

CS350

Lecture 0: Overview

Fall 2018

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Why Software Engineering?

- Is Software really important?
 - Why or why not?
 - Do you have any evidence for why or why not it is important?

SW Development Examples

- Developing a university student course registration system
 - Developing a 'Go Game Player', such as Alpha Go.
 - Developing an SNS program for KAIST students
 - Developing a nuclear power plant safety monitoring system
 - Developing an ATM control system
 - Developing an unmanned vehicle driving system
 - Developing a missile defense system
 - Point of Sales, Air traffic control, robot control, smart grid,..
- ** Not just software development, but sometimes, HW involved,

A Typical Scenario of SW Development

- Step 1: Identify needs (req.s)
 - Customer, consumer, user, etc
- Step 2: Develop it
 - Option 1: Start coding and debugging until ..
 - Option 2: Identify users' req.s & design and then coding&testing
- For your data structure programming assignment, which option do you follow?
 - Why?
 - When is the other option for if necessary?
- For industry projects, which option do you follow?

Why Software, Is It Really Important? (1/4)

- Global 30 IT Companies (market capitalization)

(source: 정보통신기술진흥센터)









1980년	1990년	2000년	2010년	2014년
1 IBM	1 IBM	1 Cisco Systems	1 Apple	1 Apple
2 HEWLETT PACKARD	2 HITACHI	2 Microsoft	2 Microsoft	2 Microsoft
3 Panasonic	3 Panasonic	3 NOKIA	3 Google	3 Google
4 Xerox	4 Hitachi	4 Intel	4 IBM	4 Alibaba.com
5 Intel	5 NEC	5 ORACLE	5 ORACLE	5 facebook
6 SONY	6 SONY	6 IBM	6 SAMSUNG	6 ORACLE
7 TEXAS INSTRUMENTS	7 FUJITSU	7 EMC	7 Intel	7 SAMSUNG
8 HITACHI	8 Nintendo	8 NOKTEL	8 CISCO	8 Intel
9 MOTOROLA	9 FUJIFILM	9 Sun	9 HEWLETT PACKARD	9 IBM
10 UNISYS	10 SHARP	10 ERICSSON	10 amazon.com	10 amazon.com
11 Intel	11 SANYO	11 TEXAS INSTRUMENTS	11 Qualcomm	11 CISCO
12 Fujitsu	12 Microsoft	12 SONY	12 Canon	12 Tencent
13 SANYO	13 KYOCERA	13 HEWLETT PACKARD	13 tsmc	13 QUALCOMM
14 NEC	14 Intel	14 Hitachi	14 SAP	14 tsmc
15 FUJITSU	15 Canon	15 Qualcomm	15 TATA CONSULTANCY SERVICES	15 SAP
16 PHILIPS	16 MOTOROLA	16 Panasonic	16 EMC	16 Baidu
17 Canon	17 NOKTEL	17 PHILIPS	17 Infosys	17 TATA CONSULTANCY SERVICES
18 SHARP	18 ERICSSON	18 CORNING	18 Tencent	18 HEWLETT PACKARD
19 Telekom	19 Hitachi	19 DELL	19 Foxconn	19 eBay
20 FUJIFILM	20 Pioneer	20 Lucent Technologies	20 Texas Instruments	20 EMC
21 CORNING	21 Apple	21 MOTOROLA	21 NOKIA	21 TEXAS INSTRUMENTS
22 NOKTEL	22 COMPAQ	22 JDS Uniphase	22 Nintendo	22 accenture
23 Pioneer	23 CORNING	23 JDS Uniphase	23 ERICSSON	23 Yahoo!
24 KYOCERA	24 JDS	24 JDS	24 VMware	24 ASML
25 National Semiconductor	25 Sun	25 VERITAS	25 eBay	25 Foxconn
26 AVNET	26 TEXAS INSTRUMENTS	26 Yahoo!	26 SONY	26 JDS
27 JDS	27 TDK	27 AOL	27 Baidu	27 ERICSSON
28 Data General	28 muRata	28 Canon	28 accenture	28 micron
29 CRAY	29 PHILIPS	29 NEC	29 BlackBerry	29 salesforce
			30 CORNING	30 HITACHI

Why Software, Is It Really Important?(2/4)

1980年			1990年			2000年			2010年		
1	IBM	 HW	IBM	 HW		시스코	 HW		애플	 HW	
2	코닥	 HW	히타치	 HW		마이크로소프트	 SW		마이크로소프트	 SW	
3	휴렛 팩커드	 HW	파나소닉	 HW		노키아	 HW		구글	 SW	
4	파나소닉	 HW	루슨트 테크놀로지	 HW		인텔	 HW		IBM	 SW	
5	소니	 HW	NEC	 SW		오라클	 SW		오라클	 SW	
6	산요	 HW	소니	 HW		IBM	 SW		인텔	 HW	
7	텍사스 인스트루먼트	 HW	코닥	 HW		EMC	 HW		시스코	 HW	
8	모토로라	 HW	후지쯔	 SW		에릭슨	 HW		삼성	 HW	
9	에머슨	 HW	샤프	 HW		텍사스 인스트루먼트	 HW		휴렛 팩커드	 HW	
10	유니시스	 SW	산요	 HW		루슨트 테크놀로지	 HW		퀄컴	 HW	

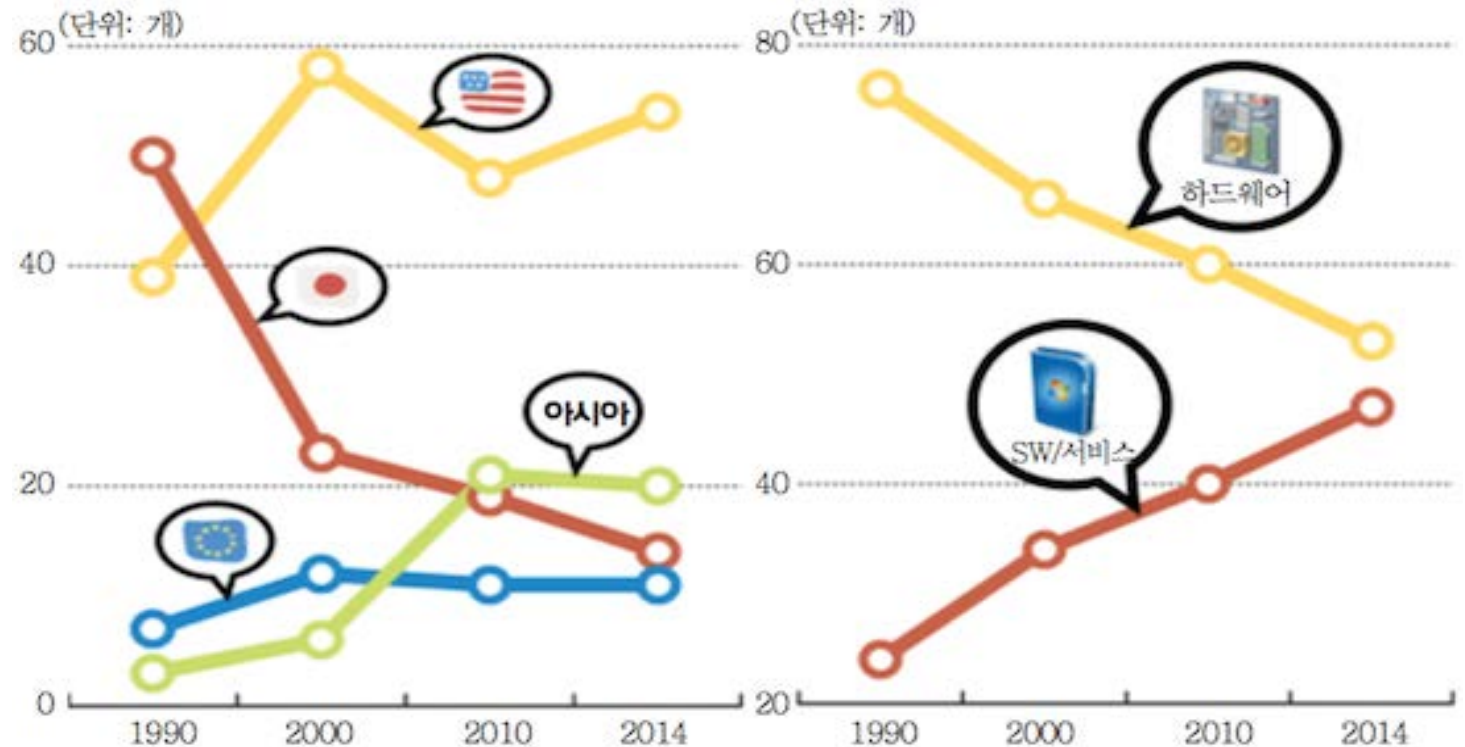
Why Software, Is It Really Important?(3/4)

- source: S&P Capital IQ

	2012.12.31	2013.12.31	2014.12.31	2015.5.1
1				
2				
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Why Software, Is It Really Important?(4/4)

- Among 100 IT Companies



Why Software Engineering?

- Developing SW with just programming skills
 - Name a few programming skills,
- Developing SW with SE knowledge in addition to such programming skills
 - Comparison to a small house and large skyscraper building construction
- I met an Oracle HR team recruiting manager visiting us
 - "What are the minimum course requirements for programmers at Oracle?"
 - ➔ "....."

Software Engineering for Specific Systems and Services (in addition to specific domain)

- Software Engineering for Safety-Critical Systems
 - What are such system examples around us?
 - How is engineering for such different from other systems?
- Software Engineering for Cyber-Physical Systems(CPS)?
 - What is CPS?
 - Why is it important?
 - What are engineering issues for CPS?
- Software Engineering for Internet Services
 - What are the companies for providing internet services

SE for Safety-Critical Systems

- Safety-Critical Systems(SCS)
 - Examples of SCS:
- Suppose that your system's MTTF is 365days.
 - MTTF: Mean Time To Failure
 - Are you going to ride that airplane, unmanned vehicle?
 - Do you accept a nuclear power plant in your town?
- Is SE more important for SCS than for other non-SCS?
 - Most of Systems become more dependent on software than
 - How can we ensure **reasonable safety** on systems around us?
 - How is software different from hardware with respect to safety

SE for CPS(1/3)

- Cyber Physical Systems(CPS)
 - System with embedded sw, which:
 - Directly record physical data using sensors and affect physical processes using actuators,
 - Evaluate and save recorded data, and actively or reactively interact with the physical and digital world,
 - Are connected with one another and in global networks via global communication facilities,
 - Use globally available data and services,
 - Have a series of dedicated, multi-modal human-machine interfaces
 - Example systems: Medical CPS, Smart Grid, Smart buildings, autonomous vehicles, ...

SE for CPS(2/3)

CPS SW characteristics requiring new SW approaches

- Real-time support
- Heterogeneous devices
- Distributed processing
- Security and privacy
- Reliability and Fault tolerance
- Communication
- Mobility
- Power limitation
- Integration with other systems
- Context awareness

SE for CPS(3/3)

(SE Challenges for CPS)

- Analysis Complexity
 - Collect and analyze functional and non-functional requirements
 - Deal with wide range of disciplines: SE, ME, EE, ...
- Design Complexity
 - Satisfy a large set of requirements imposed by various entities including CPS components, application logic, external entities
- Implementation Complexity
 - Use of different dev. Environments, PLs, and interface mechanisms
 - Integration with existing services, ..
- Testing Complexity
 - Ensure compliance with regulations and requirements

SE for Internet Services (1/3)

- What are the companies doing business through platforms by providing internet services to customers and/or consumers?
 - Customer vs. Consumer
 - What are the companies doing business well with consumers?
 - FAANG!



- SE issues for (platform based) internet service
 - What issues?

SE for Internet Services (2/3)

Customer vs. Consumer

(<http://smallbusiness.chron.com/customer-consumer-definitions-5048.html>)

- What's the difference?
- Customers are the ones who purchase your products.
- Consumers are the ones who actually use your products, so the customer may not be the actual consumer of your product.
 - For example, suppose you own a small business that manufactures and distributes children's games or toys. While the children are the actual users, or consumers, of your product, they are not your customers. Instead, the customers are the parents of the children who actually purchase your products for them.
 - For another example, a customer is best exemplified by a coffee shop, that buys a coffee maker, from a coffee maker manufacturer. This means that the restaurant buys the said equipment, for the benefit of its patrons or guests. In this connection, the restaurant is clearly pictured as a customer and not the actual consumer.
(<http://www.differencebetween.net/language/difference-between-customer-and-consumer/>)

SE for Internet Services (3/3)

Customer vs. Consumer

- Someone told that Amazon dealt with *consumer* and Google dealt with *customer*, or Amazon was the first to treat its users as consumer. That might be a reason why Amazon achieved a bigger success than Google nowadays.
- How is the 'customer vs consumer' issue related to SE?
 - Is SE for customer or consumer?
 - When you develop a software system, who you have to deal with?
 - Technically, to support business for consumer, what do we need to do as a software engineer?

Latest Trends in software industry(2017)

(<https://apiumhub.com/tech-blog-barcelona/tech-trends-software/>)

- Programming Languages
 - Typescript/Javascript, Java 9, Kotlin, Swift, Scala
- Software Architecture
 - Microservices, Docker, Reactive programming, Resilient SW design
- Frameworks
 - Angular 4, React.js, Spring, Express.js,

5 SW Development Trends for 2018

<https://stackify.com/software-development-trends-2018/> (NOV., 2017)

- Demand for Blockchain developers will explode
 - Only 5K developers in 2016: 18M Java...
- IoT gets pushed to the edge
 - [Edge computing](#)
 - [BizDevOps](#)
- Cybersecurity reaches an inflection point
 - [Lack of talents,](#)
 - [Automated security testing](#)
- AI becomes a necessity
- Virtual reality (might) go mainstream

Trends 2017 & 2018

- How many CS things addressed do you know of, or at least hear about?
 - Technology keeps changing so fast: will be faster and faster.
 - How to catch them all or just a few?
 - How to identify which one to choose?
- Recent Technology trends
 - Low-code platform,
 - Container: Docker, Kubernetes
 - Software 2.0, etc
- Really, really important to understand fundamentals of technology!!

How to Prepare for Future as S/W Engineer or Computer Scientist

- As a Programmer?
- As a Software Engineer?
- As a Computer Scientist?
- As an Engineering Major?
 - What's the major difference between Science and Engineering?

Topics to be Covered in CS350 SE

- SE: Past, Present, Future
- SE principles
- SW Dev. Processes (life cycle models)
- SW qualities
- SW requirements analysis & specification
- SW design
- SW testing
- New trend: continuous Software Engineering,....