



Faculty of Science



# Net4Care: Towards a Mission-Critical Software Ecosystem ?

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## Motivation – healthcare systems as a burning platform

### Demographic challenges

- 2009
  - 70% of public health expenditure goes to chronic diseases
  - 2/3 of all above 60 has at least one chronic disease
- 2040: 100% more elderly

### Geographical challenges

- Larger, fewer hospitals
- Fewer general practitioners

### Leads to a need for *telemedical solutions*

- ICT-supported healthcare services where some of the people participating in service delivery are not co-located with the receiver of the service



## Architectural solutions for growing a platform

We need to create a platform for designing, developing, providing telemedical solutions. How to do this?

Create a *product line*, manage a set of core assets, produce applications from these?

- Has worked for various organizations
- Most successful for single-organization, technical/embedded systems (cf. Nokia)

Create and control *common platform*, source *components* from suppliers, reuse existing components?

- Has been tried over and over again; seldom works
- A long and somewhat painful history (e.g., EPR in Denmark, UK, ...; IBM IFW)

Nurture a *software ecosystem*, allowing suppliers and users to create applications in this



# Software ecosystems



## Working definition

- “consists of a software platform, a set of internal and external developers and a community of domain experts in service to a community of users that compose relevant solution elements to satisfy their needs” (Bosch, 2009)
- Cf. also Moore (1993), Messerschmitt & Szyperski (2003)

## Many existing keystone examples,

- Microsoft Windows
- Apple iOS
- Google Android

Ecosystems go through birth, expansion, leadership, self-renewal (Moore, 1993)

Net4Care aims to be the basis of a software ecosystem within (Danish) telemedicine



## Net4Care goals – the developer perspective

*An SMB developer with a strong background in electronics and hardware-near computing [source] wants to develop a telemedical application for the home that supports uploading measured clinical values [stimulus] using the Net4Care framework [artifact] as part of preliminary exploration and prototyping [environment]. The developer downloads, installs, and tests a first prototype having a full round-trip of clinical measurements (from device to simulated server and back again) [response] within four staff hours [response measure].*



## Mission-critical software systems

*Software systems in which a software failure may mean business failure*

### Examples

- *Healthcare*
  - *E.g., telemedical applications*
- Industrial
  - E.g., process control
- Finance
  - E.g., (internet)banking



### Observation

- Many software systems in this category are built as a product on top of a platform using service-oriented principles

How can such platforms be opened up to become an ecosystem?

## Challenges in mission-critical software ecosystems

Dependability is a central concern

- How can dependability of externally developed and composed systems be guaranteed?
- (Net4Care: staged testing environment, towards architectural tests)

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Regulations, standards, and certification are the norm

- Specifications such as HL7, IHE XDS, LOINC, UCUM, ... may have to be followed; standardized services may have to be used
- (Net4Care: learning resources, standard facades, towards local certification)

There is a high barrier of entry for developers (and organizations)

- There are many missed opportunities of reuse
- (Net4Care: learning resources, standard facades, service platform)



## Summary

A software ecosystem approach to mission-critical applications may provide opportunities for open innovation

Telemedicine presents one example of an application domain for which a software ecosystem approach may be useful

- The Net4Care project is working towards this in a Danish context

Challenges for mission-critical software ecosystems include

- Dependability is a central concern
- Regulations, standards, and certification are the norm
- There is a high barrier of entry for developers (and organizations)

