = (A=B \wedge S \subseteq T)$

This is a partial ordering in the sense that:

L1: $P \subseteq P$

L2: $P \subseteq Q \wedge Q \subseteq P \Rightarrow P = Q$

L3: $P \subseteq Q \wedge Q \subseteq R \Rightarrow P \subseteq R$

Define a chain in a partial ordering:

$\{ P_0, P_1, P_2, \ldots \}$ such that $P_i \subseteq P_{i+1}$ for all i

Define the limit (least upper bound) of each chain …

$\sqcup P_i = (\alpha P_0, \cup \text{traces}(P_i))$

..Is a complete partial ordering iff

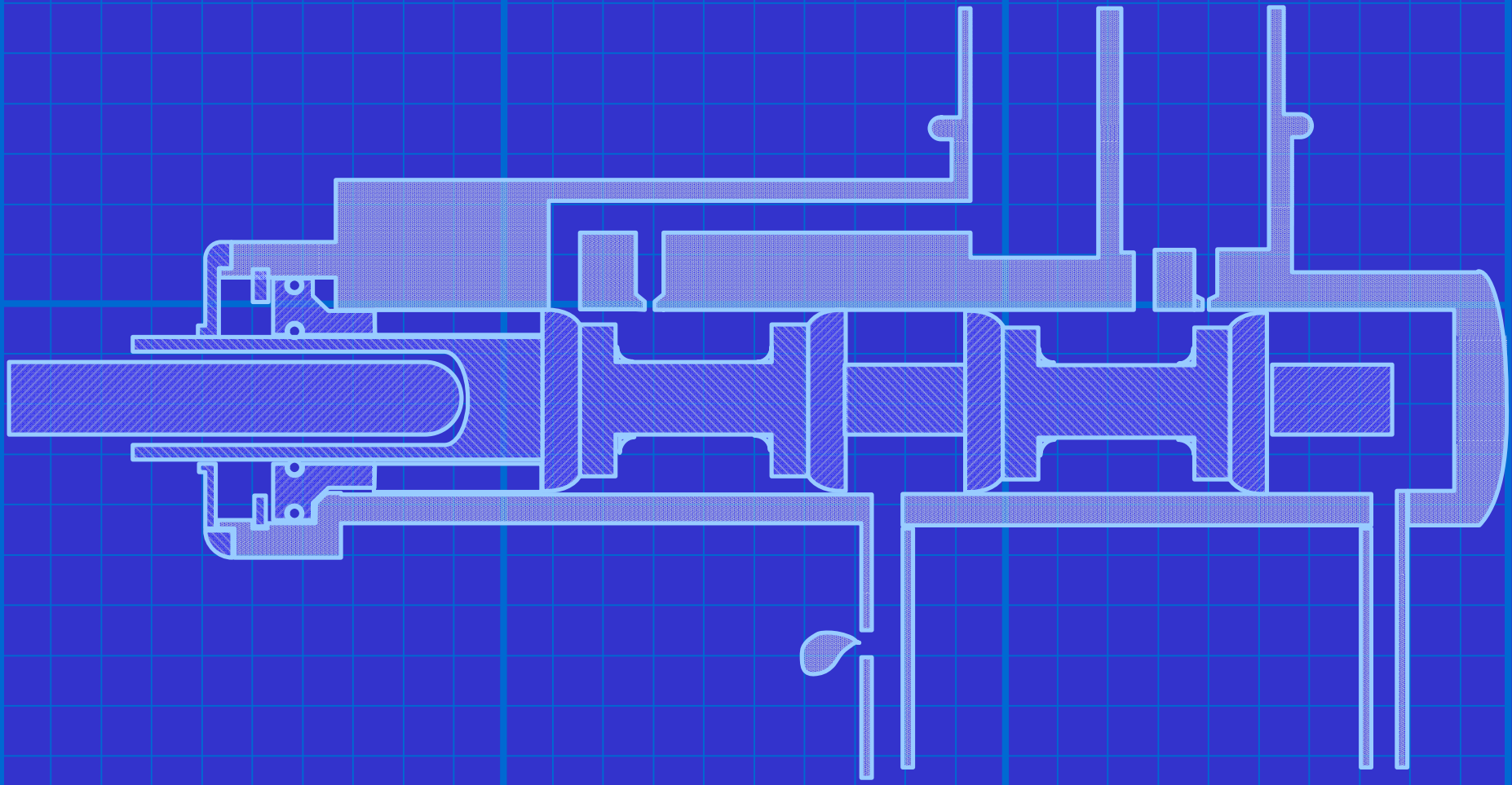
L4: $STOP_A \subseteq P$, provided $\alpha P = A$

L5: $P_i \subseteq \sqcup P_i$

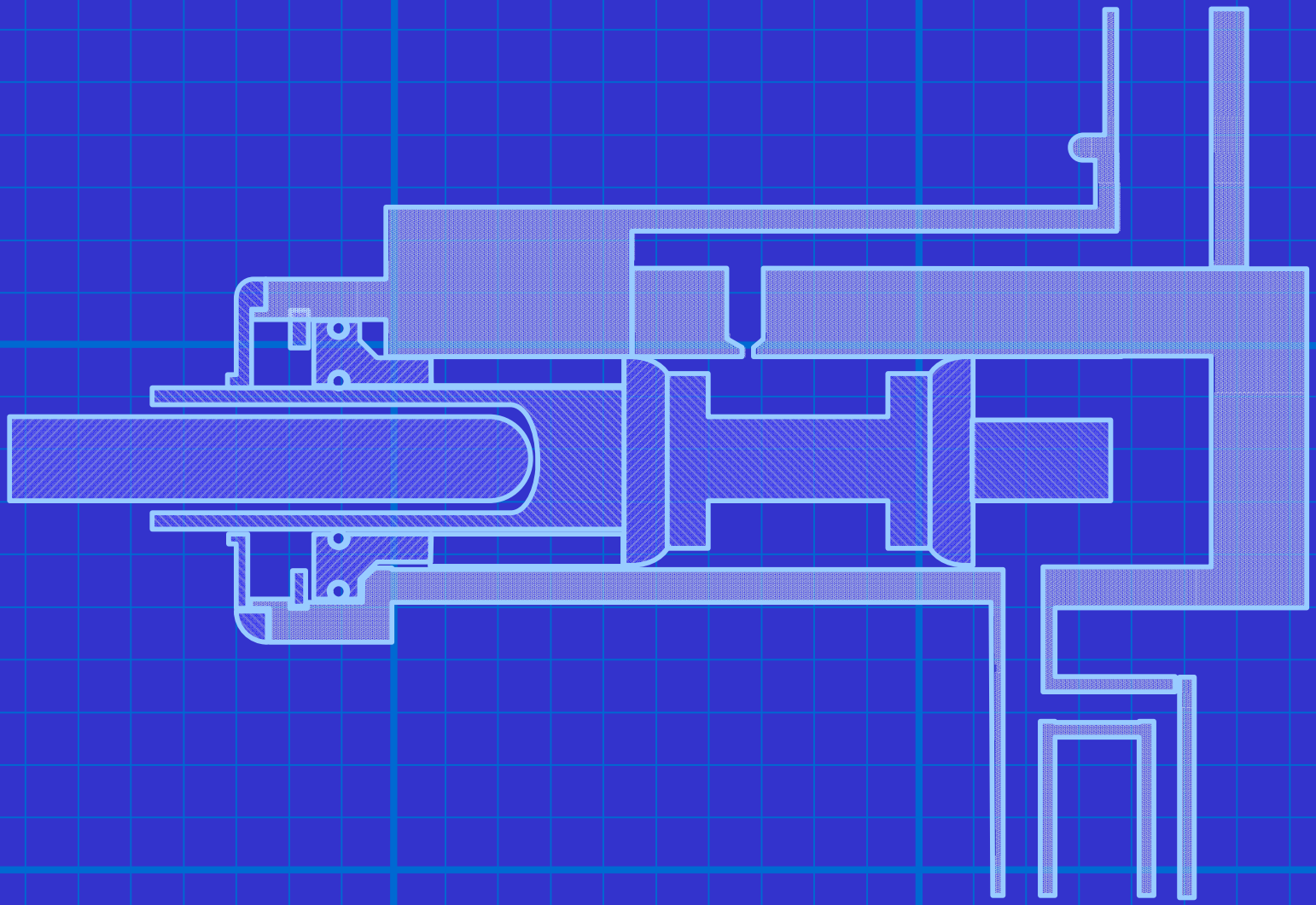
L6: $(\forall i \geq 0, P_i \subseteq Q) \Rightarrow (\sqcup P_i) \subseteq Q$


DPL 292T

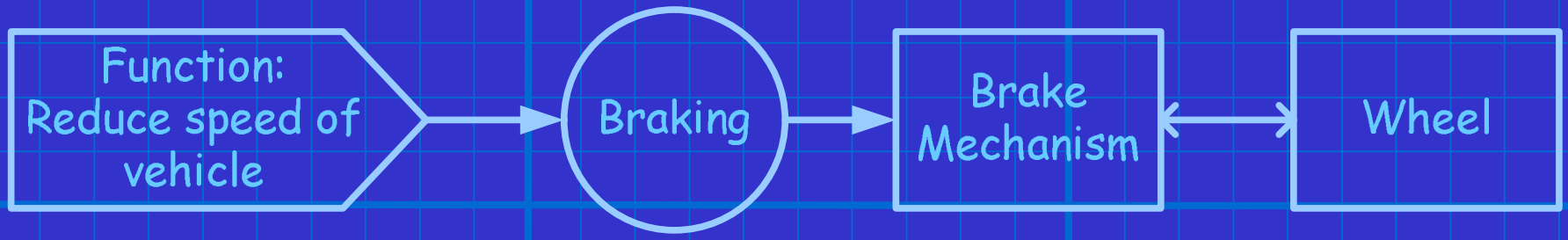
Over Engineering



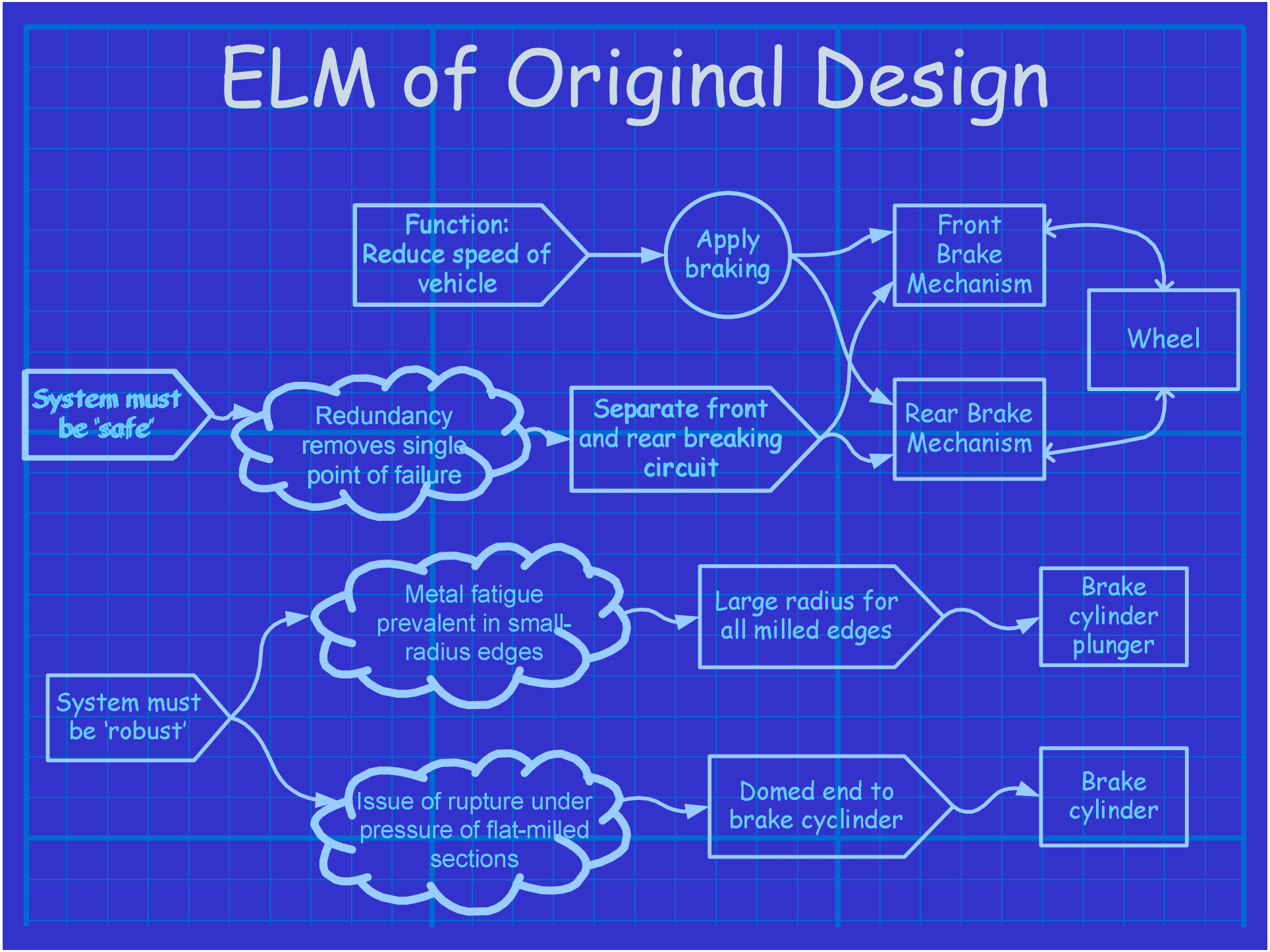
Lean Engineering!



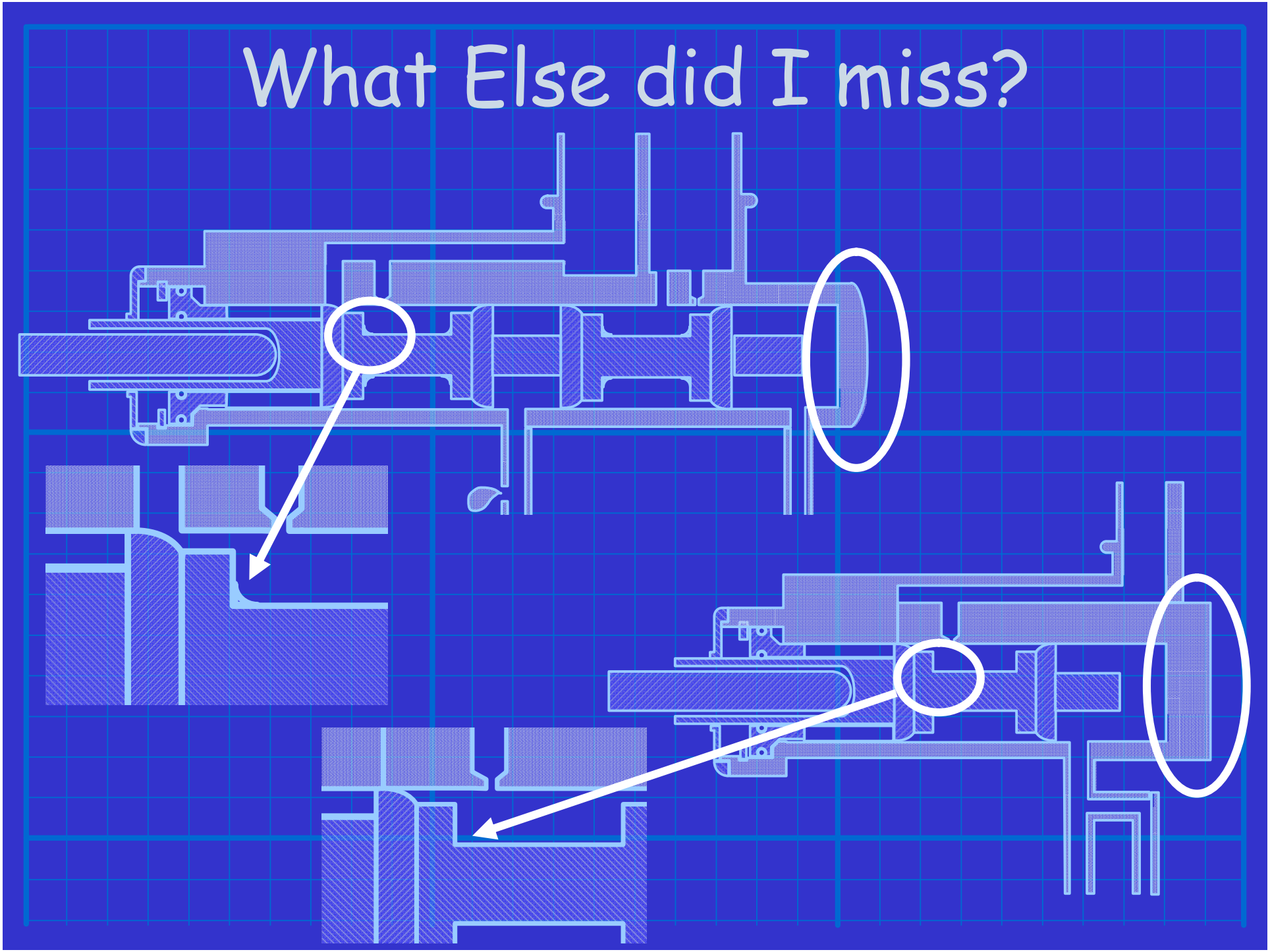
ELM of Original Design



ELM of Original Design



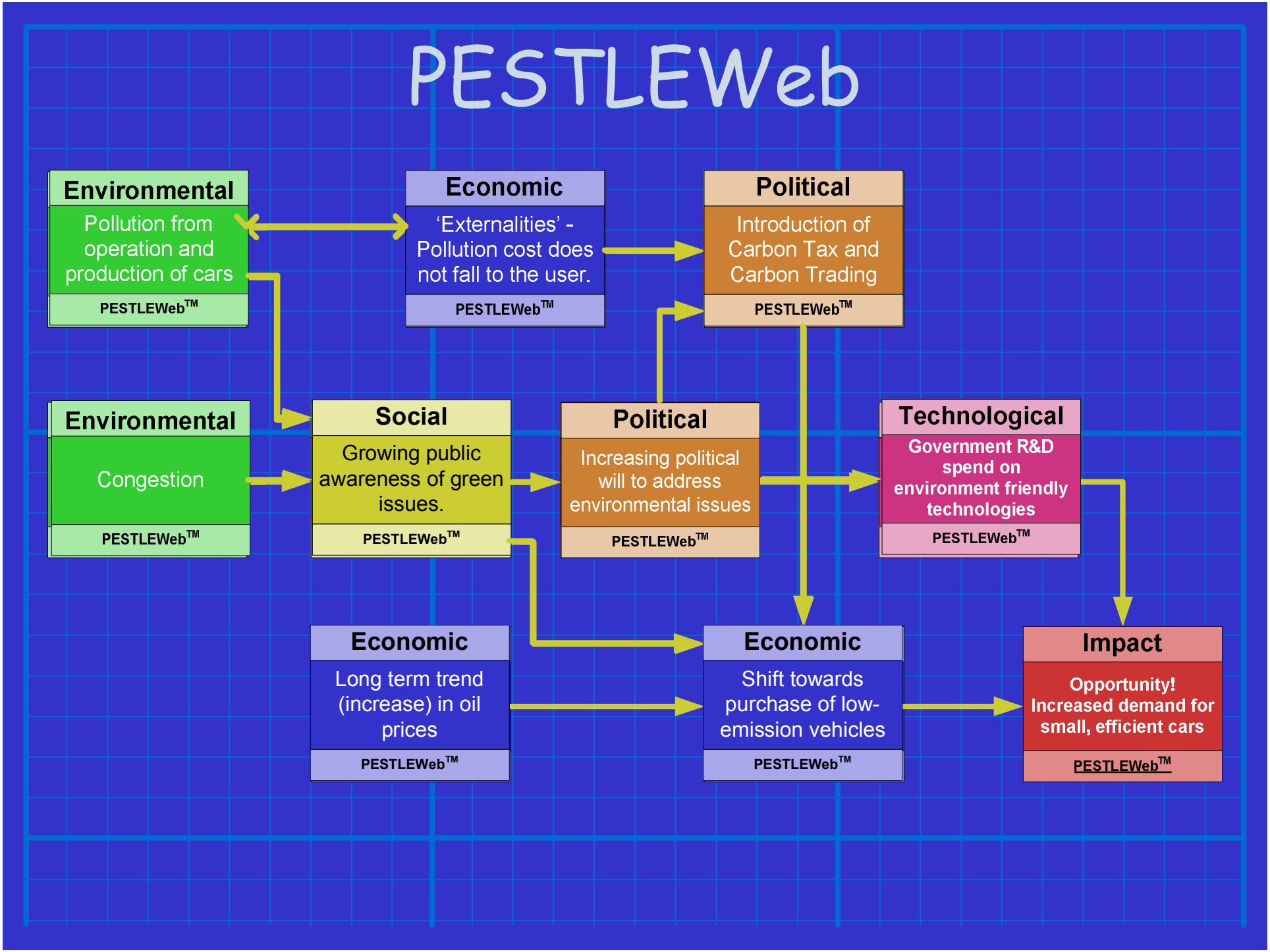
What Else did I miss?



Enterprise Environment

- Prerequisite of successful strategy …
  - Develop a shared understanding of context
- Traditional PESTLE analysis ..
  - P = Political
  - E = Economic, etc. etc.
- We need more than a mnemonic to:
  - Gain deep understanding
  - Develop consensus in diverse teams
  - Consider structure and dynamics

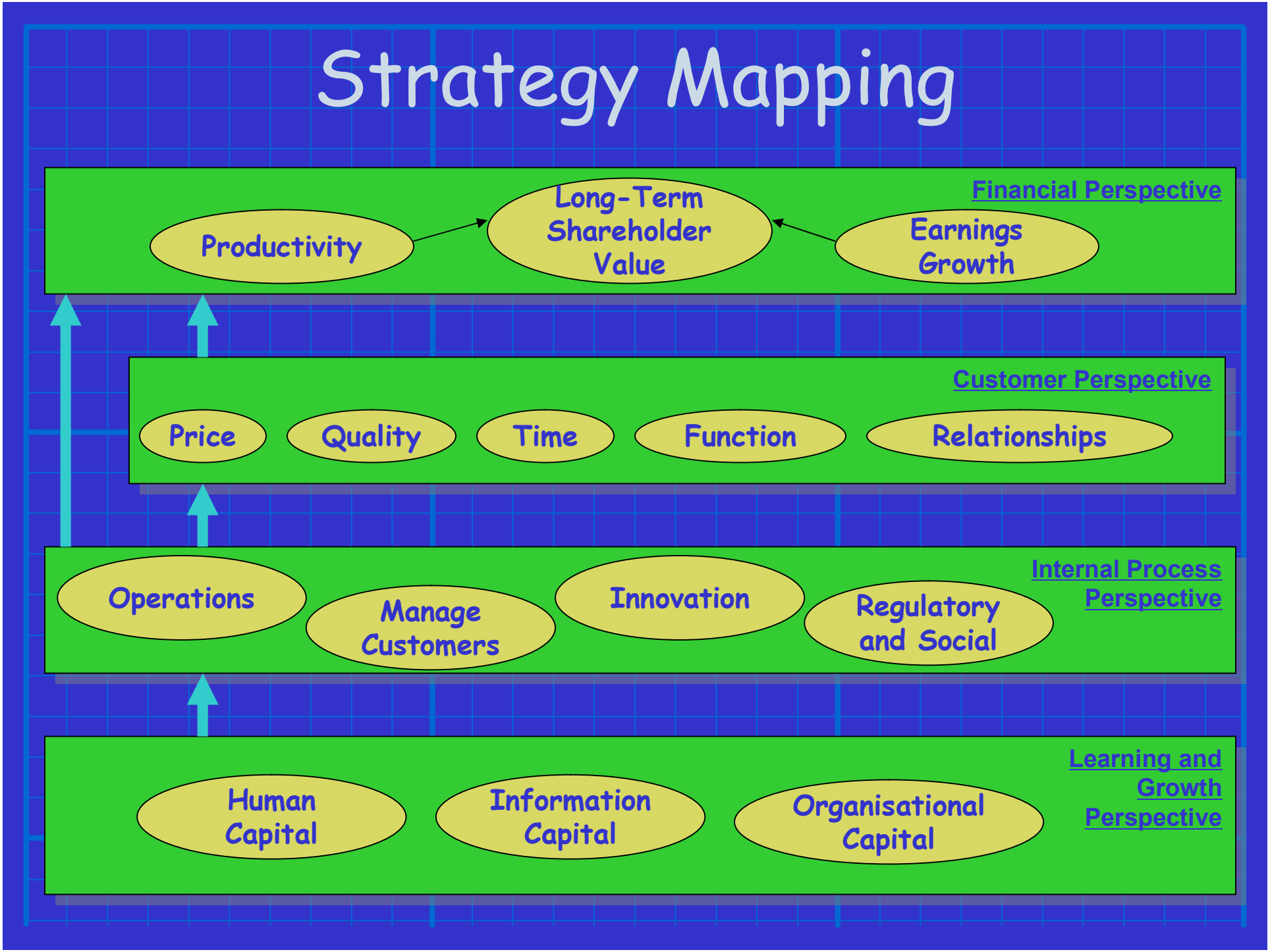
PESTLEWeb


Environmental
Pollution from operation and production of cars
PESTLEWeb™
Economic
'Externalities' - Pollution cost does not fall to the user.
PESTLEWeb™
Political
Introduction of Carbon Tax and Carbon Trading
PESTLEWeb™
Environmental
Congestion
PESTLEWeb™
Social
Growing public awareness of green issues.
PESTLEWeb™
Political
Increasing political will to address environmental issues
PESTLEWeb™
Technological
Government R&D spend on environment friendly technologies
PESTLEWeb™
Economic
Long term trend (increase) in oil prices
PESTLEWeb™
Economic
Shift towards purchase of low-emission vehicles
PESTLEWeb™
Impact
Opportunity! Increased demand for small, efficient cars
PESTLEWeb™

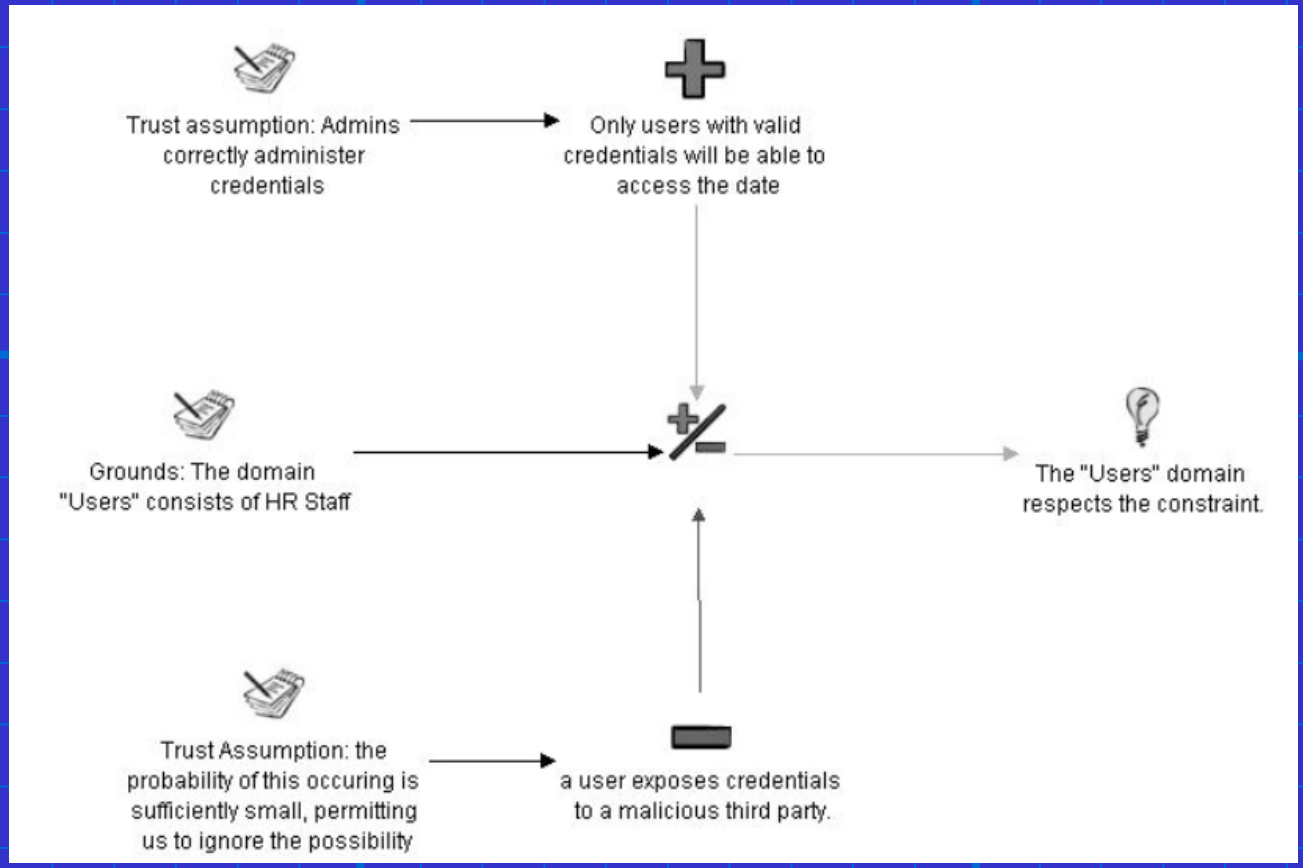
PESTLEWeb Results

- In a controlled, experimental study, PESTLEWeb models were considered:
  - More persuasive
  - More engaging (interesting) and
  - More 'rational'
  - (Statistically significant result at 1% level)
- In a qualitative, observational study: Easy to teach, learn and use
- 6000+ downloads of tutorial slides on slideshare.net

Strategy Mapping



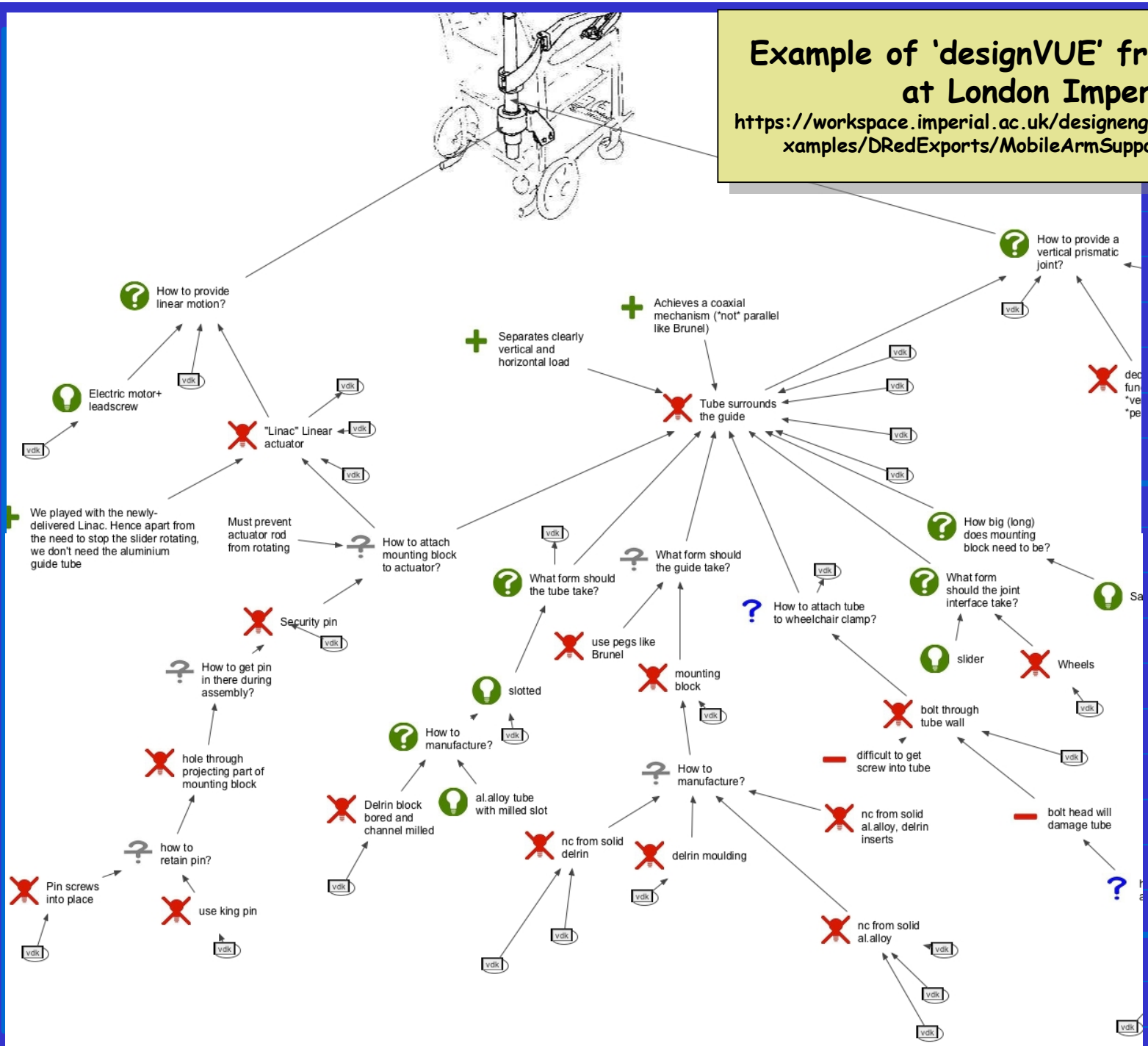
More examples of Visual Argumentation for Design



Buckingham Shum's use of Compendium Argumentation tool in Software Engineering (Example argument about security)

Example of 'designVUE' from the team at London Imperial

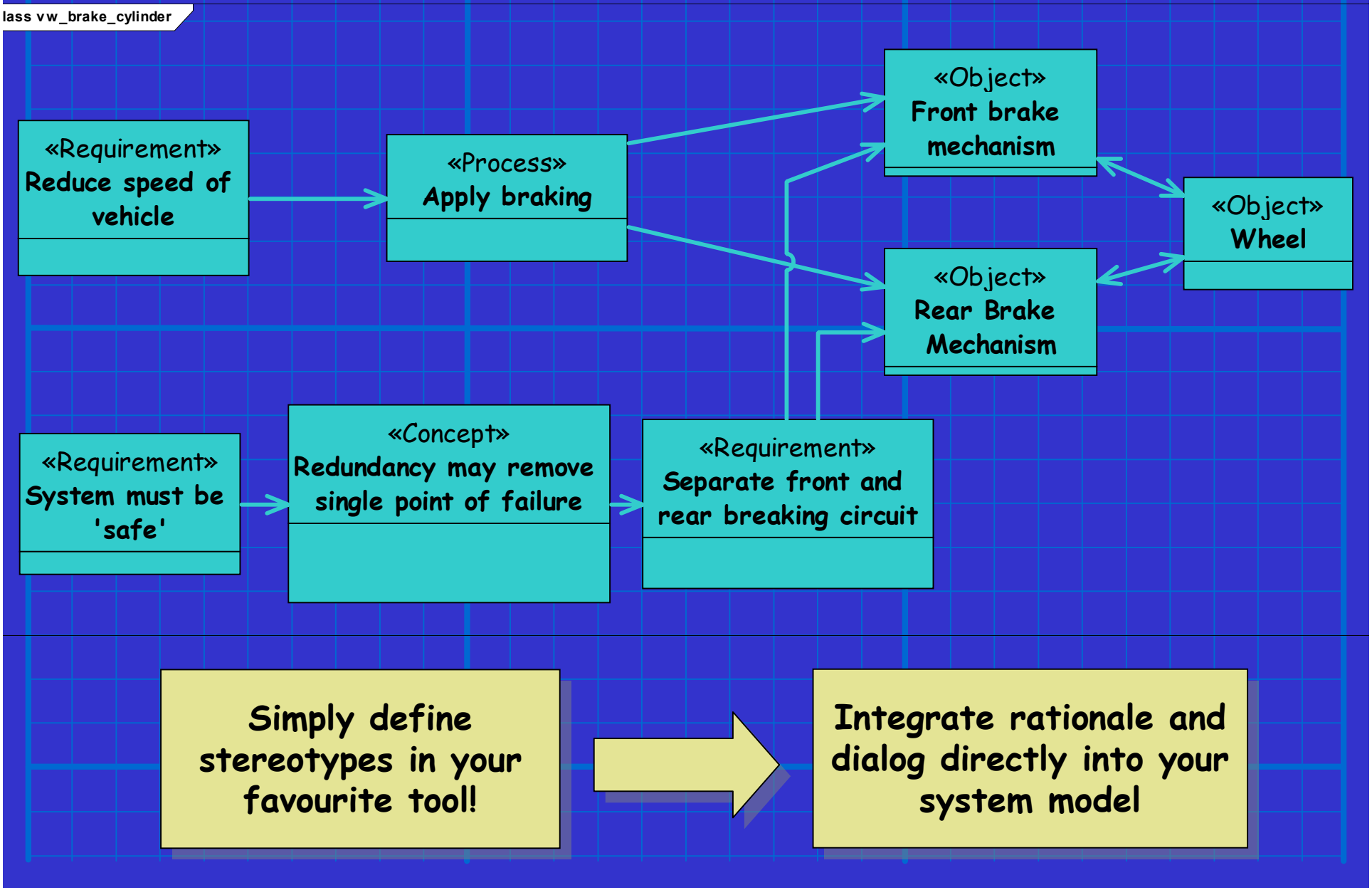
https://workspace.imperial.ac.uk/designengineering/Public/VUE/Examples/DRedExports/MobileArmSupport/ReadMe.html



What is VA doing for us?

- Providing explanations
- Capturing deep knowledge and experience
- Mapping dialogues …
  - Drawing on the wisdom of crowds
  - Building consensus
  - Respecting diverse viewpoints
- Representing rich traceability from abstract ideas and loosely defined concepts down to concrete design realisations

I need to buy a new tool? ☹



Simply define stereotypes in your favourite tool!

Integrate rationale and dialog directly into your system model

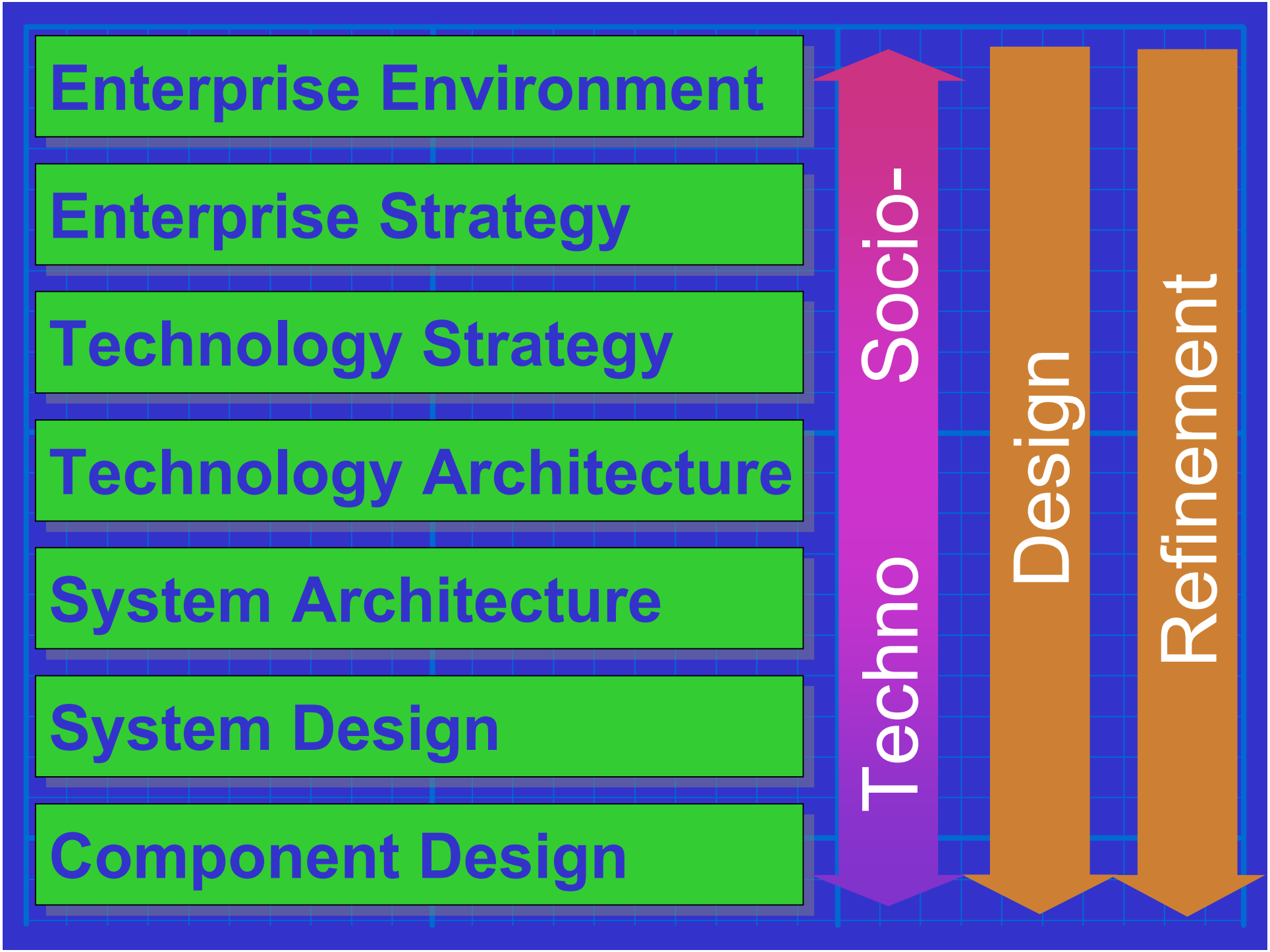
Why Visual Argumentation for Enterprise Systems Engineering?

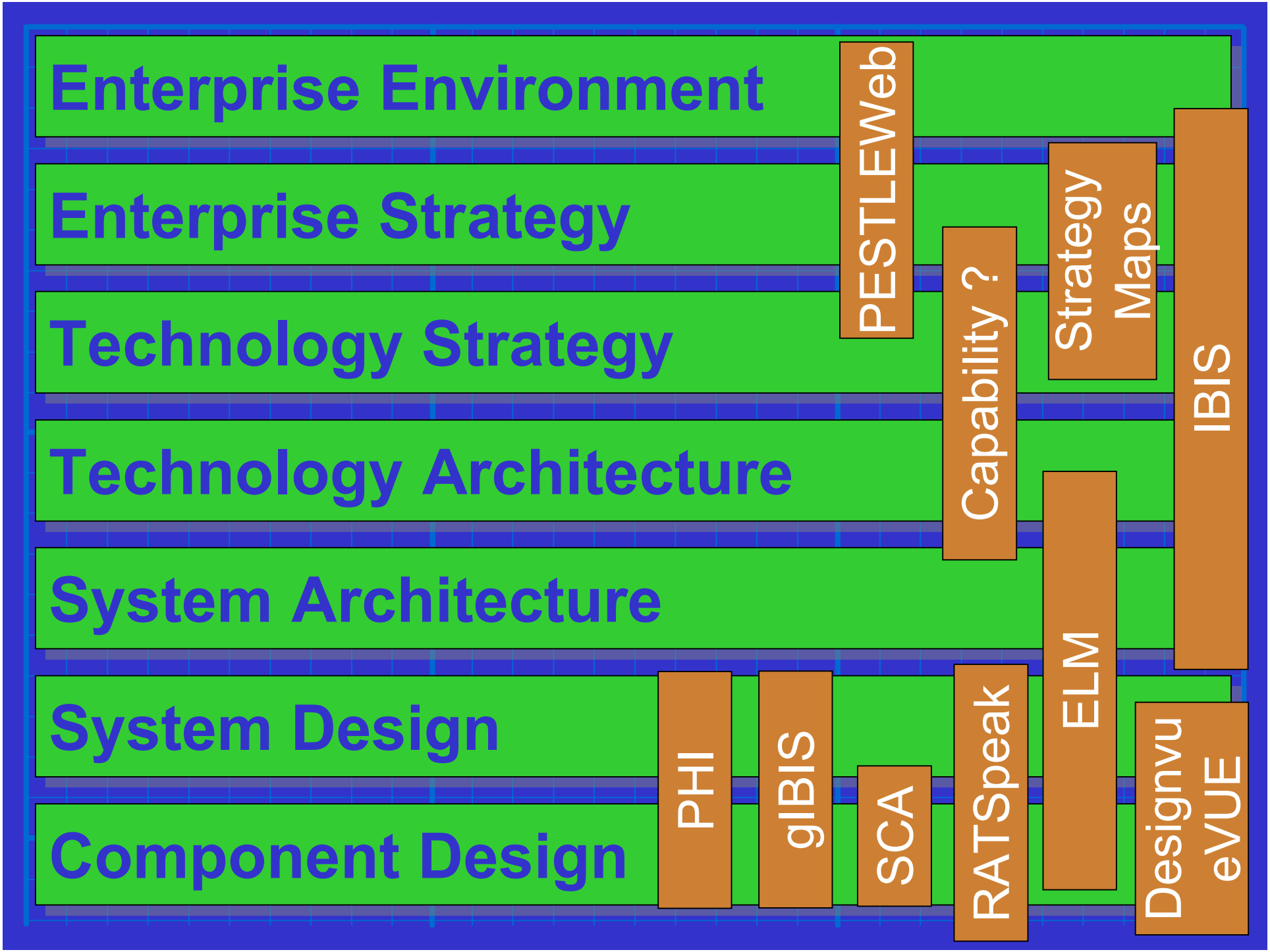
Wicked Problems

- Cannot be easily defined; stakeholders don't even agree on the problem
- Complex judgments about level of abstraction in which to define problem
- No clear stopping rules
- Often have a strong moral or political dimension – particularly for success
- Solutions are not 'right' / 'wrong' but 'better' worse
- Every solution is a 'one-shot' operation

- "My recommendation for future design methodologies would be to emphasise investigations into the understanding of designing as an argumentative process"

Rittel, H. W.J. (1972) "Second Generation Design Methods" Interview in: Design Methods Group 5th Anniversary Report


Enterprise Environment
Enterprise Strategy
Technology Strategy
Technology Architecture
System Architecture
System Design
Component Design
Socio-
Techno
Design
Refinement


Enterprise Environment
Enterprise Strategy
Technology Strategy
Technology Architecture
System Architecture
System Design
Component Design
PESTLEWeb
Capability ?
Strategy Maps
IBIS
ELM
PHI
gIBIS
SCA
RATSpeak
Designvu eVUE

Visual Argumentation Works

- Refine from the very abstract to the very concrete
  - Enable coherence in design
- Draw on the knowledge and experience of very diverse groups
  - Do we know what we know? - Autoepistemic
- Develop consensus
- Engage in dialog
- Enable iteration ..
  - whilst reducing endless iteration

The VA Thesis

- The case for Model Based Systems Engineering has been proven
  - 'Traditionally' that has meant fairly concrete representations of structure and behaviour
- But in the worlds of ESE and SoS we additionally need tools / models that operate at higher levels of abstraction
- We need tools for dialog, consensus, refinement, diversity of knowledge and belief and resolution…
- .. We need Visual Argumentation as the *lingua franca* of Enterprise Systems Engineering

Visual Argumentation as the *lingua franca* of Enterprise Systems Engineering

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