

# Systems Integration

## 0 - Preface

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v1.1 September 2019

Source: A significant part is from Mark W. Maier and Eberhardt Rechtin's *The Art of Systems Engineering 3rd Ed*

# Preface

## Premise

- ▶ Creating and building systems...
- ▶ ...too complex to be treated by engineering analysis alone...
- ▶ ...can be addressed through structured methods...
- ▶ ...at the level of heuristics

## Observation

- ▶ The success or failure of systems often seems pre-ordained (traceable to the beginnings)
  - ▶ Some start doomed. No downstream engineering can help.
  - ▶ Some seem fated for success. Regardless of poor implementation.

# Preface

## New types of systems

- ▶ Very high quality
- ▶ Real time
- ▶ Reconfigurable
- ▶ ...

## A modern problem

- ▶ e.g. Automobiles: stable architectures during decades. Global competition

# Architecting and Engineering

## Architecting vs Engineering

- ▶ Engineering: Deals with measurables using analytic tools derived from mathematics and *hard sciences*.
- ▶ Architecting: Deals with unmeasurables using nonquantitative tools and guidelines based on practical lessons learned.

## Architecting

- ▶ Works in the world of user/sponsor/client. Ambiguity and imprecision
- ▶ Communicate user/sponsor/client with engineer/developer
- ▶ Provide sufficient definition to engage developers

## Architecting vs Engineering

- ▶ Engineering: quantifiable costs, technical optimization, science
- ▶ Architecting: qualitative worth, client satisfaction, art

## Table: Architecting...Engineering

Characteristic	Architecting		Engineering
Situation/goals	Ill-structured	Constrained	Understood
Methods	Satisfaction	Compliance	Optimization
	Heuristics		Equations
Interfaces	Synthesis		Analysis
	<b>Art</b> and science	Art <b>and</b> science	Art and <b>science</b>
System integrity	Focus on "mis-fits"	Critical	Completeness
Management issues	"Single mind"	Clear objectives	Disciplined methodology
	Working for client	Working with client	Working for builder
	Conceptualization and certification	Whole waterfall	Meeting project requirements
	Confidentiality	Conflict of interest	Profit vs. cost

# Architecting

## Architecting

- ▶ Architecting deals with ill-structured situations. Goals?  
Means?
- ▶ Vague requirements. Client can *not* resolve! This is *the* role of the architect!
- ▶ Architect explores *jointly* requirements and design

## Ill-structured problem

- ▶ Knowing what you *can* do changes what you *want* to do

## Interfaces

- ▶ System: Collection of interfaces
- ▶ Objective: Identify interfaces that cannot work: Mis-fits

# Management

## Working for the client/builder

- ▶ Architect: Works for the client
- ▶ Engineer: Works for the builder

## Project management

- ▶ Architecting exists during the the big picture of the project
- ▶ But: Project management often deals with systems engineering (narrower focus, within one organization)
  - ▶ Definite requirements
  - ▶ Budget and schedule defined
  - ▶ Specific milestones
- ▶ When systems engineering takes place, the project may already be doomed to failure or on its way to success

# Architecture as Art and Science

## Working for the client/builder

- ▶ Architect: Works for the client
- ▶ Engineer: Works for the builder

## Art and Science

- ▶ Good architecting is not only an art
- ▶ Architects have strong science background
- ▶ *Architecture* means *structure*
- ▶ *Architecting* means *process*