# Project Management (PRO)

## Kandidatekursus CS/INF

## *Lecture 9: Execution and monitoring stage*

## *Part 1: execution and monitoring*

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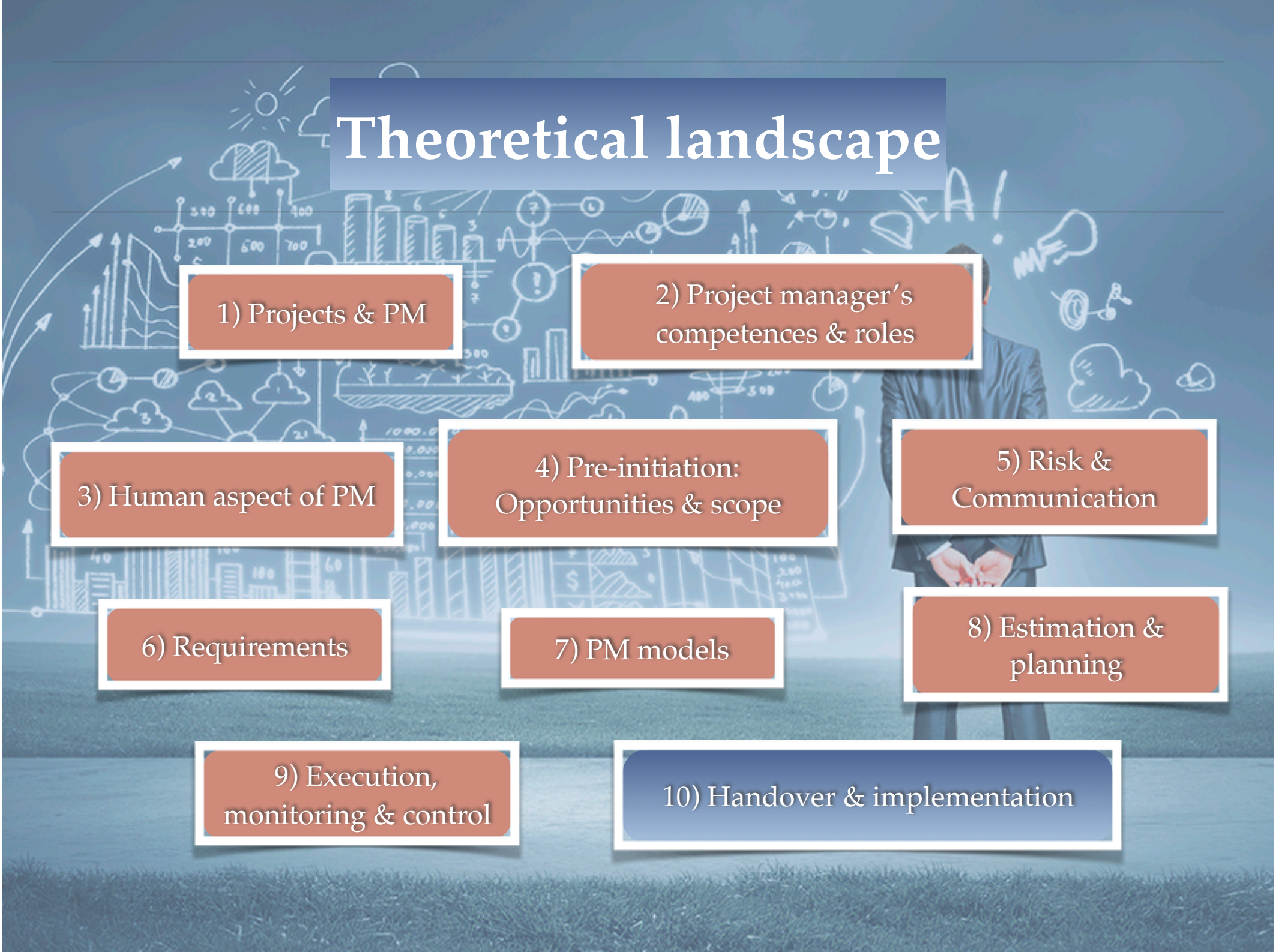
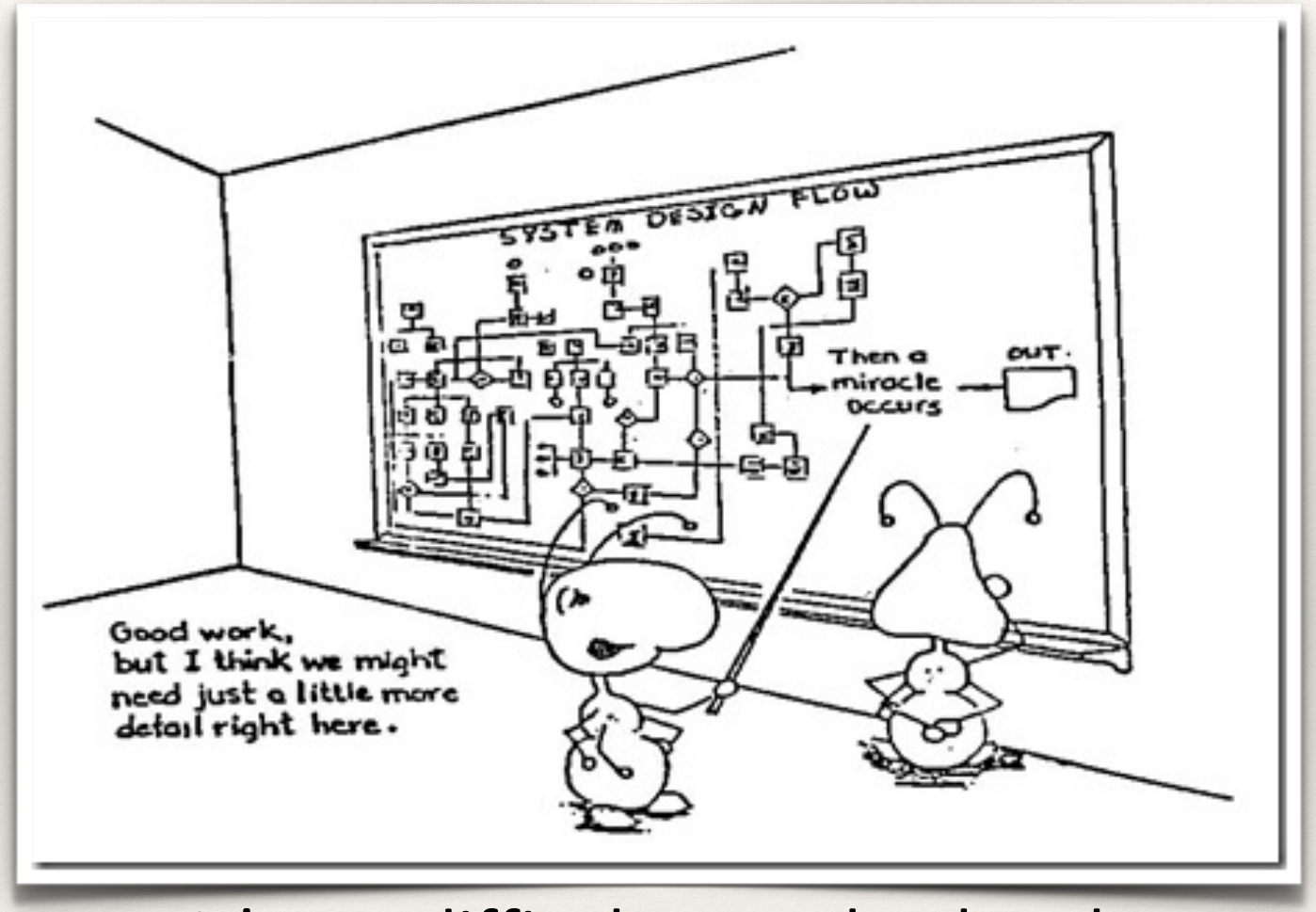
# Where were we?

- **Estimation techniques**
  - Experience-based
    - Analogies and experts
    - Historical data
    - Checklists
    - Successive calculations
    - DELPHI-technique
  - Model-based
    - COCOMO
    - Functional points
- **Scheduling**
  - Estimates and planning
  - Schedules and tools: 3 levels plans; milestone; gantt-charts; wall plan; PERT
- **Organising and chairing meetings**


Theoretical landscape
1) Projects & PM
2) Project manager's competences & roles
3) Human aspect of PM
4) Pre-initiation: Opportunities & scope
5) Risk & Communication
6) Requirements
7) PM models
8) Estimation & planning
9) Execution, monitoring & control
10) Handover & implementation

# Execution and Monitoring stage




- It’s not difficult to make the plans,

but making the plans come real in practice

# After this lesson you will

**Know the purpose of the 3 main processes in the execution and monitoring stage**

- Manage and control project execution
- Monitor and control the project work
- Coordinate and manage changes

**Be able to follow up** on all the important aspect of a project:

- Estimate and costs
- Schedule (time)
- Scope and requirements
- Risks
- Stakeholders
- Quality and product

**Be able to use the ”Earned Value” technique for the follow-up**

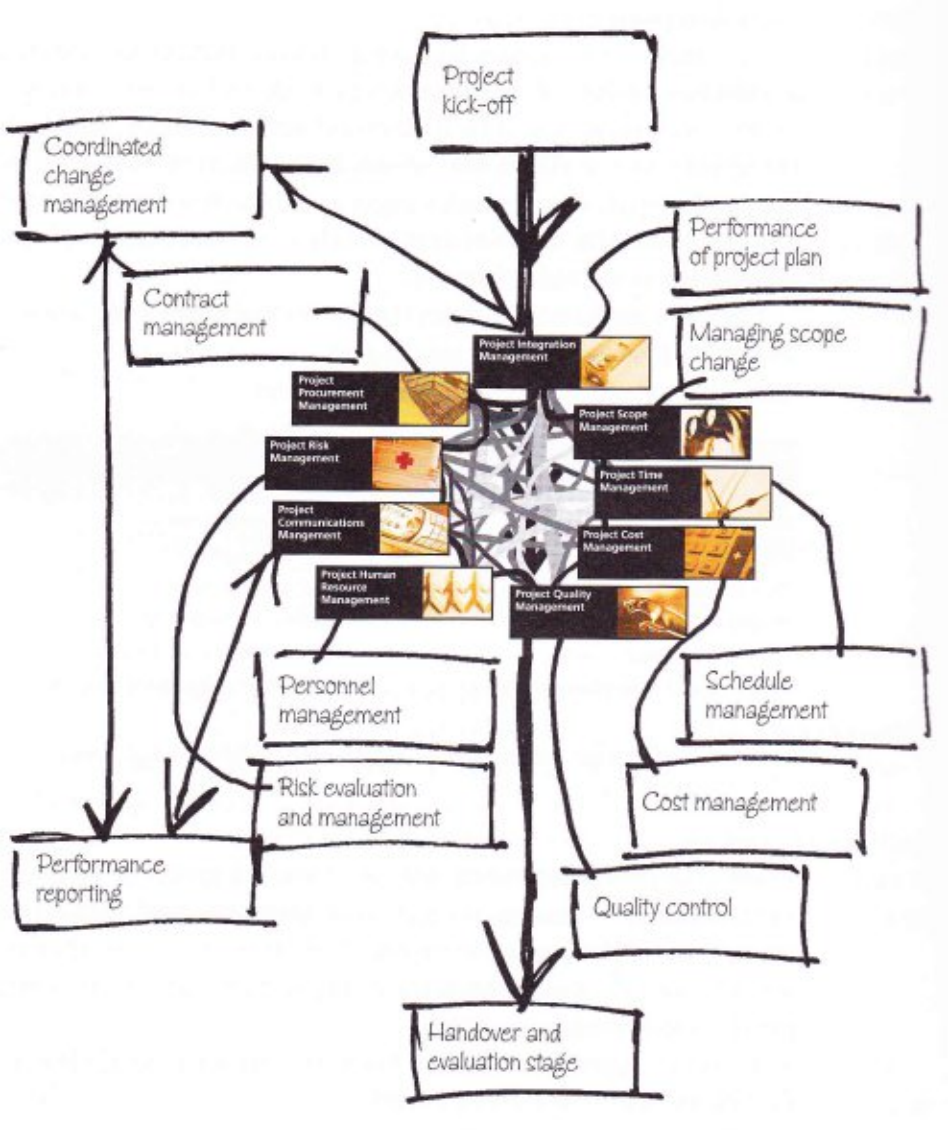
# Execution and Monitoring stage consists of 3 main processes

1. Manage and control project execution
   - (=HR management)
2. Monitor and control the project work
   - (=follow-up)
3. Coordinate and manage changes
   - (=managing scope)

# The purpose of the Execution and Monitoring stage

- The purpose of the Planning and Specification stage is to **develop the project plan**
- The purpose of the Execution and Monitoring stage is to **carry out the project plan**
  - Being aware that the plan does not hold, and that **follow-up and corrective actions** are needed

# The Execution and Monitoring stage



# Exercise 1: Follow-up

Form groups of three

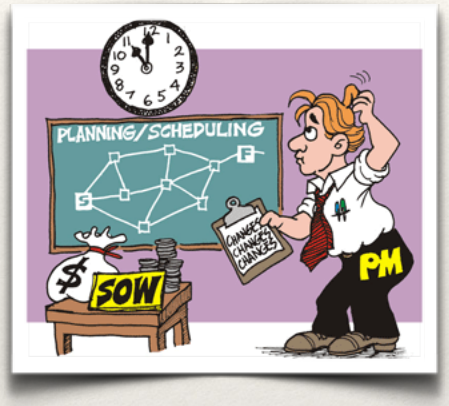
Select one type of follow-up from the next slide and discuss:

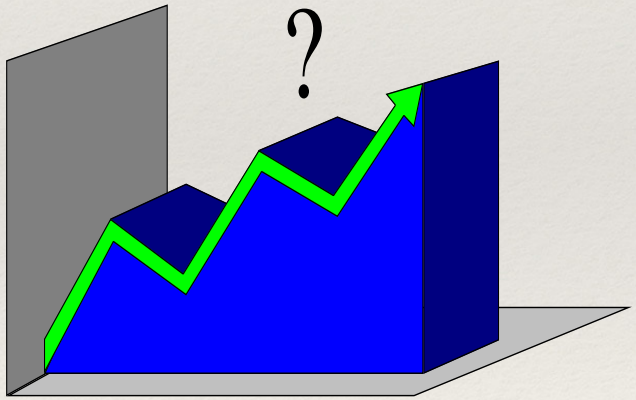
1. Why is it necessary to follow up on this
2. Which issues (what) should be included in the follow-up
3. Who should participate in the follow-up
4. How should the follow-up take place
5. When should the follow-up take place

Presentation in the plenary

# When a project is underway – and until it ends – you must follow up on:

- Estimate and costs
- Schedule (time)
- Scope and requirements
- Risks
- Stakeholders
- Quality and product



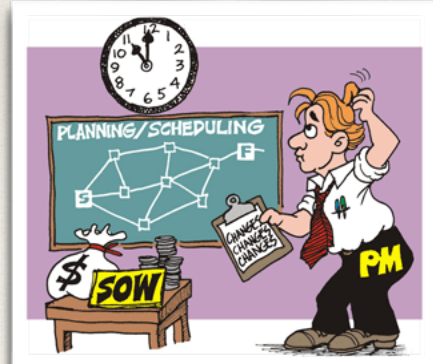
# Follow up on the project's **estimate and costs**

## Questions:

- Does actual resource consumption correspond to what was expected?
- Have we forgotten work items in the estimate?

## Methods and tools to answer them:

- Close contact with the project group
- Regularly (weekly) estimate the remaining work on ongoing tasks
- Regularly (monthly) re-estimate the project



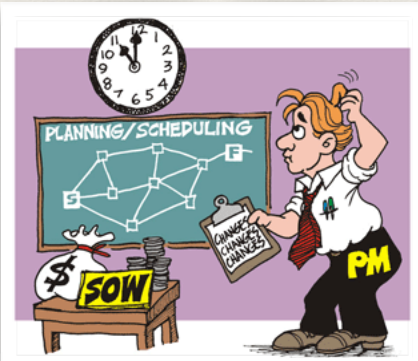
# Follow up on the project's **scope & requirements**

## Questions:

- Have the **goals** changed?
- Have the assumptions changed?
- Is there still a **need for the project** e.g. will it still give the expected benefits?

## Methods and tools to answer them:

- Close contact to the owner/sponsor/client/customer
- Close contact to the target group, e.g. the end-users of the project results
- Review the requirements specification and change log, f.ex. before steering group / status meetings



# Follow up on the project's **risks**

**Questions:**

- Have risks changed – probability / consequences?
- Have new risks emerged?
- New / revised ways to prevent or mitigate (Plan B)?

**Methods and tools to answer them:**

- Close contact to the owner / sponsor / client / customer
- An audit of the project's risk management –
  - e.g. someone from the outside comes to study the process
- Regular (monthly) risk identification and revision
- Repeat the risk analysis, f.ex. before steering group / status meetings

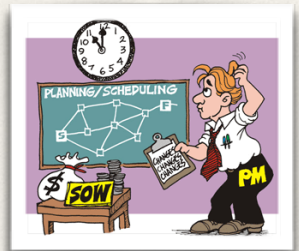
# Follow up on the project's **stakeholders (1/2)**

Don't forget your (key) stakeholders during the project

- especially not when you are most busy handling crises on the project

**Questions**

- Does the owner/sponsor still back up the project?
- Is there resistance to change in the target group?
- Are the project champions, ambassadors, super users still enthusiastic?
- Have there been changes among stakeholders, their attitude and influence?
- Is there a need to change your communication with them?



# Follow up on the project's **stakeholders (1/2)**

**Methods and tools to answer those questions:**

- Repeat the stakeholder analysis at regular intervals
  - Especially on projects of longer duration because important changes can take place under way
  - At least before steering group / status meetings

- Be in contact with the target group: worries? motivations?
  - Take the lead and be ready for change yourself
  - Get the project's owner/sponsor to tell about the vision in public
  - Find, involve and motivate the champions/ambassadors early

- Communicate, communicate and communicate:
  - Use the steering group
  - Send out newsletters
  - Hold information sessions

- Keep eyes and ears open and listen to the informal talks

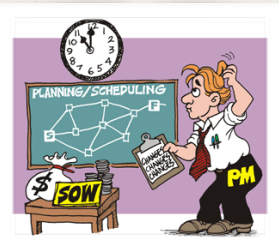
# Follow up on the project's **quality and product**

**Questions:**

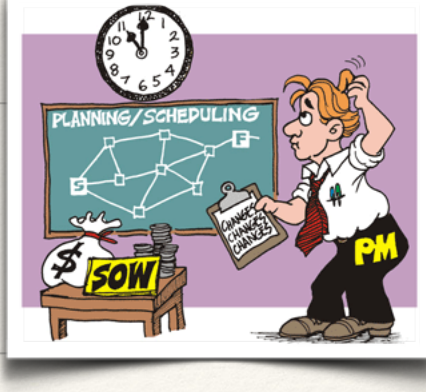
- Are we producing quality work and intermediate results?
- Do the product parts (components) evolve steadily towards a release?

**Methods and tools to answer them:**

- Inspection: process audits, reviews of results, and other types of walk-throughs
- Status accounts from configuration management on product parts
- Status accounts on quality management activities (reviews, tests)
- Trends in number of defects and their severity
- Statistical sampling
- Root cause analysis, of e.g. where in the process the problems stem and why



# Frequency of follow-up




**How often should you follow up on a project ?**

- At suitable intervals. But what is suitable?
  - Each day – i.e. 3,3% (1/30) of duration of a Sprint (SCRUM)
  - 2% of total project duration (Tom Gilb)

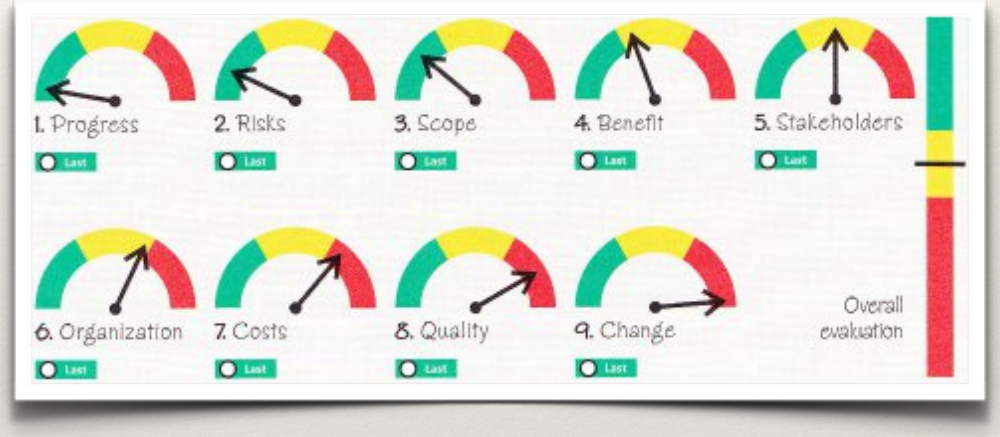
- In practice you should follow up on the project:
  - Daily for durations up to 6 weeks (1½ month)
  - Twice a week for durations up to 1 quarter (3 months)
  - Weekly for durations longer than a quarter

NB: The follow-up on the project should take place more frequently than status reporting to management

# Status reporting to management

**Regularly report status on:**

- Estimate and costs (consumption)
- Schedule (progress wrt. time)
- Scope (requirement changes)
- Risks
- Stakeholders (persons)
- Quality and product

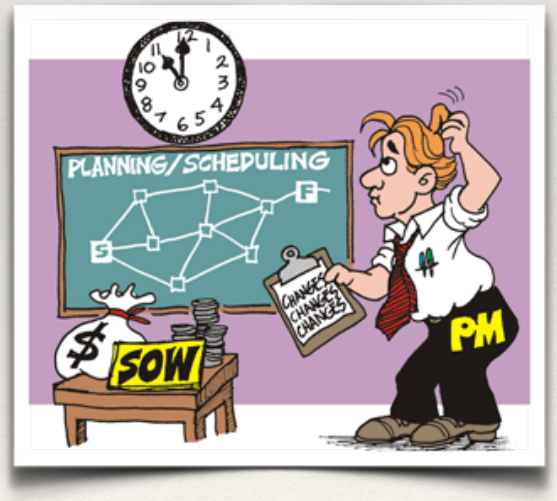



**How often should you report?**

- Typically monthly for project duration less than ½ year (6 months)
- Quarterly for project duration longer than ½ year
- But at least 3 times during the project
- Plus of course at significant changes/problems on the project

# Earned Value Technique

**The most important technique for following up on the project's estimate and costs**



# The Execution and Monitoring stage - the main issue

**It can be difficult to get to know the real status**
– before it is too late, i.e. before the money *has been* spent, the schedule *is* exceeded, etc.

But it is absolutely necessary to get the 'correct' information about the real status in proper time so that corrective actions can be performed

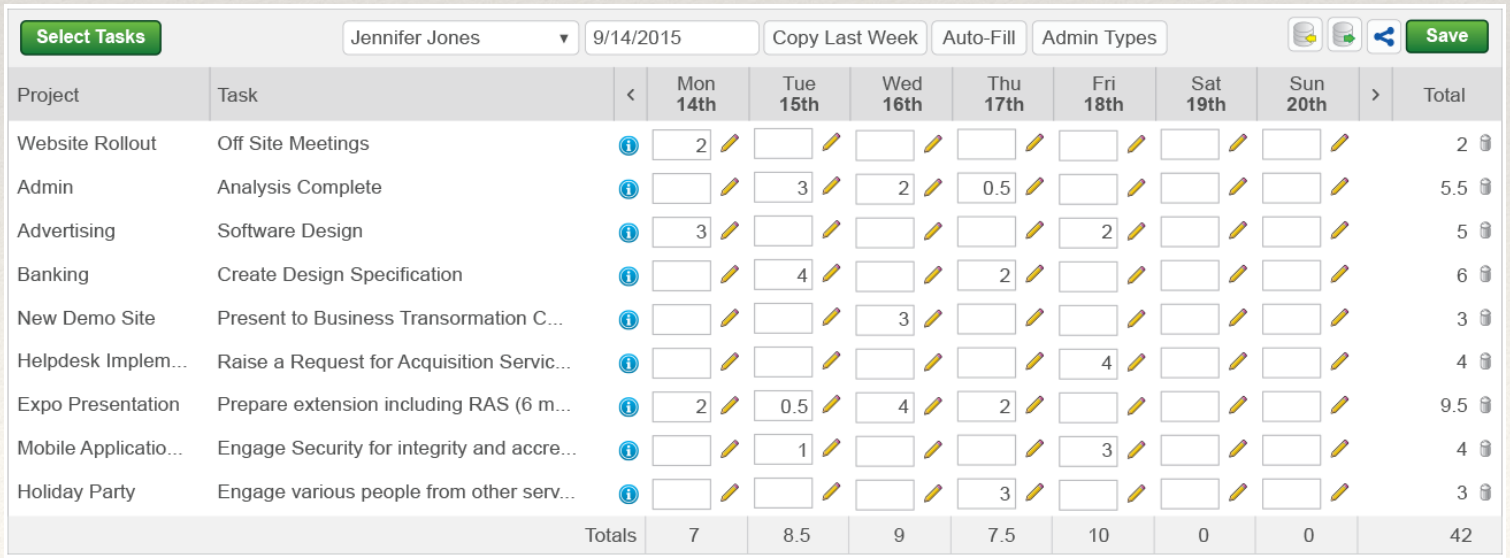
I.e:

- Pay attention to the quality of information; always use several sources
- Rate the information on the basis of (your personal) experience with the messenger's credibility

# The Execution and Monitoring stage - another issue: **Time sheets**

*If you don't keep a record of time consumption, you have no basis for any credible follow-up on progress*

- On the one hand, ensure a precise and accurate reporting of time spent
- On the other hand, make sure that the time sheets are completed at a level that makes sense (per hour?, day?) and on the right 'accounts'



Select Tasks | Jennifer Jones | 9/14/2015 | Copy Last Week | Auto-Fill | Admin Types | Save

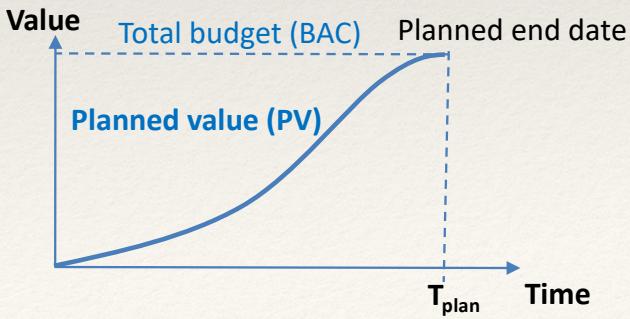
| Project | Task | Mon 14th | Tue 15th | Wed 16th | Thu 17th | Fri 18th | Sat 19th | Sun 20th | Total |
|---|---|---|---|---|---|---|---|---|---|
| Website Rollout | Off Site Meetings | 2 | | | | | | | 2 |
| Admin | Analysis Complete | | 3 | 2 | 0.5 | | | | 5.5 |
| Advertising | Software Design | 3 | | | | 2 | | | 5 |
| Banking | Create Design Specification | | 4 | | 2 | | | | 6 |
| New Demo Site | Present to Business Transormation C... | | | 3 | | | | | 3 |
| Helpdesk Implem... | Raise a Request for Acquisition Servic... | | | | | 4 | | | 4 |
| Expo Presentation | Prepare extension including RAS (6 m... | 2 | 0.5 | 4 | 2 | | | | 9.5 |
| Mobile Applicatio... | Engage Security for integrity and accre... | | 1 | | | 3 | | | 4 |
| Holiday Party | Engage various people from other serv... | | | | 3 | | | | 3 |
| | Totals | 7 | 8.5 | 9 | 7.5 | 10 | 0 | 0 | 42 |

# Earned Value Technique: **Planned Value (PV)**

- Estimate every activity on the project (f.ex. hours)
- The results of the estimation is the approved <u>total</u> budget = **Budget at Completion (BAC)**

- The ”value” of each activity on the project is normally considered proportional to the estimate for the activity
  - E.g. a 100 hour activity is considered as twice the ”value” of a 50 hour activity

- Plan <u>when</u> each activity should take place in time (schedule), and from this derive the planned value that is expected to be delivered over time = **Planned Value (PV)**
  - E.g. you have a project to be completed in 12 months.
  - Budget: 100,000 USD.
  - 6 mth passed by and 50% work should be completed (per schedule)
  - PV: (50/100)* 100,000= 50,000 USD



# Earned Value Technique: **Monitor consumption**

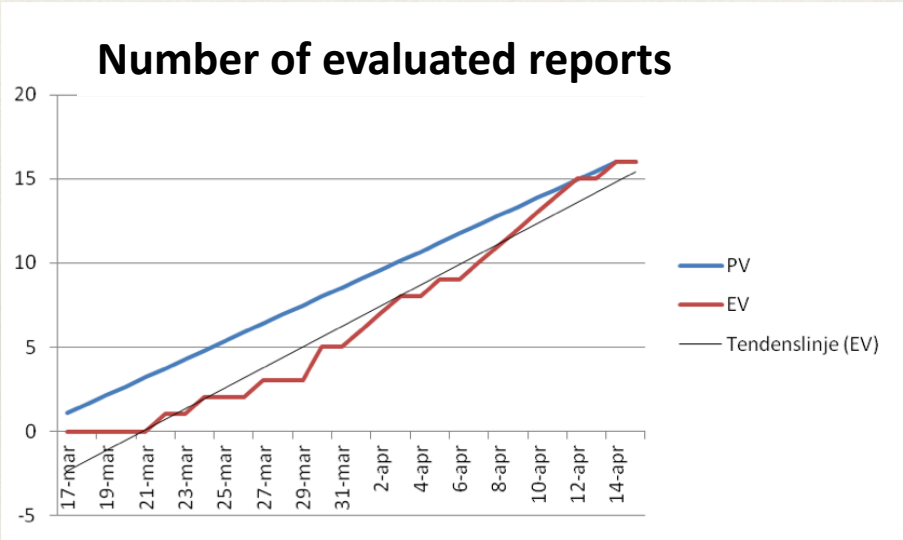
- A simple counting of the (time) consumption e.g. **Actual Cost (AC)** is not adequate for credible follow-up
  - The remaining work on ongoing activities may turn out to exceed the remaining budget

- Therefore:
  - Follow-up exclusively based on consumption is very optimistic
  - Need a more realistic estimate of the real value earned than pure consumption

# Earned Value Technique: Earned Value (1:2)

The most realistic account is of course to wait until the activity is <u>completed</u> (100% done), because then the planned value for sure has been earned = **Earned Value (EV)**

- For e.g.,:




- But other models, which include a <u>percentage</u> of the planned value for ongoing activities in EV can also be used (f.ex. 20% or 50% at start)

# Earned Value Technique: Earned Value (2:2)

- Another calculation method is to estimate the remaining work at the status point and adjust the current consumption (AC) accordingly:
  - Estimate the remaining work = **Estimate to Complete (ETC)** and from this derive a revised estimate for the total work on the activity: **Estimate at Completion (EAC)** = AC + ETC (current consumption + remaining work)
  - The Earned Value can now be derived from the estimate for the activity: **EV = (AC / EAC) * BAC** (i.e. as the degree of completion relative to the original estimate)

| Original Budget (BAC) | Actual Consumption (AC) | Remaining work (ETC) | Estimated final consumption (EAC) | Earned value (EV) adjusted for remaining work |
|---|---|---|---|---|
| 450 | 100 | 400 | 500 | (100/500)*450 = 90 |

# EVM so far…

| Term | Explanation | Questions |
|---|---|---|
| Planned Value (PV) | Approved budget for the work *scheduled* to be completed by a specified date | How much work should be done? |
| Earned Value (EV) | Approved budget for the work *actually completed* by the specified date | How much work was done? |
| Actual cost (AC) | The costs actually incurred for the work completed by the specified date | How much did the work cost? |
| Budget at Completion (BAC) | The total amount budgeted for the task | What is the total job budgeted to cost? |
| Estimate at Completion (EAC) | Your estimate today of the total cost of the task | Your estimate today of the toal cost of the task |

# So, back to the world of fruits…

You asked your friend to purchase 100 apples in 10 days (10 apples per day)
Planned cost of one apple= $10

- Total cost of purchase: $10* 100 apple= $1000
- Time= 10 days
- Scope= 100 apples

On the 5th day, your friend purchased 40 apples and spent 500.

- Actual percentage= 40% (40 apples)
- Planned percentage= 50% (50 apples)

Performance:

- Planned value= 50 apples* $10= $500
- Earned value= 40 apples* $10= $400
- Actual costs= $500

On the 5th day your friend will claim $500, but according to earned value you can pay him a cheque of $400

# Exercise 2: Earned Value Technique

Join together in groups of three

1. Assume that distribution of the work was planned evenly over the 3 months
2. Add to the graph the actual consumption (AC) and estimated final consumption (EAC)
3. Calculate EV at the different status accounts and plot them in the graph - Using the earned value (EV) model where actual consumption (AC) is adjusted with the remaining work (ETC)

Summary in the plenary

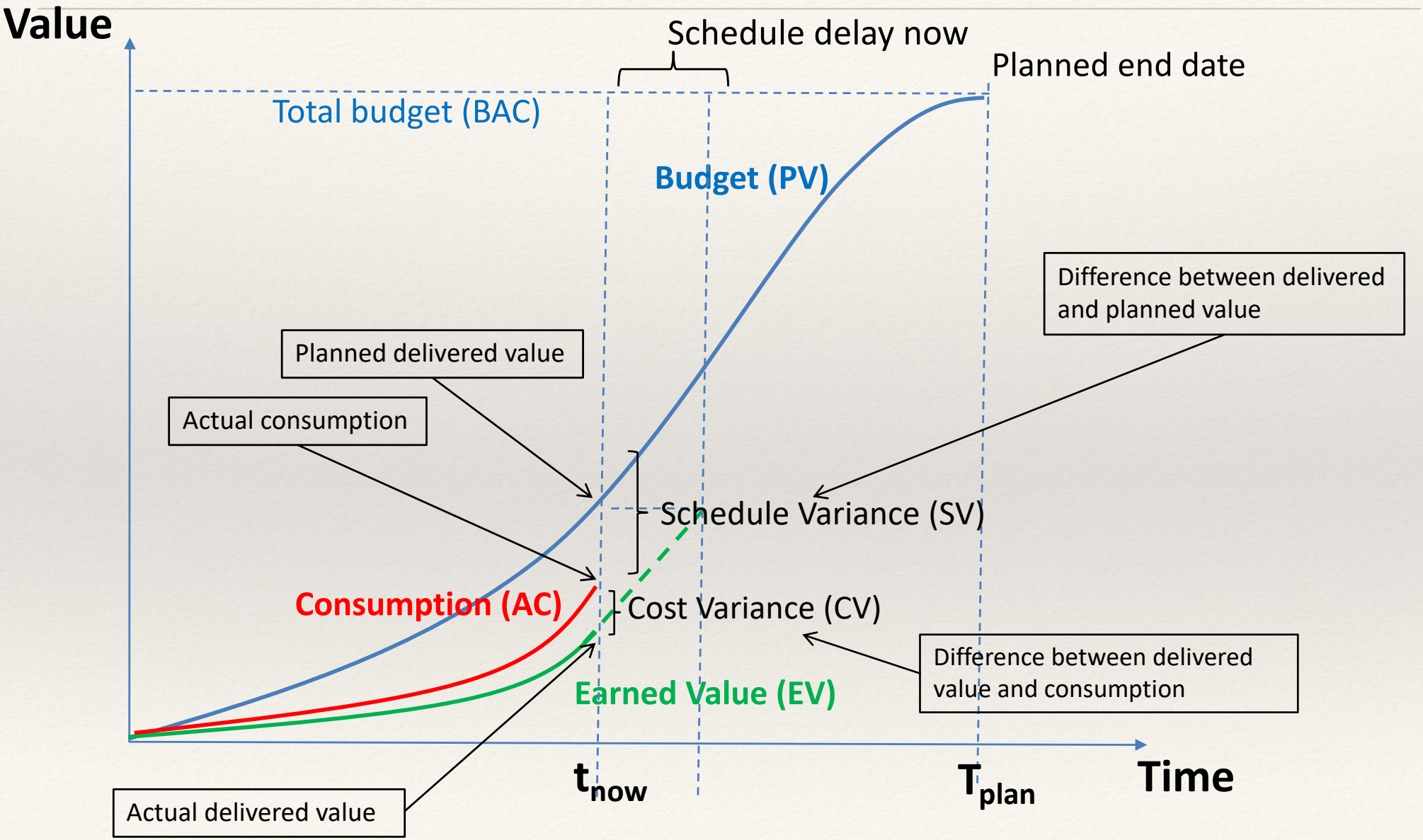
| Description | Status account date | Approved Budget (BAC) | Actual Consumption (AC) | Remaining work (ETC) |
|---|---|---|---|---|
| Activity Adam | 1.Jan | 450 | 0 | 450 |
| Activity Adam | 1.Feb | 450 | 100 | 500 |
| Activity Adam | 1.Mar | 450 | 250 | 300 |
| Activity Adam | 1.Apr | 450 | 500 | 0 |

# When should you use the different Earned Value models?

- No Earned Value is accounted until the activity is 100% completed
  - EV=PV is only taken into account when the work is 100% done
  - Used when the follow-up frequency is comparable to the length of the activities (duration of the activity is max. twice the follow-up frequency)
- At the start of the activity EV is accounted as a % of PV
  - At activity start EV is accounted f.ex. 20% or 50% of PV
  - When 100% is done the rest of PV is accounted (80% or 50% respectively)
  - Used when there are significant costs at the start of the activity (f.ex. purchase of equipment, license payments)
- Consumption adjusted for remaining work
  - At each status account EV is counted as the current degree of completion relative to the original estimate for the activity: EV=(AC/EAC)*BAC
  - Used in most cases

NB: When EV is accounted based on completed activities or percentage for ongoing, PV must be planned by the same principle for proper comparison

# Earned Value Technique Graphically



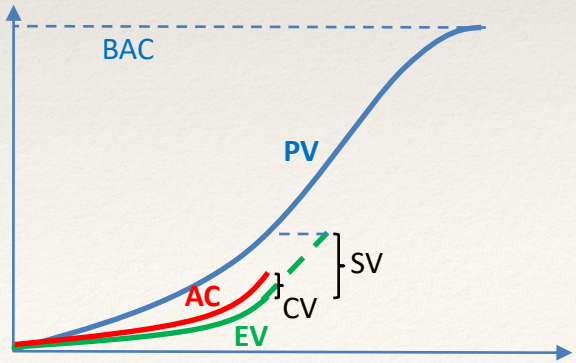
# Earned Value Technique: **Budget compliance**

- From the project time sheets we can see the **Actual Cost (AC)** and therefore we can calculate how much we have spent to achieve "real" **Earned Value (EV)** at the status point, i.e. how effective we are

- We can compare the "real value" we have achieved to the cost we have spent, i.e. when AC and EV are compared we can see the progress relative to the budget:

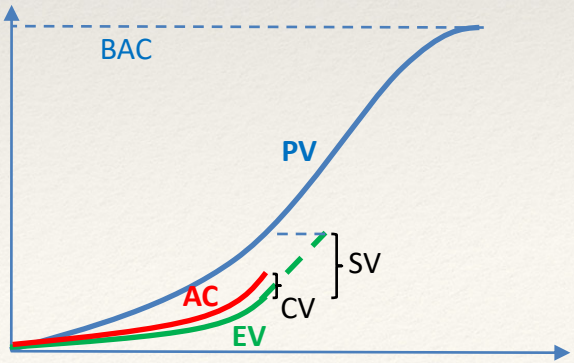
- **Cost Variance (CV) = EV-AC**
  - If CV= 0= on budget
  - If CV= positive: under budget.
  - If CV = negative: over budget.=> a potential budget deficit

- **Budget deficit = -CV/EV %**



# Earned Value Technique: **Schedule compliance**

- From the project schedule we can see how many activities we should have executed and therefore how much ”value” we should have delivered
- We can compare the ”value” we had planned to achieve to what we have actually achieved, i.e. when PV and EV are compared we can see the progress relative to the schedule:
- **Schedule Variance (SV) = EV-PV**
  - If SV= 0= on schedule
  - If SV= positive: ahead of schedule .
  - If SV = negative: behind schedule (too slow, potential delay)
- **Schedule delay = -SV/EV %**



# Earned Value Technique: **Schedule compliance**

- We take the example with activity Adam
- At the status account March 1st we realize that we are behind schedule because of lack of resources and increased consumption until now. This means that we now anticipate a delay:

| Description | Status account date | BAC (hours) | AC (hours) | ETC (hours) |
|---|---|---|---|---|
| Activity Adam | 1.Jan | 450 | 0 | 450 |
| Activity Adam | 1.Feb | 450 | 100 | 500 |
| Activity Adam | 1.Mar | 450 | 250 | 300 |
| Activity Adam | 1.Apr | 450 | ~~500~~ 400 | ~~0~~ 100 |
| Activity Adam | 1.May | 450 | 500 | 0 |

# Exercise 3: Earned Value Technique

Rejoin the groups from exercise 2

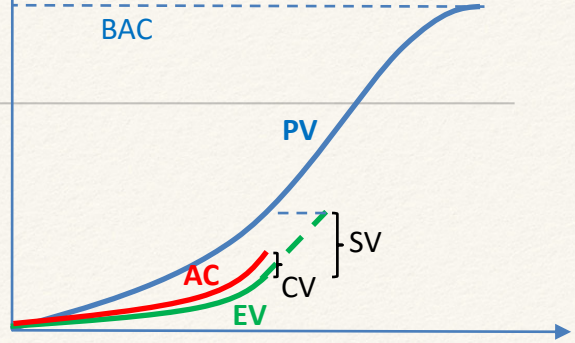
For Activity "Adam" from the previous slide:

1. Assume that distribution of the work was planned evenly over the 3 months
2. Calculate PV at each of the monthly status accounts and plot it in a graph
3. Add to the graph the estimated final consumption (EAC) and actual consumption (AC)
4. Calculate EV at the status accounts Feb 1st and Mar 1st, and plot them in the graph - using the earned value (EV) model where actual consumption (AC) is adjusted with the remaining work (ETC)
5. Calculate SV and CV at the status account Mar 1st
6. Reflect over what the graph shows, i.e. the relationship between plan and reality
7. What should have been done at the first status account?

NB: you have already done bullet 1-4 in Exercise 2, except for status accounts at Apr and May 1st

Summary in the plenary

# Earned Value Technique:
# Re-estimate the project?




Finally we must find out, how much the final consumption will become at the end of the project, i.e: **Estimate at Completion (EAC)** There are four situations:

1. **We are <u>on track</u>**
   - I.e. SV and CV are close to 0, or we think we can catch up on the deviations
   - => No change to the budget: EAC = BAC (Original budget)

2. **Deviations until now were a <u>one-off</u>**
   - In the future, we can work with the originally planned efficiency
   - => Past deviations are included in the budget : EAC = AC + (BAC – EV)

3. **Deviations will also be <u>typical</u> for future activities**
   - Systematic deviation! Our current effectivity will not change
   - => The observed effectivity must be included in the budget: EAC = AC + (BAC-EV)*AC/EV

4. **The assumptions for the estimates were <u>wrong</u>**
   - => We must base the budget on the remaining work: EAC = AC + ETC (Estimate to Complete)

***And then start negotiations with the customer/sponsor !***

# New budget for a typical deviation - Example

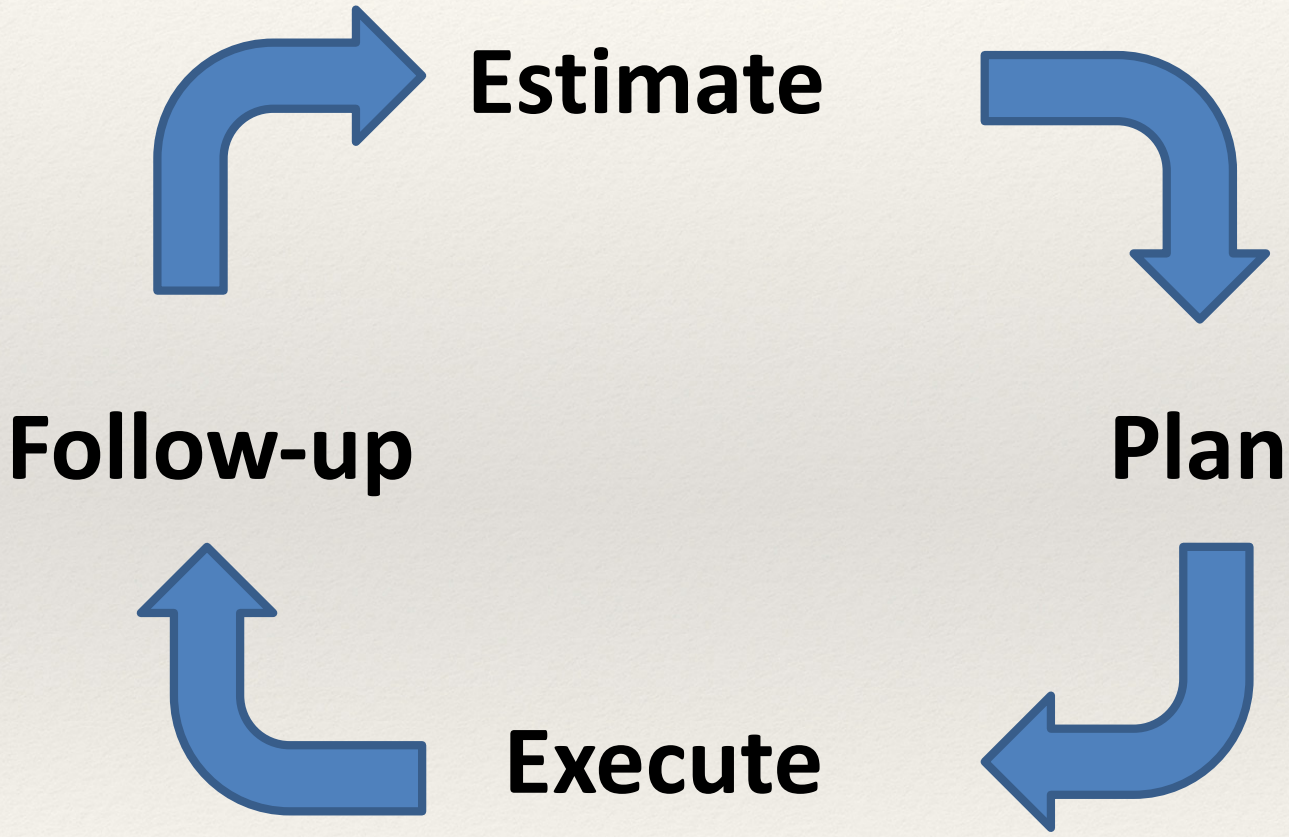
- We originally estimated the project to take 7200 hours (BAC)
- At this status point we realize that:
  - We have achieved a value of 2400 hours out of the planned work (EV)
  - But we have consumed 3000 hours (AC)

- Evidently it has cost us 25% more hours than planned to deliver each hour of value :
  - AC/EV = 3000/2400 = 1.25

- We anticipate that progress so far (our effectivity) will be typical for the rest of the project (situation 3 on the previous slide). The new estimate to finish the project (EAC) then becomes:
  - EAC = AC + (BAC-EV)*AC/EV

- EAC = 3000 + (7200-2400)*1.25 = 9000 hours
  - instead of the originally planned 7200 hours

# Coherence in the Execution and Monitoring stage



# Additional sources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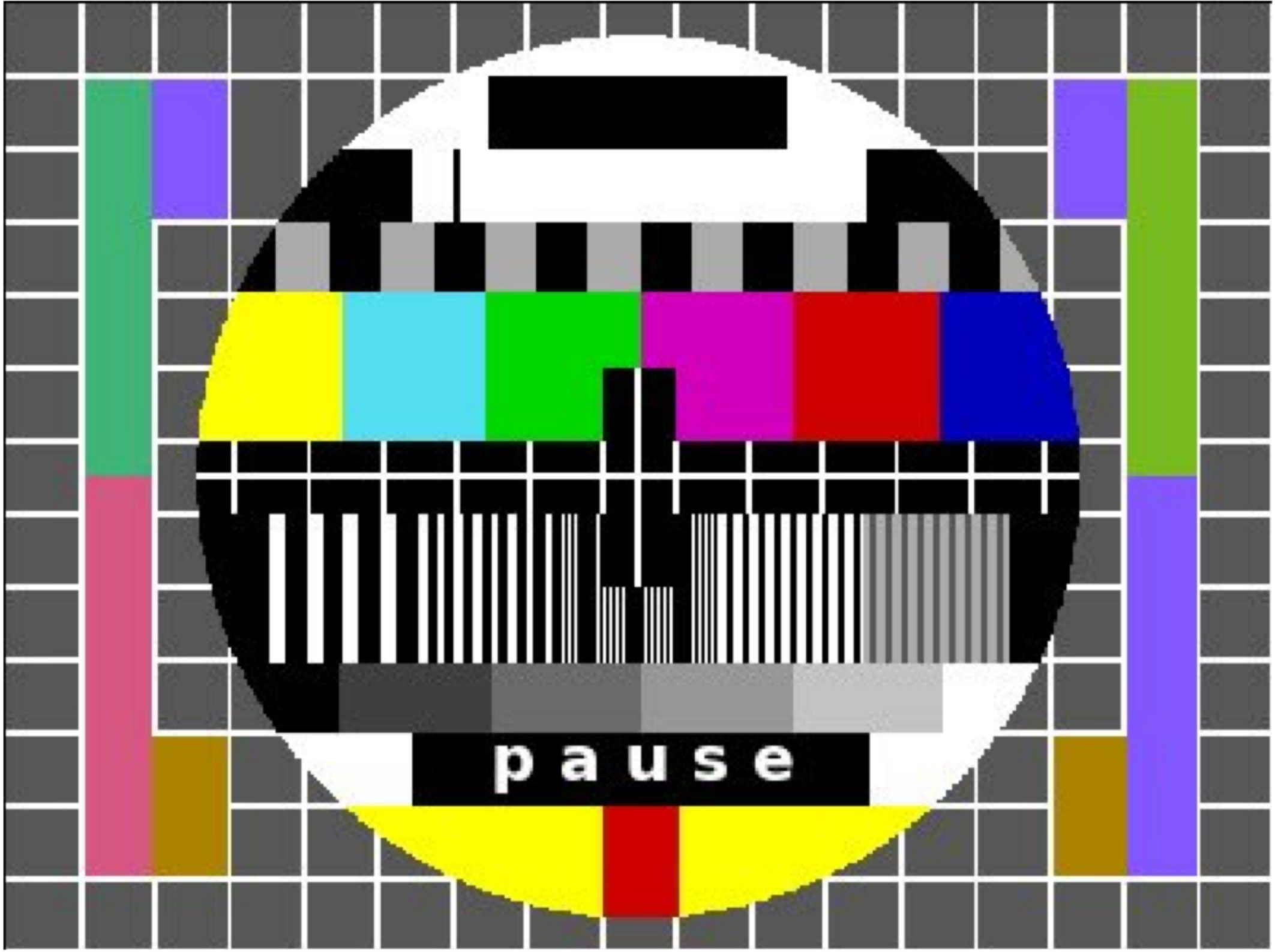
- PMP Exam: https://www.youtube.com/watch?v=UggTFk2EiUg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