Status of IT Architecting: Progression or Regression?

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

Abstract

Today’s IT capabilities are seemingly limitless. From the point of view of last century we have amazing functionality available to consumers, businesses, governments et cetera. Technology advances have made this possible. At the same time we suffer from unwanted, unexpected incidents, ranging from slow or no response to loss or theft of sensitive data. The growth of systems and its complexity play a role. We will look at the role of the human creators of these systems and the available technology to discuss our concurrent progression and regression, and we will look at the role of the architect in particular.
Functionality is Limitless

financial transactions anywhere, anytime
financial infrastructure

consumers

businesses
government

financial institutes
But Problems seem to be Pervasive

slow response, outages, human-less helpdesks, silly excuses (the computer could not...), identity-theft, lost privacy

consumers

financial transactions anywhere

financial institutes

"entrepreneurial" employees

businesses
government

late delivery of new products,
poor scaling of new services,
interference of features,

...
Do we Gain or do we Lose?

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
PRSITquestion
Figure Of Contents™

question
gain or lose?

role of architect

example
webshop application

performance
technology

solution?
reference architecture

reflection on size and complexity

analysis

Status of IT Architecting: Progression or Regression?
Gerrit Muller
version: 0
March 6, 2013
PRSITlogo
Example, Case Webshop

Up-to-date information: Bestsellers
What Other Customers Are Looking At Right Now

catalogue entries
main access through search
personalization

standard boilerplate

other advertisements

styling: frequently updated, fashion!

snapshot of www.amazon.com

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
MALCmoreChanges

Gerrit Muller
**Some Numbers: New Books per Year**

<table>
<thead>
<tr>
<th>Country</th>
<th>New Books per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK (1)</td>
<td>206k (2005)</td>
</tr>
<tr>
<td>USA (2)</td>
<td>172k (2005)</td>
</tr>
<tr>
<td>China (3)</td>
<td>101k (1994)</td>
</tr>
<tr>
<td>India (21)</td>
<td>12k (1996)</td>
</tr>
</tbody>
</table>

*Source: http://en.wikipedia.org/wiki/Books_published_per_country_per_year*
Technology

question gain or lose?

role of architect

example

webshop application

performance

technology

solution? reference architecture

reflection on size and complexity

analysis

Status of IT Architecting: Progression or Regression?

8 Gerrit Muller

version: 0
March 6, 2013
PRSITlogoTechnology
Typical Block Diagram and Typical Resources

Status of IT Architecting: Progression or Regression?

Gerrit Muller

March 6, 2013

version: 0

MAFTgenericBlockDiagram
## Hierarchy of Storage Technology

### Figures of Merit

<table>
<thead>
<tr>
<th>Type</th>
<th>Technology</th>
<th>Latency</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor Cache</td>
<td>L1 cache</td>
<td>sub ns</td>
<td>n kB</td>
</tr>
<tr>
<td></td>
<td>L2 cache</td>
<td>ns</td>
<td>n MB</td>
</tr>
<tr>
<td></td>
<td>L3 cache</td>
<td>ns</td>
<td>n MB</td>
</tr>
<tr>
<td>Fast Volatile</td>
<td>Main Memory</td>
<td>tens ns</td>
<td>n GB</td>
</tr>
<tr>
<td>Persistent</td>
<td>Disks</td>
<td>ms</td>
<td>n*100 GB</td>
</tr>
<tr>
<td></td>
<td>Disk Arrays</td>
<td></td>
<td>n*10 TB</td>
</tr>
<tr>
<td></td>
<td>Disk Farms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Archival</td>
<td>Robotized Optical Media</td>
<td>&gt;s</td>
<td>n PB</td>
</tr>
<tr>
<td></td>
<td>Tape</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Performance as Function of Data Set Size

random data processing performance in ops/s

L1 cache
L3 cache
main memory
hard disk
disk farm
robotized media

data set size in bytes

10³ 10⁶ 10⁹ 10¹² 10¹⁵

version: 0
March 6, 2013
MAFTstoragePerformance
## Communication Technology  Figures of Merit

<table>
<thead>
<tr>
<th></th>
<th>latency</th>
<th>frequency</th>
<th>distance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>on chip</strong></td>
<td>sub ns</td>
<td>n GHz</td>
<td>n mm</td>
</tr>
<tr>
<td><strong>connection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>network</strong></td>
<td>n ns</td>
<td>n GHz</td>
<td>n mm</td>
</tr>
<tr>
<td><strong>PCB level</strong></td>
<td>tens ns</td>
<td>n 100MHz</td>
<td>n cm</td>
</tr>
<tr>
<td><strong>Serial I/O</strong></td>
<td>n ms</td>
<td>n 100MHz</td>
<td>n m</td>
</tr>
<tr>
<td><strong>network</strong></td>
<td>n ms</td>
<td>100MHz</td>
<td>n km</td>
</tr>
<tr>
<td><strong>LAN</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WAN</strong></td>
<td>n 10ms</td>
<td>n GHz</td>
<td>global</td>
</tr>
</tbody>
</table>
Performance

question
gain or lose?

webshop
application
technology

solution?
reference
architecture

reflection
on size and complexity

role of architect

example

performance

analysis

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
Example Web Shop

Status of IT Architecting: Progression or Regression?

14  Gerrit Muller
Impact of Picture Cache

- Fast response
- Less load
- Less server costs

Diagram:
- Screen
- Client
- Network
- Mid office server
- Back office server
- Product descriptions
- Logistics ERP
- Financial
- Customer relations

Status of IT Architecting: Progression or Regression?

Gerrit Muller

version: 0
March 6, 2013
Multiple Layers of Caching

<table>
<thead>
<tr>
<th>Cache Type</th>
<th>Cache Miss Penalty</th>
<th>Cache Hit Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Cache</td>
<td>1 s</td>
<td>10 ms</td>
</tr>
<tr>
<td>Network Layer Cache</td>
<td>100 ms</td>
<td>1 ms</td>
</tr>
<tr>
<td>File Cache</td>
<td>10 ms</td>
<td>10 us</td>
</tr>
<tr>
<td>Virtual Memory</td>
<td>1 ms</td>
<td>100 ns</td>
</tr>
<tr>
<td>Memory Caches L1, L2, L3</td>
<td>100 ns</td>
<td>1 ns</td>
</tr>
</tbody>
</table>

Status of IT Architecting: Progression or Regression?

March 6, 2013

Gerrit Muller
Why Caching?

- project risk
- performance
- response time
- life cycle
- cost

- long latency
- mass storage

- long latency
- communication

- overhead
- communication

- resource intensive
- processing

- limit storage needs to fit in fast local storage

- frequently used subset

- low latency

- fast storage

- local storage

- less communication

- larger chunks

- latency penalty once

- overhead once

- in (pre)processed format

- design parameters
  - caching algorithm
  - storage location
  - cache size
  - chunk size
  - format
Risks of Caching

- frequently used subset
- fast storage
- local storage
- larger chunks
- in (pre)processed format
- robustness for application changes
- ability to benefit from technology improvements
- robustness for changing context (e.g. scalability)
- robustness for concurrent applications
- failure modes in exceptional user space
- life cycle
- cost
- effort

Project Risk

- cost
- effort

Status of IT Architecting: Progression or Regression?
question
gain or lose?

role of architect

example
webshop application
performance
technology

solution? reference architecture

reflection on size and complexity

analysis

Status of IT Architecting: Progression or Regression?
Gerrit Muller

version: 0
March 6, 2013
PRSITlogoSize
Level of Abstraction Single System

- Static system definition
- Multidisciplinary design
- System requirements

Number of details:
- \(10^0\)
- \(10^1\)
- \(10^2\)
- \(10^3\)
- \(10^4\)
- \(10^5\)
- \(10^6\)
- \(10^7\)
Number of Details in Today’s Services

- parts, connections, lines of code
- multi-disciplinary design
- systems
- processes
- stakeholders
- enterprise
- enterprises
- society
- employees in the field
- enterprise architects
- information architects
- suppliers outsourced

Status of IT Architecting: Progression or Regression?

Gerrit Muller

version: 0  
March 6, 2013

PRSITdiabolo
question

 gain or
 lose?

role of
architect

example

webshop
application

performance

technology

solution?

reference
architecture

reflection
on size and
complexity

analysis
Reference Architecture as Solution?

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
PRSITdiaboloRA
1.1 One of several prerequisites for architecture creative synthesis is the definition of **5-7 specific key drivers** that are critical for success, along with the rationale behind the selection of these items.

2.1. The essence of a system can be captured in about **10 models/views**.

2.2. A **diversity** of architecture descriptions and models is needed: languages, schemata and the degree of formalism.

2.3. The level of **formality** increases as we move closer to the implementation level.

from http://www.architectingforum.org/bestpractices.shtml
actual figures and references to their use at http://www.gaudisite.nl/figures/<name>.html
Ideal Structure does not exist
Synthesis, Integration, Relation oriented

1. Functional Decomposition
2. Construction Decomposition
3. Allocation
4. Infrastructure
5. Choice of integrating concepts
Checklist for RA content

customer context
- business
- financials
- stakeholders
- benefits, concerns
- concept of operations

technical architecture
- key performance parameters
- product features, functions
- core technologies
- critical resources
- design issues
- dominant patterns

relations

guidance

business architecture
- business model
- life cycle
- stakeholders
- benefits, concerns
Role of Architect

question

role of architect

example

webshop
application

solution?
reference
architecture

reflection
on size and
complexity

gain or
lose?

performance
technology

analysis

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013

PRSITIogoRole
Tasks of Architect

- select data
- guide sales, deployment
- overview
- understand fitness
- design realization
- select data

10^12 society
10^9 enterprises
10^6 enterprise
10^3 stakeholders
10^0 processes
10^3 systems
10^6 multi-disciplinary design
10^9 parts, connections, lines of code

Status of IT Architecting: Progression or Regression?

Gerrit Muller

version: 0
March 6, 2013
Responsibilities

- Balance
- Consistency
- Decomposition
- Integration
- Overview

KISS
- Elegance
- Integrity
- Simple
- Fitting

satisfied stakeholders

system

context

Quality
Function
modules

Requirements
Spec
Design
Realization

module
subsystem

system
Status of IT Architecting: Progression or Regression?

33 Gerrit Muller

version: 0
March 6, 2013
LWAstakeholdersArchitecture
Gain or Lose?

question

role of architect

example

webshop application

performance

technology

solution?

reference architecture

reflection on size and complexity

analysis

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
Loss Scenario

desired properties
functionality
performance

not desired
failures
threats
progression
regression

complexity
size
tech capabilities
understanding
overview
= architecting skills

Status of IT Architecting: Progression or Regression?

version: 0
March 6, 2013
PRSITlossScenario

Gerrit Muller
Gain Scenario

- **desired properties**
  - functionality
  - performance

- **not desired properties**
  - failures
  - threats

- **complexity**
- **size**
- **tech capabilities**
- **architecting skills**

- **progression**
- **regression**

- **time**

- **understanding**
- **overview**

Status of IT Architecting: Progression or Regression?

36    Gerrit Muller

version: 0
March 6, 2013
PRSITgainScenario
We need to improve architecting skills to gain.
Read More at the Gaudisite

http://www.gaudisite.nl/

Reference Architecture Primer


Webshop case is part of System Modeling and Analysis

http://www.gaudisite.nl/SystemModelingAndAnalysisBook.pdf

All about Architecting: System Architecting