



 POLITECNICO DI MILANO

Dipartimento di
Elettronica e Informazione

Planning and Managing Software Projects 2014-15
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

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- 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)

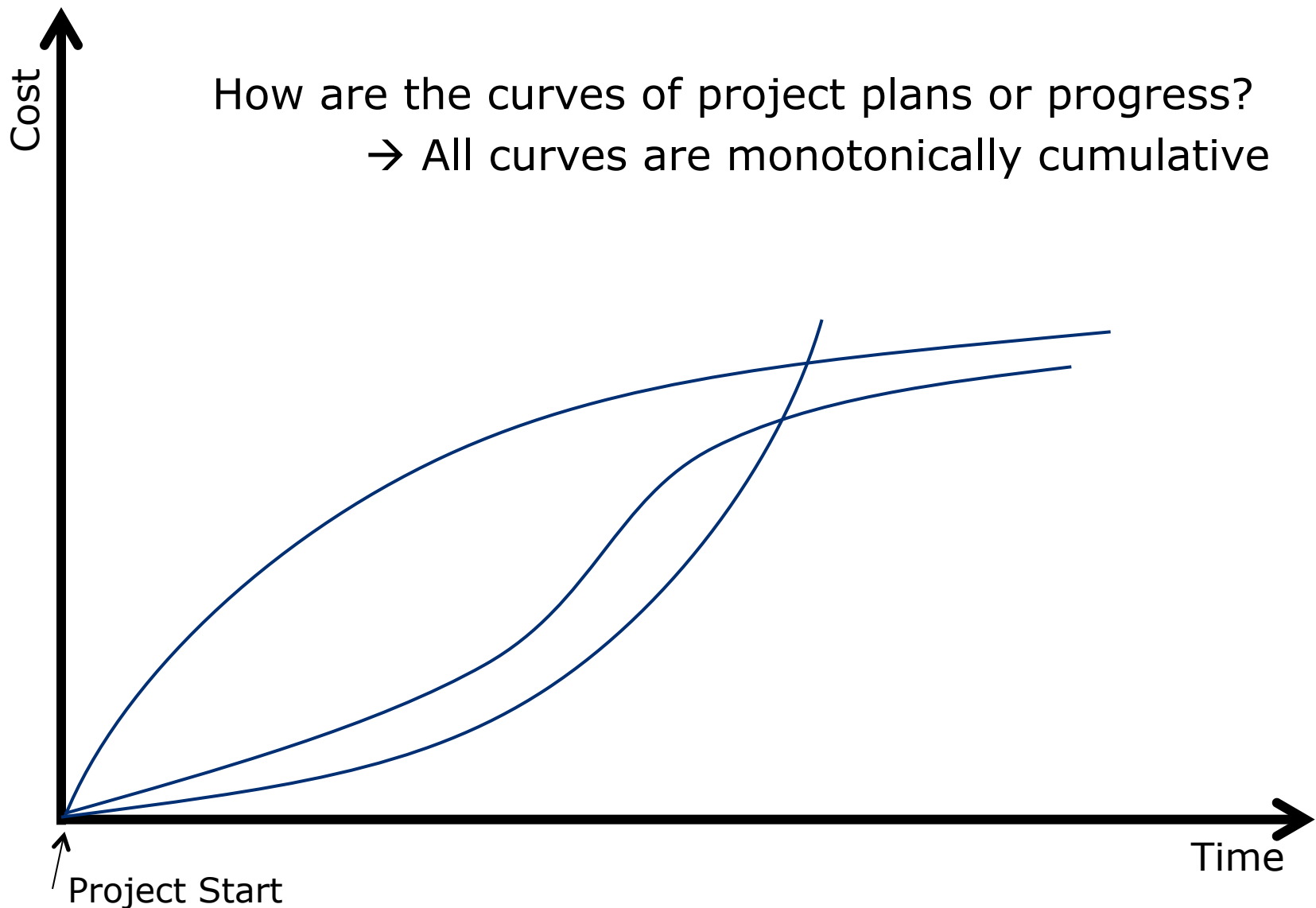
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- Also known as Earned Value Management (EVM) or Variance Analysis
 - It's a metric of project tracking
 - It measures the **real physical progress**
 - "What you got for what you paid"
 - "Traditional" non-EVA approach
 - Two dimensions for *time* 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**
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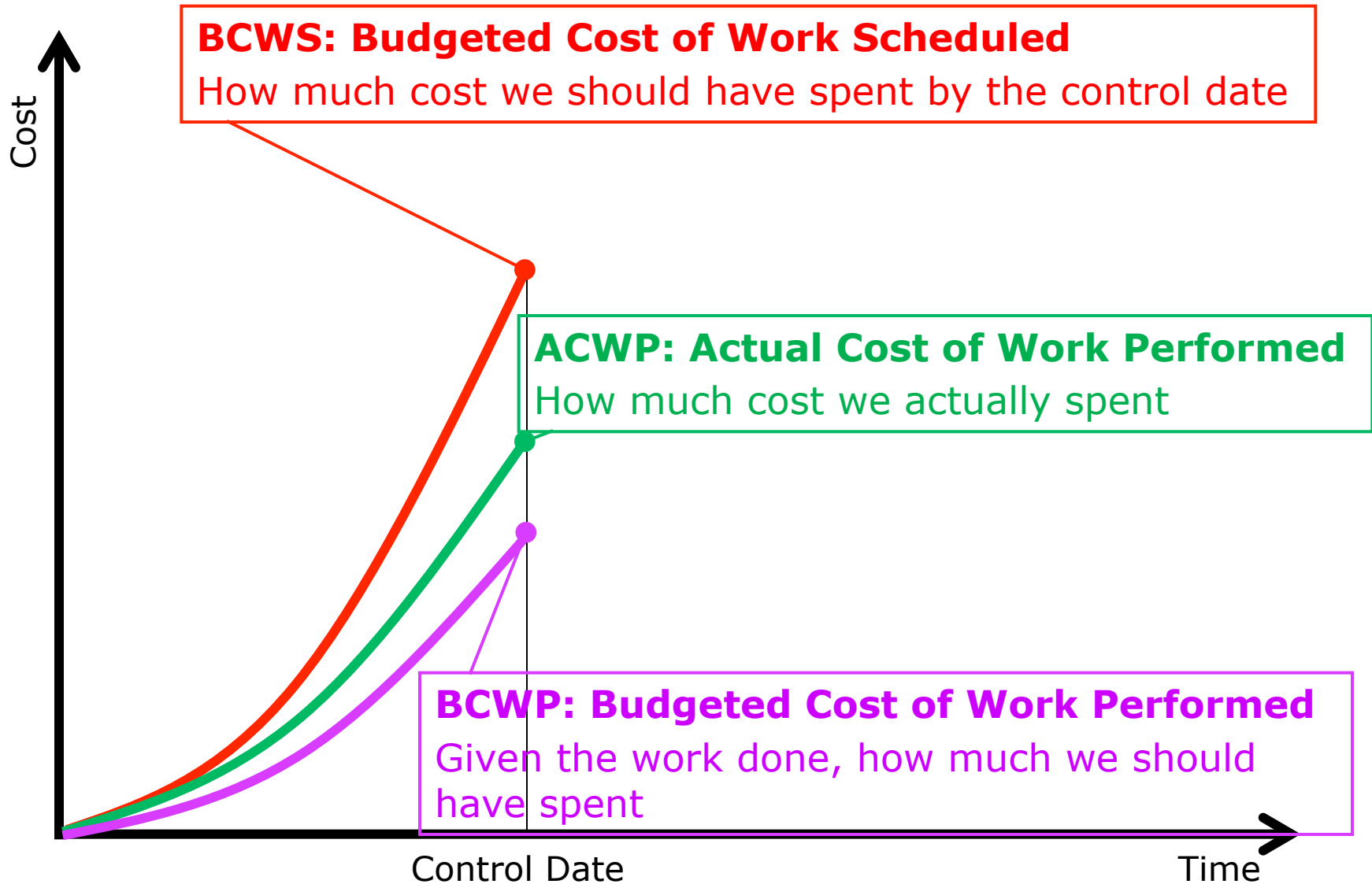
- EVA is calculated as comparison to the Performance Measurement Baseline (PMB) that is:
 - Time-phased budget plan against which contract performance is measured
 - It establishes the scope, schedule and budget targeted for the project
 - The PMB is a plan with well-defined milestones upon which contract 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

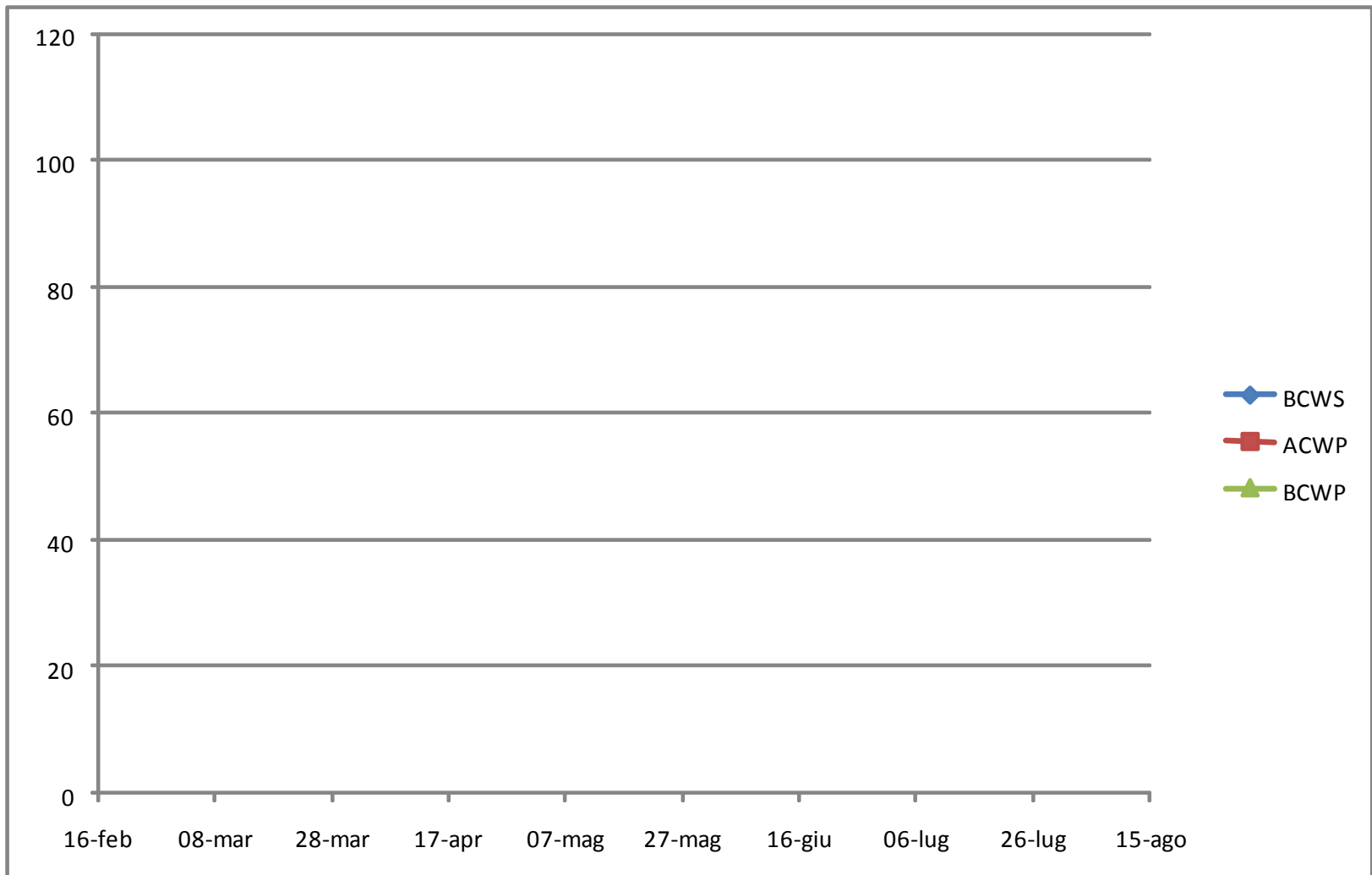
EVA Example

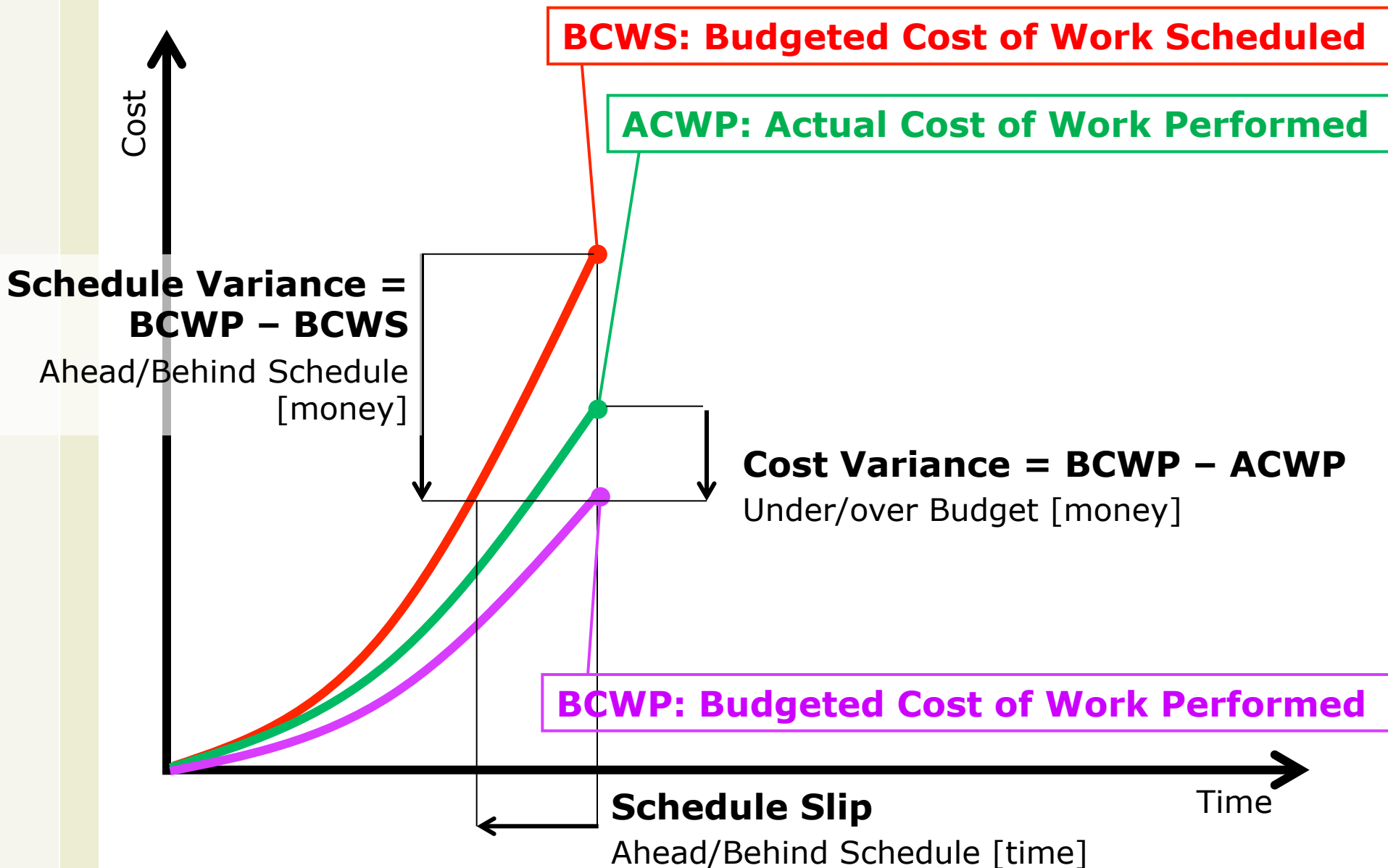
WBS	Completion Date		Cost	
	Planned	Actual	Planned	Actual
Project Start	01-mar	01-mar	€ 0	€ 0
Milestone A	01-apr	20-apr	€ 25.000	€ 20.000
Milestone B	01-mag	28-mag	€ 15.000	€ 10.000
Milestone C	01-giu	18-giu	€ 10.000	€ 15.000
Milestone D	01-lug		€ 15.000	
Milestone E	01-ago		€ 10.000	
TOTALS			€ 75.000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

- 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 ☹️

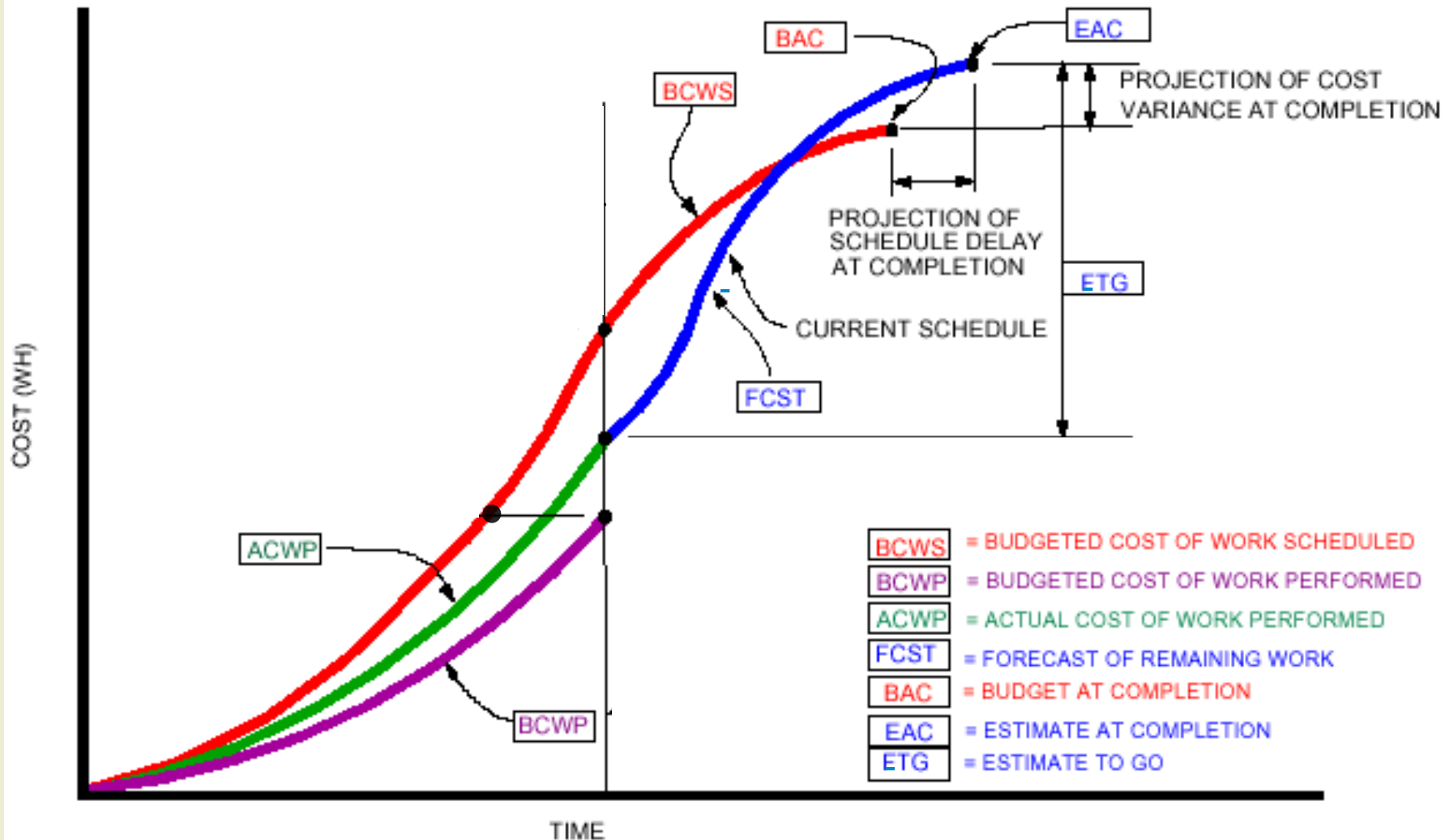
- **CPI:** Cost Performance Index
 - $BCWP / ACWP (=EV/AC)$
- **SPI:** Schedule Performance Index
 - $BCWP / BCWS (=EV/PV)$
- Problems are when these indexes are less than 1
- **CR:** Critical Ratio
 - $SPI \times CPI \rightarrow$ it's a proportional combination
 - 1 \rightarrow everything is on track
 - $< 1 \rightarrow$ 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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	Planned	Actual	Planned	Actual
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TOTALS			€ 75.000	€ 45.000

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



- **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?