Key Aspects for Sustainable Product Development

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Starting point

- If, like me, you observed that...
  - Customers needs are too fuzzy... and/or their needs feel to be a solution
  - Communication between technical silos is difficult
  - How to assert that all technical points of view are coherent?
  - Lack of trust in software development (i.e. difficult to respect costs, schedule, quality)
  - Software does not scale easily
  - Some systems feel simple while others feel too complex without reason
  - Reuse is a challenge
  - Difficulties in mastering complexity
  and the list goes on...

- I want to share with you some important findings I have found on how to fix such kinds of problems.
- I have worked for 25 years in technical systems development with many industries in several domains, now mainly delivering consulting.

- Let us make a first experience...
The fish’s experience
What is this?

However, they are very different but using the same name... Scrambling...
What do I miss?
The Real World

- I am living in it
- Seems there is only one
- Time is always now!
- Contains only objects and fields of physics (electric, magnetic…)
- Limited by reality (i.e. physic, chemistry, biology…)
- Symbolic colour: **Black** = strong reality…
- Easy to manage Energies
- Difficult to manage Information

The real fish

- Exists in the real world - visible with my eyes
- Is a kind of (real) object (i.e. existing by itself)
- Has a behaviour
The ideal fish

- Exists in my brain – could be visualized closing my eyes
- Is a kind of (virtual) object (i.e. existing without any context)
- Has a behaviour

The Ideal World

- It is living within me
- Seems there is one by (living) people
- Based on Plato’s Theory of Ideas
  - Ideal does not mean perfect, just means “made of ideas”
- Time is an idea, among others
- Contains ideas
  - Seems that ideal object is one good concept, with some others
- No limit…
- Symbolic colour: Green, hope…
The virtual fish

- Exists in running Serene Screen’s Marine Aquarium program executed by my computer - visible with my eyes looking at my computer’s display
- Is a kind of (virtual) object (i.e. existing by itself)
- Has a behaviour

The Virtual World

- It is living in a “computer”, made existing by a computer executing a program
- It seems there could be many!
  - If one computer is executing multiple programs
    - Ex: My laptop executing text editors, web browsers…
  - If multiple connected computers executing multiple programs
    - Ex: World Wide Web
- Time is data, among others
- Contains ? (occupying memory)
  - Seem virtual object is one good concept, with some others
- No limit…
- Symbolic colour: Red, passion… ;-)
- Impossible to manage Energies
- Easy to manage Information
So what?

- Seems interesting but how to use it?
- Let us make another experience…
“To go on Mars” - project experience
“To go on Mars” Project

1. I try to understand customer’s need from his/her point of view.

2. I imagine a principle solution containing new and existing elements.

3. For each element of this solution, I have to find, create, discover or reuse technical solutions (mechanic, electric, electronic, thermic… and software) then I have to choose the best one.

4. When chosen, I have to put all these technical solutions together to build the technical system.
Intuitive Development Process

- This process does not feel new
- Illuminated by the “3” worlds makes it clearer and simpler
- Let’s look at it as a model
In a Model...

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In a Model...

MarsTraveller

ToGoOnMarsSystem

ToGoOnMarch

«ConceptualDesign»

ToGoOnMarsObject

SpinningMotor

itsSpinningMotor
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Need Capture & Analysis

Conceptual Design
Technical Design

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IdealWorld
  SpinningMotor
    The SystemEngineer Motor

DCMotorWithSoftwareController
  One Technical Design Choice

VirtualWorld
  itsDCMotorController 1
    DCMotor
      The SoftwareEngineer Motor

RealWorld
  itsDCMotor 1
    DCMotor
      Axis
      BindingPoint
      ElectricFeed
        The ElectricalEngineer Motor
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« Real » Design
« Real » Design
« Virtual » Design + Digital Electronic Design

VirtualWorld

DCMotor

DCMotorWithSoftwareController

DCMotorWithSoftwareControllerUsingDAC

DCMotor4DAC

GenericDAC

DACDriver

DAC

RealWorld

Axis

BindingPoint

DCMotor

ElectricFeed

0,1

PowerPlug

Amplifier

OrderPlug

itsDCMotorController 1

<<ConsistOf>>

«Control»

<<Refine>>

itsDCMotor 1

itsDCMotor 0,1

itsDCMotor

itsAmplifier 1

itsDAC 1

itsDACDriver 1

itsGenericDAC 1

itsDACDriver 1

Out
Synthesis
In equations

- System Need is an equivalence class of Conceptual Solution:
  \[ \text{System Need} \subseteq \text{Conceptual Solution} \]

- Technical choice aims at that whole technical solution equals Conceptual Solution:
  \[ \text{Conceptual Solution} = \text{Virtual Solution} + \text{Real Solution} \]

- As, with real world we do what we can, and as with virtual world all is possible, the effective equation becomes:
  \[ \text{Virtual Solution} = \text{Conceptual Solution} - \text{Real Solution} \]
“Everything should be made as simple as possible. But not simpler.”

Albert Einstein
Conclusion - Good News!

- Rules that makes things as simple as possible exist!
  Among others:
  - Think in the “right” world and avoid to mix them.
  - Use the intuitive design process:
    - Need understanding
    - Conceptual solution design
    - Technical solution design (incl. trade-off studies)
      - Real parts (i.e. mechanic, electric, electronic (A&D)…)
      - Virtual parts (i.e. software…)
    - Use objects
      - Easy to understand and to validate (no “side effect”)
      - Allows high reuse ratio
  - Simpler => Reduction of Costs and Delay, Increase of Quality, Increase of satisfaction for Professionals, Customers and Finance
  - Already used by many customers in diverse industries
THANK YOU

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Serenity