

 POLITECNICO DI MILANO

Dipartimento di  
Elettronica e Informazione

Planning and Managing Software Projects 2013-14  
Class 15

# **Project Control**

## **Controlling of Projects and Earned Value Analysis**

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- This slides are largely based on Prof. John Musser class notes on “Principles of Software Project Management”
- Original slides are available at <http://www.projectreference.com/>
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# Today Agenda

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- **Project Control**
- Status Reporting
- Earned Value Analysis

- Ongoing effort to keep your project on track
- 4 primary activities:
  1. Planning performance
    - A Software Development Process (SDP), schedule, and a control process
  2. Measuring status of work performed
    - Actual
  3. Comparing to baseline
    - Variances
  4. Taking corrective action as needed
    - Response
- Prerequisite to good control is a good plan

- “Control”
  - Power, authority, domination. No.
  - Guiding a course of action to meet an objective. Yes.
- Principles
  - Work is controlled, not workers
    - Control helps workers be more effective & efficient
  - Control based on work completed
    - Use concrete deliverables (no fuzzy milestones!)
  - Balance
    - Appropriate level between too much and too little
    - Avoid the extremes:
      - Micro-managing vs. neglect
      - Too much tracking vs. too less tracking

- The three key Progress Monitoring Questions
  1. What is the actual status?
  2. If there's a variance, what is the cause?
  3. What to do about it?
  
- The three possible responses:
  - a) Ignore
  - b) Take corrective action
  - c) Review the plan

- Monitoring rates
  - Daily, weekly, monthly
  - There is not a formula to define the correct monitor rates
  - It depends by:
    - Project Duration
    - Project Complexity
    - Critical phases
      - You may have to monitor problematic areas more closely
      - Almost always there's one or more areas under closer scrutiny, for some period of time

# Today Agenda

- Project Control
- **Status Reporting**
- Earned Value Analysis
- Controlling a Project with Microsoft Project



- Status Reporting
  - Part of the communications management plan
    - Which is usually just a section of Software Development Plan (SDP)
- Two levels of reporting
  - From team to PM
  - From PM to stakeholders
- Status reporting “From Team to PM”
  - Email notes, chats, one minute talks, ...
  - Weekly meetings
  - More frequent meetings during crises
- Typical format for status reporting “From PM to Stakeholders”
  - Summary
  - Accomplishments for this period (done)
    - Tasks, milestones, metrics
  - Plans for next period (to-do)
  - Risk analysis and review
  - Issues & Actions

- A programmer reports that he's 80% done
  - What does this mean?
  - He completed 4,000 LOC on estimated 5,000 LOC effort
  - And what about the quality control?
  - How much work was estimated to complete the task?
    - Estimates could have been wrong
- "90% Complete Syndrome"
  - Software is 90% complete for 90% of the time
  - It's unbelievable how much work is needed to complete a work from 90% to 100%
- If you can't measure scope or quality, then you don't know "reality"
  - You really only know the cost so far (hours spent)
- How can you improve this?

- Tasks can only be in one of two states
  - Completed or Uncompleted
  - No partial credit
  - This is preferred to anything subjective!
- If you need more granularity than 0%  $\leftrightarrow$  100%
  - Use lower-level task decomposition
  - Each lower-level task is measured with binary reporting
- Use a tangible criteria to declare that a task is completed
  - E.g. Achieving sign-off for requirements
  - E.g. All regression tests pass
  - E.g. Achieving sign-off of final system

- Project Control
- Status Reporting
- **Earned Value Analysis**
- Controlling a Project with Microsoft Project

# Earned Value Analysis (EVA)

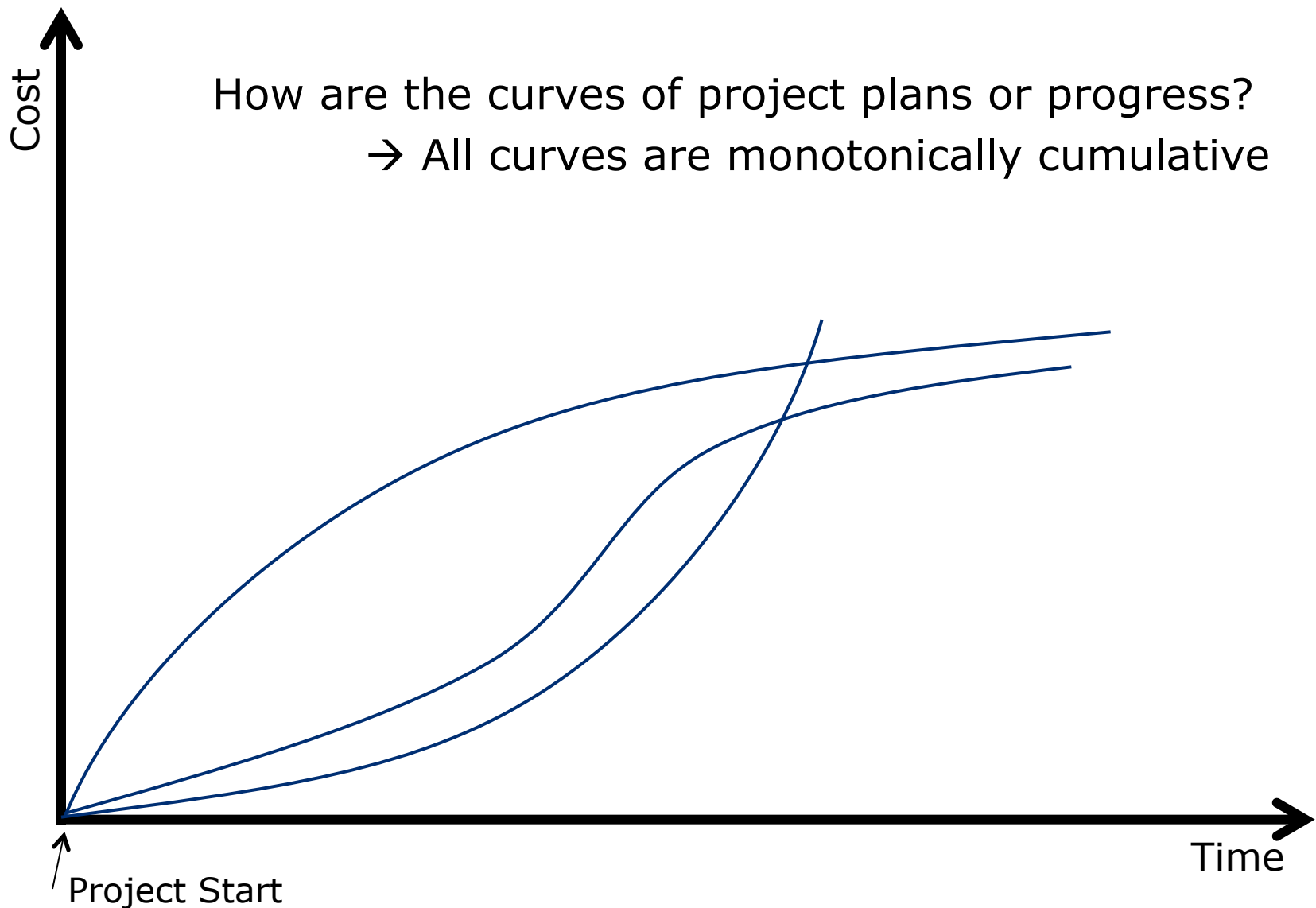
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- Also known as Earned Value Management (EVM) or Variance Analysis
- It's a metric of project tracking
  - It measures the **real physical progress**
  - "What you got for what you paid"
- "Traditional" non-EVA approach
  - Two dimensions for *time* and *cost*
    - Planned time vs. Actual time
    - Planned costs vs. Actual costs
  - Progress is defined as comparison between planned and actual
  - It doesn't not consider the value of performed tasks
- EVA approach
  - It adds a third dimension on costs:
    - Planned Cost, Actual Cost, **Earned Value**

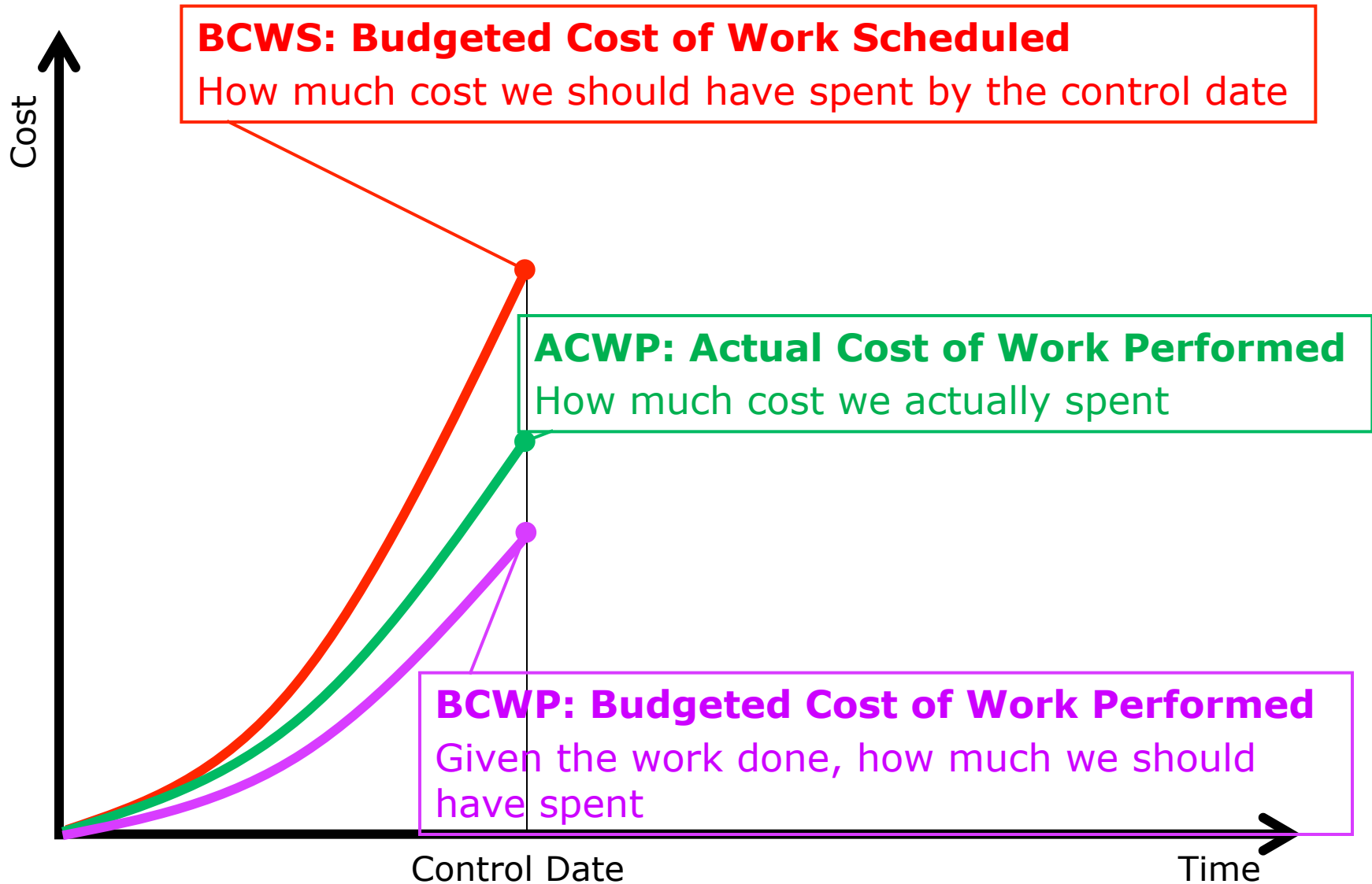
- EVA is calculated as comparison to the Performance Measurement Baseline (PMB) that is:
  - Time-phased budget plan against which contract performance is measured
  - It establishes the scope, schedule and budget targeted for the project
  - The PMB is a plan with well-defined milestones upon which contract is based
- Comparison with the PMB is usually done by using costs applied to milestones
  - PMB at minimum is a list of milestones with dates
  - Each milestone has its own planned and actual cost

# Earned Value Analysis

## The Time and Cost chart



# The Three Major Variables of EVA





# The three major Components

- **BCWS:** Budgeted Cost of Work Scheduled
  - Also called “Planned Value” (PV)
  - “Wished”
  - How much work should be done?
  
- **ACWP:** Actual Cost of Work Performed
  - Also called “Actual Cost” (AC)
  - “Burned”
  - How much did the work done cost?
  
- **BCWP:** Budgeted Cost of Work Performed
  - Also called “Earned Value” (EV)
  - “Earned”
  - How much work is actually done?
  - Calculated considering the BCWS related to the milestones actually achieved

# Earned Value Analysis

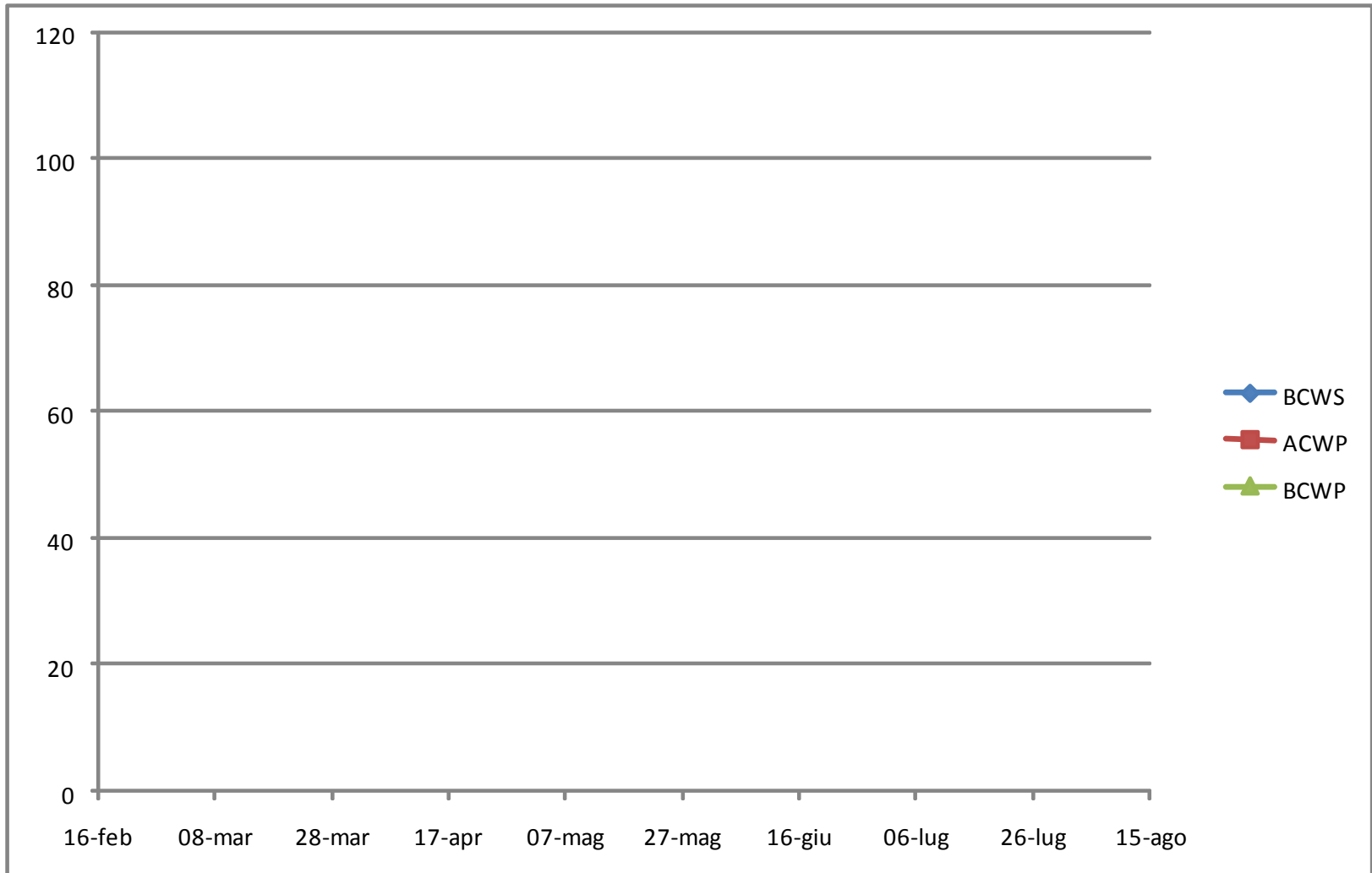
## EVA Example

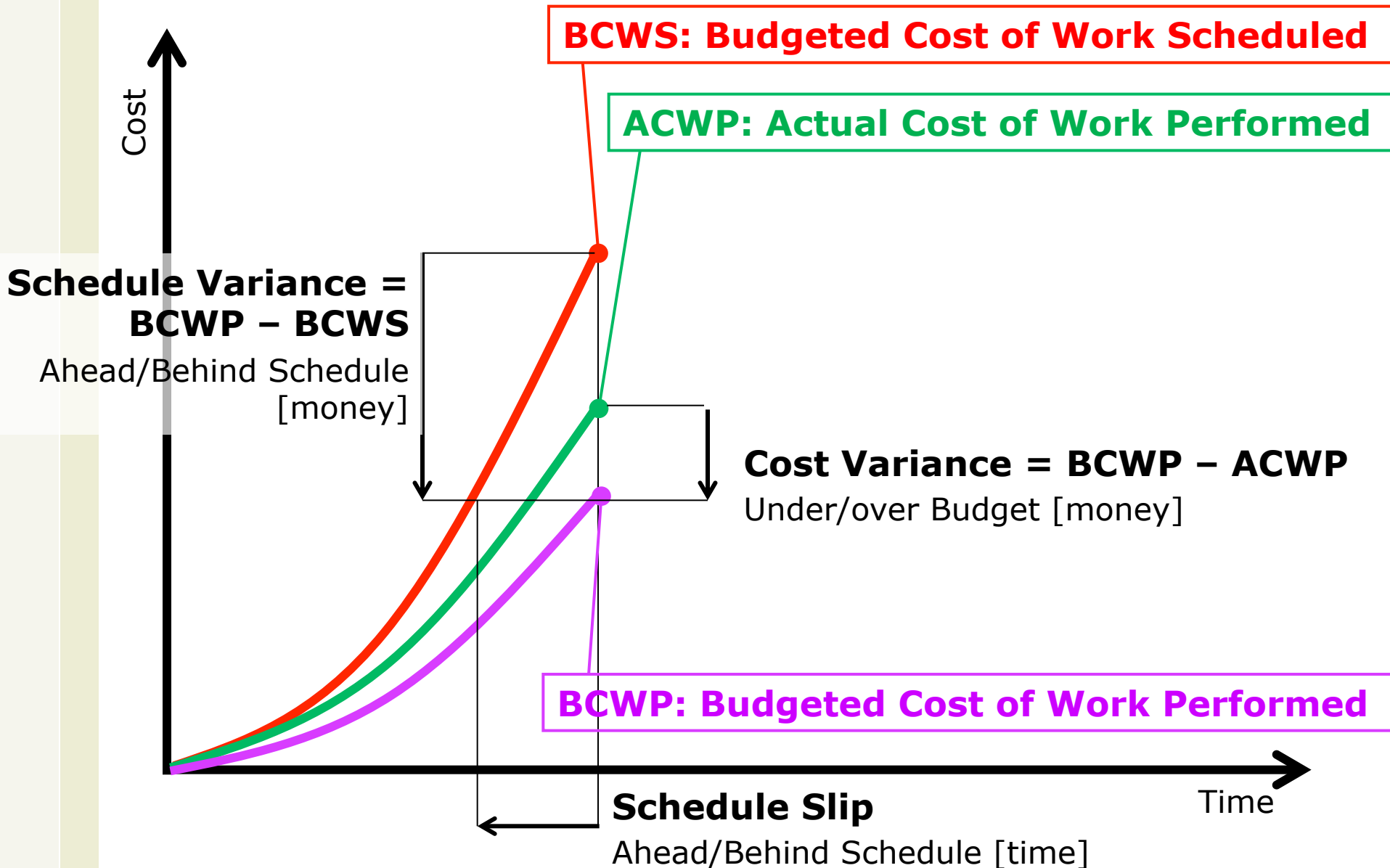
WBS	Completion Date		Cost	
	Planned	Actual	Planned	Actual
Project Start	01-mar	01-mar	€ 0	€ 0
Milestone A	01-apr	20-apr	€ 25.000	€ 20.000
Milestone B	01-mag	28-mag	€ 15.000	€ 10.000
Milestone C	01-giu	18-giu	€ 10.000	€ 15.000
Milestone D	01-lug		€ 15.000	
Milestone E	01-ago		€ 10.000	
<b>TOTALS</b>			<b>€ 75.000</b>	<b>€ 45.000</b>

- As of **1-July** where are we?
- BCWS =
- ACWP =
- BCWP =

# Earned Value Analysis

## EVA Example





- “What is the project status”?
  - You can use Derived EVA variances to answer this
- **CV**: Cost Variance
  - $BCWP - ACWP (=EV-AC)$
  - Budgeted costs vs. Actual costs
  - $>0 \rightarrow$  Under Budget (spending less) 😊
  - $<0 \rightarrow$  Over Budget (spending more) ☹️
- **SV**: Schedule Variance
  - $BCWP - BCWS (=EV-PV)$
  - Planned work vs. Work completed
  - $>0 \rightarrow$  Ahead of Schedule 😊
  - $< 0 \rightarrow$  Behind Schedule ☹️

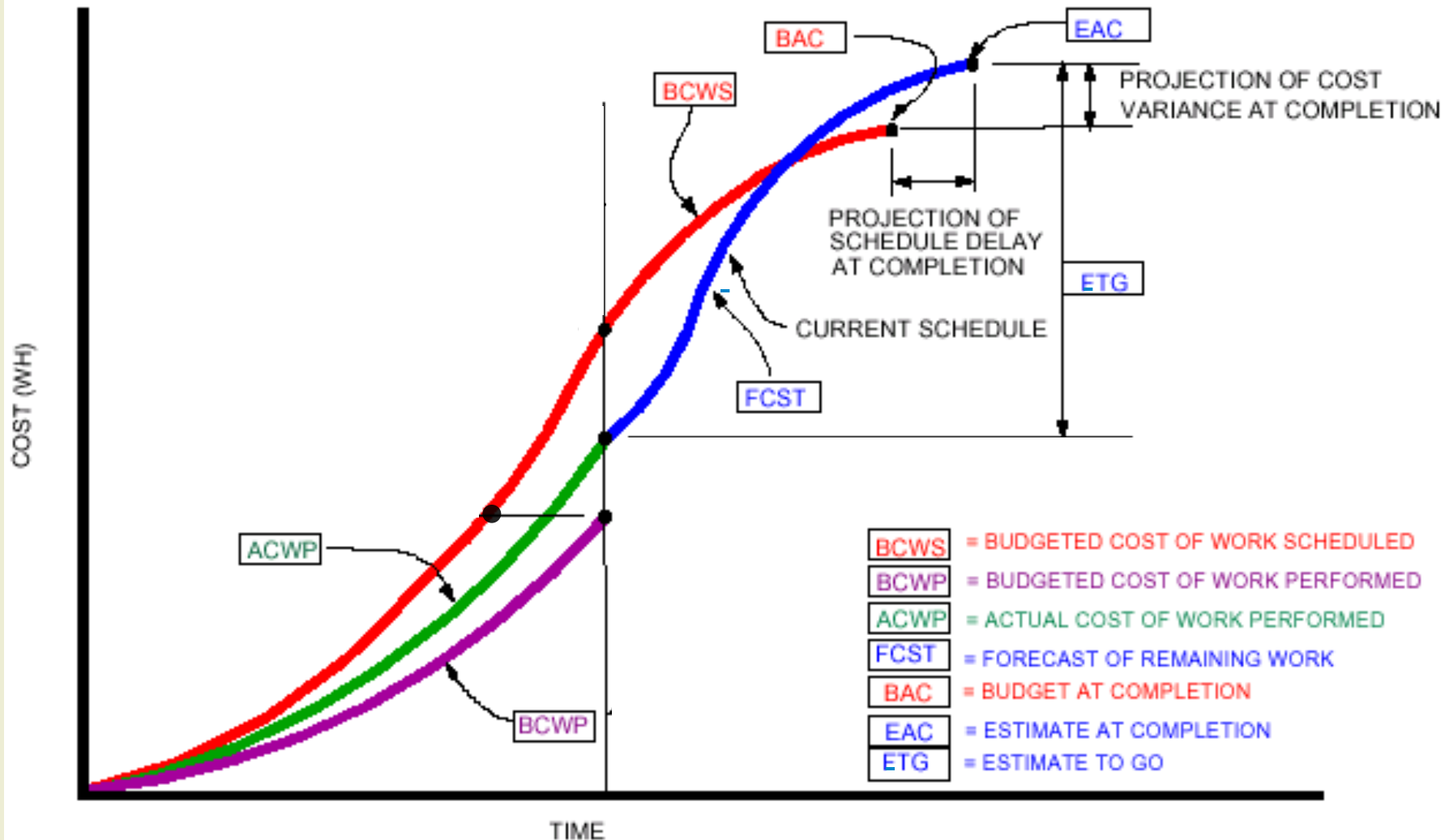
- **CPI:** Cost Performance Index
  - $BCWP / ACWP (=EV/AC)$
- **SPI:** Schedule Performance Index
  - $BCWP / BCWS (=EV/PV)$
- Problems are when these indexes are less than 1
- **CR:** Critical Ratio
  - $SPI \times CPI \rightarrow$  it's a proportional combination
  - 1  $\rightarrow$  everything is on track
  - $< 1 \rightarrow$  project is performing worse than planned
  - $> 1 \rightarrow$  project is performing better than planned
  - Pragmatically:
    - $> 0.8$  and  $< 1.2 \rightarrow$  acceptable performances
    - $< 0.8 \rightarrow$  too bad performances, project is under-performing
    - $> 1.2 \rightarrow$  project seems over-performing
      - but plan may be too pessimistic and easy to follow

# Earned Value Analysis

## EVA Example

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- $SV =$
- $CV =$
- $SPI =$
- $CPI =$
- $CR =$





- **BAC: Budget At Completion**
  - Sum of all budgets till the end of project (BCWS)
  - The end of the original budget curve
  
- **ETG: Estimate to go**
  - Forecast of additional cost from today to the end of project
  - $ETG = (BAC - BCWP)/CPI$
  - Unfinished work ( $BAC - BCWP$ ) divided by cost performance indicator (CPI)
  
- **EAC: Estimate At Completion**
  - Forecast of total cost at completion
  - $EAC = ETG + ACWP = (BAC - BCWP)/CPI + ACWP$
  - If  $CPI < 1$ , EAC will be  $> BAC$ 
    - We'll finish the project in overspending since we are less performing than estimated

# Earned Value Analysis

## EVA Example

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- BAC =
- ETG =
- EAC =

- For solution see the course Web site and download P&MSP2014\_15\_EVA-example1.xls
  
- For another example, download P&MSP2014\_15\_EVA-example2.xls

- Benefits of EVA
  - Consistent unit of measure for total progress
  - Consistent methodology
    - Across cost and completed activity
    - Apples and apples comparisons
  - Ability to forecast cost & schedule
  - Can provide early warnings
    - EVA can signal errors as early as 15% into project
  
- Success factors
  - A full WBS is required
  - Beware of GIGO: Garbage-in, garbage-out

- Warnings:
  - BCWS
    - Use 'loaded labor' rates if possible
      - Consider direct pay and also overhead
  - Remember that EVA variables are aggregate figures
    - Their may hide where the problem lies
    - Be aware of counterbalancing issues
      - Over in one area vs. under in another area
  
- A guide on Earned Value Analysis
  - <http://www.projectsmart.co.uk/docs/earned-value.pdf>

## Optional Readings

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- McConnell: 11 "Motivation", 13 "Team Structure"
- Schwalbe, 8, "Project Human Resource Management"

# Questions?