<table>
<tr><td>project</td><td>is a temporary endeavor undertaken to create a unique product, service, or result</td></tr>
<tr><td colspan="2">Characteristics of a Project</td></tr>
<tr><td>Temporary</td><td>–Definitive begin and end (either because the goals are met orthe project is closed -goals cannot or will not be met)
–Projects’ results are not necessarily temporary(see project and product lifecycle)</td></tr>
<tr><td>Unique products, service, or result</td><td>–A product which is quantifiable (e.g. a component,…)
–A capability to perform a service, such a business function
–A result, such as knowledge (collected in documents, presentation,…)</td></tr>
<tr><td>Progressive elaboration</td><td>–Development by steps and in increments (necessary to keep a project under scope)</td></tr>
<tr><td>Resource constrained</td><td>(like everything else in life)</td></tr>
<tr><td colspan="2">Project Management Context</td></tr>
<tr><td>Subprojects</td><td>Projects may be divided in sub projects(although the sub projects may be referred to as “projects” and managed as such)</td></tr>
<tr><td>Project and Program Management</td><td>–Set of related projects managed in a coordinated way in order to achieve some sort of benefit</td></tr>
<tr><td>Portfolios and Portfolio Management</td><td>–Collection of unrelated projects or programs and other work grouped together to facilitate management and meet strategic objectives</td></tr>
<tr><td colspan="2">Types of application development</td></tr>
<tr><td>One-offs</td><td>systems specifically created for a client</td></tr>
<tr><td>Off-the-shelf</td><td>to fill the need of a large set of users</td></tr>
<tr><td>Customized off-the-shelf</td><td>Standardized systems which require a significant amount of customization to be used in an organization.
Example: Enterprise Resource Planning (ERP) systems</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Process and Systems Re-Engineering
• Goal: change the way in which the operational work of an organization is carried out to achieve some strategic goal (e.g., improve quality, become more efficient)</td></tr>
<tr><td colspan="2">System Integration Services
Goal: automating the information flow among the systems of an organization</td></tr>
<tr><td colspan="2">Types of integration</td></tr>
<tr><td>Vertical:</td><td>integration of systems performing similar operations</td></tr>
<tr><td>Horizontal:</td><td>integration of systems automating different steps of a procedure</td></tr>
<tr><td colspan="2">Other types of Projects</td></tr>
<tr><td>Consulting Services</td><td>–Typically asked to gain a know-how outsize a company’s core competence</td></tr>
<tr><td>Installation and Training Services</td><td>–Services related to the installation or training on specific software systems
–Remark: also a revenue model in open source development</td></tr>
</table>

<table>
<tr><td>project stakeholder</td><td>Is any individual or an organization that is actively involved in a project, or whose interest might be affected (positively or negatively) as a result of project execution or completion?</td></tr>
<tr><td colspan="2">The Players Some characteristics
• They may have different influence and varying level of responsibility during the project
• They may play different roles
• They may have positive or negative influence on the project
• They may be difficult to identify
• Their lack of intervention may negatively influence the project (need for identification and involvement)</td></tr>
<tr><td colspan="2">Types of Stakeholders :
• The project manager
• The project team
• The project sponsor
• The performing organizations
• The partners
• The client
• The “rest”: anyone who might be affected by the project outputs</td></tr>
<tr><td colspan="2">Key Stakeholders</td></tr>
<tr><td>Internal:</td><td>–Project team members: the group performing the work
–Project management team: the members of the team directly involved in project management</td></tr>
<tr><td>In between:</td><td>–Customer/User: person or organization that will use the results of a project. There may be multiple layers of users
–Sponsor: person or group providing the financial resources
–Performing Organization: the organization mostly involved in the project</td></tr>
<tr><td>External:</td><td>–Influencers: people or groups not directly related to the project who could influence the course of a project</td></tr>
<tr><td colspan="2">The code of conduct of the PMI:</td></tr>
<tr><td>Responsibility:</td><td>•the duty of taking ownership of decisions made or failed to make and their consequences</td></tr>
<tr><td>Respect:</td><td>• the duty of treating with respect the resources assigned to us, such as people, money, reputation, environment, and so on</td></tr>
<tr><td>Fairness:</td><td>• the duty of taking decisions impartially and objectively</td></tr>
<tr><td>Honesty:</td><td>• the duty of acting in a truthful manner</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Software project management</td><td>Is the integration of management techniques to software development</td></tr>
<tr><td colspan="2">Requirements
•Goal: Forming a shared view about the characteristics of the system tobuild</td></tr>
<tr><td colspan="2">List of Requirements</td></tr>
<tr><td>Format:</td><td>Free or structured text describing the functions and other properties of a system</td></tr>
<tr><td>Advantages</td><td>• Simple to draft and distribute
• The format can be used to keep track of changes(versioning)</td></tr>
<tr><td>Disadvantages</td><td>• No focus on user interaction: it can be difficult to understand for a customer
• Ambiguities and incoherencies; interactions among requirements</td></tr>
</table>

Use Case Diagrams	
Format:	• Diagrams describing the interaction between users and the system • Textual description of the interaction as a sequence of steps
Advantages	• Intuitive, simpler to understand for a customer • It focuses on what the system does (user functions)
Disadvantages	• Difficult to represent and keep track of non-functional requirements • Managing diagrams requires a bit more work than working with text only
User Stories	
Format:	Structured textual descriptions of user functions: As a [user] I want to do [this] because [of that]
Advantages	Intuitive, compact, and simple to understand for a customer It focuses on what the system does (user functions)
Disadvantages	• Difficult to represent and keep track of non-functional requirements • It is a partial specification (many details need to be worked out during the implementation) -used by Agile methodologies
Requirements Engineering • Goal: Define and maintain requirements overtime	
Requirements Structuring • Goal: Improving maintenance of requirements over time	
User Experience Design • Goal: Providing a coherent and satisfying experience on the different artifacts that constitute a software system, including its design, interface, interaction, and manuals	
Tools:	**User-centered analysis:** understanding how users will interact with the system (focus groups, experiments) **User-centered design:** specifying how users will actually interact with the system(storyboards, mock-ups, prototypes)
Requirements Validation	
Inconsistencies	scenario 1: the system should always abort in case of error scenario 2:the system should recover from a sensor-reading error
Incompleteness	the behavior is not specified for certain cases and situations
Duplicates	the same requirements is described twice (possibly in differentways)
Business process modeling models the way in which an organization works	
Business process re-engineering	plans the way in which an organization works, to make its operations more efficient ("as is" and "to be")
System Design • Goal: Defining the structure of the software to build (= systemarchitecture)	
The activity is relevant also for managerial reasons: the system architecture provides a "natural" decomposition of work	
ArchitecturalPatterns	
Pipe and filter	• Composition of data processing units • Focus: I/O specification
Layered/Hierarchical	• Hierarchy of components • Focus: control and information flow; block responsibilities
Data-Centric	• MVC: data, presentation, and logic • Focus: data model, operations • Many web applications and many desktop applications use the data-centric architectural style

Client-server	• Server (main functions) and clients (requesting services) • Focus: communication protocol / service specifications
Verification	Did we build the system right
Validation	Are we building the right system?
The main (but not the only)way of performing V&V for software systems is testing	
Verification and Validation Part of quality management	
Types of Testing	
Unit testing	Scope: a piece of code, such as a class
Integration testing	• Scope: the interaction between twocomponents • Mars Climate Orbiter bug: two components used different units (metric and imperial); • ~400M USD loss.
System testing	• Scope: the system behaves as expected and implements correctly all the requirements • Test cases
Usability testing	• Scope: verifying whether the user experience and interaction is intuitive, effective, and satisfying • Used to reduce the probability of human errors (safety-critical systems).
Factors to consider	
human factor	Is the people ready to use thesystem
data factor	Is all the data which is needed for the system to run available to the new software?
hardware factor:	Are all interfaces ready and functional?
Cut-over:	the new system replaces the oldone
Parallel Approach:	the old and the new system operate simultaneously for a period
Piloting:	the new system is installed for a limited number of users or for a specific business unit
Phased Approach:	functions are rolled out incrementally
Types of Maintenance	
Corrective,	if relative to fixing an issue discovered after the release of the system
Preventive,	if relative to fixing an issue discovered, but not occurred (or, at least, signaled by users)
Adaptive,	if relative to adapt a system to changed external conditions
Perfective,	if relative to improve some characteristics of a system, like, for instance, performances
value	generated by the project
risks	associated to the project
Value and risks can be assessed qualitatively or quantitatively	
Project Value:	–Direct and indirect value generated by the project –Sustainability of the project outputs –Alignment with strategic objectives of an organization
Project Risks	–Resource availability –Timing –Technical difficulties and uncertainties

<table>
<tr><td>Direct and Indirect Value</td><td>measures the positive and negative outcomes of a project and its outputs</td></tr>
<tr><td colspan="2">Direct and indirect value are strictly related to the business model.</td></tr>
<tr><td>Sustainability</td><td>refers to the capacity of sustaining the project and its outputs after the project end</td></tr>
<tr><td colspan="2">Often overlooked, especially when project execution generates revenues</td></tr>
<tr><td>alignment with the strategic objectives</td><td>measures how important and relevant a project is for the performing organization</td></tr>
<tr><td colspan="2">Priority, resource assigned, internal support, opportunities for the project team after the project end are all affected by how strategic a project is for an organization</td></tr>
<tr><td colspan="2">Payback Period
• Measured in months or years
• When using the payback period the projects/options that minimize the payback period are chosen in favor of the others</td></tr>
<tr><td>payback period</td><td>is the time taken to gain a financial return equal to the original investments</td></tr>
<tr><td colspan="2">Payback Weaknesses
• Different projects might have the same the same payback period, but different profiles in returning of the investments
• These profiles are not taken into account by the technique but could make the different between two projects</td></tr>
<tr><td>Return on Investment(ROI)</td><td>• ROI calculates the average annual profit and transforms it into a percentage of the total investments
• Profit = Returns - Investments
• Annual Profit = Profit / Duration
• ROI = Annual Profit / Investments</td></tr>
<tr><td colspan="2">When using ROI, choose the project with the highest ROI</td></tr>
<tr><td>Net Present Value</td><td>Net Present Value discounts sums in the future in order to provide a more realistic comparison between presents investments and future gains</td></tr>
</table>