HSLU Hochschule Luzern

Software Architecture and Techniques

Evolution Of Software Architecture Over The Last Decades

Alexandra Junghans, Marcel Baumann, tangly llc

Truths (1/2)

All architecture is design but not all design is architecture.

Architecture represents the significant design decisions that shape a system, where **significant** is measured by **cost of change**

Grady Booch, 2006

Truths (2/2)

Software development does not have economies of scale.

Development has **diseconomies of scale**.

– Allan Kelly

Architecture Definitions

The fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution.

— *ISO/IEC/IEEE 42010:2022*

The structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time.

— *The TOGAF Standard, Version 10*

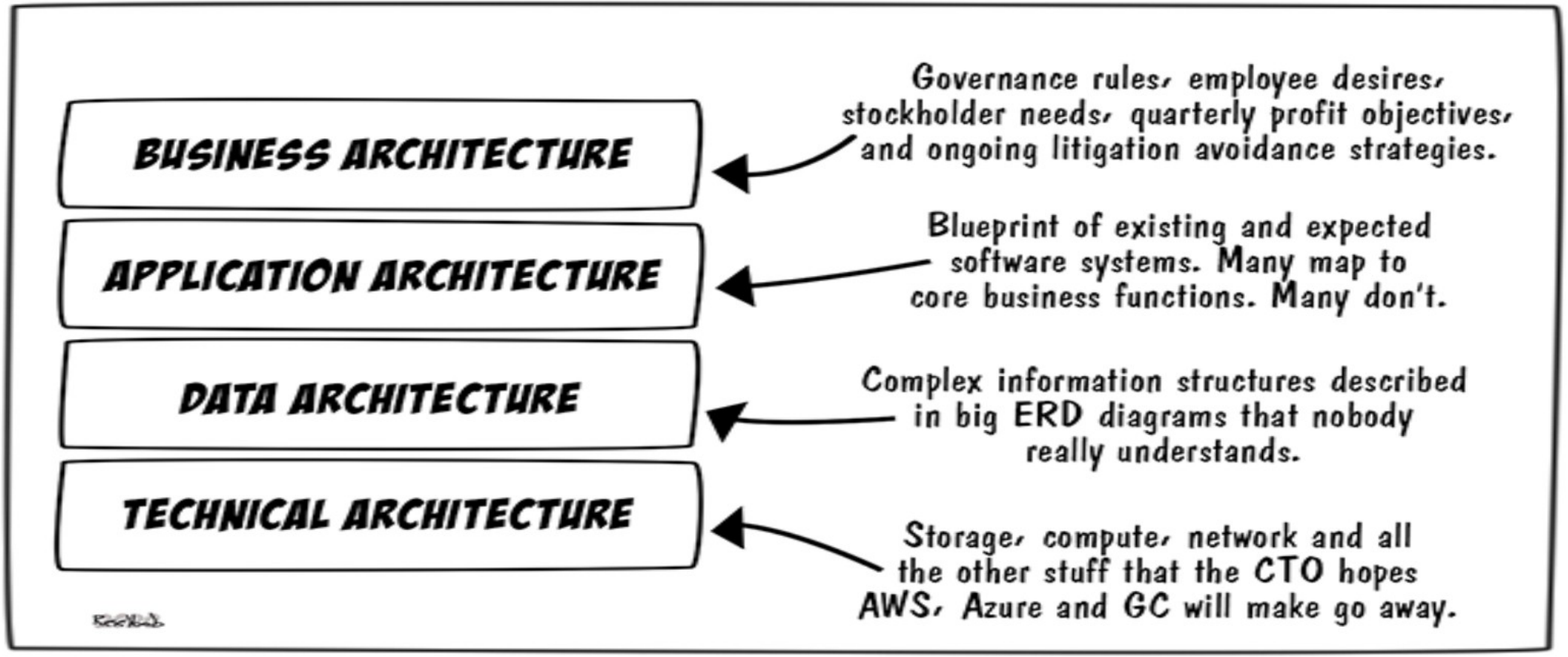
Old School Architect

- Separate position with highest status
- Decide how the architecture will be
  - Architects are smart
  - Developers are dump
- *Ivory tower syndrome*
- *Powerpoint architect syndrome*
- *Think about Conway Law – Hierarchy vs Meritocracy*

Architecture Kinds (1/2)

- Design → developer
- Application Architecture → within team
- Solution Architecture → within product
- Enterprise Architecture → whole company
  every traditional architect wants to be an enterprise architect!

Architecture Kinds (2/2)



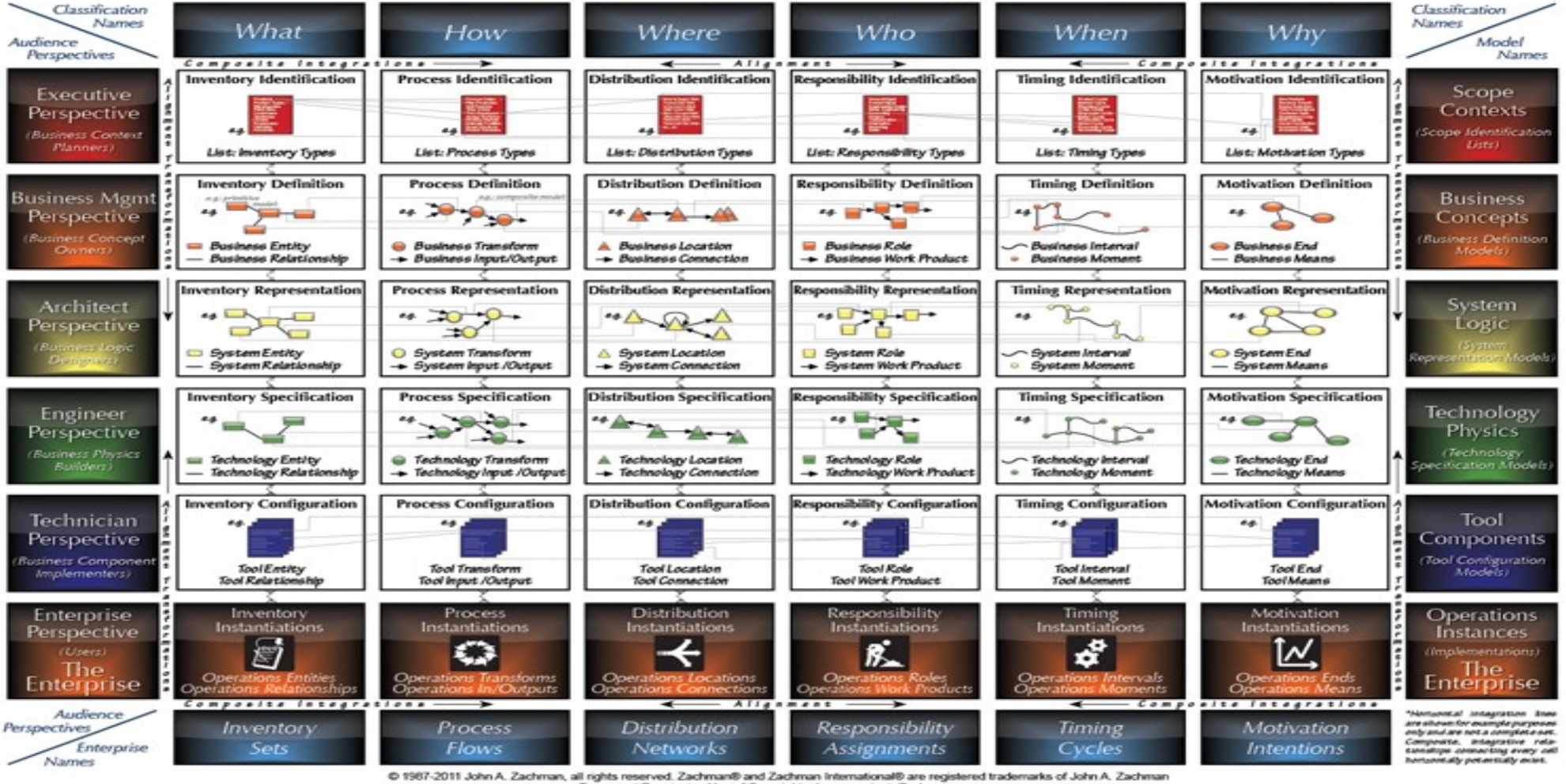
History 1960 - 2000

- Structured Programming – goto are evil -
- Structured Design – Yourdon, DeMarco -
- Structured Analysis & Design – SASD, SADT -
- Object-Oriented Approach – Booch, Rumbaugh , Jacobson -
- Enterprise Architecture – Zachmann -

The Zachman Framework for Enterprise Architecture™

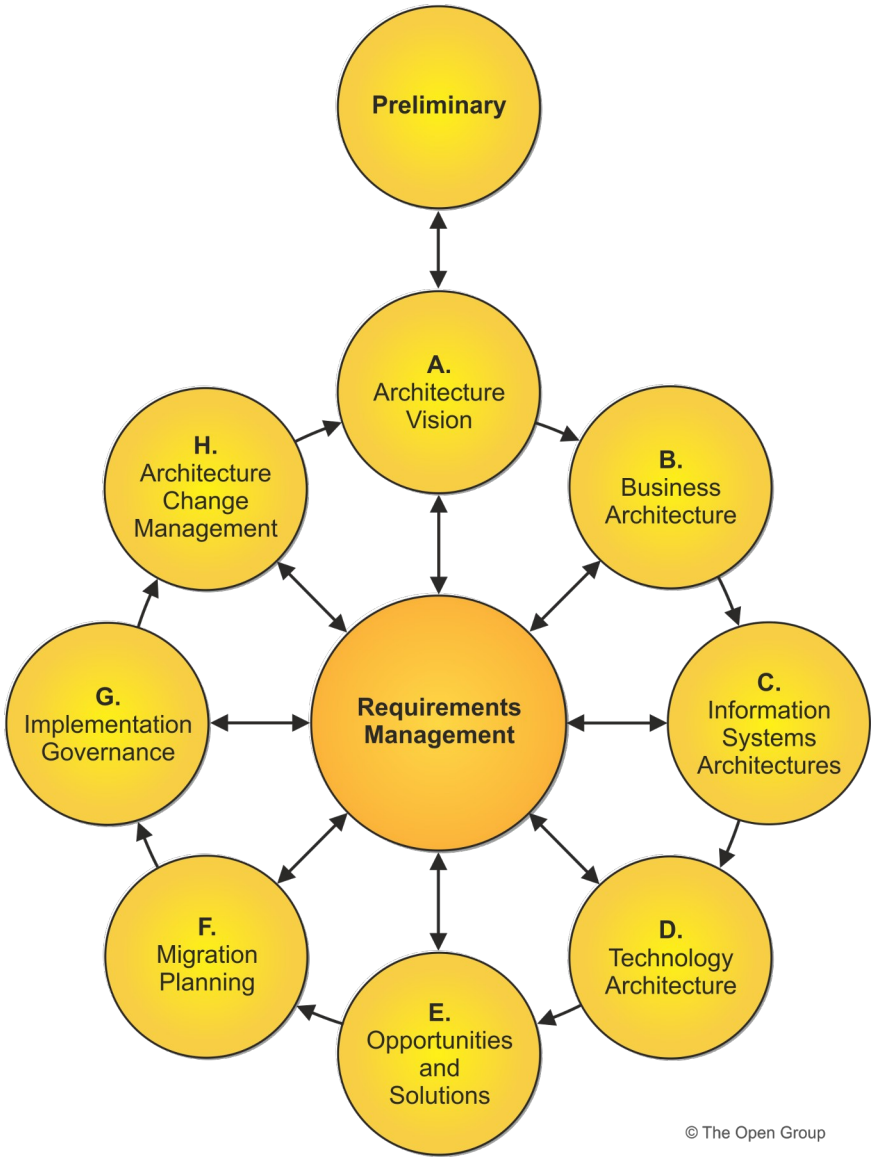
The Enterprise Ontology™

Version 3.0



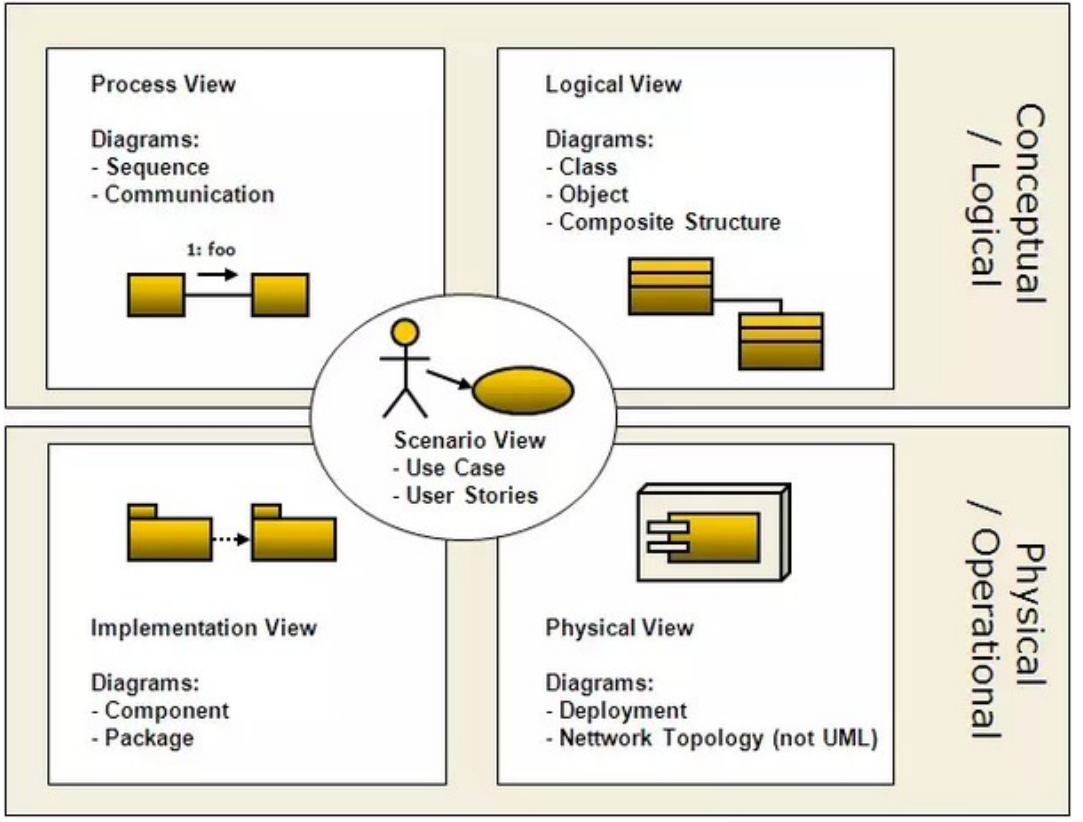
Standards (around 2000)

- TOGAF
- Arc42 and ISAQB
- RUP – Inception, Elaboration, Construction, Transition
- Hermes
- IEEE



UML – 4 + 1 View

Evaluate the views in the context of a modern development project and environment

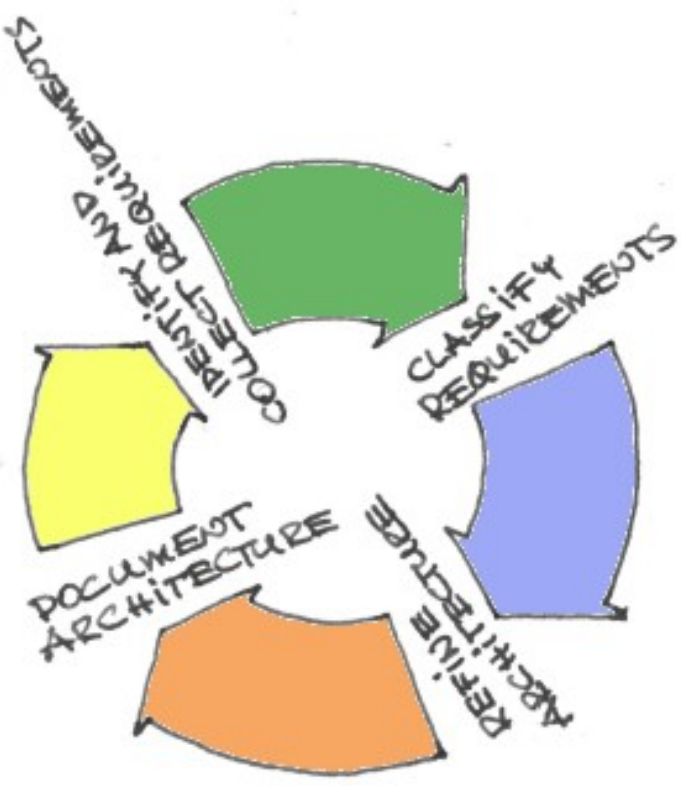


First Findings

- Architecture shall fulfill customer needs
  - Functional requirements
  - Non-functional requirements
- Dichotomy Analysis and Design
  - Analysis is requirement engineering – understand the problem
  - Design is architecture – identify a solution
  - Modern approaches killed up-front requirements documents and analysis

Understand the Problem

- Understand the domain
- Functional requirements
- Non-functional requirements
- User interface
- Process improvements



Requirements - SMART

- **S** – Specific
- **M** – Measurable
- **A** – Assignable (who will do it?)
- **R** – Realistic
- **T** – Time-related (when should it be done?)

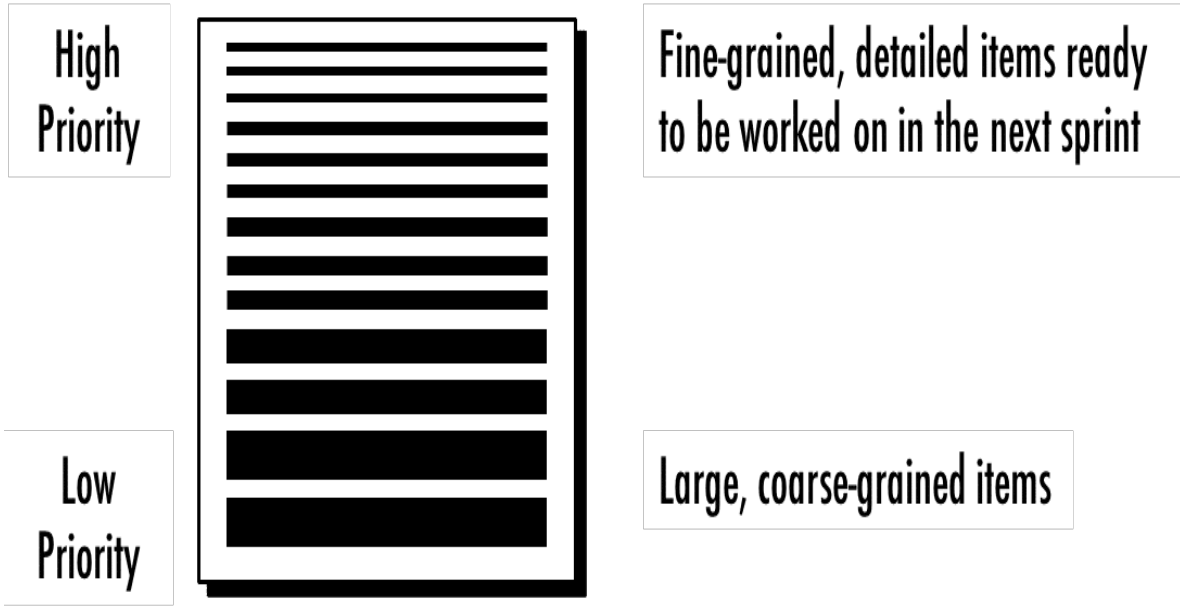
Look at SMART requirements in agile world

Stories - INVEST

- **I** – Independent
- **N** - Negotiable
- **V** - Valuable
- **E** - Estimate-able
- **S** - Small
- **T** - Testable

Backlog - DEEP

- **D** – Detailed Appropriately
- **E** – Estimated
- **E** – Emergent
- **P** – Prioritized

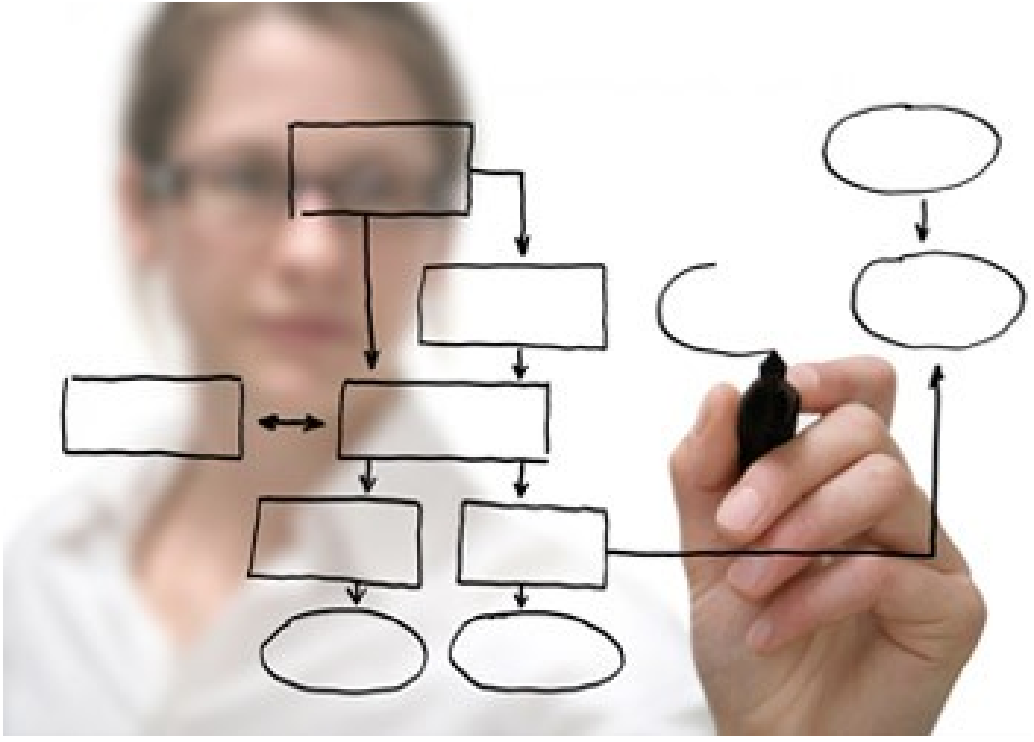


Backlog Item

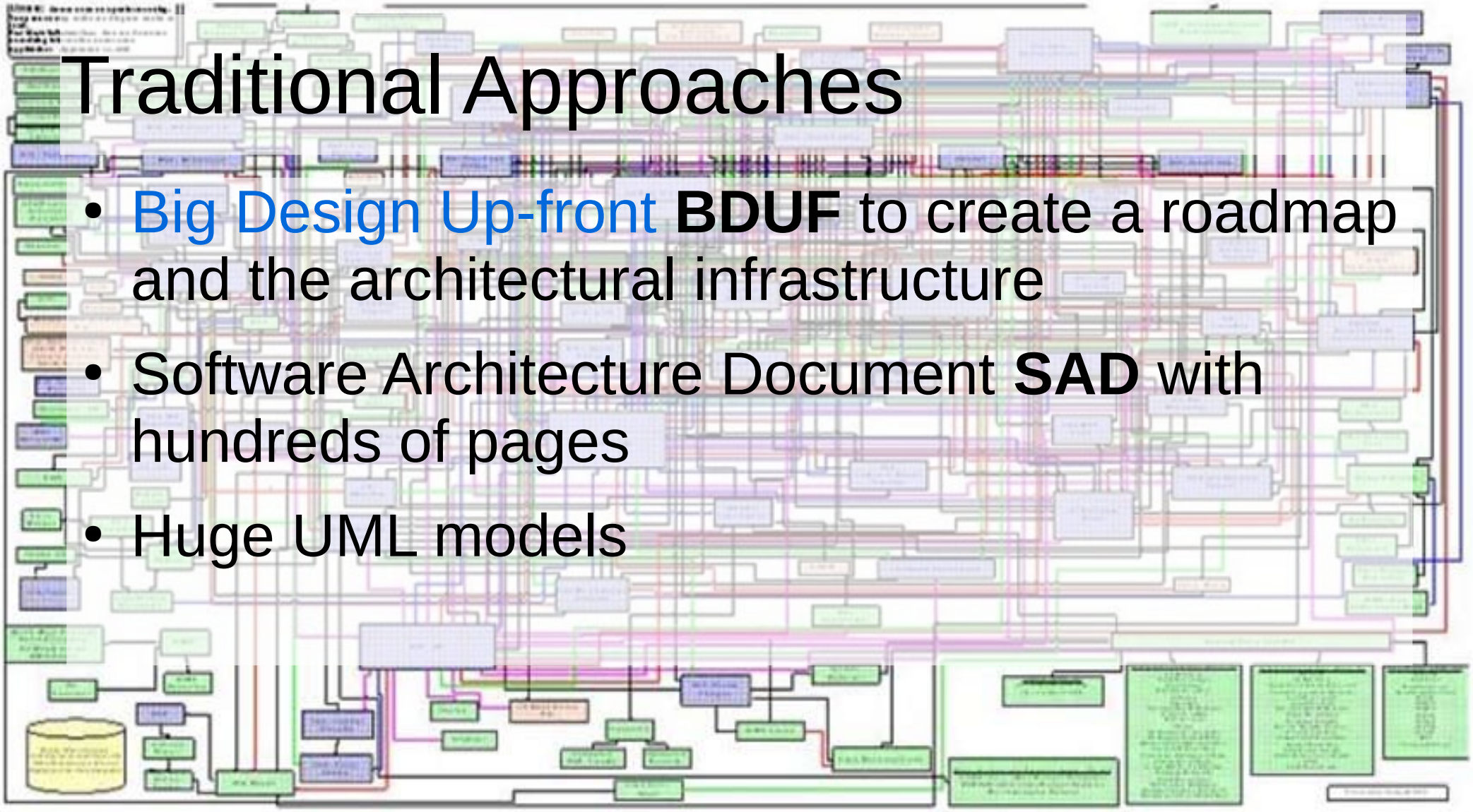
- What is a product backlog item *PBI*?
- Is a product backlog item a story?
- Why do you estimate a PBI?
- How do you know when a PBI is completed?

Create an Architecture

- Define an architecture
- Validate it
- Verify it
- Document it
- Evolve it



Traditional Approaches



- Big Design Up-front **BDUF** to create a roadmap and the architectural infrastructure
- Software Architecture Document **SAD** with hundreds of pages
- Huge UML models

DDD and Event Storming

- Customer Language
- Domain Knowledge
- Workshop and Discussion

- UX Workshop
- Design Thinking

Agile Approach (1/2)

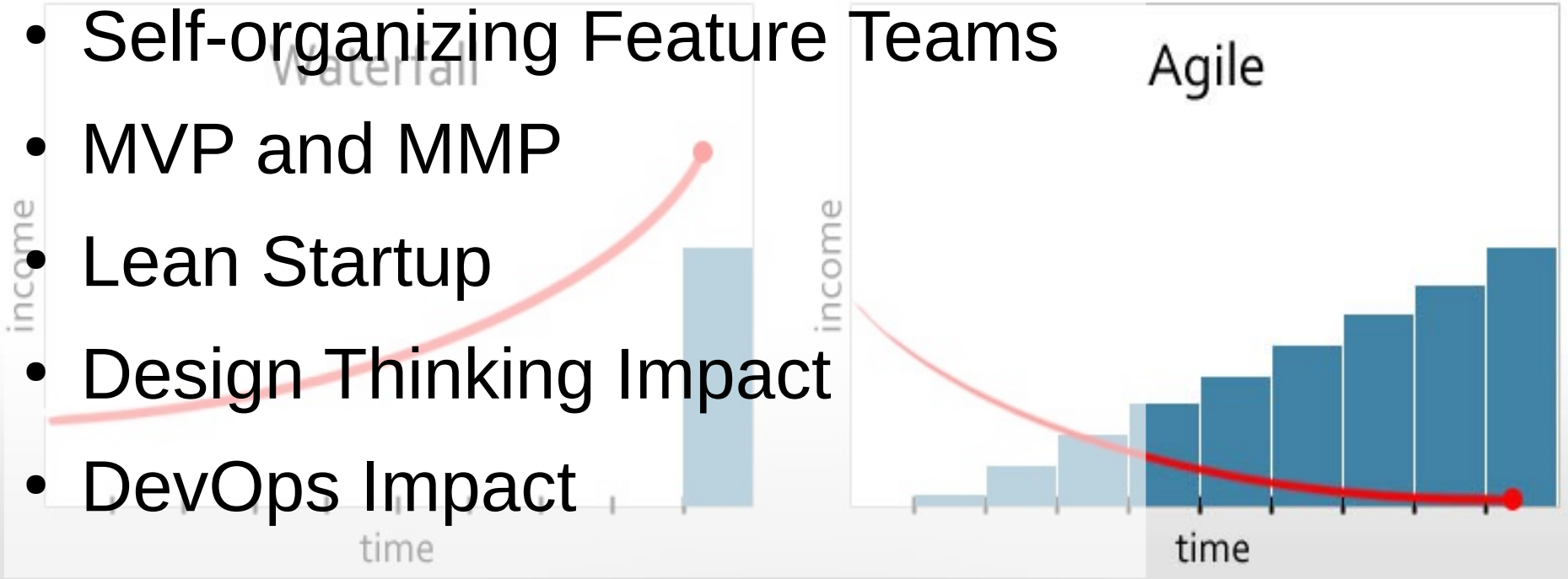
- Vision – Why?
- Roadmap – What do we get the next 9 -18 months?
- Release Planning – Story Map
- Sprint Backlog – What do we do the next 1-2 weeks?
- MVP Minimum Viable Product
- MMP Minimum Marketable Product

Agile Approach (2/2)

- *Agile Manifesto Principle 6*: The most efficient and effective method of conveying information to and within a development team is **face to face** conversation
- *Agile Manifesto Principle 11*: The best architectures, requirements, and designs emerge from **self-organizing teams**

Agile Impact to Architecture

- Self-organizing Feature Teams
- MVP and MMP
- Lean Startup
- Design Thinking Impact
- DevOps Impact



Agile Impact On Success

Standish Group, Chaos Report, 2018

Architect and Developers

- Team Work
- Craftsmanship
- Team Dynamics

Craftsmanship Approach

- Architect is a **domain expert**
- Architect is a **software craftsmanship**
- Architect is a **lean leader** – teacher, coach, mentor
- Architect discuss with stakeholders and C-level representatives

Professional Technology Decisions

- You are an engineer
- You understand the technology
- You understand your customer needs

Total

	Energy
(c) C	1.00
(c) Rust	1.03
(c) C++	1.34
(c) Ada	1.70
(v) Java	1.98
(c) Pascal	2.14
(c) Chapel	2.18
(v) Lisp	2.27
(c) Ocaml	2.40
(c) Fortran	2.52
(c) Swift	2.79
(c) Haskell	3.10
(v) C#	3.14
(c) Go	3.23
(i) Dart	3.83
(v) F#	4.13
(i) JavaScript	4.45
(v) Racket	7.91
(i) TypeScript	21.50
(i) Hack	24.02
(i) PHP	29.30
(v) Erlang	42.23
(i) Lua	45.98
(i) Jruby	46.54
(i) Ruby	69.91
(i) Python	75.88
(i) Perl	79.58

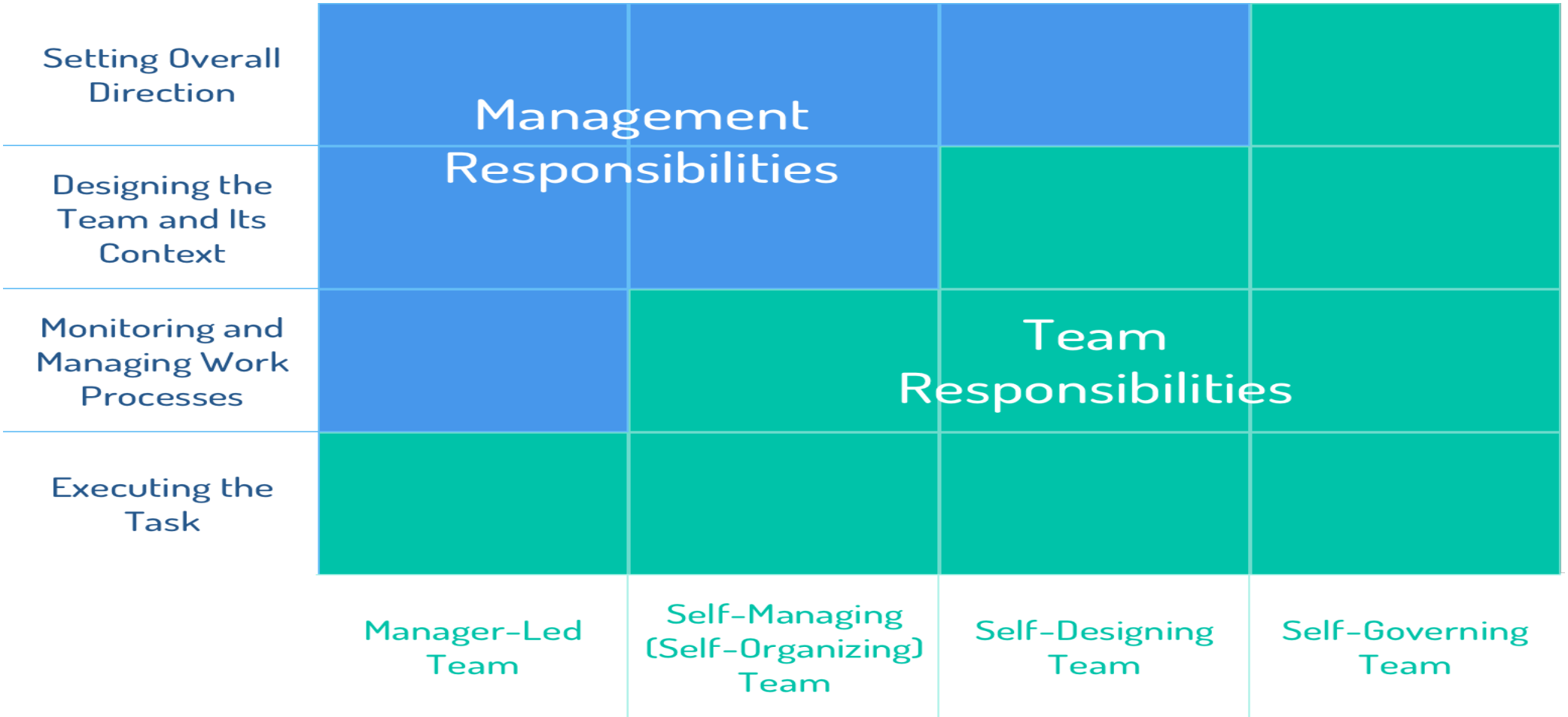
	Time
(c) C	1.00
(c) Rust	1.04
(c) C++	1.56
(c) Ada	1.85
(v) Java	1.89
(c) Chapel	2.14
(c) Go	2.83
(c) Pascal	3.02
(c) Ocaml	3.09
(v) C#	3.14
(v) Lisp	3.40
(c) Haskell	3.55
(c) Swift	4.20
(c) Fortran	4.20
(v) F#	6.30
(i) JavaScript	6.52
(i) Dart	6.67
(v) Racket	11.27
(i) Hack	26.99
(i) PHP	27.64
(v) Erlang	36.71
(i) Jruby	43.44
(i) TypeScript	46.20
(i) Ruby	59.34
(i) Perl	65.79
(i) Python	71.90
(i) Lua	82.91

	Mb
(c) Pascal	1.00
(c) Go	1.05
(c) C	1.17
(c) Fortran	1.24
(c) C++	1.34
(c) Ada	1.47
(c) Rust	1.54
(v) Lisp	1.92
(c) Haskell	2.45
(i) PHP	2.57
(c) Swift	2.71
(i) Python	2.80
(c) Ocaml	2.82
(v) C#	2.85
(i) Hack	3.34
(v) Racket	3.52
(i) Ruby	3.97
(c) Chapel	4.00
(v) F#	4.25
(i) JavaScript	4.59
(i) TypeScript	4.69
(v) Java	6.01
(i) Perl	6.62
(i) Lua	6.72
(v) Erlang	7.20
(i) Dart	8.64
(i) Jruby	19.84

Modern Architecture Tips

- KISS and YAGNI
- Do not distribute, no distributed transactions
- Asynchronous invocations
- Start with nice modular monoliths
- Use standards
- Explain your choices with ADR

Self-Organizing Teams

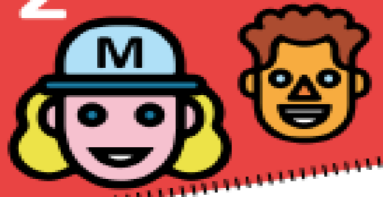


1

Tell

I will tell them

2



Sell

I will try and sell it to them

3

Consult

I will consult and then decide

4

Agree

We will agree together

5

Advise

I will advise but they decide

6

Inquire

I will inquire after they decide

7

Delegate

I will fully delegate

DELEGATION POKER

These cards are part of the Management 3.0 materials. They represent the 7 delegation levels for empowering organizations. You can find a description of their use at:
www.management30.com/delegation-poker

MANAGEMENT 3.0
CHANGE AND INNOVATION PRACTICES

Exercises (1/3)

- Create an UML diagram of your application
  - Why, when and how do you do it,
- Write a functional requirement – SMART -
  - How do you insure your requirement is testable?
  - Look at SPIDR for stories (Mike Cohn Video)
- Write a non-functional requirement
  - How do you insure your requirement is testable?
- Reflect changes introduced with agile and lean
  - Quality, speed, costs, success

Exercises (2/3)

- Read article “Agile Architecture in the Digital Age”
  - Read the ideas, you do not need to memorize the concepts
- Code examples of students
- Write unit tests, execute them in IDE, improve code coverage
  Java: JUnit 5, Mockito, AssertJ
- Execute SonarLint on the fly on your source code

Exercises (3/3)

- Explore the refactoring features of the IDE
  - IDEA configure code style, copyright, etc.
  - IDEA Analyze Menu
    - Inspect Code, Clean Code
    - Find Usage, Find Declaration
  - Refactor Menu
    - Refactor (more than 10 operations)
  - Run IDEA “Analyze/Inspect Code…”, SpotBugs, SonarLint
  - Use Git integrated client – commit, amend, push,
  - Use local history feature

Source Code Examples

- Tangly OS Components
  - Finite State Machine
  - Behavior Driven Development
  - TSV and JSON Import/Export
  - Core Components
  - ERP CRM Component