Lecture SPM

Quality Standard (ISO-9126)

CMMI

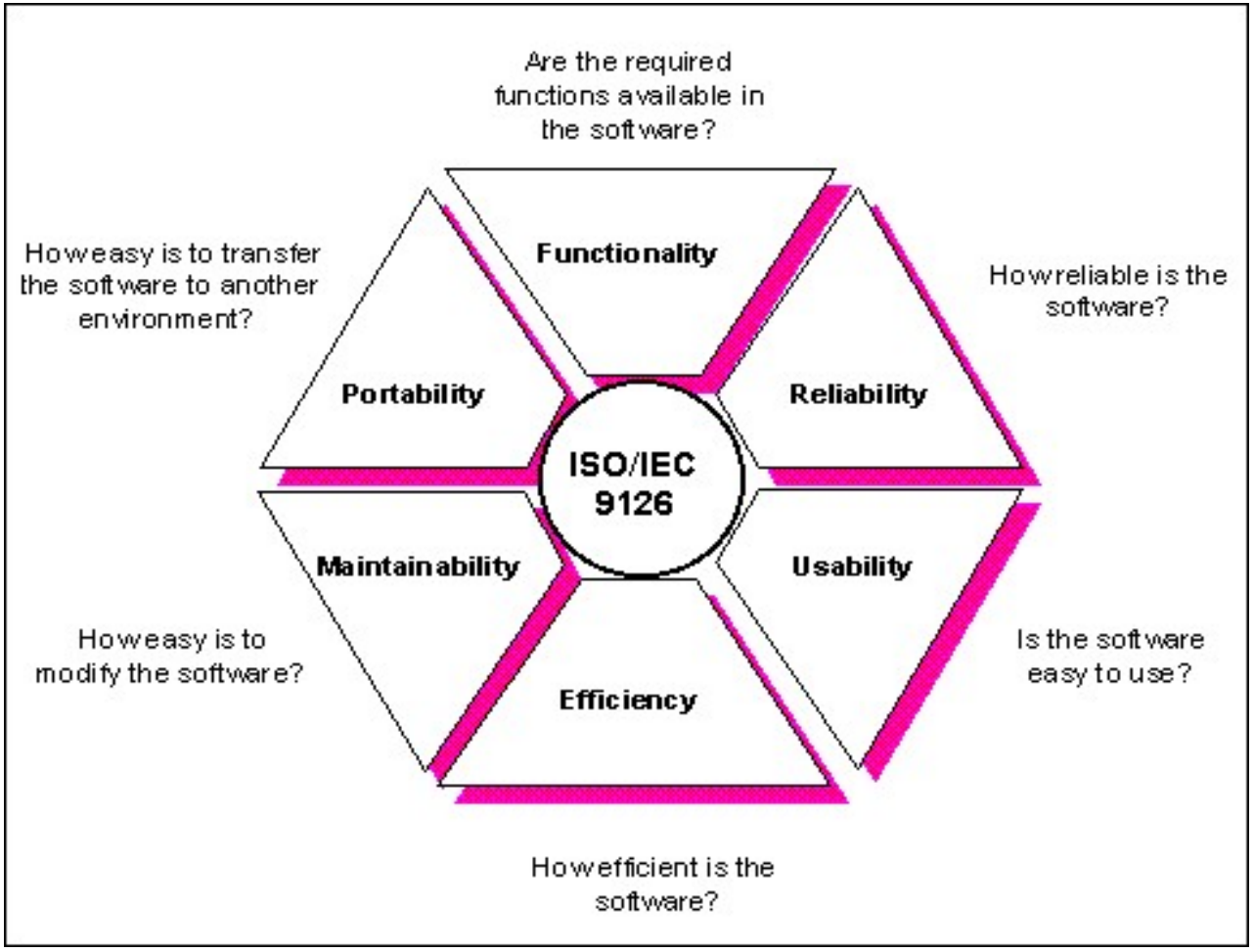
Quality Standards and Frameworks

- Two approaches to software that can be followed to ensure software quality:
  - Process based: assurance of the process by which a product is developed (ISO 9001, ISO 9000-3 provides guidelines for the application of the ISO 9001)
  - Product based: the evaluation of the quality of the end product (ISO 9126).
- Both approaches are important and both require the presence of a system for managing quality.

QUALITY FRAMEWORKS AND ISO-9126

- Various models or frameworks have been proposed to accommodate these different quality views and expectations, define quality and related attributes, features, characteristics, and measurements.
- ISO-9126 (ISO, 2001), the mostly influential one in the software engineering community today, and discuss various adaptations of such quality frameworks for specific application environments.
- Causal relationship from intangible quality views to tangible software measures.

ISO-9126


Are the required functions available in the software?
Functionality
How reliable is the software?
Reliability
Is the software easy to use?
Usability
How efficient is the software?
Efficiency
How easy is to modify the software?
Maintainability
How easy is to transfer the software to another environment?
Portability
ISO/IEC 9126

ISO-9126

- Functionality: A set of attributes that bear on the existence of a set of functions and their specified properties. The functions are those that satisfy stated or implied needs. The sub-characteristics include:
  - **Suitability- to the user's needs**
  - **Accuracy- of results**
  - **Interoperability- with other systems**
  - **Security- against unintended access**

- *Reliability: A set of attributes that bear on the capability of software to maintain* its level of performance under stated conditions for a stated period of time. The sub-characteristics include:
  - **Maturity- frequency of failures**
  - **Fault Tolerance- performance in case of faults**
  - **Recoverability- of functionality and data loss**

ISO-9126

- Usability: A set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users. The sub characteristics include:
  - **Understandability**
  - **Learnability**
  - **Operability**
- *Efficiency: A set of attributes that bear on the relationship between the level of performance* of the software and the amount of resources used, under stated conditions. The sub-characteristics include:
  - **Time behavior**
  - **Resource behavior**

ISO-9126

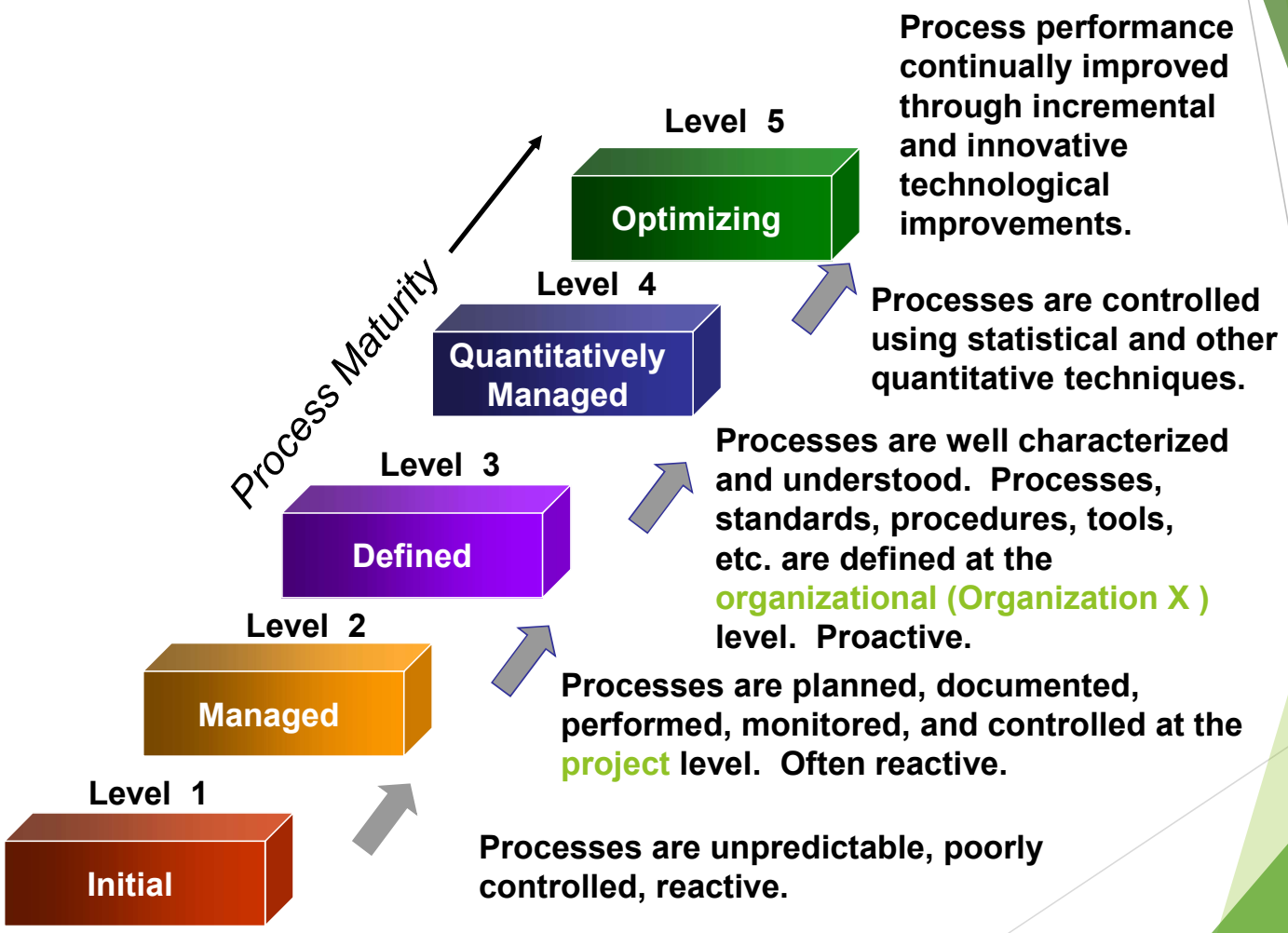
- Maintainability: A set of attributes that bear on the effort needed to make specified modifications. The sub-characteristics include:
  - **Analyzability- effort for diagnosis**
  - **Changeability- ease of modification**
  - **Stability- after change**
  - **Testability- effort required for testing after change**

- *Portability*: *A set of attributes that bear on the ability of software to be transferred* from one environment to another. The sub-characteristics include:
  - **Adaptability**
  - **Installability**
  - **Conformance**
  - **Replaceability**

What is CMMI?

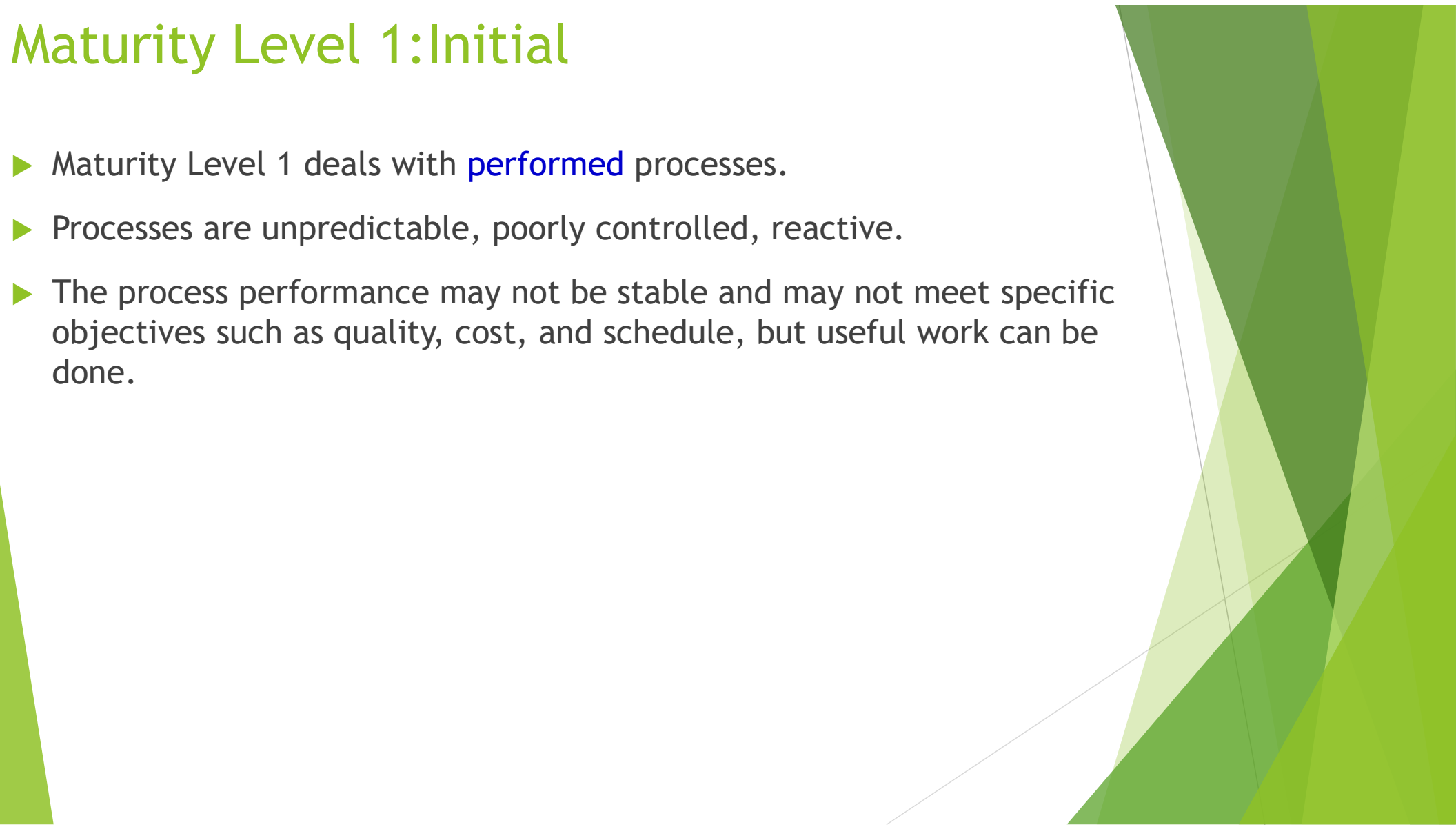
- CMMI (Capability Maturity Model Integration) is a proven industry framework to improve product quality and development efficiency for both hardware and software
  - Sponsored by US Department of Defence in cooperation with Carnegie Mellon University and the Software Engineering Institute (SEI)
  - Many companies have been involved in CMMI definition such as Motorola and Ericsson
  - CMMI has been established as a model to improve business results
- CMMI, staged, uses 5 levels to describe the maturity of the organization, same as predecessor CMM
  - Vastly improved version of the CMM
  - Emphasis on business needs, integration and institutionalization

CMMI Staged Representation - 5 Maturity Levels



Maturity Level 1:Initial

- Maturity Level 1 deals with performed processes.
- Processes are unpredictable, poorly controlled, reactive.
- The process performance may not be stable and may not meet specific objectives such as quality, cost, and schedule, but useful work can be done.



Maturity Level 2: Managed at the Project Level

- Maturity Level 2 deals with managed processes.
- A managed process is a performed process that is also:
  - Planned and executed in accordance with policy
  - Employs skilled people
  - Adequate resources are available
  - Controlled outputs are produced
  - Stakeholders are involved
  - The process is reviewed and evaluated for adherence to requirements
- Processes are planned, documented, performed, monitored, and controlled at the project level. Often reactive.
- The managed process comes closer to achieving the specific objectives such as quality, cost, and schedule.

Maturity Level 3: Defined at the Organization Level

- Maturity Level 3 deals with defined processes.
- A defined process is a managed process that:
  - Well defined, understood, deployed and executed across the entire **organization** (Proactive)
  - Processes, standards, procedures, tools, etc. are defined at the organizational (Organization X) level. Project or local tailoring is allowed, however it must be based on the organization's set of standard processes and defined per the organization's tailoring guidelines.
- Major portions of the organization cannot "opt out."

Behaviors at the Five Levels

Maturity Level	Process Characteristics	Behaviors
5 Optimizing	Focus is on continuous quantitative improvement	Focus on "fire prevention"; improvement anticipated and desired, and impacts assessed.
4 Quantitatively Managed	Process is measured and controlled	Greater sense of teamwork and inter-dependencies
3 Defined	Process is characterized for the organization and is proactive	Reliance on defined process. People understand, support and follow the process.
2 Managed	Process is characterized for projects and is often reactive	Over reliance on experience of good people – when they go, the process goes. “Heroics.”
1 Initial	Process is unpredictable, poorly controlled, and reactive	Focus on "fire fighting"; effectiveness low – frustration high.

CMMI Components

- Within each of the 5 Maturity Levels, there are basic functions that need to be performed – these are called Process Areas (PAs).
- For Maturity Level 2 there are 7 Process Areas that must be completely satisfied.
- For Maturity Level 3 there are 11 Process Areas that must be completely satisfied.
- Given the interactions and overlap, it becomes more efficient to work the Maturity Level 2 and 3 issues concurrently.
- Within each PA there are Goals to be achieved and within each Goal there are Practices, work products, etc. to be followed that will support each of the Goals.

CMMI Process Areas

Maturity Level	Project Managment	Engineering	Process Management	Support
5 Optimizing			Organizational Innovation & Deployment	Causal Analysis & Resolution
4 Quantitatively Managed	Quantitative Project Mngt		Organizational Process Performance	
3 Defined	Integrated Project Mngt Risk Management	Requirements Development Technical Solution Product Integration Verification Validation	Organizational Process Focus Organizational Process Definition Organizational Training	Decision Analysis & Resolution
2 Managed	Project Planning Project Monitoring & Control Supplier Agreement Mngt	Requirements Mngt		Measurement & Analysis Process & Product Quality Assurance Configuration Mngt
1 Initial				

Example

- For the Requirements Management Process Area:
- An example **Goal** (required):
  - "Manage Requirements"
- An example **Practice** to support the Goal (required):
  - "Maintain bi-directional traceability of requirements"
- Examples (suggested, but not required) of typical **Work Products** might be:
  - Requirements traceability matrix or
  - Requirements tracking system