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The EA Forum is a networking event sponsored by The Open Group in South Africa. It started in 2004 and is hosted every second month or so, with events in Durban, Johannesburg and Cape Town. At the EA Forum, industry leaders share their experiences and knowledge of architecture and related topics. Real-world case studies highlight how business problems are solved using the discipline and practice of architecture. The event is also an opportunity for the architecture community members to network and collaborate.

For more information or to submit your presentation topics please contact [Stuart Macgregor](#)



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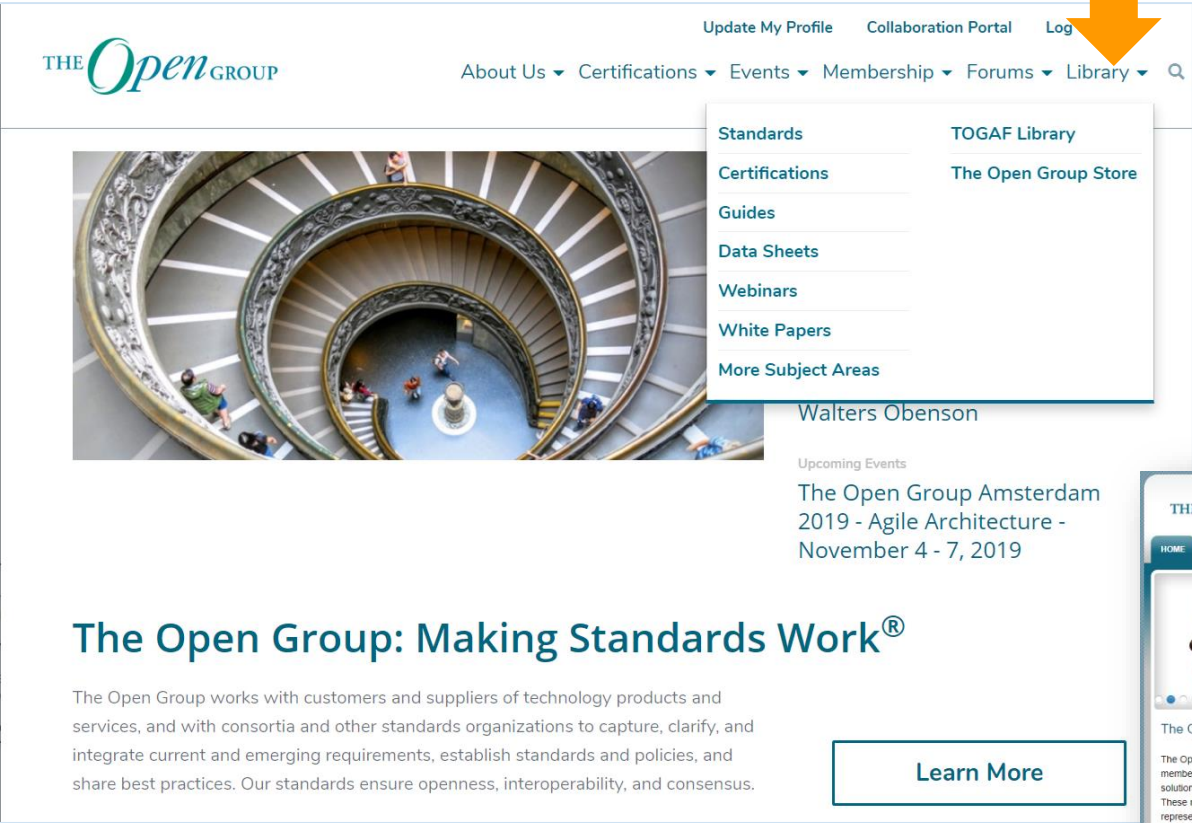
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events

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Walters Obenson

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The Open Group Amsterdam 2019 - Agile Architecture - November 4 - 7, 2019

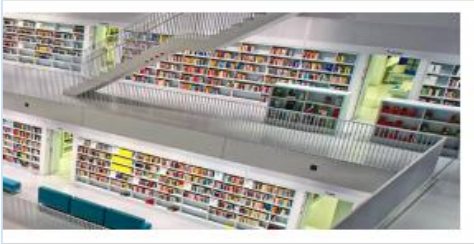
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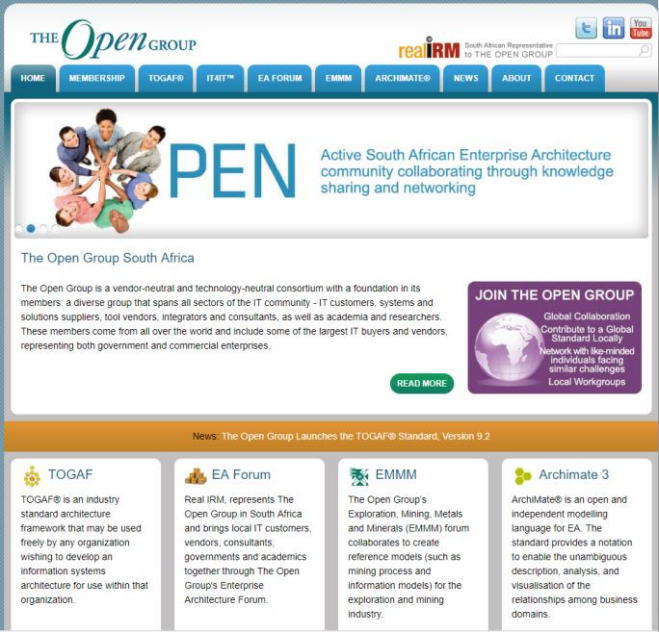
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The Open Group's Exploration, Mining, Metals and Minerals (EMMM) forum collaborates to create reference models (such as mining process and information models) for the exploration and mining industry.
- Archimate 3**
Archimate® is an open and independent modelling language for EA. The standard provides a notation to enable the unambiguous description, analysis, and visualisation of the relationships among business domains.

From Enterprise Alchemy to Enterprise Engineering

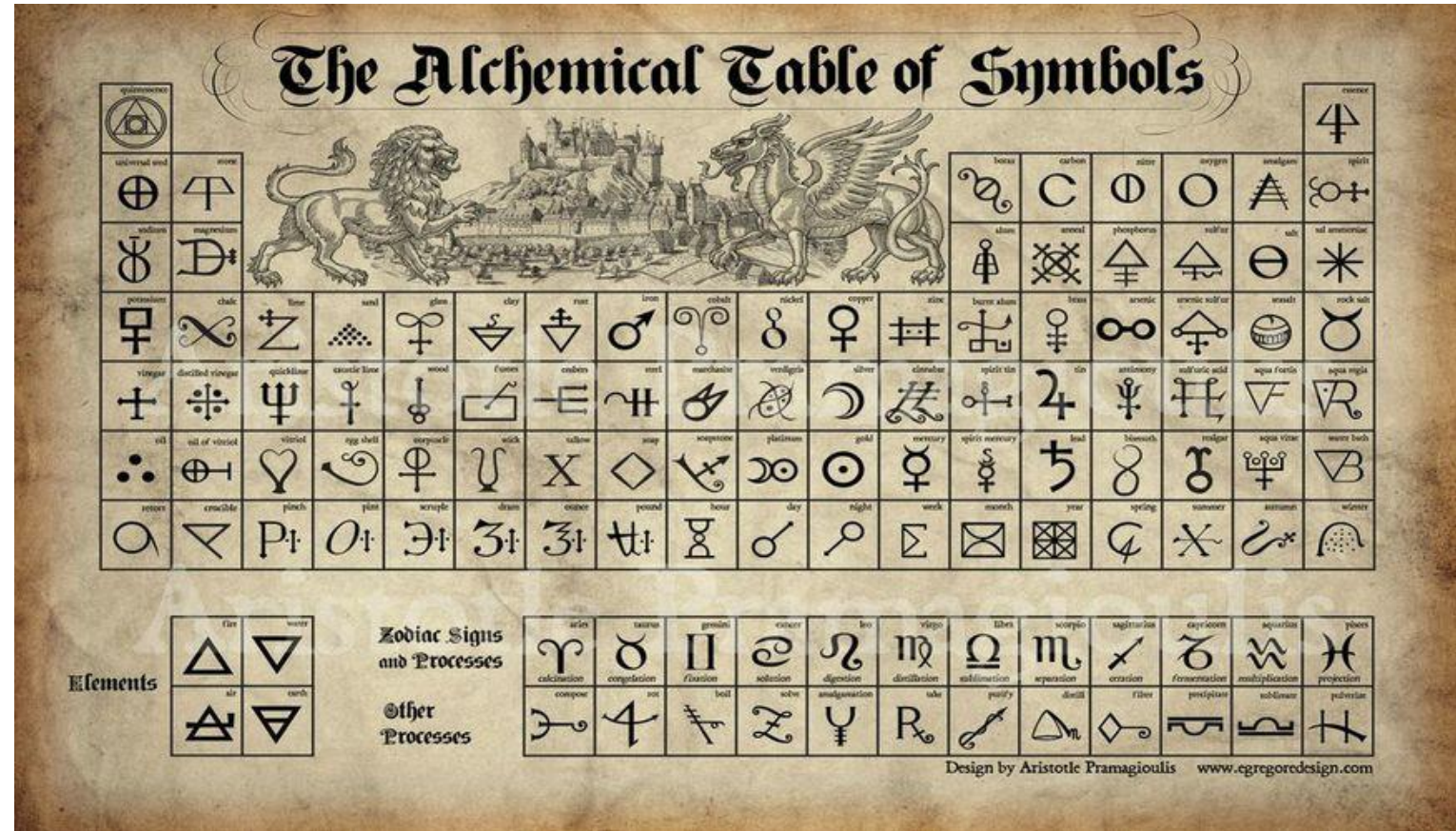
At this month's EA Forum, an old fashioned Electrical Systems Engineer considers the requirements and methodologies consistent with moving from a state of Enterprise Alchemy towards an Engineered Enterprise.

Adriaan Vorster has worked in the ICT industry for almost 30 years. He served as CIO at the University of Johannesburg and subsequently at the Mvelaserve Group where, in both positions, he was responsible for the entire ICT domain.

Adriaan is TOGAF 9 certified and holds B.Eng (1989) and M.Eng (1991) degrees in Electrical and Electronic Engineering from the Rand Afrikaans University, as well as a postgraduate Certificate in Data Resource Management (2000) from the University of Washington, Seattle.

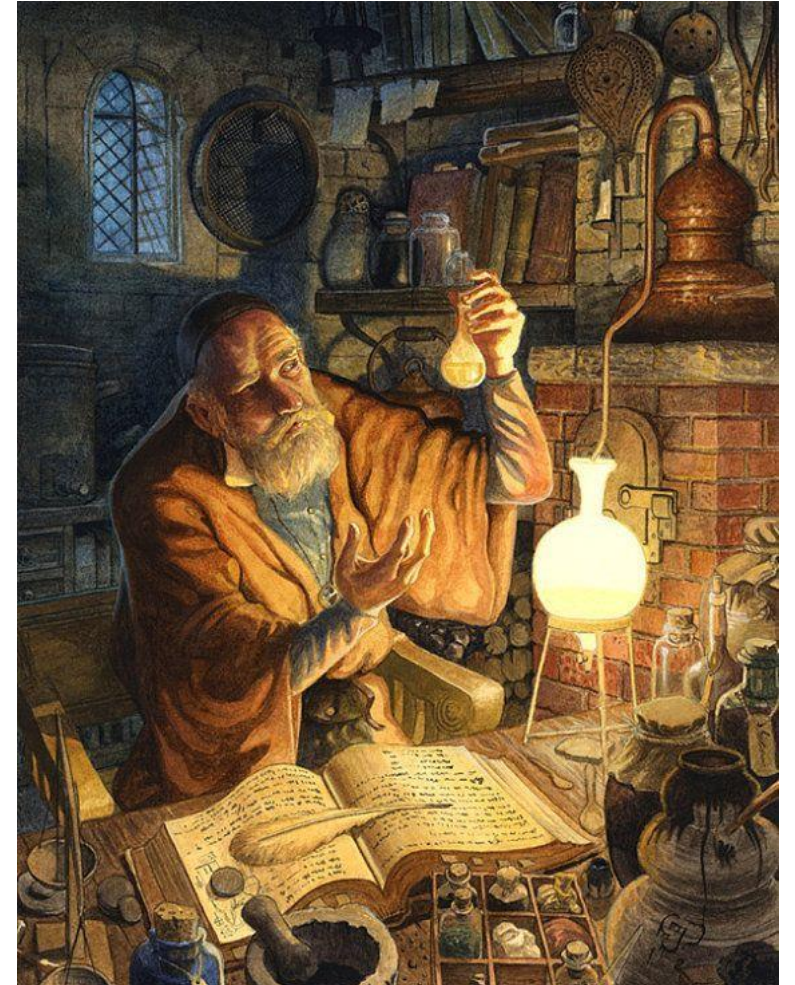
Alchemy

- Alchemy is the medieval forerunner of chemistry, concerned with the transmutation of matter, in particular attempts to convert base metals into gold or find a universal elixir.



Alchemy in action?

- Alchemy is faith based.
- Relies on a dearth of knowledge.
- Captures the gullible with promises of symptomatic relief.
- Has a high failure rate.
- Requires recurring application of the incantation of magical spells and related sorcery.
- Finds ready acceptance amongst the desperate, the ignorant and the gullible.



Chris Dunn Illustration/Fine Art: The Alchemist

The danger of Massaging Symptoms

- Symptoms are vexatious manifestations that are based on underlying problems.
- Massaging symptoms does very little or nothing to the underlying problem.
- But it does provide temporary relief by suppressing the symptoms of the underlying problem.
- Enterprise Alchemists are experts at providing Symptomatic Relief by massaging symptoms without addressing the underlying problems.

This is what you get

Marketing: what you get promised

POWERFUL RELIEF
Day or Night

VICKS

DayQuil

COLD & FLU

Multi-Symptom Relief

Acetaminophen, Phenylephrine HCl,
Dextromethorphan HBr

- ♥ Headache, Fever, Sore Throat, Minor Aches & Pains
- ♥ Nasal Congestion
- ♥ Cough

Non-Drowsy 16 DayQuil LiquiCaps®

NyQuil

COLD & FLU

Nighttime Relief

Acetaminophen, Doxylamine Succinate,
Dextromethorphan HBr

- ♥ Headache, Fever, Sore Throat, Minor Aches & Pains
- ♥ Sneezing, Runny Nose
- ♥ Cough

8 NyQuil LiquiCaps® : Total 24 Liquicaps

Notice that there is no mention of the inability to address the actual problem

Science

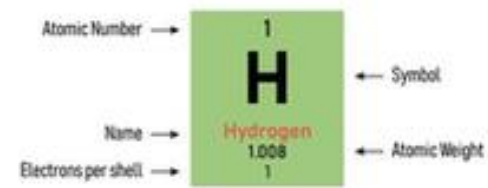
- **Definition of *science***
- **1: the state of knowing : knowledge** as distinguished from ignorance or misunderstanding
- **2a:** a department of **systematised knowledge** as an object of study
- **b:** something (such as a sport or technique) that may be **studied or learned**
- **3a:** knowledge or a system of knowledge covering general truths or the operation of general laws especially as **obtained and tested through scientific method**
- **b:** such knowledge or such a **system of knowledge** concerned with the physical world and its phenomena
- **4:** a system or method reconciling practical ends with scientific laws

The end of Alchemy

Alchemy was destroyed by
the development of the
Periodic Table of the
Elements

The end of Alchemy

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|--|---|---|--|--|---|---|--|---|---|---|--|---|
| 1 IA H Hydrogen 1.008 1 | 2 IIA He Helium 4.0026 2 | | | | | | | | | | | 13 IIIA B Boron 10.81 2-3 | 14 IVA C Carbon 12.010 2-4 | 15 VA N Nitrogen 14.007 2-5 | 16 VIA O Oxygen 15.999 2-4 | 17 VIIA F Fluorine 18.998 2-1 | 18 VIIIA Ne Neon 20.180 2-8 |
| 3 Li Lithium 6.94 2-1 | 4 Be Beryllium 9.012 2-2 | | | | | | | | | | | 13 Al Aluminum 26.982 2-8-3 | 14 Si Silicon 28.085 2-8-4 | 15 P Phosphorus 30.974 2-8-5 | 16 S Sulfur 32.06 2-8-6 | 17 Cl Chlorine 35.45 2-8-7 | 18 Ar Argon 39.948 2-8-8 |
| 11 Na Sodium 22.98976928 2-8-1 | 12 Mg Magnesium 24.305 2-8-2 | 3 IIIB | 4 IVB | 5 VB | 6 VIB | 7 VIIB | 8 VIIIB | 9 VIIIB | 10 VIIIB | 11 IB | 12 IIB | 31 Ga Gallium 69.723 2-8-3 | 32 Ge Germanium 72.630 2-8-4 | 33 As Arsenic 74.922 2-8-5 | 34 Se Selenium 78.971 2-8-6 | 35 Br Bromine 79.904 2-8-7 | 36 Kr Krypton 83.798 2-8-8 |
| 19 K Potassium 39.0983 2-8-8-1 | 20 Ca Calcium 40.078 2-8-8-2 | 21 Sc Scandium 44.955908 2-8-9-2 | 22 Ti Titanium 47.867 2-8-9-2 | 23 V Vanadium 50.9415 2-8-9-2 | 24 Cr Chromium 51.9961 2-8-9-2 | 25 Mn Manganese 54.938044 2-8-9-2 | 26 Fe Iron 55.845 2-8-9-2 | 27 Co Cobalt 58.933 2-8-9-2 | 28 Ni Nickel 58.693 2-8-9-2 | 29 Cu Copper 63.546 2-8-9-1 | 30 Zn Zinc 65.38 2-8-9-2 | 49 In Indium 114.82 2-8-9-3 | 50 Sn Tin 118.71 2-8-9-4 | 51 Sb Antimony 121.76 2-8-9-5 | 52 Te Tellurium 127.60 2-8-9-6 | 53 I Iodine 126.90 2-8-9-7 | 54 Xe Xenon 131.29 2-8-9-8 |
| 37 Rb Rubidium 85.4678 2-8-9-8-1 | 38 Sr Strontium 87.62 2-8-9-8-2 | 39 Y Yttrium 88.90584 2-8-9-9-2 | 40 Zr Zirconium 91.224 2-8-9-9-2 | 41 Nb Niobium 92.90637 2-8-9-9-1 | 42 Mo Molybdenum 95.95 2-8-9-9-1 | 43 Tc Technetium (98) 2-8-9-9-2 | 44 Ru Ruthenium 101.07 2-8-9-9-1 | 45 Rh Rhodium 102.91 2-8-9-9-1 | 46 Pd Palladium 106.42 2-8-9-9 | 47 Ag Silver 107.87 2-8-9-9-1 | 48 Cd Cadmium 112.41 2-8-9-9-2 | 81 Tl Thallium 204.38 2-8-9-9-3 | 82 Pb Lead 207.2 2-8-9-9-4 | 83 Bi Bismuth 208.98 2-8-9-9-3 | 84 Po Polonium (209) 2-8-9-9-4 | 85 At Astatine (210) 2-8-9-9-1 | 86 Rn Radon (222) 2-8-9-9-4 |
| 55 Cs Caesium 132.90545196 2-8-9-9-8-1 | 56 Ba Barium 137.327 2-8-9-9-8-2 | 57-71 Lanthanides | 72 Hf Hafnium 178.49 2-8-9-9-9-2 | 73 Ta Tantalum 180.94788 2-8-9-9-9-2 | 74 W Tungsten 183.84 2-8-9-9-9-2 | 75 Re Rhenium 186.21 2-8-9-9-9-2 | 76 Os Osmium 190.23 2-8-9-9-9-2 | 77 Ir Iridium 192.22 2-8-9-9-9-2 | 78 Pt Platinum 195.08 2-8-9-9-9-1 | 79 Au Gold 196.97 2-8-9-9-9-1 | 80 Hg Mercury 200.59 2-8-9-9-9-2 | 113 Nh Nihonium (284) 2-8-9-9-9-3 | 114 Fl Flerovium (289) 2-8-9-9-9-4 | 115 Mc Moscovium (290) 2-8-9-9-9-5 | 116 Lv Livermorium (293) 2-8-9-9-9-6 | 117 Ts Tennessine (294) 2-8-9-9-9-7 | 118 Og Oganesson (294) 2-8-9-9-9-8 |
| 87 Fr Francium (223) 2-8-9-9-9-8-1 | 88 Ra Radium (226) 2-8-9-9-9-8-2 | 89-103 Actinides | 104 Rf Rutherfordium (261) 2-8-9-9-9-9-2 | 105 Db Dubnium (268) 2-8-9-9-9-9-2 | 106 Sg Seaborgium (266) 2-8-9-9-9-9-2 | 107 Bh Bohrium (270) 2-8-9-9-9-9-2 | 108 Hs Hassium (277) 2-8-9-9-9-9-2 | 109 Mt Meitnerium (276) 2-8-9-9-9-9-2 | 110 Ds Darmstadtium (285) 2-8-9-9-9-9-1 | 111 Rg Roentgenium (282) 2-8-9-9-9-9-2 | 112 Cn Copernicium (285) 2-8-9-9-9-9-2 | 113 Nh Nihonium (284) 2-8-9-9-9-9-3 | 114 Fl Flerovium (289) 2-8-9-9-9-9-4 | 115 Mc Moscovium (290) 2-8-9-9-9-9-5 | 116 Lv Livermorium (293) 2-8-9-9-9-9-6 | 117 Ts Tennessine (294) 2-8-9-9-9-9-7 | 118 Og Oganesson (294) 2-8-9-9-9-9-8 |



State of matter (color of name)
 GAS LIQUID SOLID UNKNOWN

Subcategory in the metal-metalloid-nonmetal trend (color of background)
 ■ Alkali metals ■ Lanthanides ■ Metalloids ■ Unknown chemical properties
 ■ Alkaline earth metals ■ Actinides ■ Reactive nonmetals
 ■ Transition metals ■ Post-transition metals ■ Noble gases

| | | | | | | | | | | | | | | |
|---|---|--|---|--|--|--|--|--|--|--|---|---|--|--|
| 57 La Lanthanum 138.91 2-8-9-9-9-2 | 58 Ce Cerium 140.12 2-8-9-9-9-2 | 59 Pr Praseodymium 140.91 2-8-9-9-9-2 | 60 Nd Neodymium 144.24 2-8-9-9-9-2 | 61 Pm Promethium (145) 2-8-9-9-9-2 | 62 Sm Samarium 150.36 2-8-9-9-9-2 | 63 Eu Europium 151.96 2-8-9-9-9-2 | 64 Gd Gadolinium 157.25 2-8-9-9-9-2 | 65 Tb Terbium 158.93 2-8-9-9-9-2 | 66 Dy Dysprosium 162.59 2-8-9-9-9-2 | 67 Ho Holmium 164.93 2-8-9-9-9-2 | 68 Er Erbium 167.26 2-8-9-9-9-2 | 69 Tm Thulium 168.93 2-8-9-9-9-2 | 70 Yb Ytterbium 173.05 2-8-9-9-9-2 | 71 Lu Lutetium 174.97 2-8-9-9-9-2 |
| 89 Ac Actinium (227) 2-8-9-9-9-9-2 | 90 Th Thorium 232.04 2-8-9-9-9-9-2 | 91 Pa Protactinium 231.04 2-8-9-9-9-9-2 | 92 U Uranium 238.03 2-8-9-9-9-9-2 | 93 Np Neptunium (237) 2-8-9-9-9-9-2 | 94 Pu Plutonium (244) 2-8-9-9-9-9-2 | 95 Am Americium (243) 2-8-9-9-9-9-2 | 96 Cm Curium (247) 2-8-9-9-9-9-2 | 97 Bk Berkelium (247) 2-8-9-9-9-9-2 | 98 Cf Californium (251) 2-8-9-9-9-9-2 | 99 Es Einsteinium (253) 2-8-9-9-9-9-2 | 100 Fm Fermium (257) 2-8-9-9-9-9-2 | 101 Md Mendelevium (258) 2-8-9-9-9-9-2 | 102 No Nobelium (259) 2-8-9-9-9-9-2 | 103 Lr Lawrencium (260) 2-8-9-9-9-9-2 |

The end of Alchemy

Atomic Number → 1
Symbol ← H
Name → Hydrogen
Electrons per shell → 1

State of matter (color of name)
GAS LIQUID SOLID UNKNOWN

Subcategory in the metal-metalloid-nonmetal trend (color)
Alkali metals Alkaline earth metals Transition metals Lanthanides Actinides Post-transition metals Noble gases

| | | | | | | | | | | | | | | | | | |
|---|---|--|---|--|--|--|---|--|---|--|--|--|--|---|--|--|--|
| 1 IA 1 H Hydrogen 1.008 1 | 2 IIA 4 Be Beryllium 9.012 2 | 13 IIIA 5 B Boron 10.81 2-3 | 14 IVA 6 C Carbon 12.01 2-4 | 15 VA 7 N Nitrogen 14.007 2-5 | 16 VIA 8 O Oxygen 15.999 2-4 | 17 VIIA 9 F Fluorine 18.998 2-1 | 18 VIIIA 10 Ne Neon 20.180 2-8 | | | | | | | | | | |
| 11 3 Na Sodium 22.990 2-8-1 | 12 4 Mg Magnesium 24.305 2-8-2 | 21 3 IIIB 21 Sc Scandium 44.956 2-8-2 | 22 4 IVB 22 Ti Titanium 47.867 2-8-3-2 | 23 5 VB 23 V Vanadium 50.942 2-8-3-2 | 24 6 VIB 24 Cr Chromium 51.996 2-8-3-2 | 25 7 VIIB 25 Mn Manganese 54.938 2-8-3-2 | 26 8 VIIIB 26 Fe Iron 55.845 2-8-3-2 | 27 9 VIIIB 27 Co Cobalt 58.933 2-8-3-2 | 28 10 VIIIB 28 Ni Nickel 58.693 2-8-3-2 | 29 11 VIIIB 29 Cu Copper 63.546 2-8-3-2 | 30 12 IIB 30 Zn Zinc 65.38 2-8-3-2 | 31 13 IIIA 31 Al Aluminum 26.982 2-8-3 | 32 14 IVA 32 Si Silicon 28.085 2-8-4 | 33 15 VA 33 P Phosphorus 30.974 2-8-5 | 34 16 VIA 34 S Sulfur 32.06 2-8-6 | 35 17 VIIA 35 Cl Chlorine 35.45 2-8-7 | 36 18 VIIIA 36 Ar Argon 39.948 2-8-8 |
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| 55 39 Cs Cesium 132.905 2-8-9-4-1 | 56 40 Ba Barium 137.327 2-8-9-4-2 | 57-71 Lanthanides | 72 4 IVB 72 Hf Hafnium 178.49 2-8-9-32-3-2 | 73 5 VB 73 Ta Tantalum 180.948 2-8-9-32-3-2 | 74 6 VIB 74 W Tungsten 183.84 2-8-9-32-3-2 | 75 7 VIIB 75 Re Rhenium 186.21 2-8-9-32-3-2 | 76 8 VIIIB 76 Os Osmium 192.22 2-8-9-32-3-2 | 77 9 VIIIB 77 Ir Iridium 192.22 2-8-9-32-3-2 | 78 10 VIIIB 78 Pt Platinum 195.08 2-8-9-32-3-2 | 79 11 VIIIB 79 Au Gold 196.97 2-8-9-32-3-1 | 80 12 IIB 80 Hg Mercury 200.59 2-8-9-32-3-2 | 81 13 IIIA 81 Tl Thallium 204.38 2-8-9-32-3-2 | 82 14 IVA 82 Pb Lead 207.2 2-8-9-32-3-4 | 83 15 VA 83 Bi Bismuth 208.98 2-8-9-32-3-3 | 84 16 VIA 84 Po Polonium (209) 2-8-9-32-3-4 | 85 17 VIIA 85 At Astatine (210) 2-8-9-32-3-1 | 86 18 VIIIA 86 Rn Radon (222) 2-8-9-32-3-4 |
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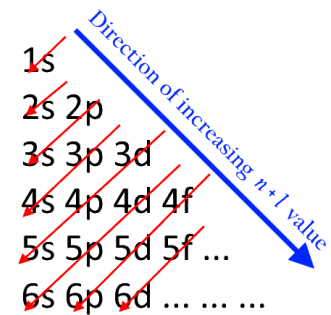
Let us now turn
Lead into Gold!

| | | | | | | | | | | | | | | |
|---|---|--|--|--|--|--|---|--|--|--|---|---|--|--|
| 57 La Lanthanum 138.91 2-8-9-3-2 | 58 Ce Cerium 140.12 2-8-9-3-2 | 59 Pr Praseodymium 140.91 2-8-9-3-2 | 60 Nd Neodymium 144.24 2-8-9-3-2 | 61 Pm Promethium (145) 2-8-9-3-2 | 62 Sm Samarium 150.36 2-8-9-3-2 | 63 Eu Europium 151.96 2-8-9-3-2 | 64 Gd Gadolinium 157.25 2-8-9-3-2 | 65 Tb Terbium 158.93 2-8-9-3-2 | 66 Dy Dysprosium 162.59 2-8-9-3-2 | 67 Ho Holmium 164.93 2-8-9-3-2 | 68 Er Erbium 167.26 2-8-9-3-2 | 69 Tm Thulium 168.93 2-8-9-3-2 | 70 Yb Ytterbium 173.05 2-8-9-3-2 | 71 Lu Lutetium 174.97 2-8-9-3-2 |
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What is the Periodic Table of the Elements?

- The Periodic Table of the Elements is a **CLASSIFICATION SCHEME**, based on a **PROFOUND KNOWLEDGE** of the **PRIMITIVES**, the electron structure of the elements.
- Let us now pull the classical Alchemist trick of transmuting a post transition metal, lead, element Pb, into a transition metal gold, element Au.
- This is the cue for the attending Alchemists to fire up their spells and incantations.
- The scientists amongst you will most probably slap their foreheads in disbelief.
- You want to transmute $[\text{Xe}] 4f^{14} 5d^{10} 6s^2 6p^2$ into $[\text{Xe}] 4f^{14} 5d^{10} 6s^1$??
- "It would cost more than one quadrillion dollars, US\$ 10^{15} , per ounce to produce gold by this experiment," Glen Seaborg, Nobel Prize winner on nuclear transmutation. (That is roughly 7.5 billion times the current gold price)

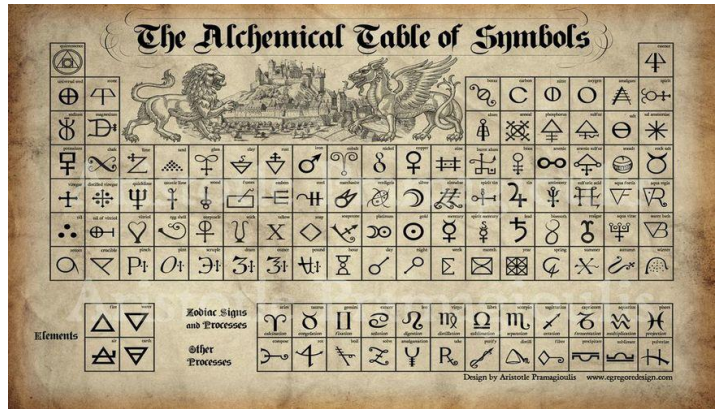
| | | | |
|--|--|---|--|
| 79 Au Gold 197.841 2-8-18-32-18-1 | 80 Hg Mercury 200.59 2-8-18-32-18-2 | 81 Tl Thallium 204.38 2-8-18-32-18-3 | 82 Pb Lead 207.2 2-8-18-32-18-4 |
|--|--|---|--|



Electrons per shell*

s=2
p=6
d=10
f=14

Contrasting Alchemy and Science

The modern periodic table of elements is a grid of elements, each represented by its chemical symbol, atomic number, and name. The table is color-coded by groups and periods. The elements are arranged in a grid, with the first row containing Hydrogen (H) and Helium (He). The table is divided into several groups, including the alkali metals, alkaline earth metals, transition metals, and noble gases. The periodic table is a fundamental tool in chemistry, used to predict the properties of elements and their reactions.

• Alchemy

- Is faith based
- Relies on spells and incantations
- Variable quality of outcomes
- Yields symptomatic relief
- Quick and easy to apply
- Typically practiced by secret societies
- High failure rate

• Science

- Is knowledge based
- Requires application of a scientific process
- Repeatable outcomes
- Capable of solving problems
- Requires effort to deliver solutions
- Open to all associations of academics and knowledge seekers
- Repeatable success

Knowledge destroyed Alchemy

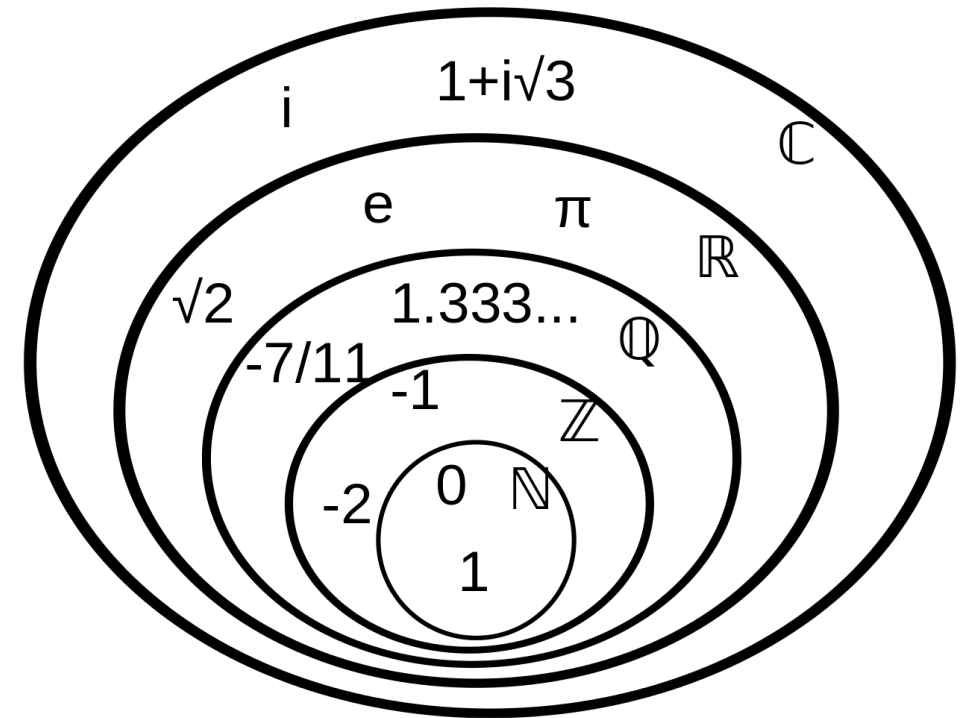
- Let us be very clear.
- A profound knowledge of the primitives, the electron structure of the elements, destroyed the practice of Alchemy.
- If you do not have the knowledge of your enterprise primitives, if you do not know how these primitives interact, you are a natural target for the Enterprise Alchemists.
- The Enterprise Alchemists will, against a financial consideration, cast their magical spells and incantations over your enterprise.
- A fine, and socially acceptable endeavour, until you require measurable, sustainable, results.

Lord Kelvin on Knowledge

- “When you can measure what you are speaking about, and express it in numbers, you know something about it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.”
- From which sprang the well known statement – To measure is to know!
- But how do you quantify your measurements?
- What are numbers?

What are Numbers?

- Numbers are the primitives of our measuring systems.
- Numbers represent quantifiable, domain specific, stationary, reference points.
- If every number represents a stationary, domain specific reference, it is a datum.
- Hence the numbers required to measure and represent a situation is the set of datums, or data!



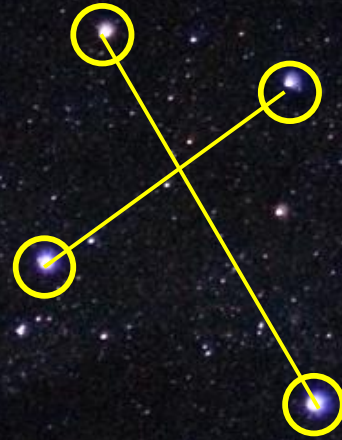
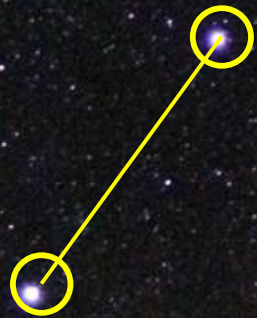
N => Natural numbers
Z => Integers
Q => Rational numbers
I => Irrational numbers
R => Real numbers
Imaginary numbers
C => Complex numbers

Paraphrasing Lord Kelvin

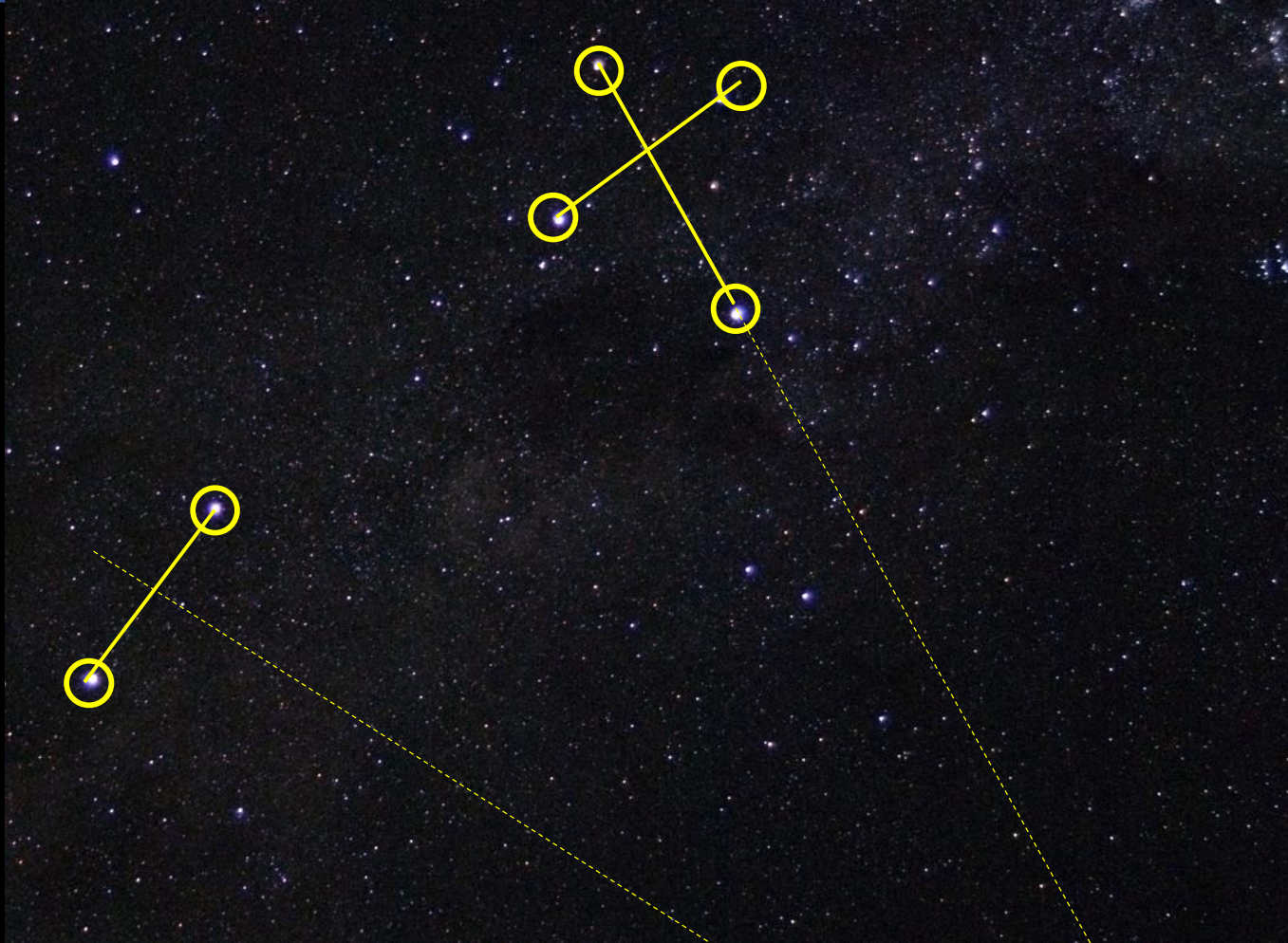
- Set **Numbers** => **Data**
- “When you can measure what you are speaking about, and express it in **data**, you know something about it, when you cannot express it in **data**, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science.”
- This implies that you have to determine the quantifiable, domain specific, stationary, reference points from which you can hang your enterprise architecture model.
- Let us try and determine our orientation and direction by looking at a large dataset.

A deep space photograph showing a vast field of stars. The stars are scattered across a dark, black background. Some stars are bright and white, while others are blue or yellow. The density of stars is higher in some areas, particularly towards the right side of the image. The overall appearance is that of a rich, multi-colored stellar population.

An example
of a large
dataset.
The stars are,
for our
lifetimes,
stationary,
domain
specific
reference
points.

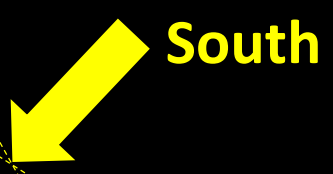


Knowledge:
the ability
to build and
evaluate
the fit of
search
patterns.
Here used
to Identify
the
Southern
Cross.



Data in context,
data that has
responded to a
search pattern.

Using the
Southern Cross
to find South






Now that
you have
the
Knowledge
to build the
Search
Pattern, try
to not see
the
Southern
Cross

Watch out for this!

Occasionally, every few million years, stars are seen to eat each other.

What tectonic shifts could invalidate your Enterprise References?

How is Big Data, AI, digitalisation and 4IR impacting you?



Last observed neutron star merger, in galaxy NGC 4993, located some 130 million light years from our own Milky Way, on 17 October 2017, created some 100 earth masses of gold.

Considering Enterprise Architecture

- According to IEEE 42010 architecture represents *“The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”*.
- Enterprise Architecture requires you to have a profound knowledge of the Enterprise components, the primitives.
- We require an Enterprise Periodic Table of the Enterprise Elements.
- A classifications schema, based on a profound knowledge of the Enterprise primitives.

Getting to the Enterprise Primitives

The Zachman Framework for Enterprise Architecture™ The Enterprise Ontology™



Definition of the Zachman Framework

- **The *Zachman Framework*[™] is a schema** - the intersection between two historical classifications that have been in use for literally thousands of years.
- The first is the fundamentals of communication found in the primitive interrogatives: **What, How, When, Who, Where, and Why**. It is the **integration of answers** to these questions that enables the **comprehensive, composite description of complex ideas**.
- The second is derived from **reification**, the transformation of an abstract idea into an instantiation, that was initially postulated by ancient Greek philosophers and is labelled in the *Zachman Framework*[™]: Identification, Definition, Representation, Specification, Configuration and Instantiation.

How will the Zachman Framework help me?

- The Zachman Framework very clearly identifies the Enterprise Architecture domain.
- The use of the six primitive interrogatives provides the required analysis and the primitive nature of the interrogatives means that there are no natural projections between these primitives, thus identifying the alignment and integration requirements.
- Mathematically speaking all six of these primitives, the Zachman Framework columns, are orthogonal to each other.
- Thus the enterprise presents us with having to construct integrated solutions within a six dimensional hypercube.
- The challenge of Enterprise Architecture is to ensure continual consistency, at every level, both in the analysis and the reification, across all the columns and all the rows of the Zachman Framework.
- The Zachman Framework provides the analytical tools, as well as an organising structure, that allows you to concentrate on specifics without neglecting the contextual arrangements

Getting to the Enterprise Primitives



- What are Information Systems?
- Information Systems are Business Process Enablers
- An information system allows a competent person, using ICT resources, at a certain location, at a certain time, to follow a specified process that will correctly map the business rules to the enterprise data.

Architecture is about Reification

- A study of architectural styles invariably leads to the study of the reification of that architecture and the built environment.
- The study of the outcomes, the built structures.
- Similarly Enterprise Architecture is about the outcomes, the robust, scalable, secure, fit for purpose, functioning systems.
- It is not about shelfware, reams and meters of documentation, that describe aspects of situations with no evidence of implementation.



Architecture in practice – Lessons from Lego

The Primitives



The Architecture



The Reification



Architecture is about Re-Use

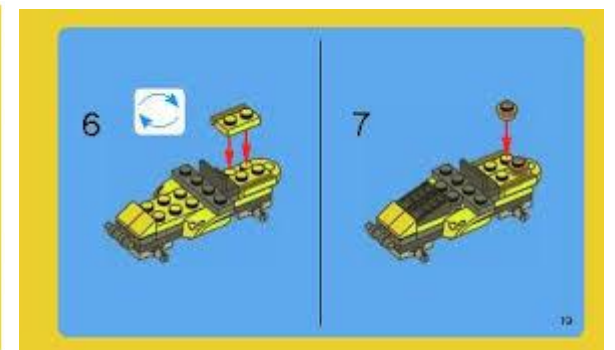
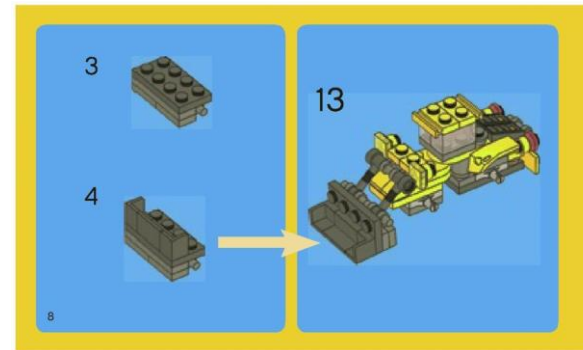
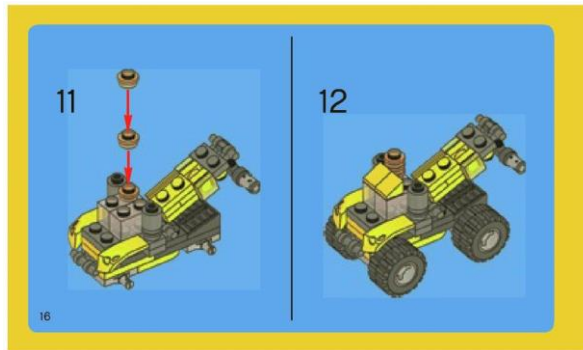
The same primitives could be re-used to instantiate different outcomes.



Different

Architectures

describe different spatial arrangements of the same primitives



Different Reifications.

The different spatial arrangement of the Primitives yield different outcomes.



The Lego Architecture

Definition of architecture: *The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.*

Does the Lego Architecture conform to this definition?

Architecture is about reification – the description of the arrangement and interactions of the **primitives** of a **not yet existing**, complex, artefact. Aimed at communicating the **primitives** and the **realisation techniques** and requirements to the relevant **stakeholders** in order to **instantiate the outcome**.

How does the Lego Architecture succeed in accomplishing this?

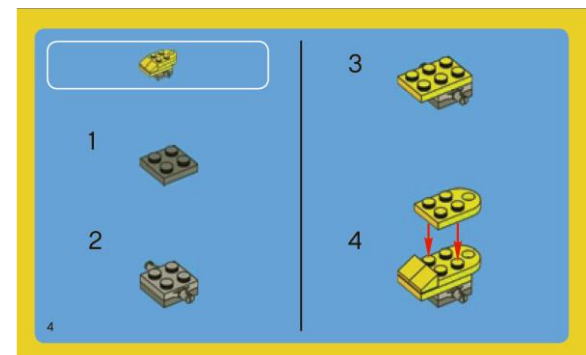
Not yet existing



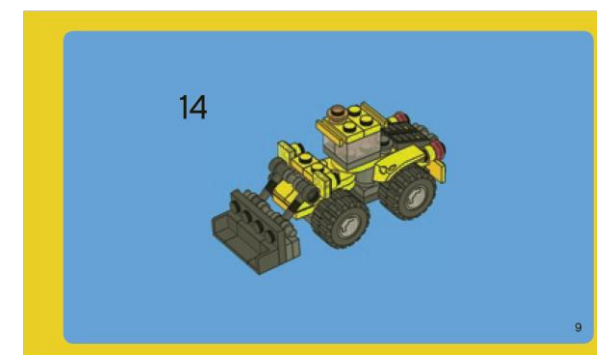
Primitives



Realisation techniques

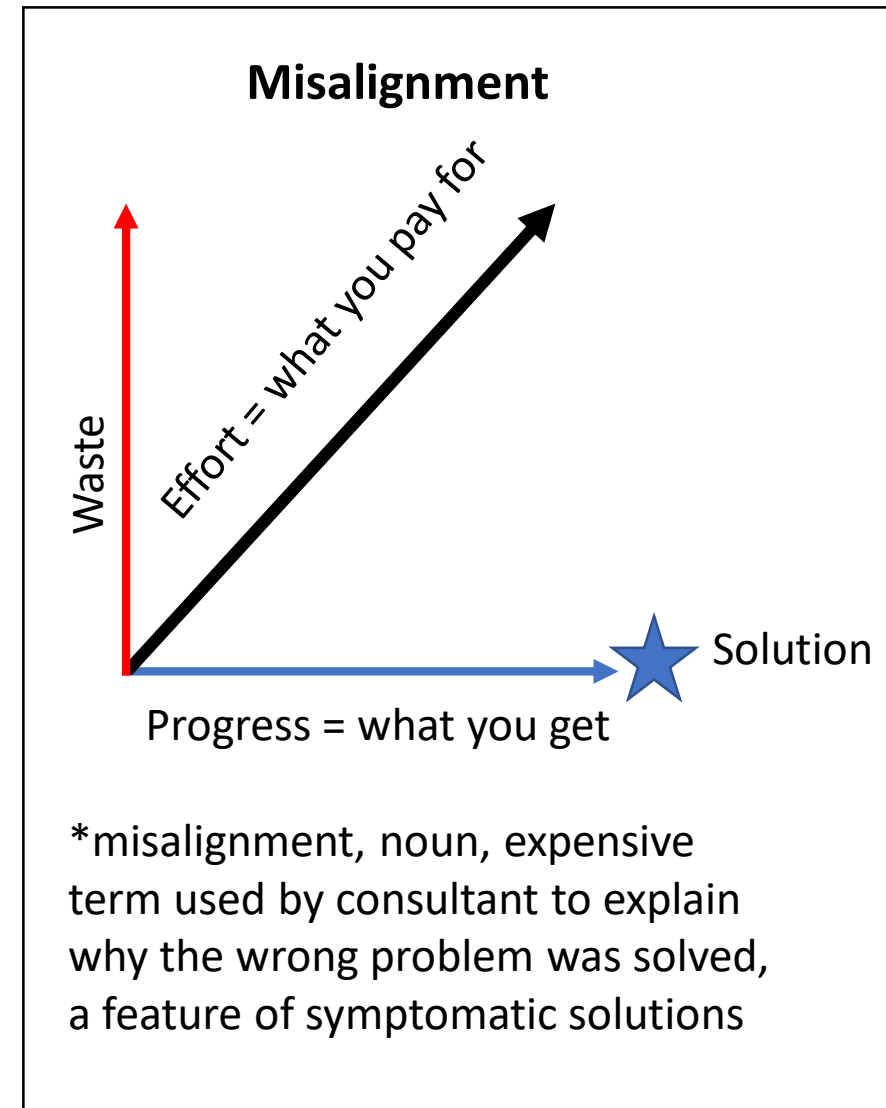


Instantiation



Responding to the Stakeholders Lament

- A humorous poem, *T'was the night before Implementation** ends with the following observation:
- *"Heh!", the customer exclaimed with a snarl and a taunt,
"It's just what I asked for, but not what I want!"*
- Just what I asked for, but not what I want! is the perineal stakeholder lament.
- Generally this manifests as a misalignment* between the business requirements and the enabling systems.
- The ISO 42010 – 2007 standard provides a very good methodology to address stakeholder concerns and generate aligned solutions.

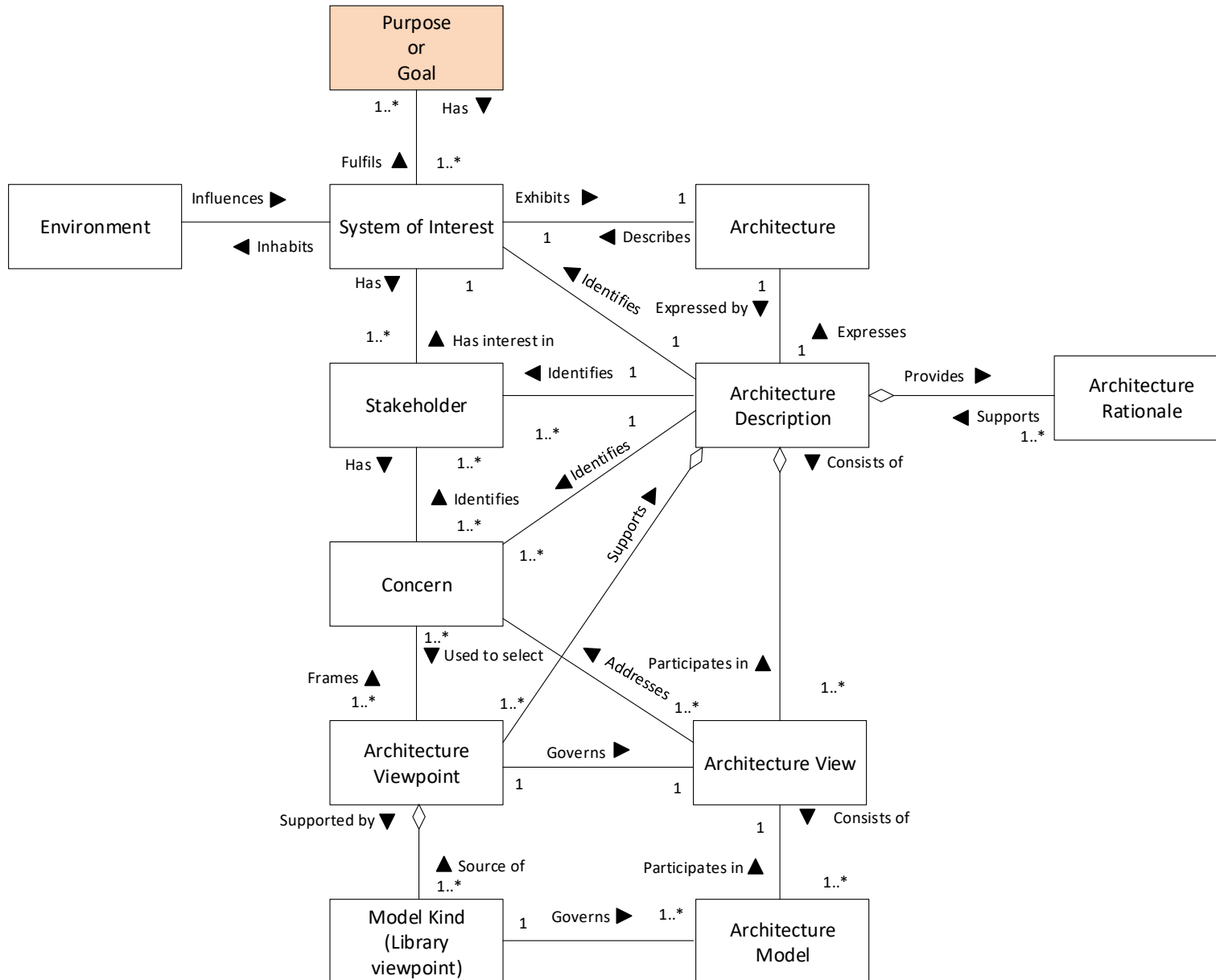


* <https://www.kaitaia.com/jokes/Lyrics/Lyrics30.htm>

ISO 42010 : 2007 Systems and Software Engineering — Architecture Description

- The ISO 42010 : 2007 Systems and Software Engineering — Architecture Description standard, provides a structured way of developing Enterprise Architectures.
- It provides a holistic, integrated means for driving out implicit models and reaching consensus on the architectural requirements .
- It is very firmly rooted in Engineering design and, as with the Zachman Framework, emphasise the importance of the analytical phase before the synthesis of solutions start.
- Thinking precedes doing.
- Understand the problem before you start solving it.
 - This is typically not the Enterprise Alchemist approach as their quiver of spells, incantations and shrink wrapped software solutions is relied upon to invoke miracles and wonders.

A journey through ISO/IEC/IEEE 42010 - 2007



Every system has a Goal or Purpose.
One or more beneficial outcome(s) that ensure survival and growth.

It is absolutely essential to properly define the Goal or Purpose of the system and to achieve consensus on the definition and evaluation criteria associated with attaining the Goal or Purpose.

If you aim at nothing, you will hit it!

Definition of an Environment

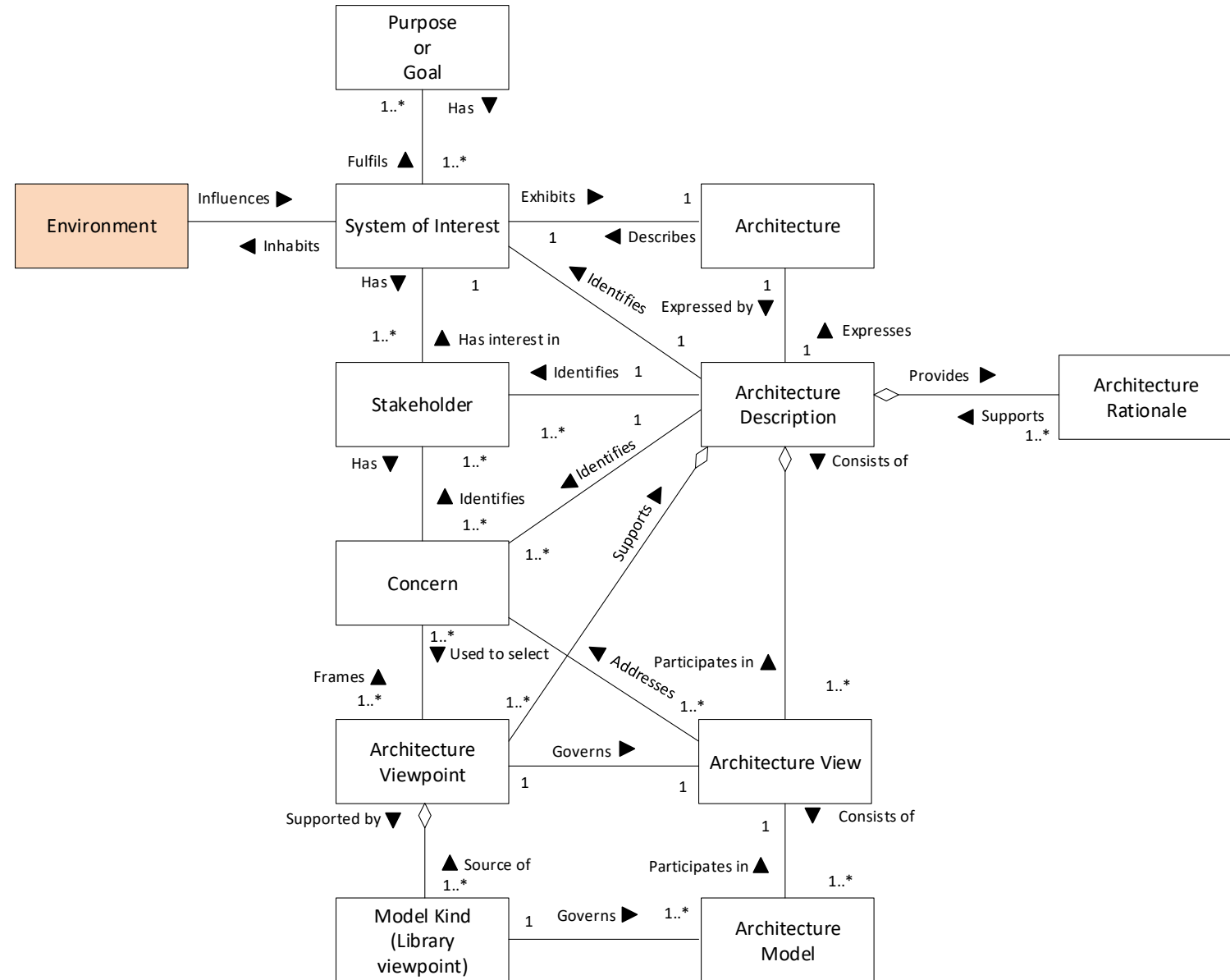
Every system inhabits one or more environments.

It is usual to identify at least two environments.

The External and the Internal environments.

Interactions across the Environmental Boundaries will require Appropriate Protocols.

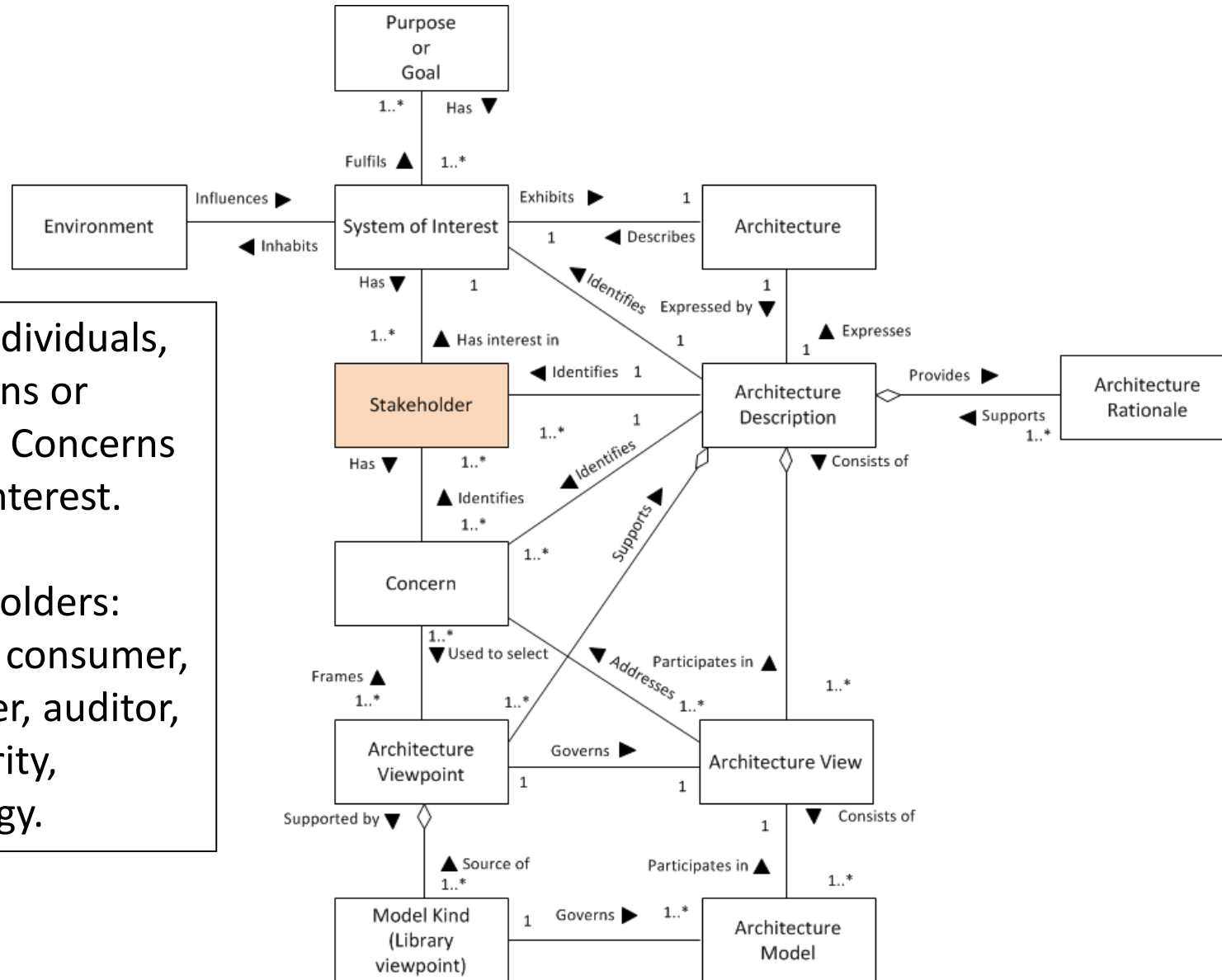
Most of the system Constraints and Enablers will be found in the environments.



Definition of a Stakeholder

Stakeholders are individuals, groups, organizations or technology holding Concerns for the System of Interest.

Examples of stakeholders: client, owner, user, consumer, designer, maintainer, auditor, certification authority, architect, technology.



Definition of a Concern

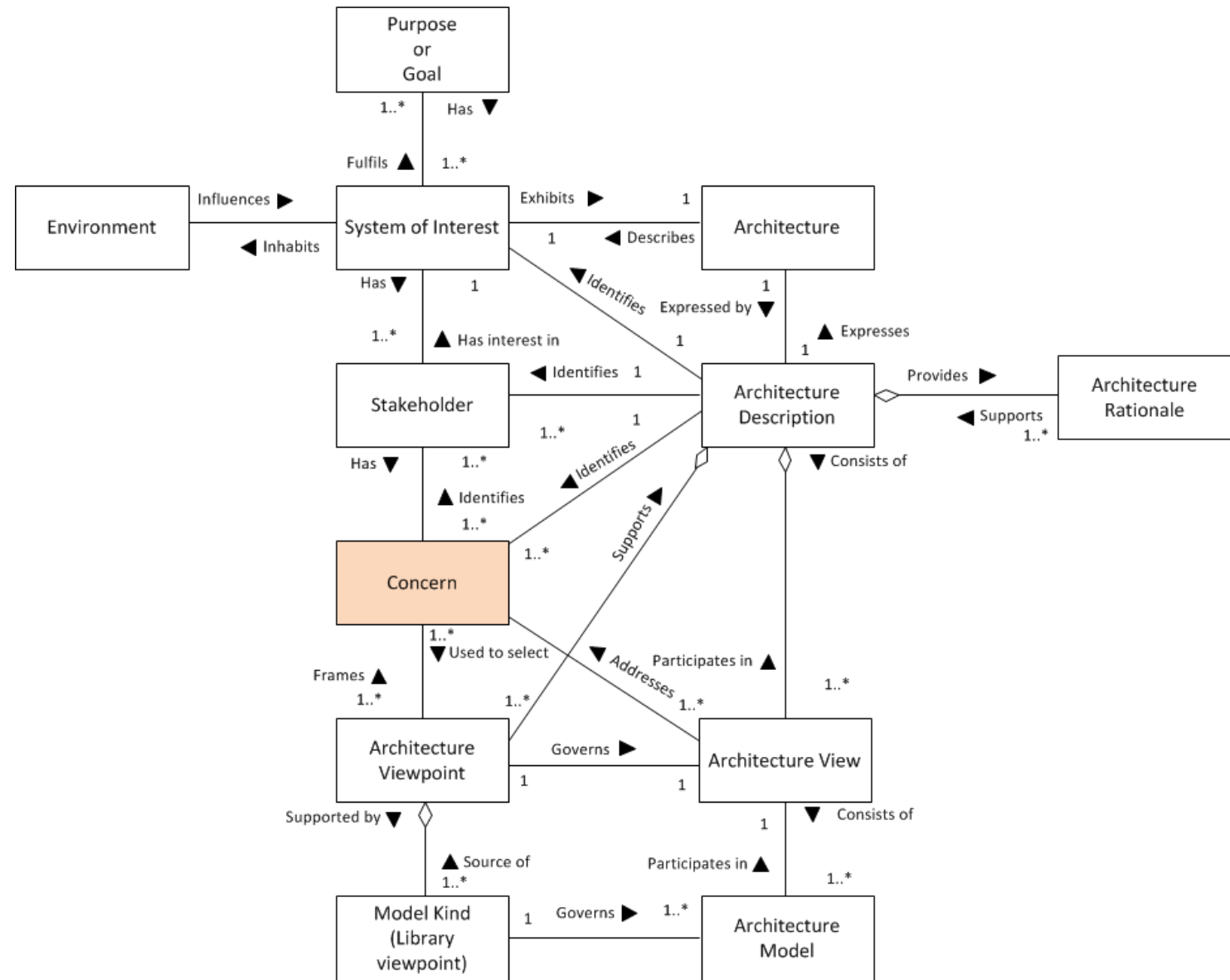
A Concern is any interest in the system.

The term derives from the phrase "separation of concerns" as originally coined by Edger Dijkstra.

Examples of concerns: (system) purpose, functionality, structure, behaviour, cost, supportability, safety, interoperability.

Concerns are those measurable aspects of the system that must perform to the stakeholder specifications for the system to be fit for purpose.

Different stakeholders may have different concerns.



Definition of a Viewpoint

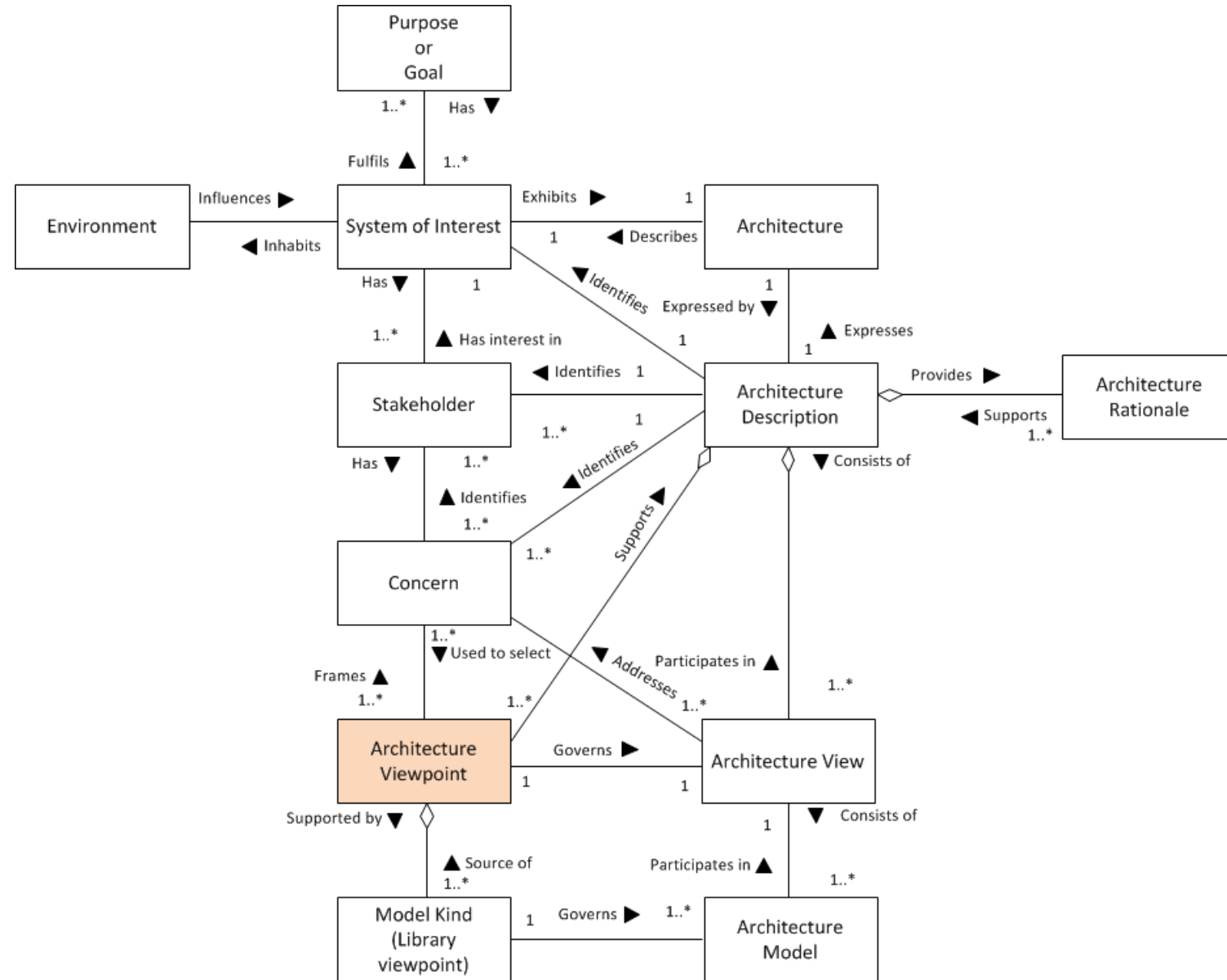
An Architecture Viewpoint is a set of conventions for constructing, interpreting, using and analysing one type of Architecture View.

A Viewpoint includes Model Kinds, viewpoint languages and notations, modelling methods and analytic techniques to frame a specific set of Concerns.

Examples of viewpoints could be: operational, systems, technical, logical, deployment, process, and information.

Model Kinds represent visualisation artefacts, like a Procure to Pay process.

Architecture Viewpoints and Model Kinds are used to group Stakeholder Concerns

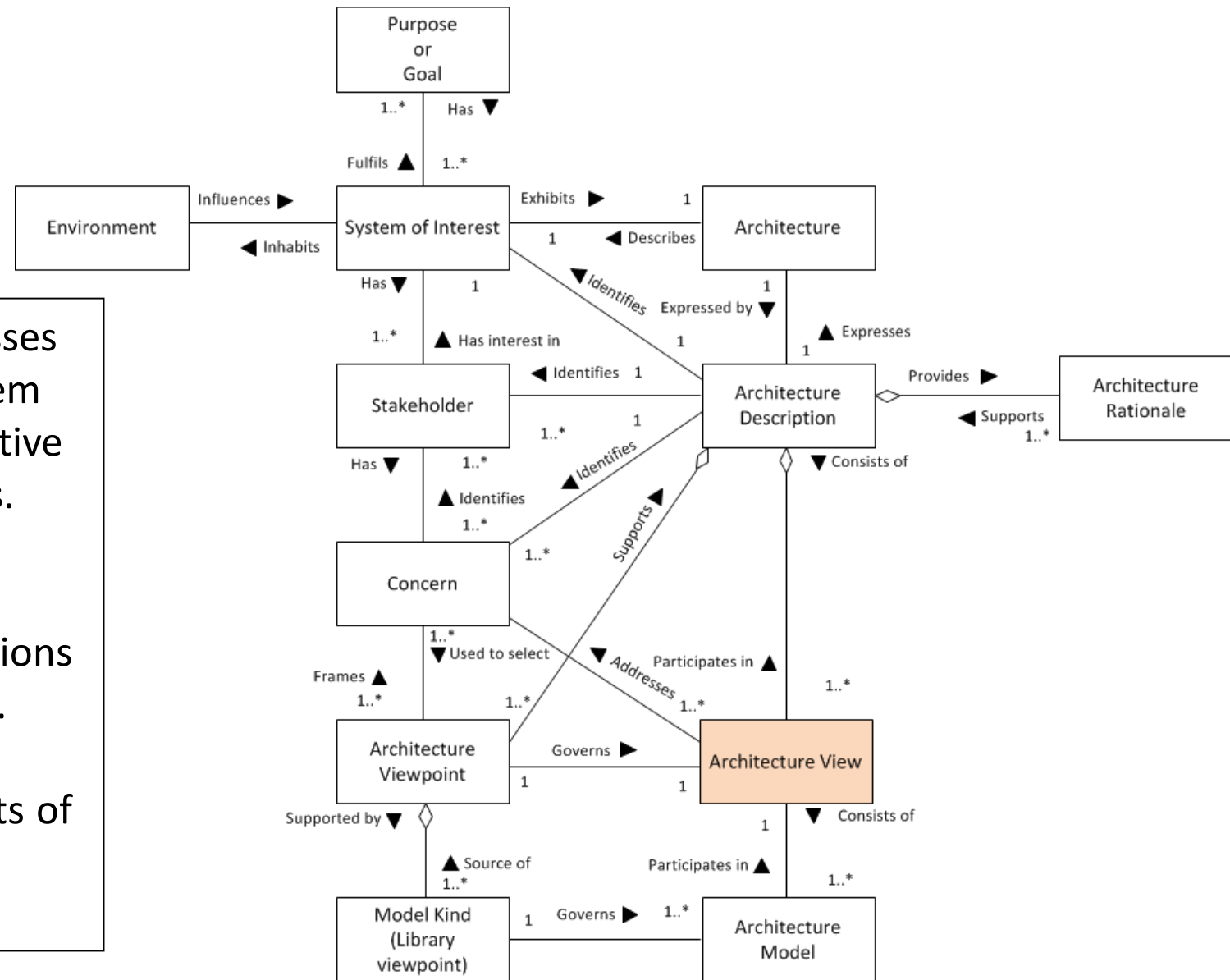


Definition of an Architecture View

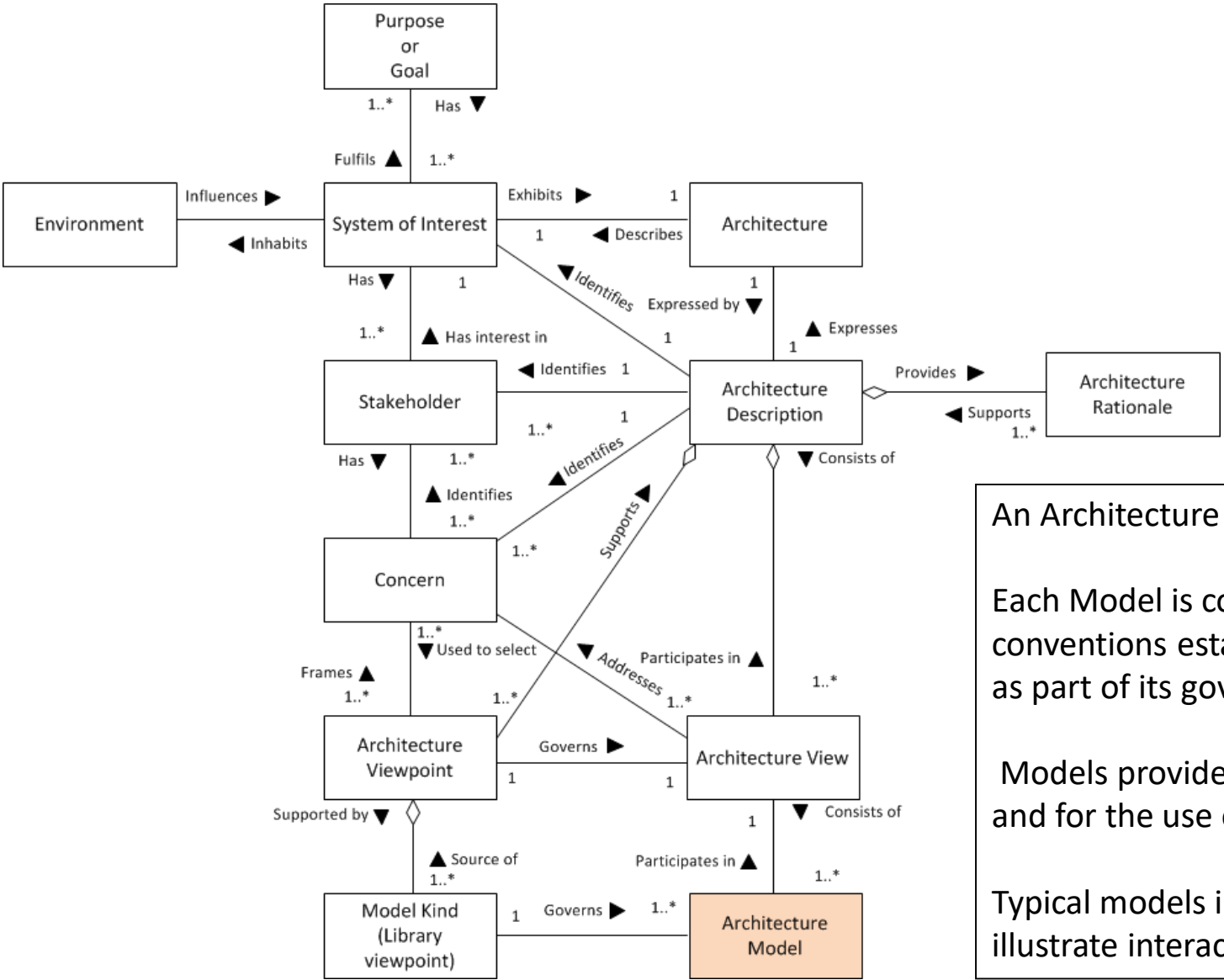
An Architecture View expresses the Architecture of the System of Interest from the perspective of one or more Stakeholders.

It is used to address specific Concerns, using the conventions established by its Viewpoint.

An Architecture View consists of one or more Architecture Models.



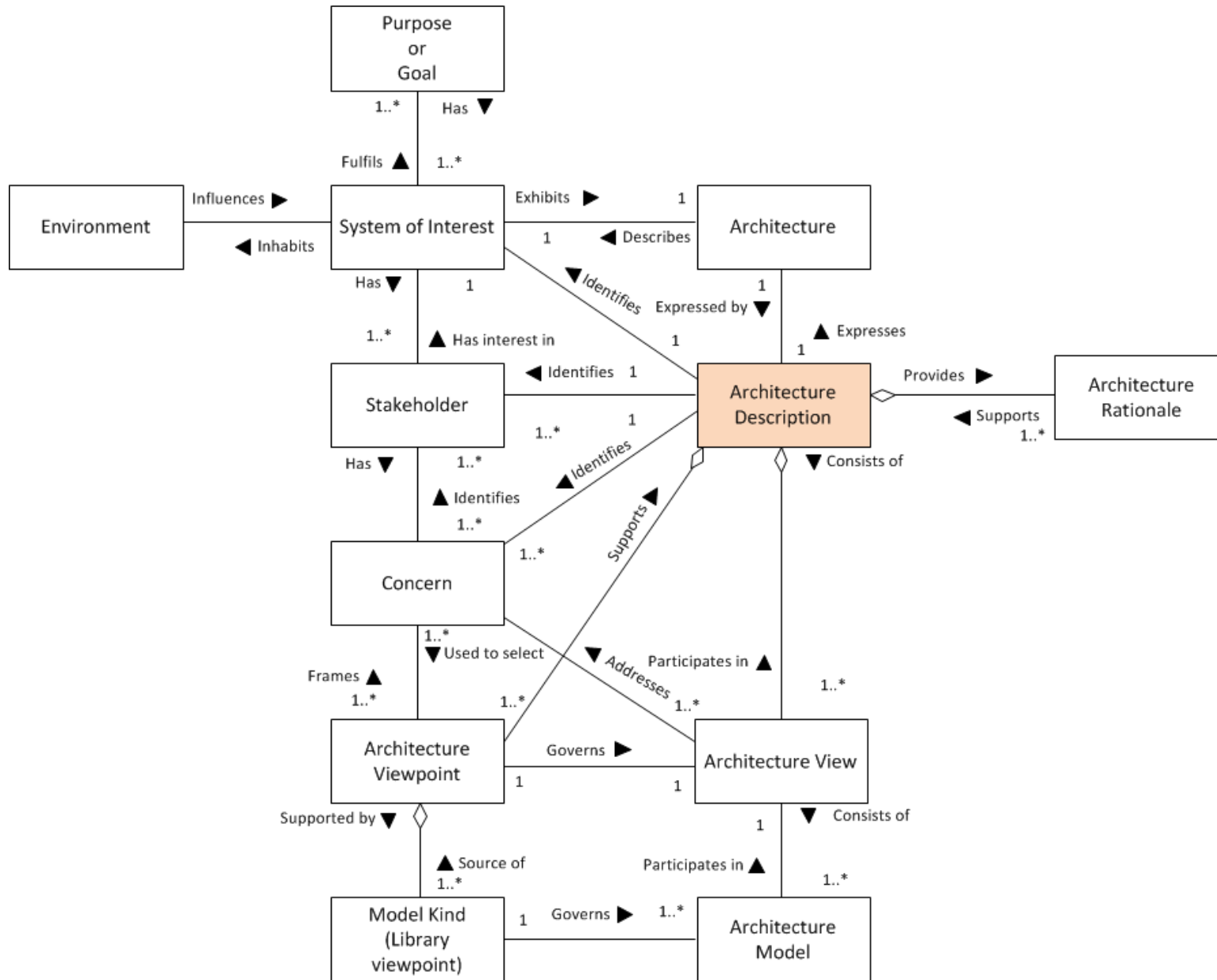
Definition of a Model



Cool definition of a Model
 For any system S
 M is a model of S
 if M can be used
 to answer questions
 about S

An Architecture View is comprised of Architecture Models.
 Each Model is constructed in accordance with the conventions established by its Model Kind, typically defined as part of its governing Architecture Viewpoint.
 Models provide a means for sharing details between views and for the use of multiple notations within a view.
 Typical models include Catalogues of items, Matrices which illustrate interactions and Diagrams

Definition of an Architecture Description



An Architecture Description is a work product used to express the Architecture of some System Of Interest.

An Architecture Description describes one possible Architecture for a System Of Interest.

An Architecture Description may take the form of a document, a set of models, a model repository, or some other form (the AD format is not defined by the Standard)..

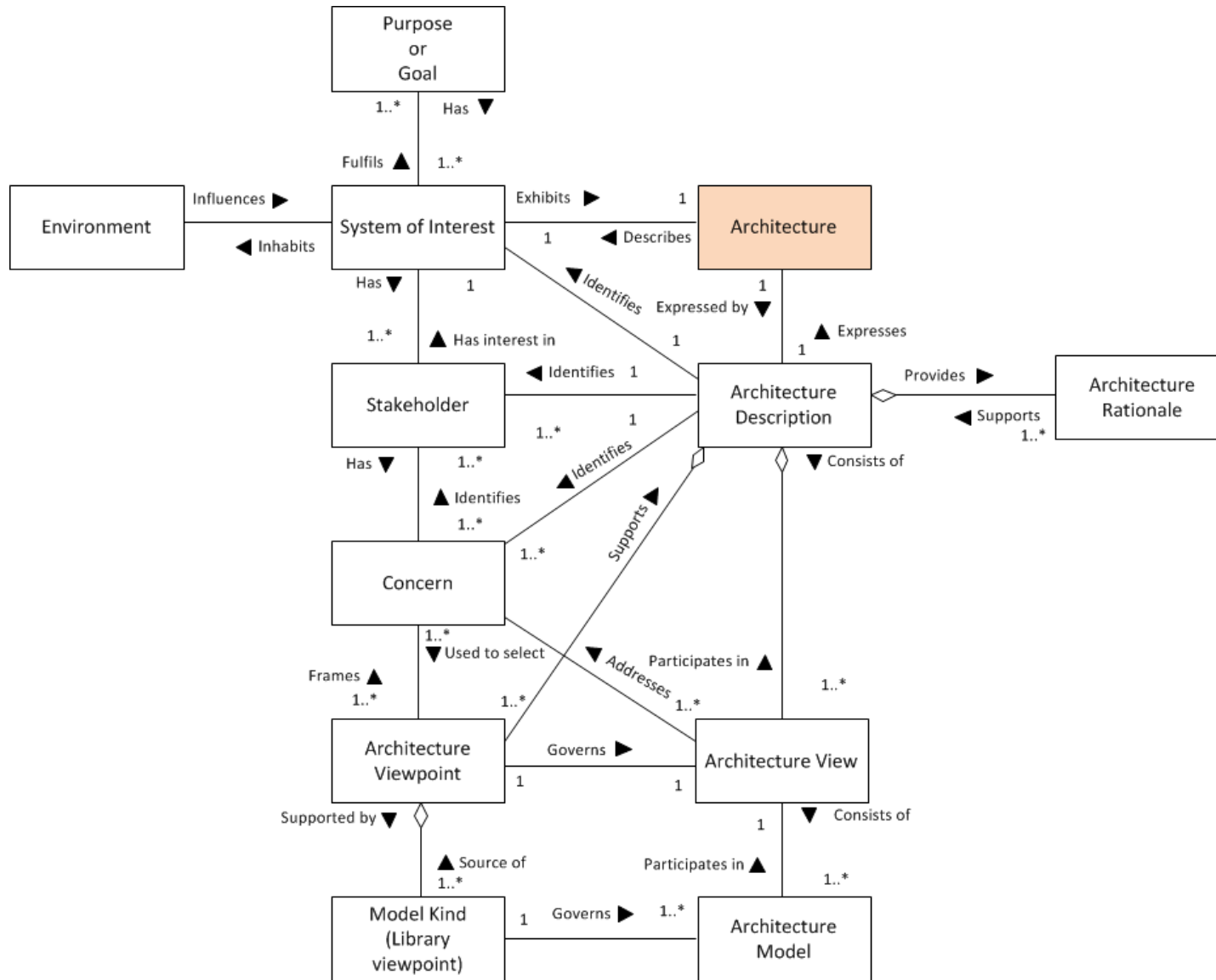
Definition of an Architecture Rationale



The Architecture Rationale captures the reasons why certain architectural choices have been made (such as viewpoints selected for use, and architectural decisions).

The Architecture Rationale provides the audit trail of decisions and is consistent with the requirements of King III, paragraph 5.

Definition of an Architecture



All systems have Architectures.

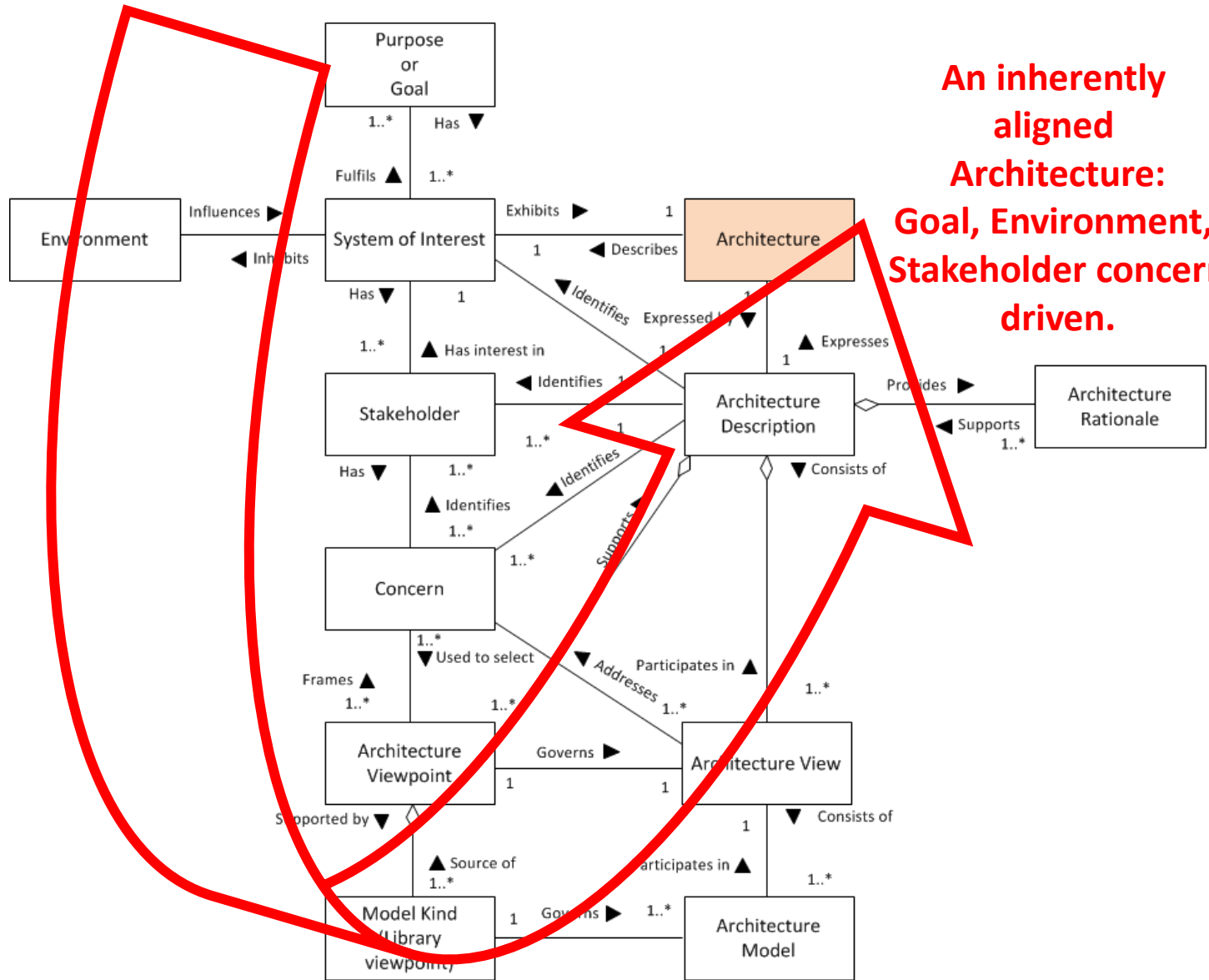
In the Standard, the architecture of a system is defined as:

“The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution”.

The definition was chosen

- (i) to fit the broad range of things noted above under System: the architecture of an enterprise, system, system of systems, ... is what is fundamental to it;
- (ii) (ii) to emphasize (through use of the phrase "concepts or properties") that a system has an architecture ***even if that architecture is not written down.***
- (iii) Notice that the Architecture has been informed by and has to conform to, the Goal, Environment and the Stakeholder Concerns – inherent alignment

Driving out requirements



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- (iii) Notice that the Architecture has been informed by and has to conform to, the Goal, Environment and the Stakeholder Concerns – inherent alignment

Benefits of using ISO/IEC/IEEE 42010 - 2007

- A simple, structured approach.
- Well defined, measurable, goals and outcomes.
- Significant Stakeholder involvement.
- Destruction of implicit models.
- Implementable solutions that are grounded in reality.
- Iterative approach allows for trade off decisions and optimisation.
- Readily adaptable to manage different levels of discussion throughout the Enterprise

My favourite Architecture Methodology

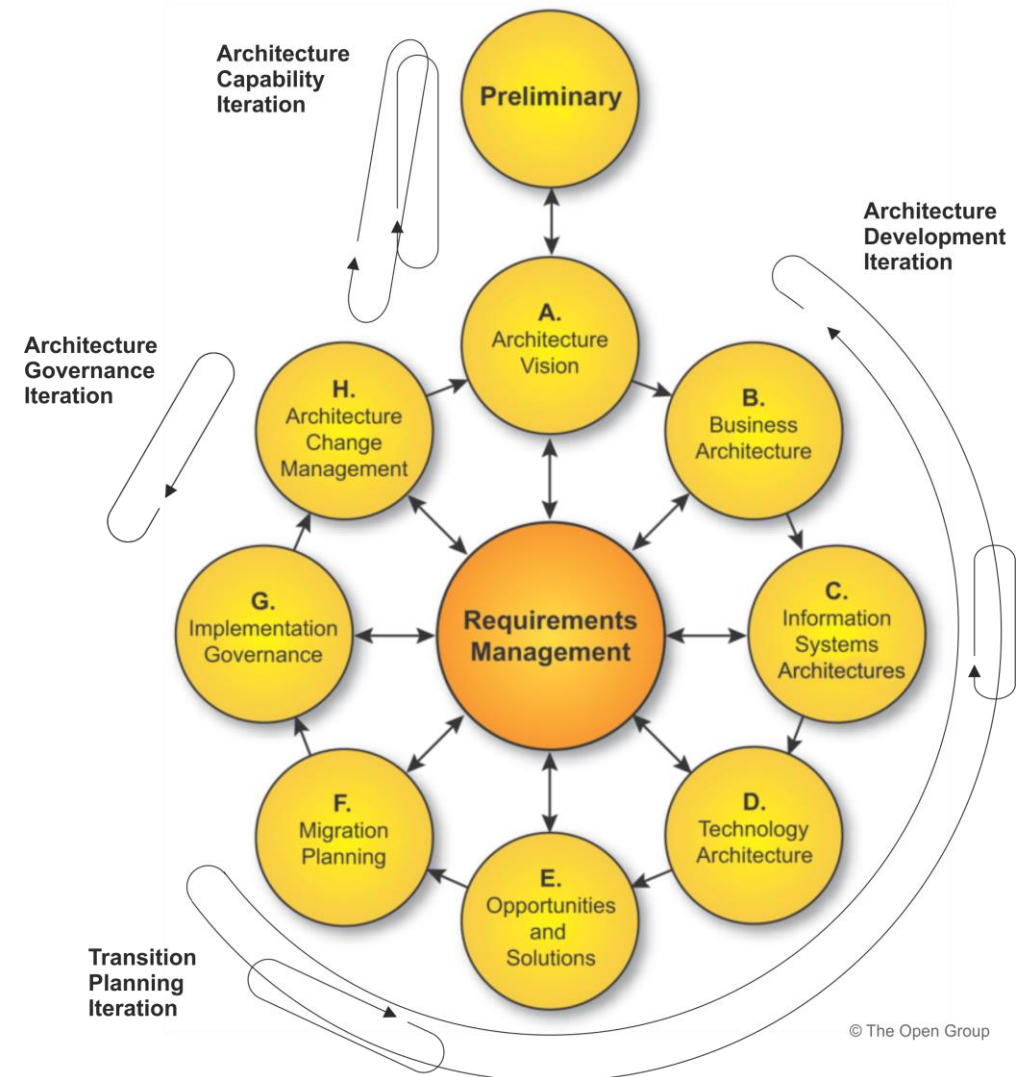
I really like the TOGAF approach to Architecture development.

It provides a scalable and repeatable approach to analysing, synthesizing, realising and operating Enterprise Architectures.

It is adaptable and technology and terminology neutral.

It provides guidance on best practice approaches to real situations and continually evolves to suit business requirements.

It forms the core of an Architectural Body of Knowledge that supports the development of professional Architecture competencies, certification and recognition.



TOGAF Criticisms

- There are several well publicised comments about the suitability of the TOGAF approach.
- Svyatoslav Kotusev has written two critiques of the TOGAF approach, seemingly contending that TOGAF offers a new kind of snake oil to the Religious Architecture Sect of the Church of the Open Group.
- In contrast Jason Bloomberg's article "Don't be a Fool with a Tool", provides a more balanced approach to the use of this methodology.
- In my opinion neither of these authors discuss the actual problem inherent to Enterprise Architecture – the requirement to work with a six dimensional hypercube.

<https://www.bcs.org/content-hub/enterprise-architecture-is-not-togaf/>

<https://www.bcs.org/content/conWebDoc/55892?changeNav=10130>

<https://www.forbes.com/sites/jasonbloomberg/2014/08/07/enterprise-architecture-dont-be-a-fool-with-a-tool/#3ba01a427860>

TOGAF Failures – blindly following a recipe

My Failed Chocolate Cake!

Ingredients

- 2 cups flour
- $\frac{3}{4}$ cups cocoa powder
- 1 $\frac{1}{2}$ tsp baking powder
- 2 tsp baking soda
- pinch of salt
- 1 cup milk
- 1 tsp vanilla essence
- 2 cups sugar
- $\frac{1}{2}$ cup oil
- 1 cup boiling water or hot coffee
- 2 eggs

The Goal



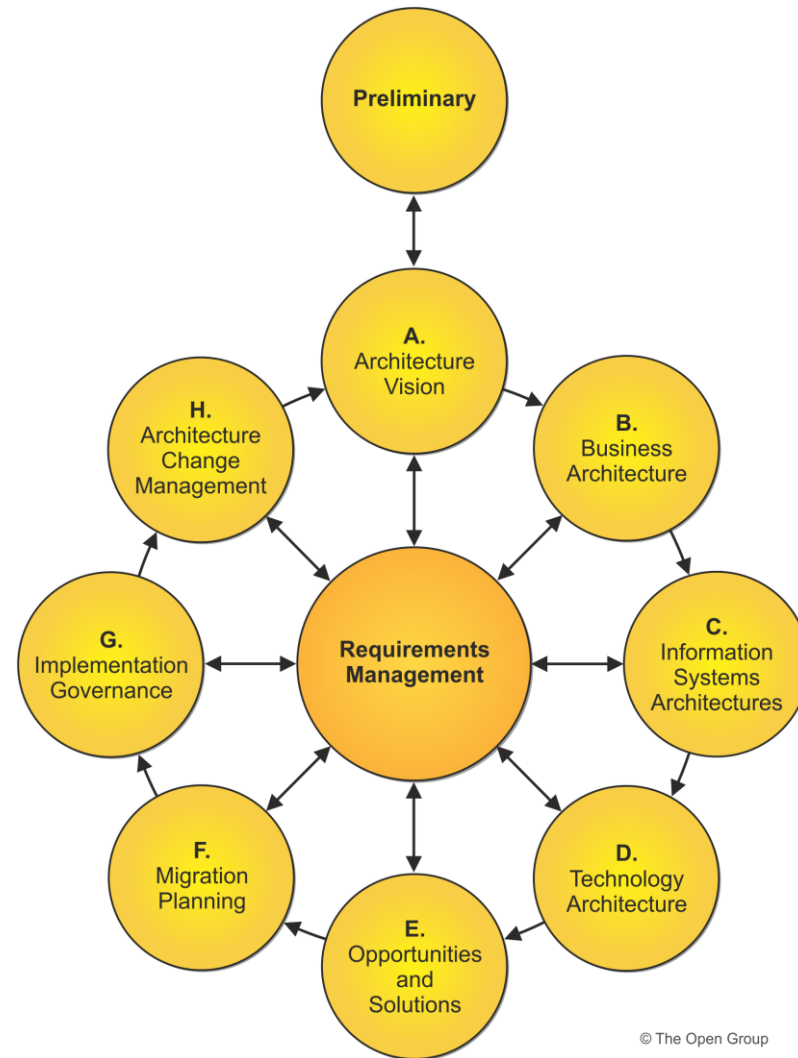
Methodology

- Preheat the oven to 180°C. Line two 23cm round cake pans, or one 23x33cm rectangular baking pan, with wax paper. Grease the paper and the sides of the pan well.
- In a large bowl, sift the dry ingredients together.
- Add the eggs, milk, oil and vanilla essence and beat with an electric mixer for about two minutes. Add the boiling water or coffee and mix until combined.
- Pour the batter evenly into the prepared pans and bake for 30-40 minutes.
- To test if the cake is ready, insert a toothpick into the middle of the pan. If it comes out clean, the cake is ready. A single rectangular cake will take slightly longer to bake than two round layers.
- Slide a knife around the edge of each cake to loosen it from the pan, turn the pan over onto a metal rack and peel off the paper.
- Let the cake cool completely before covering with icing.

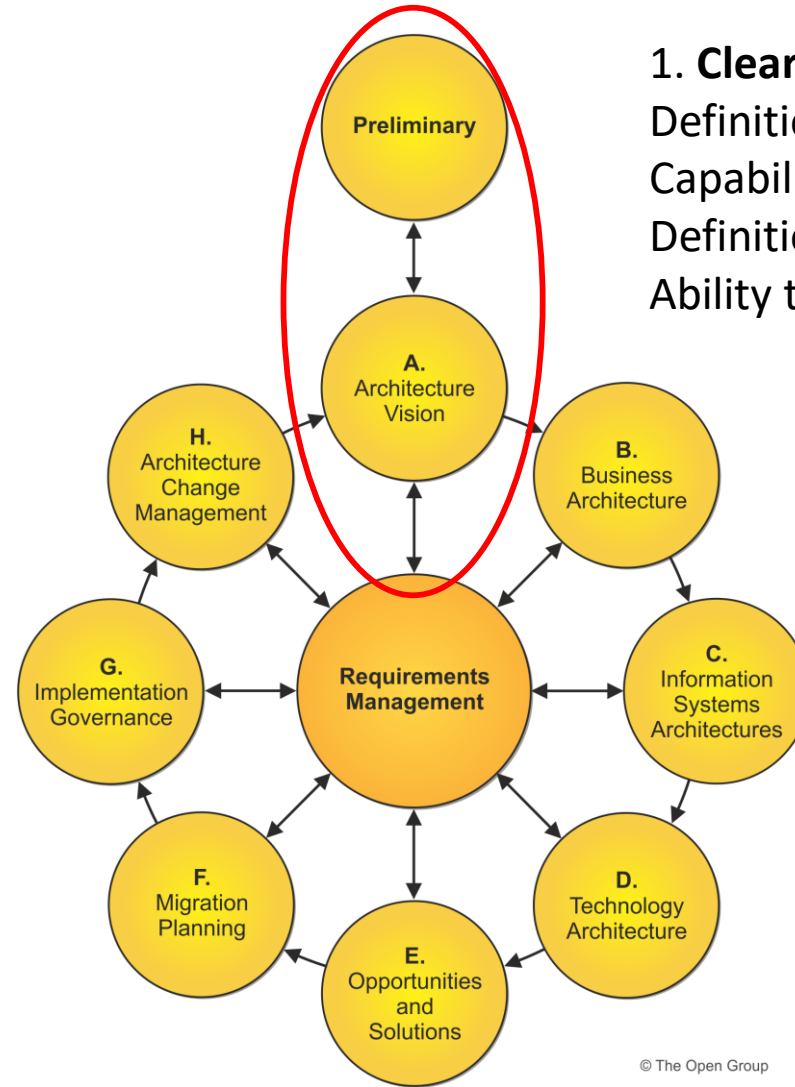
Failed Cake Analysis – blindly doing it by the book

- Total lack of a Technology Architecture
- Lots of assumed knowledge and the context has not been clarified
- No mention that the eggs should be shelled!
 - Preheat the oven to 180°C. Line two 23cm round cake pans, or one 23x33cm rectangular baking pan, with wax paper. Grease the paper and the sides of the pan well.
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How TOGAF would have saved my cake



How TOGAF would have saved my cake



1. Clear statement of intent

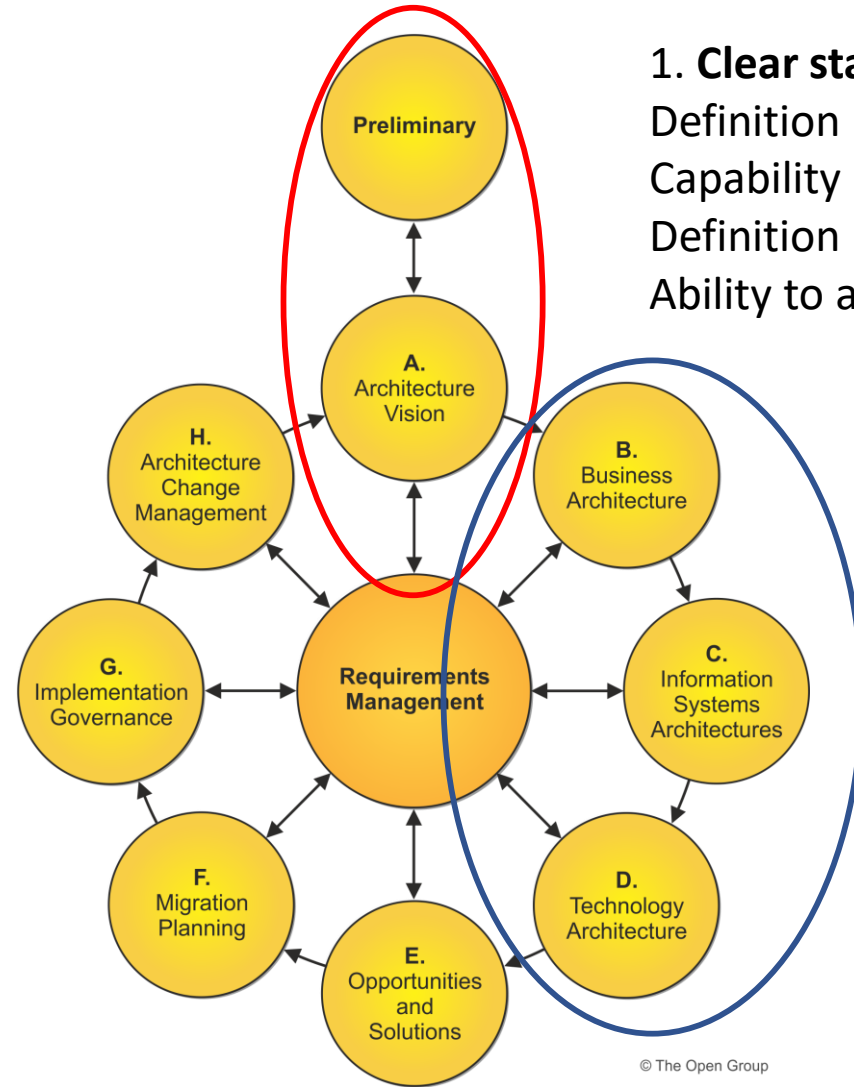
Definition of rules and measures

Capability and competency evaluation

Definition and selection of tools and technology

Ability to assimilate several frameworks, like Zachman

How TOGAF would have saved my cake



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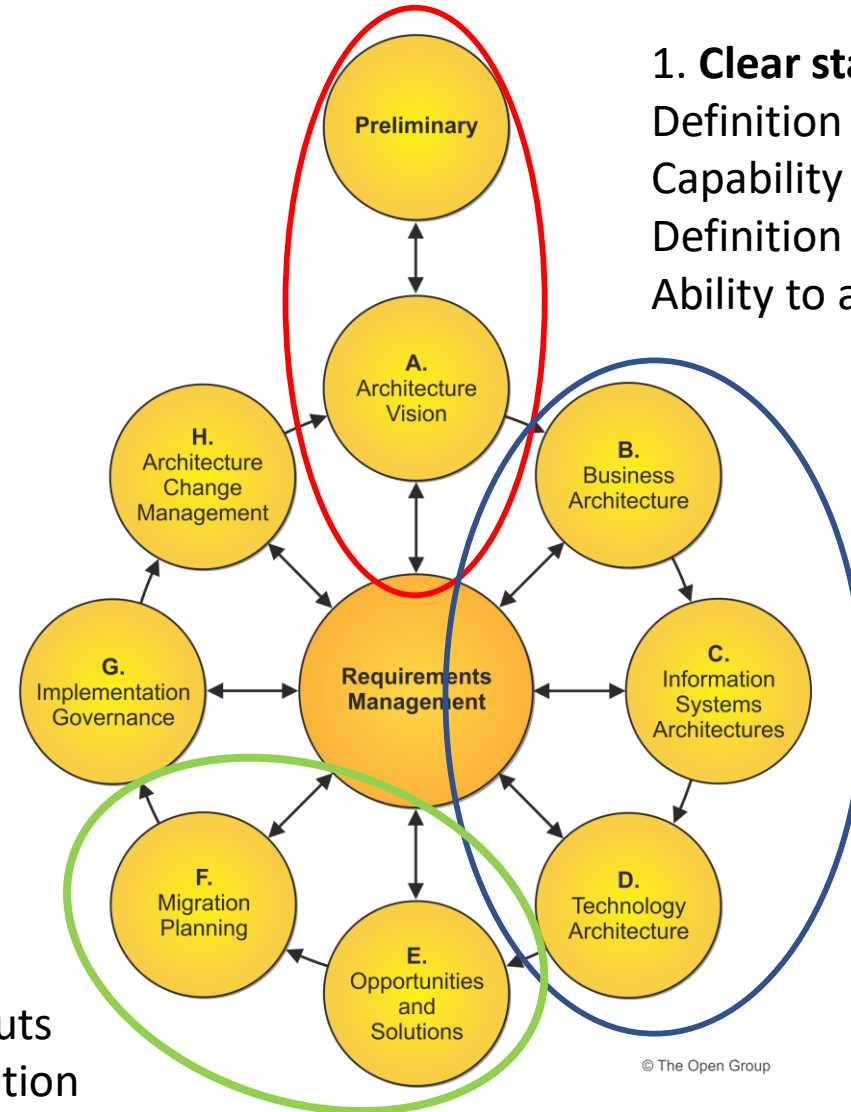
2. Requirements analysis

As is – To Be and Gap identification

Interoperability evaluation

Evaluate against the Zachman framework

How TOGAF would have saved my cake



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Evaluate against the Zachman framework

© The Open Group

3. Solution synthesis

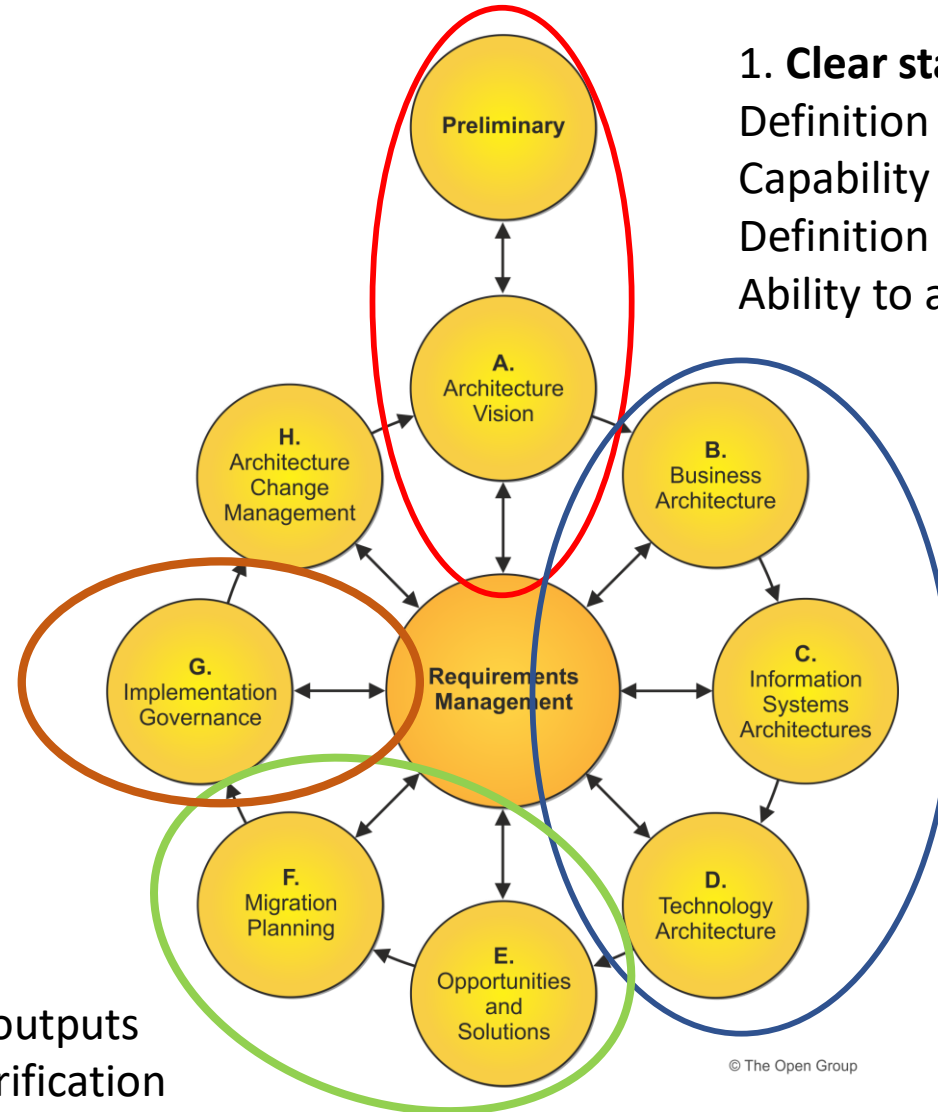
Consolidation of gap analysis outputs

End to end interoperability verification

End to end resource requirement and schedule

Implementable realisation plan

How TOGAF would have saved my cake



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Evaluate against the Zachman framework

4. Implementation

The mixing of ingredients

Baking of the cake

Quality control

3. Solution synthesis

Consolidation of gap analysis outputs

End to end interoperability verification

End to end resource requirement and schedule

Implementable realisation plan

How TOGAF would have saved my cake

5. Operation

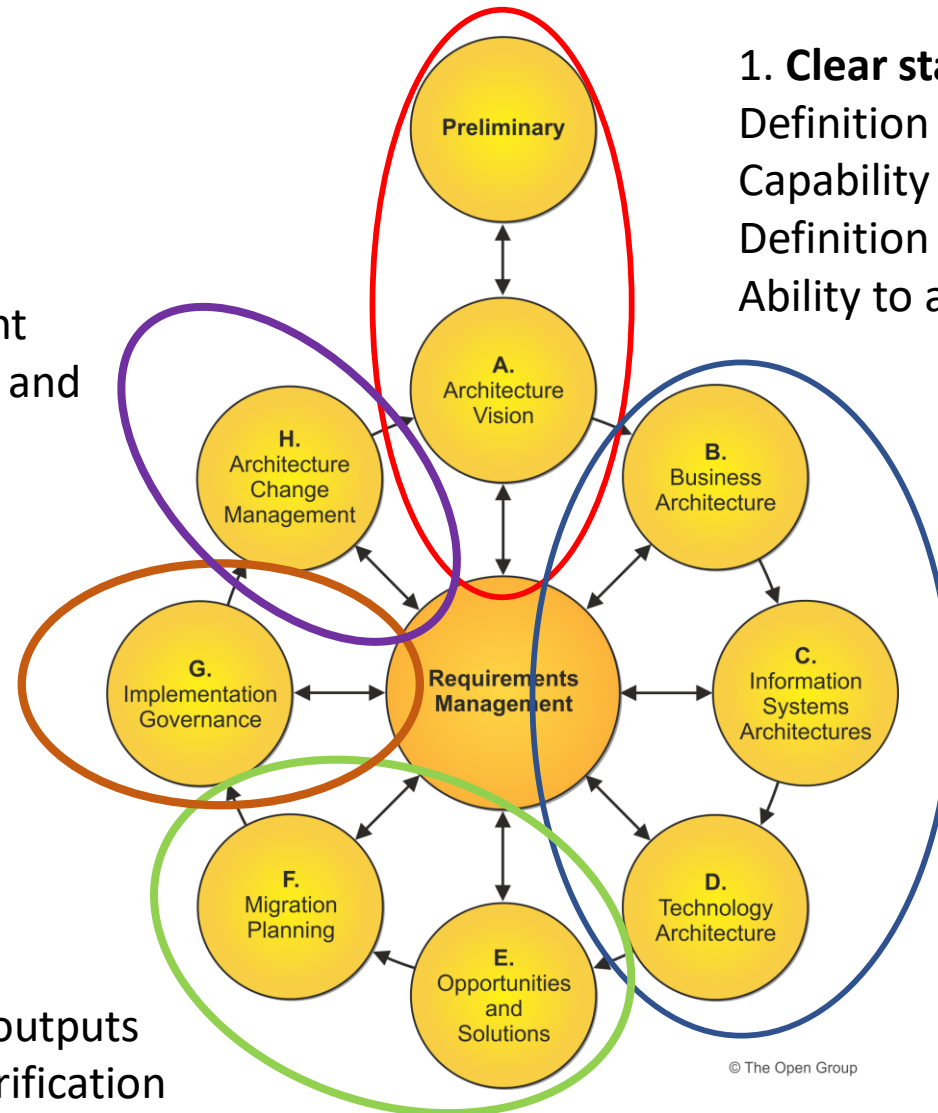
Eating of the cake
Quality assessment
Recipe evaluation and change requests

4. Implementation

The mixing of ingredients
Baking of the cake
Quality control

3. Solution synthesis

Consolidation of gap analysis outputs
End to end interoperability verification
End to end resource requirement and schedule
Implementable realisation plan



© The Open Group

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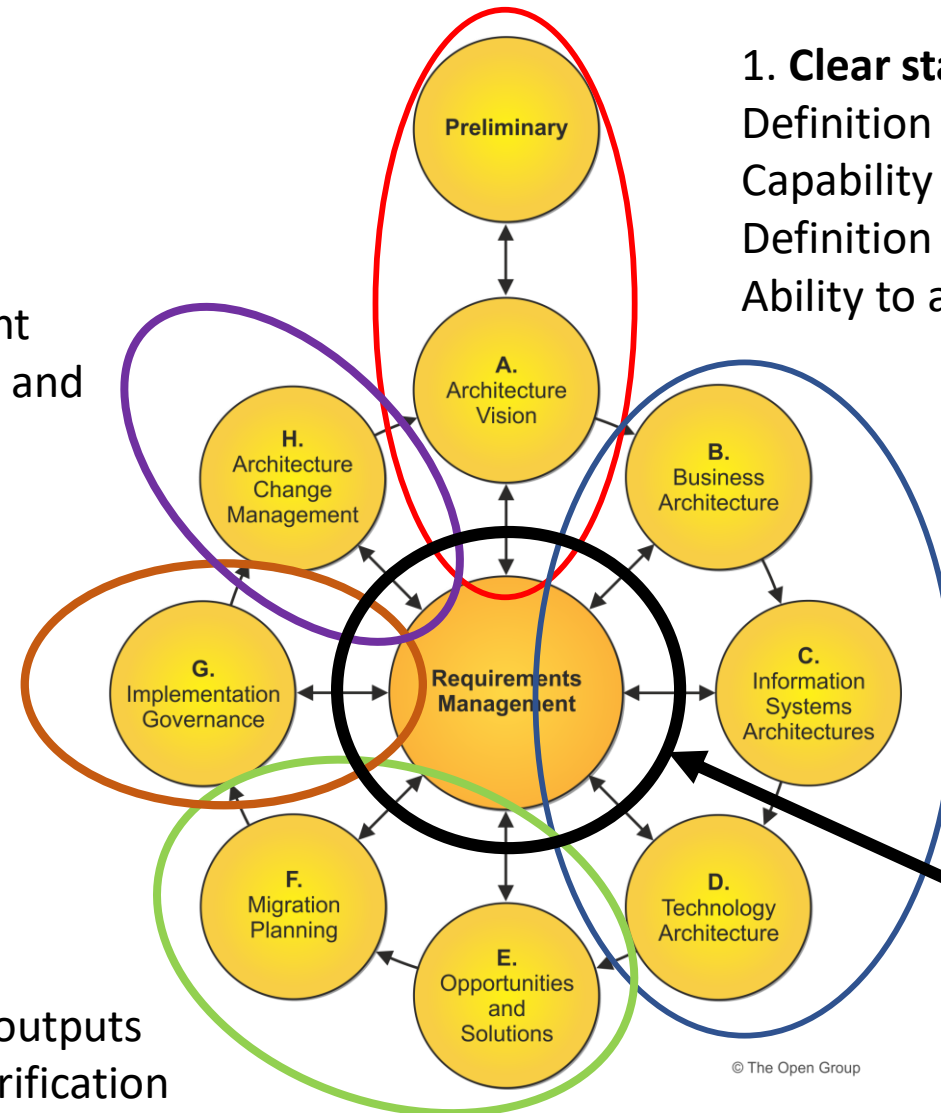
Definition of rules and measures
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Ability to assimilate several frameworks, like Zachman

2. Requirements analysis

As is – To Be and Gap identification
Interoperability evaluation
Evaluate against the Zachman framework

6. My memory and conscience

The knowledge database that allows for critical evaluation and repeatable success



5. Operation

Eating of the cake
Quality assessment
Recipe evaluation and change requests

4. Implementation

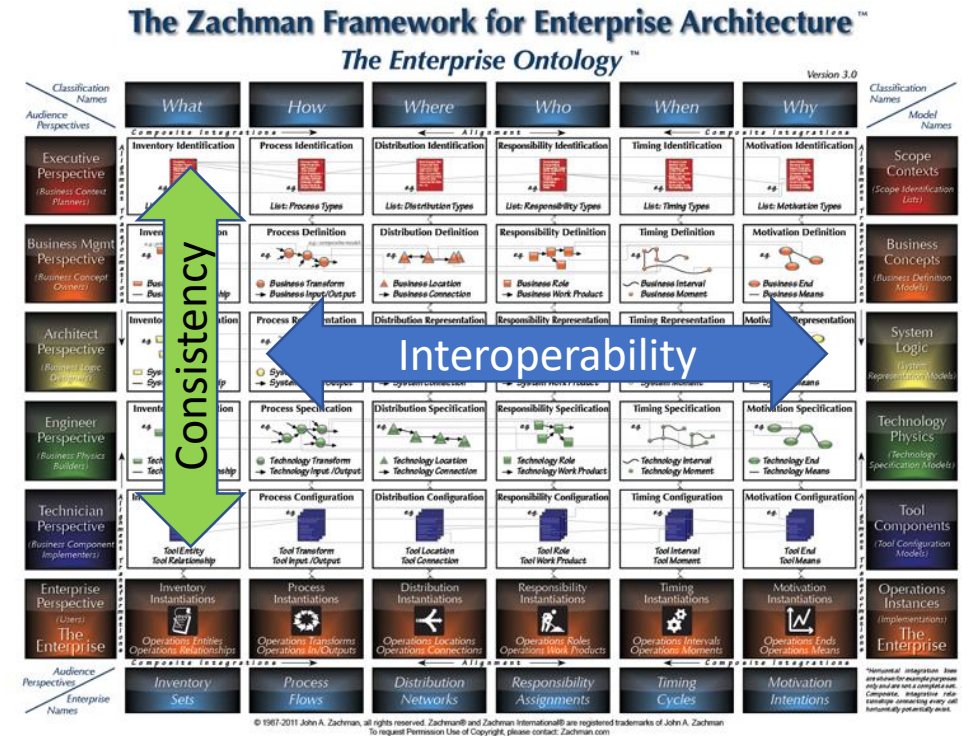
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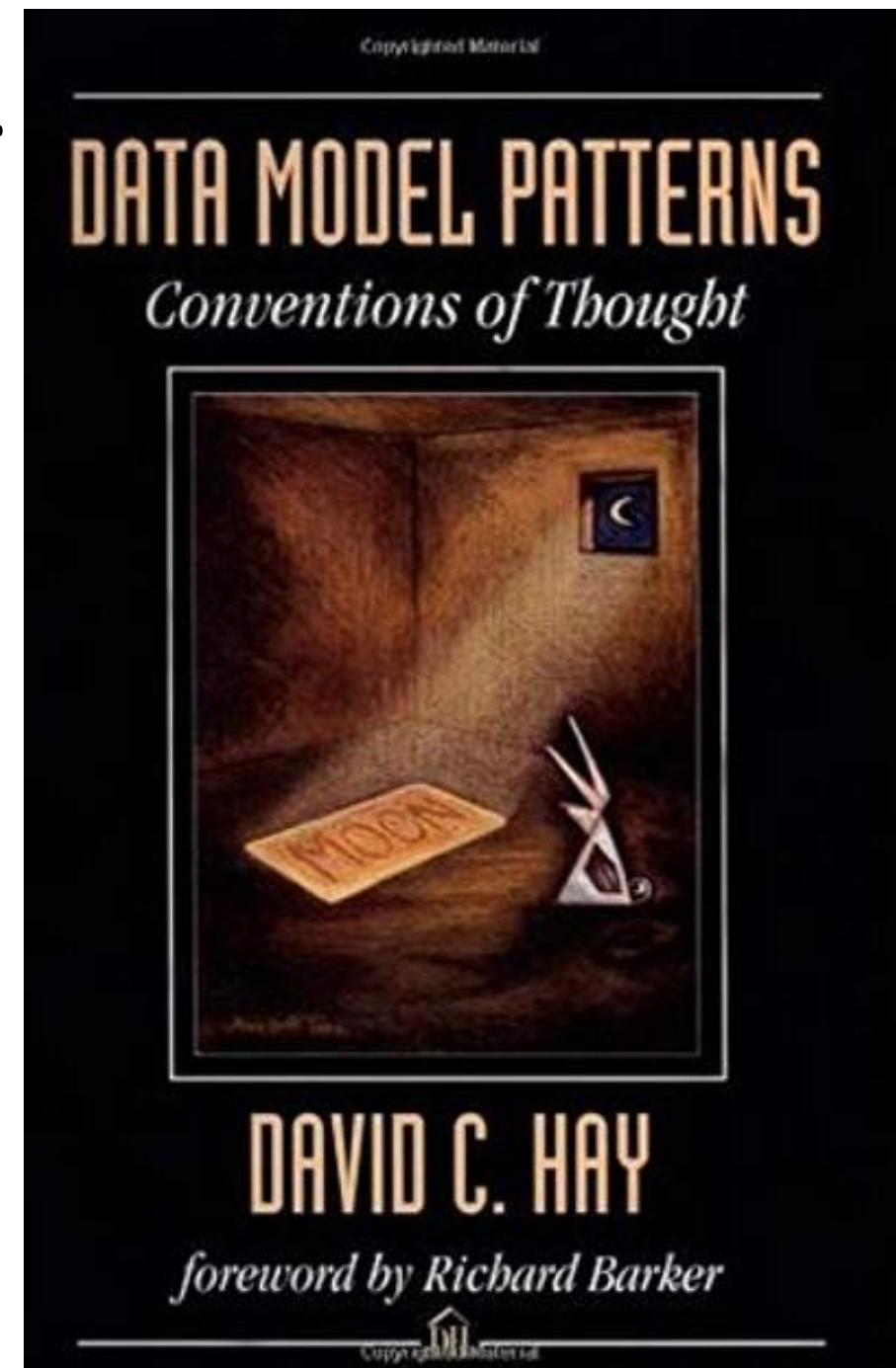
The real challenge of Enterprise Architecture

- Enterprise Architecture represents a six dimensional hypercube.
- Your enterprise has all of the Zachman Framework models, at all levels, at all times.
- Your enterprise has a Business Rules model, a Temporal model, a Data model, a Technology model, a Process model and a People model.
- The Enterprise Architect has to ensure consistency and interoperability amongst all of these models, at all times.



And just when you have it all done.....

- The cover of the excellent book: **Data Model Patterns** by David C Hay, data guru, wise man, origami master and stand up comic, captures the problem with modelling.
- The dog in the illustration stares at a rectangle of light on a floor that has been designated MOON.
- We all know that it actually is a filtered, reflected projection of the light of the sun.
- And, in time, the movement of the celestial bodies will cause that rectangle of light to shift, invalidating the MOON designation.
- Similarly our Enterprise Architecture represents a snapshot in time and requires continual maintenance to remain current.
- **THE REQUIREMENT TO CONTINUALLY MANAGE CHANGE IS INHERENT TO ENTERPRSE ARCHITECTCURE!**



System Types: Open and Closed Systems

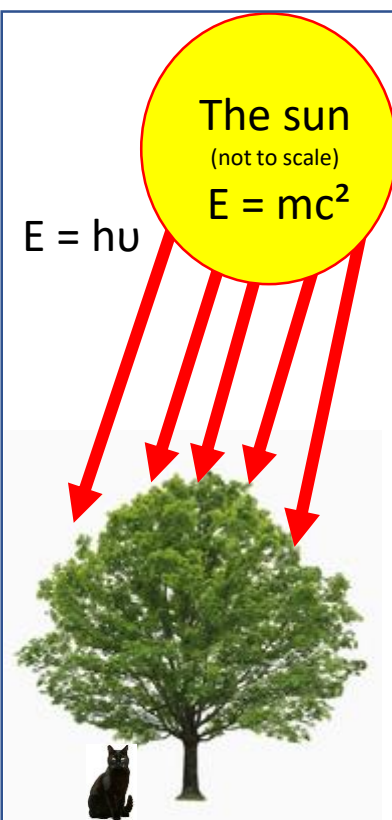
- There are two basic types of systems.
- Open Systems, like a tree, can absorb energy, sunlight, across the System, tree, boundary to build structure, cellulose, and create order.
- Closed Systems do not have the ability to absorb energy across their systems boundaries to effect change and create order.
- The only natural occurring process that happens in Closed Systems is one where the Energy decreases and the Entropy, or chaos or disorder or complexity, increases.
- Closed systems require Continual Energy Input, Simply to Maintain the State of the System.
- Enterprise Architectures represent Closed Systems, they do not have self healing properties, there are no Architecture Elves that descend in the dark of night to fix architectural issues. This is an Enterprise Alchemy myth!

The Six Fake Elves of Enterprise Alchemy that fix systems at night.



$E = hu$

The sun
(not to scale)
 $E = mc^2$



Open System (Tree)
Leaves are solar panels.
They eat the energy from the sun, sunlight, and use that to make wood.
We burn the wood for heat – releasing the energy of the sunlight that was stored in the wood.
Note the presence of Schrodinger's cat!

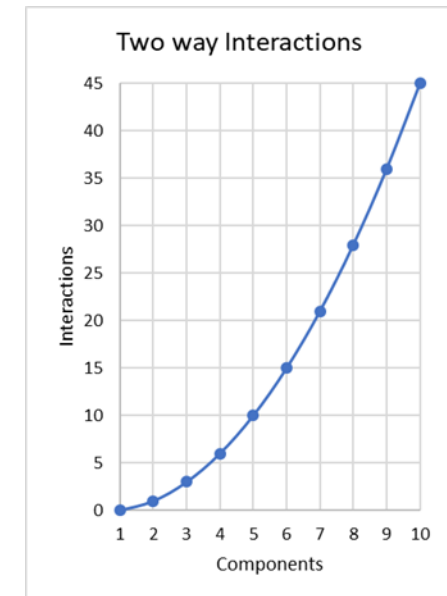
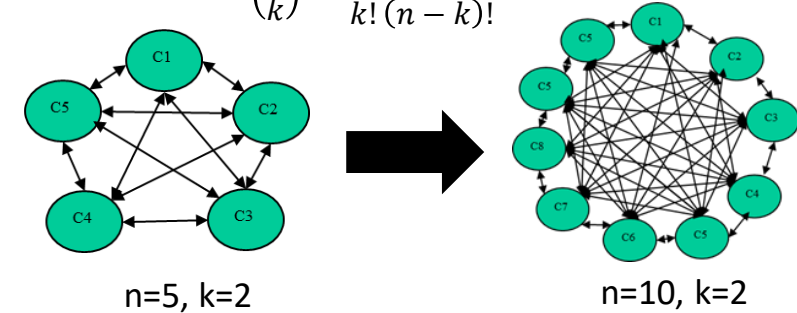
Lehman's Laws of Software Systems Evolution

- Lehman proposed the concept of Embedded, Evolutionary or E-systems, systems that will continually evolve to suit emerging requirements.
- An E-program is written to perform some real-world activity; how it should behave is strongly linked to the environment in which it runs, and such a program needs to adapt to varying requirements and circumstances in that environment. (Long before Marketing developed the term DevOps!!)
- The notion of continual evolution is consistent with the IEEE Architecture definition: *"The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and **evolution**"*.
- Law 1: "Continuing Change" — an E-type system must be continually adapted or it becomes progressively less satisfactory.
- Law 2: "Increasing Complexity" — as an E-type system evolves, its **complexity increases unless work is done to maintain or reduce it**.
- Law 2 is a restatement of the Second Law of Thermodynamics

Interactions / Complexity

Increased components result in a non linear increase in complexity

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$



Analysing Lehman's Second Law

Let us start with a complex, closed, system with initial complexity E and introduce a small change ΔE at some time.

We can expect the change in complexity to be proportional to the initial complexity.

$\Delta E \sim E$ or $\Delta E = kE$ where k is an arbitrary positive proportionality constant yielding the increase in complexity.

Applying differential calculus to the change over time

$$\frac{dE}{dt} = kE \text{ and rearrange the terms to yield } \frac{dE}{E} = kdt$$

Solving this equation yields : $\ln(E) = kt + b$ where b is some constant of integration

This can be rewritten as: $E = e^{(kt+b)}$ from where, at $t=0$, the initial complexity is given by $E_0 = e^b$

The equation for the systems complexity is given by

$$E = E_0 e^{kt}$$

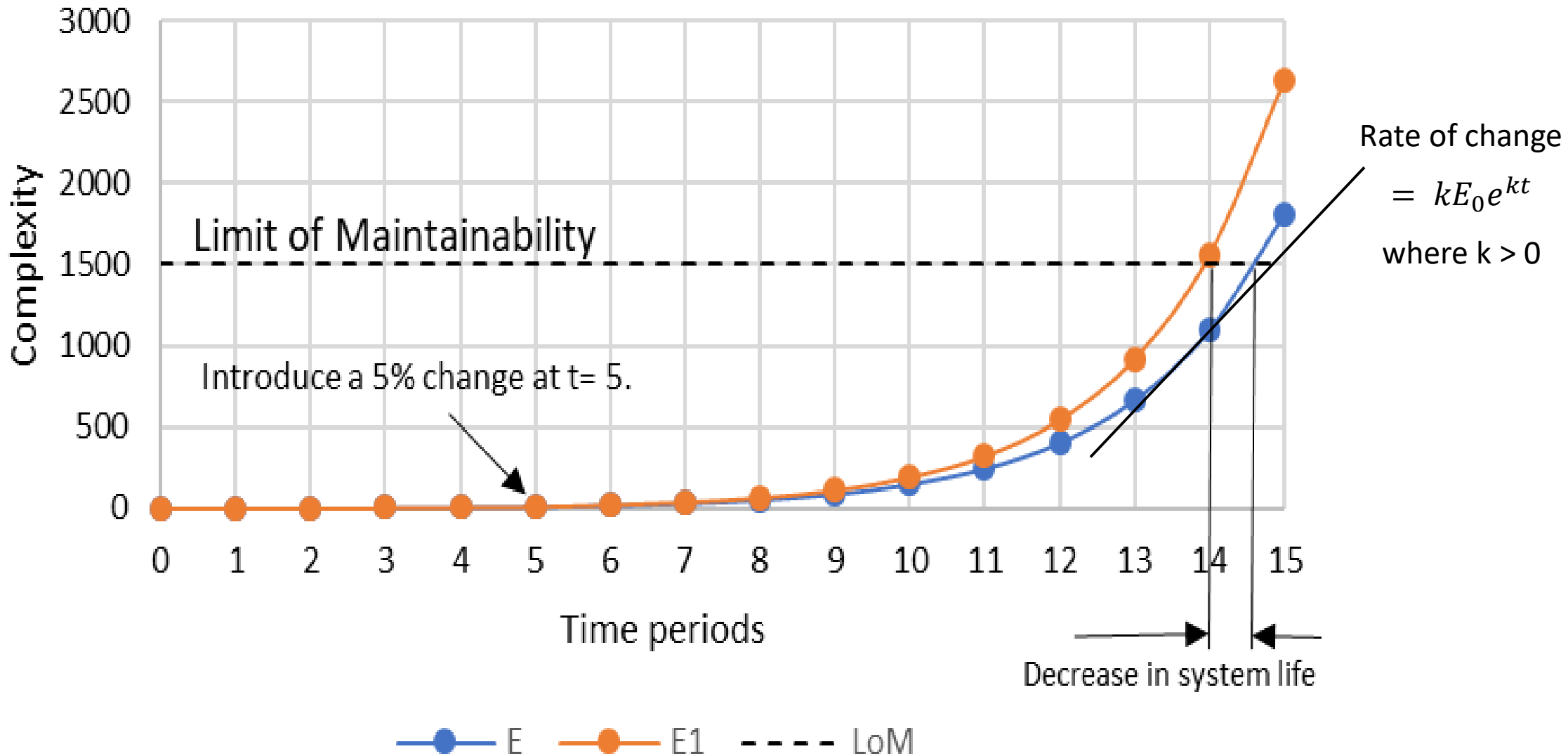
This is an exponential curve and the gradient, slope or the rate of change, is given by $\frac{dE}{dt} = kE_0 e^{kt}$

Note that the rate of change at any point of the trajectory is k times higher than the value of the curve at that point. This results in a non-linear situation that is difficult to estimate without knowing the trajectory.

Lehman's Second Law Graphic

Complexity over Time

Shape of curve: $E = E_0 e^{kt}$



Maintainability

- Are systems infinitely maintainable??
- No
- Recall that systems are under continual pressure to change as per Lehman 1.
- Implementing change invariably increases the system complexity as per Lehman 2.
- There is a Limit of Maintainability where the complexity of the system results in the maintenance burden becoming so high that the system is rendered useless.
 - You are fixing things so frequently that users cannot log in!
 - And your fixing introduces more complexity that causes the system to fail more frequently!
- This is the time when you junk the old system and start fresh.
- This is also the real reason behind Windows 95, Windows 98, Windows 2000, Windows ME, Windows XP, Windows 7, Windows 10

Implications of Lehman's Laws

- All systems are under constant pressure to change.
- Unless you are very careful, and apply significant work, you will increase the complexity of the system.
- Complex systems are more prone to failure.
- There is a Limit of Complexity beyond which it is better to replace the systems than to try and maintain it.
- Systems require constant work, energy, money, simply to maintain the state of the system.
- Carefully consider the current state of your systems in terms of maintenance efforts and possible end of life scenarios.
- Use this information to determine the Re-Use, Buy or Build decisions.

Some sleight of hand to think about

- Let us for a moment consider the famous statement of John Zachman: **The system is the Enterprise** and apply this to Lehman's Laws of System Evolution.
- We substitute the term **E-type system** with the term **Enterprise**

1. "Continuing Change" — an E-type system must be continually adapted or it becomes progressively less satisfactory.
2. "Increasing Complexity" — as an E-type system evolves, its complexity increases unless work is done to maintain or reduce it.
3. "Self Regulation" — E-type system evolution processes are self-regulating with the distribution of product and process measures close to normal.
4. "Conservation of Organisational Stability (invariant work rate)" — the average effective global activity rate in an evolving E-type system is invariant over the product's lifetime.
5. "Conservation of Familiarity" — as an E-type system evolves, all associated with it, developers, sales personnel and users, for example, must maintain mastery of its content and behaviour to achieve satisfactory evolution. Excessive growth diminishes that mastery. Hence the average incremental growth remains invariant as the system evolves.
6. "Continuing Growth" — the functional content of an E-type system must be continually increased to maintain user satisfaction over its lifetime.
7. "Declining Quality" — the quality of an E-type system will appear to be declining unless it is rigorously maintained and adapted to operational environment changes.
8. "Feedback System" (first stated 1974, formalised as law 1996) — E-type evolution processes constitute multi-level, multi-loop, multi-agent feedback systems and must be treated as such to achieve significant improvement over any reasonable base.

1. "Continuing Change" — an **Enterprise** must be continually adapted or it becomes progressively less satisfactory.
2. "Increasing Complexity" — as an **Enterprise** evolves, its complexity increases unless work is done to maintain or reduce it.
3. "Self Regulation" — **Enterprise** evolution processes are self-regulating with the distribution of product and process measures close to normal.
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https://en.wikipedia.org/wiki/Lehman%27s_laws_of_software_evolution

https://blogs.msdn.microsoft.com/karchworld_identity/2011/04/01/lehman-laws-of-software-evolution-and-the-staged-model/

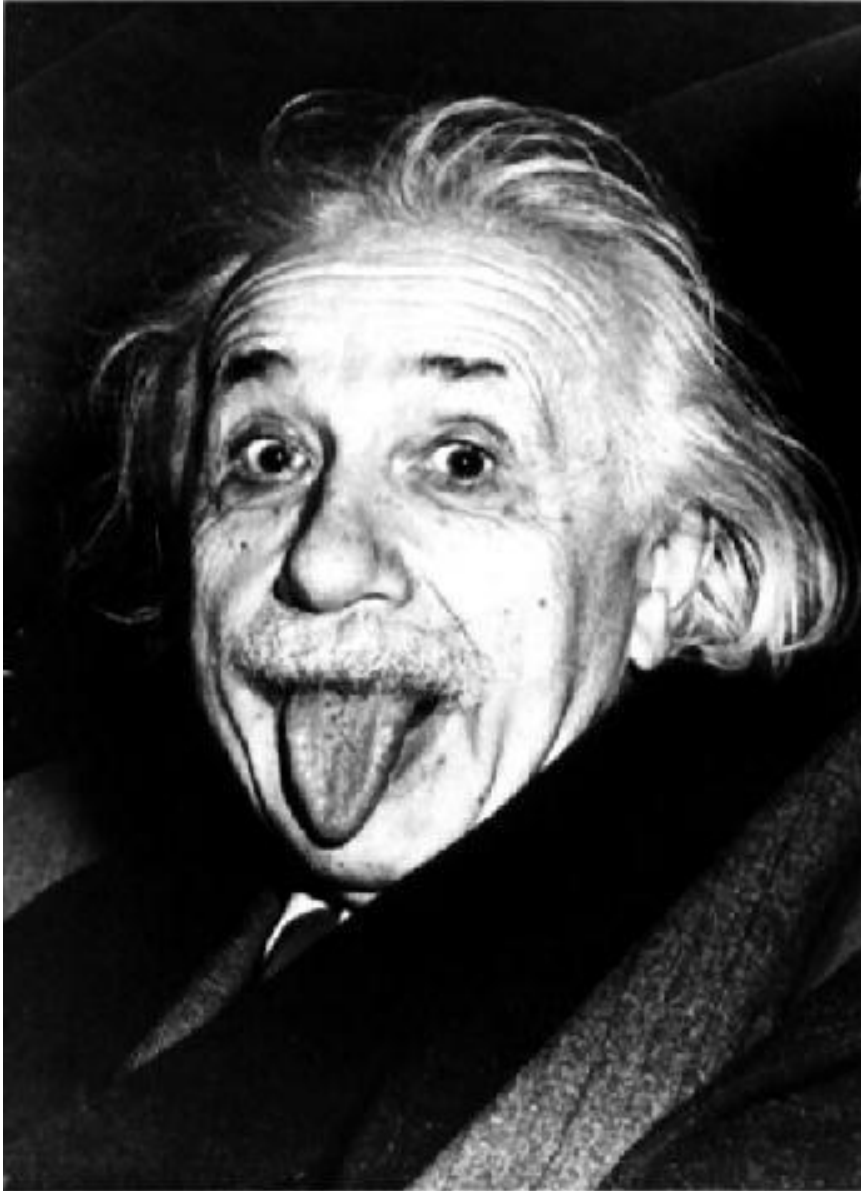
Becoming an Enterprise Engineer

- Realise that all the easy solutions to Enterprise Architecture have already failed.
- Acknowledge that the Enterprise complexity requires working in a six dimensional hypercube.
- Understand that Enterprise Architecture is a necessary, strategic, requirement, you are building the Enterprise of Tomorrow.
- Adopt a Thinking Tool, the Zachman Framework, that will enable you to analyse and manage the complexity of the Enterprise and work with the Enterprise Primitives.
- Adopt a consistent methodology, like TOGAF, that will allow you to analyse situations, synthesize solutions and implement robust, durable enterprise support capabilities.
- Never, ever, suspend Common Sense!

Conclusion: in my opinion.....

- Enterprise Architecture is a complex endeavour that requires the consistent management of all of the aspects of a six dimensional hypercube.
- The Zachman Framework provides the best thinking tool for the analysis and reification of Enterprise Architecture.
- The ISO 42010: 2007 standard provides a means for structured conversations that will drive out implicit models and deliver clear descriptions of architectural requirements.
- TOGAF provides a suitable methodology for developing Enterprise Architectures.
- Understand Lehman's Laws, your change efforts could increase complexity, reducing systems life.
- Enterprise Alchemy is dangerous, typically based on the massaging of symptoms and provides no lasting cure or relief.
- Enterprise Engineering is knowledge based, requires thinking before doing, and provides the tools for repeatable successful outcomes.

Questions?



The significant problems we face will not be solved by the same level of thinking that created them

A. Einstein