Decomposing the Architect; What are Critical Success Factors?

by Gerrit Muller  Buskerud University College  
e-mail: gaudisite@gmail.com  
www.gaudisite.nl

Abstract
System architects are scarce. If we want to search or educate potential system architects, then it is useful to know factors that determine the success of system architects. In this presentation we look at 4 areas: nature, education, environment and experience. We will make these areas more specific by quantification and illustration.
Decomposing Contributing Factors

Environment
variation
feedback
stimulating

Experience
patterns
skills

Education

Nature

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DTAdecomposition
Structure of this Presentation

1. Architect
2. Education
3. Nature
4. Experience
5. Environment
6. Conclusion

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DTAdecompositionContent
Decomposing the Architect; What are Critical Success Factors?

1. Architect
2. Education
3. Nature
4. Experience
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6. Conclusion
Observed Typical Growth of System Architects

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MATsystemArchitectGrowth

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MAT from Specialist to System Architect

From Specialist to Generalist

- all-round specialist
- aspect architect
- systems architect

breadth of knowledge

depth of knowledge

root knowledge

specialist

all-round specialist

aspect architect

systems architect
Different Architecting Scopes

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Proposed Curriculum for System Architects

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FARcurriculumSA
Overview of CAFCR framework

**method outline**

- **Customer objectives**
- **Application**
- **Functional**
- **Conceptual**
- **Realization**

**submethods**

- + key drivers
- + value chain
- + business models
- + supplier map
- + stakeholders and concerns
- + context diagram
- + entity relationship models
- + dynamic models
- + use case
- + commercial, logistics decompositions
- + mapping technical functions
- + and several more
- + construction decomposition
- + functional decomposition
- + information model
- + and many more
- + budget
- + benchmarking
- + performance analysis
- + safety analysis
- + and many more

**integration via qualities**

- safety
- performance

**explore specific details**

- market vision
- a priori solution know-how
- story
- analyse design
- use case
- analyse design
- detailed design

**reasoning**
Connecting System Design to Detailed Design

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RATWpyramid
Organizational Problem: Disconnect

What does Customer need in Product and Why?

Customer objectives
Application
Functional
Conceptual
Realisation

How can the product be realized
What are the critical decisions

system requirements
design decisions
parts connections lines of code
and growing every year....

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Architect: Connecting Problem and Technical Solution

What does Customer need in Product and Why?

How can the product be realized

What are the critical decisions

Customer objectives
Application
Functional
Conceptual
Realisation

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RATWbreadthAndDepth

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Major Bottleneck: Mental Dynamic Range

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RATWmentalDynamicRange
Profile of an "Ideal" System Architect

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FPsystemArchitect
### For Comparison: Profile of a Project Leader

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DITAspiderDiagram
Most Discriminating Characteristics

- Generalist
- Multi-tasking
- Authority by expertise
- Constructive critical
- Balance between conceptual and pragmatic
Example: Trapezoid Pattern

grey level mapping

gradient field generation

wafer stage movement

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DTAtrapezoidPatterns
From SW input to physical Effect

breakpoints

(x_1, y_1) (x_2, y_2)

(x_3, y_3) (x_4, y_4)

(discrete samples

(1, v_1)

(2, v_2)

(t, v_t)

analog signal

V(t)

mechanical or physical effect

[m/s]

[mT/m]
Discretization effects

- input is discrete
- output is discrete

**potential problems:**
- staircase effects
- not all values can be reached
- impact on frequency domain
- broken invariants (surface)

**potential benefits:**
- optimized algoritms (fixed point)
Example of Discretization Problem

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MITORfalseContouring
Example of Generic Smoothing Consideration

- **discontinuity in first derivative**
- **smooth**
- **smooth curves prevent artefacts**
  *(vibration, image, clipping)*
Architects Collect a Rich Set of Patterns

Architects move from:
product to product
environment to environment

Architects experience:
thousands of patterns
*design* patterns in systems
*process* patterns in environments
*human* patterns in environments
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DTAlogoEnvironment
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PDBprocessDecomposition
Business Organization Stovepipe

- **Business Unit 1**: Product/market oriented
  - Project 1
  - Project 2

- **Business Unit 2**: Product/market oriented
  - Project 3
  - Project 4

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Different Concerns

- sales
- customer support
- marketing
- mechanical engineering
- electrical engineering
- software engineering
- purchasing
- logistics
- manufacturing

- competence, skill oriented
- synergy, re-use driven
- long term

- introvert
- extrovert

- customer oriented
- result driven
- short term

- dominating stovepipe or complementary cultures?

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Positioning System Architecting

Customer-Oriented Process

Product Creation Process

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SAPprocessSimplified
systems engineering as discipline
job rotation
stimulate architect exposure
stretch all engineers
cultivate customer & market oriented culture
share and invest in future exploration and vision
Conclusion

Environment: stimulate job rotation, expose engineers, recognize multi-disciplinary

Experience: >1000 design patterns and process patterns

Education: How to educate, stimulate depth and breadth?

Nature: Foster engineers with architect potential