SOFTWARE ENGINEERING IN A SYSTEMS CONTEXT

STOCKHOLM

2015-11-27

Ett frukostseminarium från Syntell

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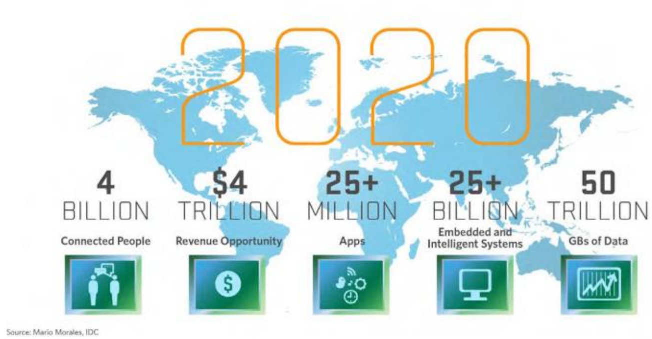
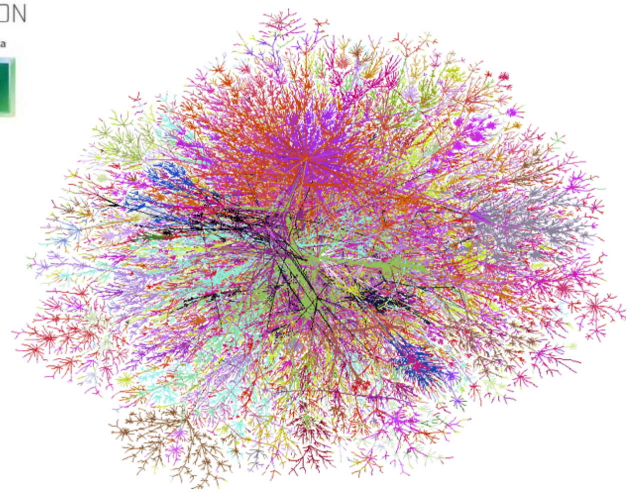
VÅR VERKSAMHET - INDUSTRI

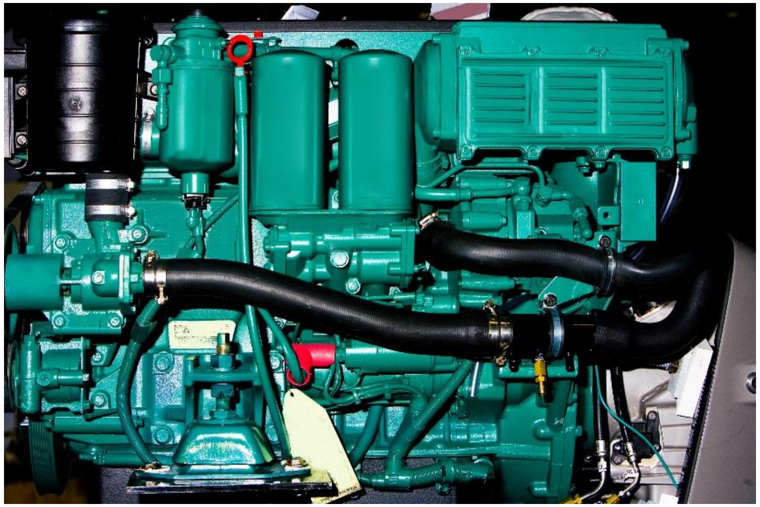
	Försvarsindustri	Järnväg	Tunga fordon	Medicinteknik	Övrig Industri
Strategi	■	■	■	■	
Verksamhetsutveckling	■		■	■	■
Projekt	■	■	■	■	■
Upphandlingsstöd					
Anbudsstöd	■		■		
Utbildning	■	■	■	■	■
Produktleverans	■				

VART ÄR VÄRLDEN PÅ VÄG…?





DET HÄNDER ÄVEN HÄR!



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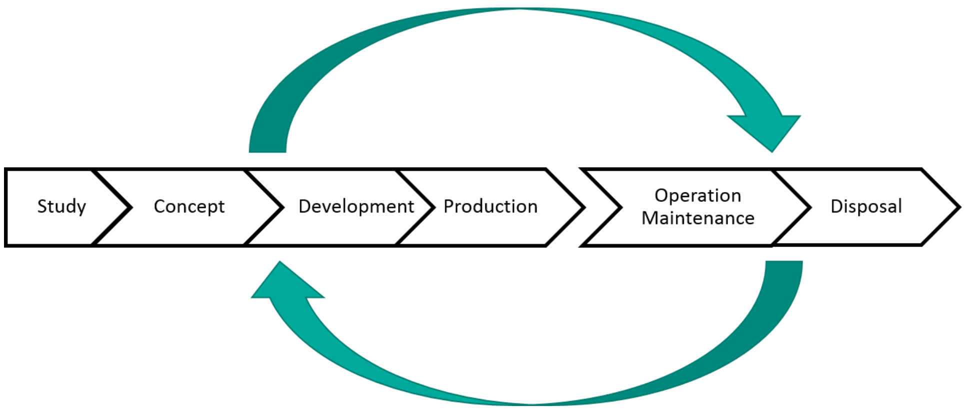
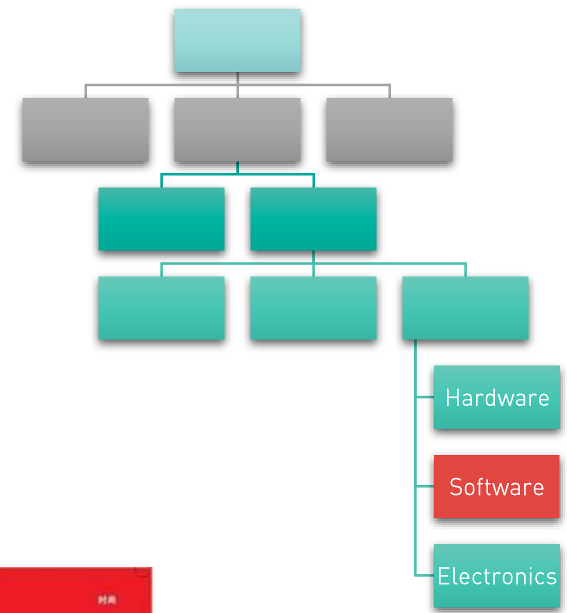
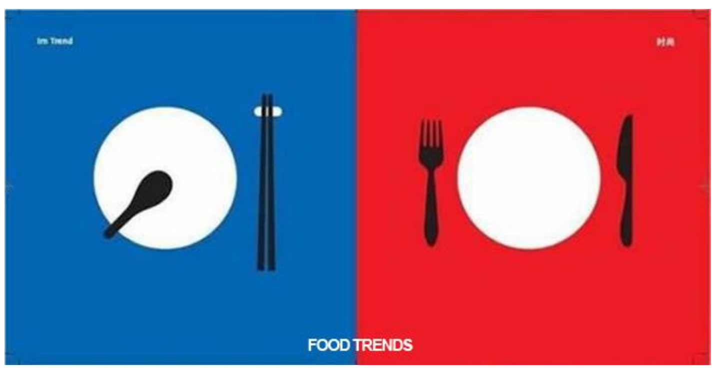
VARFÖR DAGENS TEMA VIKTIGT?







FÖR DET KAN GÅ FEL...

10 år

Bn USD

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SOFTWARE ENGINEERING IN A SYSTEMS CONTEXT

Dr. Harold ”Bud” Lawson – Syntell Partner

Software Engineering in the Systems Context

Harold "Bud" Lawson

IEEE COMPUTER SOCIETY
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Advancing Computing as a Science & Profession

FELLOW

IEEE computer society

FELLOW and LIFE MEMBER

INCOSE
International Council on Systems Engineering

FELLOW

Central Role of Software

"Software has become the critical infrastructure within the critical infrastructure" – 2005

Dr. Alan B. Salisbury, Former Commanding General,
U.S. Army Information Systems Engineering Command,
Co-founder and editor, The Journal of Systems and Software

The Era of Cyber-Physical Systems and the Internet of Things will be a game changer for Software and Systems Engineers demanding Unification of the two professions.

The Software Business

"The uniqueness of software business stems from the peculiar nature of software systems—intangible, free from reproduction costs, continually changeable, more complex than perhaps any other human construct, requiring team-oriented, intellect-intensive endeavors, and tolerate no mismatch among the interfaces of system components"

"The Mythical Man Month".

Fred Brooks, 1975.

SEMAT INITIATIVE
(SOFTWARE ENGINEERING METHOD AND THEORY)
RICHARD SOLEY, BERTRAND MEYER AND IVAR JACOBSON

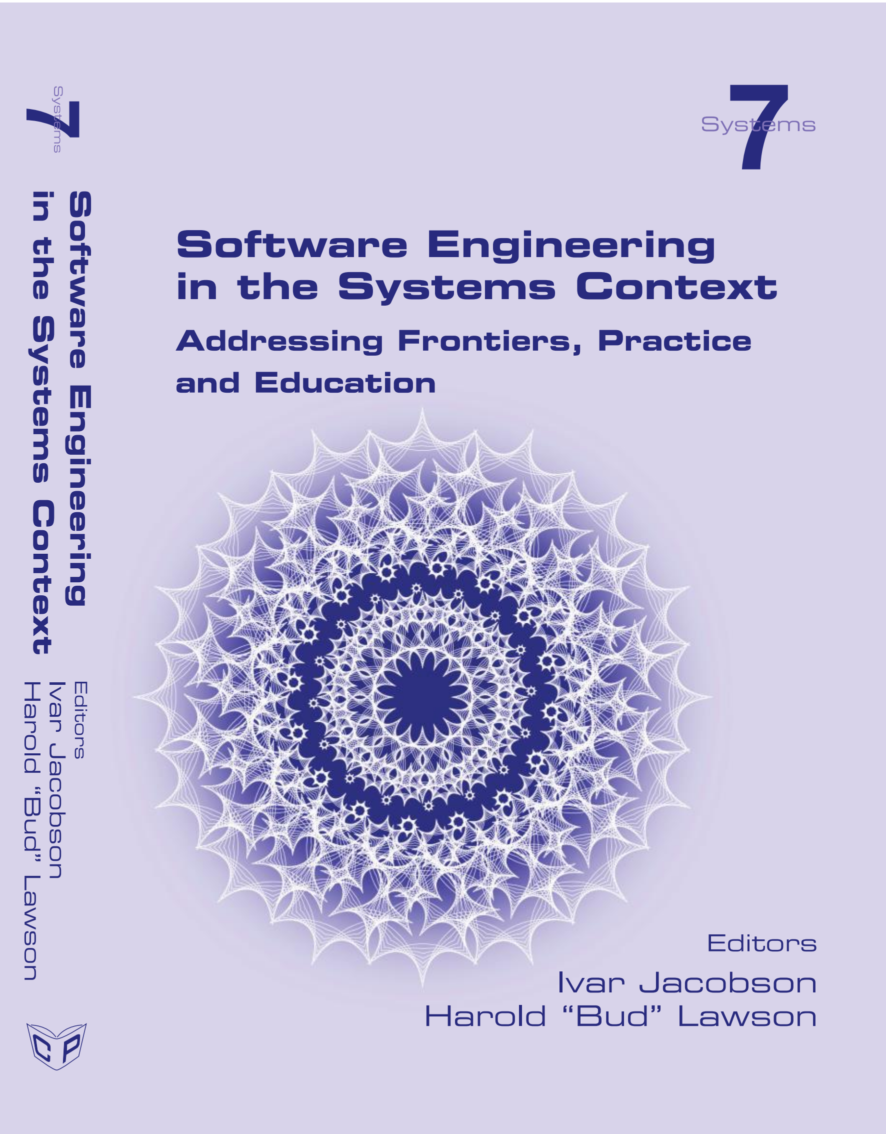
- Software Engineering suffers from:
  - The prevalence of fads more typical of fashion industry than of an engineering discipline.
  - The lack of a sound, widely accepted theoretical basis.
  - The huge number of methods and method variants, with differences little understood and artificially magnified.
  - The lack of credible experimental evaluation and validation.
  - The split between industry practice and academic research.

www.semat.org

Re-Founding of Software Engineering

- SEMAT Supports a Process To:
  - Include a kernel of widely-agreed elements, extensible for specific uses
  - Addresses both technology and people issues
  - Are supported by industry, academia, researchers and users
  - Support extension in the face of changing requirements and technology

RESULTED IN THE OBJECT MANAGEMENT GROUP (OMG) STANDARD ON THE ESSENCE KERNEL



THE CAST

Ilia Bider   Barry Boehm   Lindsey Brodie

Francois Coallier   Tom Gilb

Rich Hilliard   Ivar Jacobson

Harold "Bud" Lawson   Anatoly Levenchuk

Svante Lidman   Paul E. McMahon

Moacyr de Mello   Barry Myburgh

Pan-Wei Ng   Don O'Neill

June Sung Park   Sarah Sheard

Ian Sommerville   Ian Spence

A MUST READ FOR ALL SOFTWARE AND SYSTEMS ENGINEERS!!!

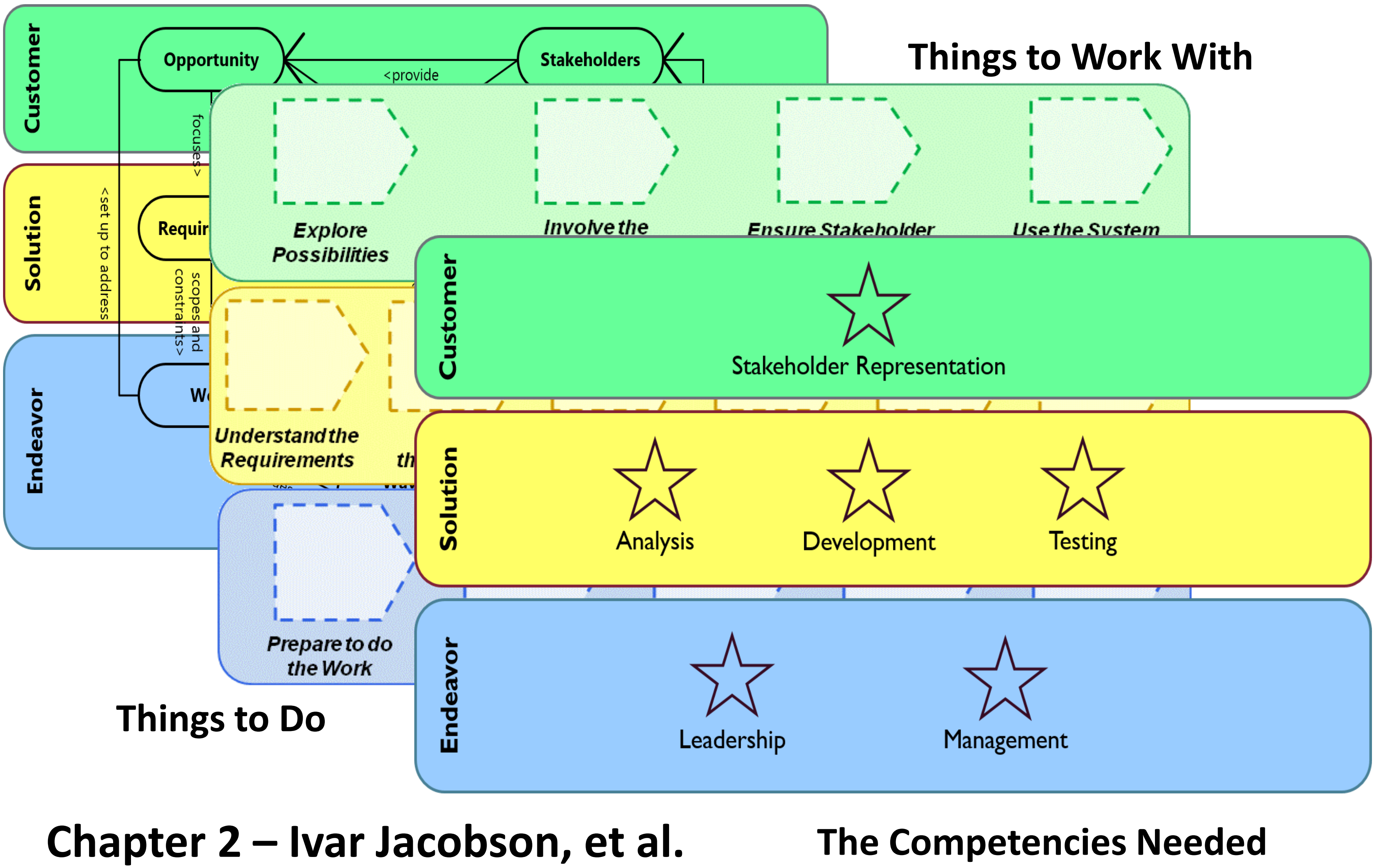
Exploring and Defining Software – Systems Relationships
(Perspectives)

- driving concepts and principles
- guidance on selecting development approaches
- issues of complexity
- stakeholder concerns and requirements
- the vital role of architecture
- agility, governance
- resilience, trust, risk
- acquisition, supply chains
- technical debt
- socio-technical aspects
- standards
- fundamental aspects of improving communication and understanding

A CALL FOR ACTION – TO STRIVE TOWARDS UNIFYING SOFTWARE AND SYSTEMS ENGINEERING

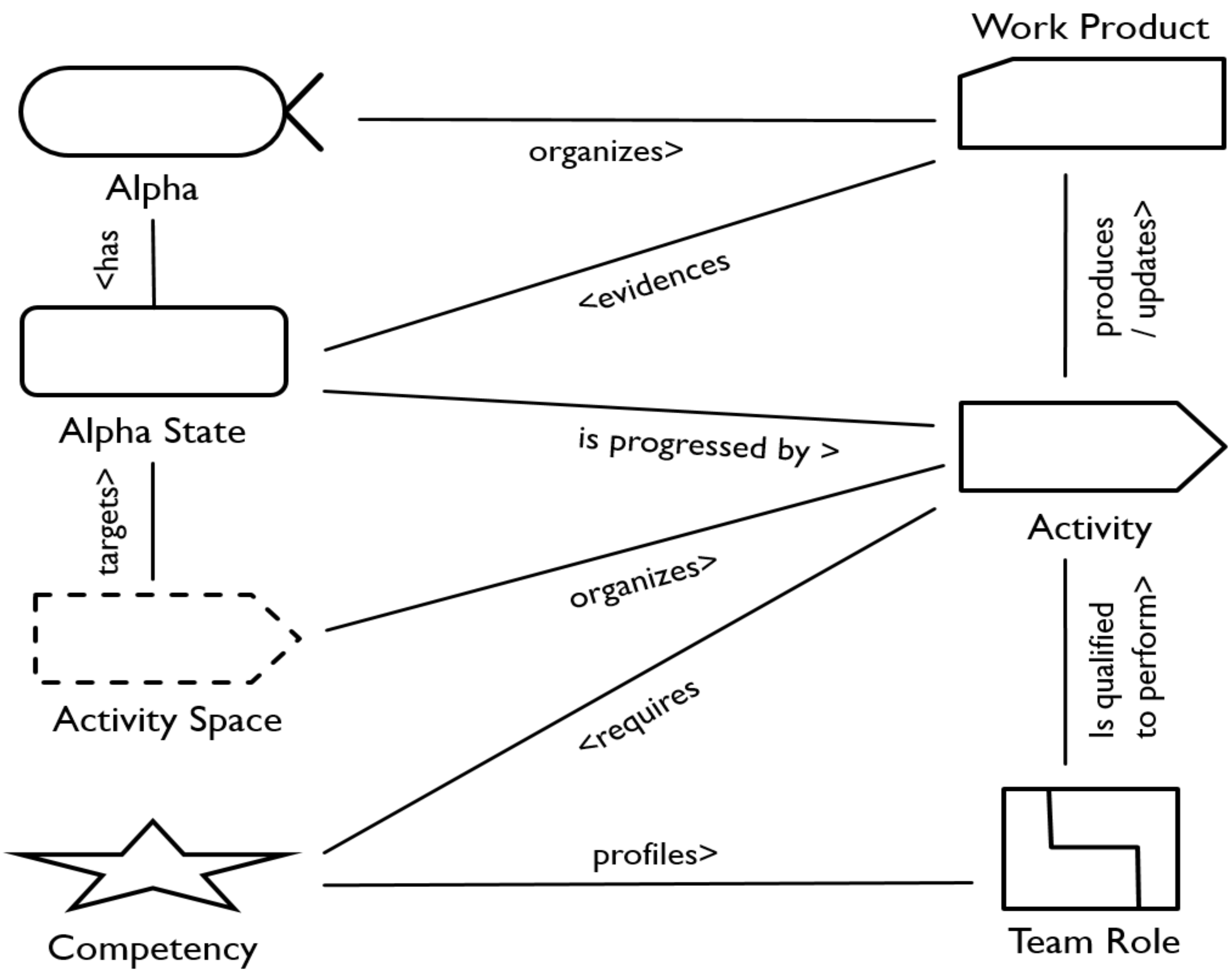
A SYSTEMS ENGINEERING ESSENCE KERNEL

Essence Kernel
A Framework for Thinking and Acting



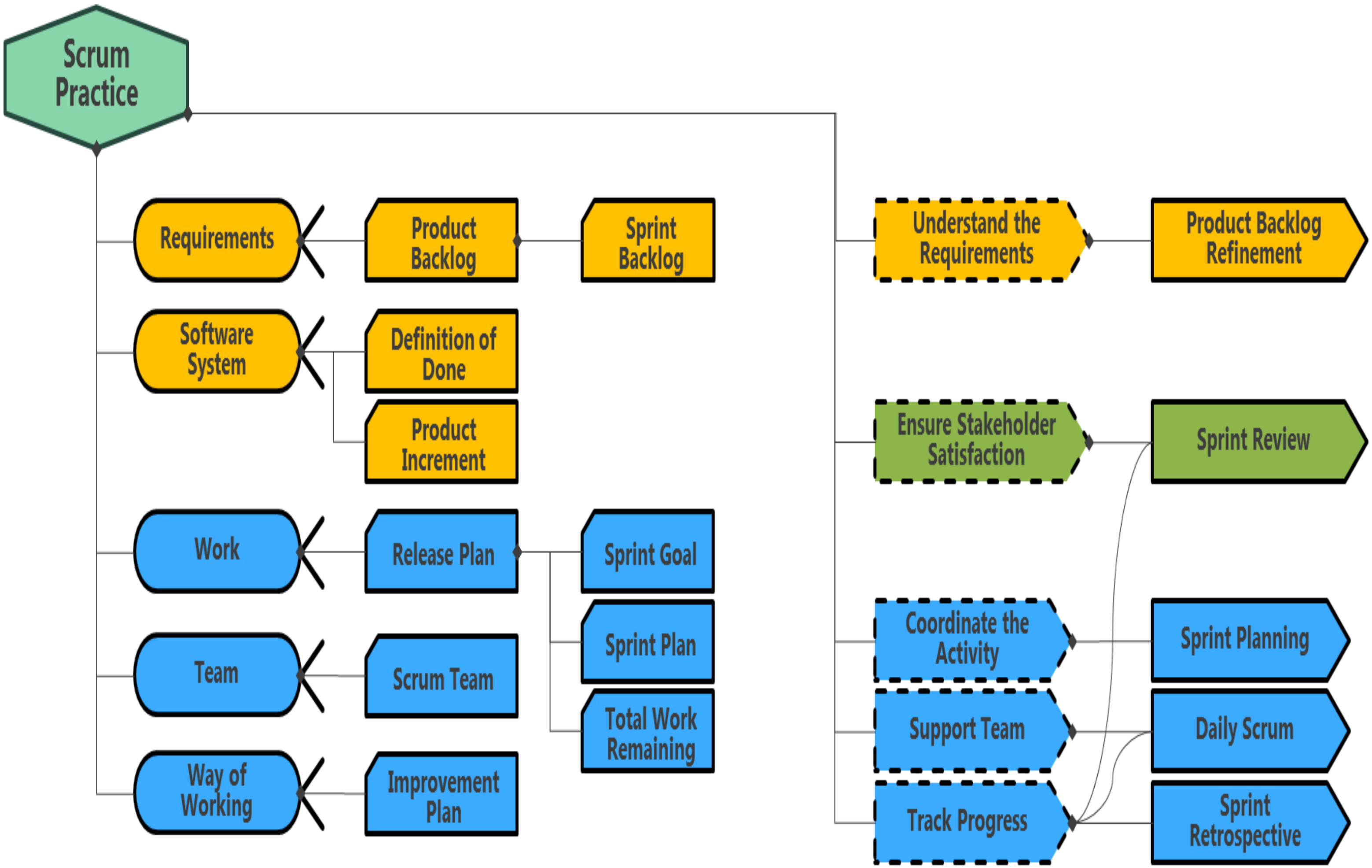
Chapter 2 – Ivar Jacobson, et al.

Defining Practices and Work Products



Chapter 15 – June Sung Park

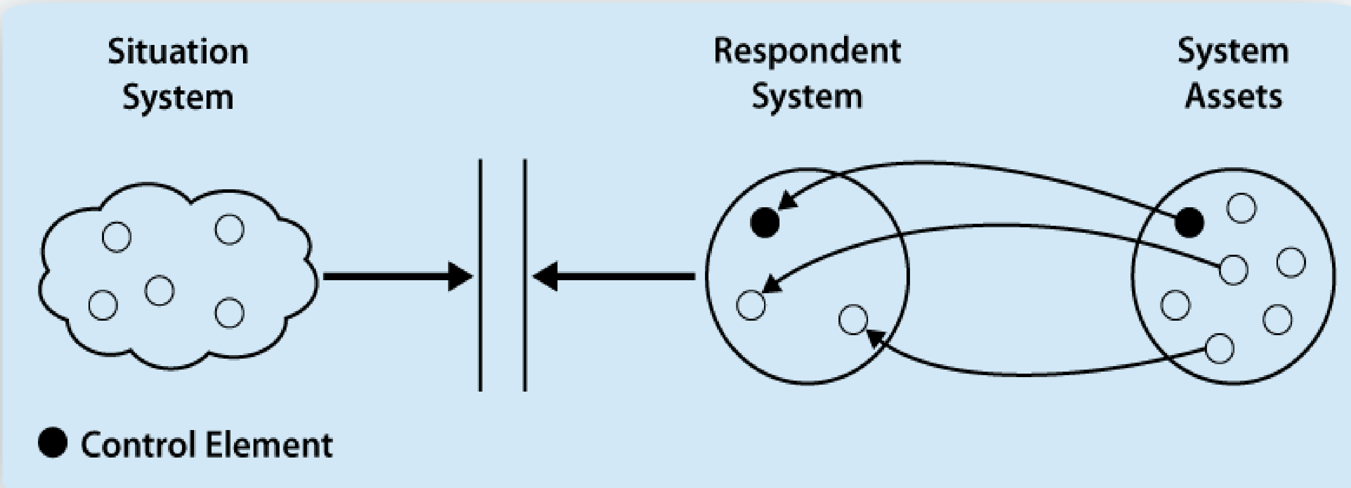
Practice and Method Independent SCRUM – Defined in Essence



Chapter 15 – June Sung Park

Attaining a Systems Perspective

(Learning to "Think" and "Act" in Terms of Systems)



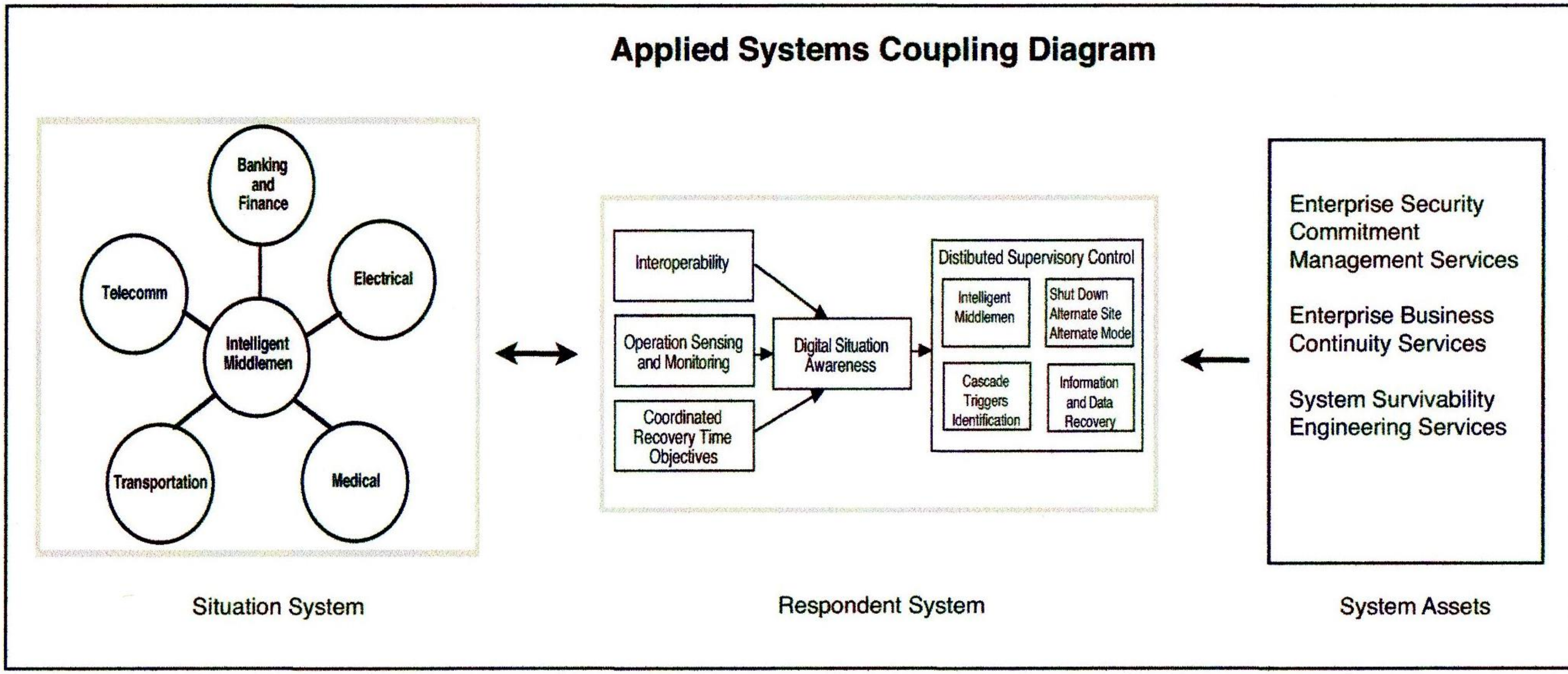
SYSTEM COUPLING DIAGRAM

Situation Systems	Respondent Systems	System Assets
Natural	Project	Facilities, Instruments,
Man-Made	Team	Theory, Knowledge,
Mixed	Mission	Standards, Processes,
Thematic	Program	Methods, Practices.
	Task	Frameworks, Tools,
	Sprint	Policies, Guidelines,
	Study	Competencies,
	Experiment	Essence Kernel

NAMING SYSTEMS

Chapter 3 – Bud Lawson

Infrastructure Resilience



Way of Working Foundations

SEMAT Kernel and Essence
Alpha State Checkpoints
Critical Infrastructure Target Domain
Resiliency Maturity Framework
User Story: Critical Infrastructure
The System Coupling Diagram

Software System Architecture: Critical Infrastructure
The Cleanroom Method and Process
Trustworthy Software Assurance
Risk Management
Project Plan: Increments and Iteration

Chapter 4 – Don O'Neill

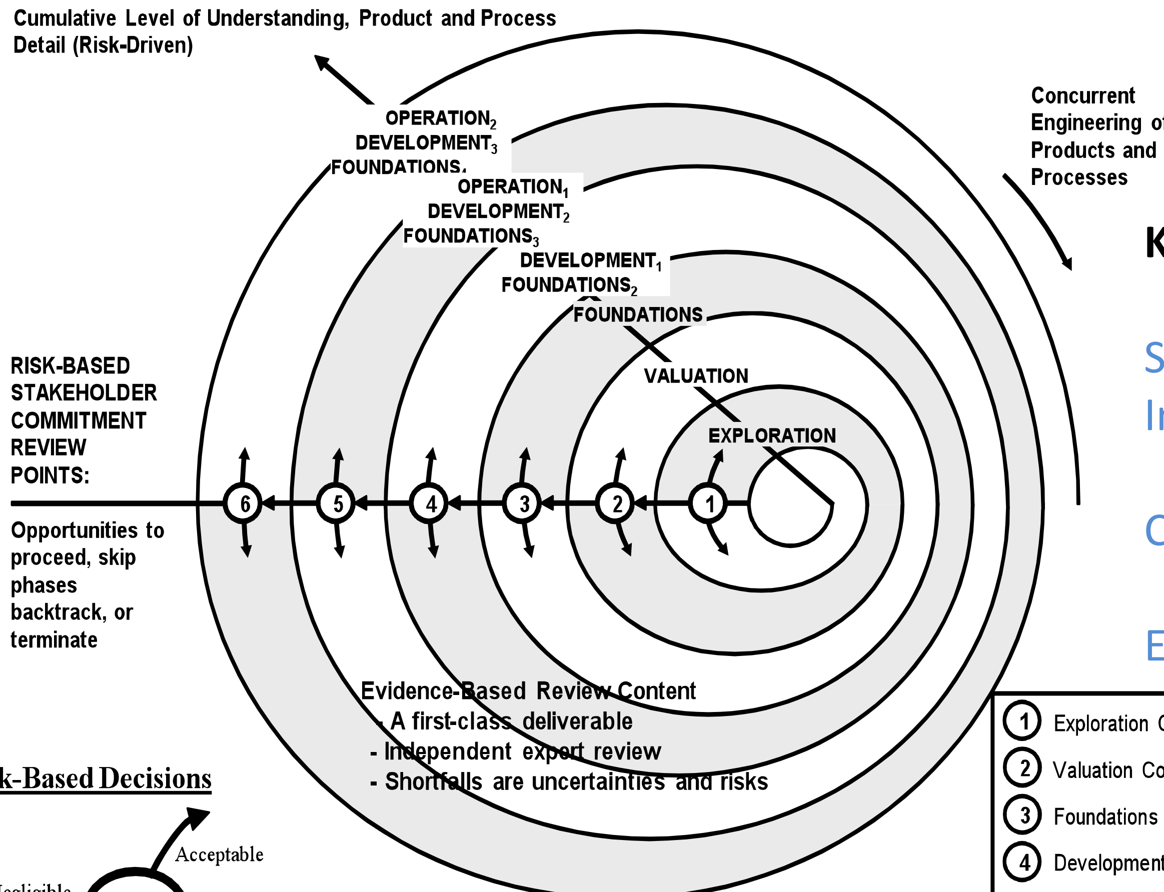
Complexity, Systems, and Software

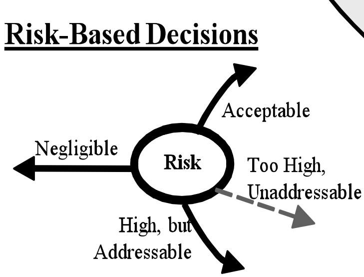
Complexity Characteristics

Objective	Subjective
Tight Coupling	Costly
Large Size	Uncertain
Multiple Scales	Risky
Decentralized	Difficult to Understand
Adaptive	Difficult to Predict
Non-Mechanical	Frustrating
Emergent	Uncontrollable
Self-Organizing	Obsolete when built
Chaotic	Unclear causality
Nonlinear	

Chapter 5 – Sarah Sheard

Incremental Commitment Spiral Model (ICSM)





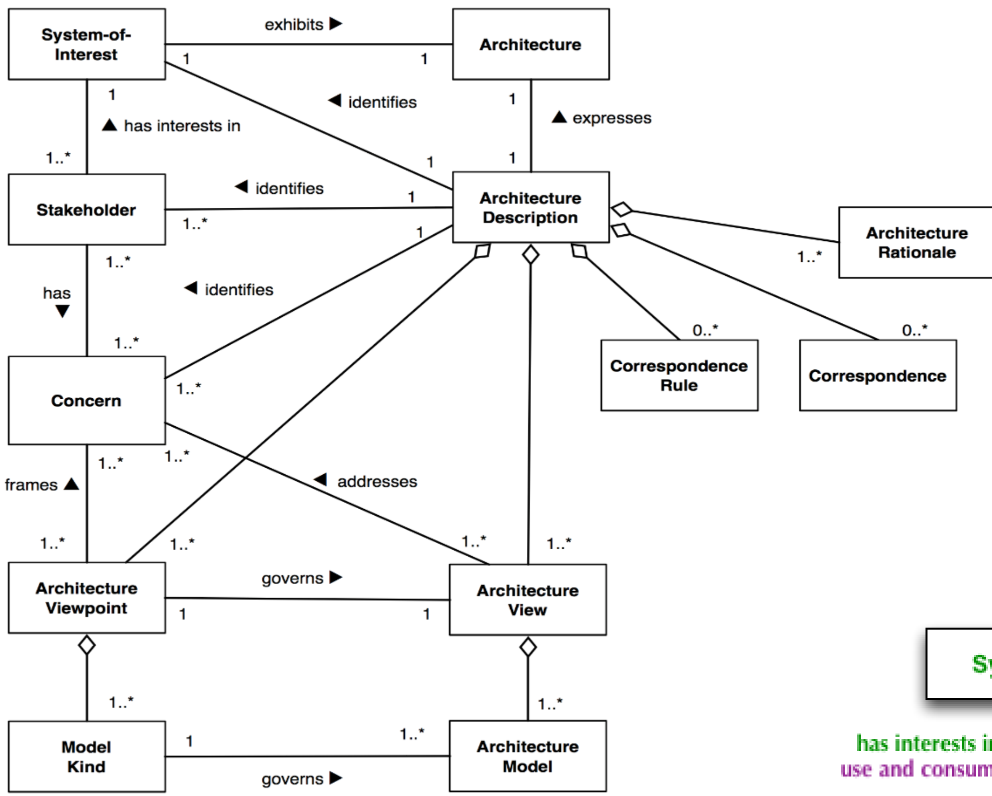
KEY PRINCIPLES

- Stakeholder Value-Based Guidance
- Incremental Commitment and Accountability
- Concurrent Multi-Discipline Engineering
- Evidence and Risk-based Decisions

Chapter 6 – Barry Boehm

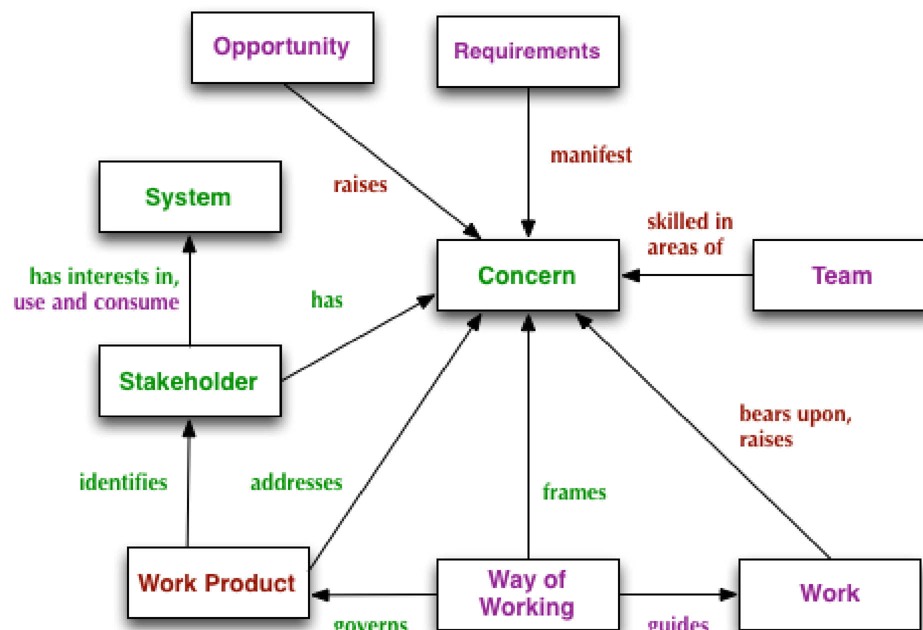
Architecture Description

(ISO/IEC/IEEE 42010)



Architecture Description meta model

Concerns cross-cut familiar entities



Chapter 10 - Rich Hilliard

Guiding Principles for Essence

Principle One*:* Common Ground Acceptance By Broad Community Without Poor Compromises.

Principle Two*:* Natural Naming. In developing the names of alphas, states, and in arriving at the words for checklists we were constantly attuned to choosing words that fit naturally with software practitioners

Principle Three*:* The checklists have intentional ambiguity. Intentional because their role is to stimulate conversations and not to be prescriptive.

Principle Four: Keeping the model small at all cost. We did not dictate the number of states, nor the number of checklists, but we were always conscious of keeping it small enough so that practitioners could learn the model in a relatively short period of time, and start using it and gaining value without extensive training.

<u>Additional for a Systems Engineering Essence</u>

Principle Five*:* Reuse As Much As Possible. Since Essence is an existing standard the development team must motivate what has to be changed relative to this standard. In the search for an Essence kernel for System Engineering work should start from the existing standard.

Chapter 16 – Ivar Jacobson, Bud Lawson, Paul McMahon

A Call for Action

(Taking our own Medicine)

- There is a clear **Opportunity**.
- The **Stakeholders** are all System and Software Engineers and their surrounding community of interests.
- The **Requirements** have started to be identified in this book but need to be further developed.
- The **System of Interest** is the Essence Kernel for Systems Engineering.
- The **Team** should be seeded with people that participated in developing the current Essence, experts and users of ISO/IEC/IEEE 15288 and 42010 as well as CMMI.
- The goals of the **Work** are certainly clear.
- The **Way of Working** must be established by the team.

Chapter 16 – Ivar Jacobson, Bud Lawson, Paul McMahon

Case Study - Socio-Technical System

Scottish Digital Learning Environment

1. The need to accommodate a range of users from age 3 to (potentially) age 83. Parents and grandparents were potential system users. An unusual constraint that we had was that some of the most creative users couldn't actually read.
2. The very complex system of governance for the system involving at least 33 separate bodies.
3. A heterogeneous hardware base, widely differing hardware procurement policies and network access across schools.
4. An operational environment where policies were not necessarily driven by educational considerations but were focused on avoiding reputational and legal risks.
5. A user base that had either never taken up the existing system or who were abandoning its use.

Requirements Engineering???

it was abundantly clear that the problems with this system were political and socio-technical rather than technical.

User Stories Provided Vision

Twenty-six user stories were developed of varying length.

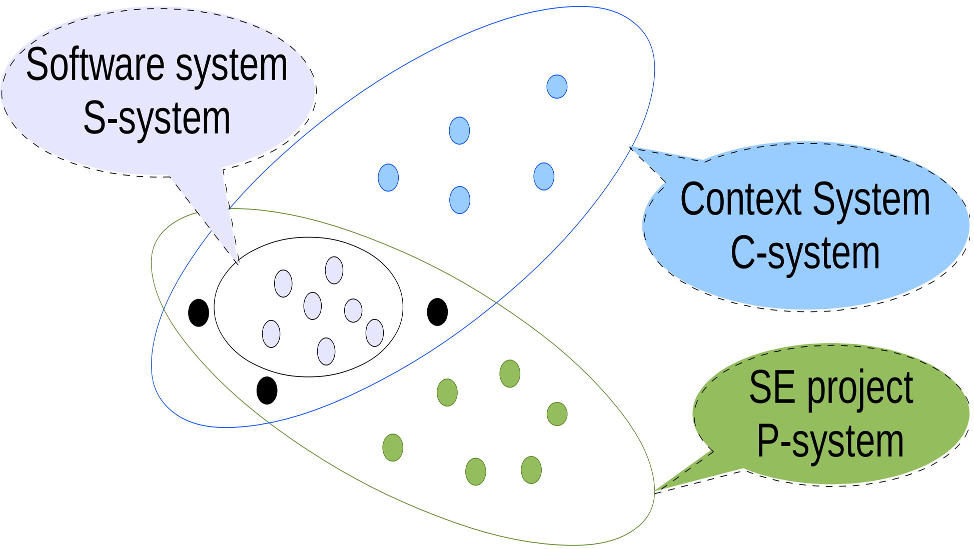
Results

Proposed architecture
Understandability based on User Stories
Lessons Learned
Important Issues for Essence

Chapter 17 - Ian Sommerville

Applying a Systems Perspective

(Three Interacting Systems)



The software system (S-system), i.e., the virtual artifact being developed or modified.

The software project (P-system), i.e., the work system undertaking the development or modification of S-system.

The software context (C-system), i.e., the environment in which the software product is being, or is intended to be used.

Case Studies Illuminate both Successes and Failures in respect to the interaction of the three systems

Chapter 18 – Ilia Bider

BOOK CONTENTS

BOOK CONTENTS (Continued)

Acknowledgements

- The Editors thank all of the authors for their great contributions
- The Editors especially thank Mats Persson for his dedicated efforts in commenting, editing and integrating the book
- Thanks to Steve Bailey for early reviews
- Richard Soley and Bertrand Meyer for their thoughtful Forewords
- Allan Salisbury, Martin Griss, Dinesh Verma, Cecilia Haskins, Asmus Pandikow and Jakob Axelsson for their endorsements

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FRÅGOR?

KONTAKT

- Daniel Falk
  +46 760 47 01 21
  falk@syntell.se

- Dr. Harold ”Bud” Lawson
  +46 705 65 80 77
  bud@lawson.se

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