Seminar in Software and Service Engineering: Software Ecosystems and Infrastructures

Lecture 1: Background to the topic area

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Course details

- Topic area
- Objectives
- Work forms
- Lectures
- Research plan
- Seminar presentation
- Opponent role
- Seminar report
- Schedule
Software ecosystems and infrastructures
• Or: platforms for software development and business

How software integrates to its business and use environment
• Most often this is implemented through existing ecosystems or infrastructures
  - They offer some basic and general functionality (economy of scale)
  - They provide means to access a large audience of users and technology providers (two-sided markets)

Many kinds of infrastructures, for many purposes
• Enterprise-wide, national, global
• General, domain specific
• A single software application may integrate to many of these.
Objectives

General learning objectives
• Students are able to
  - search information related to a research topic
  - analyze information from different sources
  - write a scientific report in English
  - Also: improve skills to carry out Master's Thesis.

Topic-related learning objectives
• The students will understand
  - the challenges related to software ecosystems and infrastructures
  - how they affect software development practices
Work forms

Introductory lectures

Research planning
• Write a short research plan of a given topic
• Present the research plan to the supervisor

Seminar report and presentation
• Make a seminar presentation
• Act as an opponent in another presentation
• Write a research paper from the given topic
Lectures

Thu 25 Feb, 12:15 PM » 2:00 PM, B353 (B353)
• Introduction to the seminar topic area

Thu, 3 Mar, 12:15 PM » 2:00 PM, B353 (B353)
• Material finding, scientific writing

Thu, 17 Mar, 12:15 PM » 2:00 PM, B353 (B353)
• Briefing to the seminar plan, report and presentation
Research plan

A short research plan is presented to supervisor in the end of March

It includes

• Short description of the topic
• Short description of research objectives
• Evaluation of literature availability and other information sources
• Schedule for the rest of the study
• Description of possible outcomes
Seminar presentation

• Length: 15 min for the presentation + 10 min for discussions, including the opponent duty.
• Do not use too many slides, recommended 1 slide/2 minutes
  Something else than just slides?
• It is better to have a shorter presentation than too long.
Opponent role

- Each student serves once as an opponent for another presenting student

Opponent tasks
- Read the report that you are opposing
- Give feedback based on the written report and the presentation
- Your task is to help in learning and understanding
Seminar report

• Use the official Aalto CS thesis instructions (either Word or Latex) for formatting
• Some instructions are here: https://into.aalto.fi/display/entik/Master's+Thesis
• Your seminar report is in practice a literature review
• You are not expected to collect data, develop new methods or to perform own experiments
• You are expected to explain existing experiences and empirical results, and created descriptions of the technology that you are evaluating
• Report requirements
  - length: about 16 - 23 pages including all the pages
  - Citations: at minimum seven citations to scientific articles
Schedule

Introductory lectures
• 25.2., 3.3. and 17.3.2016

Research plan submission
• 29.3.2016

Research plan feedback
• 31.3.2016

Deadline for the initial seminar report
• 21.4.2016

Seminar presentations
• 28.4.2016

Deadline for the final seminar report
• 15.5.2016
Next meetings

Today
• Ecosystems, infrastructures and platforms in software development

Thursday 3.3.
• Scientific publishing, finding literature
• Research topics for this seminar

Thursday 17.3.
• Instructions for the seminar work
Ecosystems, infrastructures and platforms
Platforms, Infrastructures and Ecosystems in Software Development

Why is this topic important and interesting?

• Software is always on a platform
• Different levels of platforms
• There is an infrastructure underneath
• Enterprises have an infrastructure as well
Software is always on a platform

Old ideals of computing
• Hide implementation details from application programmers
• Allow separation of concerns to different modules
• Facilitate interoperability between applications
• Facilitate hardware independence through abstraction

More recent ideals
• "online platforms", networked runtime environments that
  - Enable two-sided markets
  - Enable platform-based innovation
Examples of different levels of platforms

**Single computer**
- Operating system
- APIs

**Local/enterprise**
- Enterprise infrastructure, enterprise architecture
- Enterprise service bus
- Database management systems, application servers

**National/regional**
- Healthcare data exchange, electricity smart grid, ...

**Global**
- Google Play, App store – Android, IOS, ...
- Industry-specific platforms
- Amazon web services
- Steam, Playstation, ...
There is an infrastructure underneath

All recent digital innovations require a running infrastructure that integrate users, service providers, devices and other parties

• Cloud computing
  - *Software as a service*
  - *Platform as a service*
  - *Infrastructure as a service*

• Big data
  - *The data provided by the infrastructure from various sources*

• Internet of Things
  - *Requires integration to a cloud infrastructure*

• Social media, human interaction
• ...
Enterprises have an infrastructure as well

**IT infrastructure (ITIL v3)**

- a combined set of hardware, software, networks, facilities, etc. (including all of the information technology), in order to develop, test, deliver, monitor, control or support IT services

**In other words**

- What kind of information technology is needed in the enterprise?
- How is this IT planned and developed?
- How is IT and its change monitored and controlled?
- How is its use supported?

**Enterprise architecture**

- A model and a plan of the combination of business processes and IT (more later)
Change in Software Development

• What "digitalization" means?
• Platforms and economies of scope
• Accessing the markets with platforms
• Integration as the essence
What ”digitalization” means?

Digitalization is a social/societal change, that happens simultaneously in

• Technology
• Business (in its large meaning)
• Social relationships and interaction

Difference between automation and digitalization

• Automation is the combination of technology and business
• Digitalization includes also the social
• In a way, digitalization is also automation of the social

The business core becomes digital

• The value is created digitally, with digital transactions
• It is necessary for most businesses to integrate to this digital infrastructure
General effects of digitalization to industry

Transformation of value chains
• The value chain of a single product or service may become less important
• Customer interface and management of the whole network of related value chains more important

Physical production and products may become replaceable “global bulk”
• Automated production is based on digital information
• Digital information has the tendency to become free
• Costs related to transactions, data communications and information processing are minimal

Many things happen outside of markets
• It is difficult to manage, package and sell digital information
• Open source as the principle
Effects of digitalization to software engineering

Digital as business core + automation of the social

• It is difficult to separate software from the social network of its users
• The technical construction and the business service are difficult to distinguish from each other (c.f. Uber)
• → The producer of a digital service must be able to manage continuous development and deployment of the service

It is therefore possible that

• Outsourcing will not be a viable alternative for many businesses
• IT becomes a core business function instead of a cost
• Time-constrained development (= project) will not be the only dominant development model
• Managing changes in the digital environment (integration) becomes an essential software engineering skill
Platforms/infrastructure enable the economy of scope

Instead of economy of scale, platforms and infrastructures are about economy of scope

• Economy of scale is not so relevant in software

”Design hierarchy” is essential in product development, especially in software

• Use and reuse of common assets as templates for product innovation
• Platforms can be seen as component and subsystem assets

“Economies of scope” exist when the cost of joint production is less than the cost of producing each output separately (Gawer, 2014)

• Applies both to production and to innovation (ibid.)
  - Innovation ecosystems – not only about buyer-supplier relationships
Economy of scope – Platforms as technological architectures

Structural commonalities
• Modular technological architecture
• Include a core and a periphery
  - A “stable” core (= the platform itself)
  - A variable periphery

Management of complexity
• Eliminate unmanageable spaghetti tangle of systemic interconnections
• Reduce the scope if information that designers need to designs
• Allow specialization and division of innovative labour
Accessing the markets

Platforms as markets

• “Two-sided markets”, “multi-sided markets”
• Facilitators of exchange between different types of consumers that would not otherwise transact with each other (Gawer, 2014)
• A platform coordinates these groups of consumers for example through pricing

Network effect

• Agents interacting via platforms where one group’s benefit is dependent on the size of the other group joining
  - E.g. app developers and users of the app platform (such as Android)
  - Self-reinforcing feedback loop – may lead to “winner-take-all” outcome
Integration as the essence

Rodon (2006) identifies eight meanings of integration:

• 1) integration as the interoperability of systems
• 2) integration as developing a whole new system
• 3) integration when combining existing systems into one logical system
• 4) integration as establishing communication between systems
• 5) integration as inter-organizational process reengineering
• 6) integration as standardizing existing systems
• 7) integration as becoming a natural extension of the users or a routine
• 8) integration as the adoption or diffusion of a system.

Infrastructures and platforms provide means for many of these

• Interoperability, combination, communication, process reengineering, standardizing, extension
Essential concepts

• Platform
• Software Ecosystem
• IT Infrastructure
• Enterprise Architecture
Platform

**Essential features**

- Basis for new product development and incremental innovation
- Enable the creation of a family of related products or sets of new features by deploying components defined by the platform

The first mention (Brown, 1985): Baldwin Locomotive Works (1854)

- A rigorous program to standardize locomotive parts
- Standard components that can be used in standard engines or even in custom designs

Platforms are the basis for modern manufacturing and globalization

Platforms for IT and software are similar

- Two-sided markets
- Modular technological architectures
Software Ecosystem (Jansen, 2015)

• A software ecosystem is a set of actors functioning as a unit and interacting with a shared market for software and services, together with the relationships among them.

• These relationships are frequently underpinned by a common technological platform or market and operate through the exchange of information, resources and artifacts.
Examples of Software Ecosystems

- Facebook
- Google
- Steam
- Salesforce
- Amazon
- Autodesk/AutoCAD
- Playstation
- Microsoft Windows
- E-Estonia/X-Road
- ...
Enterprise architecture

An enterprise wide design/structure including such elements as
• Business processes and strategies
• Information systems and IT applications
• Information and databases
• Technical infrastructure

May describe
• Current or “as-is” status
• Target or “to-be” structures
• A migration plan describing how to reach the target from the current
Enterprise architecture

Organizing logic for business processes and IT infrastructure

• Reflects the integration and standardization requirements of the company’s operating model
• Provides a long term view of a company’s processes, systems, and technologies
Enterprise architecture: some key concepts

**Business processes**
- Tasks related to a particular issue
- Management, operational and supporting processes

**IT infrastructure**
- IT services offered by an organization
- Information systems, office tools, networks, etc.

**IT governance**
- The system by which the current and future use of IT is directed and controlled in an organization
IT infrastructure

Enabling IT services in an organization

• Hardware and software infrastructure
• Service delivery and support
• Security management
• Application management
• Asset management

ITIL - Information Technology Infrastructure Library

• An industry standard for managing IT infrastructure
• Defines the procedures for IT management
Enterprise architecture vs. software infrastructure

Enterprises need to integrate to various digital infrastructures

• Access the markets
• Communicate with the stakeholders
• Organize logistics and supply chain
• Enable sales and marketing
• Organize HR management and health care
• Enable financial transactions
• Deal with governments and tax offices
• ...

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Summary

- Digital infrastructures are everywhere
- Most activities must integrate to them
- This integration is an essential skill for software and business developers
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Task

What infrastructures/platforms/ecosystems are you
  • Using?
  • Developing on?
  • Interested in?

Select one infrastructure/platform/ecosystem and explain its
  • Economy of scope
  • Two-sided markets