Enterprise Architecture

Building and Running Systems is NOT Enterprise Architecture and vice versa

John A. Zachman
Zachman International

The Information Age

"The next information revolution is well underway. But it is not happening where information scientists, information executives, and the information industry in general are looking for it. It is not a revolution in technology, machinery, techniques, software, or speed. It is a revolution in CONCEPTS."

Peter Drucker. Forbes ASAP, August 24, 1998

"Future Shock" (1970) - The rate of change.
"The Third Wave" (1980) - The structure of change.
"Powershift" (1990) - The culture of change.
-Alvin Toffler

"We are living in an extraordinary moment in history. Historians will look back on our times, the 40-year time span between 1980 and 2020, and classify it among the handful of historic moments when humans reorganized their entire civilization around a new tool, a new idea."

Peter Leyden. Minneapolis Star Tribune. June 4, 1995
"On the Edge of the Digital Age: The Historic Moment"

Introduction

Enterprise Architecture presently appears to be a grossly misunderstood concept among management.

It is NOT an Information Technology issue.
It is an ENTERPRISE issue.
It is likely perceived to be an Information Technology issue as opposed to a Management issue for two reasons:

- Awareness of it tends to surface in the Enterprise through the Information Systems community.
- Information Technology people seem to have the skills to do Enterprise Architecture if any Enterprise Architecture is being or is to be done.

Origins of Enterprise Architecture

- Frederick Taylor "Principles of Scientific Management" 1911
- Walter A. Shewhart "The Economic Control of Quality of Manufactured Product" 1931 (Dr. Edward Demming's Mgr.)
- Peter Drucker "The Practice of Management" 1954
- Jay Forrester "Industrial Dynamics" 1961
- Peter Senge "The Fifth Discipline" 1990
- Eric Helfert "Techniques of Financial Analysis" 1962
- Robert Anthony "Planning and Control Systems: A Framework for Analysis" 1965
- Sherman Blumenthal "Management Information Systems: A Framework for Planning and Development" 1969
- Alvin Toffler "Future Shock" 1970
- George Steiner "Comprehensive Managerial Planning" 1972
- Etc., etc., etc.

Day 1: Urgency and Introduction to EA

- Introduction
- Doing Enterprise Architecture
- The Paradigms
- Engineering Versus Manufacturing
- Defining Enterprise Architecture
- Complexity
- A Zachman Framework Story
- Change
- Ontology and Methodology
- Observations

Introduction to
Enterprise Architecture

Doing Enterprise Architecture

John A. Zachman
Zachman International

The Zachman Framework for Enterprise Architecture™

The Enterprise Ontology™

Version 3.0

Classification Names / Audience Perspectives	What	How	Where	Who	When	Why	Classification Names / Model Names
	Composite Integrations →		← Alignment →		← Composite Integrations		
Executive Perspective (Business Context Planners)	Inventory Identification e.g. List: Inventory Types	Process Identification e.g. List: Process Types	Distribution Identification e.g. List: Distribution Types	Responsibility Identification e.g. List: Responsibility Types	Timing Identification e.g. List: Timing Types	Motivation Identification e.g. List: Motivation Types	Scope Contexts (Scope Identification Lists)
Business Mgmt Perspective (Business Concept Owners)	Inventory Definition e.g.: primitive model: e.g. Business Entity Business Relationship	Process Definition e.g.: composite model: e.g. Business Transform Business Input/Output	Distribution Definition e.g. Business Location Business Connection	Responsibility Definition e.g. Business Role Business Work Product	Timing Definition e.g. Business Interval Business Moment	Motivation Definition e.g. Business End Business Means	Business Concepts (Business Definition Models)
Architect Perspective (Business Logic Designers)	Inventory Representation e.g. System Entity System Relationship	Process Representation e.g. System Transform System Input /Output	Distribution Representation e.g. System Location System Connection	Responsibility Representation e.g. System Role System Work Product	Timing Representation e.g. System Interval System Moment	Motivation Representation e.g. System End System Means	System Logic (System Representation Models)
Engineer Perspective (Business Physics Builders)	Inventory Specification e.g. Technology Entity Technology Relationship	Process Specification e.g. Technology Transform Technology Input /Output	Distribution Specification e.g. Technology Location Technology Connection	Responsibility Specification e.g. Technology Role Technology Work Product	Timing Specification e.g. Technology Interval Technology Moment	Motivation Specification e.g. Technology End Technology Means	Technology Physics (Technology Specification Models)
Technician Perspective (Business Component Implementers)	Inventory Configuration e.g. Tool Entity Tool Relationship	Process Configuration e.g. Tool Transform Tool Input /Output	Distribution Configuration e.g. Tool Location Tool Connection	Responsibility Configuration e.g. Tool Role Tool Work Product	Timing Configuration e.g. Tool Interval Tool Moment	Motivation Configuration e.g. Tool End Tool Means	Tool Components (Tool Configuration Models)
Enterprise Perspective (Users) The Enterprise	Inventory Instantiations Operations Entities Operations Relationships	Process Instantiations Operations Transforms Operations In/Outputs	Distribution Instantiations Operations Locations Operations Connections	Responsibility Instantiations Operations Roles Operations Work Products	Timing Instantiations Operations Intervals Operations Moments	Motivation Instantiations Operations Ends Operations Means	Operations Instances (Implementations) The Enterprise
Audience Perpectives / Enterprise Names	Composite Integrations →		← Alignment →		← Composite Integrations		
	Inventory Sets	Process Flows	Distribution Networks	Responsibility Assignments	Timing Cycles	Motivation Intentions	

Alignment Transformations

*Horizontal integration lines are shown for example purposes only and are not a complete set. Composite, integrative relationships connecting every cell horizontally potentially exist.

Framework Graphic

For the latest version of the Framework Graphic,
register at **www.Zachman.com**
for a high resolution .pdf file.

(For a publication release of the Framework Graphic
send requests to the Contact Us link on zachman.com)

You may be interested in several articles by John A. Zachman at
Zachman.com
"Architecture Is Architecture Is Architecture"
"John Zachman's Concise Definition of the Zachman Framework"
and
"The Zachman Framework Evolution" by John P. Zachman

Remember! This is a PRIMITIVE (single-variable) Model used for Engineering.

It cannot be used for implementations which require COMPOSITE (multi-variable) Models.

(Some possible COMPOSITE integration relationships may be shown at the periphery of the model. The COMPOSITE implementation "view" would be created by re-using components of other Enterprise-wide, "engineered" PRIMITIVES.

What
(Column 1)
Inventory Identification

Row 1
Executive
Perspective

Note:
Air Transportation Case
Inventories (Entities)
- Countable Things (Nouns)
- (Likely have serial numbers)

A List - Scope
Level of Detail = High
Abstract (no instances)
As simple as Possible
No Recurring Concepts

Airplanes
Airplane Types
Airports
Gates
Passengers
Seats
Bookings
Employees
Vehicles
Routes
Flights
etc.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Inventory
Sets

Scope
Contexts

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

"What" Column

Inventory Sets

This Column is descriptive of Enterprise Inventories -
things the Enterprise counts,
sufficiently significant that the Enterprise will keep
inventory records of them (data records at Row 3).

Inventories =

Countable Things =

Sets =

Nouns =

"Business Entities"

Test: The instances at Row 6 will have serial numbers.

Enterprise Framework

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How
(Column 2)
Process Identification

Row 1
Executive
Perspective

Acquire Routes
Schedule Flights
Sell Bookings
Reserve Seats
Train Employees
Fly Airplanes
Schedule Crews
Repair Facilities
Develop Markets
Maintain Airplanes
etc.

Scope
Contexts

Note:
Air Transportation Case
Processes (Transformations)
(Transitive Verb-Object)
A List - Scope
Level of Detail = High
Abstract (no instances)
As simple as possible
No Recurring Concepts

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row 6.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

Process
Flows

"How" Column

Process Flows

This Column is descriptive of Enterprise Process Flows - Processes (Transformations) the Enterprise performs.

Typically expressed as a transitive verb-object.

Test: The instances at Row 6 will be actual Transformations being performed by people or machines.

(Take something in,
do something to it,
send something **different** out.)

Enterprise Framework

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Where
(Column 3)

Distribution Identification
Airplane Network
Communications Network
Parts Distribution Network
Freight Network
Airport Network (Runways, Terminals, etc.)
Regulatory Route Network
Passenger Network
Personnel Distribution Network
etc.

Row 1
Executive
Perspective

Note:
Air Transportation Case Networks (Locations of Storage and Distribution)
A List - Scope
Level of Detail = High
Abstract (no instances)
As simple as Possible
No Recurring Concepts

Scope
Contexts

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row 6.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

Distribution
Networks

"Where" Column

Distribution Networks

This Column is descriptive of Enterprise Distribution Networks the Enterprise employs for storage and transportation.

Networks = Locations for storage
and connections for transportation.

Test: The instances at Row 6 will have Latitude and Longitude (and, maybe altitude).

Network Detail

Terminal Network
- Parking Lot
- Bag Check
- Ticketing
- Embark Gate
- Debark Gate
- Baggage Carousal
- Security
- Airline Club
- Rest Room
- Rental Car Lot
- Restaurant

Communications Net.
- Origin
- Switch
- Destination
- Queue

Passenger Network
- Origin
- Embark Airport
- Debark Airport
- Hub Airport
- Destination
- Public Access

Airport Network
- Runway
- Gate
- Utility Parking
- Hanger
- Repair Facility
- Fire Station
- De-Icing Station
- Fuel Station

Enterprise Framework

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Who
(Column 4)
Responsibility Identification

Flight Crews
Reservations
Aircraft Maintenance
Flight Scheduling
Airport Operations
Customer Service
Marketing
Sales
Flight Dispatch
Accounting
Pricing
etc.

Row 1
Executive
Perspective

Scope
Contexts

Note:
Air Transportation Case
Organizations Types
(These are "Roles" or "Functions"
not Organization instances)
A List - Scope
Level of Detail = High
Abstract (no instances)
As Simple as Possible
No Recurring Concepts
(Organization instances are Row 6)
The Column has to do with allocation of responsibility - was the work as manifested in some "Work Product" completed as assigned?

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row 6.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

Responsibility
Assignments

"Who" Column

Responsibility Assignments

This Column is descriptive of Enterprise Responsibility Assignments

Roles - Innate Abilities or Learned Skills of individuals to which the Enterprise assigns responsibilities for producing specific Work Products, i.e. Assignments (e.g. Reports, Decisions, Telephone Calls, Repairs, etc.).

Test: The instances at Row 6 will be Roles (i.e. abilities, learned skills) of identifiable individuals and they likely will have a SIC Code (Standard Industrial Classification).

Enterprise Framework

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It cannot be used for implementations which require COMPOSITE (multi-variable) Models.
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When
(Column 5)
Timing Identification

Row 1
Executive
Perspective

Flight Cycle
Customer Cycle (Origin to Destination)
Passenger Transfer (Connection Cycle)
Maintenance Cycle
Telephone Wait Cycle
Airplane Turnaround Cycle
De-icing Cycle
Air Traffic Control Cycle
Tarmac Cycle
Airplane Cycle (Acquisition to Retirement)
Baggage Handling Cycle
Security Cycle
etc.

Scope
Contexts

Note:
Air Transportation Case
Timing Cycles
A List - Scope
Level of Detail = High
Abstract (no instances)
As Simple as Possible
No Recurring Concepts

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row 6.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

Timing
Cycles

"When" Column

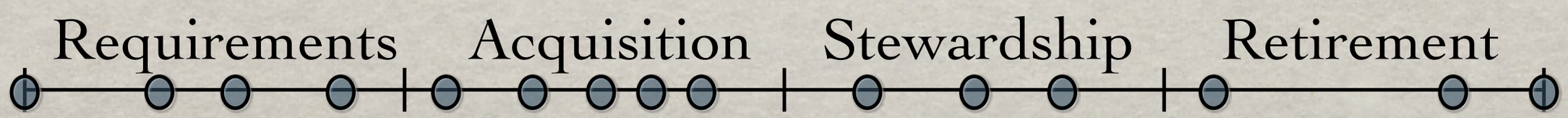
Timing Cycles

This Column is descriptive of Enterprise Timing Cycles

Timing Cycles sufficiently significant
that the Enterprise records them.

Test: The instances at Row 6 have actual clock/calendar times (Points in Time and Lengths of Time).

Note: The classic "Resource Life Cycle" has four stages comprised of Moments (Events) that make up:



Enterprise Framework

Remember! This is a PRIMITIVE (single-variable) Model used for Engineering.
It cannot be used for implementations which require COMPOSITE (multi-variable) Models.
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Why
(Column 6)
Motivation Identification

Row 1
Executive
Perspective

Equipment Utilization
New Markets
Revenue Growth
Expense Reduction
Customer Convenience
Customer Satisfaction
New Labor Contracts
Regulatory Compliance
New Capital
Load Factor
Route Optimization
Freight Expansion
etc.

Scope
Contexts

Note:
Air Transportation Case
Motivation Identification
Business Ends (Objectives)
A List - Scope
Level of Detail = High
Abstract (no instances)
As Simple as Possible
No Recurring Concepts

Composites
There can be composite relationships with any or all other Row 1 Cells and with the Cell below and Instances in Row6.

Row 6 Instances AS IS may or may not have anything to do with Owner's, Designer's, Builders perceptions until those are made explicit and transformed to Row 6.

Note: This sample model is meant to illustrate the form of the expected Primitive, not necessarily the content.

Motivation
Intentions

"Why" Column

Motivation Identification

This Column is descriptive of Enterprise Motivation Intentions
to change the "status quo"
"Ends" (Objectives)… Enterprise State Changes
"Means" (Strategies) … changes to the state of
Inventory Levels (including Products, Services, etc.),
Transformation Yields (including Manual, Automation, etc.),
Distribution Capacities (including Sources, Markets, etc.),
Role Assignments (internal, external, etc.),
Cycle Times.

Test: The instances at Row 6 have quantifiable targets.

Inventory Sets	Process Flows	Distr. Networks
Airplanes	Acquire Routes	Terminal Network
Airplane Types	Schedule Flights	Parts Distr. Net.
Airports	Reserve Seats	Communications
Gates	Train Employees	Freight Net.
Passengers	Fly Airplanes	Airport Network
Shareholders	Schedule Crews	(Runways, etc.)
Local Carriers	Repair Facilities	Regulatory Net.
Seats	Develop Markets	Passenger Net.
Bookings	Maint. Airplanes	Personnel Net.
Routes	Load Airplanes	Catering Net.
Employees	Release Flights	etc.
Vehicles	Develop Flt. Plans	
Flights	ScheduleMaint.	
etc.	etc.	

Respon Assmts	Timing Cycles	Motive Intent.
Pilots	Flight Cycle	Equip. Utilization
Co-pilots	Customer Cycle	New Markets
Engineers	Maintenance Cyc.	Revenue Growth
Flt. Attend.	Telephone Wait C.	Exp. Reduction
Reservations	Plane Turnaround	Cust Convenience
Aircraft Maint.	De-Icing Cycle	Cust. Satisfaction
Flight Scheduling	Air Traffic Cntl. C.	Labor Contracts
Airport Ops.Mgt	Tarmac Cycle	Regulatory Comp
Customer Service	Airplane Cycle	New Capital
Marketing	Bag Handling C.	Load Factor
Sales	(TSA)Cycle	Route Optimize
Flight Dispatch	Planning Cycle	Flight Expansion
Accounting	Budget Cycle	Acquisition
etc.	etc.	etc.

This IS Enterprise Architecture

This is NOT "Building and Running Systems"
(Building and Running Systems is a MANUFACTURING idea.")

This is "Enterprise Architecture"
(Enterprise Architecture is an ENGINEERING idea.)
(Which is a DIFFERENT idea.)

This is NOT complete "Enterprise Architecture"
(Enterprise Architecture may NEVER be "complete.")

Introduction to
Enterprise Architecture

The Zachman Paradigms

John A. Zachman
Zachman International

Origins of Enterprise Architecture

- Frederick Taylor "Principles of Scientific Management" 1911
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- Alvin Toffler "Future Shock" 1970
- George Steiner "Comprehensive Managerial Planning" 1972
- Etc., etc., etc.

"Computers!"

Better!
Quality!!

Faster!
Time!!

Cheaper!
Money!!

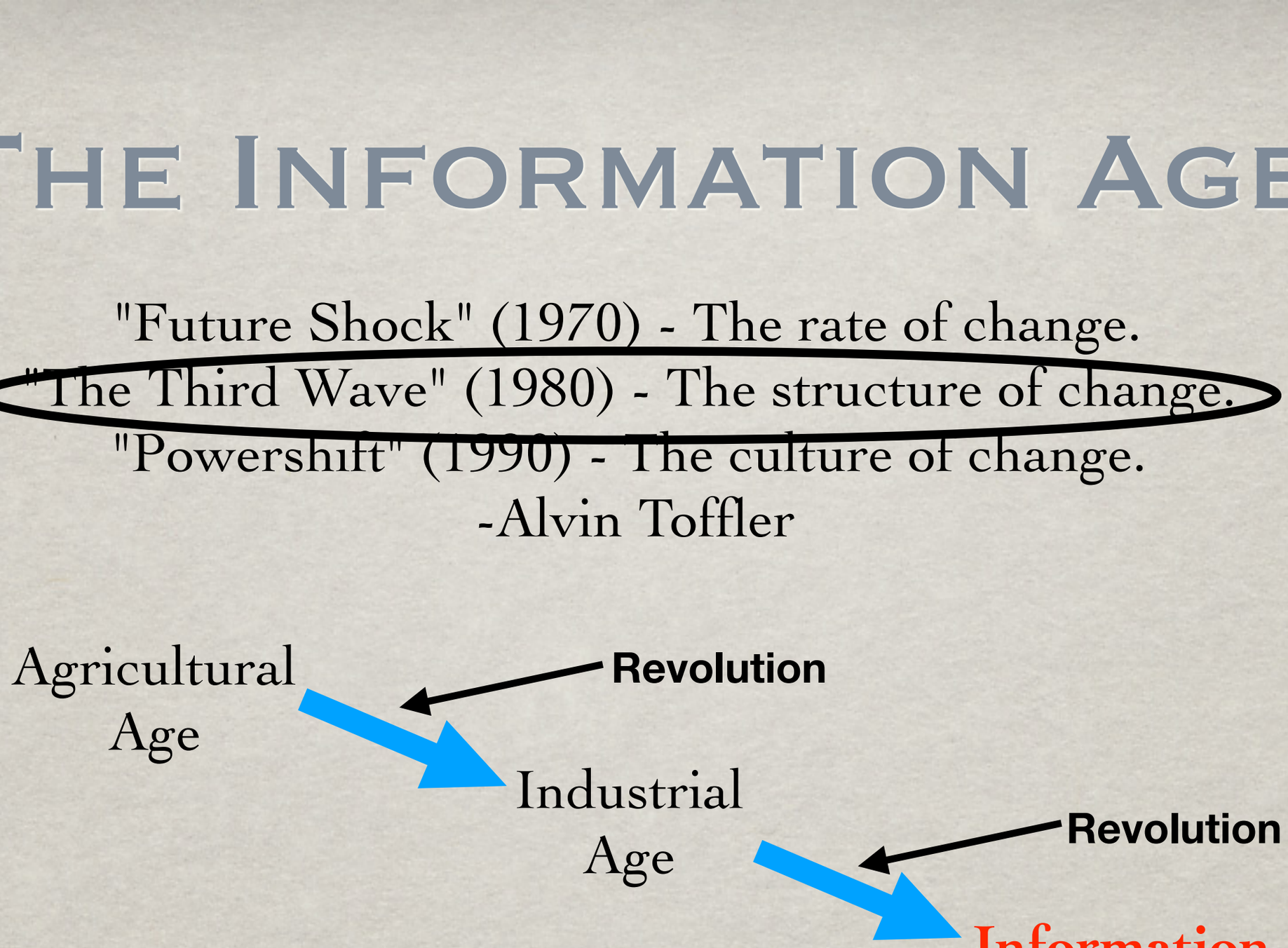
Every minute it's not implemented, it is costing:
quality, time and money!!

Intense motivation to get to implementation ASAP!

This motivation presently permeates the entire IT community!!

The Information Age

"Future Shock" (1970) - The rate of change.
"The Third Wave" (1980) - The structure of change.
"Powershift" (1990) - The culture of change.
-Alvin Toffler



Extreme Complexity!
and
Extreme Change!

Complexity and Change

The NEW Challenge

What is your strategy (Chief) for addressing

Orders of magnitude increases in complexity

and

Orders of magnitude increases in the rate of change?

Seven thousand years of history would suggest that the only known strategy for addressing complexity and change is:

ARCHITECTURE

If it (whatever it is) gets so complex that you can't remember how it works
(at the level of definition required to create it or change it)
you have to write it down,
that is: **ARCHITECTURE**

If you ever want to change what you have created,
you have to retain the descriptive representations you created
to identify and avoid the unintended consequences of change
that is: **ARCHITECTURE**

The KEY to accommodating complexity and change is:

ARCHITECTURE

The Information Age

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"The Third Wave" (1980) - The structure of change.
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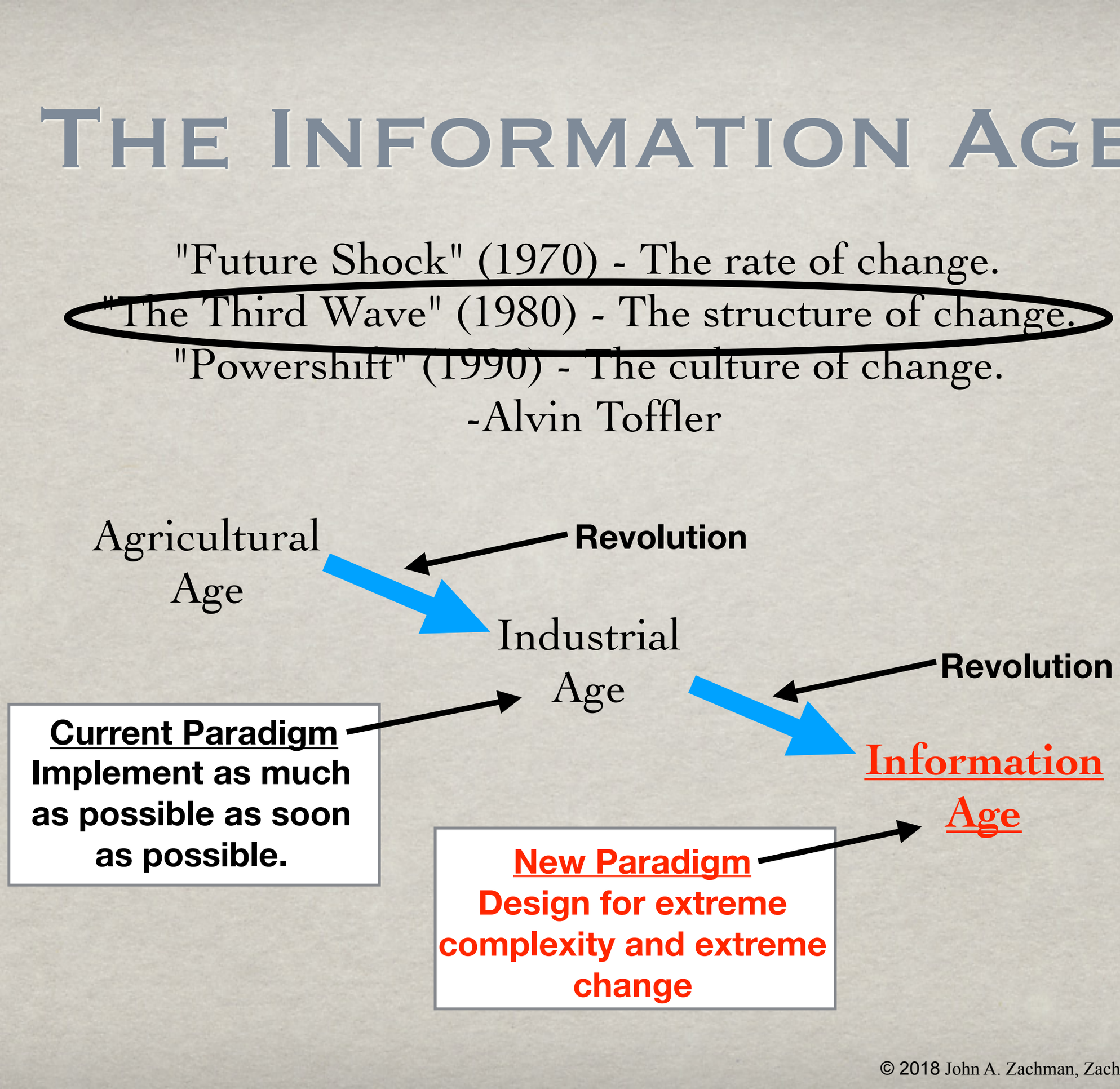
-Alvin Toffler



New Paradigm

Enterprise Architecture
is NOT about "Building and Running Systems"
(Building and Running Systems is a MANUFACTURING idea.")

CURRENT (Industrial Age) Paradigm

Enterprise Architecture is an ENGINEERING idea.

(Which is a DIFFERENT idea.)

NEW (Knowledge Age) Paradigm

The end object is NOT to get the code to run.

The end object is to create and manage the Knowledgebase
required to design and change the Enterprise …

… DYNAMICALLY!!

… and THEN reuse it to write the code and get it to run.

Introduction to
Enterprise Architecture

Engineering vs Manufacturing

John A. Zachman
Zachman International

Engineering Versus Manufacturing

Information Technology (IT) is a manufacturing business.

The "system" IS the business.

Therefore, IT is "manufacturing" YOUR business (for you, Chief).

BUT … your business was never "engineered" (i.e. never "designed.")

Therefore, IT isn't "manufacturing" your business …

They are only "manufacturing" **PARTS** of your business.

Engineering Versus Manufacturing

And the question is, do the parts fit together??
(That is, in the IT vernacular, are the systems
"Enterprise-wide INTEGRATED??")

What do you do with PARTS that don't fit together??

SCRAP AND REWORK!!
(Nobody wants to hear this!!)

If you wants **PARTS** to fit together,
you have to **ENGINEER** them to fit together
BEFORE you manufacture them!

John Zachman

Engineering Versus Manufacturing

ENGINEERING derived characteristics:

<u>Enterprise (i.e. Business):</u>
Integration
Interoperability
Flexibility
Alignment
Reusability
etc., etc.

You will never realize these engineering derived characteristics without doing any engineering!

"Programming is manufacturing, NOT engineering."

Fred Brooks

John Zachman

Engineering Versus Manufacturing

Organizations built by committee and intuition perform no better than would an airplane built by the same methods. As in bad airplane design, which no pilot can fly successfully, such badly designed corporations lie beyond the ability of real life managers.

"Designing the Future" by Jay W. Forrester. Seville University. 12/15/98

A manager runs an organization just as a pilot runs an airplane. Success of a pilot depends on an aircraft designer who created a successful airplane … who created the corporation that a manager runs?

"Designing the Future" by Jay W. Forrester. Seville University. 12/15/98

Somebody?

Anybody?

Nobody?

Engineering Versus Manufacturing

"The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult … No other part of the work so cripples the resulting system if done wrong. No other part is as difficult to rectify later." *Frederick P. Brooks. "No Silver Bullets" 1986*

"You can use an eraser on the drawing board
or a sledgehammer on the construction site."

Frank Lloyd Wright

Enterprise Architecture

The problem with Enterprise Architecture:

It requires actual work, ENGINEERING work!

Enterprise Engineering is DIFFERENT from Building and Running Systems

(Re: "Programming is manufacturing, NOT engineering.")

Fred Brooks

Complexity and Change MEANS Enterprise Architecture

Enterprise Architecture is not in a cloud someplace … it IS YOUR future

That is, if you have a future!

Introduction to
Enterprise Architecture

Defining Enterprise Architecture

John A. Zachman
Zachman International

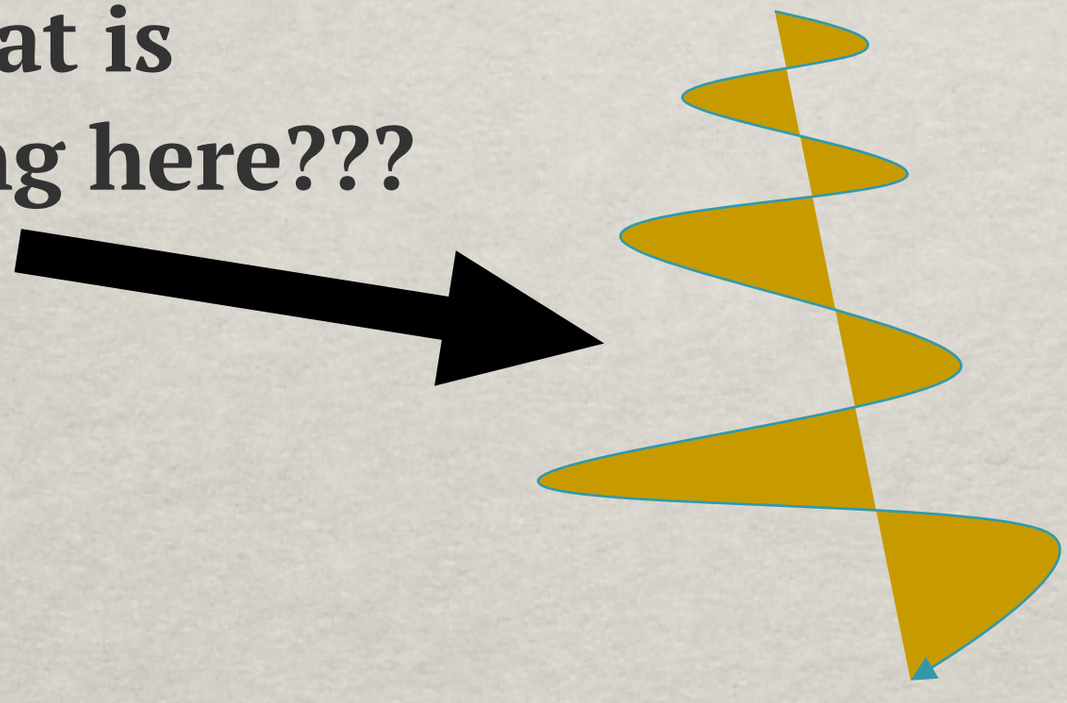
Business Knowledge Engineering

Traceability, Impact Assessment & Compliance

Governing Rules

Acts, Laws, Statutes, Regulations, MOU's, Agreements, Term & Conditions, Deals, Bids, Deeds of Sale, Warranties, Guarantees, Prospectuses, Licenses, Citations, Certifications, Notices … and Business Policies.

What is happening here???



I **LOVE** this slide!!
This is **EXACTLY** the issue that set me on the path to discovering the pattern that constitutes
ENTERPRISE ARCHITECTURE

Automated Rules

Code Tables, Parameter Settings, Procedural Code, Implementation Rule Statements, Help Messages

Ron Ross
Business Agility Manifesto

Architecture

Architecture … what is it?

Some people think this is Architecture:

That is a common

MISCONCEPTION

(Note: This same misconception about Enterprises is what leads people to misconstrue Enterprise Architecture as being big, monolithic, static, inflexible and unachievable and … it takes too long and costs too much.)

Architecture

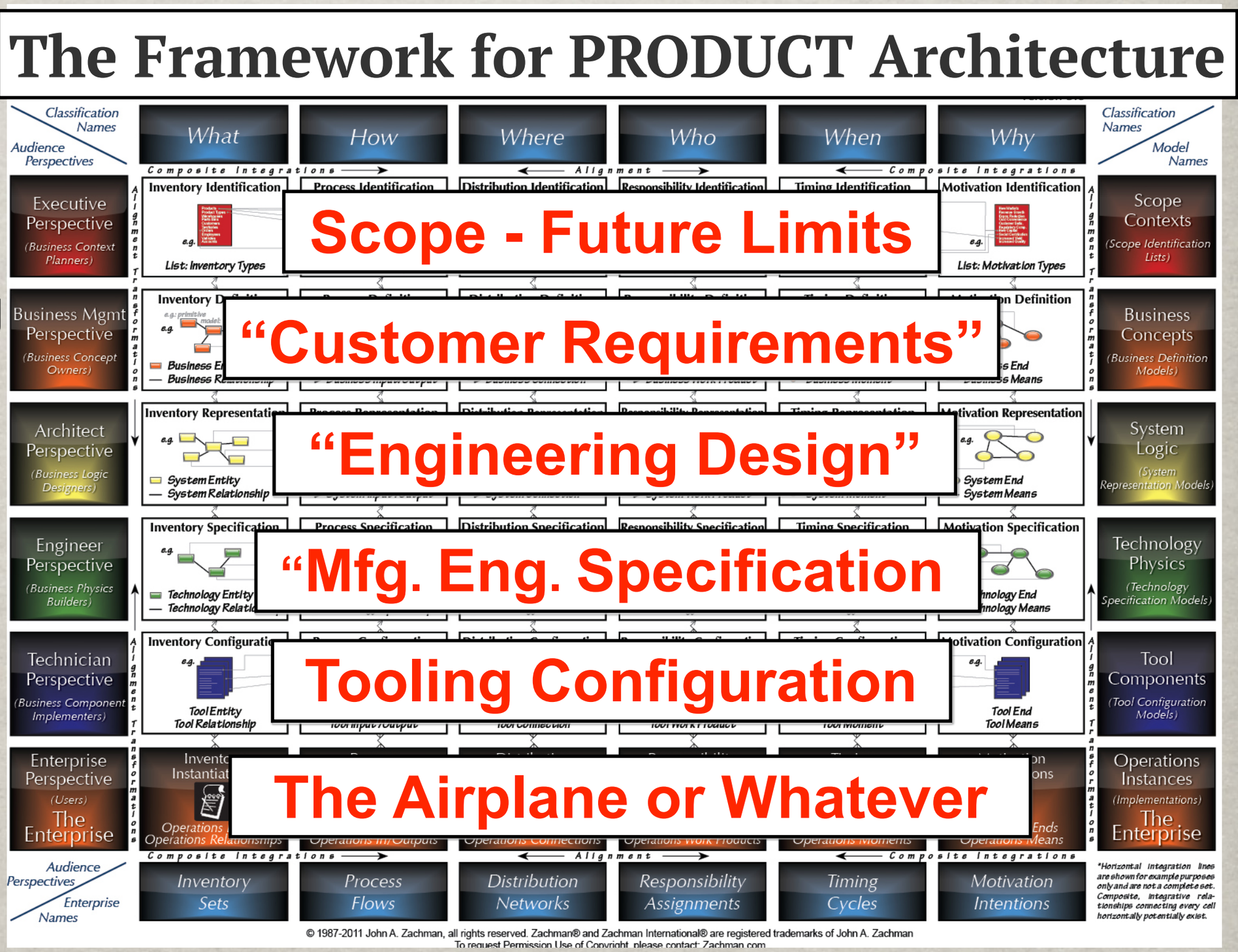
This is the RESULT of architecture. In the RESULT you can see the Architect's "architecture".
The RESULT is an implementation, an instance.

"Architecture" IS the set of descriptive representations relevant for describing a complex object (actually, any object) such that an instance of the object can be created and such that the descriptive representations serve as the baseline for changing an object instance (assuming that the descriptive representations are maintained consistent with the instantiation).

The "Enterprise Ontology"

Framework Origin

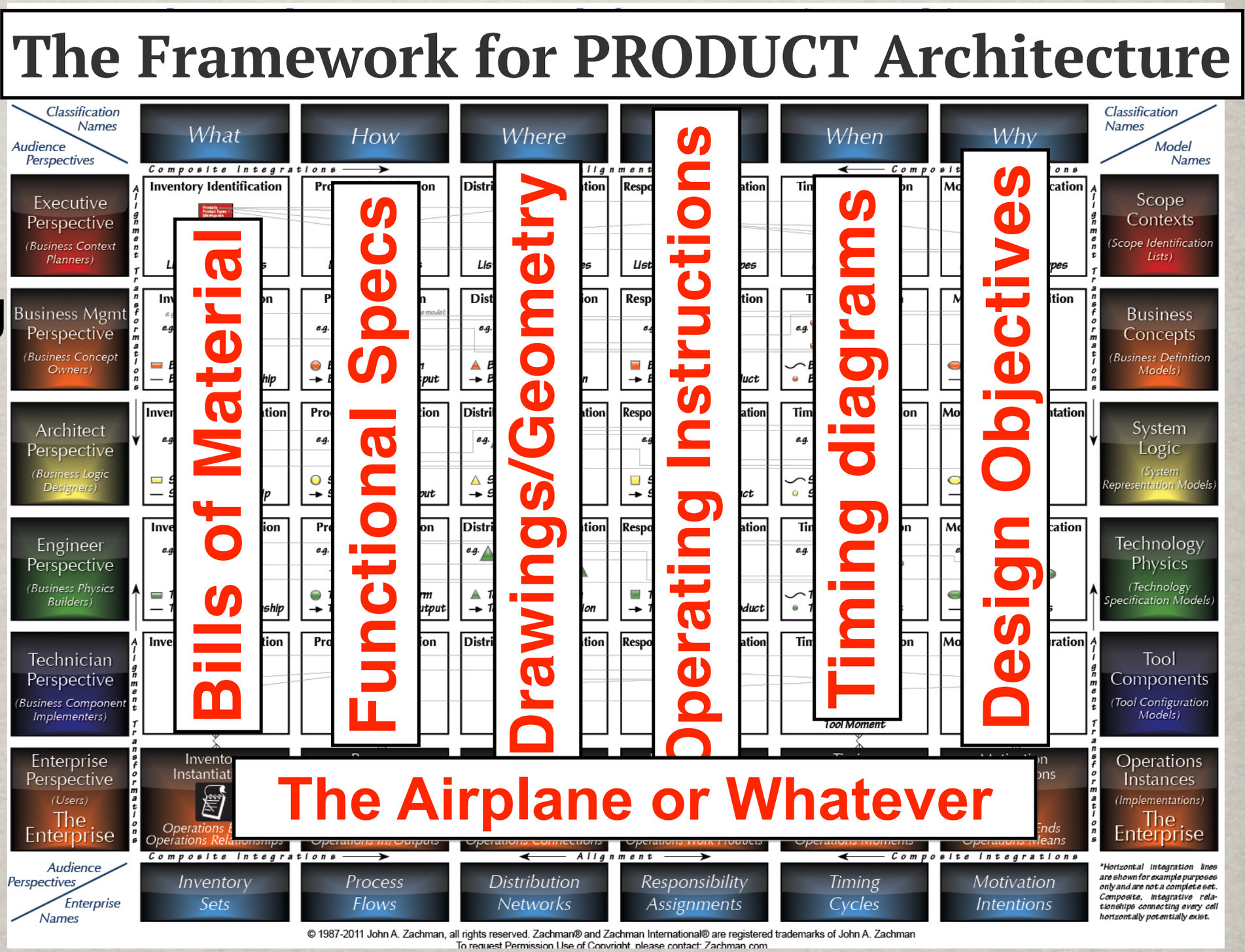
Manufacturing Terminology



The "Enterprise Ontology"

Framework Origin

Manufacturing Terminology

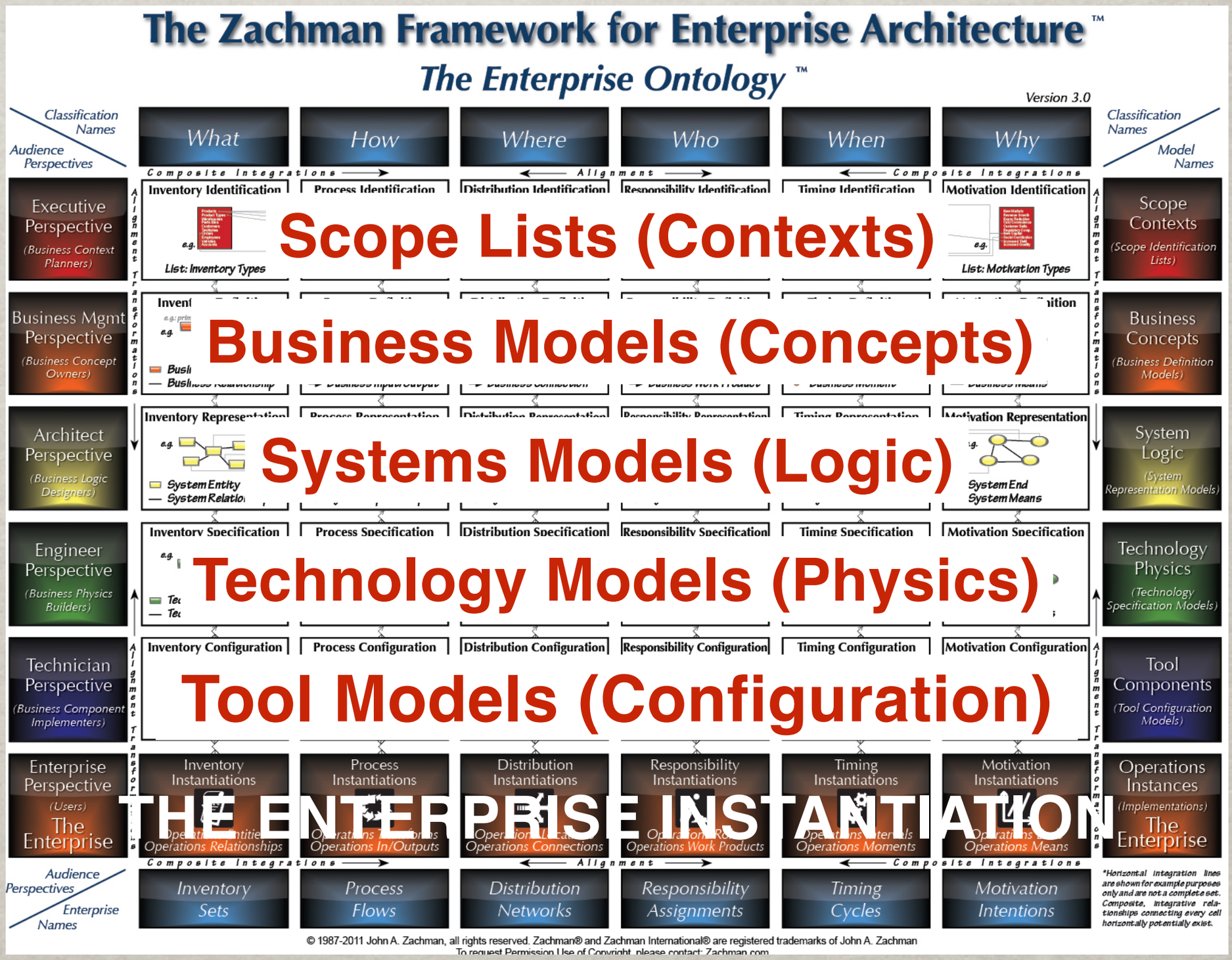


The "Enterprise Ontology"

Framework Origin

All I did was to change the names in the Engineering/Manufacturing and Architecture/Construction patterns to Enterprise names

Enterprise Terminology



Scope Lists (Contexts)

Business Models (Concepts)

Systems Models (Logic)

Technology Models (Physics)

Tool Models (Configuration)

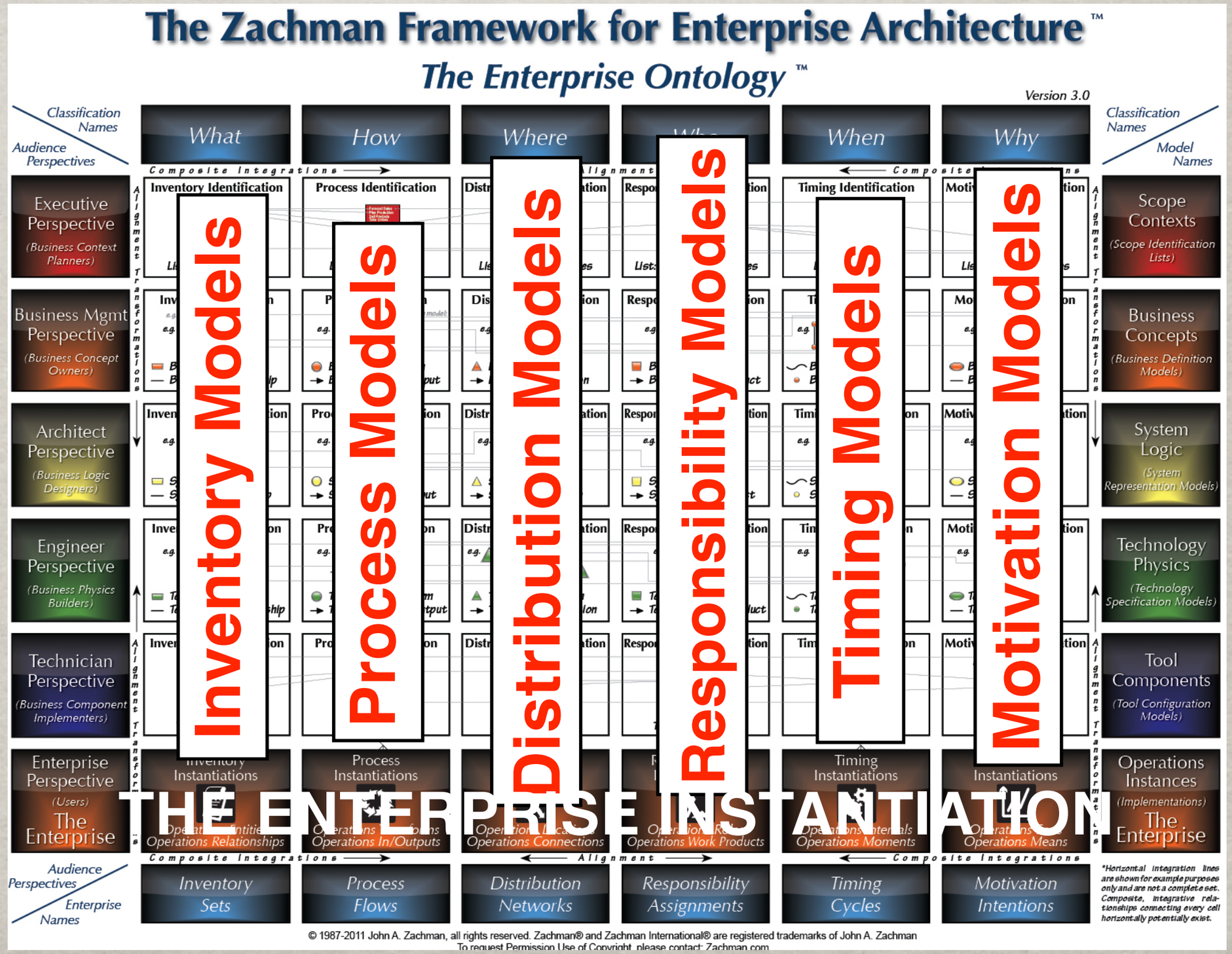
THE ENTERPRISE INSTANTIATION

The "Enterprise Ontology"

Framework Origin

All I did was to change the names in the Engineering/Manufacturing and Architecture/Construction patterns to Enterprise names

Enterprise Terminology



Architecture Is Architecture

I simply put Enterprise names on the same descriptive representations relevant for describing anything.

Why would anyone think that the descriptions of an Enterprise are going to be any different from the descriptions of anything else humanity has ever described?

ARCHITECTURE IS ARCHITECTURE IS ARCHITECTURE

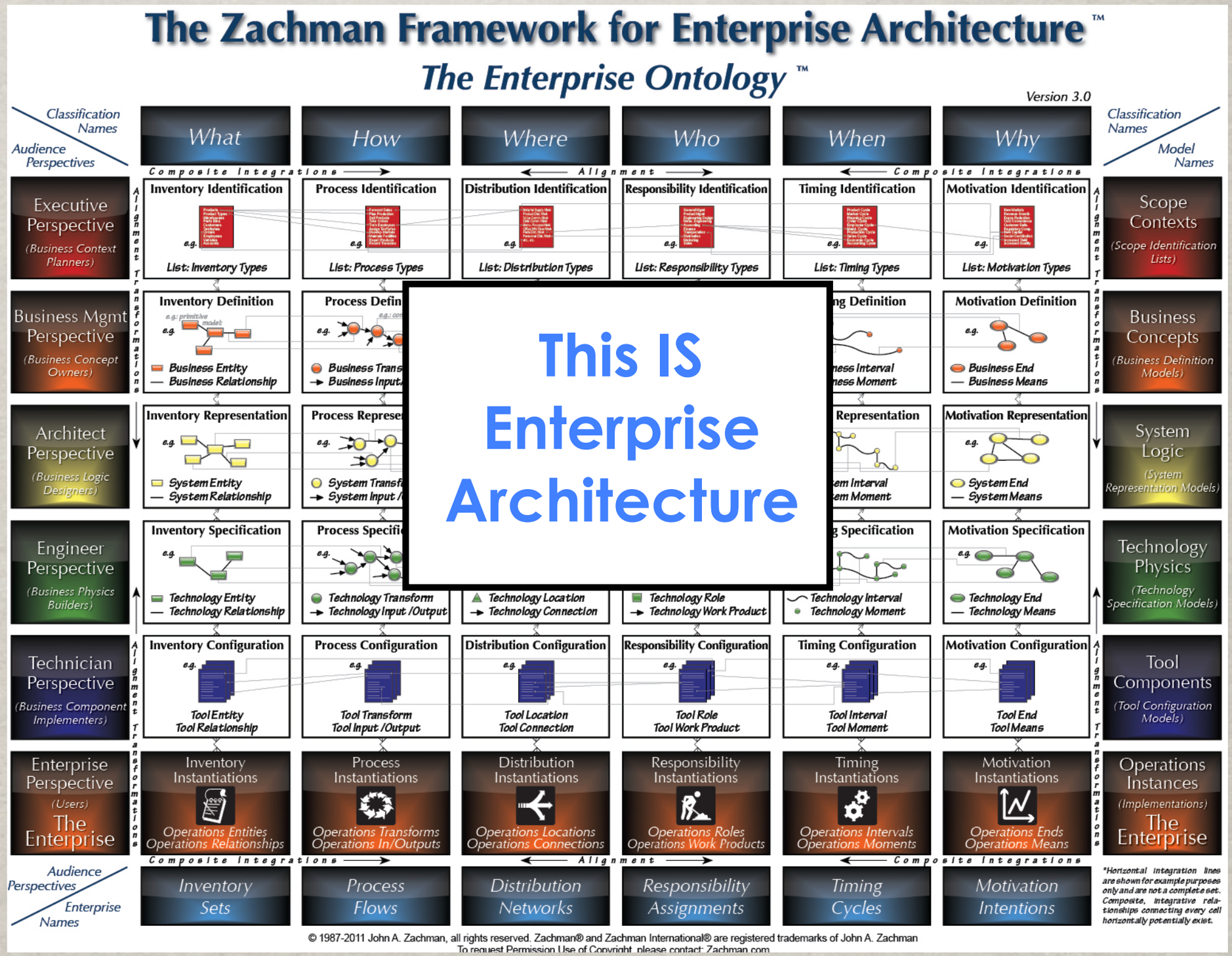
I don't think Enterprise Architecture is arbitrary ... and it is ***not negotiable***. My opinion is, we ought to accept the definitions of Architecture that the older disciplines of Architecture and Construction, Engineering and Manufacturing have established and focus our energy on learning how to use them to actually engineer Enterprises.

The "Enterprise Ontology"

The "Business Knowledge-base"

For Engineering & Manufacturing Enterprises

Prerequisite for Agility



The Zachman Framework for Enterprise Architecture™

The Enterprise Ontology ™

Version 3.0

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	Scope Lists (Contexts)						
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	Systems Models (Logic)						
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Alignment Transformations (left) / *Alignment Transformations* (right)

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Alignment Transformations

Technology Models (Physics)

REALITY

Tool Models (Configuration)

THE ENTERPRISE INSTANTIATION

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Inventory Models

Process Models

Distribution Models

RESOURCE

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Alignment Transformations

Responsibility Models

Timing Models

Motivation Models

BEHAVIOR

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Alignment Transformations (Inventory Models)

RESOURCE

Alignment Transformations (Responsibility Models)

BEHAVIOR

Alignment Transformations (Timing Models)

Alignment Transformations (Motivation Models)

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Alignment Transformations (between each adjacent pair of perspectives)

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RESOURCE REALITY

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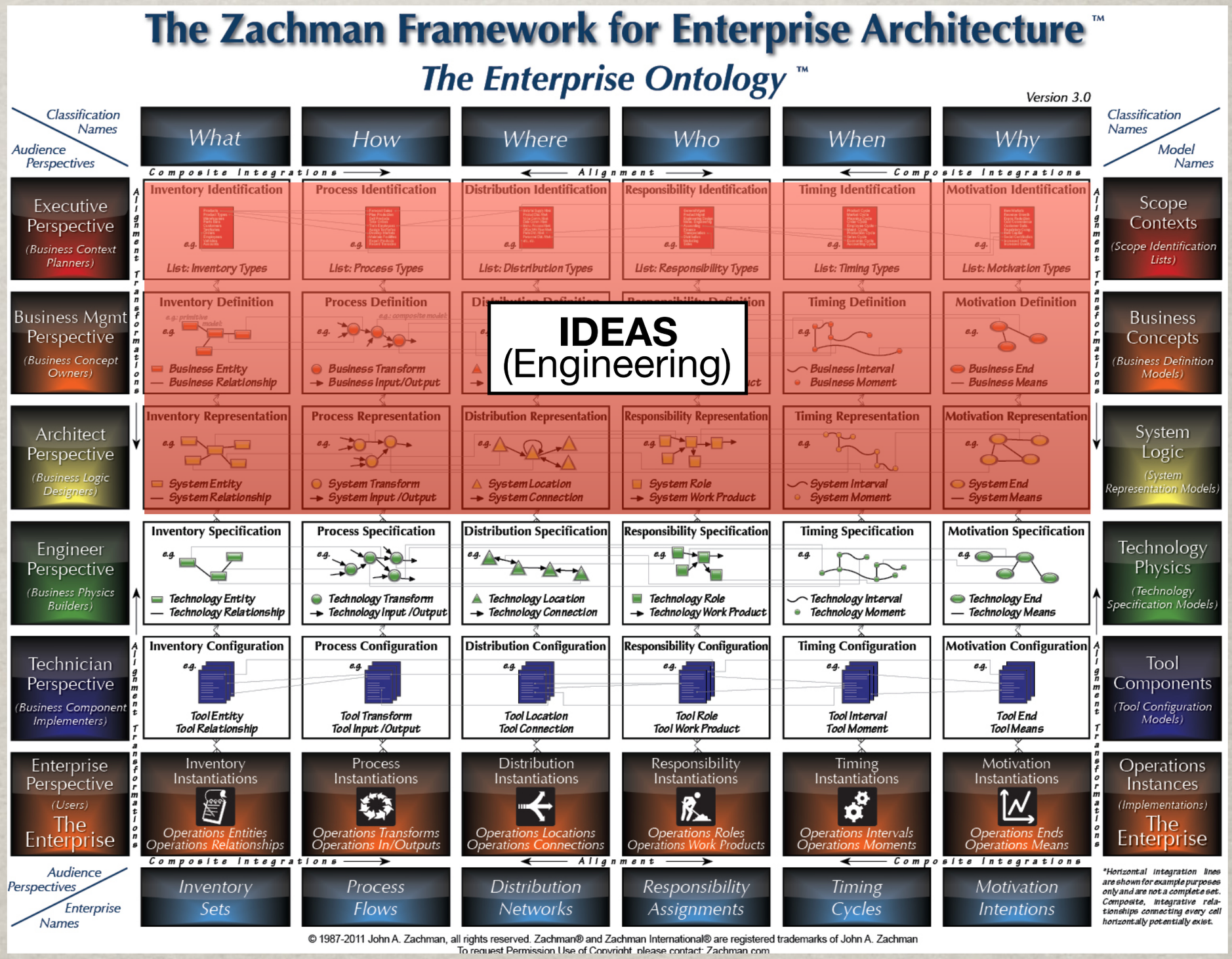
Engineering Versus Manufacturing

Enterprise Architecture

The “Business Knowledge-base”

For Engineering & Manufacturing Enterprises

Prerequisite for Agility



John Zachman

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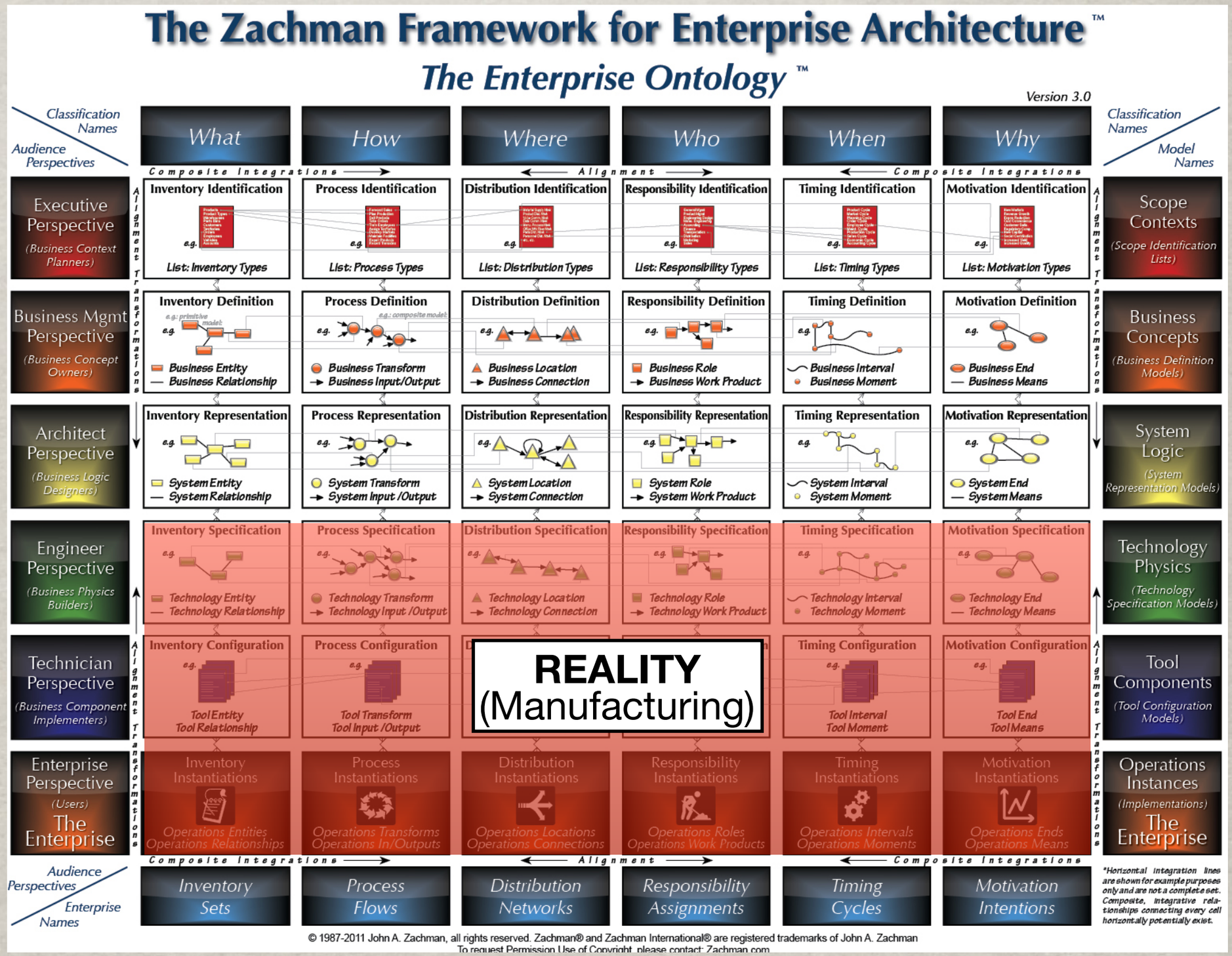
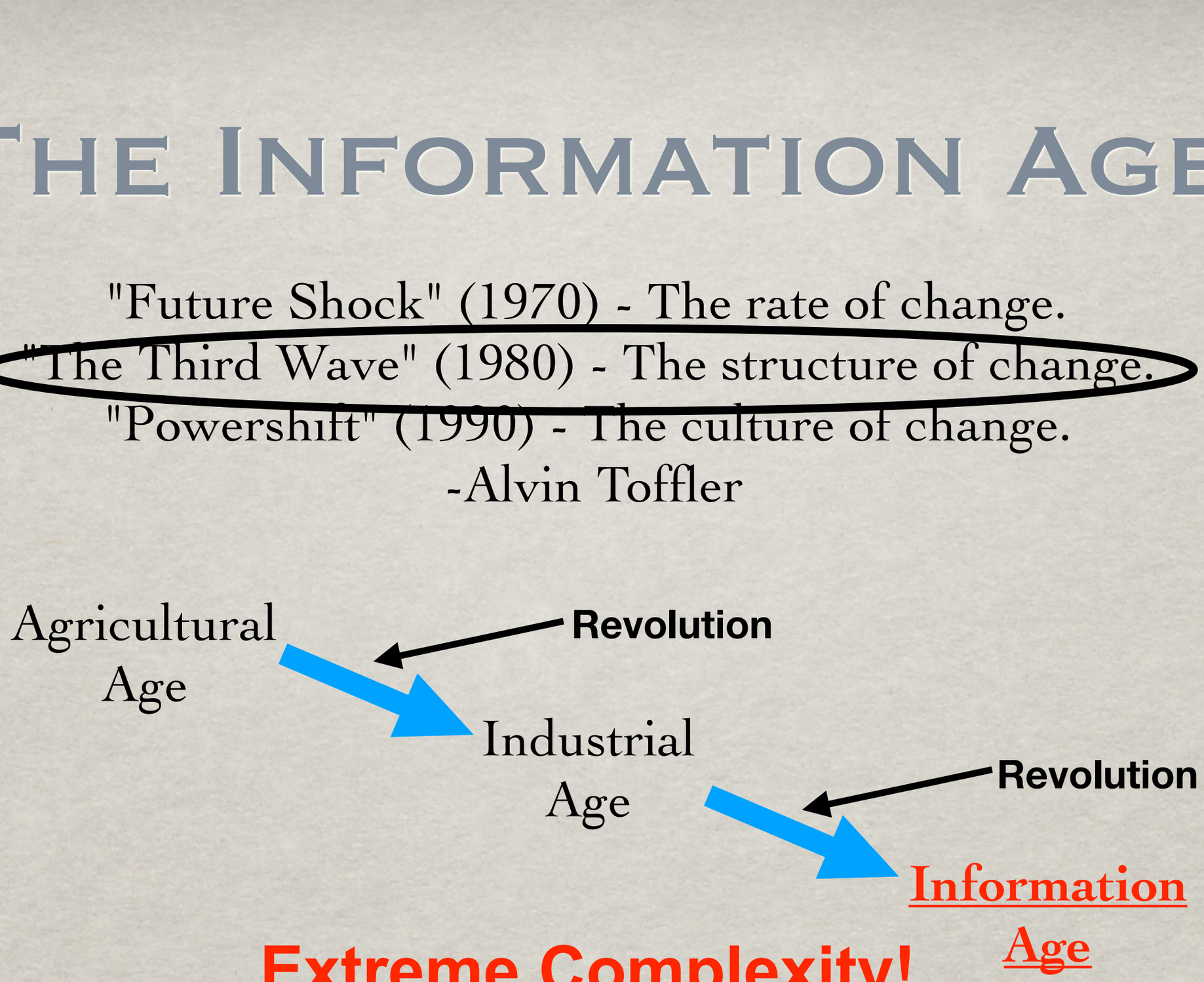


John Zachman

The Information Age

"Future Shock" (1970) - The rate of change.
"The Third Wave" (1980) - The structure of change.
"Powershift" (1990) - The culture of change.
-Alvin Toffler



Extreme Complexity!
and
Extreme Change!

Introduction to Enterprise Architecture

COMPLEXITY

John A. Zachman
Zachman International

Complexity

Reduce the sample size through Classification

One Dimensional

Decomposition (Hierarchy, "Taxonomy")

The deeper the tree, the smaller the parts (faster and cheaper).

The same content can occur in multiple nodes.

ANALYSIS

Lends itself to implementation (Manufacturing)

Multi Dimensional

(For "multi-dimensional" classification
see slide in "New Paradigm" section)

DATA MODEL

(Which you probably wouldn't build because it delays code production!)

Customer

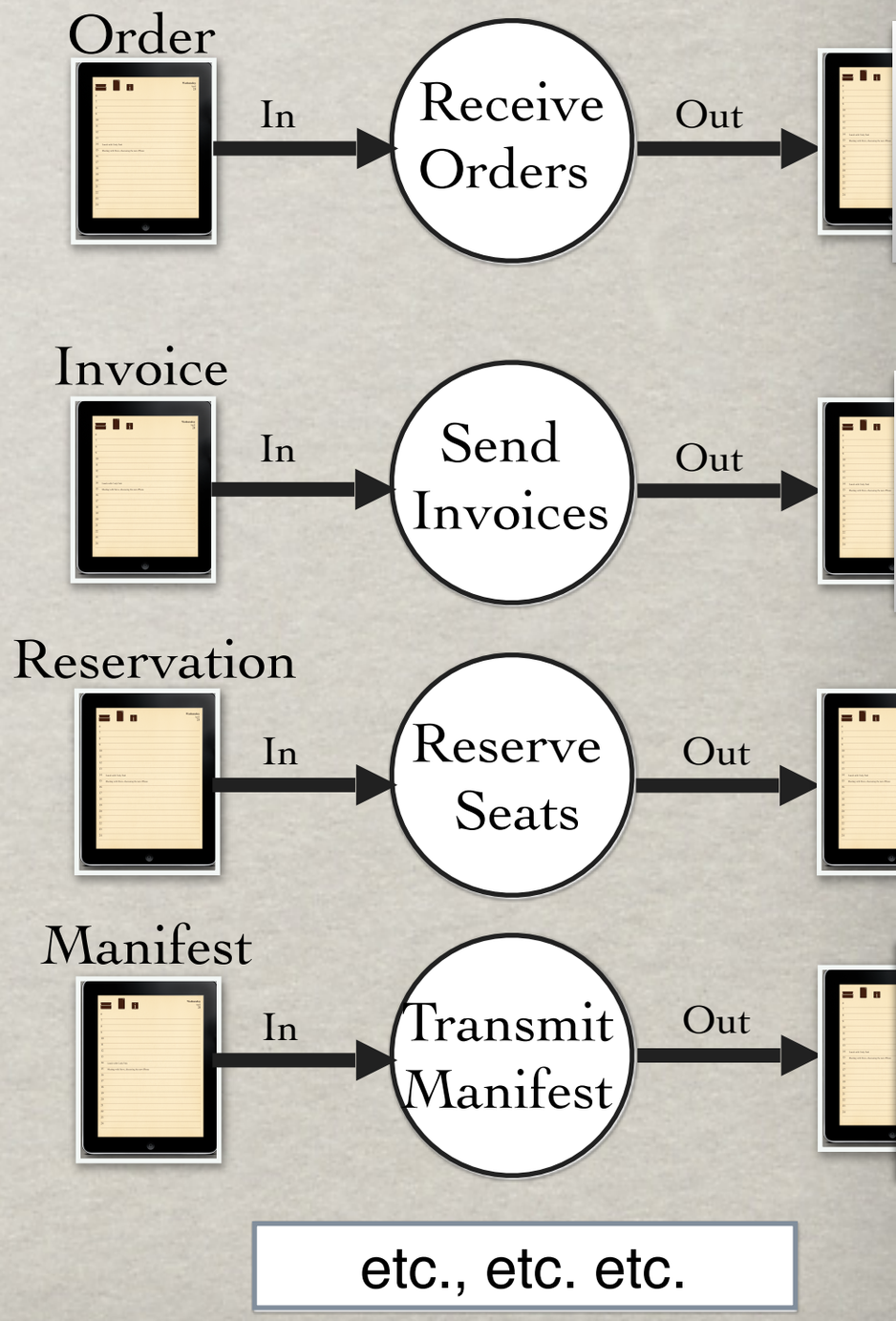
Airport

Airplane

Flight

Airline Reservation System

One-Dimensional, Decomposition

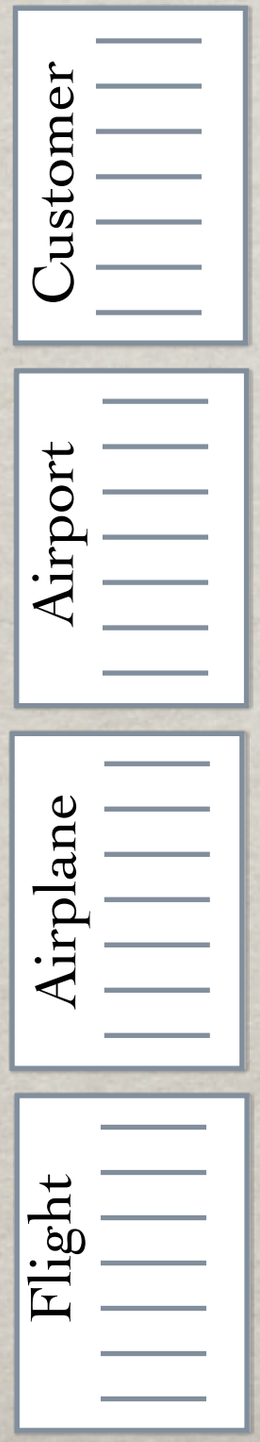


HOWEVER

Column 1
DATA

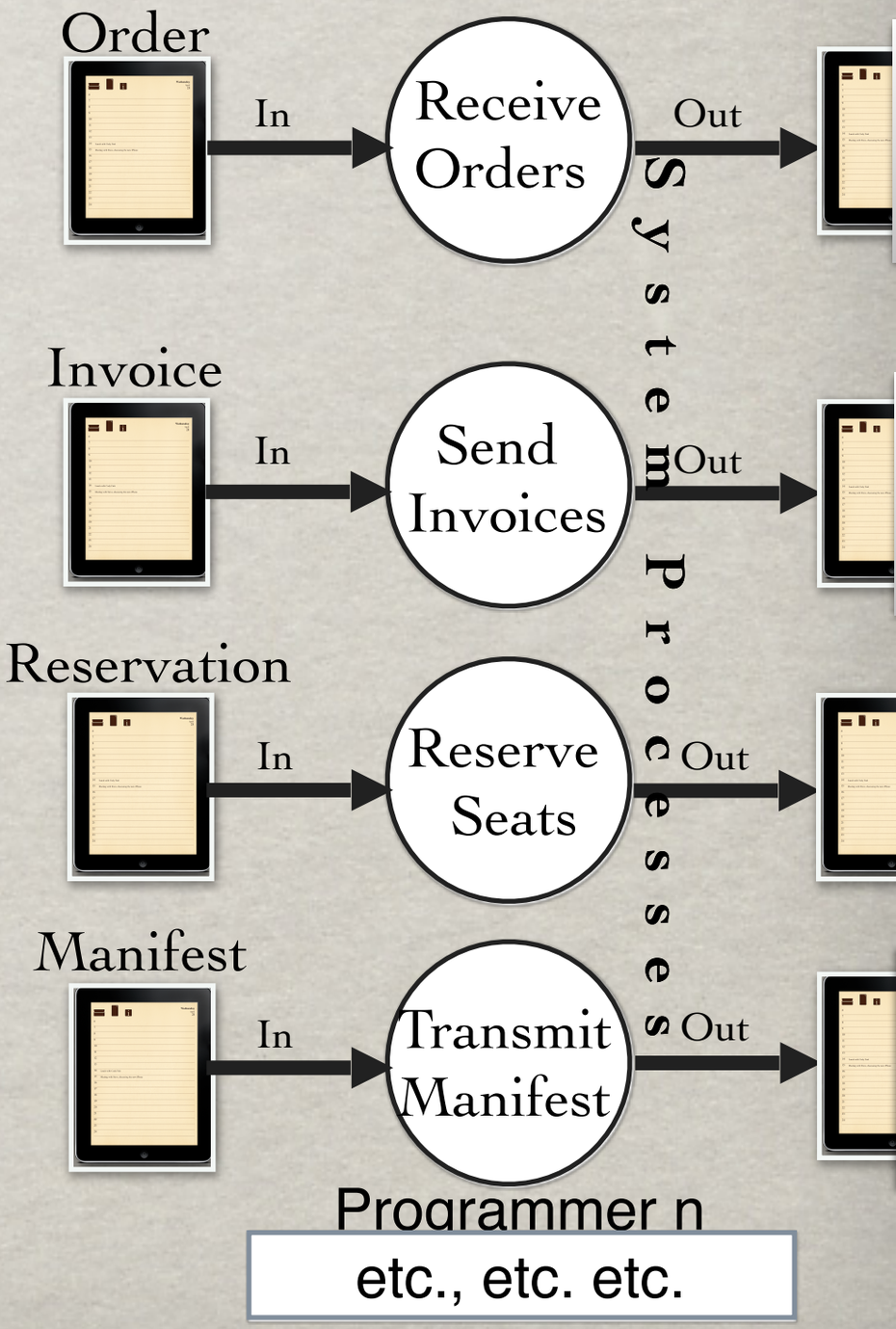
Multi-Dimensional, Relational

Row 3
Systems Entities



Column 2
PROCESS

One-Dimensional, Decomposition



HOWEVER

Column 1

DATA

(Data as it exists)

"Attributes"

(Normalized)

Column 2

PROCESS

INFORMATION ("Data in the context of its use.")

"Data Elements "

(**De**-normalized)

Row 3

Systems Entities

Customer

Airport

Airplane

Flight

Systems Processes

Order

Programmer 1

In

Receive Orders

Out

Invoice

Programmer 2

In

Send Invoices

Out

Reservation

Programmer 3

In

Reserve Seats

Out

Manifest

Programmer 4

In

Transmit Manifest

Out

Programmer n

etc., etc. etc.

Reuse

Column 1

DATA

(Data as it exists)

"Attributes"

(Normalized)

Column 2

PROCESS

INFORMATION ("Data in the context of its use.")

"Data Elements "

(**De**-norm lized)

Row 3 Systems Entities

Customer

Airport

Airplane

The problem is, this not … es the Data, … it disintegrates EV… …ata, Process, Location, Resp… …g and Motivation

No wonder there are unintended consequences of change

Programmer 1

Receive Orders

Out

Systems Process

Programmer 2

Send Invoices

Out

Reservation

Programmer 3

In

Reserve Seats

Out

Manifest

Programmer 4

etc., etc. etc.

Note: This slide is intended to illustrate the legacy disintegration problem which could be resolved by governance, requiring REUSE of the single-variable, ontologically-defined, "Primitive" components in the creation of every "Composite" implementation instantiation.

The Problem

The UN-Architected, DIS-integrated, DE-normalized implementations where single-variable, ontologically-defined, "Primitive" "elements" are indiscriminately replicated which facilitates instantiation (manufacturing) (which is good) but is the source of unintended consequences of change and therefore inhibit (i.e. prohibit!) change in the increasingly complex and changing environment (marketplace) (which is **BAD** … **VERY BAD** for **SURVIVAL!)**

The problem is not only data. It's dis-integrated Instructions, dis-integrated Locations, dis-integrated Roles, dis-integrated Cycles, dis-integrated Objectives … dis-integrated **EVERYTHING!**

Talk about unintended consequences of change - Jeeeeeeze!!!

The Enterprise Architecture Knowledgebase is not only helpful for designing the Enterprise but also for solving Enterprise problems
(See Zachman Framework Story - below)…

but also **MANDATORY** for precluding unintended consequences of change.

The Solution

Don't disintegrate it!!

(Disintegration **IS** the **Current (Manufacturing)** Paradigm)

The end object is
NOT to get the code to run!!!
(If you have to replicate something,
it has to be "controlled.")

The end object is
to design the Enterprise to accommodate
EXTREME Complexity and DYNAMIC Change!!

(Complexity and Change **IS** the **New** Paradigm)

ENTERPRISE ARCHITECTURE

(But Still produce short term results in the process.
See Zachman Framework Story next.)

Introduction to
Enterprise Architecture

A
Zachman Framework
Story

John A. Zachman
Zachman International

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Murder/Kidnapping Case

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In two weeks - identified new terrorist Cell and linkages with all existing cells

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Generated - Not Built
Key to Diagnosis
This is NOT a "System"

Courtesy of Sunil Dutt Jha ICMG

The Key

1. Single-variable, precisely unique, relevant (not arbitrary), ontologically-defined components.

2. Binary Relationships (only two components at a time).

The Key to
diagnosing the CEO's Problems and prescribing alternative solutions

This IS an (incomplete) Enterprise Architecture
(Not Enterprise-wide, No Relationship Entities)

A "system" **REUSES** these Architecture components.

Introduction to Enterprise Architecture

CHANGE

John A. Zachman
Zachman International

"Architecture"

If the object you are trying to create is simple, you can see the whole thing all at one time, and it is not likely to change, (e.g. a log cabin, a program, etc.), then you don't need Architecture.

```
for m1 = 1,M do begin
 for m2 = 1,M do begin
  for u1 = u_min,u_max do begin
   for u2 = u_min,u_max do begin
    if u1 gt u2 then begin
     for v1 = v_min,v_max do begin
      if v1 lt u1 then begin
       for v2 = v_min,v_max do begin
        if v2 ge v1 then begin
         KE_B = double(m1*u1^2+m2*u2^2)
         KE_A = double(m1*v1^2+m2*v2^2)
         if (KE_B gt KE_A) and (KE_A ge 0.965*KE_B) then begin
          x_axis[index]=index
          LM_B = double(m1*u1+m2*u2)
          LM_A = double(m1*v1+m2*v2)
          y_LM_Diffs[index]=LM_B-LM_A
          Total_LM=Total_LM+LM_B-LM_A
          y_LM_Total[index]=double(Total_LM/(index+1))
          index=index+1
          if index gt 65535 then goto, end_of_loop
         endif
        endif
       endfor
      endif
     endfor
    endif
   endfor
  endfor
 endfor
endfor
```

All you need is a tool (e.g. an ax, a compiler, etc.), some raw material (e.g. a forest, some data, etc.) and some time (then, build log cabins, write programs, etc.).

"Architecture"

On the other hand, if the object is complex, you can't see it in its entirety at one time and it is likely to change considerably over time (e.g. a hundred story building, or an Enterprise, etc.), now you need Architecture.

In short, the reasons you need Architecture:

COMPLEXITY AND CHANGE

"Architecture"

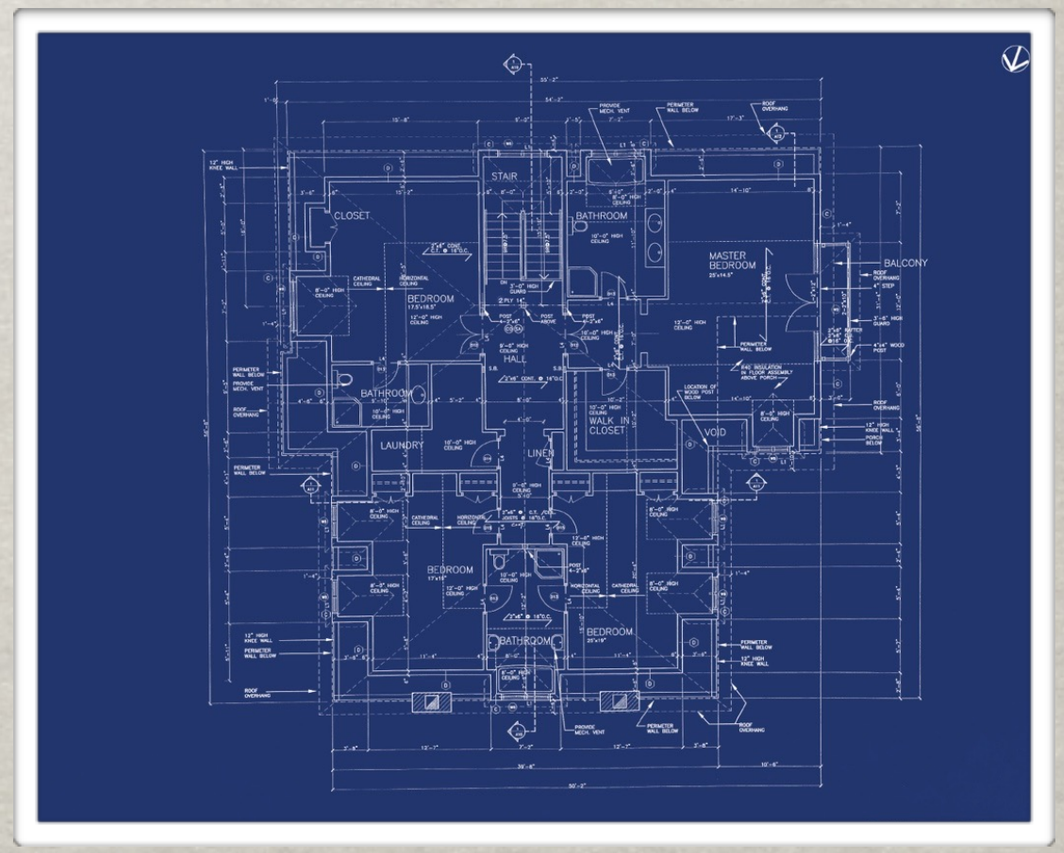
COMPLEXITY

If you can't describe it, you can't create it (whatever "it" is).

CHANGE

If you don't retain the descriptive representations after you create them (or if you never created them in the first place) and you need to change the resultant implementation, you have only three options:

- Change the instance and see what happens. (High risk!)
- Recreate ("reverse engineer") the architectural representations from the existing ("as is") implementation. (Takes time and costs money!)
- Scrap the whole thing and start over again.



Complexity

Reduce the sample size through Classification

One Dimensional

Decomposition (Hierarchy, "Taxonomy")

The deeper the tree, the smaller the parts (faster and cheaper).

The same content can occur in multiple nodes.

ANALYSIS

Lends itself to implementation (Manufacturing)

Multi Dimensional

Normalization (Matrix, Cube)

One (type of) fact in one place (set theory).

Identify and eliminate recurrences (redundancies)

SYNTHESIS

Lends itself to design (Engineering)

The "Enterprise Ontology"

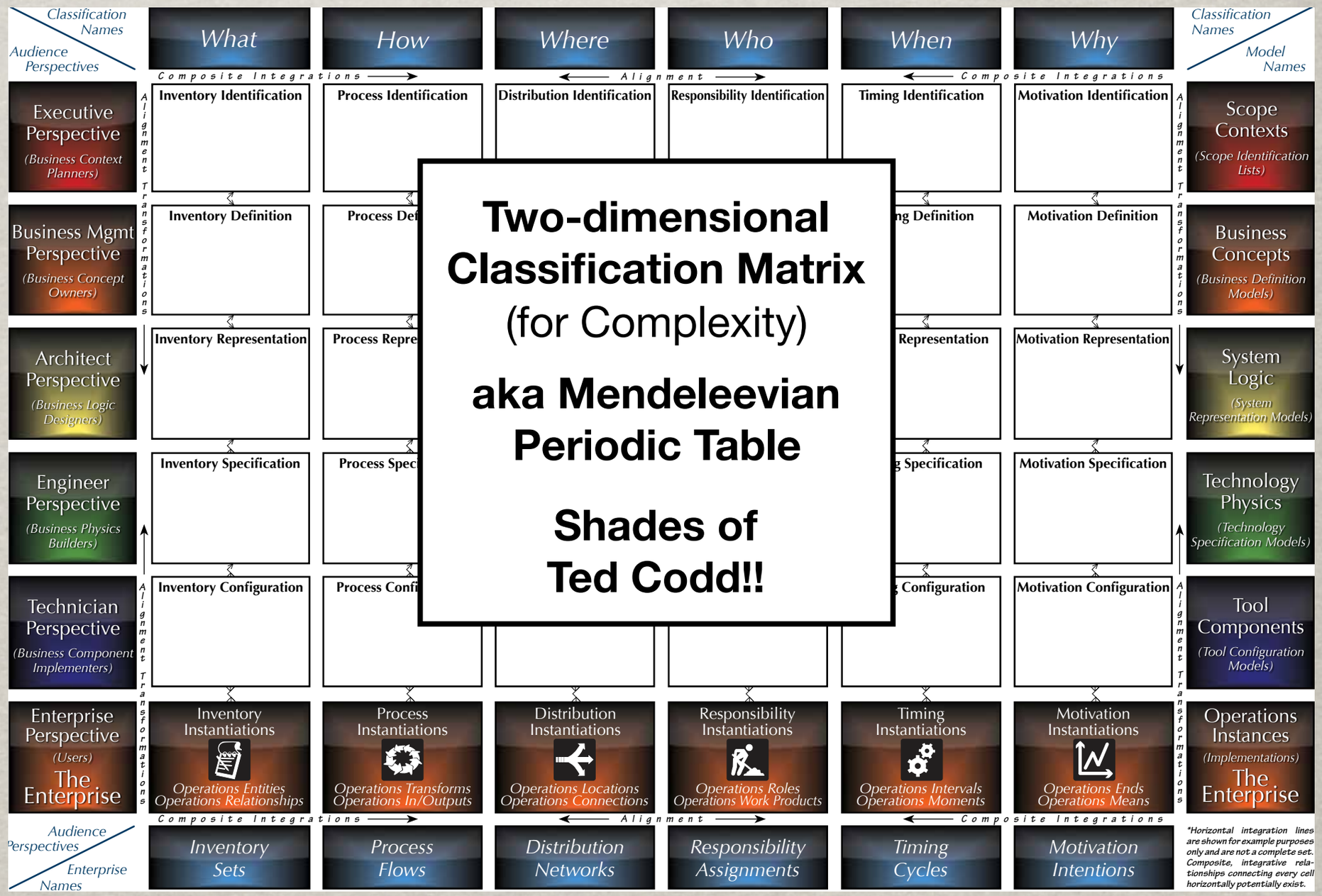
"ONTOLOGY"

"Primitive Interrogatives" - (Orthogonal)

What How Where Who When Why

"Reification" - Unique Stages

- Identification
- Definition
- Representation
- Specification
- Configuration
- Instantiation



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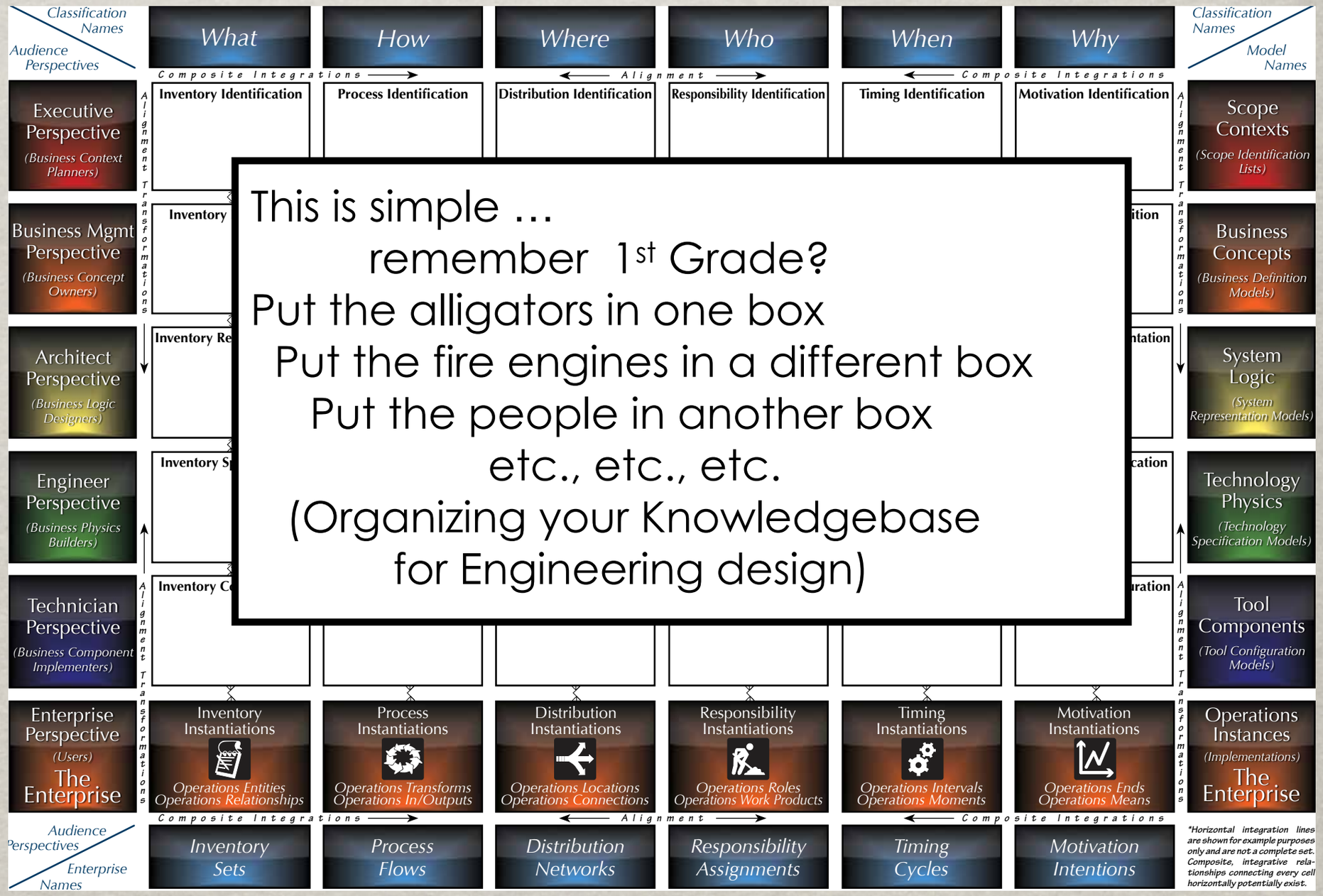

This is simple …
remember 1st Grade?
Put the alligators in one box
Put the fire engines in a different box
Put the people in another box
etc., etc., etc.
(Organizing your Knowledgebase for Engineering design)

The "Enterprise Ontology"

"ONTOLOGY"

"Primitive Interrogatives" - (Orthogonal)

What How Where Who When Why

"Reification" - Unique Stages

- Identification
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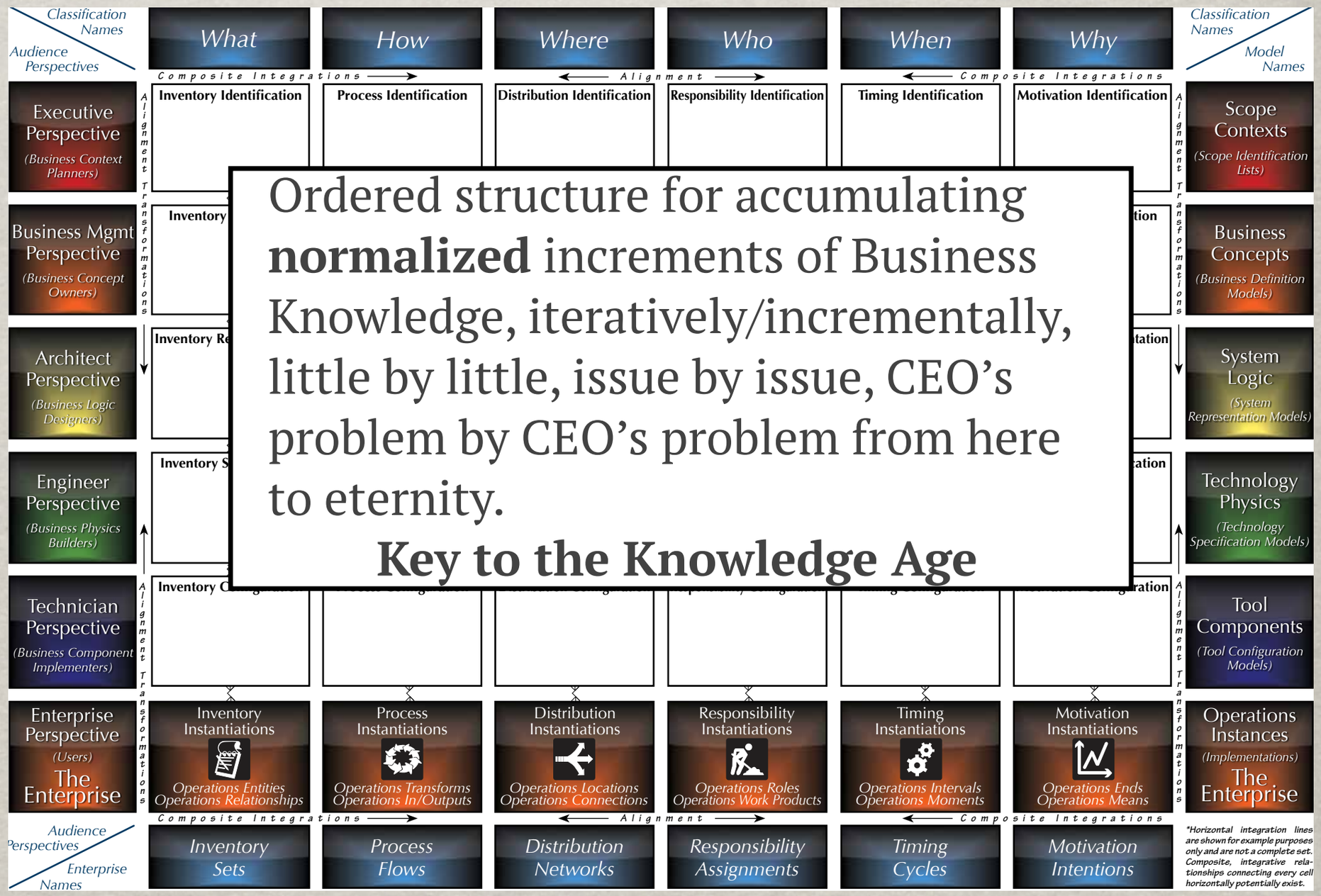


Ordered structure for accumulating **normalized** increments of Business Knowledge, iteratively/incrementally, little by little, issue by issue, CEO's problem by CEO's problem from here to eternity.

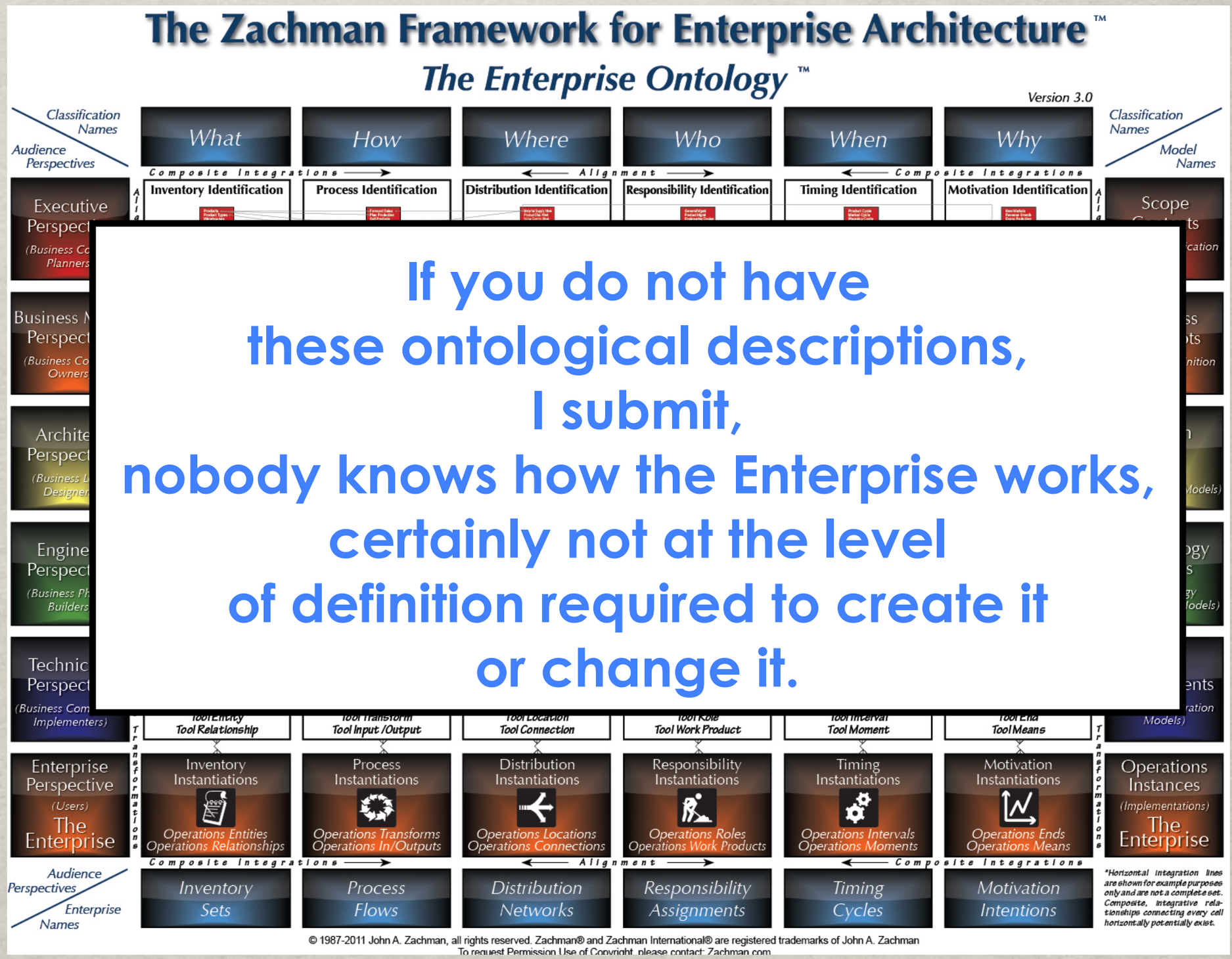
Key to the Knowledge Age

The "Enterprise Ontology"

The "Business Knowledge-base"

For Engineering & Manufacturing Enterprises

Prerequisite for Agility



If you do not have these ontological descriptions, I submit, nobody knows how the Enterprise works, certainly not at the level of definition required to create it or change it.

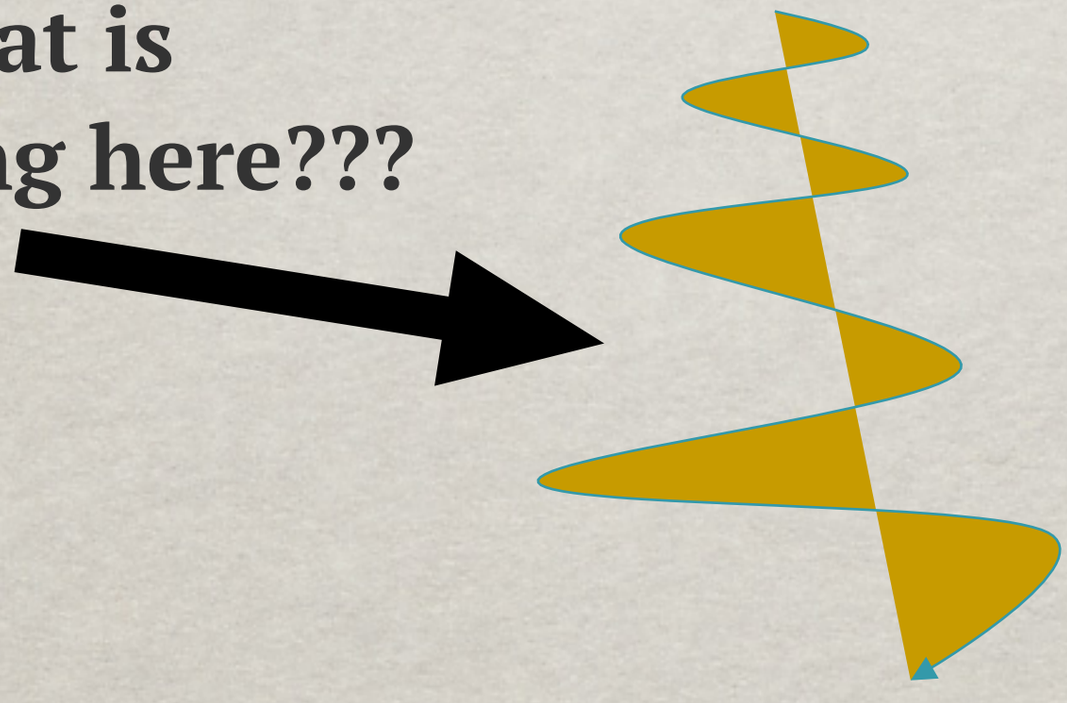
Business Knowledge Engineering

Traceability, Impact Assessment & Compliance

Governing Rules

Acts, Laws, Statutes, Regulations, MOU's, Agreements, Term & Conditions, Deals, Bids, Deeds of Sale, Warranties, Guarantees, Prospectuses, Licenses, Citations, Certifications, Notices … and Business Policies.

What is happening here???



I **LOVE** this slide!!
This is **EXACTLY** the issue that set me on the path to discovering the pattern that constitutes
ENTERPRISE ARCHITECTURE

Automated Rules

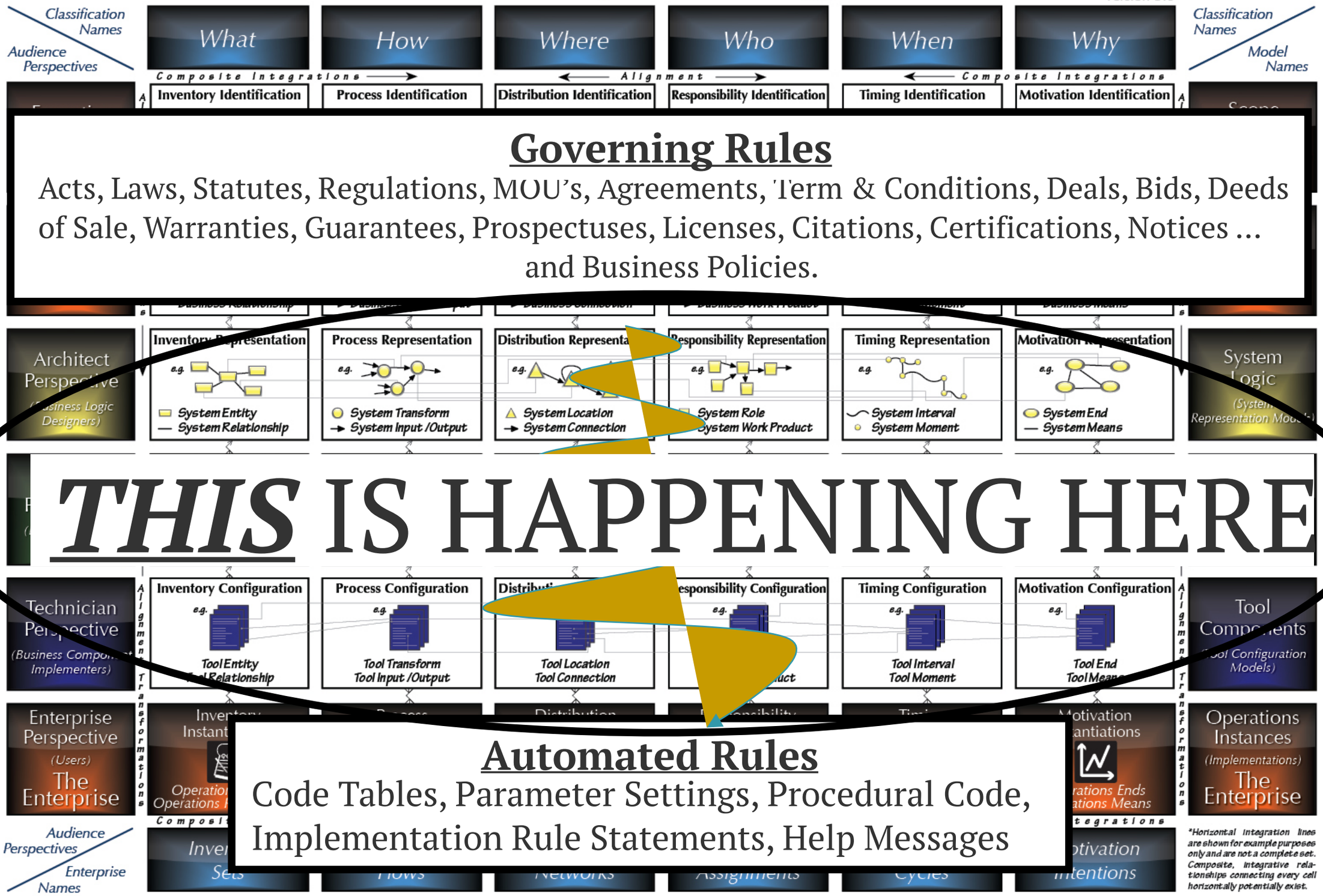
Code Tables, Parameter Settings, Procedural Code, Implementation Rule Statements, Help Messages

Ron Ross
Business Agility Manifesto

The Zachman Framework for Enterprise Architecture™

The Enterprise Ontology™

Version 3.0



Governing Rules

Acts, Laws, Statutes, Regulations, MOU's, Agreements, Term & Conditions, Deals, Bids, Deeds of Sale, Warranties, Guarantees, Prospectuses, Licenses, Citations, Certifications, Notices … and Business Policies.

THIS IS HAPPENING HERE

Automated Rules

Code Tables, Parameter Settings, Procedural Code, Implementation Rule Statements, Help Messages

John Zachman

The Zachman Framework for Enterprise Architecture™

The Enterprise Ontology™

Version 3.0

Classification Names / Audience Perspectives	What	How	Where	Who	When	Why	Classification Names / Model Names
	Composite Integrations →		← Alignment →		← Composite Integrations		
	Inventory Identification	Process Identification	Distribution Identification	Responsibility Identification	Timing Identification	Motivation Identification	

Governing Rules

Acts, Laws, Statutes, Regulations, MOU's, Agreements, Term & Conditions, Deals, Bids, Deeds of Sale, Warranties, C… …ifications, Notices …

You have to transform the Business Concepts at Row 2
to the System Logic of Row 3
and transform the System Logic of Row 3
to the Technology Physics of Row 4
and transform the Technology Physics of Row 4
to the Tooling Configuration of Row 5
and then transform the Tooling Configuration of Row 5
to the Row 6 Instantiation
and retain the transformation relationships.
Then (and only then) will you have
"Traceability, Impact Assessment and Compliance"
and ALIGNMENT

Automated Rules

Code Tables, Parameter Settings, Procedural Code, Implementation Rule Statements, Help Messages

Audience Perspectives / Enterprise Names							
Enterprise Perspective (Users) The Enterprise	Inventories Sets	Process Flows	Distribution Networks	Responsibility Assignments	Timing Cycles	Motivation Intentions	Operations Instances (Implementations) The Enterprise

*Horizontal integration lines are shown for example purposes only and are not a complete set. Composite, integrative relationships connecting every cell horizontally potentially exist.

John Zachman

Engineering Versus Manufacturing

"Concept models which address precision and disambiguation in business communications of all kinds is the first priority. Business knowledge is extremely complex. Until you can express it precisely, you are doomed to a world of miscommunication and misinterpretation. A comprehensive, active, semantically rich, business vocabulary is a must have in the Knowledge Age. You can't expect customers and software developers to make up for what you can't communicate precisely yourself."

Ronald G. Ross. "Authors Speak …" 2018

Roger T. Burlton, Ronald G. Ross and John A. Zachman "The Business Agility Manifesto - The Authors Speak Out" Business Rules Journal Vol. 19 No. 3 (Mar. 2018)

The Zachman Framework for Enterprise Architecture™

The Enterprise Ontology™

Version 3.0

Classification Names / Audience Perspectives	What	How	Where	Who	When	Why	Classification Names / Model Names
	Composite Integrations →		← Alignment →		← Composite Integrations		
Executive Perspective (Business Context Planners)	Inventory Identification e.g. List: Inventory Types	Process Identification e.g. List: Process Types	Distribution Identification e.g. List: Distribution Types	Responsibility Identification e.g. List: Responsibility Types	Timing Identification e.g. List: Timing Types	Motivation Identification e.g. List: Motivation Types	Scope Contexts (Scope Identification Lists)
Business Mgmt Perspective (Business Concept Owners)	Inventory Definition e.g. e.g.: primitive model: Business Entity Business Relationship	Process Definition e.g. Business Input/Output	Distribution Definition e.g. Business Location Business Connection	Responsibility Definition e.g. Role Business Work Product	Timing Definition e.g. Business Interval Business Moment	Motivation Definition e.g. Business End Business Means	Business Concept (Business Definition Models)
Architect Perspective (Business Logic Designers)	Inventory Representation e.g. System Entity System Relationship	Process Representation e.g. System Transform System Input /Output	Distribution Representation e.g. System Location System Connection	Responsibility Representation e.g. System Role System Work Product	Timing Representation e.g. System Interval System Moment	Motivation Representation e.g. System End System Means	System Logic (System Representation Models)
Engineer Perspective (Business Physics Builders)	Inventory Specification e.g. Technology Entity Technology Relationship	Process Specification e.g. Technology Transform Technology Input /Output	Distribution Specification e.g. Technology Location Technology Connection	Responsibility Specification e.g. Technology Role Technology Work Product	Timing Specification e.g. Technology Interval Technology Moment	Motivation Specification e.g. Technology End Technology Means	Technology Physics (Technology Specification Models)
Technician Perspective (Business Component Implementers)	Inventory Configuration e.g. Tool Entity Tool Relationship	Process Configuration e.g. Tool Transform Tool Input /Output	Distribution Configuration e.g. Tool Location Tool Connection	Responsibility Configuration e.g. Tool Role Tool Work Product	Timing Configuration e.g. Tool Interval Tool Moment	Motivation Configuration e.g. Tool End Tool Means	Tool Components (Tool Configuration Models)
Enterprise Perspective (Operations Users)							Operations Instances (Operations Models)
Audience Perpectives / Enterprise Names	Inventory Sets	Process Flows	Distribution Networks	Responsibility Assignments	Timing Cycles	Motivation Intentions	

*Horizontal integration lines are shown for example purposes only and are not a complete set. Composite, integrative relationships connecting every cell horizontally potentially exist.

CONCEPTS

DEVELOPERS

CUSTOMERS

Manufacturing vs Engineering

Manufacturing work requires

multi-variable,

holistic descriptions

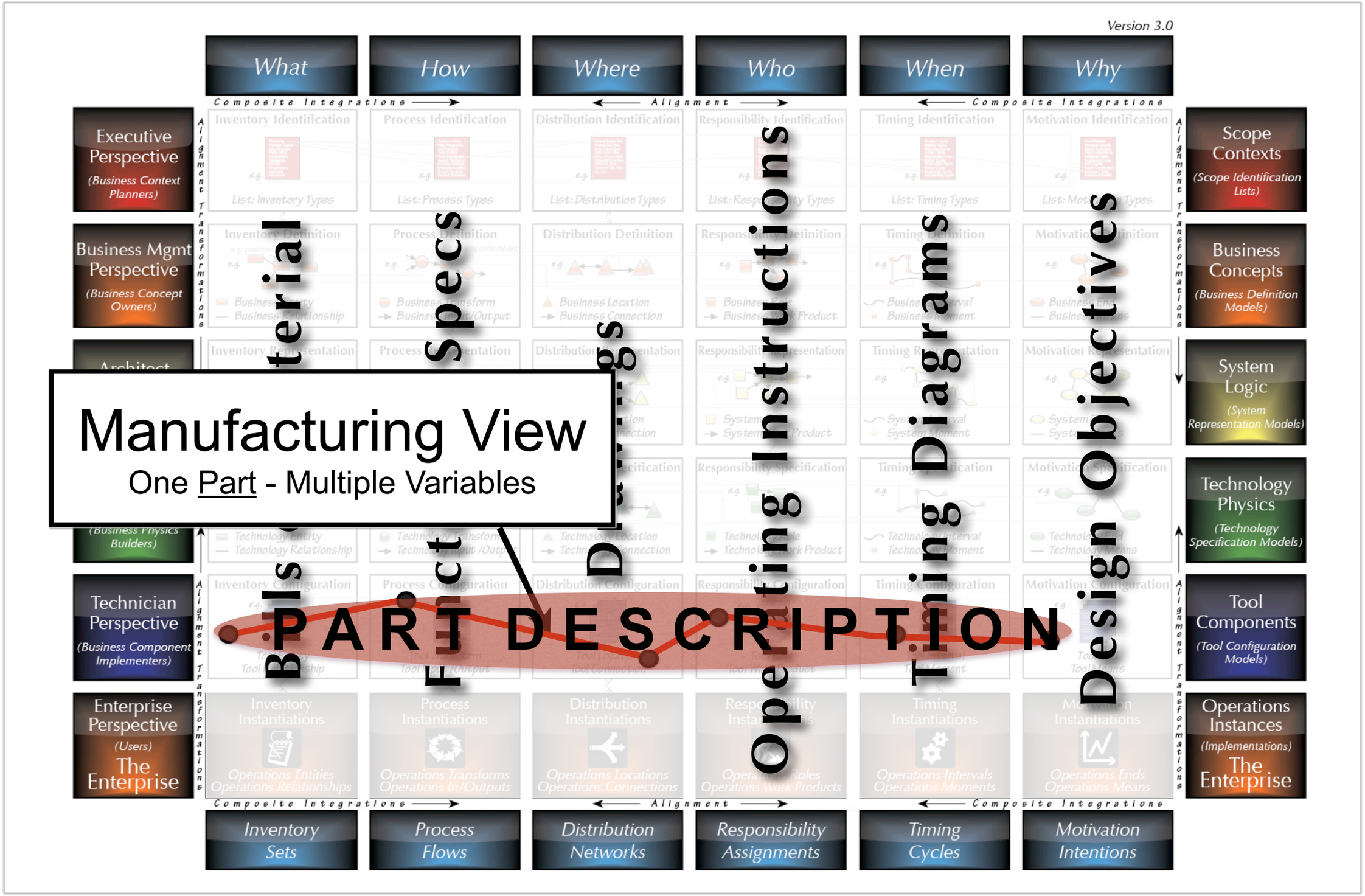
of ***parts*** of the object.

(Composite)

(Analysis - Decomposition)

(This is the CURRENT paradigm)

Engineering Versus Manufacturing



Manufacturing vs Engineering

Manufacturing work requires

multi-variable,

holistic descriptions

of ***parts*** of the object.

(Composite)

(Analysis - Decomposition)

(This is the Current paradigm)

IN CONTRAST

Engineering work requires

single-variable,

ontologically-defined descriptions

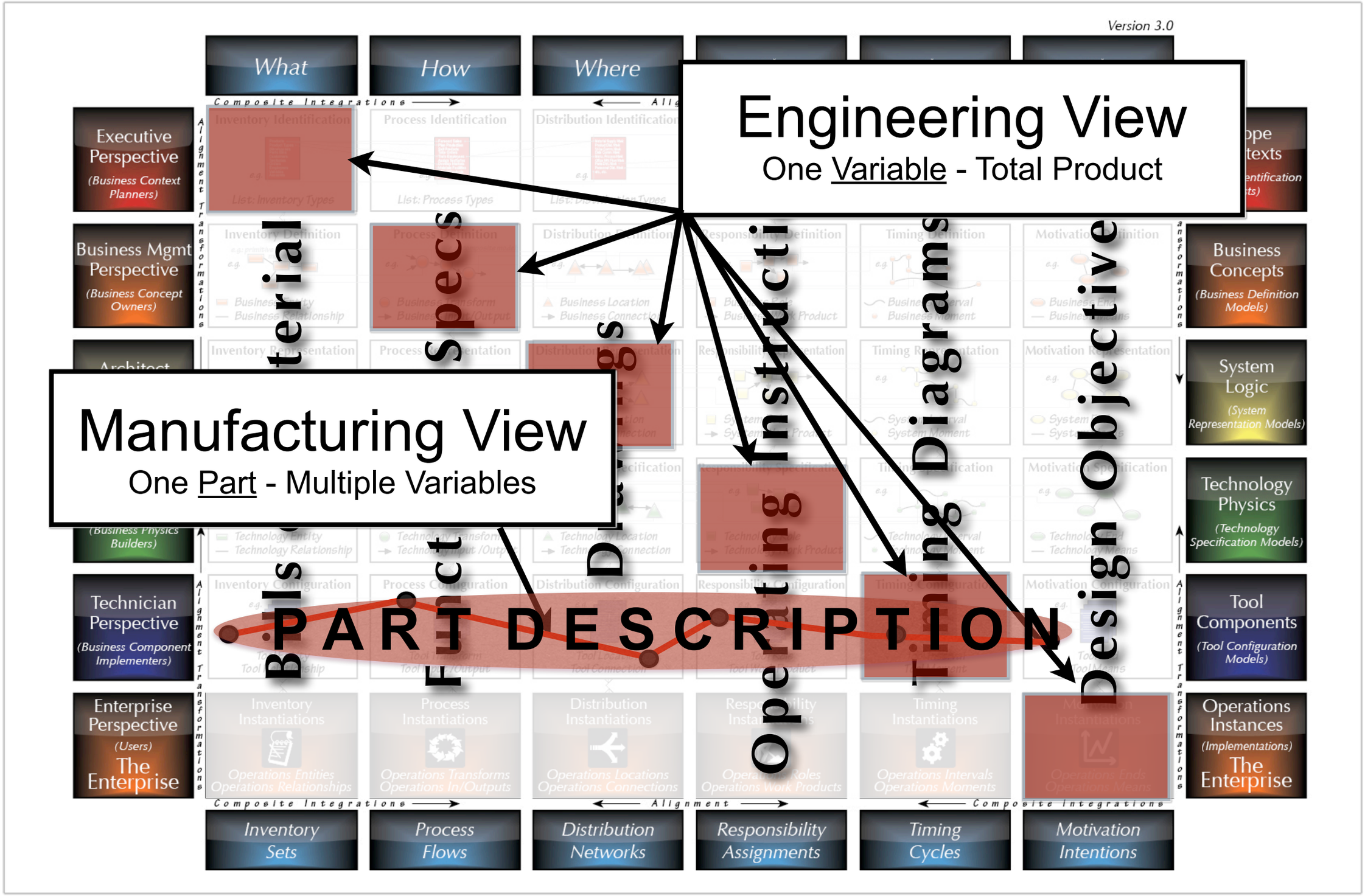
of the ***whole*** of the object.

(Primitive)

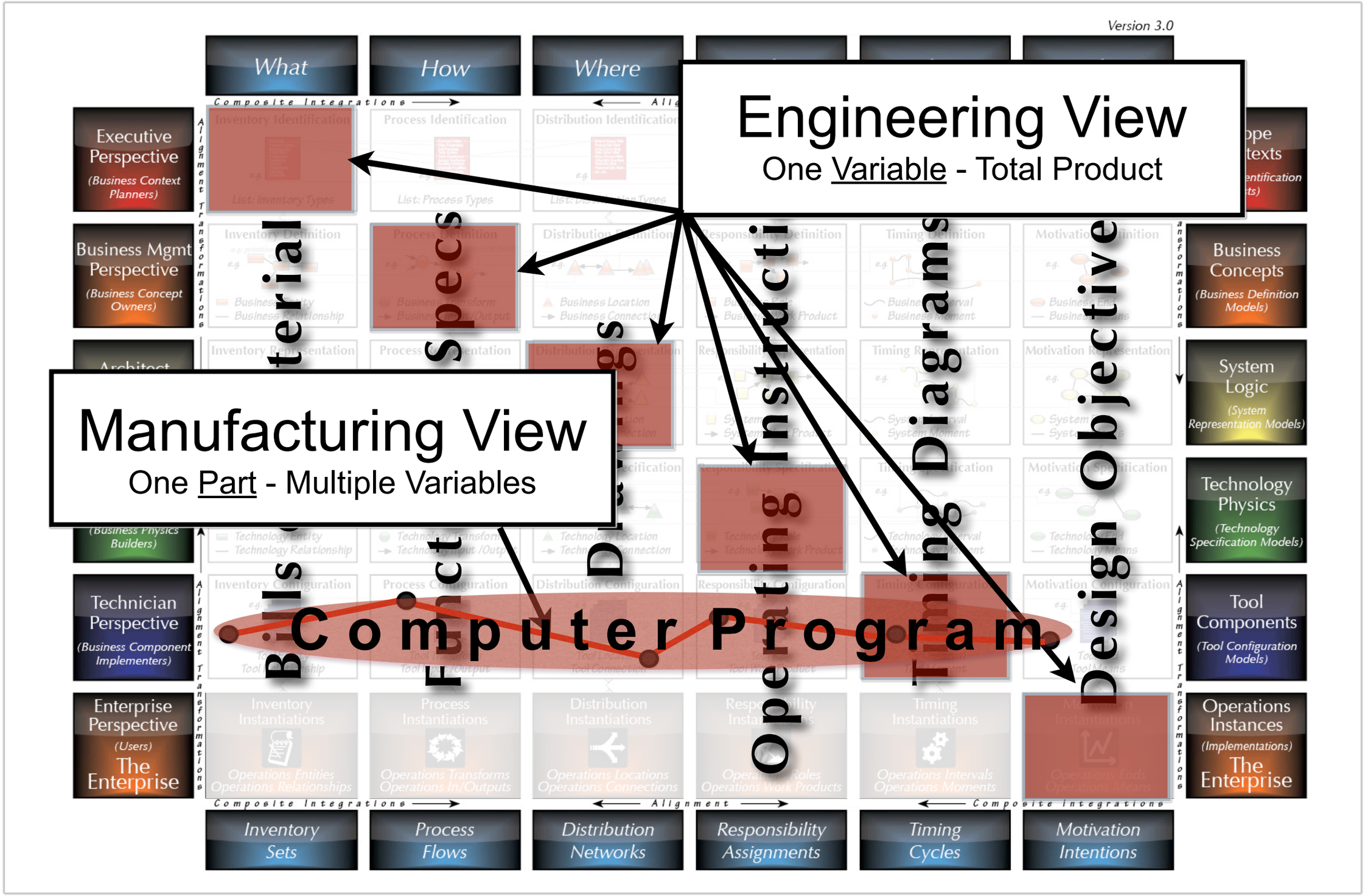
(Normalization -Synthesis)

(This is the NEW paradigm)

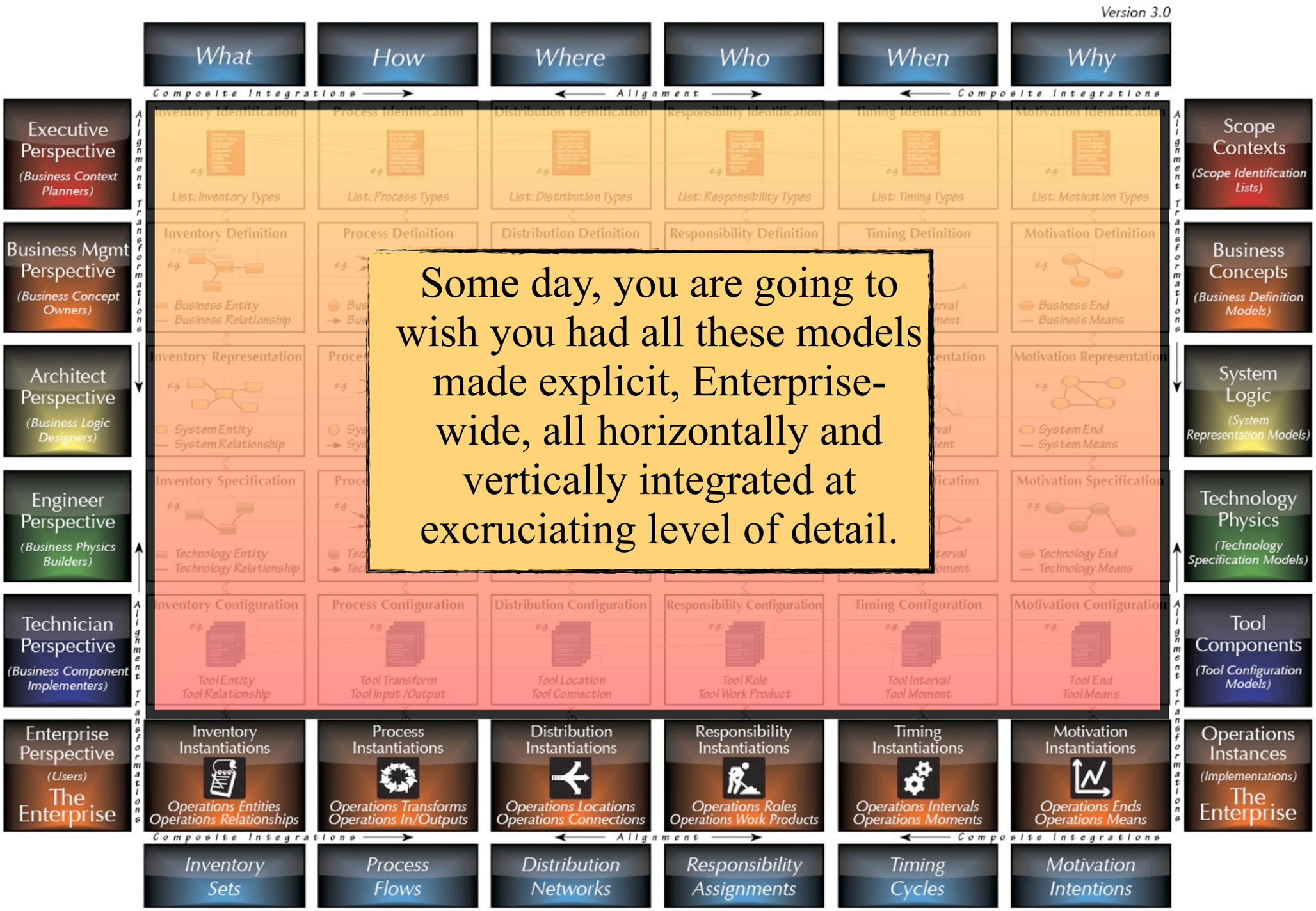
Engineering Versus Manufacturing



Engineering Versus Manufacturing



End State Vision



Some day, you are going to wish you had all these models made explicit, Enterprise-wide, all horizontally and vertically integrated at excruciating level of detail.

The "Enterprise Ontology"

Enterprise Architecture

The "Business Knowledge-base"

For Engineering & Manufacturing Enterprises

Prerequisite for Agility

Introduction to
Enterprise Architecture

Ontologies and MethodOlogies

John A. Zachman
Zachman International

Ontology

The Zachman Framework™ schema technically is an ontology -
a theory of the existence of a structured set
of essential components of an object
for which explicit expression is necessary (is mandatory?)
for designing, operating and changing the object
(the object being an Enterprise, a department, a value chain,
a "sliver," a solution, a project,
an airplane, a building, a bathtub or whatever or whatever).

A Framework is a STRUCTURE.
(A Structure DEFINES something.)

Methodology

A Methodology is a PROCESS.
(A Process TRANSFORMS something.)

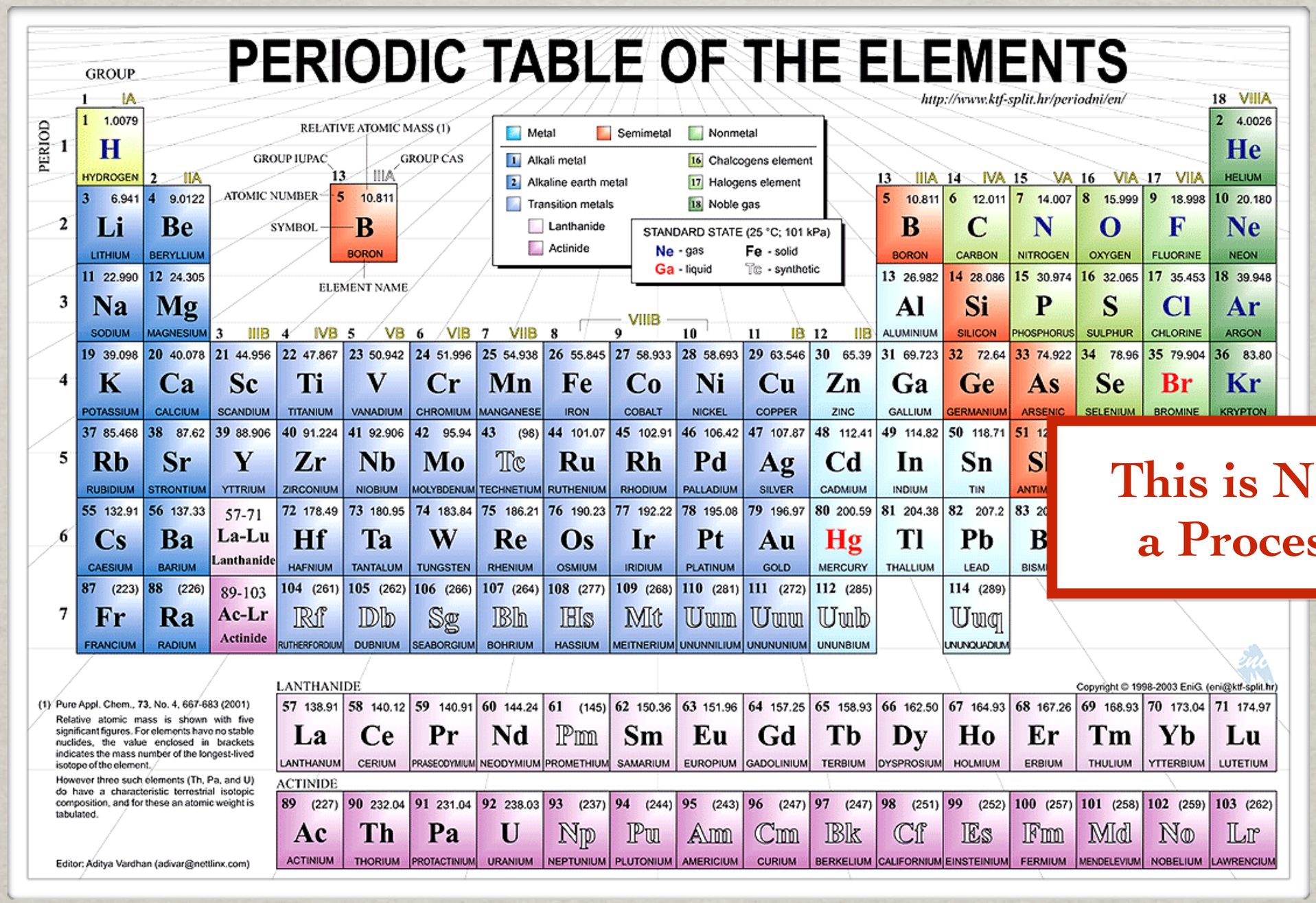
A Structure IS NOT A Process
A Process IS NOT a Structure.

Ontology

As an Ontology, Enterprise Architecture is a two-dimensional, **normalized** classification of all the facts that are relevant to the existence of the Enterprise, the total "knowledgebase" of the Enterprise from which **any** and **every** composite implementation of the Enterprise could be assembled dynamically when the Framework is completely populated.

Note: It can be effectively employed when only partially, sparsely populated.
See the Zachman Framework Story above.

Ontology



This is NOT a Process.

Elements are Timeless

Until an ontology exists, nothing is repeatable, nothing is predictable.
There is no DISCIPLINE.

Process

(Methodology)

A Process TRANSFORMS something.

This is a Process:

Add Bleach to an Alkali and it is transformed into Saltwater.

This is NOT an Ontology.

Compounds are Temporal

Process

(methodology)

Add Bleach to an Alkali and
it is transformed into Saltwater.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

Compounds

Salt	$NaCl$
Aspirin	$C_9H_8O_4$
Vicodin	$C_{18}H_{21}NO_3$
Naproxen	$C_{14}H_{14}O_3$
Ibuprophen	$C_{13}H_{18}O_2$
Viagra	$C_{22}H_{30}N_6O_4S$
Sulphuric Acid	H_2SO_4
Water	H_2O

etc., etc., etc.

Compounds are Temporal

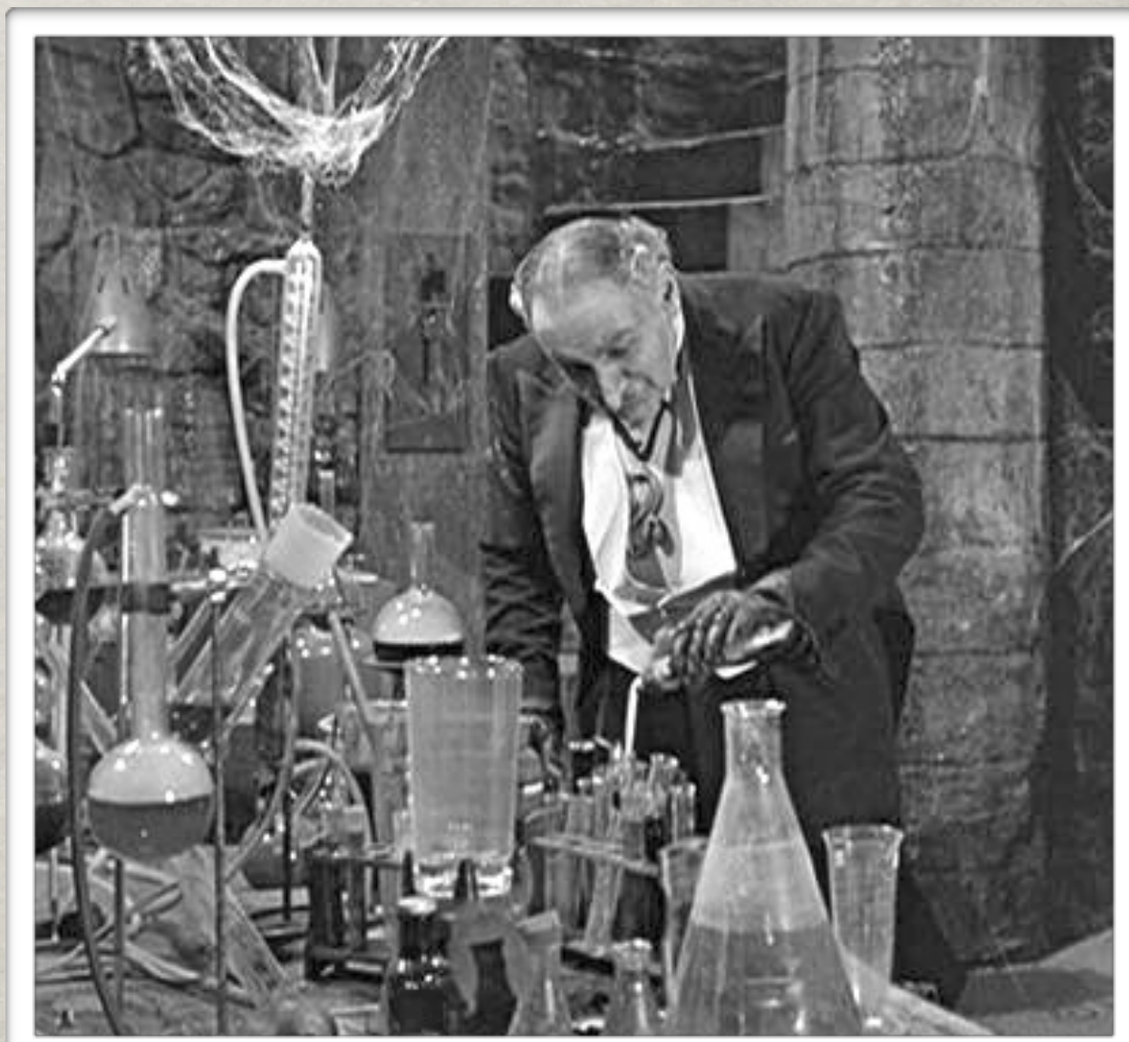
Alchemy - A Practice

This is a Methodology WITHOUT an Ontology

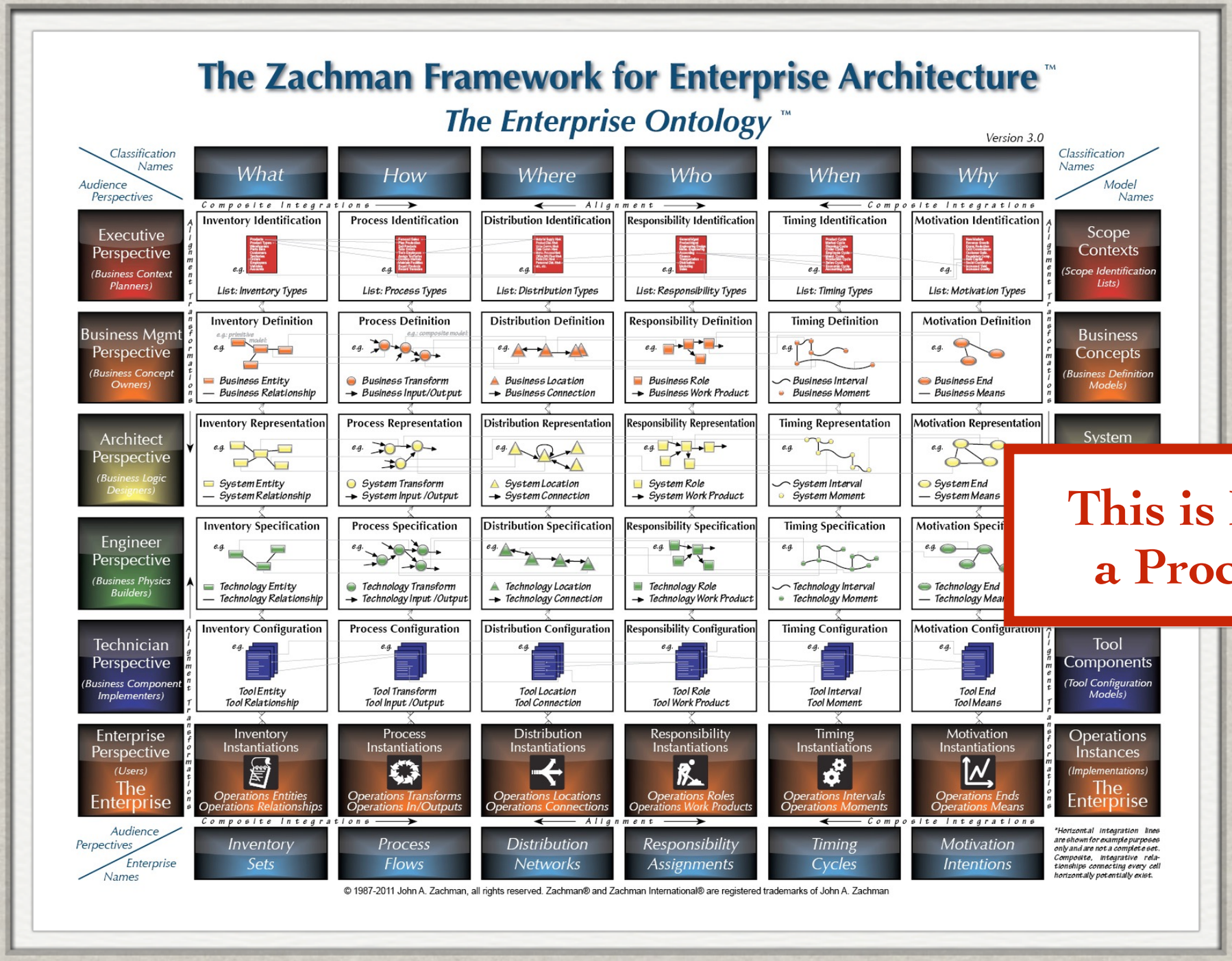
A Process with no ontological structure is ad hoc, fixed and dependent on practitioner skills.

This is NOT a science.

It is ALCHEMY, a "**practice**."



Ontology



This is NOT a Process.

"Primitives" are Timeless.

Until an ontology exists, nothing is repeatable, nothing is predictable.

There is no DISCIPLINE.

Process

(METHODOLOGY)

Composites

(COMPOUNDS)

COBOL Programs
Objects
BPMN Models
Swimlanes
Business Architecture
Capabilities
Mobility
Applications
Data Models
Security Architecture
Services

COTS
Technology Architecture
Big Data
Missions/Visions
Agile Code
Business Processes
DoDAF Models
Balanced Scorecard
Clouds
I.B. Watson
TOGAF Artifacts

Etc., etc., etc.

Compounds are Temporal

Alchemy - A Practice

This is a Methodology WITHOUT an Ontology

A Process with no ontological structure is ad hoc, fixed and dependent on practitioner skills.

This is NOT a science.

It is ALCHEMY, a "**practice**."

Ontology vs Methodology

An Ontology is the classification of the total set of
"**Primitive**" (elemental) components that exist and
that are relevant to the existence of an object.

A Methodology produces "**Composite**" (compound)
implementations of the Primitives.
(Assuming the Primitives are identified and managed.)

Primitives (elements) are timeless.

Composites (compounds) are temporal.

People who build **Composite** Models
think the **Roman Coliseum (implementation)** is Architecture.

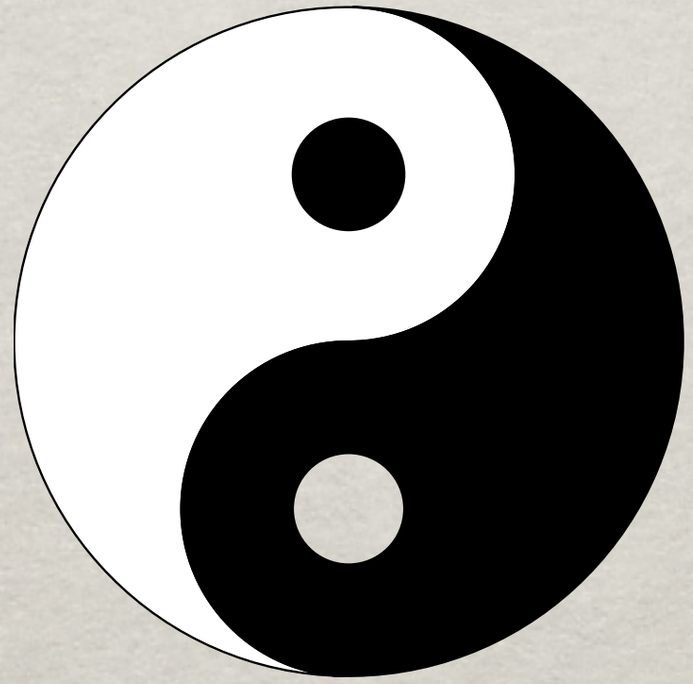
People who build **Primitive** Models
think the **Descriptive Representations** are Architecture.

What do YOU think is Architecture?

Ontology and Methodology

It is NOT either Ontology OR Methodology

It IS Ontology AND Methodology



Ontology and Methodologies
do not COMPETE
they COMPLETE

Ontology and Methodology

Methodologies **WITH** Ontology produce

ARCHITECTURE

Methodologies **WITHOUT** Ontology produce

LEGACY

(What you already, presently have.)

Timeless architectural Primitives (Ontology)
can be dynamically assembled (Methodology)
into an infinite number of
temporal Enterprise implementation Composites,
that is,
Custom Enterprises, mass-produced in quantities of 1 for immediate delivery.
(Enterprise "Mass-Customization.")

The EA Discipline
(Not "EA Practice")

Until an Ontology exists, nothing is repeatable and nothing is predictable. There is no research. Learning is by practice, "best practice." After 7,000 years of practice, within 50 years or so of embracing the Periodic Table, the Alchemists became Scientists and Engineers and were splitting atoms. The Ontology was the basis for the Discipline of Chemistry.
Elements are timeless. Compounds are temporal.

The single-variable, ontologically-defined, "Primitive" "elements" can be hypothetically and dynamically structured to evaluate and test various strategy alternatives without investing in implementation i.e. in "practicing." (See "Developing Strategy Alternatives.")

Introduction to
Enterprise Architecture

Observations

John A. Zachman
Zachman International

Enterprise Engineering Design Issues

Boundaries Are Not Fixed
("Federated Architecture)

An Enterprise always already exists
(Continuous, dynamic, migration from "as is" to " to be")

Unstructured Text - Internal and External
(Ontological classification + graf/relational databases for analytics/diagnostics)

Instantaneous Time to Market
(Enterprise mass-customization - assemble to order)

Simulation of Strategy Alternatives
(Optimization and comparison of multiple knowledgebase variables)

Alignment of Products (Things) and Enterprises and Enterprise Designers
(Meta framework alignment)

KEY: Single-variable, precisely unique, relevant, ontologically-defined components ("Primitives") and binary relationships, two components at a time.

Designed for Change

Ontological Primitives
(separation of independent variables -
change one thing without changing everything)

Normalization
(eliminate redundancy unless specifically controlled)

Reusability
(changes to a "Primitive" changes it for every deployment)

Mass Customization
(custom enterprises, mass-produced in quantities of one
for immediate delivery - dynamic reconfiguration of Primitives)

Enterprise Architecture
(Knowledgebase - precisely represents the "as is,"
"real time" description of the Enterprise with versioning)

Reification Traceability
(Stage to stage retention of binary relationships between
Reified Primitives)

Enterprise Impact Analysis
(Problem diagnosis)

Observation

If:

1. The Enterprise has no Enterprise Architecture,
2. EA Primitives do not = the Enterprise at every given moment,
3. And, any fact recurs anywhere in the Enterprise unsynchronized,

Then, I humbly submit that the strong possibility exists that:

1. No one actually knows how the Enterprise works
2. Problems can't be diagnosed and multiple solution alternatives posed/simulated before making investments
3. General Management would not be able to change the Enterprise in time to accommodate the external rate of change.
4. The cost of operations is likely escalating.

Systems are NOT Architecture

Enterprise Architecture is the SET of descriptive representations that constitute the knowledgebase of "primitives" required to accommodate EXTREME COMPLEXITY and EXTREME CHANGE for designing an Enterprise with viability in the Information Age.

Building "composite" implementations (systems) reuse the "primitive" components by "late binding" the required binary relationships in response to changing external demands by "changing foreign keys in repository-type products," effectively realizing "mass-customization"

OR

Diagnosing Enterprise essential (not symptomatic) problems and prescribing appropriate range of problem solutions including hypothetical, alternative binary relationships for simulation and for prediction of unintended consequences of change.

The KEY: A Knowledgebase of Ontologically-defined, single variable, "primitive" components, and binary relationships.

i.e. ENTERPRISE ARCHITECTURE.

(The end object is NOT to get the code to run.)