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

- Nature
- Education
- Experience
  - patterns
  - skills
- Environment
  - variation
  - feedback
  - stimulating

Experience

Education

Nature

Decomposing the Architect; What are Critical Success Factors?

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DTAdecomposition
Decomposing the Architect; What are Critical Success Factors?

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

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Observed Typical Growth of System Architects

- root technical knowledge
- generalist technical knowledge
- business, application insight
- process insight
- psychosocial skills

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From Specialist to Generalist

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MATfromSpecialistToSystemArchitect
Different Architecting Scopes

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MSArchitectingScope
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DTAlogoEducation
Proposed Curriculum for System Architects

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Overview of CAFCR framework

**method outline**

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

**submethods**

- key drivers
- value chain
- business models
- supplier map
- stakeholders
- 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**

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

**reasoning**

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AMOoverview
Connecting System Design to Detailed Design

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RATWpyramid

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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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RATW/disconnect

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Architect: Connecting Problem and Technical Solution

**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?

1. **Customer objectives**
2. **Application**
3. **Functional**
4. **Conceptual**
5. **Realisation**

- How can the product be realized
- What are the critical decisions
- What does Customer need in Product and Why?

- 10^0
- 10^1
- 10^2
- 10^3
- 10^4
- 10^5
- 10^6
- 10^7
- 10^8

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

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RATWbreadthAndDepth
Major Bottleneck: Mental Dynamic Range

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RATWmentalDynamicRange
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Profile of an "Ideal" System Architect

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For Comparison: Profile of a Project Leader

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Project Leader vs System Architect

- project leader
- system architect

Communication
Teamwork
Documentation
Multi-tasking
Flexible, open
Auth by expertise

Specialist
Generalist
Conceptual
Pragmatic
Constructive
Critical
Absorption know-how
Creativity

Process
Insight
Politics insight
Improvement

Process
Insight
Politics insight
Improvement

Interpersonal skills

Human resource man
Coaching
Selection
Appraisal
Motivation

Commercial
Customer value
Sales feature
Commercial insight

Project man
Completeness
Schedule
Monitor progress
Initial cost
Decision making

Reasoning power

Know-how

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DTAspiderDiagram

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Most Discriminating Characteristics

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

grey level mapping

Look up table
invert contrast / brightness

brightness
contrast
input
output

gradient field generation

RF
Gz
Gx
Gy

TE
TR

wafer stage movement

v
Vy
t
vx
expose
step
expose

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DTAtrapezoidPatterns
From SW input to physical Effect

breakpoints
(x₁, y₁) (x₂, y₂)
(x₃, y₃) (x₄, y₄)

analog signal
discrete samples
(1, v₁) (2, v₂)
(t, vₙ)

V(t)
DAC

mechanical optical 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 algorithms (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

Decomposing the Architect; What are Critical Success Factors?
Decomposing the Architect; What are Critical Success Factors?

3. Nature
2. Education
4. Experience
5. Environment
1. Architect
6. Conclusion
Simplified Decomposition of the Business

**Customer-Oriented Process**

- Sales
- Logistics
- Production
- Service
- Presales

**Product Creation Process**

- Policy and Planning Process
- Customer Roadmap
- Business Drivers

- Product Needs and Feedback
- Product roadmap
- Budget, plan

- Technical Product Documentation
- Needs and Feedback
- Product-related processes

- People, Technology, and Process roadmaps
- Budgets

**People, Process, and Technology Management Process**

**Needs and Feedback**

- Material

**Support**

- **Presales**
- **Sales**
- **Logistics**
- **Production**
- **Service**

**Business Drivers**

- Customer Roadmap
- Budget, plan

**Needs and Feedback**

- Technical Product Documentation
- Needs and Feedback
- Product-related processes

**People, Technology, and Process Management Process**

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*Deconstructing the Architect: What are Critical Success Factors?*

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PDBprocessDecomposition
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D'TAbusinessOrganization
Different Concerns

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

customer oriented
result driven
short term

introvert

extrovert

dominating stovepipe or
complementary cultures?
Positioning System Architecting

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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
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**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