Abstract
The automotive domain is quite demanding. Trucks and Cars have to be highly dependable (e.g. safe and reliable), and to operate in wildly varying conditions (from harsh environments such as deserts up to extreme winter weather). The life time of the vehicles is decade(s). The production volume demands mass production and well tuned supply chains to operate in a competitive environment. More and faster market and technology changes come on top of all these demands.

Partial solution to this demanding environment is an intricate set of processes. Good processes are crucial. Unfortunately, processes can also hamper the business, for instance by focusing so much on form that content gets lost.

Architecting is an activity that delivers content (needs analysis, requirements, design concepts, design decisions). Architecting can benefits a lot from good
process interaction, reversely it can suffer tremendously from lack of process or overkill of process.
architecting in business context

What is a process?

How much process is needed?

performance of supporting processes

solutions to common problems

workshops, time-boxes and iteration

model

summary
Balancing Process and Content

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RSPprocessDecomposition
Tension between processes

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RSPProcessDecompositionAnnotated
Platform strategy adds one layer

- **customer oriented**
- **supplying business**
  - **strategy**
  - **product creation**
    - **value**
      - **component or platform creation**
        - **people, process and technology**
          - **long term assets**
            - **long term know how (soft) assets**
          - **mid term; cashflow next year!**
        - **short term; cashflow!**
System Architecture Process in Business Context

Customer-Oriented Process

Product Creation Process

People, Process, and Technology Management Process

Budget, plan
Product roadmap
Technology, Process and People roadmaps

Reality check
Needs and Feedback
Support
Stakeholder interaction
Product related processes
Product
Order
Material
Information
Presales, sales, logistics, production, service

Context, Vision

Systems Architecting Process

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SAPprocessSimplified
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Process Attributes

**Purpose** What is to be achieved and why

**Structure** How will the goal be achieved

**Rationale** What is the reasoning behind this process

**Roles** What roles are present, what responsibilities are associated, what incentives are present, what are the criteria for these roles

**Ordering** What phasing or sequence is applied
Definition of a Process

"A process is an activity which takes place over time and which has a precise aim regarding the result to be achieved. The concept of a process is hierarchical which means that a process may consist of a partially ordered set of subprocesses."

"Method Integration; Concepts and Case Studies" by Klaus Kronlöf
A process within an abstraction hierarchy

principle — drives — process — elaborated in — procedure — supported by — tool

abstract — specific and executable — formalism

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SAPAbstractionHierarchy
How much process is needed?

- What is a process?
- Architecting in business context
- Performance of supporting processes
- Solutions to common problems
- Workshops, time-boxes and iteration
- Summary
Effectiveness (Flexibility, Manageability)

- Flexibility:
  - Evolution
  - Responsiveness
  - Market change
  - Technology change

- Manageability:
  - Supply chain
  - Mass production
  - Long life times
  - Dependability

Effectiveness vs. Process weight

- Very low
- Low
- Medium
- High
- Very high

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BPCAEffectivenessCurves
Effectiveness = Flexibility $W_F$ * Manageability $W_M$

Effectiveness = $W_F=0.1$ $W_M=0.9$

process weight

very low low medium high very high

Flexibility

Manageability
Effectiveness = \( W_F \times \text{Manageability} \times W_M \)

Effectiveness = \( W_F = 0.3 \quad W_M = 0.7 \)
Typical Situation in Defense

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Effectiveness vs. Manageability

Flexibility
Manageability

desired weight
actual weight
effectiveness loss

very low
low
medium
high
very high

process weight

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BPCAeffectivenessDefense
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BPCAlogoPerformanceSupporting
Supporting Processes for Architecting

people, process and technology managers intend to support systems architecting by processes, tool, et cetera

- product creation process
- phase gate process
- documentation process
- reviewing process
- engineering process
- meeting structure
- templates
- check lists
- repositories
- tools

people, process and technology management process
How effective are these Processes?

How many hours per week do you sit in meetings?

How many hours per week does the system architect spend on writing documentation?

How satisfied are the consumers of documentation?

   How easy can information be found?

   How up-to-date is the information?

   How timely is documentation available?

What is the quality of the review process?

Does the system architect feel supported by the processes at all times?
large monolithic documents

- late, not up-to-date, time consuming to review and update

system architects spending 70%+ of time in meetings

ineffective reviews

- too many reviewers, lack of ownership, too little time and attention, form rather than content

noise generation due to too much prescribing templates or frameworks

- information overload, essentials are hidden

poorly searchable repositories

- data and information cannot be found
Balance Form and Content

*de facto activities*
- form
  - meetings
  - reading
  - writing
  - thinking
  - analyzing
  - testing
  - walking & listening

*core competences*
- content
  - understanding customer needs
  - specifications requirements
  - key performance parameters
  - hands-on
  - analyzing and making trade-offs
  - understanding technologies and options
What is a process?

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Design Modular Documentation

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DGcompoundDocument

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Recursive as "Normal" Designs
Documenting with A3’s

Legend

Functional View

Visual aid

Quantification of key parameters

Physical View

Constraints Choices

A3 Architecture Overviews Focusing architectural knowledge to support evolution of complex systems
by: Daniel Borches and Maarten Bonnema, INCOSE 2010

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LAWFexampleDDASoverview
Light-weight Distributed Reviews

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LWRstateDiagram

- wide group of people, with an active concern or an expected contribution;
- many iterations
- multiple media:
  - meetings,
  - on paper
  - informal et cetera

specification specific Change Control Board
4 peoples/roles:
1 producer
1 consumer
1 context
1 independent

criteria for reviewers:
+ know how
+ critical
+ sufficient time

by "lowest" operational manager:
project leader, subsystem PL, ...

the author is responsible for contents and organization of the flow (consults and review)

draft

final review
= final check contents

consultation & review

concept

authorization
= check process

change request

authorized
What is a process?

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CAFCR model

Workshops, time-boxes and iteration

Summary

Architecting in business context
The “CAFCR” model

- What does Customer need in Product and Why?
  - Customer What
  - Customer How
  - Product What
  - Product How

- Customer Objectives
- Application
- Functional
- Conceptual
- Realization

- Drives, justifies, needs
- Enables, supports
CAFCR can be applied recursively

Consumer

- Drives

Customer's Customer Business

- Enables

Customer Business

- Drives

Value Chain

larger scope has smaller influence on architecture

System (producer)

- Enables

Customer Business

- Drives

Enables
CAFCR+ model; Life Cycle View

Customer objectives
Application
Functional
Conceptual
Realization

Life cycle
operations
maintenance
upgrade

sales, service, logistics, production, R&D

development
manufacturing
installation

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BCAFCRplusLifeCycle
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Summary
Time-boxes and Iteration

bottom-up  top down  second iteration  story ->use case

shared overview  improved overview  depth insight  1st big picture

day 1  day 2
Workshop timeline

- **start**
- **prerequisite**
  - goal
  - owner
  - leader
  - facilitator

- **conception**
  - participants
  - date reservations
  - preliminary program and invitation
  - definite date

- **preparation**
  - (optional) distribute presentations
  - allocate roles
  - anticipate problems

- **workshop**
  - program
  - workshop format
  - invitation

- **consolidation and follow-up**

- **time**
  - ca 10 weeks
Sequence of Workshops

ratio of effort/time

1 : 4 : 1

ca 2 weeks

Problem understanding
individual digesting and processing

Analysis
individual digesting and processing

Decision
time

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WHTratios
Most Subject Progress Outside Workshop

- Problem understanding
- Analysis

Balancing Process and Content

Progress

individual digesting and processing

subject progress

shared vision

Time
Venue Requirements

- open seating formation
- sufficient walking space
- ask for a room for 2* #participants

plenary area
Secret Workshop Success Factors

- active: >70% of the time active, short intro, short broadcasts
- focused: clear scope and goal, format
- well-prepared: timely invitation, seed presentations, seed questions
- involved participants: full-time present, no cellphone, no e-mail
Summary

What is a process?  
How much process is needed?  
Performance of supporting processes  
Solutions to common problems  
Different time scales  
Documentation needs modular design  
Distributed review  
Balancing process and content