Software Project Management (8 – 20191127)

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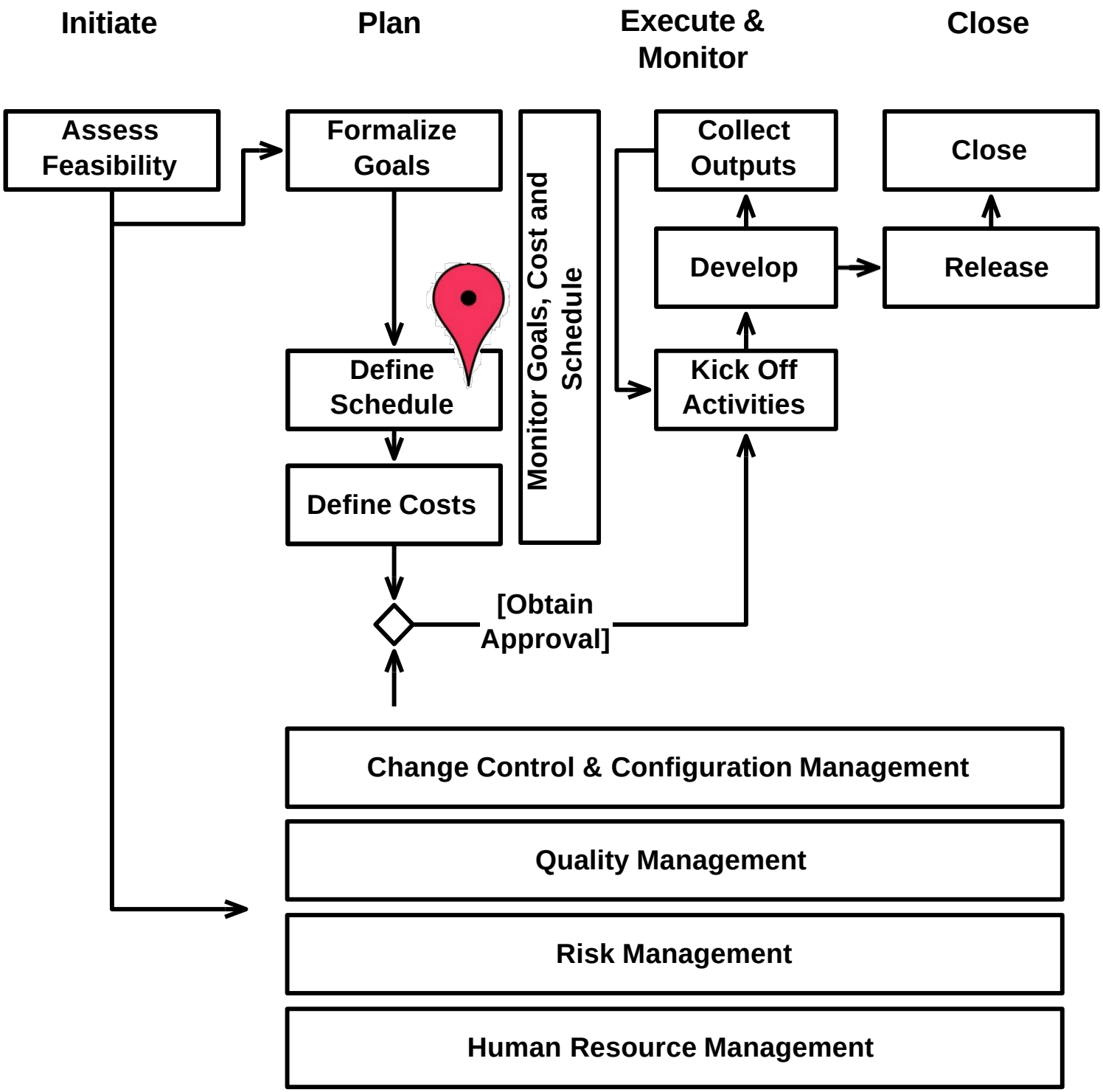
Optimizing the Plan


Initiate
Plan
Execute & Monitor
Close
Assess Feasibility
Formalize Goals
Monitor Goals, Cost and Schedule
Collect Outputs
Close
Develop
Release
Define Schedule
Kick Off Activities
Define Costs
[Obtain Approval]
Change Control & Configuration Management
Quality Management
Risk Management
Human Resource Management

Preliminary Consideration

- The first version of your plan will most likely show that you will not be able to deliver according to the deadline set by the sponsor
- On the hypothesis that the plan is accurate, there are two options:
  - The project is not started (since it is not feasible, given the constraints)
  - The project is shortened, using one of the techniques described in this unit
- The “third” option (the estimations are revised) is a bad idea

Making your plan feasible

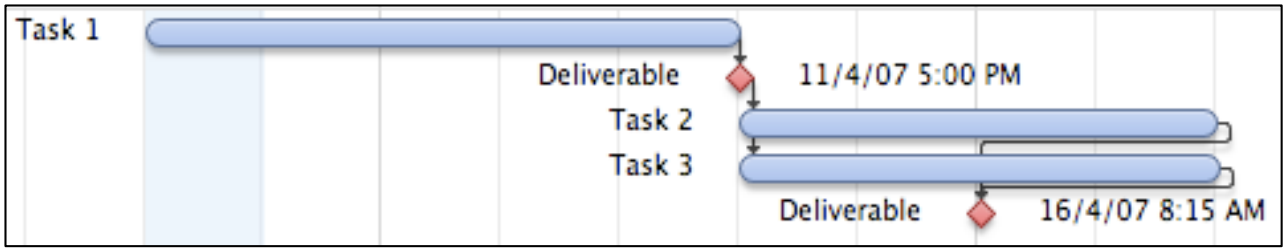
- Change some of the hypotheses on which your plan is based. For instance:
  1. Reduce scope (it makes some activities shorter or useless)
  2. Reduce quality (it makes some activities shorter or useless)
  3. Outsource some activities (it increases risk and, possibly, costs)
- Act on the logic of the plan:
  4. Increase resources (it makes the project more costly) [**PROJECT CRASHING**]
  5. Evaluate alternative courses of actions (e.g. change development process). However: it might be difficult, if your team is accustomed to a specific development process.
  6. Break the rules: eliminate hard constraints on your plan (it increases risk, and, possibly costs, due to re-work) [**FAST TRACKING**]
  7. Work on probability of delivering on time [**CRITICAL CHAIN MANAGEMENT**]

Project Crashing

Project Crashing

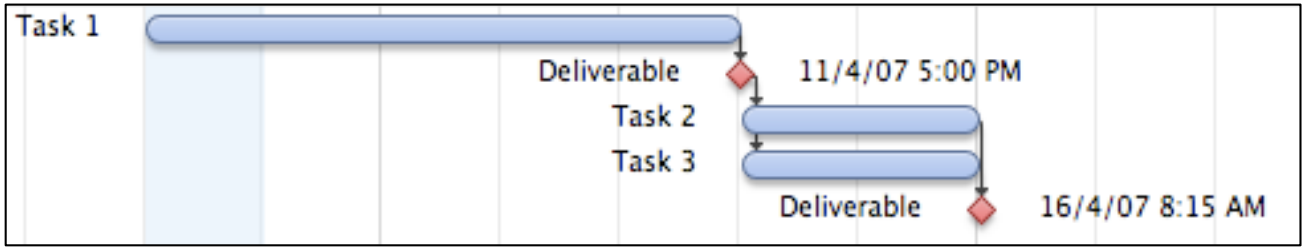
- Project duration can (often) be reduced by assigning more labor to project activities, in the form of over time, and by assigning more resources, such as material, equipment, etc.
- However, the additional labor and resources increase the project cost.
- So, the decision to reduce the project duration must be based on an analysis of the trade-off between time and cost.
- Project crashing is a method for **shortening the project duration by reducing the time of one or more of the critical project activities to less than its normal activity time**. The objective of crashing is to reduce project duration while minimizing the cost of crashing.

Project Crashing Example



cost = $ 3000
cost = $ 4000

Project Crashing: we allocate more people to Task 2 an 3



cost = $ 6000
cost = $ 8000

CRASH TIME = 2 calendar units (e.g. months)

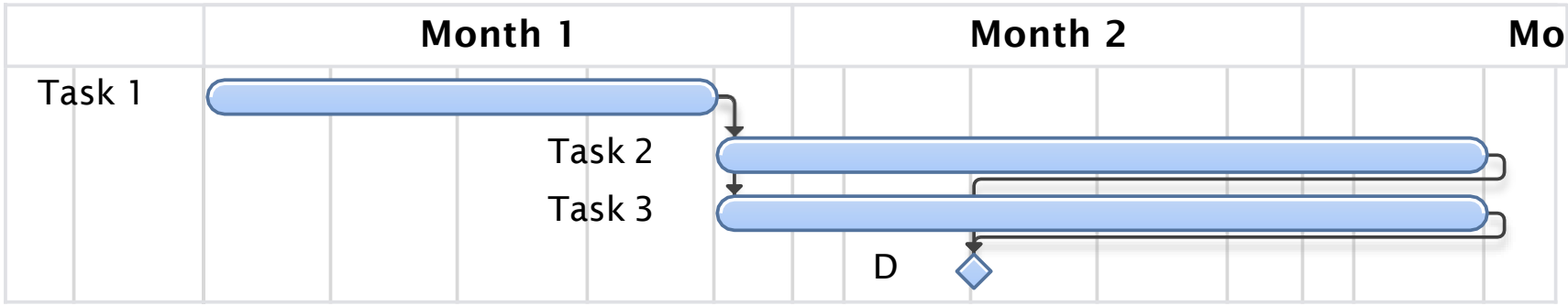
CRASH COST = (6000 + 8000) - (3000 + 4000) =

= 14000 - 7000 = 7000

Crashing convenient according to costs of delivering late

Project Crashing (simple) Example

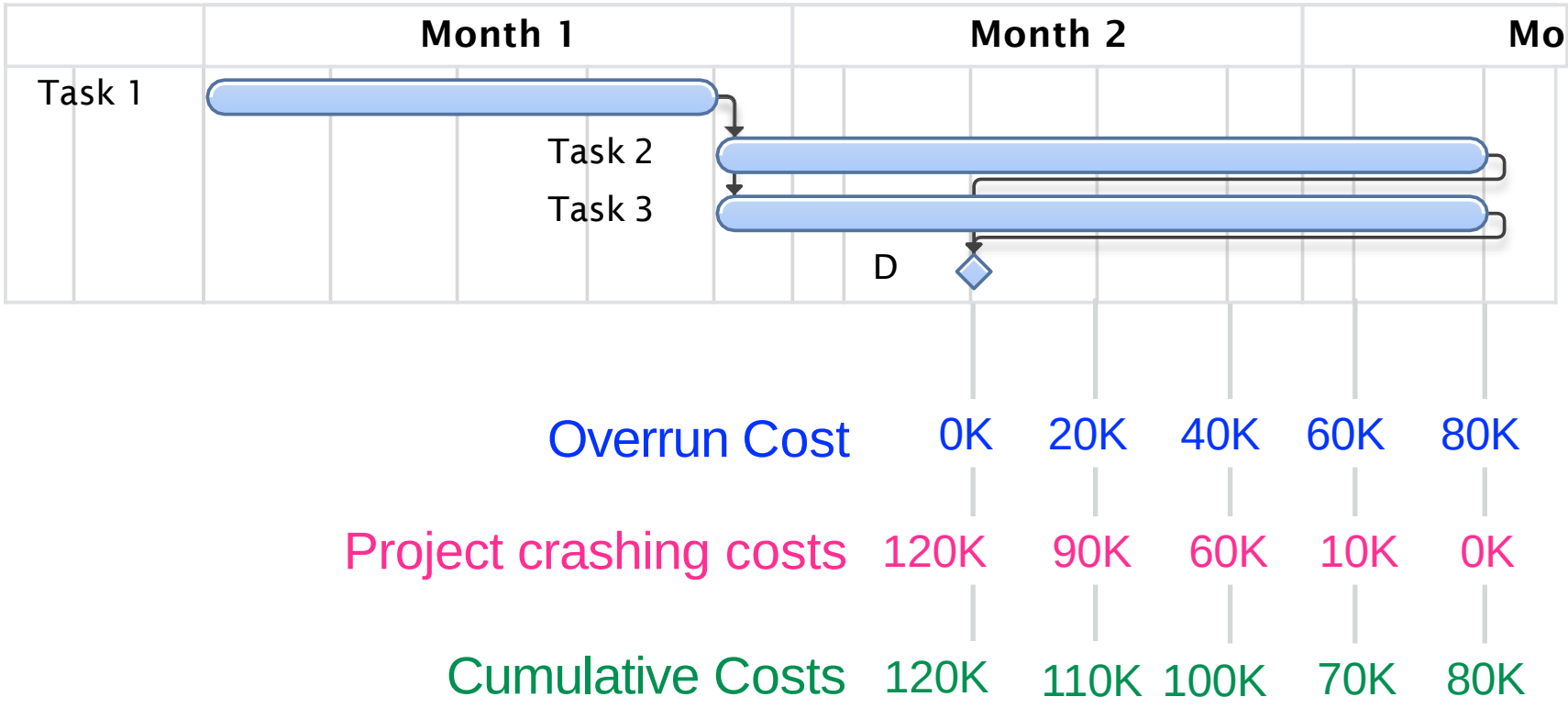
- Project is late: we are supposed to pay 20K euro per week of delay



- We can reduce Task 2 and Task 3 by allocating more resources: 10K for a week, 60K for two weeks, 90K for three weeks, 120K for four weeks)

Project Crashing (simple) Example

- Project is late: we are supposed to pay 20K euro per week of delay



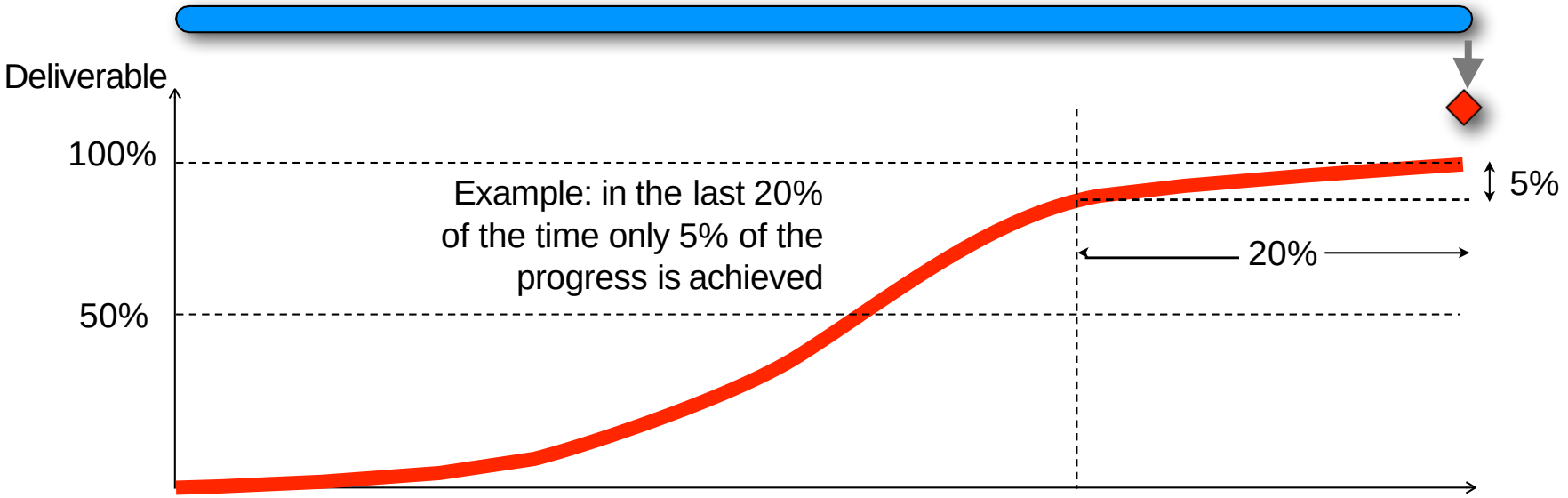
Project Crashing (simple) Example

- Best solution (only if costs matter): shorten by a week (cumulative costs is the minimum value)
- Other considerations might make other choices more appealing. For instance:
  - Delivering on time might be essential to keep a client. In such a case we might decide to incur in increased expenditures
  - We might decide to deliver late (and keep activities as they are) to avoid having our team work overtime or because risks associated to decreased quality might increase with shortening activities

Fast Tracking

Fast Tracking

- Fast tracking is based on the fact that deliverables of activities are incrementally produced (and refined) during the execution of the activity
- Example: a requirement document is not written on the last day of the “requirement writing” activity. Rather it gets written a bit at a time, when the activity is executed

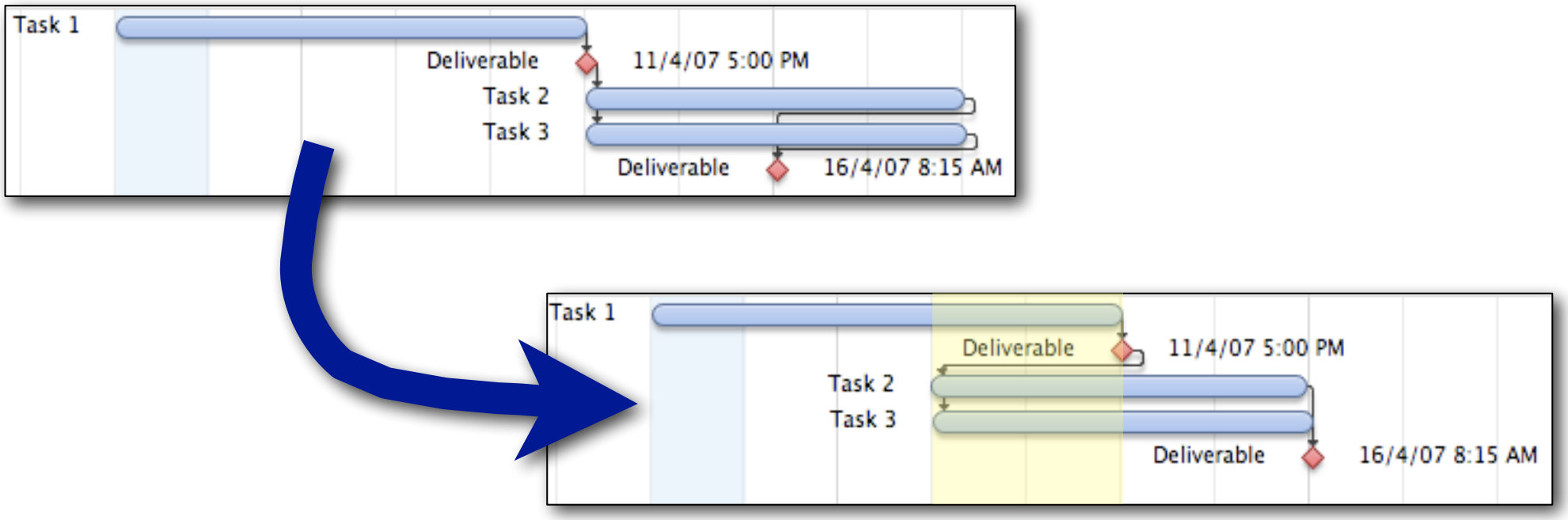


Fast Tracking

- Consider the example of the previous slide: if the last 5% is not the critical part of your deliverable, then we could start the activities depending on the requirement document earlier.

Fast Tracking

- Fast tracking works by overlapping activities which would otherwise be sequential



Fast Tracking: Issues and Rules of the Thumb

- Fast tracking is risky and it might cause rework
- When deciding what dependencies are better to break, consider the following:
  - How the deliverable production during the activity will progress (will it produce intermediate outputs?) and consolidate (will the intermediate output be stable?)
  - The risk involved in changes to the output (what if the consequence of re-work in the subsequent activity; how will it affect the rest of the plan?)

Critical Chain Management

Critical Chain Management

- Critical Chain Management starts from the assumption that estimations are averages guesses
- Saying that an activity lasts X (or it takes an effort of Y) means that **most of the times** the activity will take X to complete. **There could be cases,** however, in which the activity will take shorter or longer to complete
- To manage contingencies (and contrast their optimism), project managers pad their estimations, moving the estimations to the “pessimistic” side
- However, only some of the buffers will actually be needed

Some statistical considerations

- Critical Chain Management is interesting and effective for two reasons:

  1. We reason on most probable estimates rather than pessimistic estimates: in particular we call contingency the difference in duration between a 50% probable estimate and a 90% probable estimate

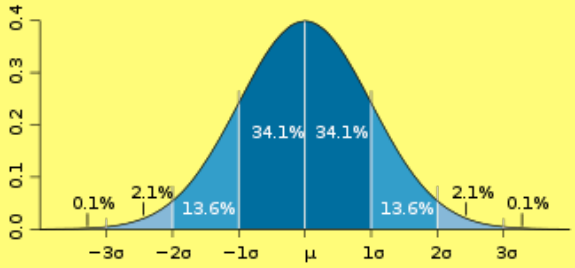
  2. We reason on **chains of activities**. The **standard deviation** of a chain of activities is less than the sum of the standard deviations of the activities in the chain

CCM: Item 1 (Estimations)

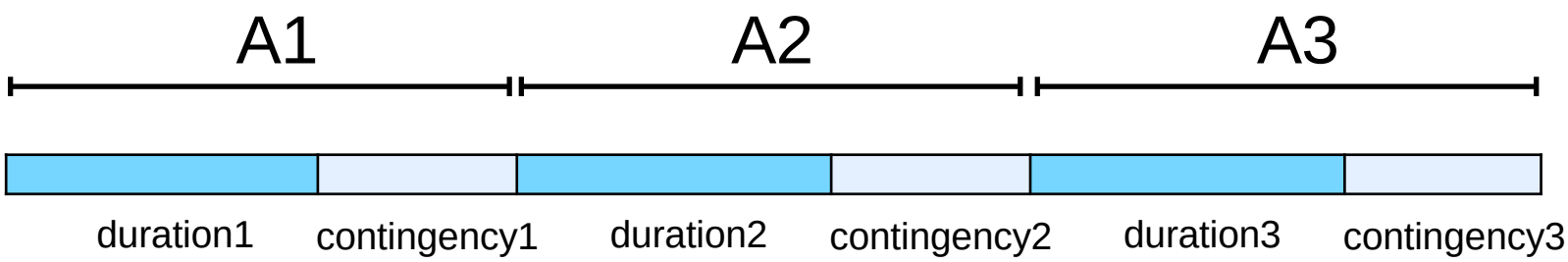
Traditional Estimation

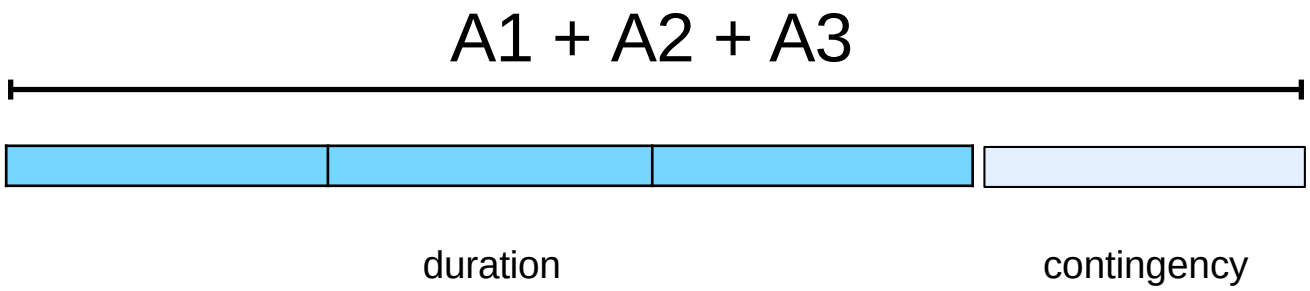
CCM estimation

Notice that the contingency depends upon the standard deviation!



CCM: Item 2 (sum of variances)





duration = duration1 + duration2 + duration3

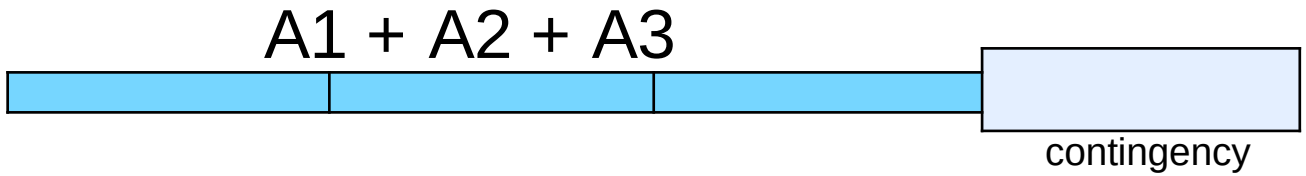
contingency < contingency1 + contingency2 + contingency3

CCM Basic Idea

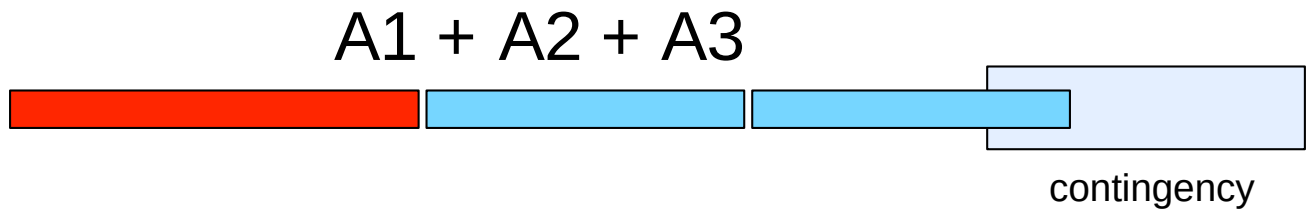
- When planning **we reason and monitor chains** and **we make the contingency buffer explicit**
- Item 1 (duration + contingency) + Item 2 (sum of variances) ensures that the plan is shorter than those obtained from the standard approach
- During plan execution the statistical variation will make some activities last longer than planned. These activities will make the chain overflow the contingency buffer, which is ok up to a point.
- **The manager manages the chains, not activities**

Example

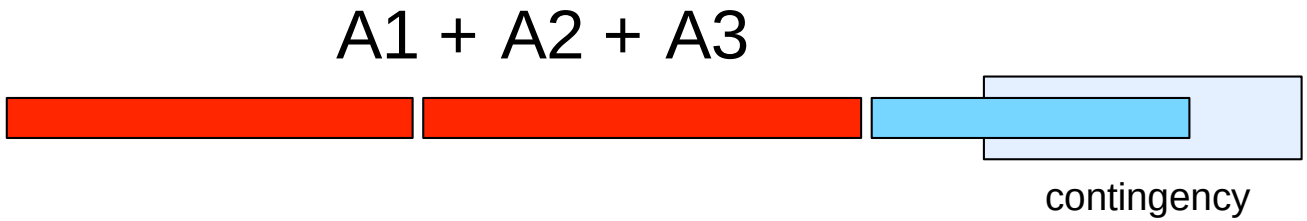
Plan



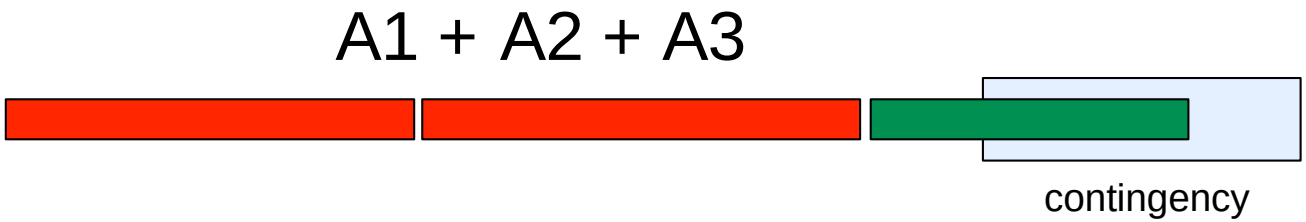
Actual



A1 lasts longer than planned and the chain enters the contingency buffer



A2 lasts longer than planned and the chain continues entering the contingency buffer



However A3 lasts as planned and some buffer is spared.

CCM: Managing Chains

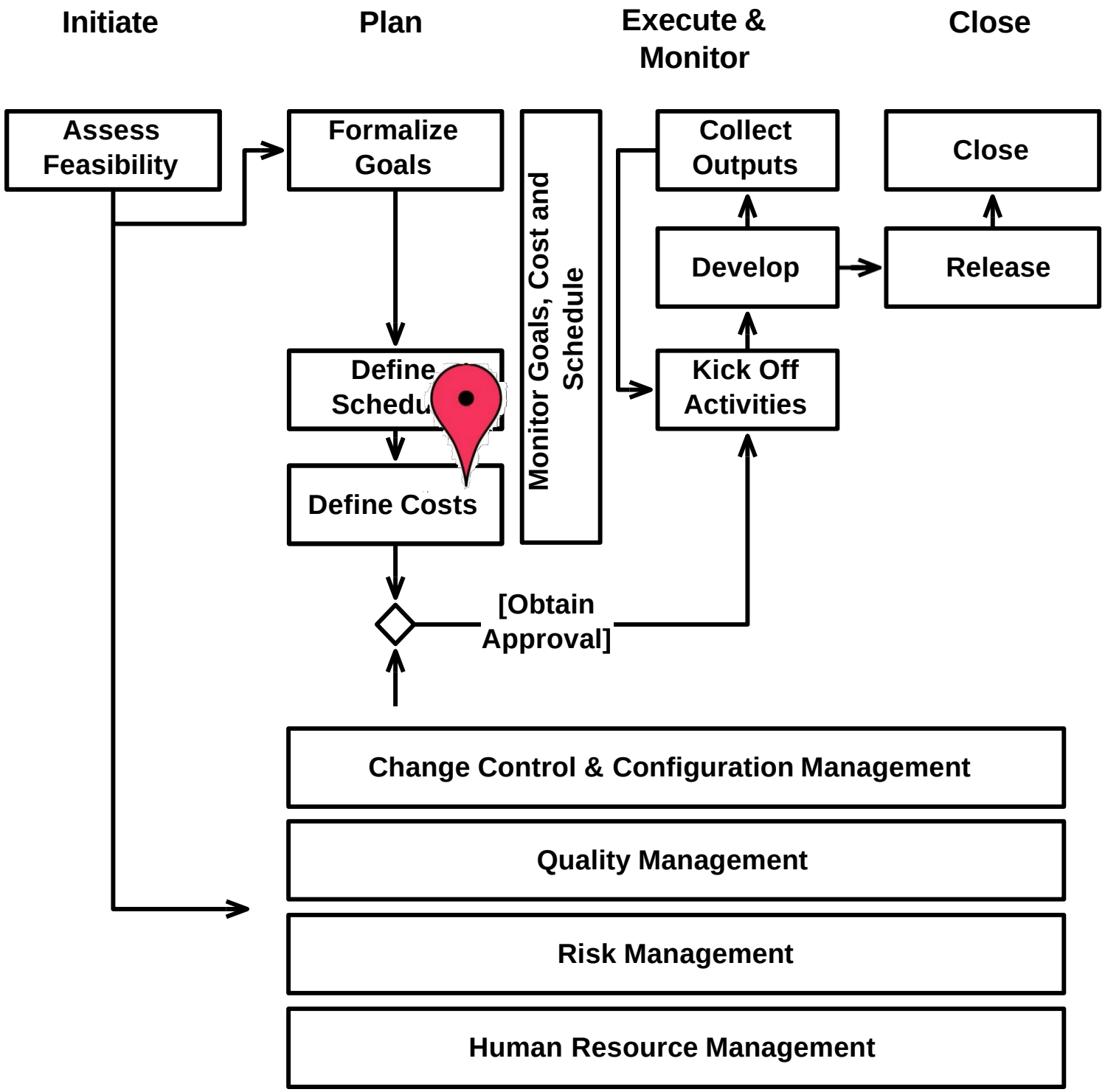
- When using CCM two important questions arise:
  - **Buffer definition:** What chains are best to consider or, put it another way, where we put the buffers
  - **Buffer management:** When do we need to start worrying about overflow in the contingency buffer

Buffer Management

Task Execution Status	Buffer Penetration: First Third	Buffer Penetration: Second Third	Buffer Penetration: Final Third
First Third	NO ACTION	Serious problem	**Very serious problem**
Second Third	NO ACTION	Could be a problem: identify and formulate solution	Serious problem
Final Third	**Very good! We are early**	NO ACTION	Monitor the situation

Costing and Budgeting

From cost to value: methods and techniques to set the right cost to software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Some Definitions

- **Costing:** determining the bare costs to deliver a project
- **Budgeting (and cost control):** determining the financial needs of a project and preparing the books to monitor expenditures (and incomes)
- **Pricing:** determining how much you will charge for the project
- **Life Cycle Cost (LCC) (also called Total Cost of Ownership):** costs to be sustained to operate (use) a system throughout its lifecycle

(Software)
Project Costing

(Software) Project Costing

- **Project cost:**
  - The expenses we will incur into to finish a project
  - It does not take into account profit
  - Made of direct and indirect costs (next slide)
- **Cost Element Structure:**
  - Hierarchical structure which defines the cost items which determine the project budget
  - It helps structure the costing and monitoring processes and it reduces the risk of double accounting the same expenses

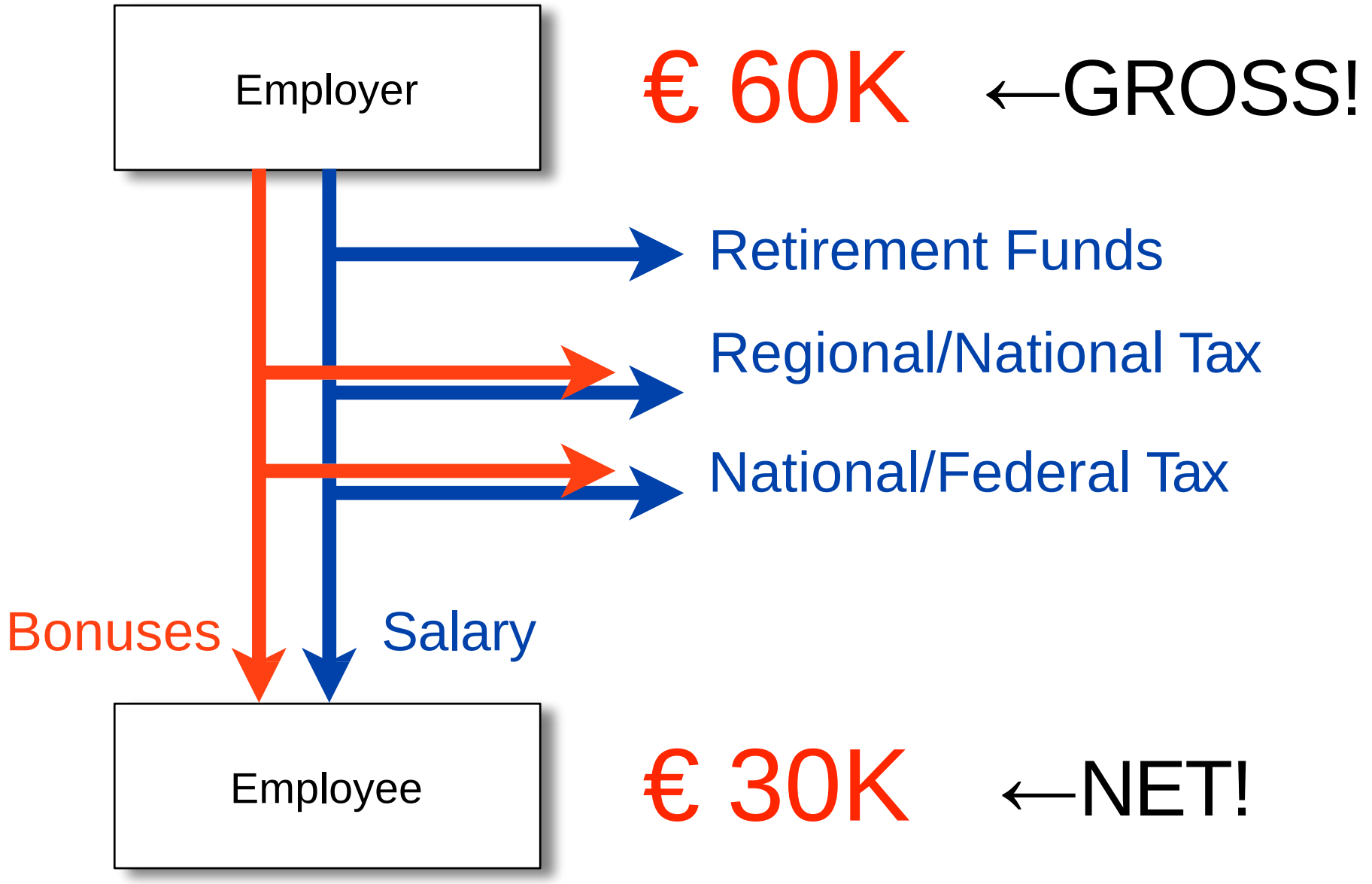
Direct Costs

- **Direct costs:** costs related to the production of the project outputs
- Direct Costs for software projects
  - **Personnel:**
    - The salaries of people directly involved in the project
  - **Materials and Supply**
    - Costs of the material necessary to produce project outputs
    - Usually accounted if the project has specific needs
  - **Hardware and software**
    - Systems required for developing the system
    - Usually accounted if the project has specific needs
  - **Travel, meetings and events**
  - **Other Costs**
    - Books, Training, Renting equipment, …

(Software) Project Costing

- **Indirect Costs:** expenses necessary to run the facility and make work actually doable
- Main cost elements for software development:
  - General Overheads
    * Office space costs (rent, heating, ...)
    * Consumables
    * Standard equipment
    * Administrative Staff
  - Project Overheads
    * For larger projects, overheads directly accountable to a project

Personnel Costs: Gross vs. Net

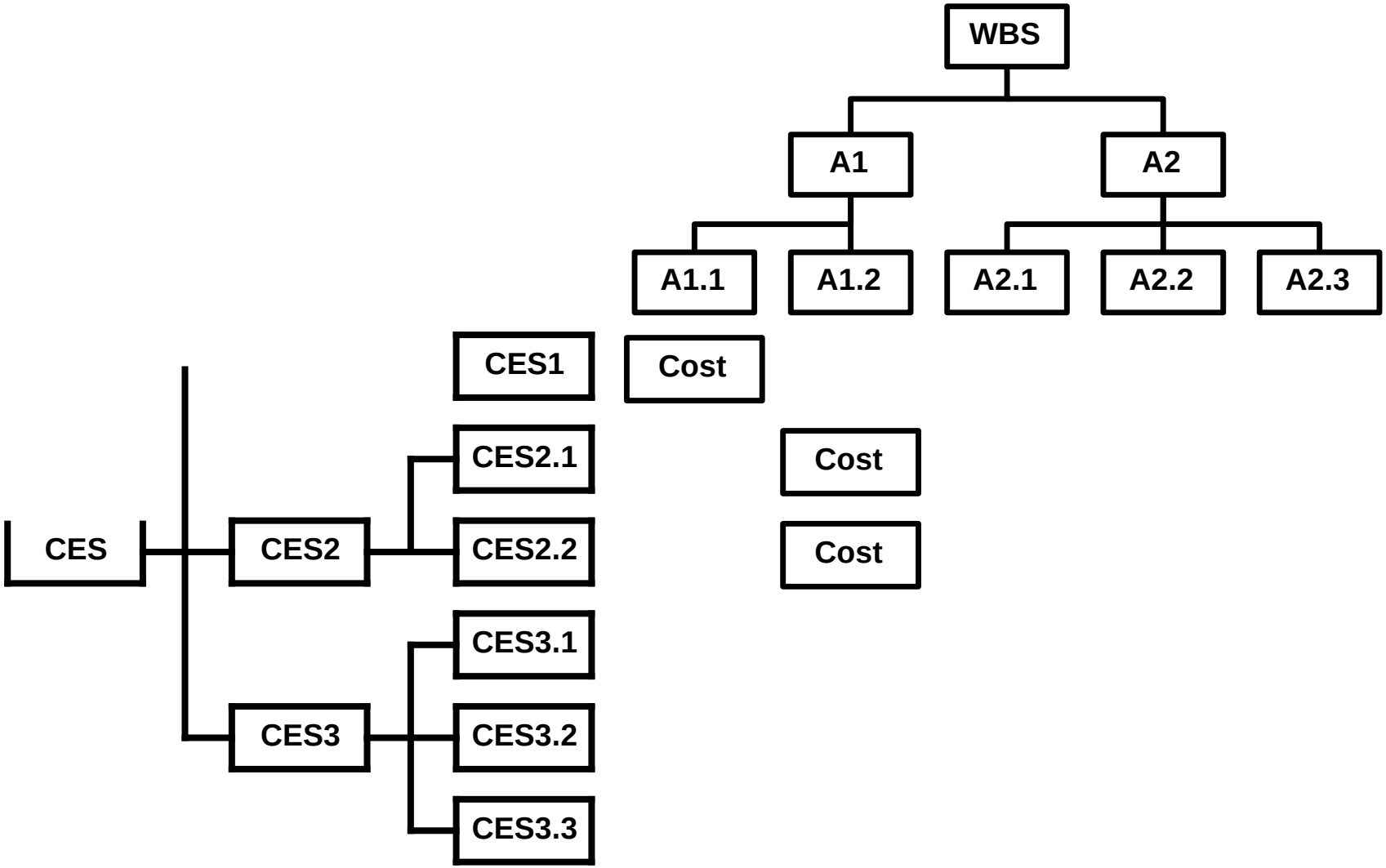


Managing Project Costs

Goals and Means

- Goals
  - Ensuring that the money is available when it needs to be spent
  - Monitoring project expenditures so that the project remains within budget, or the appropriate actions can be taken when this is not the case
- Means
  - Definition of a baseline/cash flow (see next slides)
  - Expense Authorization
  - Expense book keeping (double entry accounting is quite fine)

Project Costs and Project Structure



Project Costs and Time

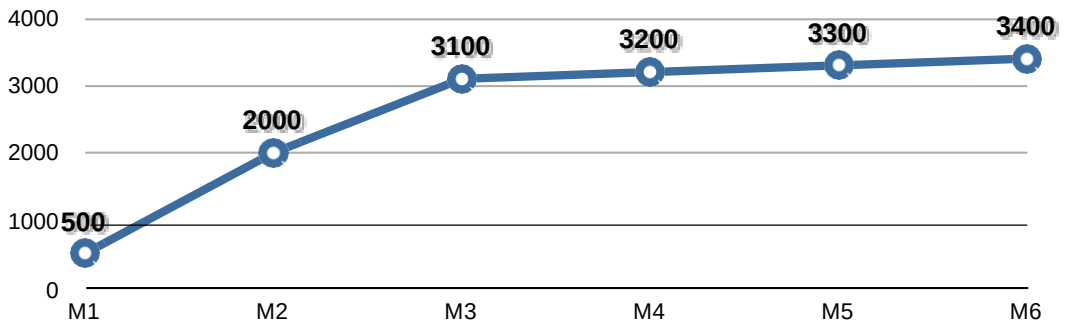
	Q1	Q2	Q3	Q4	Total
Expenses					
Expense 1	€ 10,000	€ 30,000	€ 50,000	€ 10,000	**€ 100,000**
Expense 2	€ 20,000	€ 40,000	€ 60,000		**€ 120,000**
Total Expenses	**€ 30,000**	**€ 70,000**	**€ 110,000**	**€ 10,000**	**€ 220,000**
Incomes					
Payment	€ 50,000			€ 200,000	**€ 250,000**
Total Incomes	**€ 50,000**	**€ 0**	**€ 0**	**€ 200,000**	**€ 250,000**
Balance	€ 20,000	-€ 70,000	-€ 110,000	€ 190,000	**€ 30,000**
Financial Need		-€ 50,000	-€ 180,000		

Project Costs and Time

Name	Planned Cost	Time
A	1000	A
B	2000	B
C	400	C

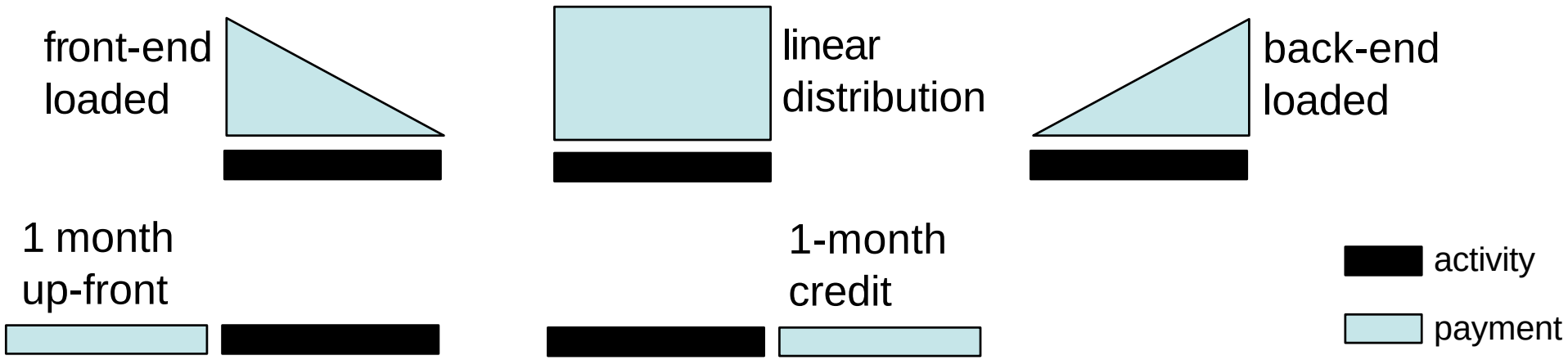
A	1000	500	500			
B	2000		1000	1000		
C	400			100	100	100	100

Total	500	1500	1100	100	100	100
Cumulative	**500**	**2000**	**3100**	**3200**	**3300**	**3400**



Expenditure/Load Profile

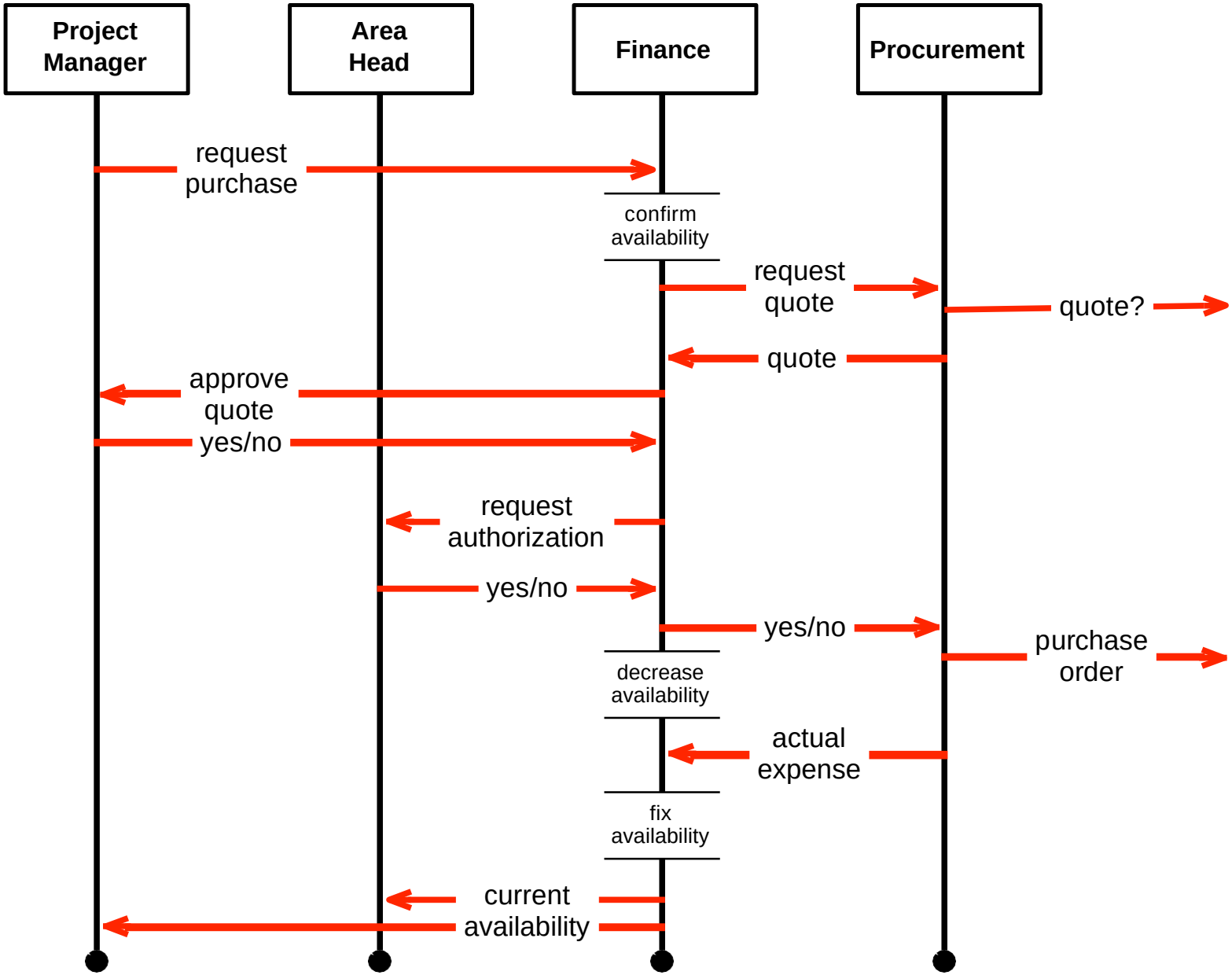
- In general we assume workload distributes uniformly during an activity:
  - A resource working in an activity requiring 40 hours of effort and 1 week of duration is assumed to work 8 hours per day.
- However, this is not necessarily the case, and different profiles can be defined for effort and expenditure:



Expense Authorization

- Project management and financial management are usually allocated to different structures
- According to the organizational structure, the power to authorize expenditures and payments might be solely on the project manager or require a more complex workflow.
- Rules take into account aspects such as:
  - funds availability
  - whether the required expense is budgeted or not
  - the amount of money (expenditures higher than a threshold might require a special authorization)

Expense Authorization: an Example



End of period Report

- At the end of each reporting period, documentation is produced about a project financial status
- Two information are available:
  - Budgeted expenditure vs. actual expenditure
  - Expenditure accounting
- The information is used in different ways:
  - To analyze **deviations** (what differences there have been)
  - To confirm/update **projections to end**
  - To evaluate project health and take appropriate actions

Questions