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EH2750 Computer Applications in Power Systems, Advanced Course.

Lecture 9

4 November 2014

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Agenda

- Project Assignment
- Project Planning & Execution
- System specification tools

Structure of the Assignment

The project assignment is divided into three parts,

Part 1 of the Project assignment involves analysing Smartgrid application requirements on the IEEE 14 bus model, designing a solution and document this in a Use Case as specified in the Use Case assignment.

Part 2 of the assignment involves implementing the system using the components in the ICS lab with a specific focus on the Multi-agent platform JACK and all necessary process communication equipment such as RTUs and IEDs.

Part 3 Involves creating a final report about the conducted work and presenting the results to the colleagues in the course during a final seminar.

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Submission of Assignment

- The final part 3 (report) shall be submitted via e-mail in PDF format to Lars Nordström, no later than:

December 17th 2011 at 23.59

Grading of the Assignment

The grade of the project assignment is set as below:

4 Grade points or less	Fail
5 Grade points	Grade E
6 Grade points	Grade D
8 Grade points*	Grade C
10 Grade points*	Grade B
12 Grade points	Grade A

* = with at least 4 points in category C

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Grading categories

- **Project organisation & Independence** (taking own initiatives, clear presentation and individual contribution at steering group meetings, good organisation in the group.) **1-3 grade points**
- **Quality of project presentation** (report and presentation skills, language, figures, readability, pedagogic skills – making the work understandable and interesting.) **1-3 grade points**
- **Level of technical refinement** (How advanced, technically sound complete is the solution.) **1-6 grade points**

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Level of technical refinement:

- **1 Grade Point:** The design of the solution is presented using a consistent methodology and diagrams required during steering group meetings, and during the tracing of progress, risks are constantly monitored. The project team has developed a system that interfaces the hardware devices and ICS Village. However, the intended function was not implemented as specified. Note that this means that although the system is not working properly, the project team are able to interface the necessary system components but have not been able to implement the proper functionality.
- **2-3 Grade Points:** The project team has fulfilled all requirements for 1-2 credit point and also implemented a system that operates according to specifications in Annex II employing the artificial intelligence techniques presented in the course.
- **5-6 Grade Points:** The project team has implemented a system that operates according to the specifications in Annex II. In addition, the project team has developed additional functionality that was not considered in the specification.

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Project organization and independence:

- **1 Grade Point:** The project team presents the plan of the project at Steering group meetings.
- **2 Grade Points:** The project team performs planning of the project with clear time-plan and allocates task to individual members. This project plan is attached to the final report as an appendix to the project report, including minutes of project meetings, etc. During steering group meetings the students present clearly the progress.
- **3 Grade Points:** The project team fulfils all the requirements for 2 credit points. In addition, the additional functionality selected for implementation is tracked both in terms of progress as well as risks. The progress of the entire project is documented using appropriate templates.

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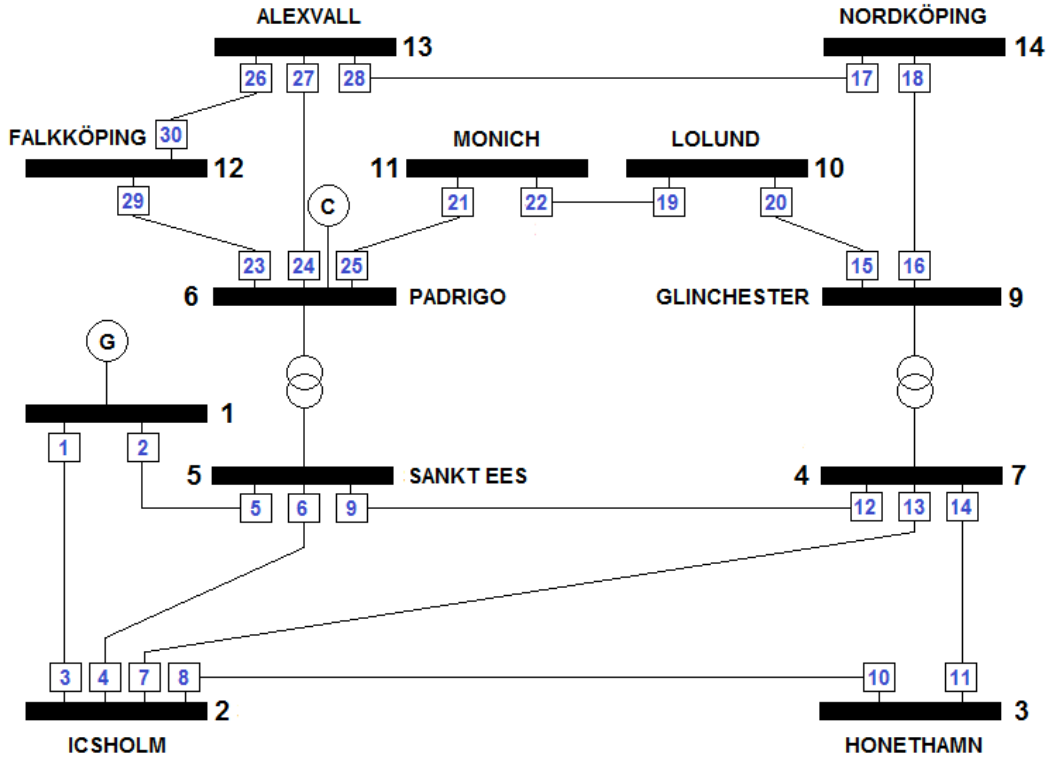
Quality of Project Presentation

- **1 Grade Point:** report in well-written English that describes the technical solution implemented handed in before deadline. The group performs an oral presentation at the final seminar.
- **2 Grade Points**: In addition to the requirements for 1 Grade Point, the following is necessary to achieve 2 Grade points: The report covers all stages of the project and it is easy to follow the steps in the project through clear presentations at the Steering group meetings. Most important is that design documents from the early stages of the project are updated to reflect the actual solution.
- **3 Grade Points**: In addition to the requirements for 2 Grade Point, the following is necessary to achieve 3 Grade points: The report describes the work during each of the steps of the project (Analysis, Design & Implementation) covering aspects such as which methods were used, what risks were identified and addressed, which problems arose and how were those addressed. The report clearly lists lessons learned from each step of the work. The report also clearly indicates individual effort of each team member during all phases of the project. Moreover, the report properly documents implementation of the bonus functionality.

Project Task at hand

- **Function 1 – FLIR – Fault Localisation, Isolation and Restoration**



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Review of some Project Management material

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Project phases

- A project is always divided into phases
- Each phase includes activities
- Check points for phases:
  - Milestone
  - Tollgate

Experience shows that such an approach provides a well thought through structure guiding the work to focus on the most important activities, ensuring final results of high quality

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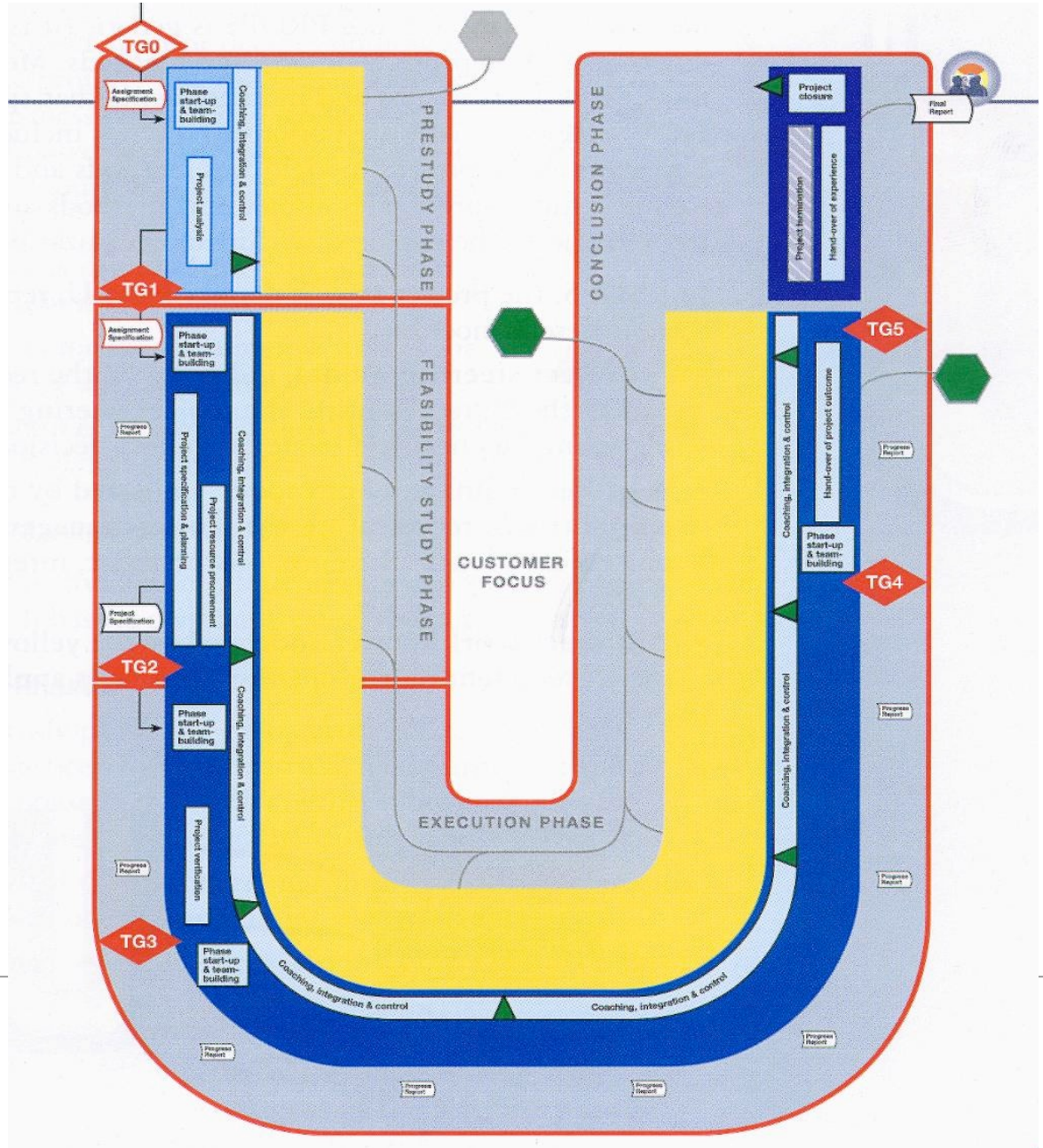
Basic phases

All projects include following phases:
(Name and number can vary)

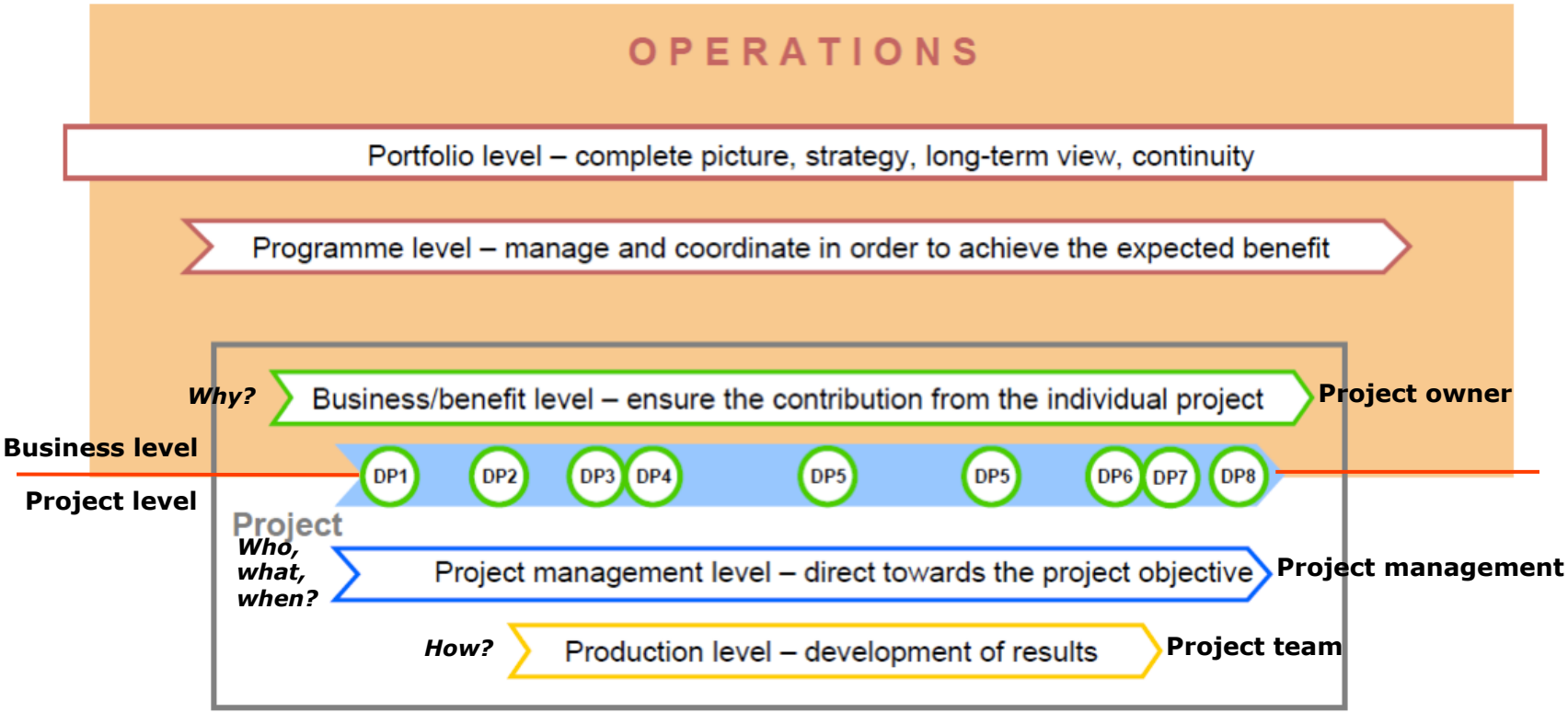
- Initiation
- Planning
- Execution
- Monitoring and control
- Closing

PROPS, or PROjektet ProjektStyrning



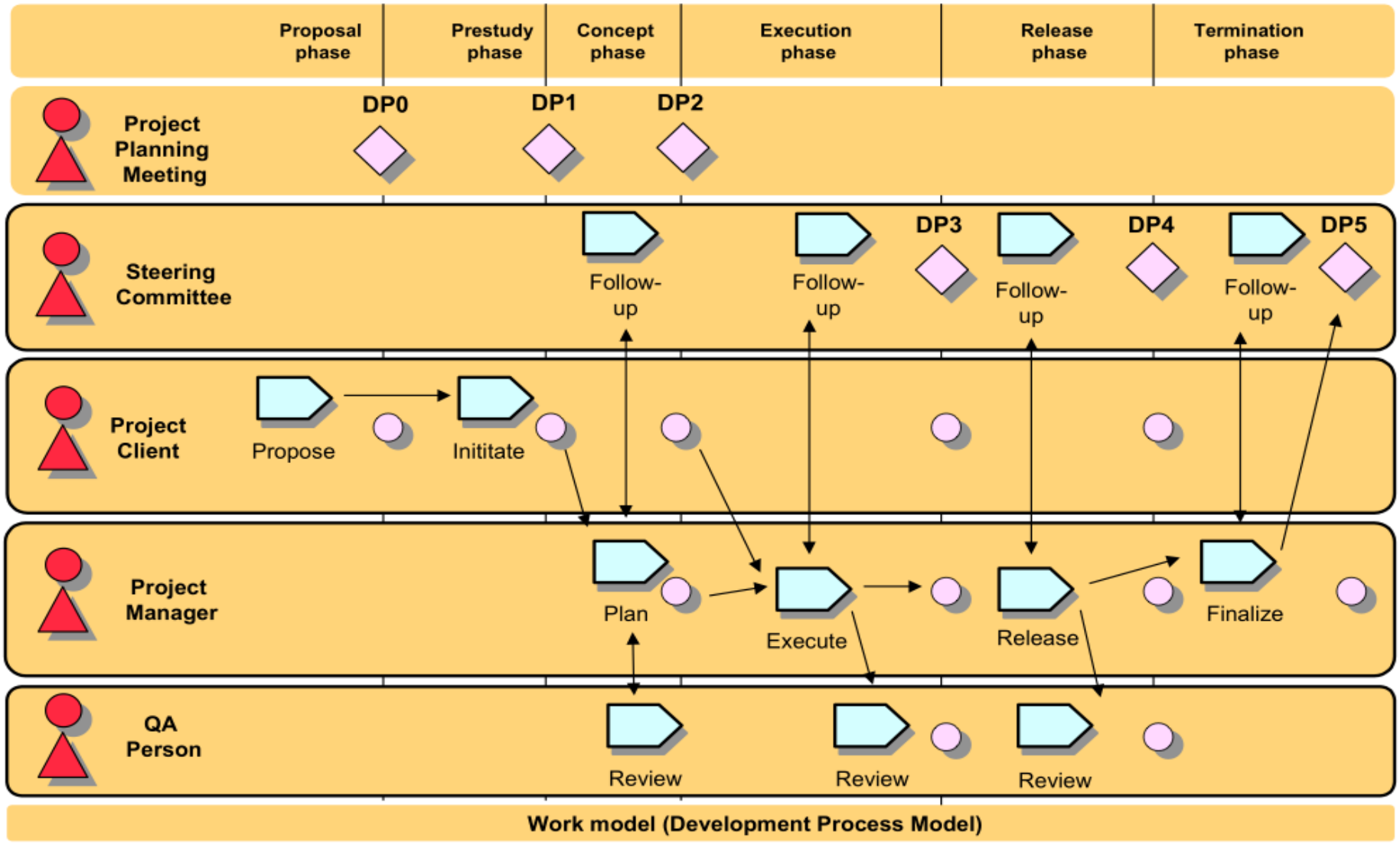
Source: PROPS

Practical Project Steering, PPS



Source: Tieto

Project model ABB Automation Products



Source: ABB

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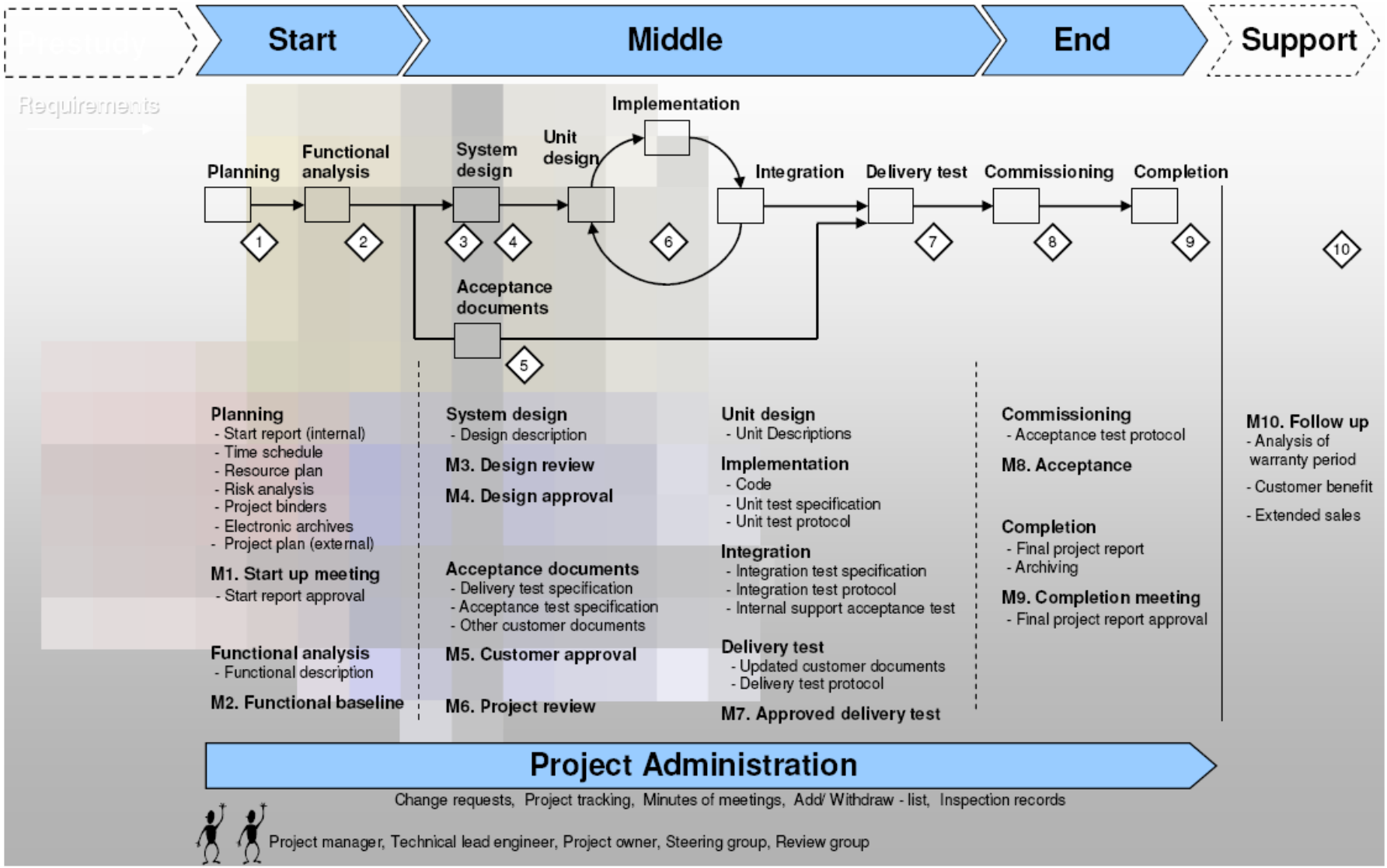
Prevas project model

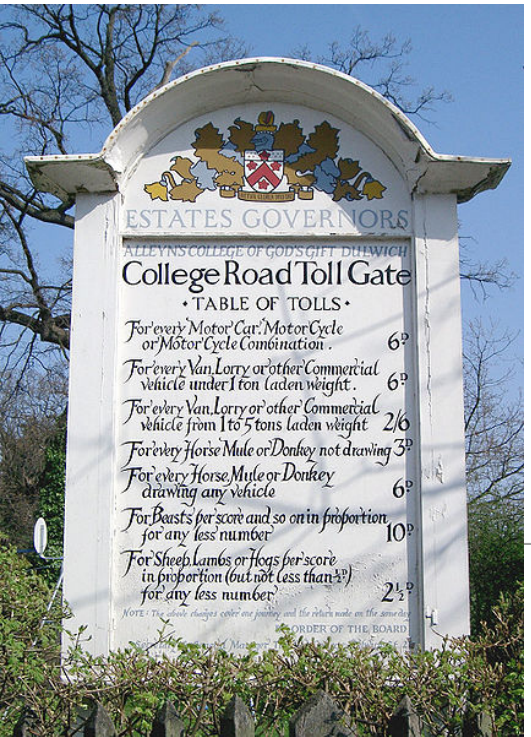


Source: http://www.it.uu.se/edu/course/homepage/pvt/Prevas.pdf

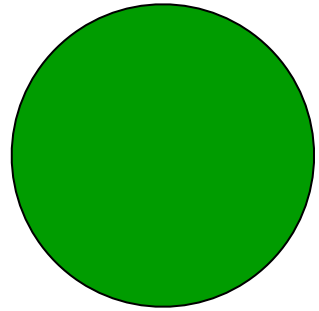
Choice of tollgates

Choosing tollgates is not hard

- The project's external check points with respect to the customer or project initiator
  - Most tollgates are more or less given by the customer, but it can be up to the project manager to plan them in a smart way

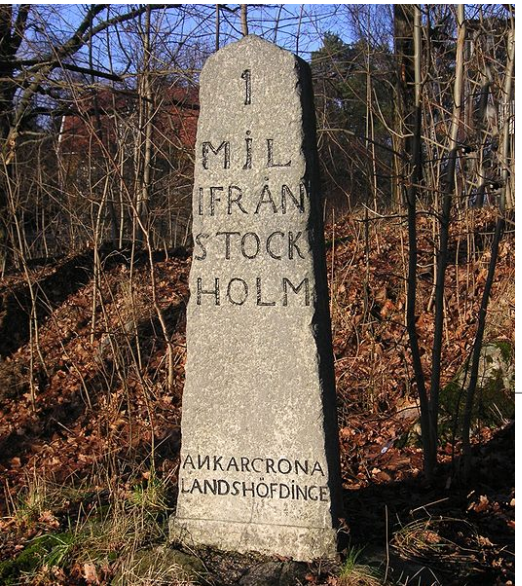


Choice of milestones



Choosing milestones is hard.

- The project's internal check points
  - Choose milestones so that you will *never* be late and *never* risk to miss a tollgate.
  - Don't put the milestones in direct relation to a tollgate
- Should be chosen so you think you can control the project



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(Name and number can vary)

- Initiation
- Planning
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Initiation

- Specify project goals, extent, content, delivery points and conditions
- Identify project stakeholders
- Assign a project manager
- Project sponsor ensures the project's initial resources and needs

Tollgate	Document
Project specification approved	Project specification/ pre-study

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Planning

- Go through and complete the feasibility study
- Analyze and define the outcome
- Describe the scope and results
- Select and adapt the approach
- Organizing the project and secure resources
- Planning and budgeting the project
- Perform risk and opportunity analysis

Tollgate	Document
Project plan approved	Project plan

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Execution

Differ from project to project, such as stages:

Stage	Example milestone
Functional Investigation	*Function description*
System design	*Construction description*
Module design	*Module description*
Programme development	*Module test protocol*
Composition	*Integration test protocol*
Commissioning	*Acceptance protocol*

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Important during execution

- Identify the project's critical issues
- Monitor technology/quality, time and cost
- Monitor risks and opportunities
- Manage, prepare, decide and make changes
- Report and communicate

<u>Tollgates</u>

Varies depending on the phases. Always associated with deliverables.

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Closing

- Analyze the outcome of the objectives, results, schedules and costs
- Compare with the original specification / plan
- Comment deviations

Tollgate	Document
Final report approved	Final report

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Project planning

1. Formulate the project goal
2. WBS – Work Breakdown Structure
3. Identify tasks
4. Identify dependencies
5. Estimate time
6. Identify the critical path
7. Distribute resources
8. Transfer to Gantt-schedules or other diagrams

2. WBS - Work Breakdown Structure

- A WBS is the most common way to analyze a project in order to achieve a detailed overall picture of what is to be done
- Can be drawn in from many different perspectives
- A WBS shall answer the question:
  - What must be done in order to complete the project?
- It does not answer the question:
  - By whom? or...
  - When?

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WBS

- The more levels, the more detailed information
- A WBS does not have a time perspective
  - i.e. nothing in the WBS tells you what should be done before anything else, nor how long it takes
- What should be included in the WBS?
  - The deliverable parts
    - i.e. a breakdown of the system, product or service that the project will result in
  - The functional activities and tasks that are needed in order to create and deliver these parts
  - Other functional activities that are needed to manage and administrate the project

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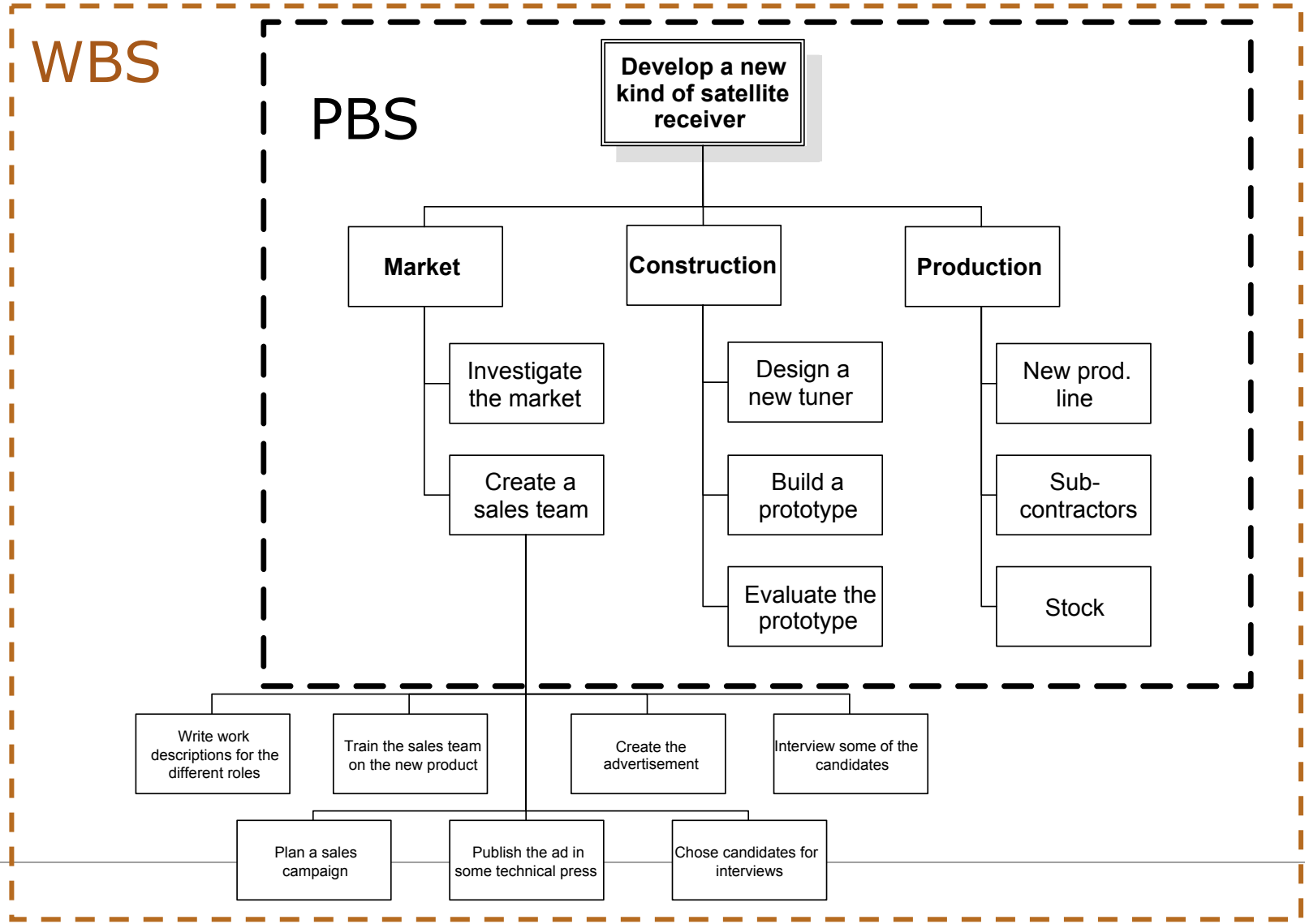
Relation WBS - PBS



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Task and responsibility contracts

- When the tasks are identified, it is time to distribute resources to them
  - Who is responsible for what?
  - Resources can also be rooms, computers and other equipments
- A task contract can be a simple table

What?	Create ads
Who?	Osquar
Starting point	Completed working instructions
Result in	Material for publication

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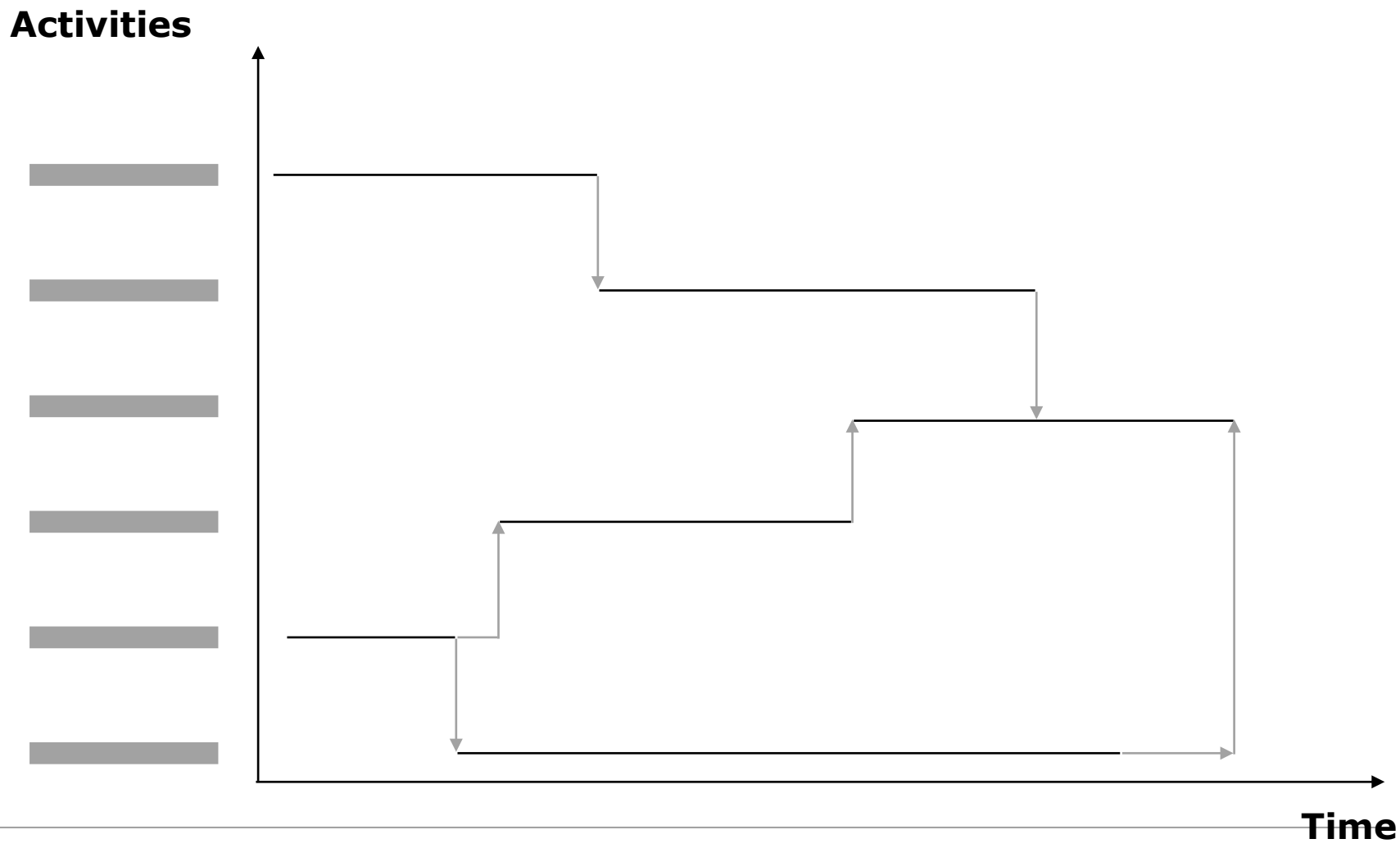
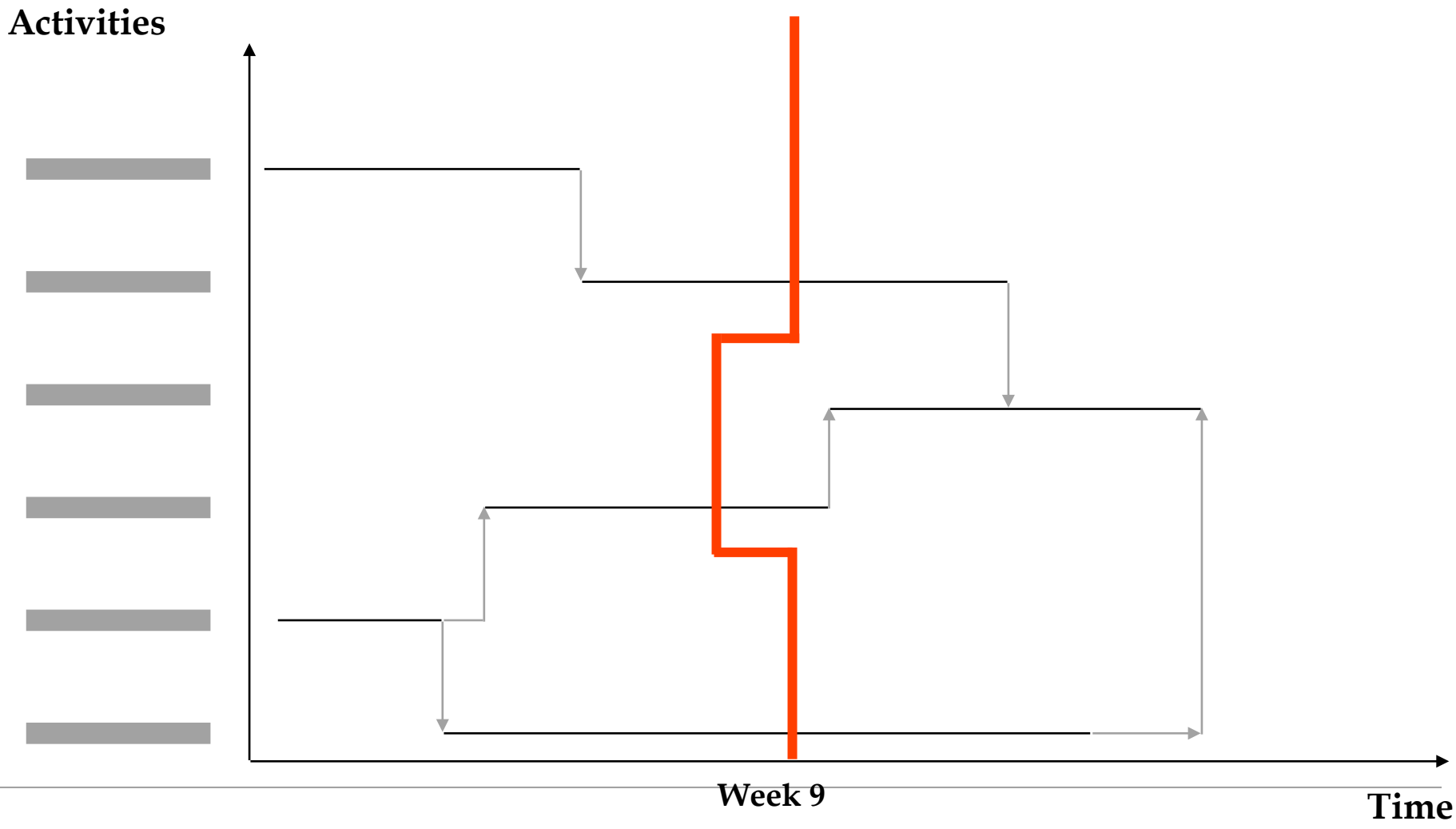
The Gantt chart



Present situation line



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How to use this in the course?

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Simplified planning
(no or few parallel activities)

1. **Formulate the project goal**
2. **Divide the** project into phases and activities
   - In what order are we going to do the work?
3. **Break down** the activities into work tasks
   - What are we going to do in each step?
   - Which are the deliveries (i.e. Milestones and Tollgates)?
4. **Time estimate** each work task
   - How much time will it take?
5. **Schedule** and divide the time estimated work tasks on each project participant (resource planning)
   - Who is spending their time on what task, and when should it be done?

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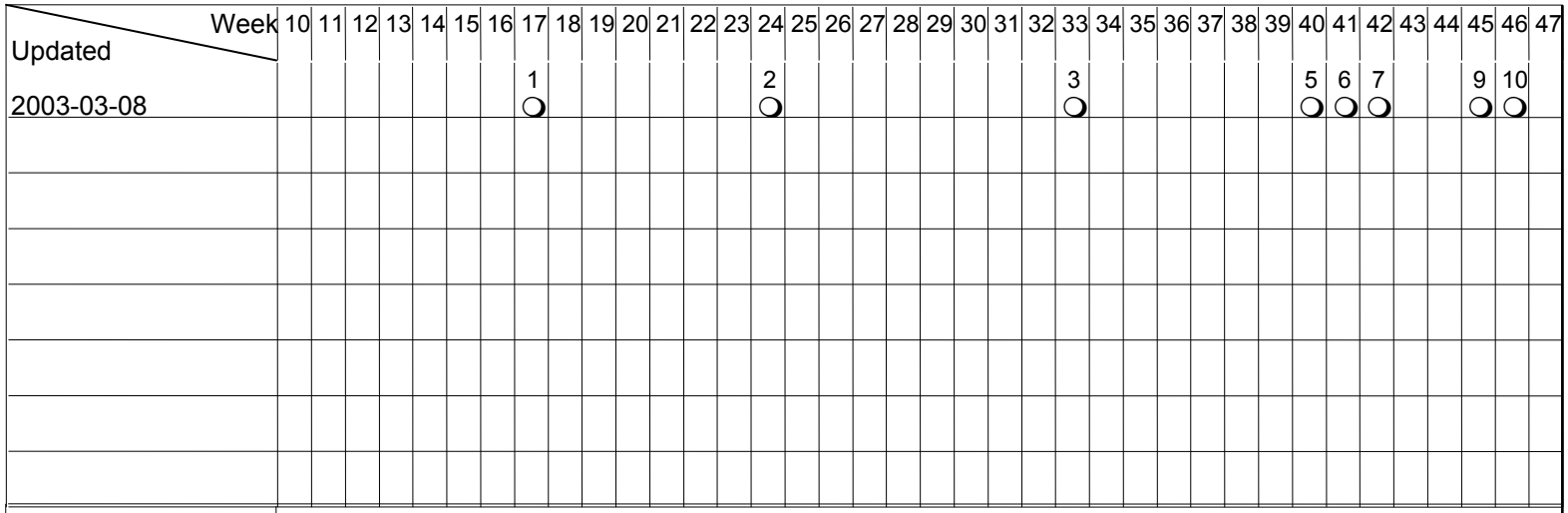
Included in the project plan

- Background
- Goals
- Organization
- Project model
- Comments on time and resource planning
- Risk analysis
- Document rules
- Appendices
  - Time plan
  - Resource plan

Milestone diagram (or time plan)



Project name:
EH2720
Manag. of projects

Project manager
Joakim Lilliesköld

Project code Date
EH2720 2003-05-01

Milestone / Tollgate

1	Scheduling	5	Lecture series	9	Course evaluation	13	
2	Contact lecturers	6	Assignment 4	10	Course final	14	
3	Print course material	7	Assignment 2	11		15	
4	Assignment 3	8	Assignment 1	12		16	

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Steering group meetings!

- The gradual progress of the project shall be reported at regular steering group meetings. The Steering group (= Professor Lars Nordström) expects you to report progress at 4 steering group meetings during the project according to the following structure:

  - Meeting 1 - Present Project plan and initial System design
  - Meeting 2 - Final System design and technical implementation
  - Meeting 3 - Report on progress of development.
  - Meeting 4 - Report on progress of testing and integration.

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Agenda

- Project Assignment
- Project Planning & Execution
- System specification tools

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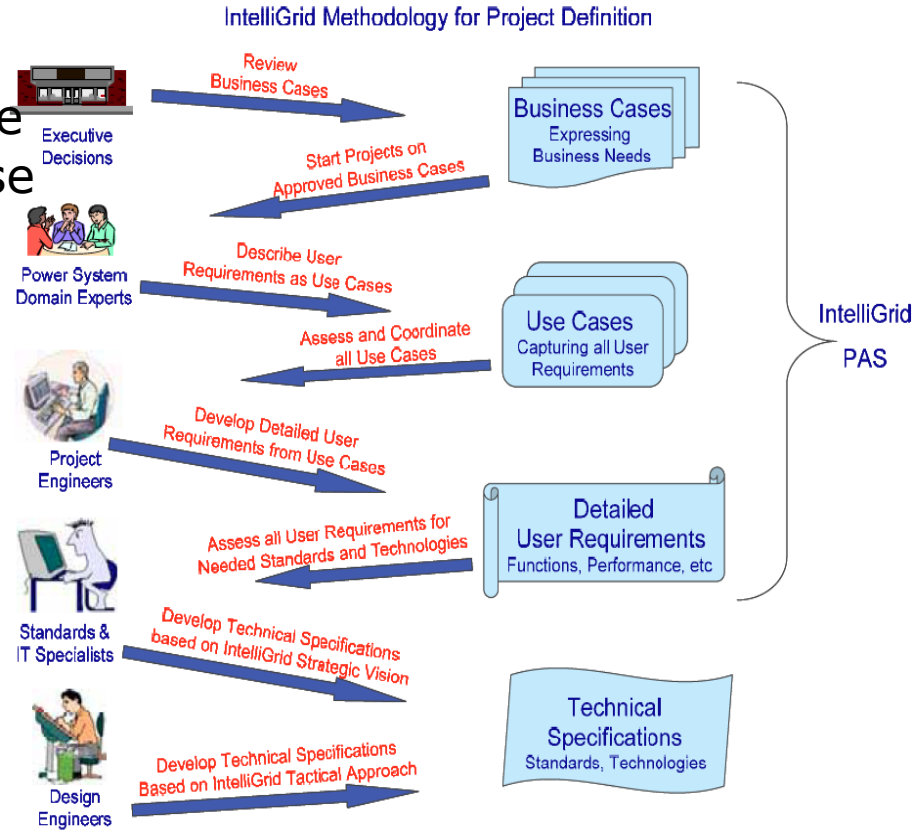
A structured approach is needed

- The IEC Publically Available Specification 62559
  - Developed initially by the EPRI in the US as part of the Intelligrid project
  - Adopted by the IEC as a PAS in 2008

- The 62559 is not a standard, it is instead a suggested way to work with developing requirements on new computer applications for power systems.

The Intelligrid method

- **Phase 1:** Executives use Business Cases to approve projects in order to meet Business
- **Phase 2:** Domain Expert Stakeholders describe their User Requirements through the formal Use Case process
- **Phase 3:** Project Engineers develop the more detailed functional and performance requirements from the Use Cases
- **Phase 4:** Project Engineers and IT Specialists assess applicability to the project of the standards, technologies, and best practices
- **Phase 5:** Design Engineers develop Technical Specifications based on Strategic Vision, Tactical Approach, & Standards



Source: IntelliGrid Methodology for Developing Requirements for Energy Systems IEC/PAS 62559

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Phase 2 – A detailed look

Definition of a Use Case:
Class specification of a sequence of actions, including variants, that a system (or other entity) can perform, interacting with actors of the system IEC 62390, ed. 1.0 (2005-01)

- **Step 1:** Identification of All Potential Stakeholders
- **Step 2:** Reviewing existing Architecture Use Cases
- **Step 3:** Brainstorming List of Functions (Use Cases) with Stakeholders
- **Step 4:** Drafting Use Cases
- **Step 5:** Reviewing and Updating Use Cases

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Step 4 – Drafting Use Cases

- Important contents of a Use Case
  - The **goal** of the use case, which is usually its name. e.g. “Utility remotely connects or disconnects customer”.
  - The **narrative**. A short English text version of the story.
  - The **actors**. An actor is anything in the system that communicates. e.g. a “customer” or a “meter”.
  - The **assumptions** that the use case is based on. These can constitute requirements in and of themselves.
  - The **contracts** and **preconditions** that exist between the actors,
  - The **triggering** event that led to the scenario taking place.
  - The **steps**. A numbered list of events that tell the story in detail.

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Step4 -continued

- First draft of Use Case is documented in the Intelligrid Use Case Template

Name of Domain Template

1 Descriptions of Function

All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work should be so noted.

1.1 Function Name

Name of Function

1.2 Function ID

Identification number of the function

1.3 Brief Description

Describe briefly the scope, objectives, and rationale of the Function.

1.4 Narrative

A complete narrative of the Function from a Domain Expert's point of view, describing what occurs when, why, how, and under what conditions. This will act as the basis for identifying the Steps in Section 2. All actors should be introduced in this narrative. All sequences to be described in section 2 should be introduced in prose here. Embedded graphics is supported in the narrative.

1.5 Actor (Stakeholder) Roles

Describe all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, technicians, end users, service personnel, executives, SCADA system, real-time database, RTO, RTU, IED, power system). Typically, these actors are logically grouped by organization or functional boundaries or just for collaboration purpose of this use case. We need to identify these groupings and their relevant roles and understand the constituency. The same actor could play different roles in different Functions, but only one role in one Function. If the same actor (e.g. the same person) does play multiple roles in one Function, list these different actor-roles as separate rows.

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Step 5 – Reviewing & updating

- Reviewing & updating continues as more information is gained.
- In Phases 3 & 4 the non-functional requirements are further detailed.

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Items to consider for detailing

- Configuration
- Quality of Service Requirements
- Security Requirements
- Data Management Issues
- Constraints or Other Issues

The PAS provides checklists for all these areas

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Use Case Diagram

”The use case view captures the behavior of a system, subsystem, or class as it appears to an outside user. It partitions the system functionality into transactions meaningful to actors—idealized users of a system”

Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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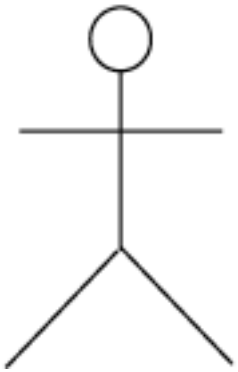
Actors in around the system



- An actor is an idealization of an external person, process, or thing interacting with a system, subsystem, or class.
- An actor may be a human, another computer system, or some executable process.
- Actors may be defined in generalization hierarchies, in which an abstract actor description is shared and augmented by one or more specific actor descriptions

Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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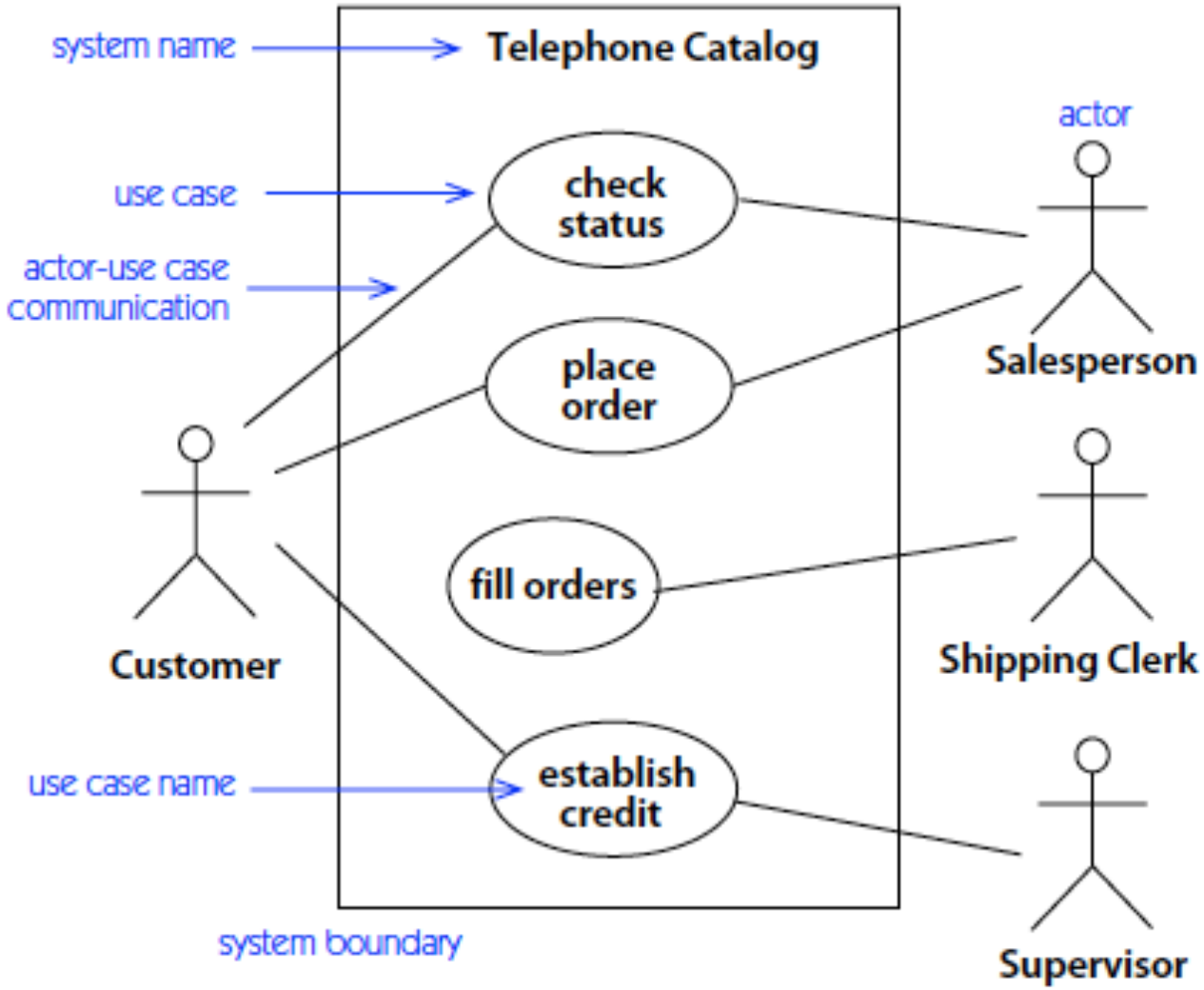
Use Case diagram



Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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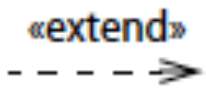
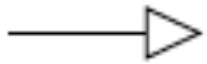
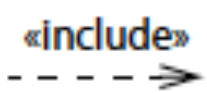
Use Case relations

Table 5-1: *Kinds of Use Case Relationships*

Relationship	*Function*	*Notation*
association	The communication path between an actor and a use case that it participates in	
extend	The insertion of additional behavior into a base use case that does not know about it	
use case generalization	A relationship between a general use case and a more specific use case that inherits and adds features to it	
include	The insertion of additional behavior into a base use case that explicitly describes the insertion	

Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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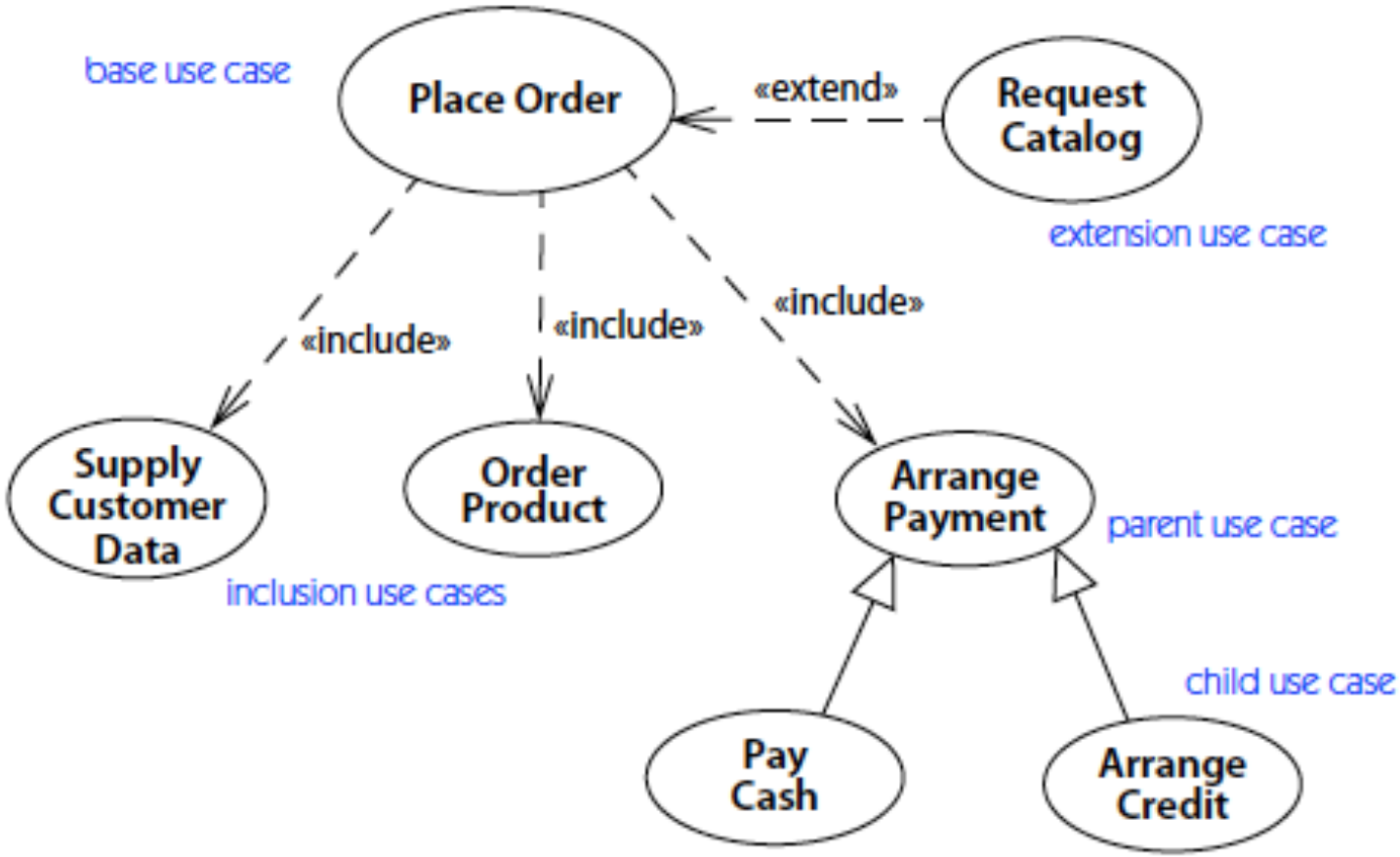
Use Case examples.



Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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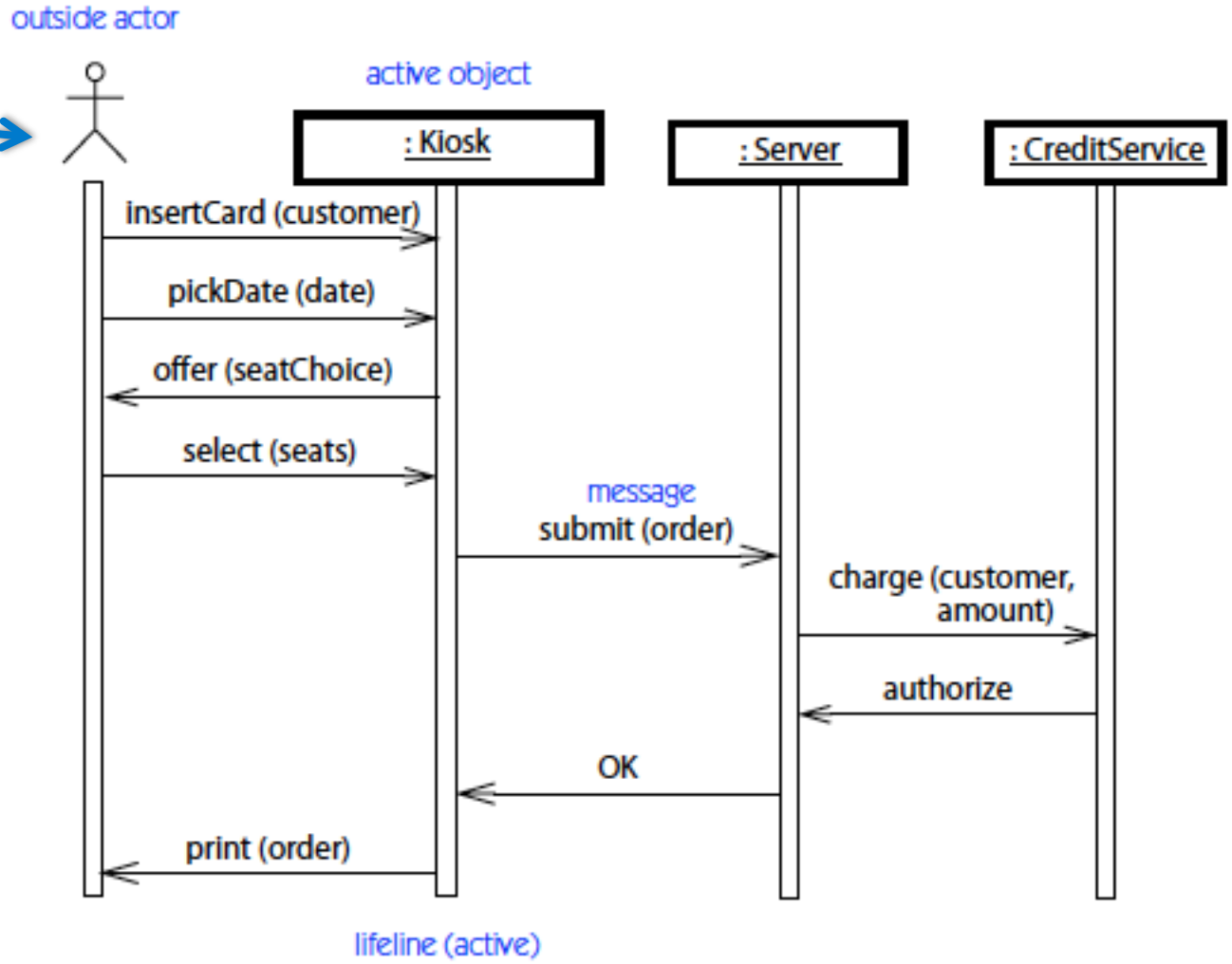
Sequence Diagrams

- A sequence diagram displays an interaction as a two-dimensional chart. The vertical dimension is the time axis; time proceeds down the page. The horizontal dimension shows the classifier roles that represent individual objects in the collaboration.

Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

Sequence diagram

- Actors or Classes(objects)



Source: Unified Modeling Language Reference Manual, ISBN 0-201-30998-X, Addison-Wesley

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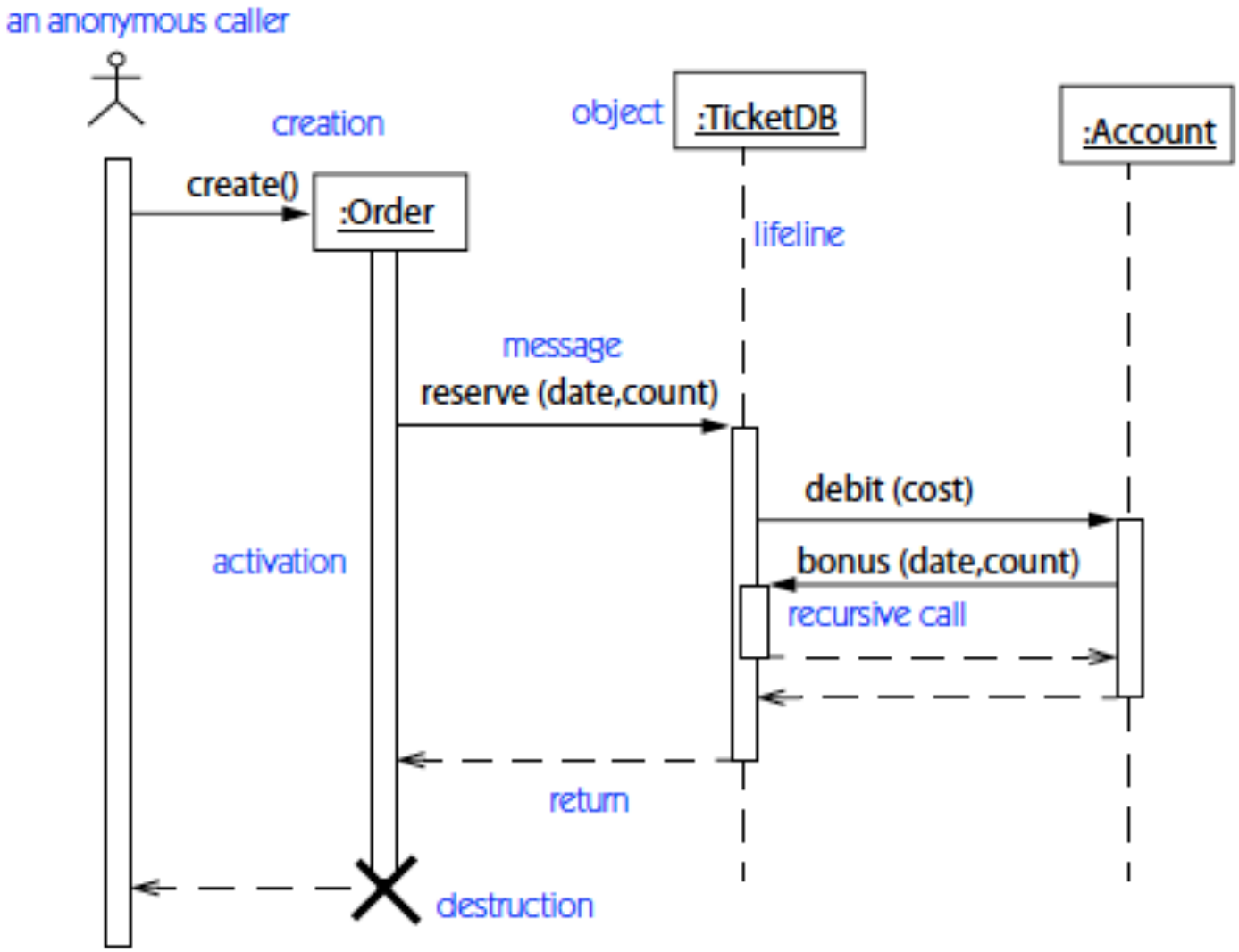
Activation & Destruction



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UML Recap

- Use Case Diagrams helps us understand the high level functions of the system
- Class Diagrams helps us identify and document the involved concepts
- The sequence diagrams helps us document how the actors and classes interact to perform the functionality.

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Use Case Method Recap

- The PAS Intelligrid methodology is a method to capture requirements computer applications for power systems
- It does not lead to consistently documented Use Cases, remember the repository files……
- By combining The IEC/PAS methodology with UML notation, we create more consistent documentation
- That is what we (mostly you) will do in the Use Case Assignment

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