# Agenda

## Context

- Capability Engineering Process (CEP)
- Patterns and Agility for Capability Engineering Methodologies(PACEM)

## Process Patterns

- Agility & Process Patterns

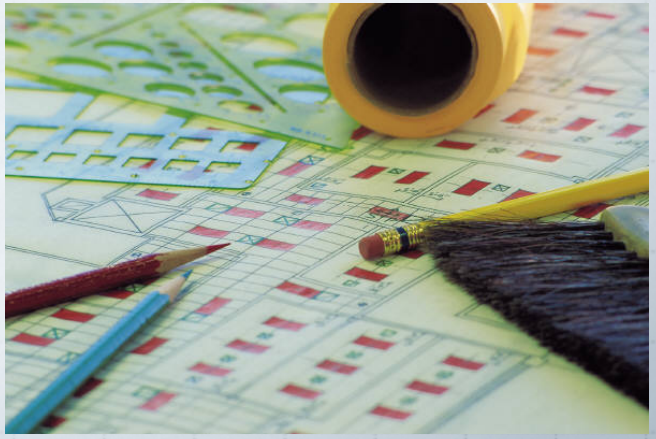
## Experimentation

- Incorporating agility within capability engineering through process patterns

## Way ahead

- Assessment through simulation or experimentation

# CONTEXT



# Defence R&D Canada

**Mission :** *To ensure the Canadian Forces are technologically prepared and operationally relevant.*


- Advise on Science & Technology
- Conduct defence research, development and analysis
- Assess technology trends, threats, and opportunities
- Engage industrial, academic and international partners in the transition of technology
- Conduct S&T projects for non-DND clients

# CapDEM project

**Collaborative cAPability Definition, Engineering and Management**

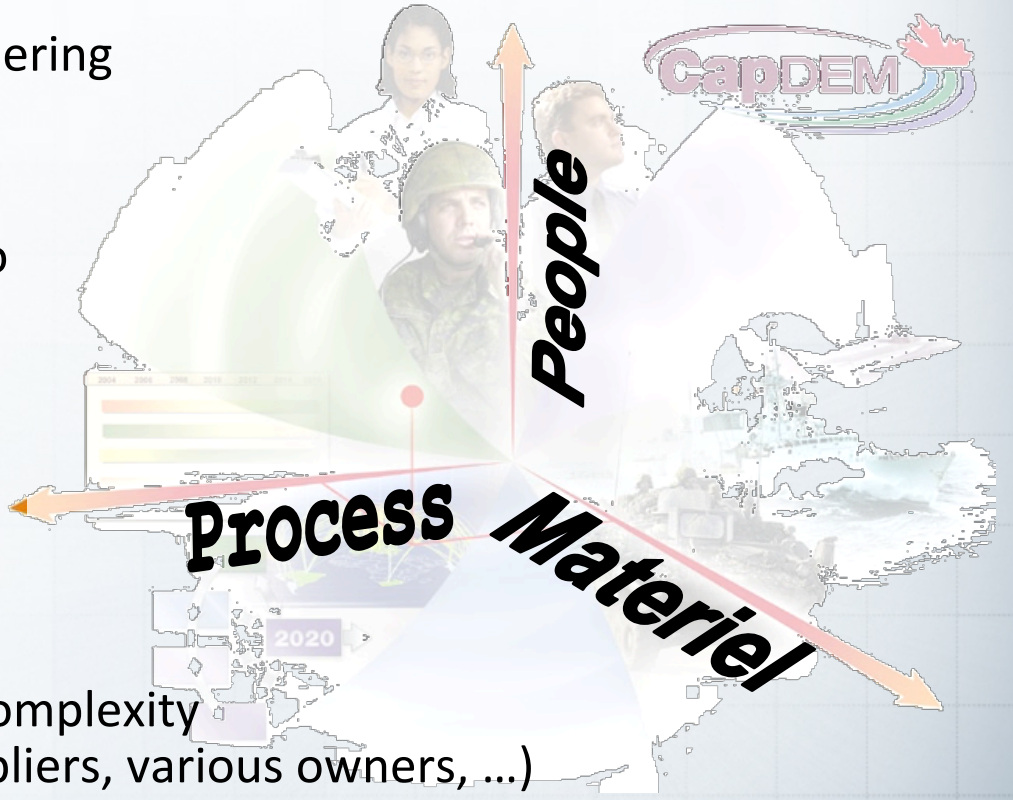
- Major R&D effort 2004-2009

- To transpose rigour of system engineering to capability/system-of-systems engineering

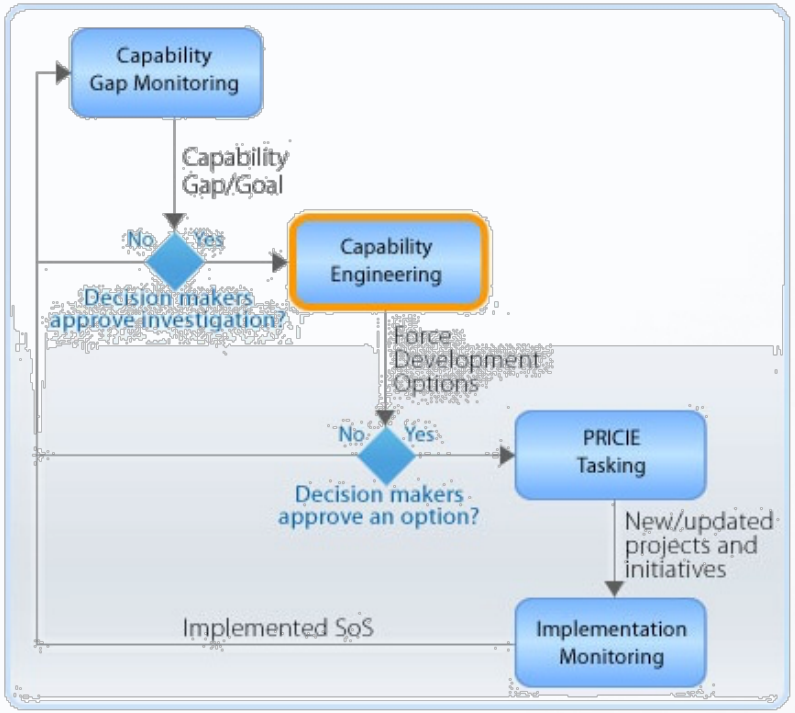
  Delivering strategic options to executive decision makers

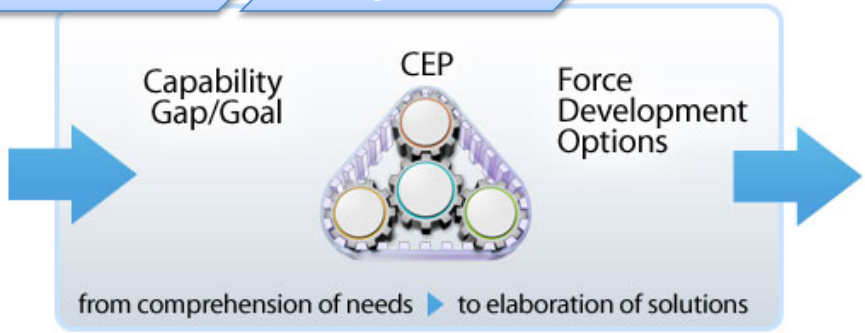
  Tested with use cases (Alpha, Beta, Gamma)

  Dealing with complexity (many systems, different suppliers, various owners, …)

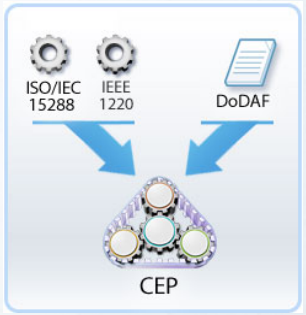


# Goal & Context



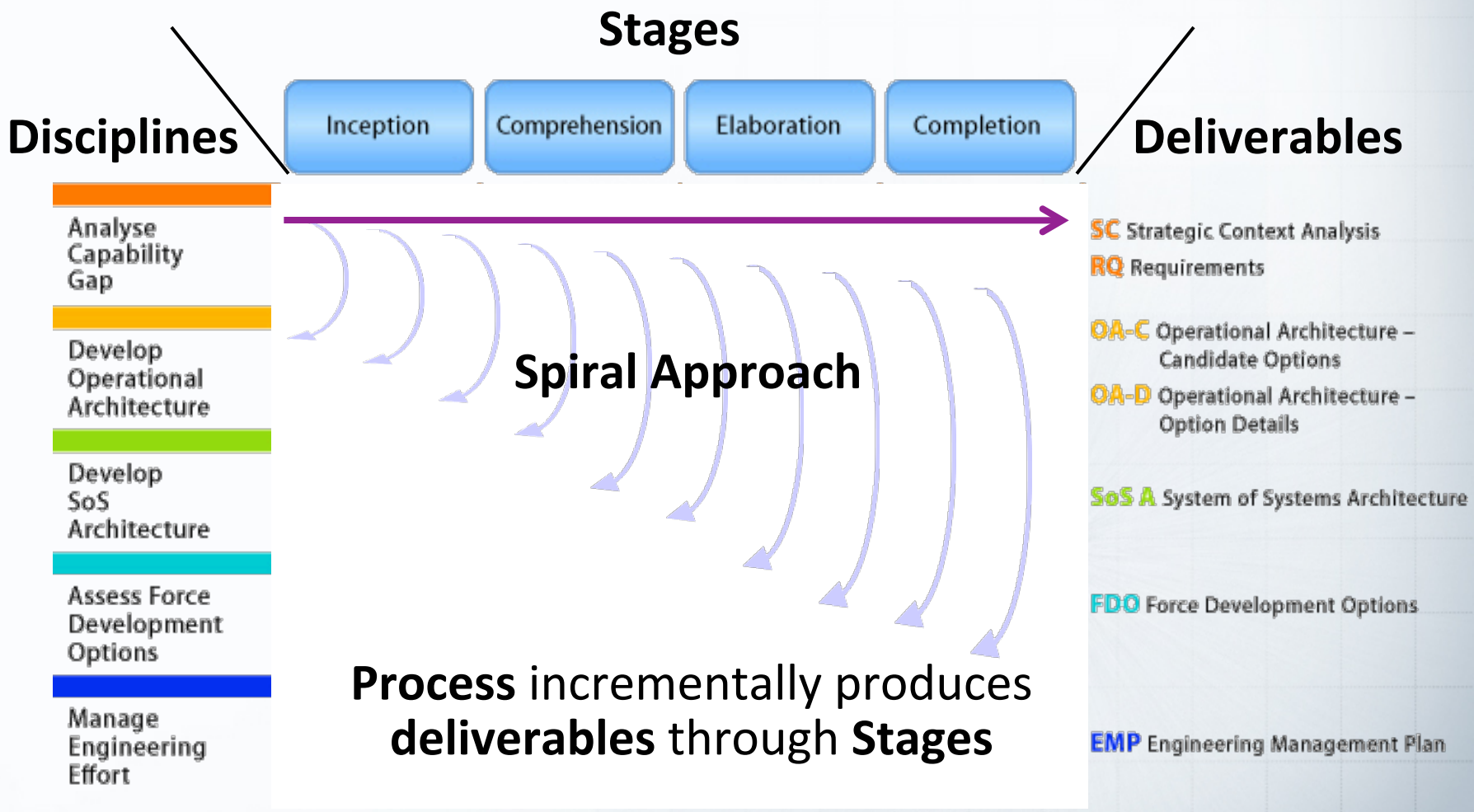




- From a capability shortcoming statement
- Explore potential options
- Issue a « Capability » recommendation
  - Justified in term of performance, cost, schedule, risk
  - With the option documentation
    - Architecture (operational and System)
    - Requirements
  - Articulated around the PRICIE elements




| | |
|---|---|
| P | • Personnel |
| R | • R&D |
| I | • Infrastructure |
| C | • Concept & Doctrine |
| I | • Information management |
| E | • Equipment & Supplies |

# Capability Engineering Process (CEP)



CEP 2011 - Google Chrome

Shared Documents | CEP 2011

pacemtest01/cep/CEP2011/

RDDC | PACEM | Recherches | Rédaction | Perso | Geek | News | Ubuntu | Divers | Mark As Read | Read It Later | Reading List | Other Bookmarks

Capability Engineering Process

Glossary | Index | Feedback | About

Print

Where am I | Tree Sets

CEP 2011

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  - Perspectives
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    - Perspective on Timeline
    - Perspective on Disciplines
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- Workflow
  - Overview
  - Inception
    - Define Decision Criteria
    - Describe Operational Concept
    - Describe Relevant Systems
    - Describe Strategic Facets
    - Evaluate Opportunity
    - Manage Iteration
    - Organize Next Iteration
    - Setup Initiative
    - Support Engineering Effort
    - Verify CEDF Inputs
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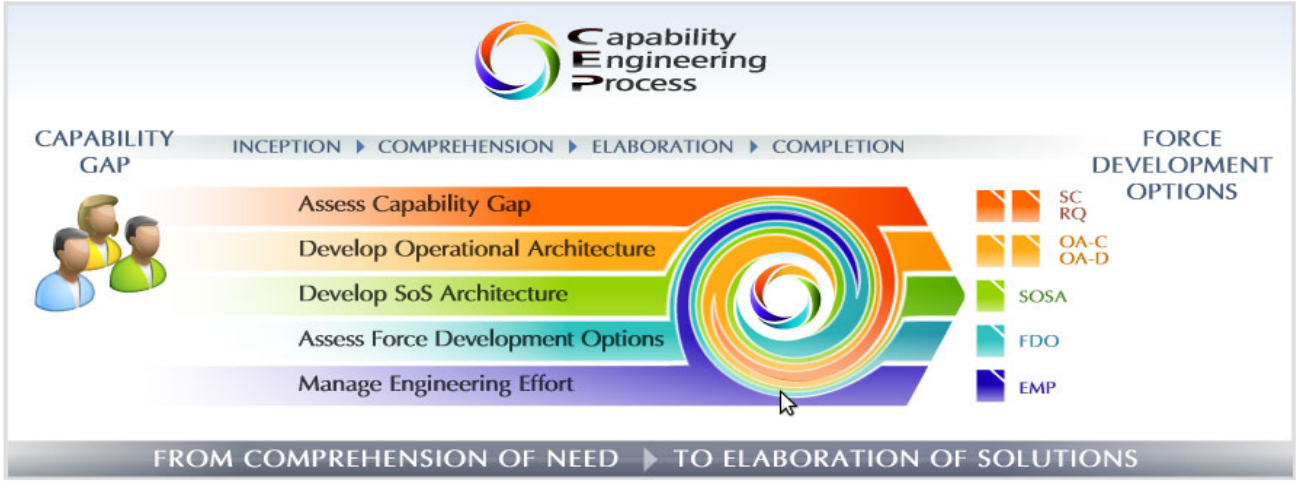
CEP 2011

# CEP 2011

This presents the CEP 2011 in a glance.

Expand All Sections | Collapse All Sections

## Main Description

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Produced by DRDC Valcartier • Current version CEP 2010 • Last update April 2010

# The PACEM project starting point

**Patterns & Agility for Capability Engineering Methodologies**

- CEP = 1 “delivery process”
  - One workflow, one size fits all
- A versatile process
  - Various domains of application
  - Various usages
  - Various project environments

- We need ***agile*** processes & tools.

# Agility

Middle French, circa 1581.
from Latin agilis, agere : to drive, lead,act,do.
from Greek agein : to drive, lead.
Other proto-Indo-European roots include :
ἄγω (agō) :to lead, (ancient Greek)
aka: to travel in a vehicle (Old Norse),
ag: Battle (Middle Irish)
अजति (ájati): to drive, propel, throw, cast. (Sanskrit)

"***Agility*** is the ***ability*** to ***respond*** to ***changing circumstances*** where:

- ***Ability*** is characterized by readiness and speed of action
- ***Response*** is:
  - Making use of an existing configuration (by internal means)
  - By reconfiguration (facilitated by external means)
- ***Changing circumstances*** may be:
  - A change in objective
  - A change in environment
  - A change in condition
- ***Agility*** is measured by:
  - Speed of action
  - Cost in resource
  - Impact on effectiveness".

Mackley, T., S. Barker, and P. John. 2008. Concepts of Agility in Network Enabled Capability. In RNEC Conference 2008. Leeds, UK

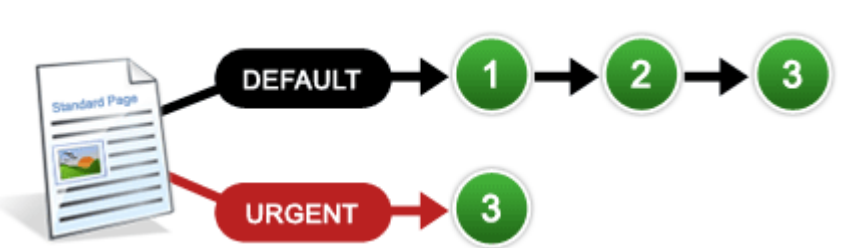
# Hint :

Patterns are successfully used in software engineering for increased agility.

- Can we borrow this approach for our needs ?

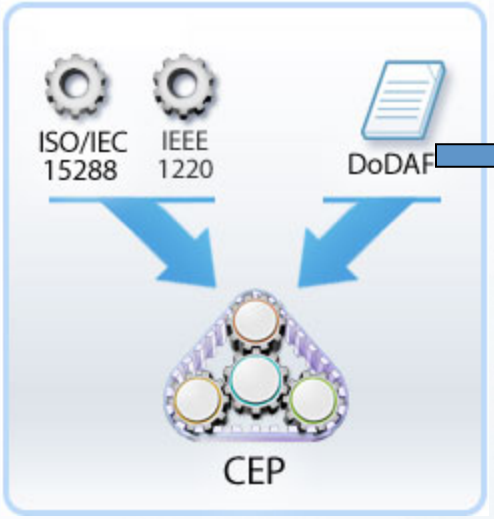
# PACEM Goals :

- Upgrade the actual capability engineering process
- Implement the concept of “Process patterns” within the CEP.
  - Identify & implement process patterns
  - Measure and assess process agility improvement resulting from patterns.



# From CEP to PACEM :

CEP : is an engineering process to recommend force development options with the support of architectures




DNDAF

+ SPEM compliant methodology

+ IEEE 1233 – 830
+IEA 632

PACEM : is an agile CEPs generator..

**SPEM** : Software Process Engineering Metamodel
**DoDAF** : Department of Defense Architecture Framework
**DNDAF** : Department of National Defence Architecture Framework

# Process Engineering, a Research Theme :

**Excerpts from the "Process Research Framework" :**

- **How to define and build processes and understand their performance?**
- E3 Providing process engineering infrastructure
  - *Determine infrastructure needed to best support this process engineering environment*
- E2 Organizing processes for reuse
  - *Engineer, assemble, combine and reuse process components to meet performance targets*
- E1 Specifying processes using evidence
  - *Specify processes with adequate empirical evidence of their performance*

**"A Process Research Framework"**
The International Process Research Consortium, Dec. 2006
www.sei.cmu.edu/iprc

From Patterns to Process Patterns

- Definition, examples and application.

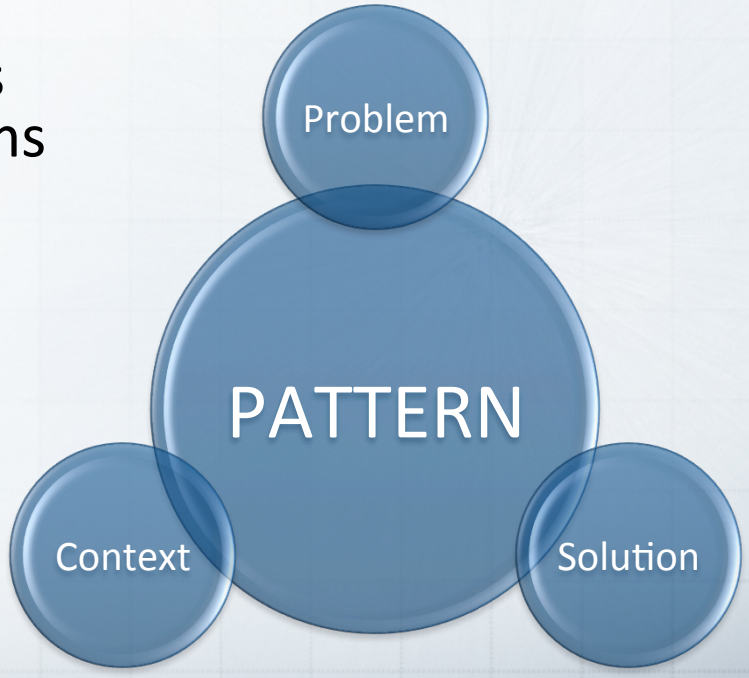
# PROCESS PATTERNS

# Origins

- Christopher Alexander, the "father" of modern pattern concept :
  - "Each pattern is a three-part rule, which express a relation between a certain context, a problem and a solution"
  - Alexander C., 1979, **"The Timeless Way of Building"**, Oxford University Press, New York

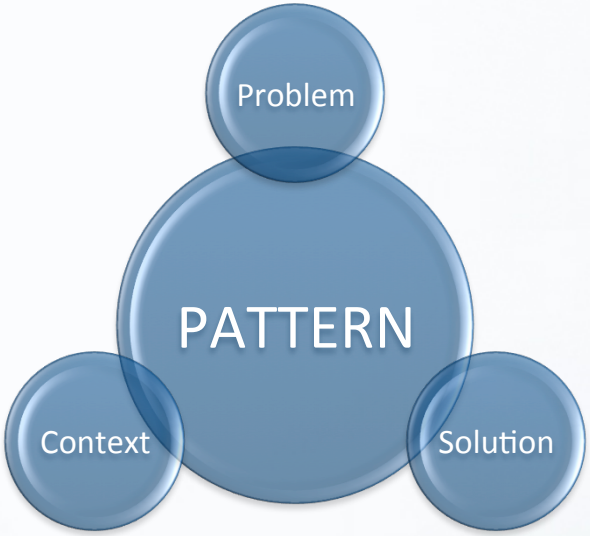
- Patterns are generic solutions adaptable to specific problems

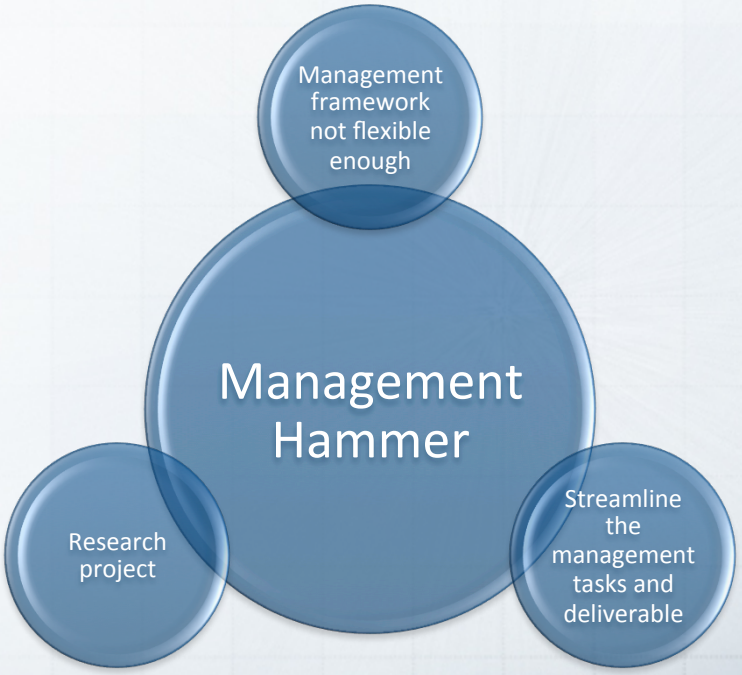
- Patterns are not invented but discovered



# Process patterns

- Process patterns are patterns which solution part applies to process.
- Process patterns describe techniques, tasks and activities used to design or adapt workflows, according to the project context and problems to be solved.



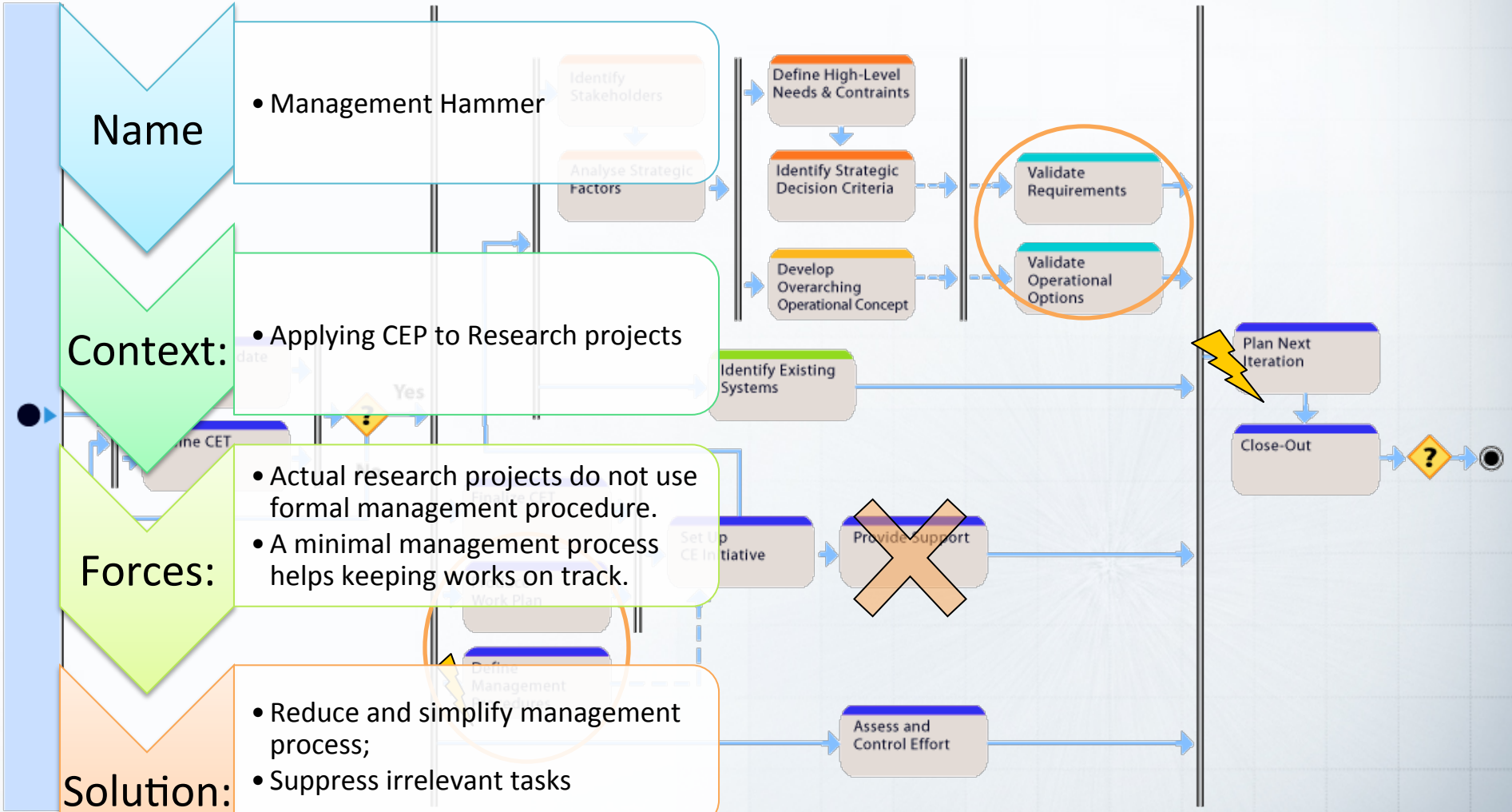
# Process Pattern example

**Name**
- Management Hammer

**Context:**
- Applying CEP to Research projects

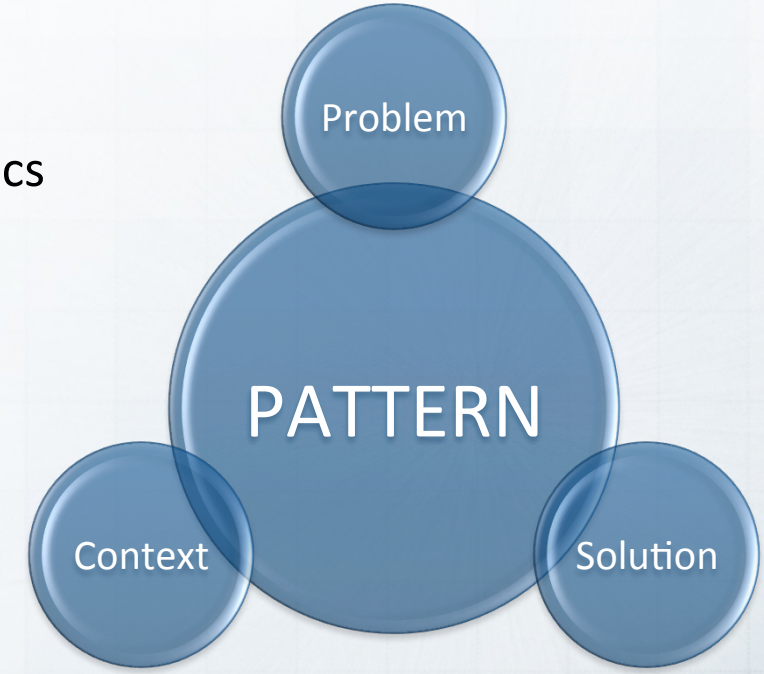
**Forces:**
- Actual research projects do not use formal management procedure.
- A minimal management process helps keeping works on track.

**Solution:**
- Reduce and simplify management process;
- Suppress irrelevant tasks



# Process patterns documentation template

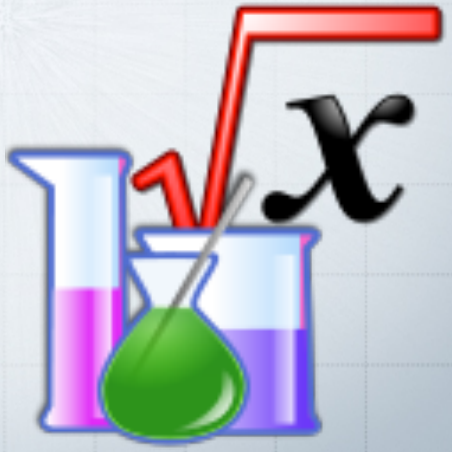
- General Info
  - Name, brief description, purpose, related patterns
- Context
  - Scope
  - Team characteristics
  - Project of concerns characteristics
- Problem
  - Description
  - Forces in presence
- Solution
  - Solution Description, Schema
  - Resulting context
  - Rationale
  - Known uses



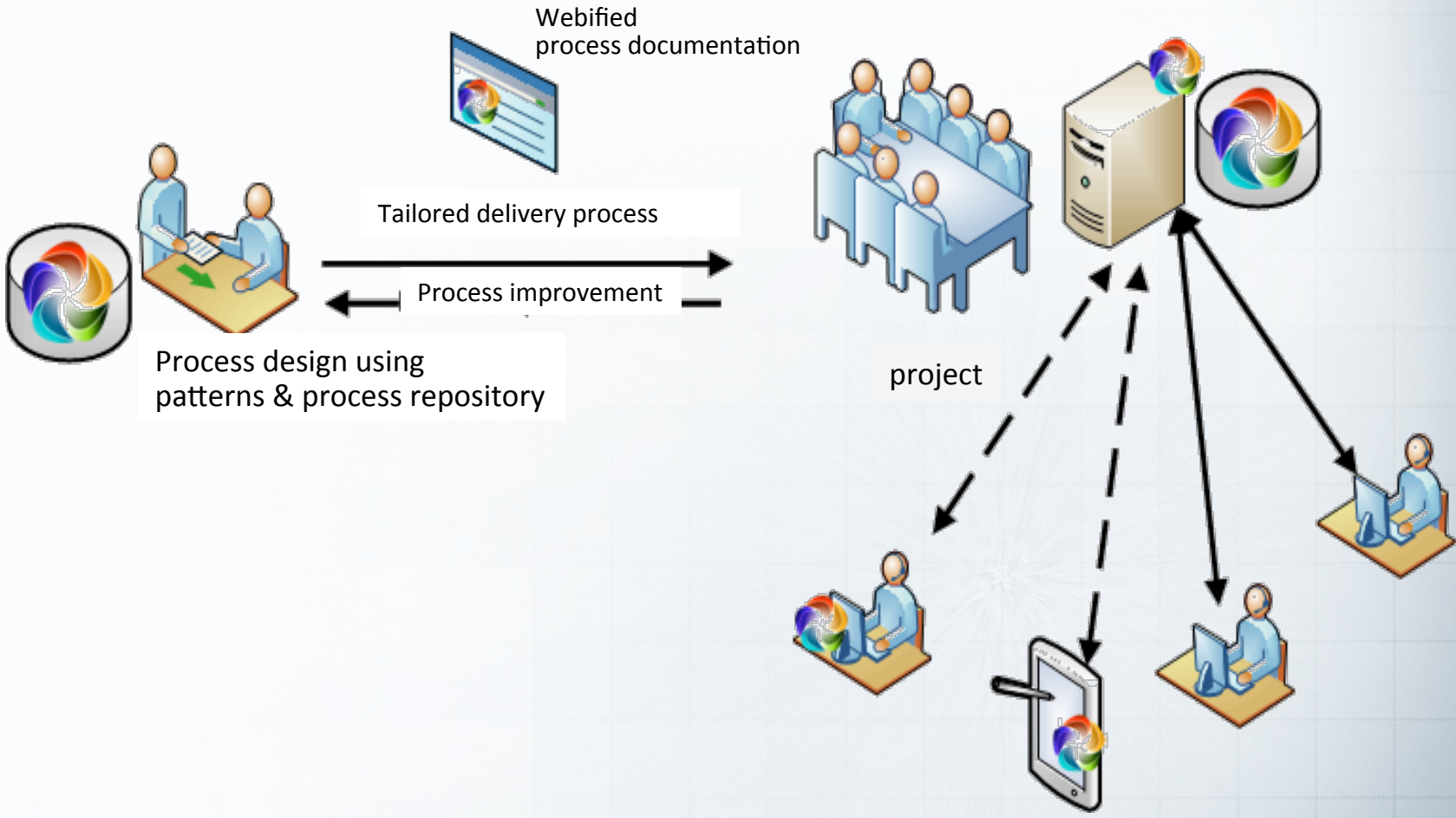
Incorporating agility within capability engineering through process patterns

- Process engineering design environment
- Process pattern identification
- The High-Spin Pattern

# THE EXPERIMENTATION



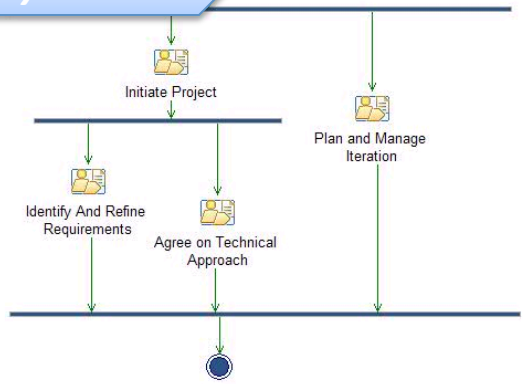
# ALADIN : Integrated Capability Engineering Process Framework



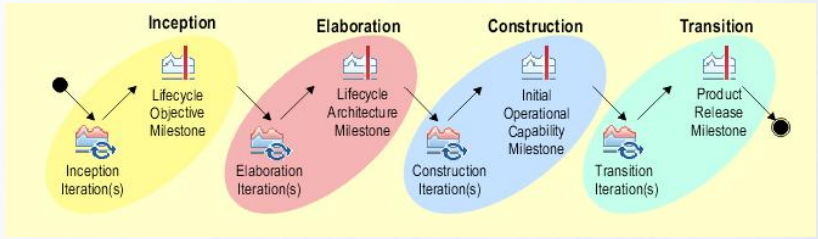
# Features and Tools

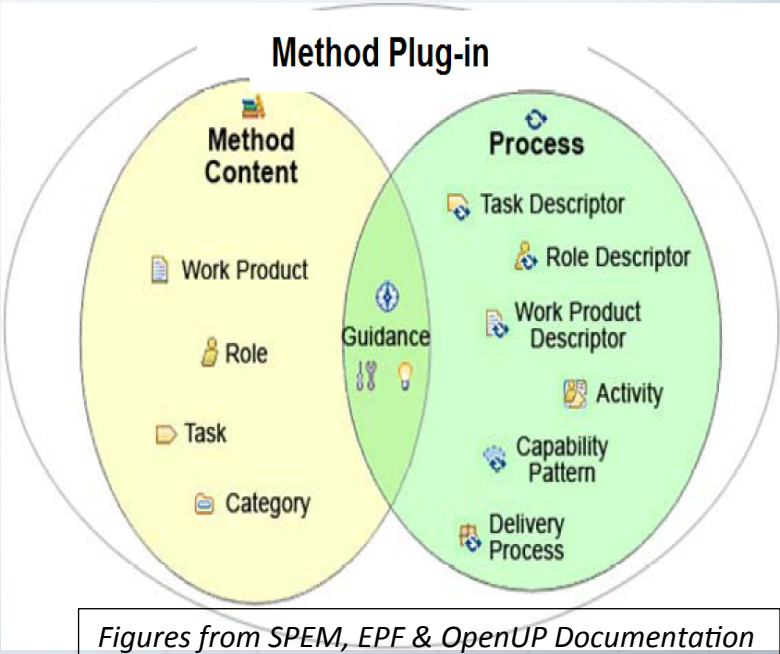
- Documentation
  - To constitute a repository of patterns and processes
    - Aladin, based on Eclipse Process Framework
- Simulation
  - To validate process agility
- Execution
  - To deploy and permit process execution
    - Using tools such as YAWL, Bonita, ...

# Related Technologies




- Process documentation standard
  - SPEM (Software Process Engineering Metam
  - OpenSource environment
    - Eclipse
      - EPF (Process Framework)
    - SVN (Deliverable repository)




*Figures from SPEM, EPF & OpenUP Documentation*

# Eclipse Process Framework

- A design environment to
  - Document method content;
  - Design reusable process chunks;
  - Publish (web) customized processes.
- Eclipse based.
- Standard compliant :
  - UMA (Unified Method Architecture)
  - SPEM (Software Process Engineering Meta-model)

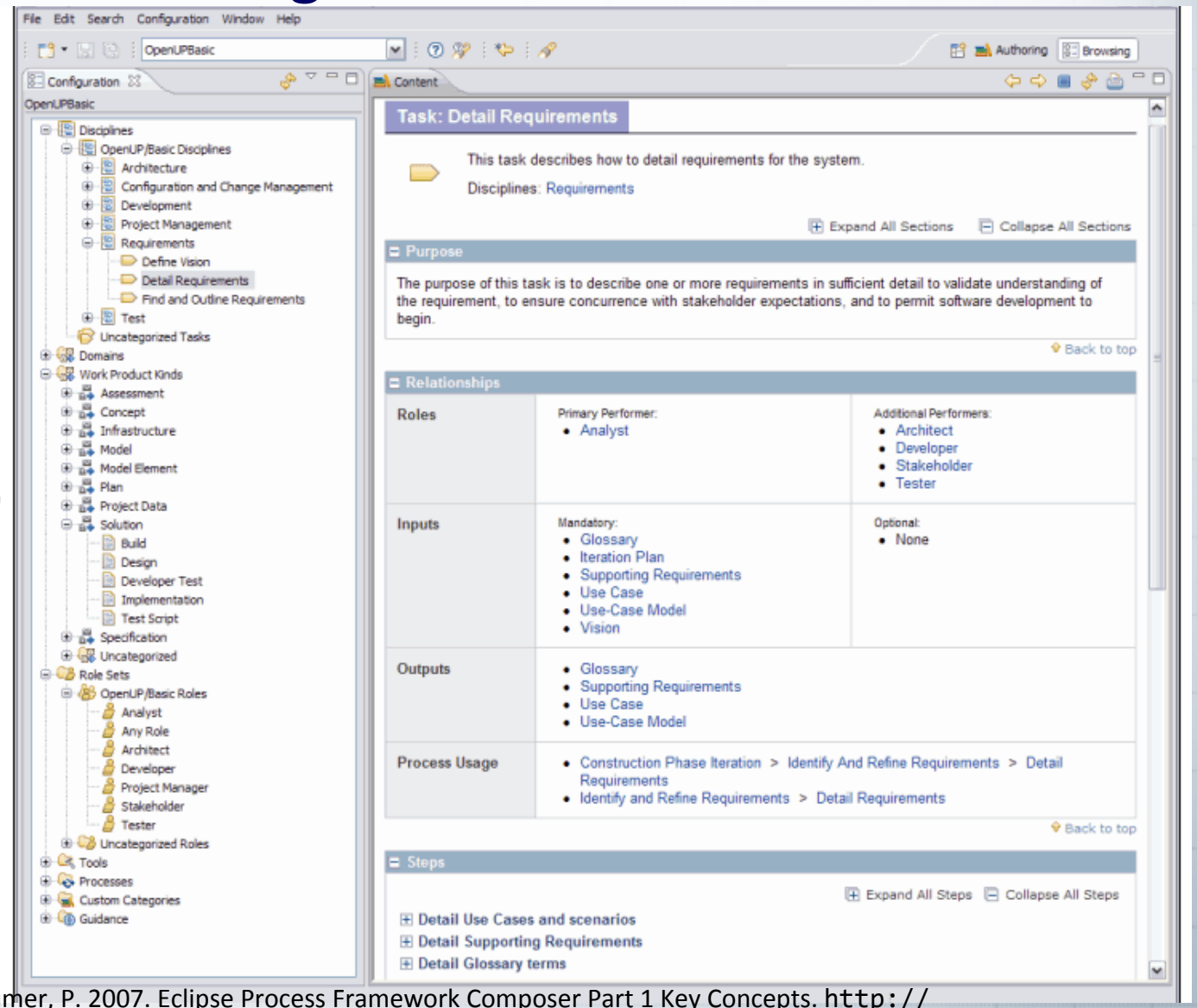
# Aladin : Method authoring

IC / Best Practices

Books / Publications

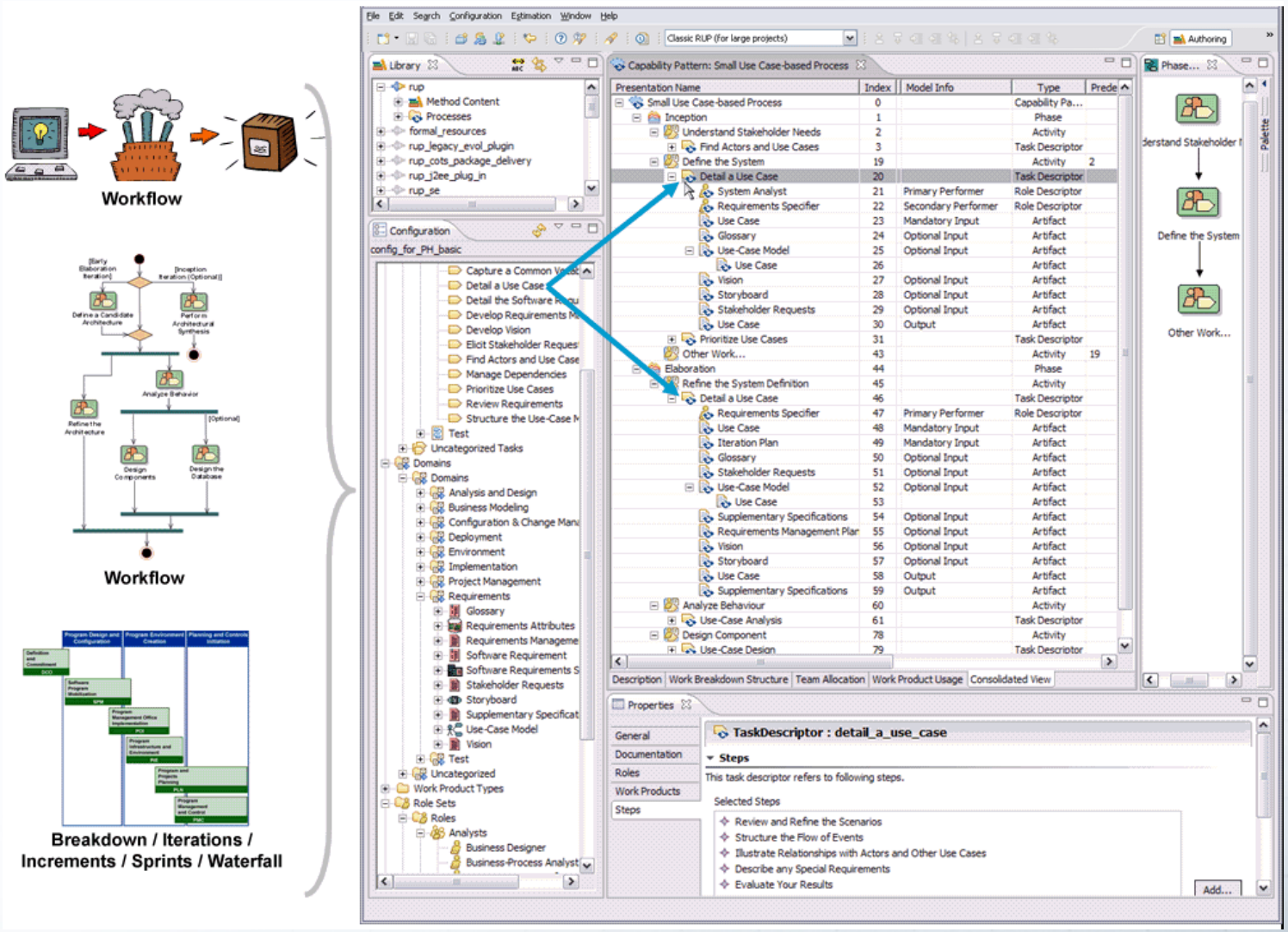
Standards / Regulations

Homegrown Methods



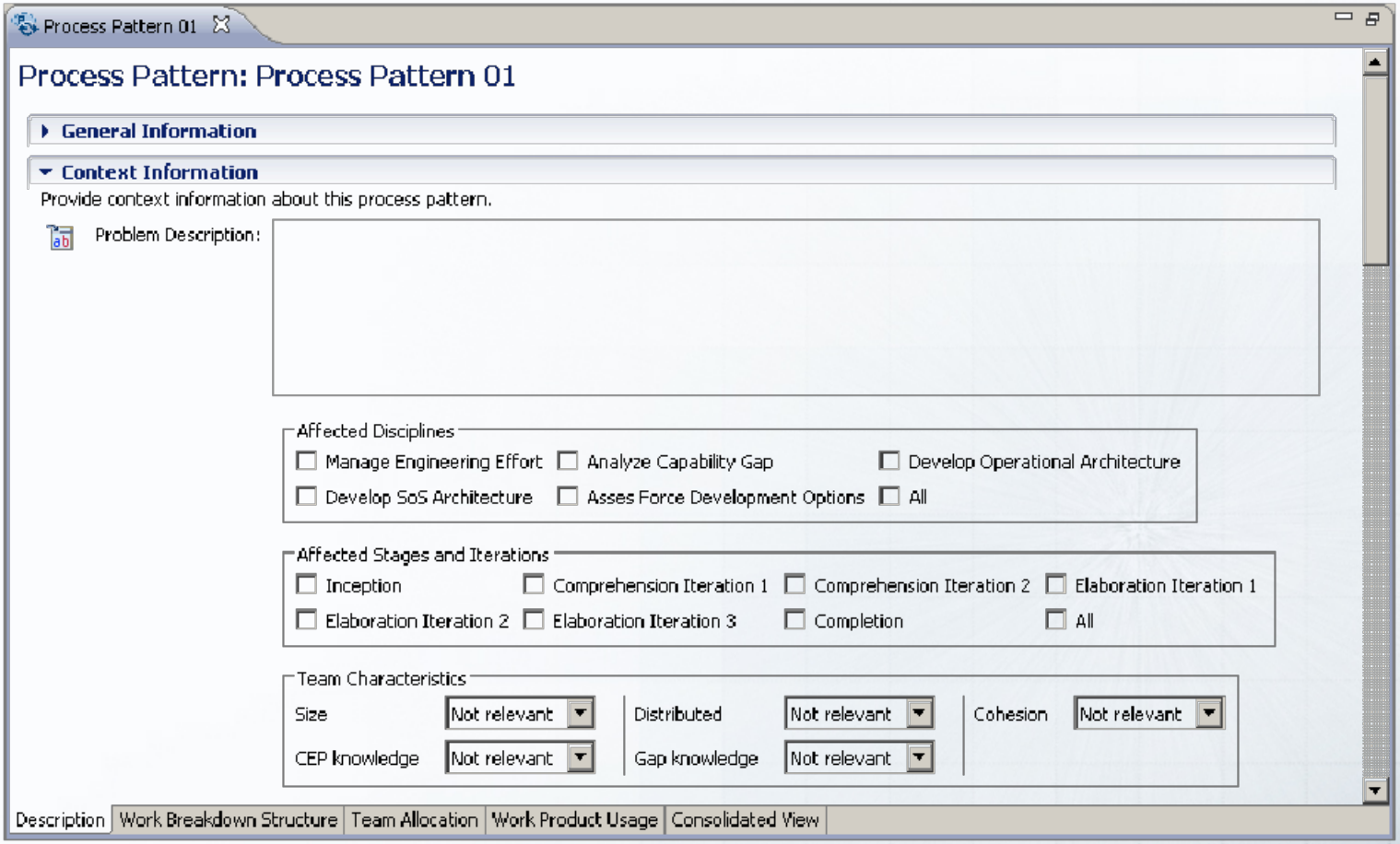

Haumer, P. 2007. Eclipse Process Framework Composer Part 1 Key Concepts. http://www.eclipse.org/epf/general/EPFComposerOverviewPart1.pdf.

# Aladin : Process authoring

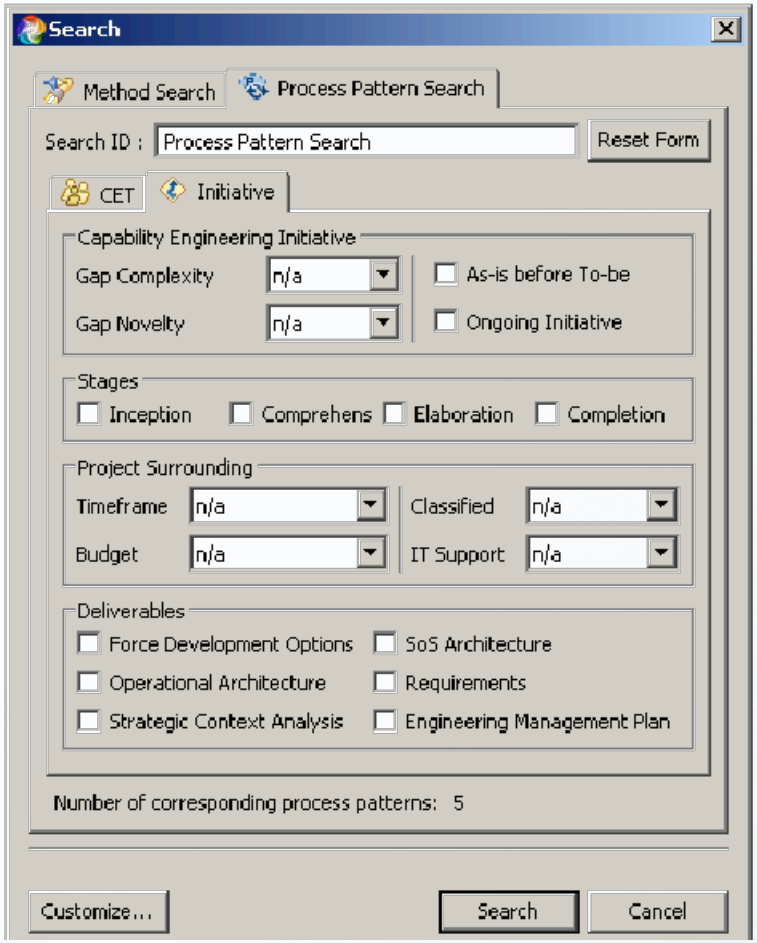


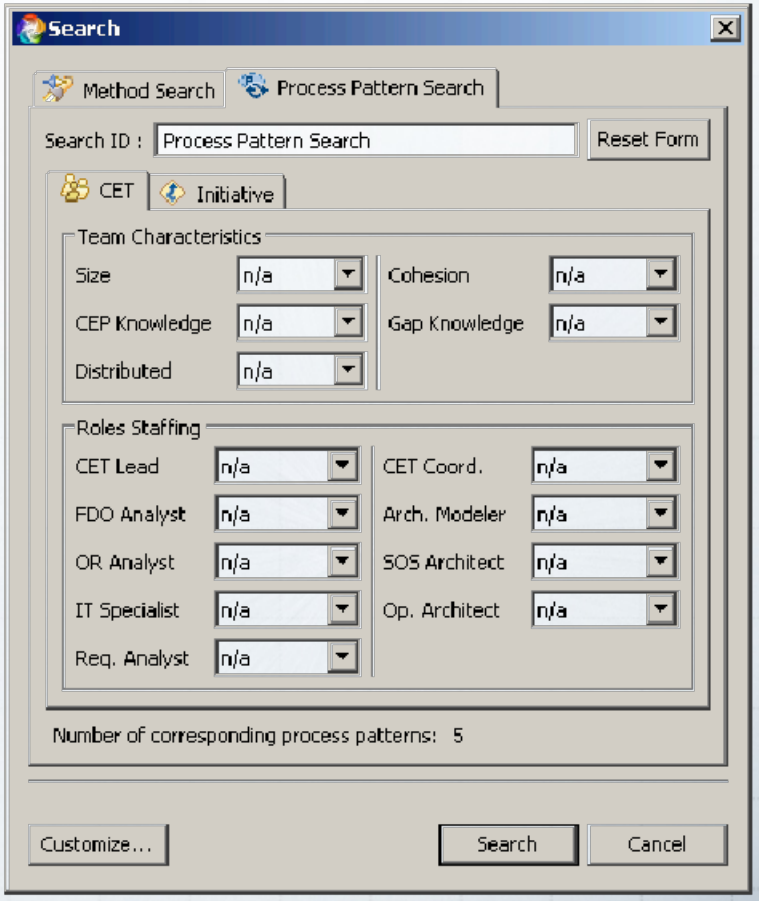

Haumer, P. 2007. Eclipse Process Framework Composer Part 1 Key Concepts. http://www.eclipse.org/epf/general/EPFComposerOverviewPart1.pdf.

# Aladin Process Patterns Support (1)



# Aladin Process Patterns Support (2)



# Some Process patterns :

- "Lite" family or patterns (a pattern per discipline)
  - Each discipline workflow is reduced to its critical activities.
- "Reuse" family (a pattern per discipline)
  - Deliverables & workproducts from a previous similar project are reused
- "High Spin"
  - No stages, but quick "sprints", to build up quickly the solution through fast-paced iterations.
- "One Option" family of patterns
  - One part of the solution is "given" by the capability manager.
- "As-is first"
  - "As-Is" option is delivered first, instead of being concurrently developed with the others.
- "Early Close-out"
  - Premature close-out due to external events.

# High Spin – Forces in Presence

**For**

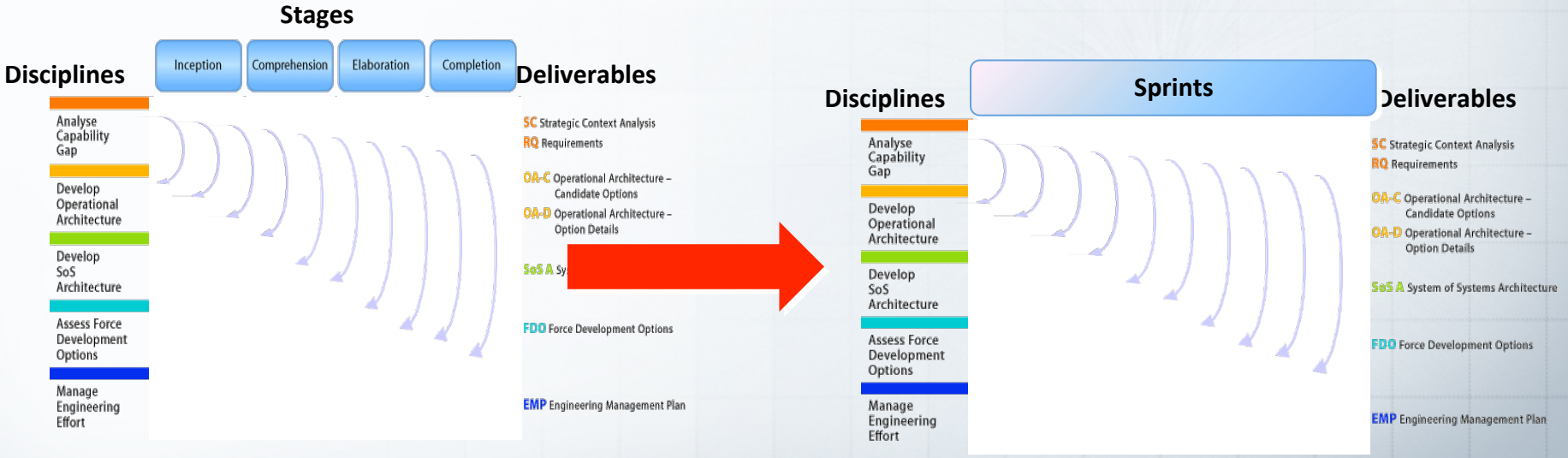
- Ill-defined gap
- Continuously evolving requirements
- Time-boxed initiative
- Client rep. on site

**Against**

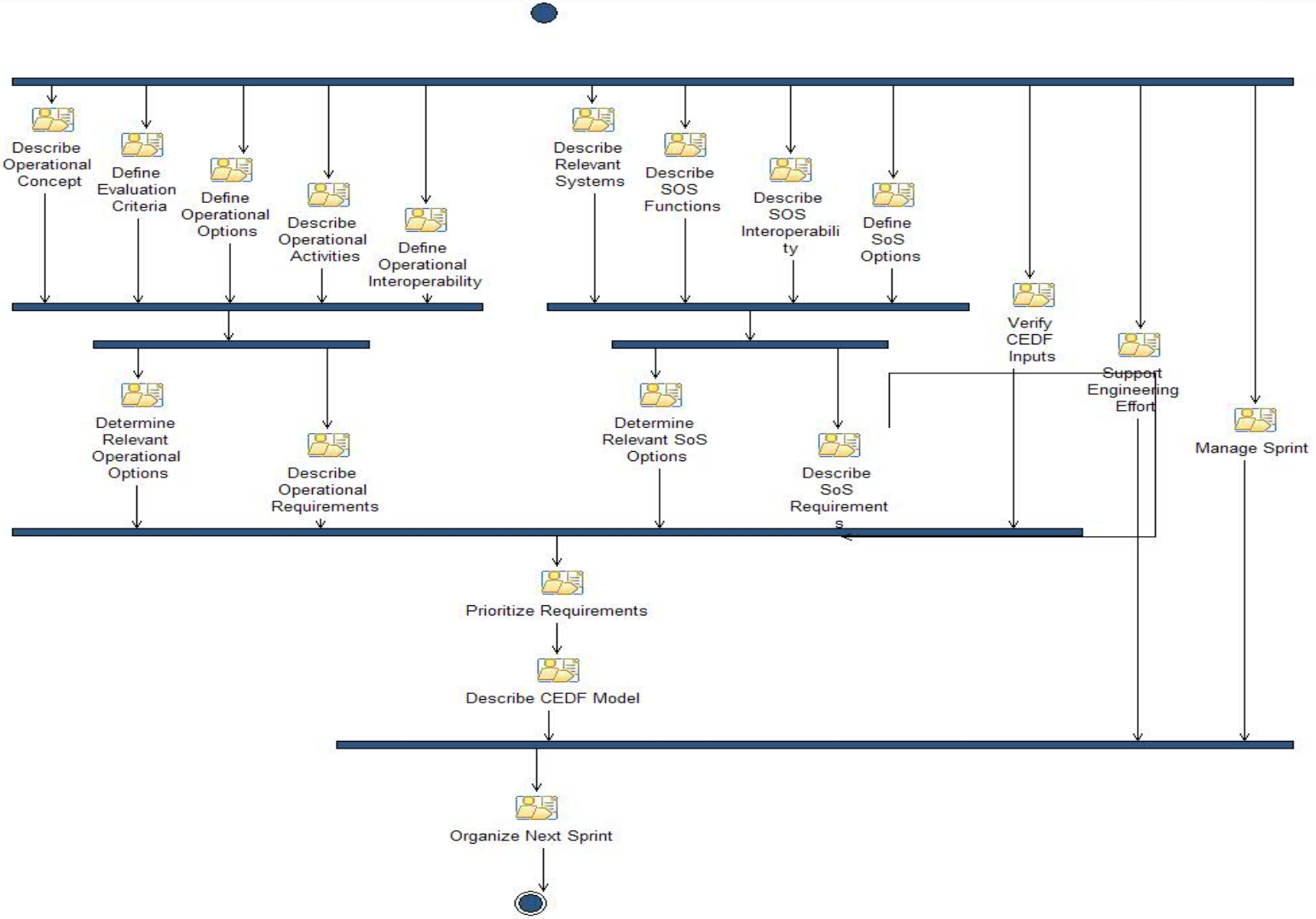
- Low Stakeholders availability
- Inexperienced CET
- Low collaboration
- Info & knowledge hard to find/use

# High-spin – Solution Overview

- All stages merged into a “sprint”
  - Effort dispensed in short bursts
  - Option refined iteratively until client agreement
- Process self evolving according to knowledge discovery



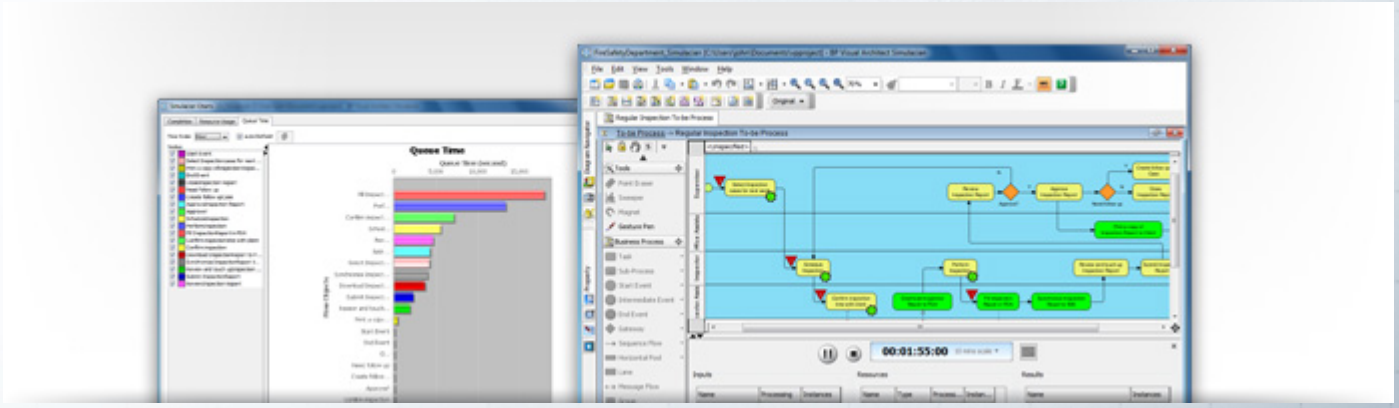
# High Spin - Solution



# How to measure process performance ?

- Different methods reviewed
  - Comprehensive audit
  - Performance dashboard
  - Capability Maturity Model
  - University of California Approach
  - Earned-Value Report
  - INCOSE Method
  - A mix of the above

**All of the above imply real experimentation.**
***Is there a way to predict performance improvement through simulation ?***



Visual-paradigm simulacian illustration
http://www.visual-paradigm.com/product/bpva/provides/simulacian.jsp

# Experimentation versus Simulation

## Experimentation

- Repeatability & Reproducibility
  - Medium to large schedule projects
  - Project specificity
  - Cost $$$
- Learning curve bias influences results
- Provide real-world results

## Simulation

- Eliminates constraints
  - Time, budget, resources availability
- Allows repeatability
- Allows "what-if" analysis
- Eliminate cognitive and learning curve biases
- What is the validity of results?

# Simulation (Way ahead)

- We are looking for ways to assess processes through simulation,
  - Through Earned-Value Reports .
  - Using agent simulation tools:
    - NetLogo,
      - multi agent programmable environment.
      - North-western University, Center for Connected Learning and Computer-Based Modeling.
    - Kepler(Kepler-project.org),
      - scientific workflow application.
      - UC Davis, UC Santa Barbara, and UC San Diego.
  - Using Business Process simulation software
    - Visual-Paradigm, YAWL, Global360 ...

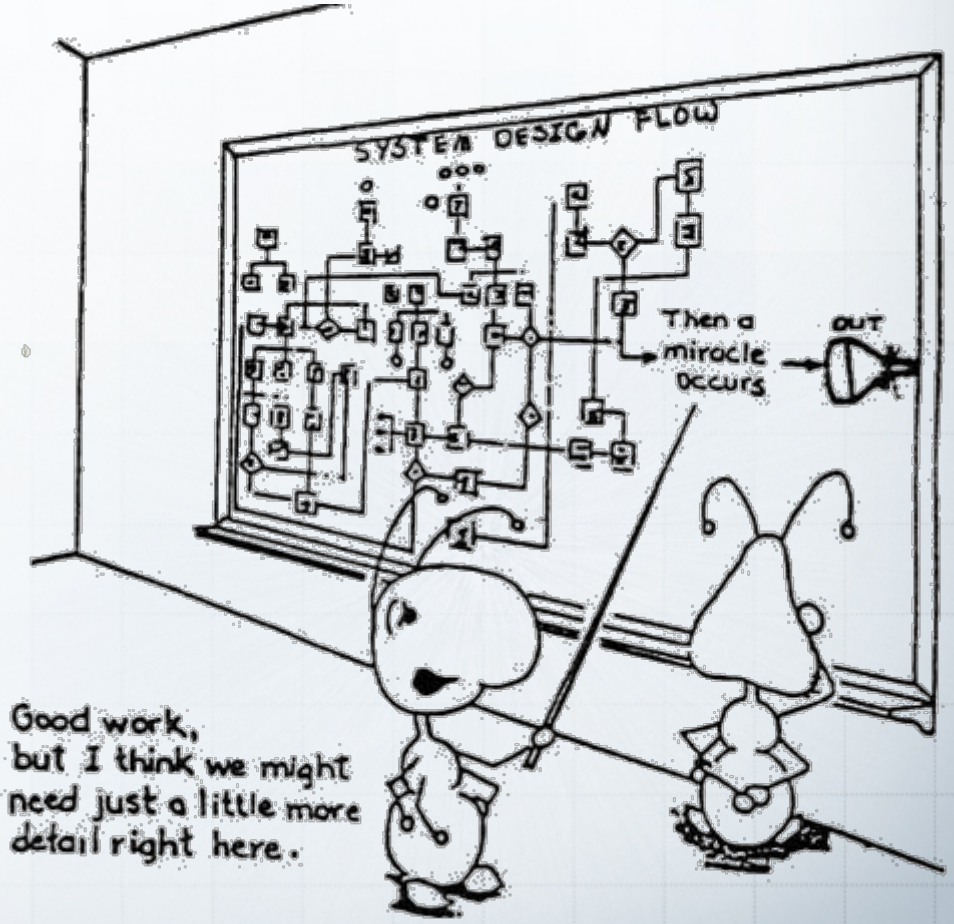
# Conclusion and way ahead

- We have gone through
  - Software engineering concepts applied to capability engineering;
  - Process patterns for improving process agility
    - Identification of High-level process patterns;
  - Agility improvement assessment
    - Through experimentation or simulation ;
- Simulation tools under investigation / development.
- Lower-level patterns to be identified too.

# Process Engineering, a research theme

- Excerpts from the “Process Research Framework” :
- How to define and build processes and understand their performance?
  - E3 Providing process engineering infrastructure
    - Determine infrastructure needed to best support this process engineering environment
  - E2 Organizing processes for reuse
    - Engineer, assemble, combine and reuse process components to meet performance targets
  - E1 Specifying processes using evidence
    - Specify processes with adequate empirical evidence of their performance

# Comments, Questions ….




http://benwarsop.files.wordpress.com/2010/06/then-a-miracle-occurs.jpg

For more information :

Christophe Necaille
Christophe.necaille@drdc-rddc.gc.ca
http://www.drdc-rddc.gc.ca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