INTRODUCTION TO SOFTWARE ENGINEERING

2. SOFTWARE LIFE CYCLE

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1. Business Application System
2. System Life Cycle
3. Software Life Cycle Process
4. Software Implementation/Development Process

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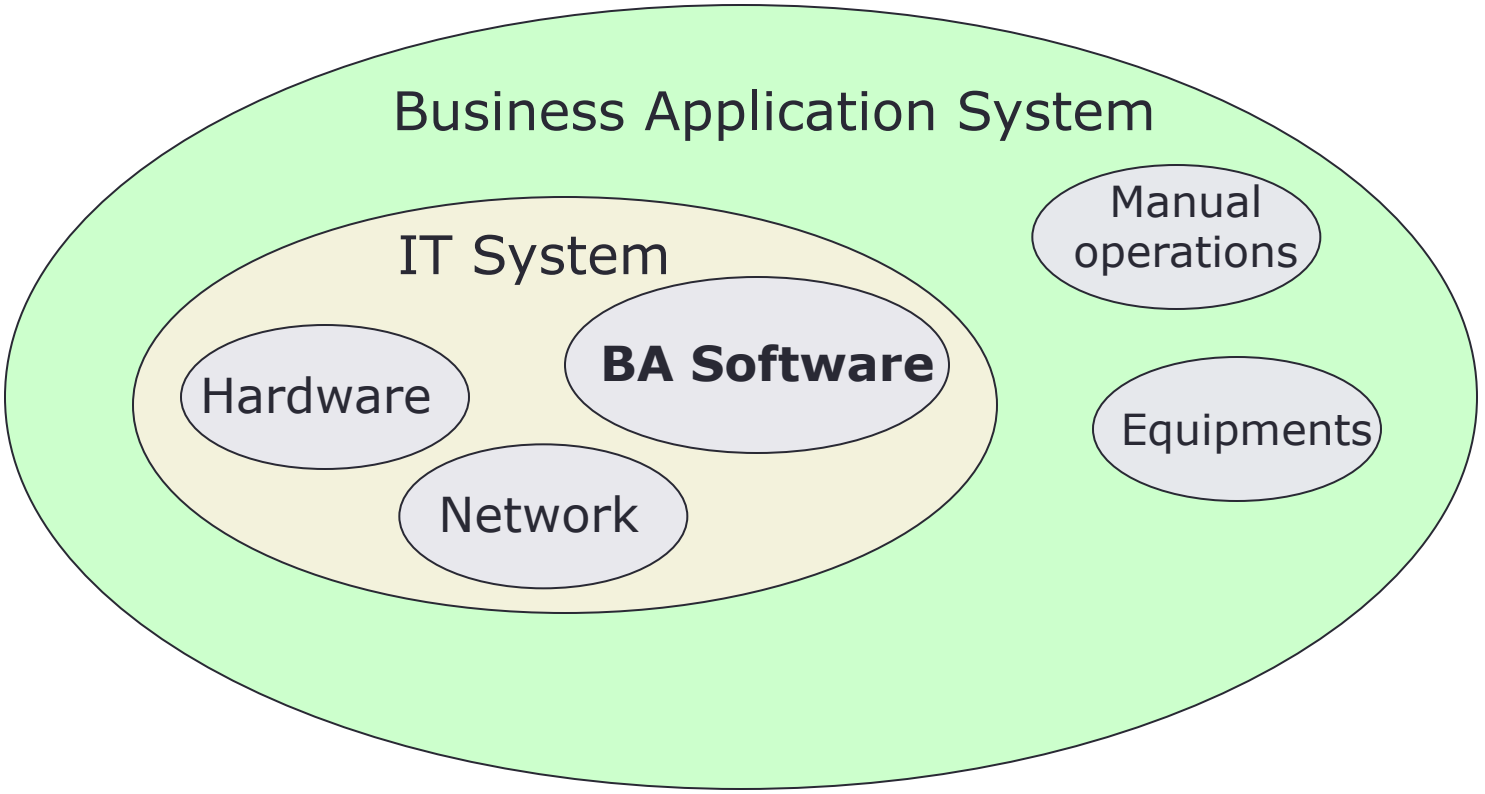
What is a Business Application System?

- "Whole system to accomplish the business"
  - Example: Personnel System, Payment System…
  - In this course, Computerized **BA System** is treated.
- The **BA System** includes:
  - hardware, networks, software*, and manual operations
    - software*: Includes platform software (OS…), middle software, and "**Business Application Software**"

A big picture of Business Application System



Importance of new IT System

- “There is No new business without new IT system”
- IT system enables organizations to react, respond, serve, store, retrieve, disseminate, and control their new valuable asset that is information.

➔ BA Software is the main component to computerize business tasks for the BA system

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Life Cycle of BA System

- Life Cycle: from birth until death
- BA system: from the conception to the retirement

1. **Conception**: Project request
   ↓
2. **System Initiation**: System proposal
   ↓
3. **System Development:** Includes the development of BA software
   ↓
4. **System Deployment**
   ↓
5. **System Operation and Maintenance**

→ Disposal (retirement) as the end of maintenance

System and Software development

- System Requirements Analysis
  - Stakeholder's requirements are extracted and defined
- System Architectural Design process
  - Envisage whole system structure is designed and the system components such as hardware, software, network, manual operation
- System Integration
  - Integrate the components including the business application software into a system
- System Qualification Testing
  - If the test is successful completion, Software developer can start to prepare the software deliverables

➔ Development of Application Software as a component of the System

System and Software operation/maintenance

- System Operation
  - Software Installation/Acceptance at same time
    - Installation of the software product in the target environment
    - Acceptance review and testing of the software product
    - Depending on the contract, software developer has to assist the activities.
  - Operation of Application System and Software
    - New Business based on the new system starts then!!!
- System maintenance
  - Software Maintenance at same time
    - Depending on the contract, software developer has to assist the activities.

➔When the operation are terminated, it is the system/software is disposed, the maintenance is also terminated.

How software is made – Video

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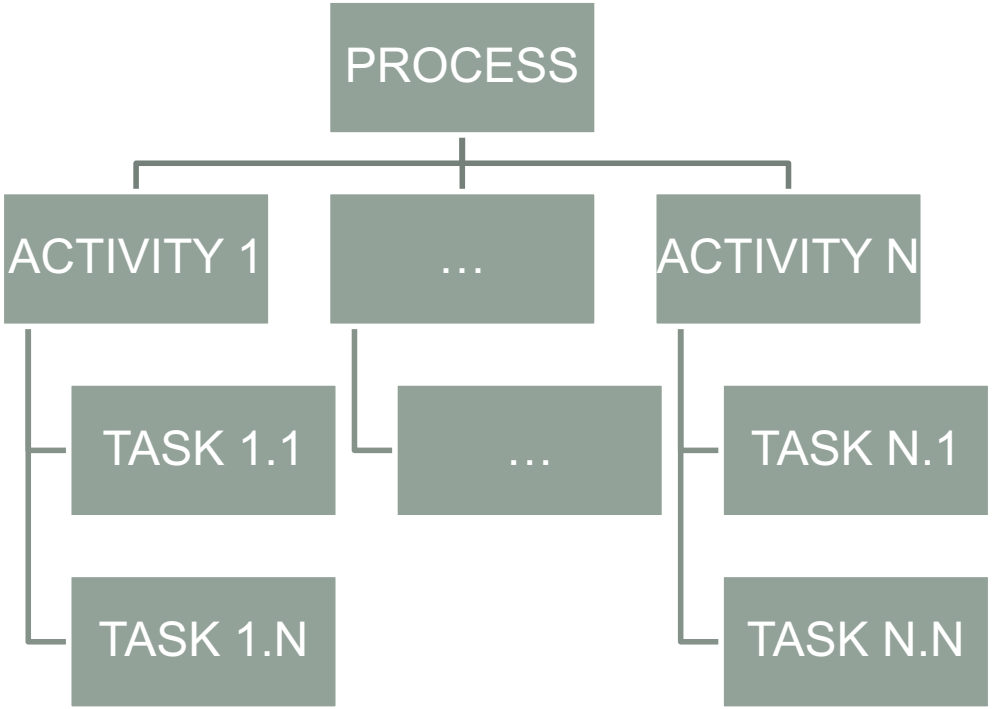
3. Software Life Cycle Process

- “ISO/IEC 12207:2008, Systems and software engineering — Software life cycle processes”
  - The latest and International Standard Software Development Process
- “The life cycle begins with an idea or a need that can be satisfied wholly or partly by software and ends with the retirement of the software.”
- Standard implementation works
  - hierarchically as processes



What are International Standards?

- In ISO, all industry standards, including Information Technology, are developed.
- In the field of Information Technology, in ISO/IEC JTC1, international standards are developed.
- ISO/IEC JTC1 has 32 principal member bodies which develop the international standards, and 44 observer member bodies.
- Some abbreviation
  - ISO: International Organization for Standard
  - IEC: International Electrotechnical Commission
  - JTC1: Joint Technical Committee

Why International Standards?

- Standards are important, especially in ICT
  - Basis of common understanding such as frameworks, and terminology / definitions
  - TBT Agreement of WTO recommends the use of ISO Standards for governmental purchase in affiliate countries
  - Based on some standards, the certifications can be got, and they make some appeal points in international transaction

WTO: World Trade Organization

TBT Agreement: Agreement on Technical Barriers to Trade

Software Life Cycle Process

- "This International Standard groups the activities that may be performed during the life cycle of a software system into seven process groups"[1]*:
  1. Agreement Processes: 2 processes
  2. Organizational Project-Enabling Processes: 5 processes
  3. Project Processes: 7 processes
  4. Technical Processes: 11 processes
  5. **Software Implementation Processes: 6 processes**
     - **Purpose: "to produce a specified system element implemented as a software product or service"** [1]**.
  6. Software Support Processes: 8 processes
  7. Software Reuse Processes: 3 processes

[1]*: clause 5.2.1; pp. 13, [1]**: clause 7.1.1.1; pp. 57,

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Software Development Life Cycle – Video

4. Software Implementation Process

System Requirements Analysis Process and System Architectural Design Process are achieved just before Software Implementation/Development Process.

Software Implementation Process includes the following lower-level processes:

1. **Software Requirements Analysis Process**
2. **Software Architecture Design Process**
3. **Software Detailed Design Process**
4. **Software Construction Process**
5. **Software Integration Process**
6. **Software Qualification Testing Process**

3.1. Software Requirements Analysis process

- Purpose: "to establish the requirements of the software elements of the system" [1]
- Main items written on the brief requirement description
  - **System environmental conditions** under which the software is to perform.
  - The **functional requirements** and the **interface requirements**.
  - **Data definition and database requirements**.
  - Some **non-functional requirement** items such as reliability, usability, time efficiency
  - **Qualification requirements**: The requirements are used as criteria or conditions to qualify a software product as complying with its specifications.

[1]: Session 7.1.2.1; pp. 59

3.2. Software Architectural Design process

- Purpose: "to provide a design for the software that implements and can be verified against the requirements" [1]
- Software architecture is designed from the software requirements
- Main items
  - a top-level structure of the software and the software components which constructs the software
  - a top-level design for the interfaces external to the software and between the software components
  - a top-level design for the database

[1]: Session 7.1.3.1; pp. 61

3.3. Software Detailed Design process

- Purpose: "to provide a design for the software that implements and can be verified against the requirements and the software architecture and is sufficiently detailed to permit coding and testing" [1]
- A detailed design for each software components are developed. In the detailed design, the following items are developed:
  - **each component** is refined into **software units** that can be coded, compiled, and tested
  - **the interfaces external to the software item**, **between the software components**, and **between the software units**

[1]: Session 7.1.4.1; pp. 62

3.4. Software Construction process

- Purpose: "to produce executable software units that properly reflect the software design" [1]
- Main items to be developed:
  - Each software unit and database
  - Test procedure and test data for software unit and database
  - Unit tests and database test
- The implementer shall evaluate software code and test results considering internal external consistency, test coverage of units and, traceability to the requirements and design of the software.

[1]: Session 7.1.5.1; pp. 63

3.5. Software Integration process

- Purpose: “to combine the software units and software components, producing integrated software items, consistent with the software design, that demonstrate that the functional and non-functional software requirements are satisfied on an equivalent or complete operational platform” [1]
- Main tasks
  - An integration plan, including test requirements, test procedure, and test cases/data.
  - Integration of software units/components
  - Program/software/integration test

[1]: Session 7.1.6.1; pp. 64

3.6. Software Qualification Testing Process

- Purpose: "to confirm that the integrated software product meets its defined requirements" [1].
- Qualification testing in accordance with the qualification requirements for the software item is conducted
  - Tests, test cases, and test procedures
- The implementer supports audit(s) to conform the software meets to the qualification requirements
  - If it is successful completion of the audits, the implementer prepare the deliverable software product for System Construction process

[1]: Session 7.1.7.1; pp. 66

Summary

- “Software Life Cycle Process – SLCP” is **the international standard** processes focused on the development and support of Application Software.
- SLCP can be used as **a common language** among the stakeholders such as acquirers and suppliers. They can communicate or order the software development using SLCP. For example, we can say “To order **the software detailed design process or later software implementation processes** of new library system”.

Learning points

"The customer's business success depends on the system development success."

BA Software is one of the major components of the BA System.

What are the main factors for the system development success?

1. The Software to be developed meets to **functional** requirements → ?
2. To keep appointed date of **delivery** → ?
3. Meets the required **quality** such as Reliability, Usability, Performance, Maintainability → ?
4. Necessary to provide **maintenance** activity during the system operation period → ?

Summary

- System Construction Process
  - Following the Software Implementation Process, **System Construction Process**, which consists of the following processes, are achieved
  - Software Developer may assist the following processes depending on contract
    - System Integration Process
    - System Qualification Testing
    - Software Installation Process
    - Software Acceptance Support Process

Summary (2)

- “Software Life Cycle Process – SLCP” is **the international standard** processes focused on the development and support of Application Software.
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