

Project Management



EPITA Information Management Master

**Project Management
Module 3**

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Time Management



Objectives of the module

- **Define the core activities required for the project time management process**
- **Understand how to use network diagrams and their dependencies in time management of a project**
- **Use a Gantt and PERT chart in planning and tracking the project schedule**

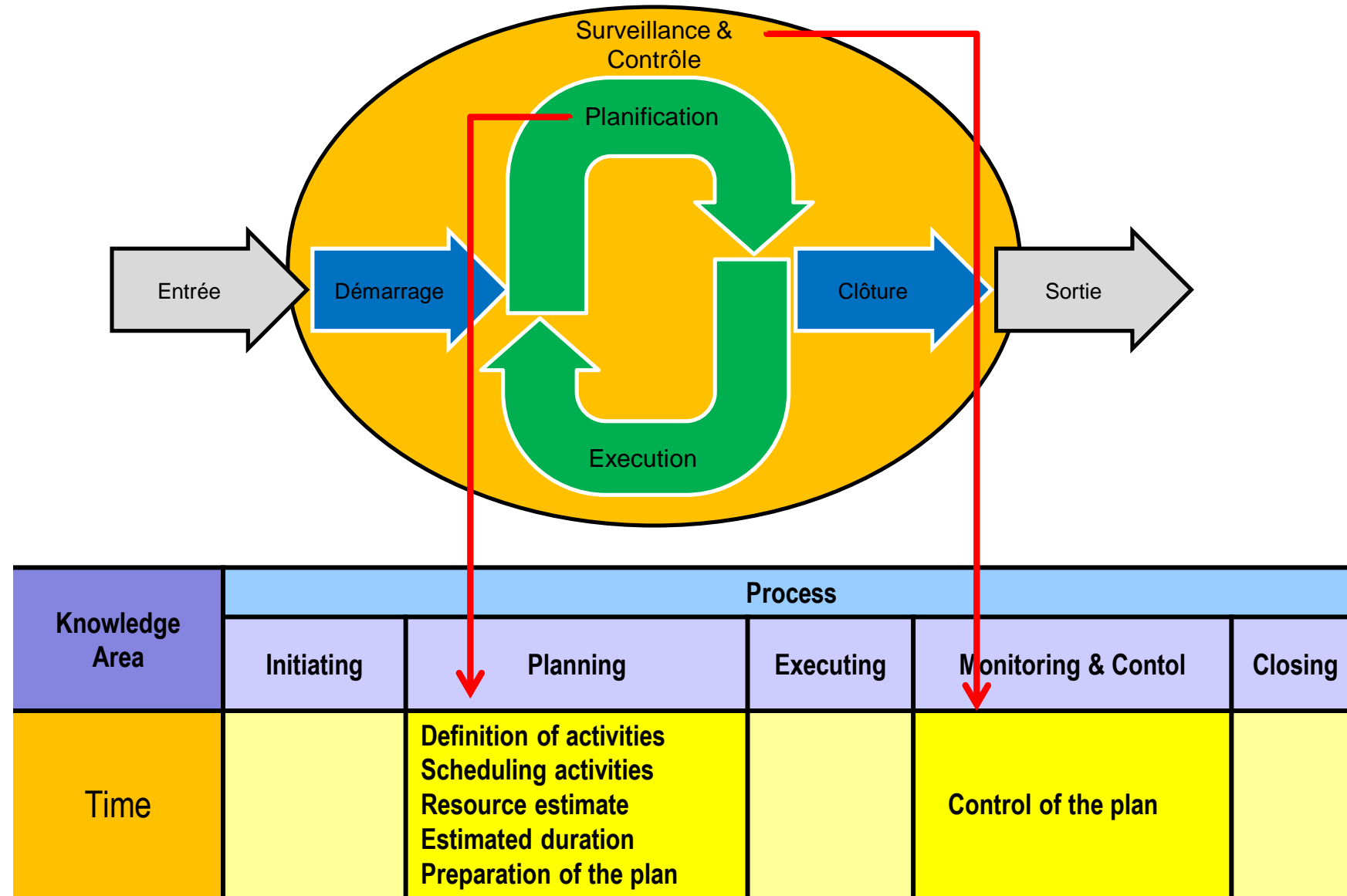


Importance of project management

- **The biggest challenge for a project manager: meeting the deadline and the cost**
- **Most projects miss their delivery times**
- **Time management is one of the main causes of conflict, especially during the second half of the projects**



Gestion de Projet



Project Time Management Process

- **5.1 Definition of activities**
 - List of activities and their attributes
- **5.2 Scheduling activities**
 - Identification and documentation of dependencies between activities
- **5.3 Resource Estimate**
 - Estimated resources needed to carry out each activity
- **5.4 Estimated duration**
 - Approximation process of duration to carry out individual activities
- **5.5 Preparation of the plan**
 - Creation of the project calendar from sequences, durations, resource requirements
- **5.6 Control of the plan**



6.1 Define the activities

- **Creating a list of activities and their attributes using the WBS (SDP in French)**
 - **Predecessors and successors**
 - **Logical relationships**
 - **Resource requirements**
 - **Constraints**
 - **Non-negotiable dates**
- **Milestone**
 - **Very important event that has no duration and is used to monitor the progress of the project**



6.2 Scheduling of activities

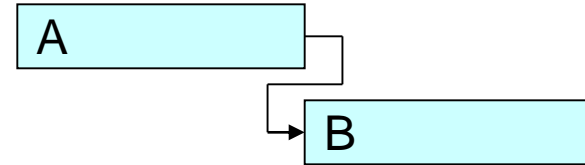
- **Identify and document logical links or dependency relationships between project activities**



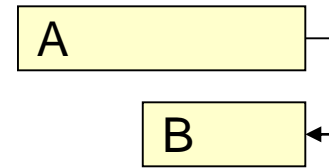
The sequencing

- **Sequencing is the establishment of a logical sequence between network activities, the most appropriate form for the project**
- **Sequencing uses the notion of antecedence between activities**

Finish - Start



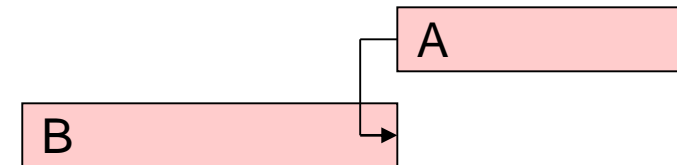
Finish - Finish



Start - Start

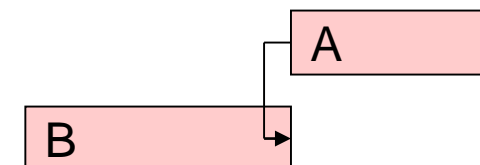
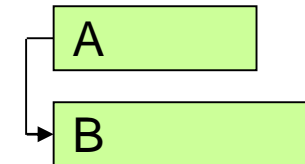
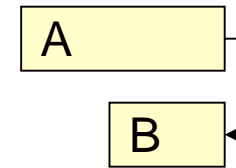
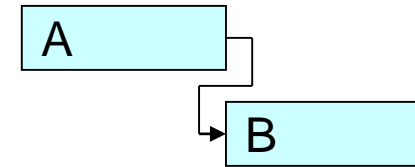


Start - Finish



Examples of sequencing

- **Finish to Start**
 - Wait for anesthesia to take effect before operating
- **Finish to Finish**
 - Wait until the end of the excavation to be able to finish removing the grounds
- **Start to Start**
 - Paste posters and advertise on the radio
- **Start to Finish**
 - Inaugurate the new hydroelectric plant to deactivate the gas station



The PERT Network

- Program Evaluation and Review Technique
- Created in 1958 at the request of the US Navy
- Focuses on the notions of flow and dependencies
- Determines the critical path

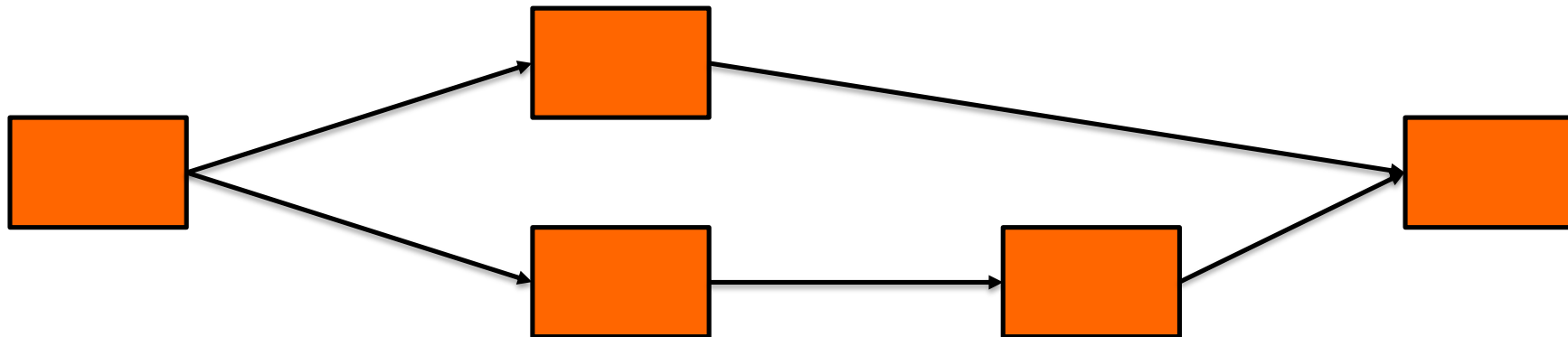
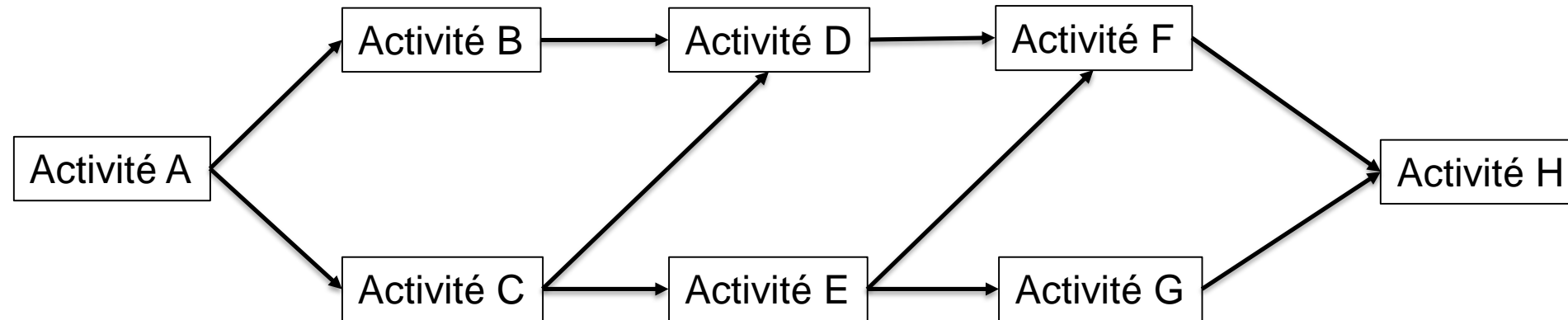


Table of Predecessors

Activité	Prédécesseur
A	
B	A
C	A
D	B,C
E	C
F	D,E
G	E
H	F,G

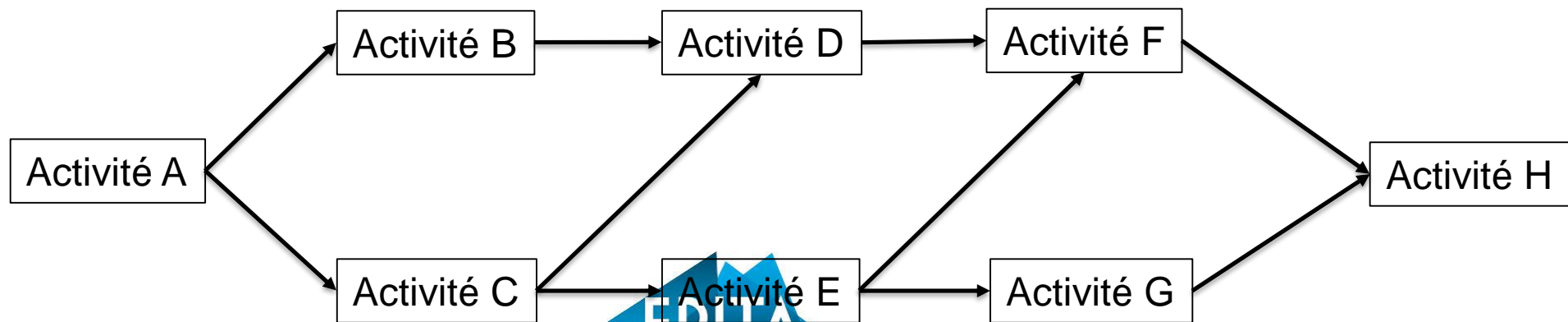
Gestion de Projet



Gestion de Projet

Activité	Prédécesseur
A	
B	A
C	A
D	B,C
E	C
F	D,E
G	E
H	F,G

Table of Predecessors



Critical path method

Activité	Durée	Prédécesseur
A	3	
B	5	A
C	4	A
D	2	B,C
E	6	C
F	5	D,E
G	4	E
H	7	F,G

Critical path method

Earliest start	Activity id	Earliest end
Total float		Duration
Latest start		Latest end

$$\text{Total float} = \text{Latest start} - \text{Earliest start}$$



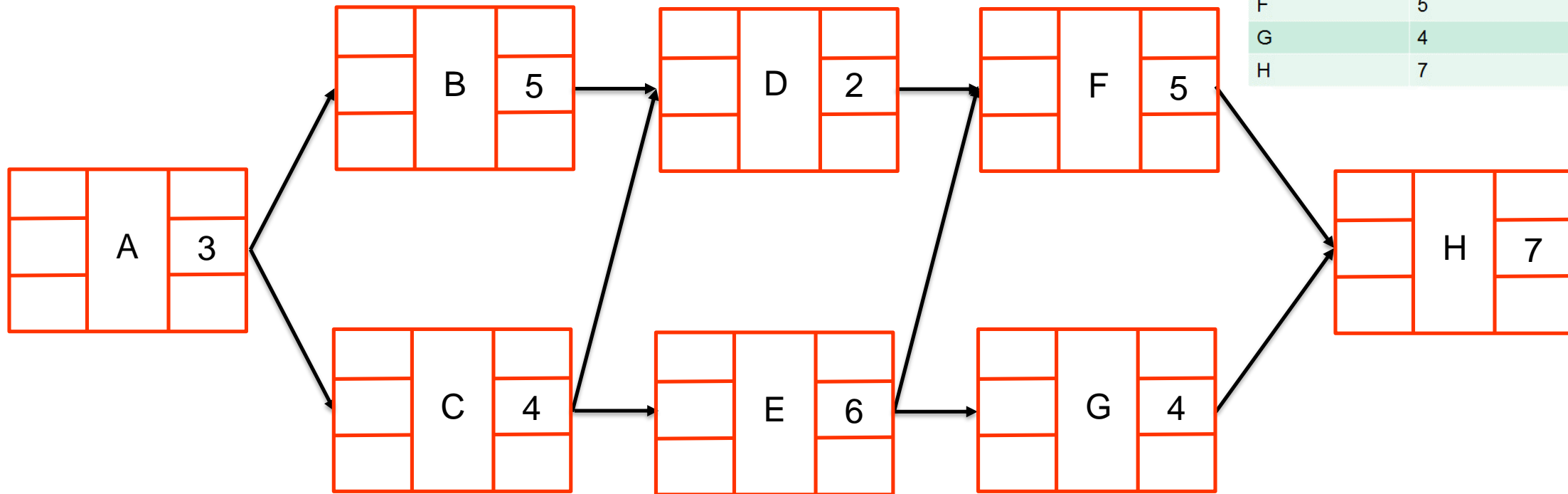
Méthode du chemin critique

Début au plus tôt	Activité ID	Fin au plus tôt
Total mou disponible		Durée
Début au plus tard		Fin au plus tard

Total mou disponible = Début au plus tard – début au plus tôt

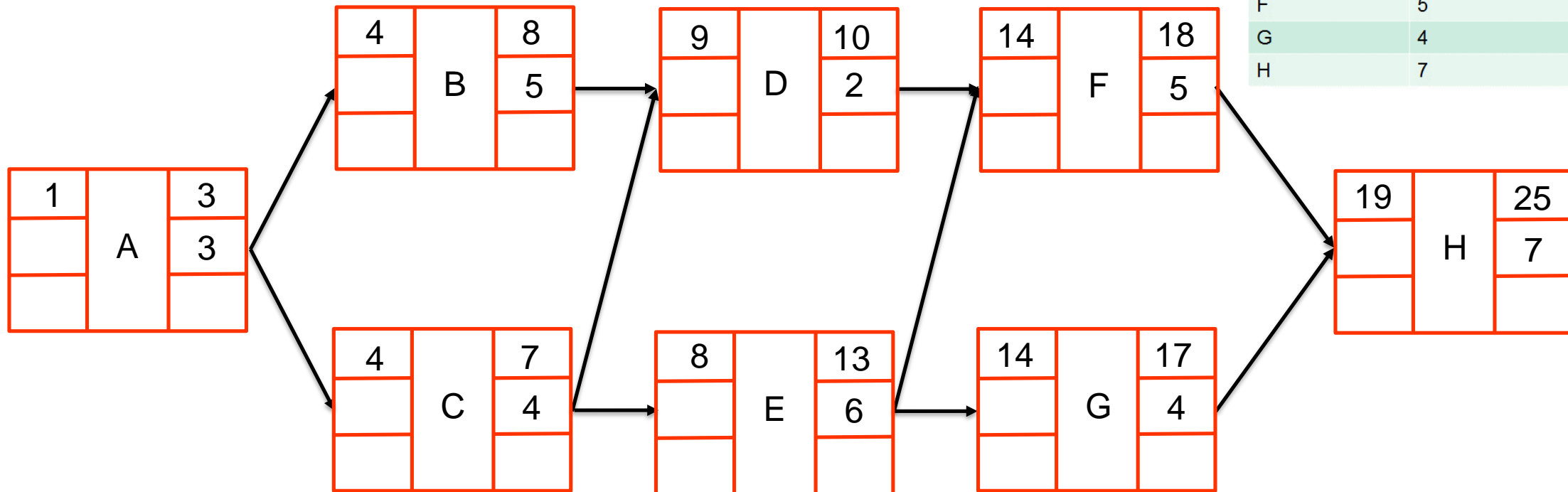


Critical path method



Activité	Durée	Prédécesseur
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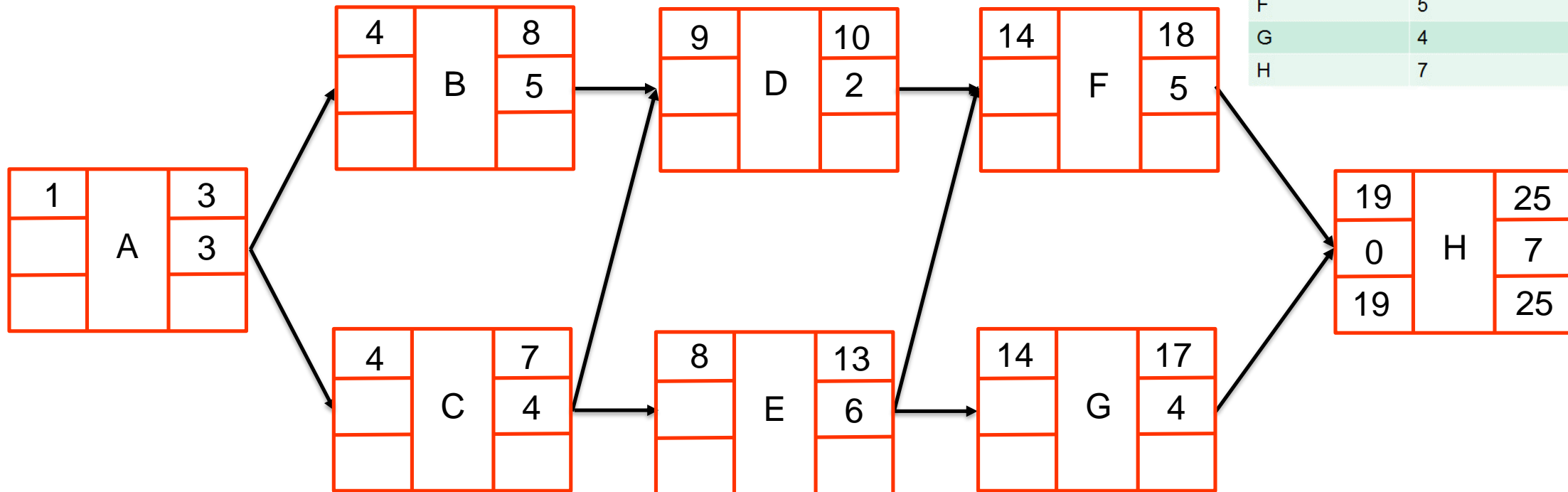
Critical path method



Activité	Durée	Prédécesseur
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Gestion de Projet

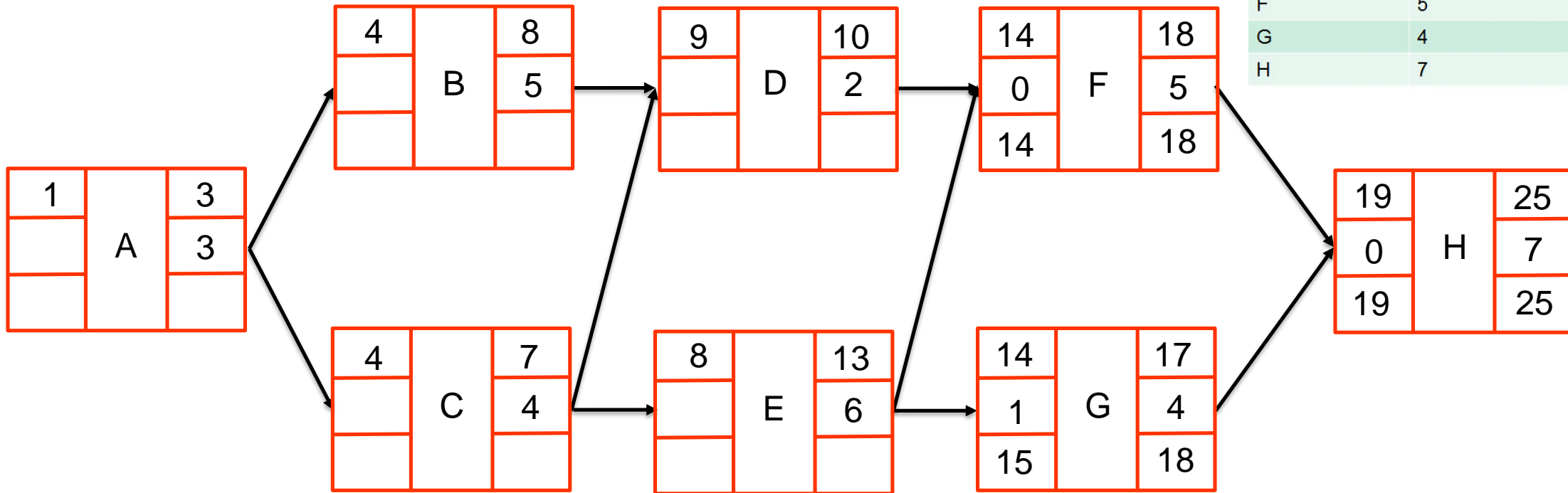
Backtracking



Gestion de Projet

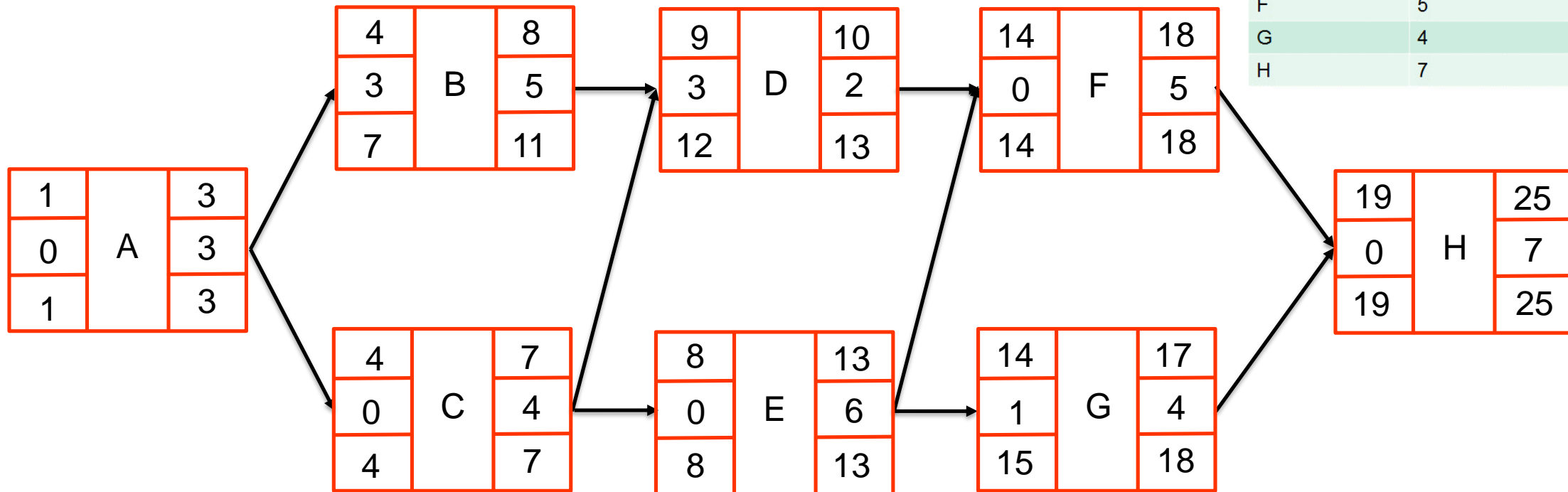
Backtracking

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Gestion de Projet

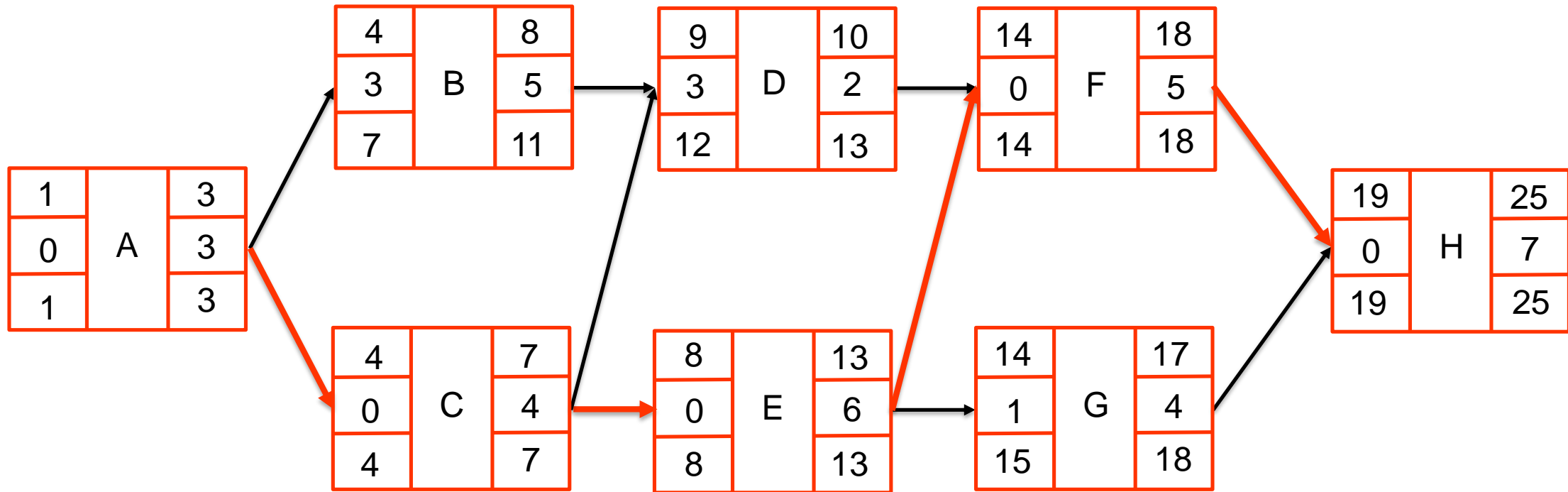
Backtracking



Activité	Durée	Prédécesseur
A	3	
B	5	A
C	4	A
D	2	B,C
E	6	C
F	5	D,E
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H	7	F,G

Where is the Critical path ?

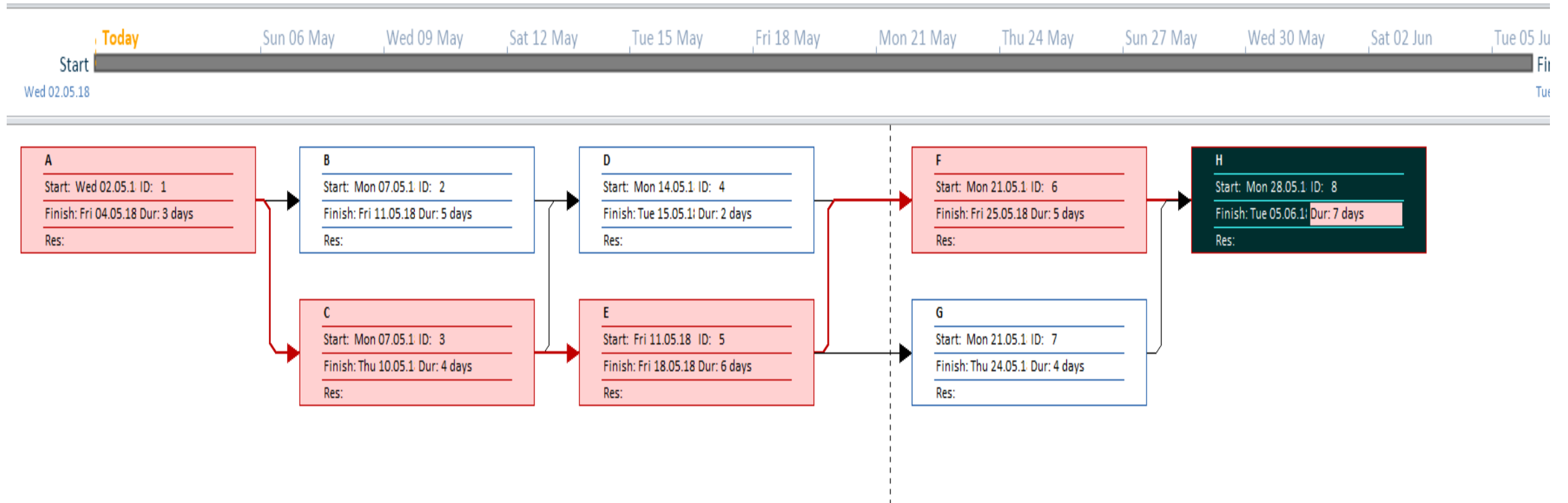
Backtracking



Critical path



Exercise: Diagram Network with MS Project



Gestion de Projet

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April 1, 2020 - 01:21 am  0 comment(s)

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Enter the terms you wish to search for.

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Problem with date persists

June 24, 2018 - 11:09 am

6.3 Resource estimate

- **Estimate of resources (people, equipment or materials) needed to carry out each activity:**
 - Resource identification (type, skills)
 - Quantities used
 - When these resources will be needed
 - When these resources will be available to carry out project activities



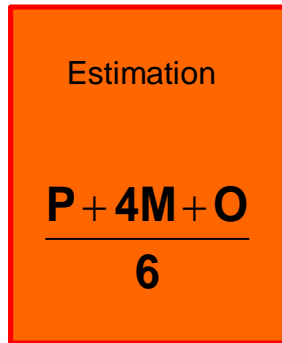
6.4 Estimated duration

- **Process of approximation of duration or number of periods (days, weeks) to carry out individual activities with their resources**
- **The duration should be as credible and realistic as possible (do not accept filling)**
- **To estimate the duration, consider:**
 - **Level of difficulty of each activity**
 - **The experience of the organization in the execution of each activity**
 - **Availability and experience of the necessary resources**



6.4 Estimated duration

- Rather than estimating the duration of an activity with a whole number (eg 4 weeks), it is often better to estimate at three levels.
 - **Optimistic, pessimistic, realistic**



Estimation

$$\frac{P + 4M + O}{6}$$

- Iterative process: modify estimates over time to be closer to reality

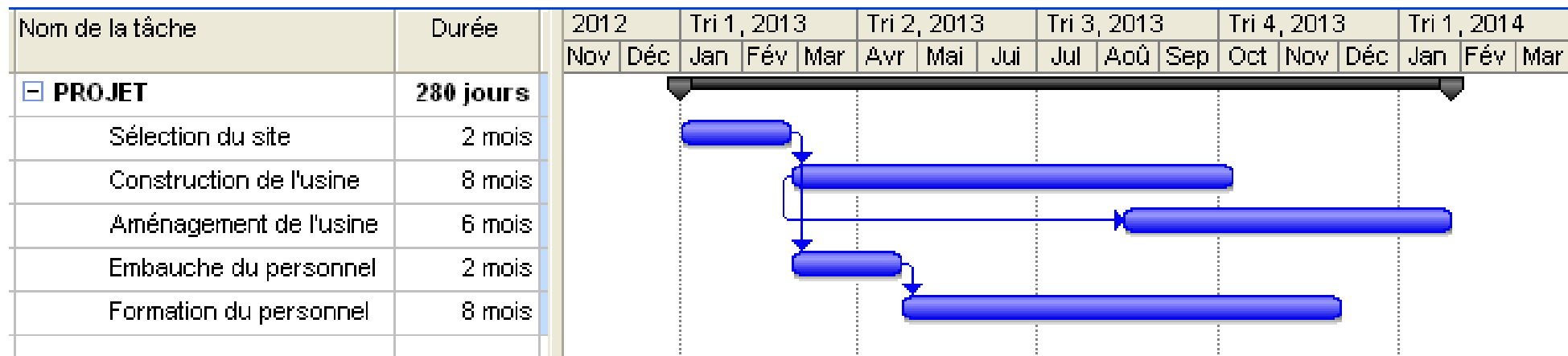
6.5 Preparation of the plan

- **Analysis of activity sequences, durations, resource requirements and calendar constraints to create the project schedule.**
- **Iterative process**
- **Use project management software**
- **Important tools for developing the plan:**
 - **Gantt diagrams: temporal visualization of project activities**
 - **Critical path analysis: useful for controlling critical project times**



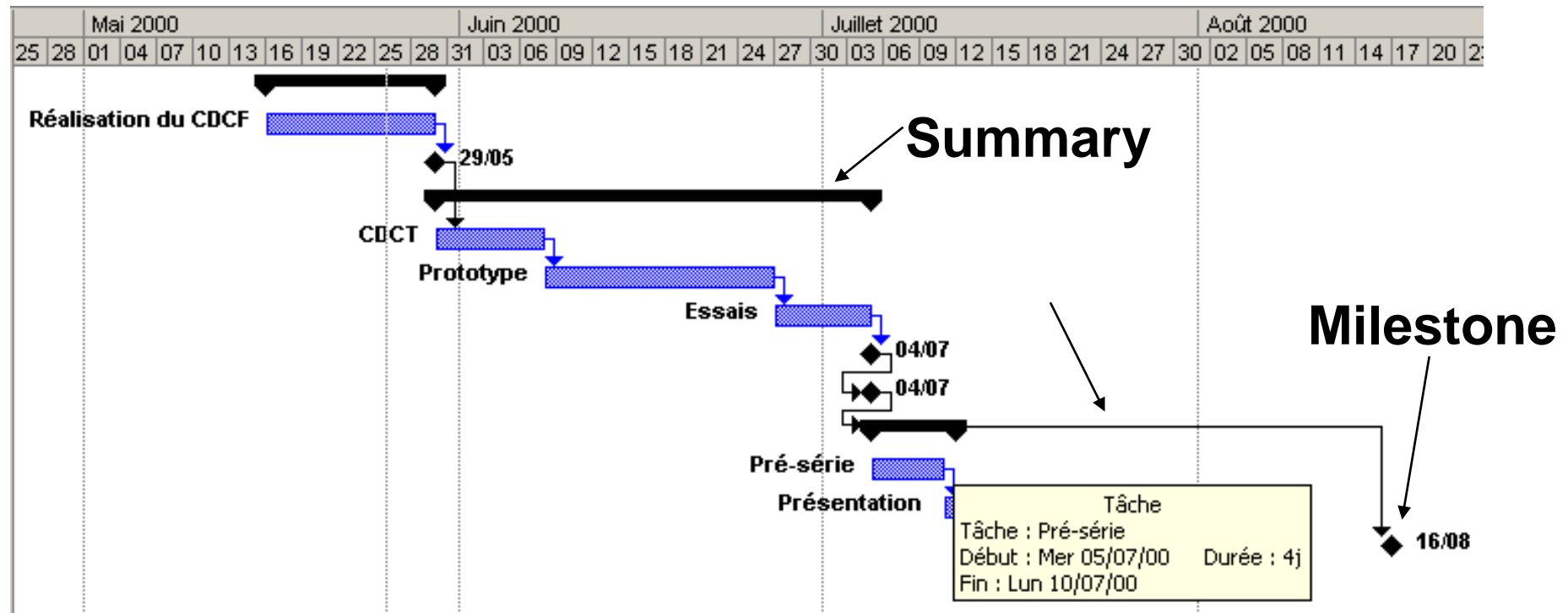
Gantt chart

- **Timescale**
- **User-friendly view and life to the project plan**
- **Dependencies between phases and tasks**



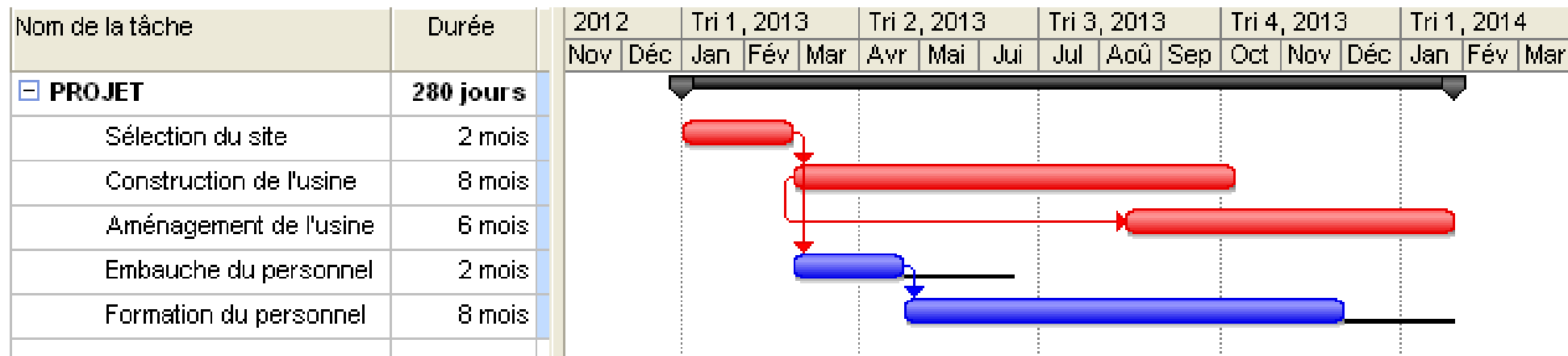
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Gantt chart

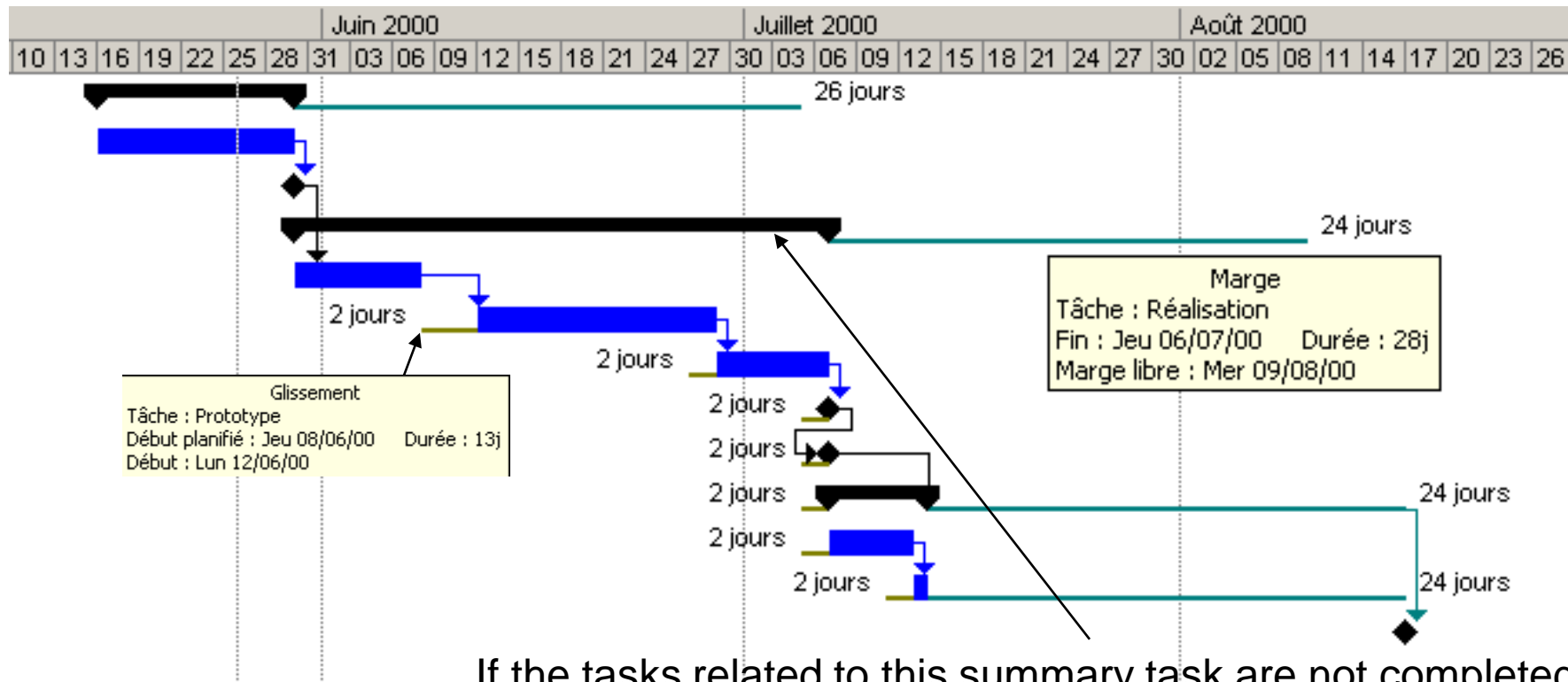


Gantt chart

- Allows you to quickly determine and visualize the critical path

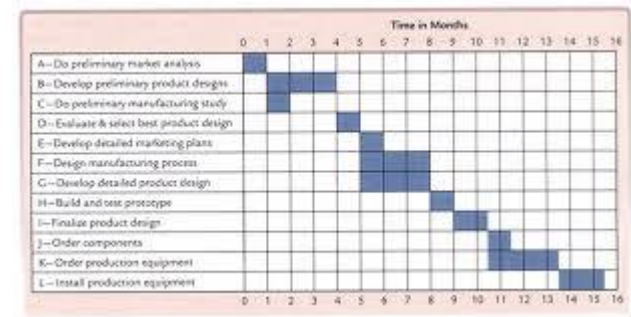
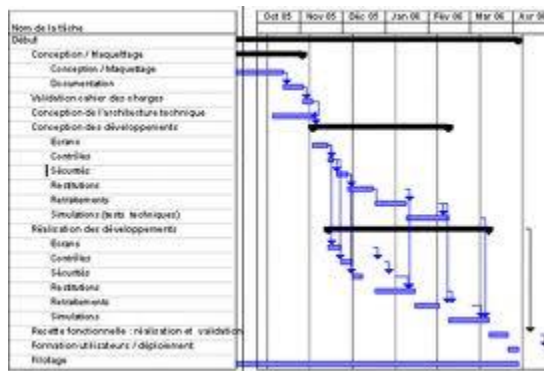
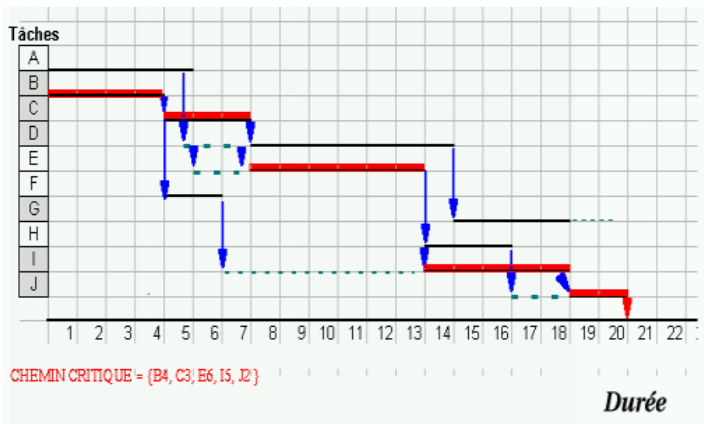


Float or Slack (Mou in French)

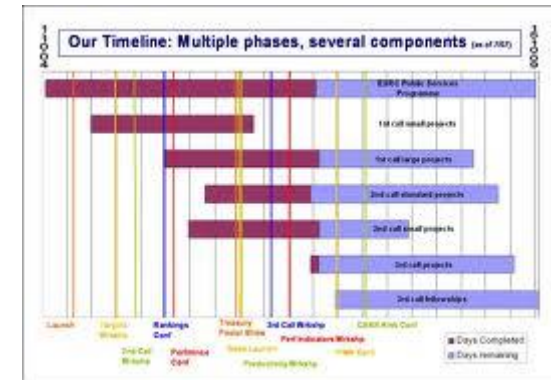
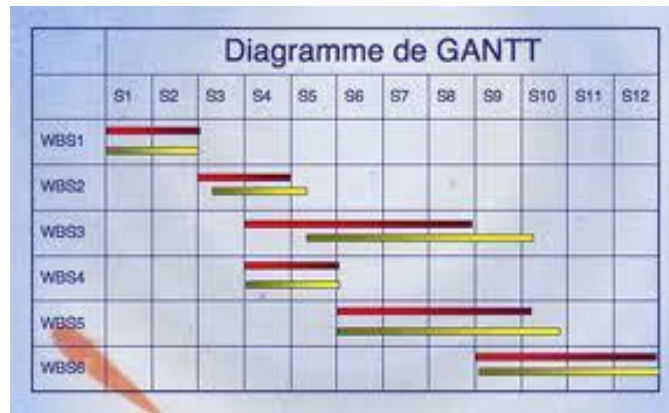


If the tasks related to this summary task are not completed before 09/08, then the project will be late ...

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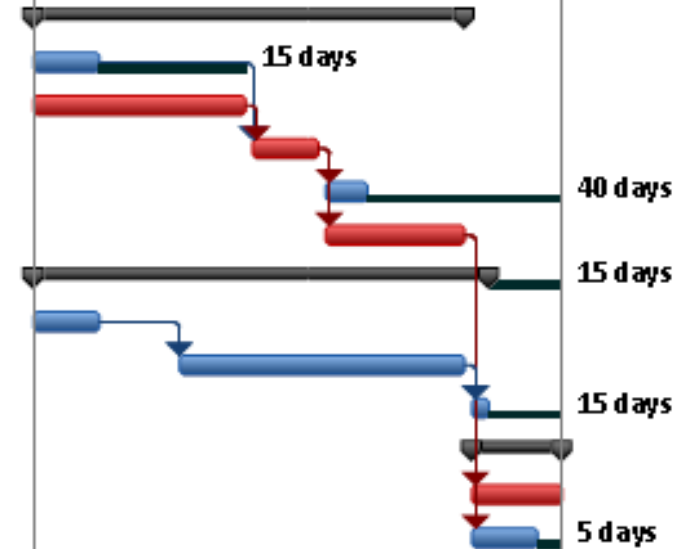


Various tools, various representations

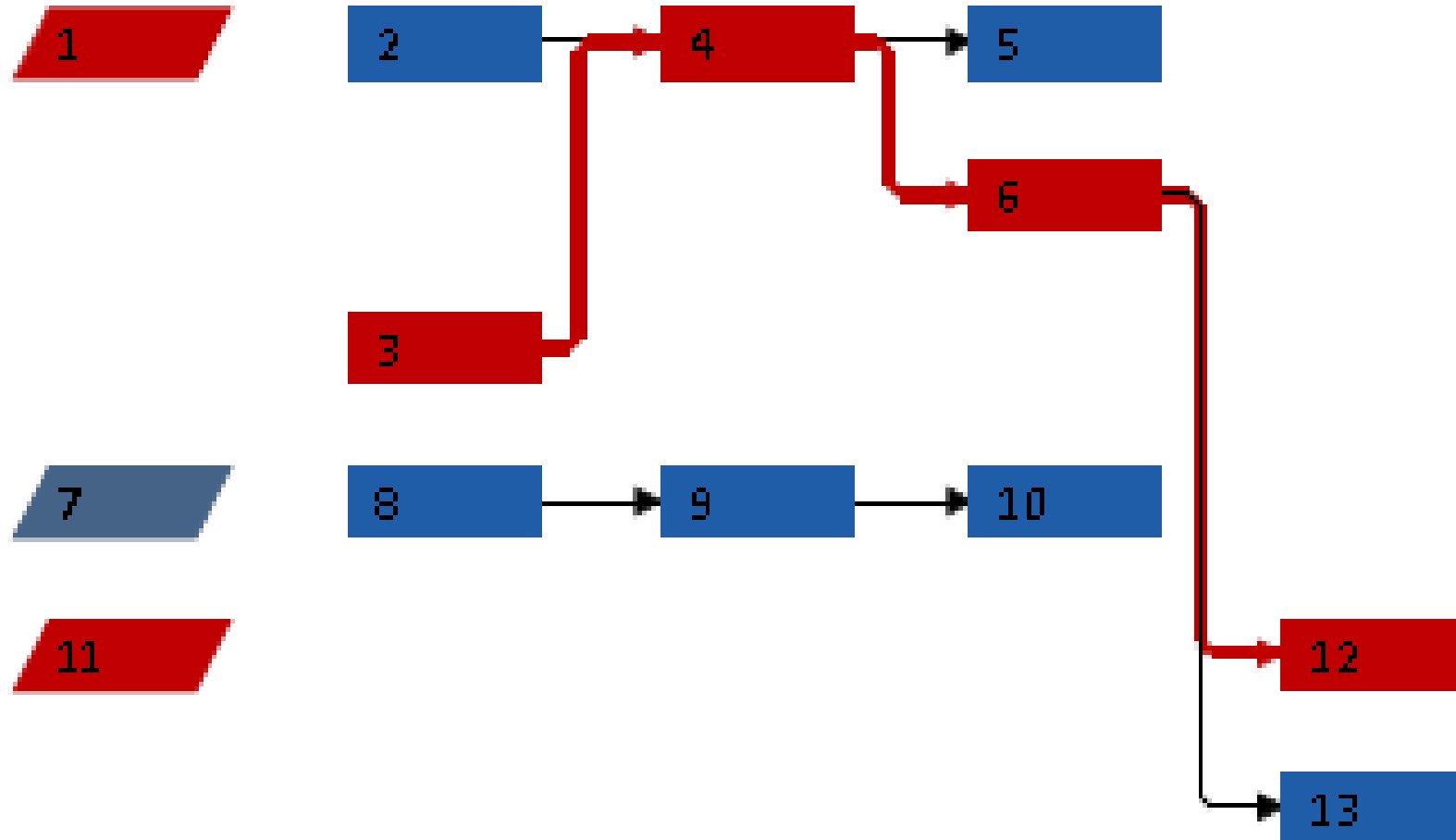


Gestion de Projet

ID	Task Mode	Name	Leveling Delay	Duration	Start	Finish	3rd Quarter				4th Quarter			1st Quarter
							Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1		Développement	0 e days	75 days	Mon 14/07/14	Fri 14/11/14								
2		Construction bancs d'ess	0 e days	15 days	Mon 14/07/14	Fri 01/08/14								
3		Etudes de conception	0 e days	30 days	Mon 14/07/14	Fri 12/09/14								
4		Fabrication prototypes	0 e days	15 days	Mon 15/09/14	Fri 03/10/14								
5		Essais amortissement	0 e days	10 days	Mon 06/10/14	Fri 17/10/14								
6		Essais endurance	0 e days	30 days	Mon 06/10/14	Fri 14/11/14								
7		Prospection	0 e days	80 days	Mon 14/07/14	Fri 21/11/14								
8		Création fichier prospect	0 e days	15 days	Mon 14/07/14	Fri 01/08/14								
9		Prospection test	0 e days	60 days	Mon 25/08/14	Fri 14/11/14								
10		Rédaction plaquette, pul	0 e days	5 days	Mon 17/11/14	Fri 21/11/14								
11		Industrialisation	0 e days	20 days	Mon 17/11/14	Fri 12/12/14								
12		Ordonnancement	0 e days	20 days	Mon 17/11/14	Fri 12/12/14								
13		Mise en place sous-trait	0 e days	15 days	Mon 17/11/14	Fri 05/12/14								

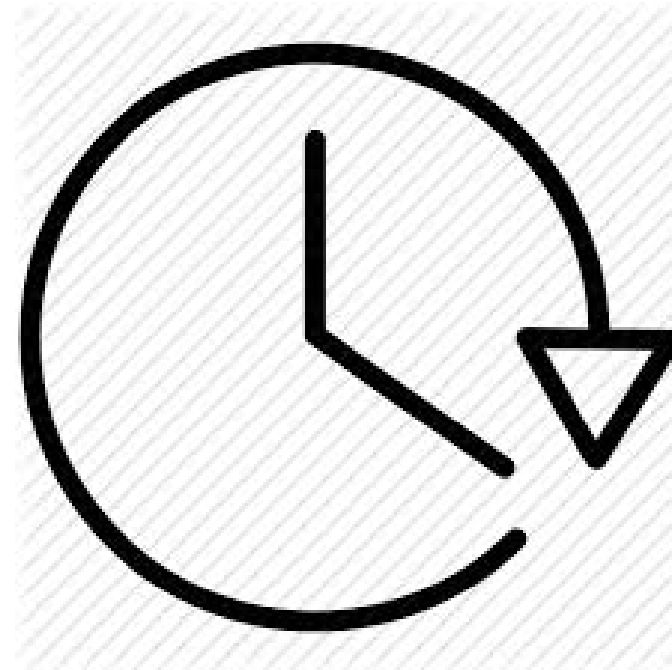


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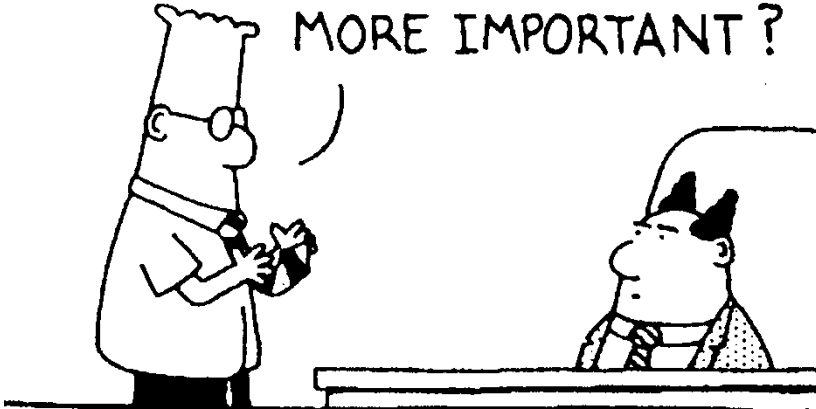
5.6. Control of the Plan

- **Periodic progress reports**
- **Various performance measures**
- **Plan for the unexpected**
- **Alert management in case of problems**

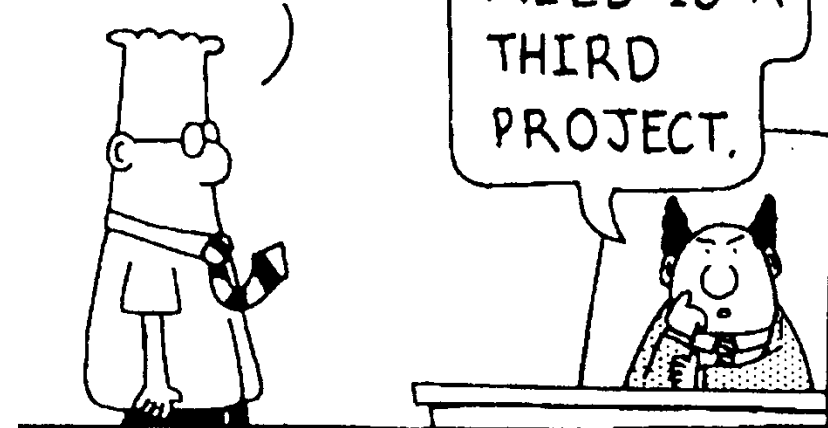


Project Management is ...

IT IS PHYSICALLY IMPOSSIBLE FOR ME TO FINISH BOTH OF MY PROJECTS ON TIME. WHICH ONE IS MORE IMPORTANT?



WOW. WHEN YOU DO THAT WITH YOUR ARMS, IT CREATES THE ILLUSION THAT YOU'RE THINKING.



Gestion de Projet

Cost Management



Cost management

- **The process of estimating, budgeting and controlling costs so that the project can be completed within the approved Initial Budget**
- **Value Analysis (value engineering): looking for less expensive ways to do the same job with the same content**
- **Law of diminishing returns: It is not by adding twice as many resources for a task that one can accomplish this task at half the time**

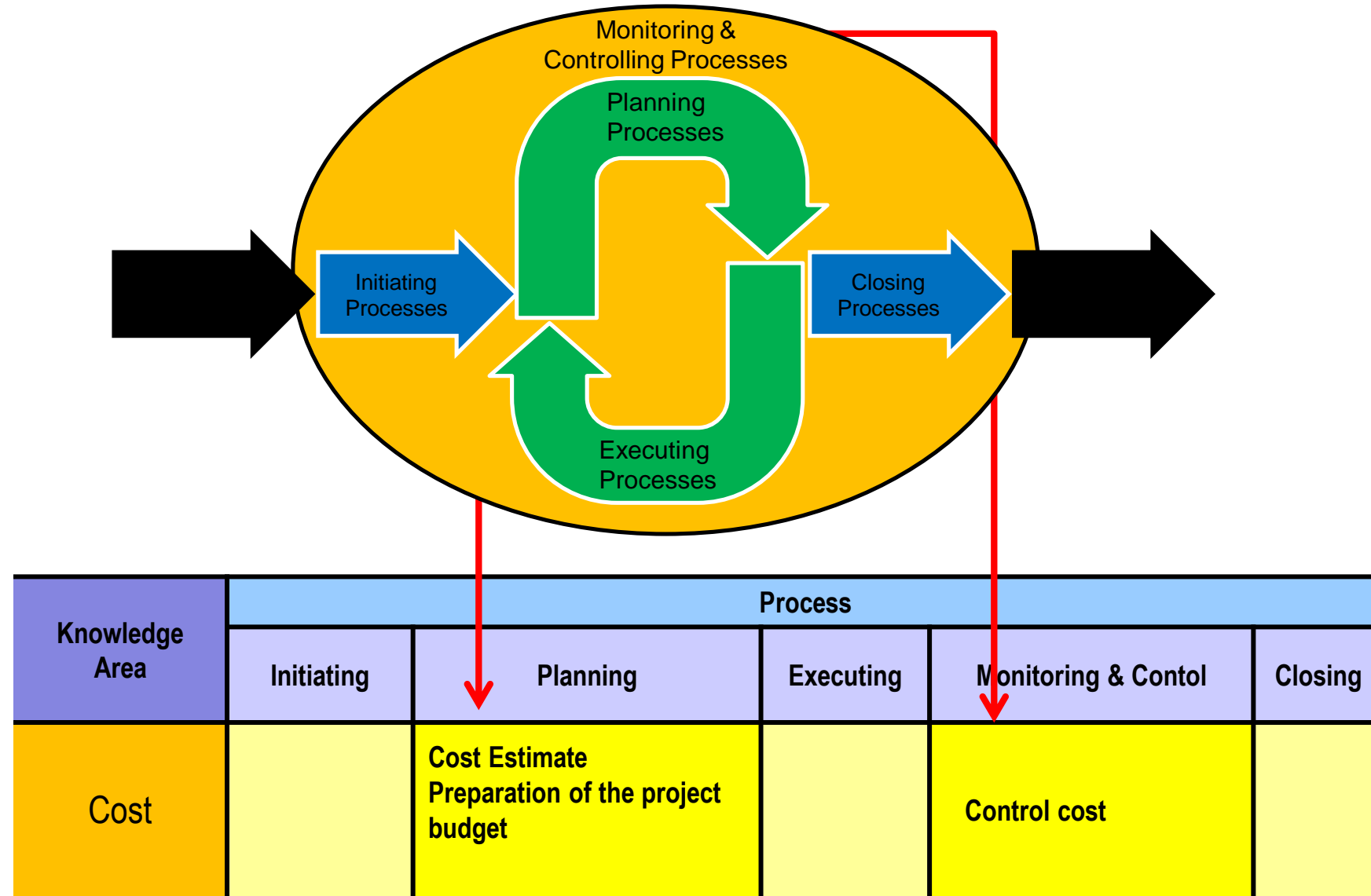


Objectives of the module

- **Understand the importance of cost management for a project to measure its performance**
- **Understand cost estimation techniques and budget preparation**
- **Master the use of the EARNED VALUE technique to control the cost of a project**



Gestion de Projet



Project Cost management process

- **7.1 Estimate Cost**
 - Determine an approximate value of the cost of resources needed to complete project activities
- **7.2 Preparation of the project budget**
 - Consolidate cost estimates for individual activities or work packages to set a baseline cost
- **7.3 Control Cost**
 - Track project status to update budget and manage changes to baseline



Types of costs

- **Variable costs**
 - are proportional to the amount of work for example hours spent in labor costs, materials, supplies
- **Fixed costs**
 - Do not change with volume changes eg start-up costs, setting up, renting an office space
- **Direct costs**
 - Directly attributable to the work of the project eg travel of team members, recognition awards, team salaries
- **Indirect costs**
 - overheads or costs incurred for the benefit of more than one project such as taxes, social security charges, business services



Quality and accuracy of the cost estimate

Estimate	Accuracy	
Rough order of Magnitude (ROM)	+/- 50%	<ul style="list-style-type: none">• The most difficult to estimate because very little information about the project is available during the project initiation process
Budgetary Estimate	+/- 10%	<ul style="list-style-type: none">• Used to finalize the authorization request and to establish a commitment made during the planning phase
Final Estimate	+/- 5%	<ul style="list-style-type: none">• During the project. Used to establish the initial Estimated Budget. Refined and updated during the project

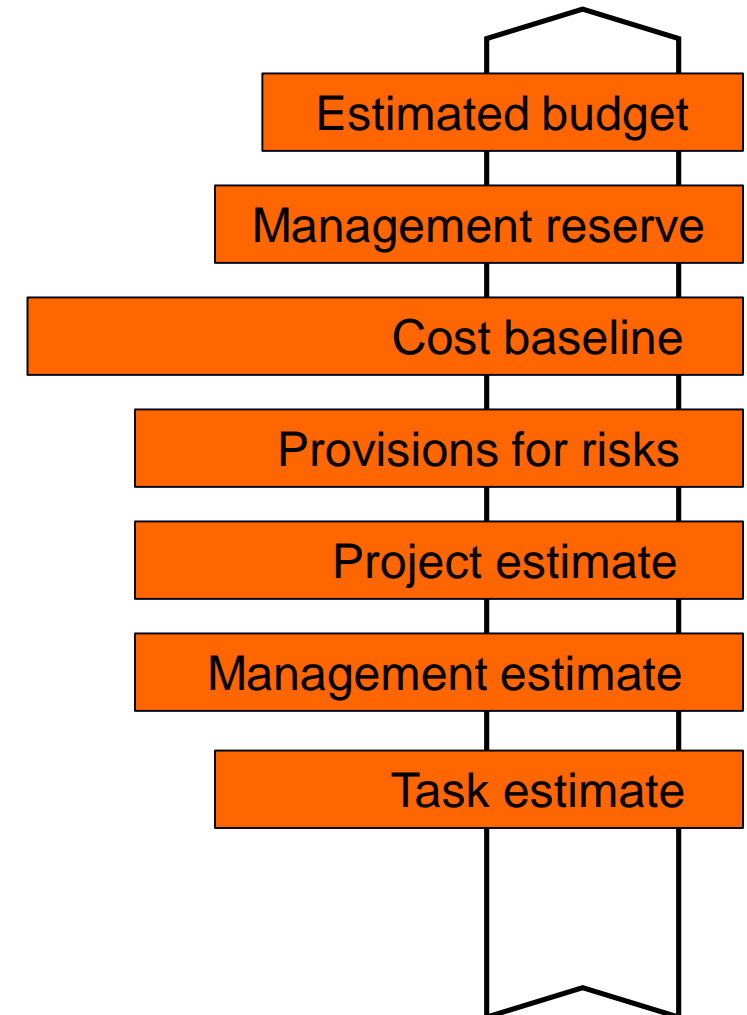
Estimating methods

- **Estimate by analogy**
 - Uses the Actual cost of similar past projects as a basis for estimating the cost of the current project
- **Ascending estimate**
 - Estimate the cost of the detailed activities (WBS work breakdown structure) then total by level
- **Expert judgment**
 - Involves an expert who will most often apply the analogical method informally
- **Delphi**
 - Involves several experts and helps to organize the confrontation in order to bring them to a consensus while limiting the mutual influences
- **Analysis of suppliers' offers**
 - Tender and Bid Process. The estimates obtained are used to determine costs.



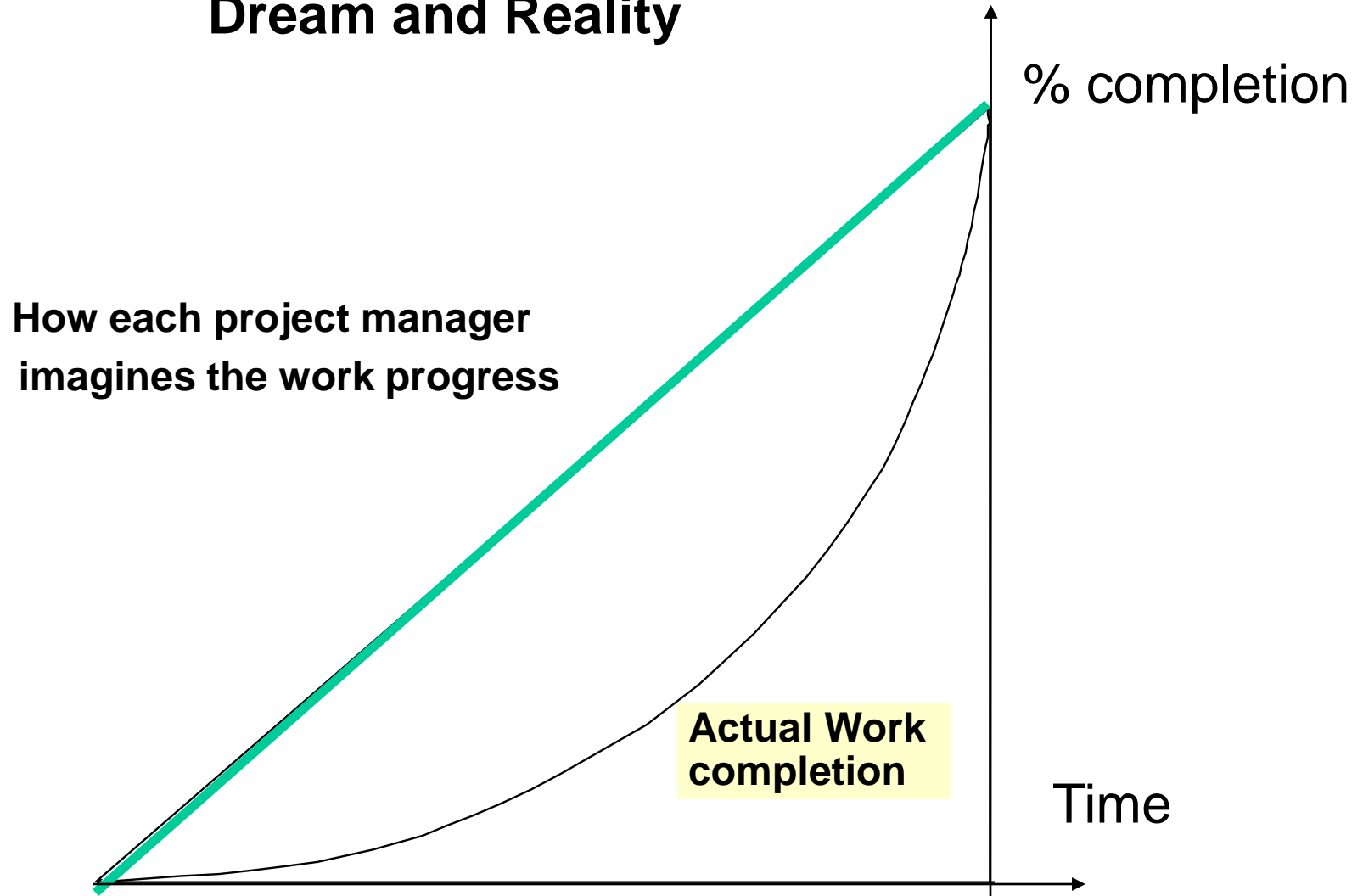
Costs consolidation

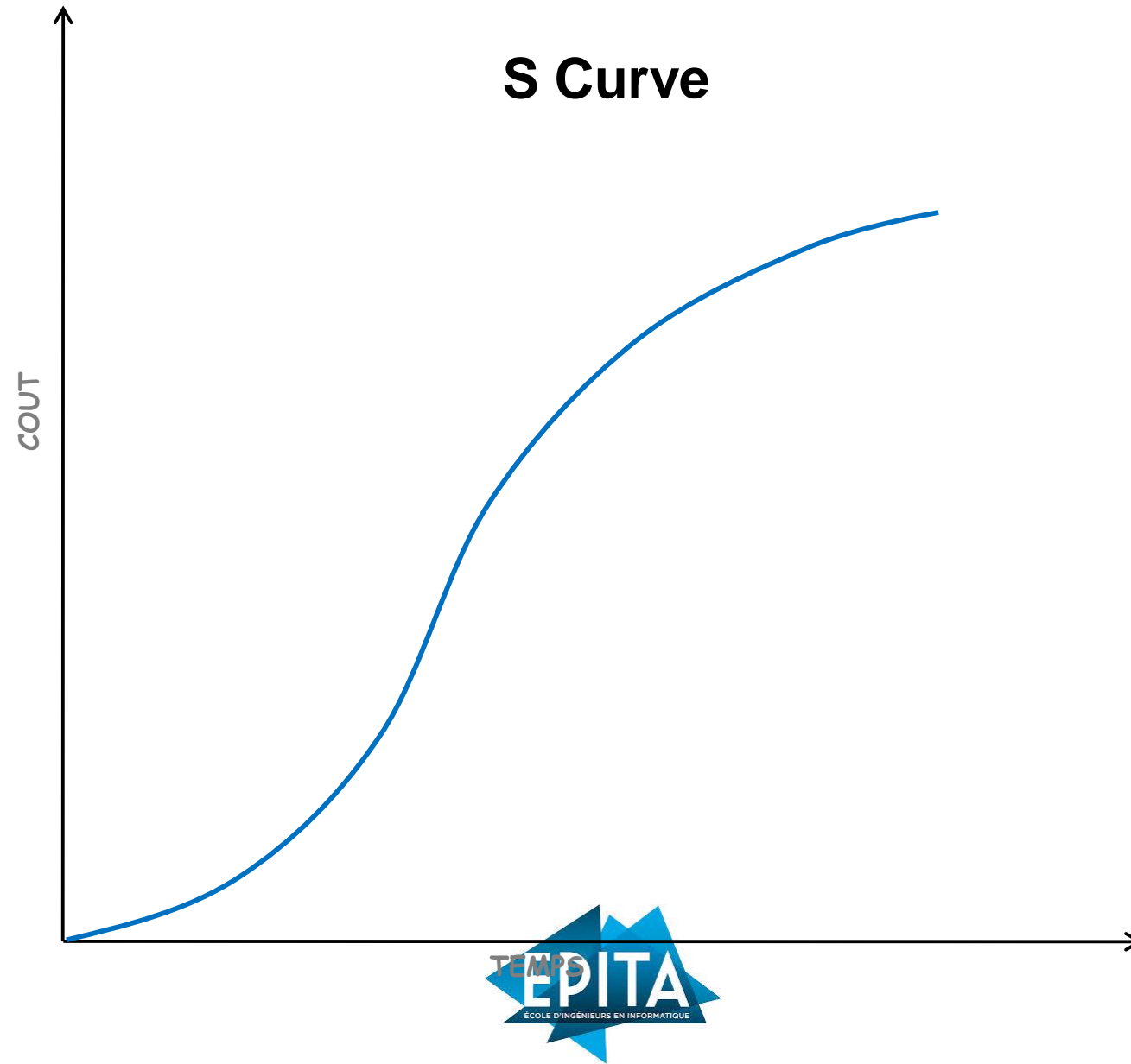
- **Provisions for risks are important for budget preparation**
 - **Provisions for risk included in the baseline**
 - Known unknowns (contingency reserve)
 - **Management reserve: additional funds to cover unforeseen circumstances or certain changes**
 - Unknown unknowns (discretionary reserve)



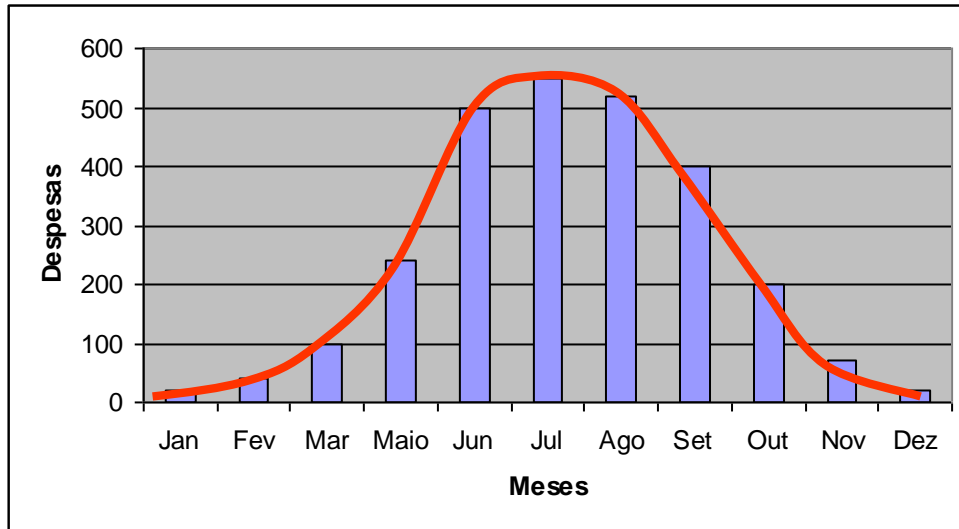
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Dream and Reality

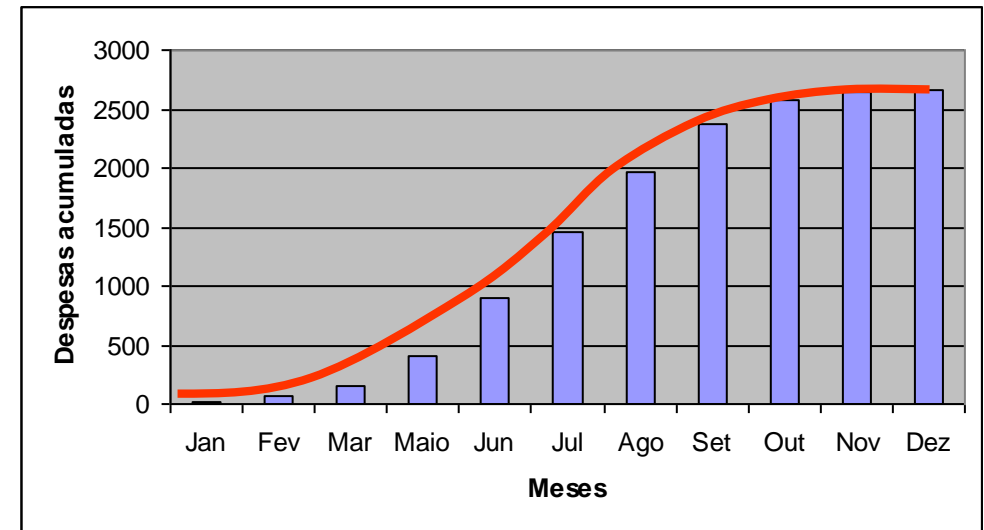




S Curve



Spend by month



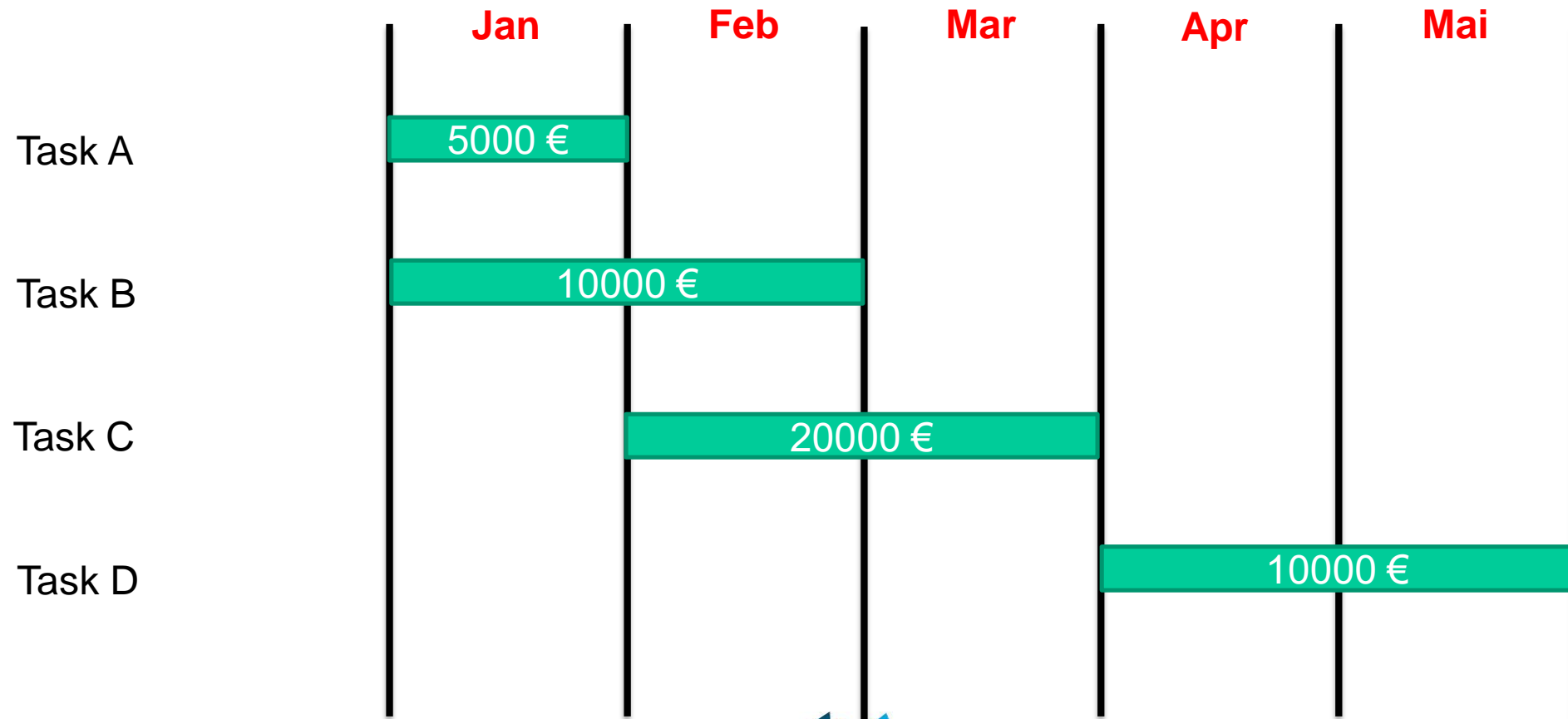
Cumulated spend

Exercise

- Trip of 300 km (charge) in 3 hours consuming 30 liters of gasoline (resources). After one hour we traveled 120 km and consumed 14 liters. What is the gap compared to the plan?
 - We did 20 km more than expected (achievement variance)
 - We consumed 4 liters more than expected (consumption gap)
 - In fact for 120 km we had planned to consume 12 liters
 - So we are 20 km ahead but we consumed more than expected

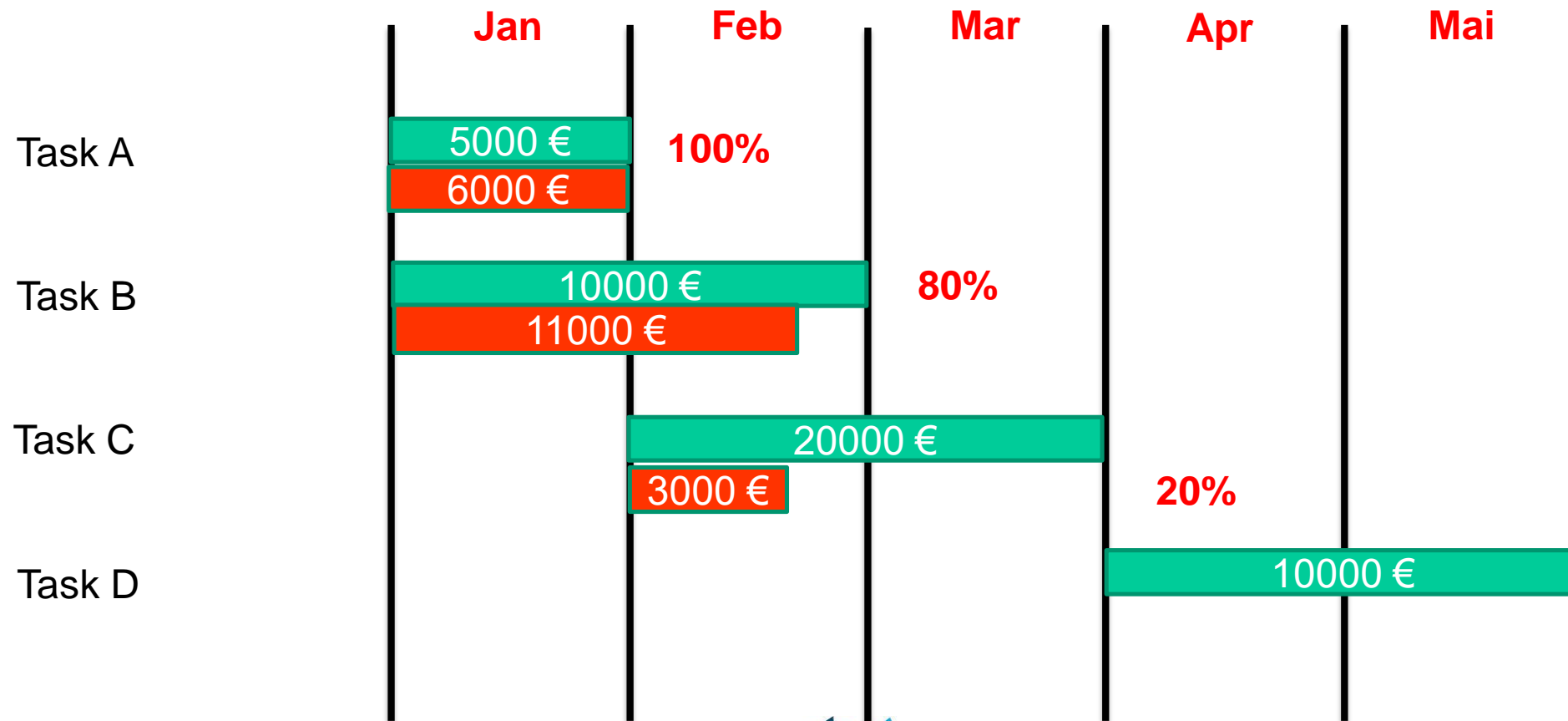


Another exercise



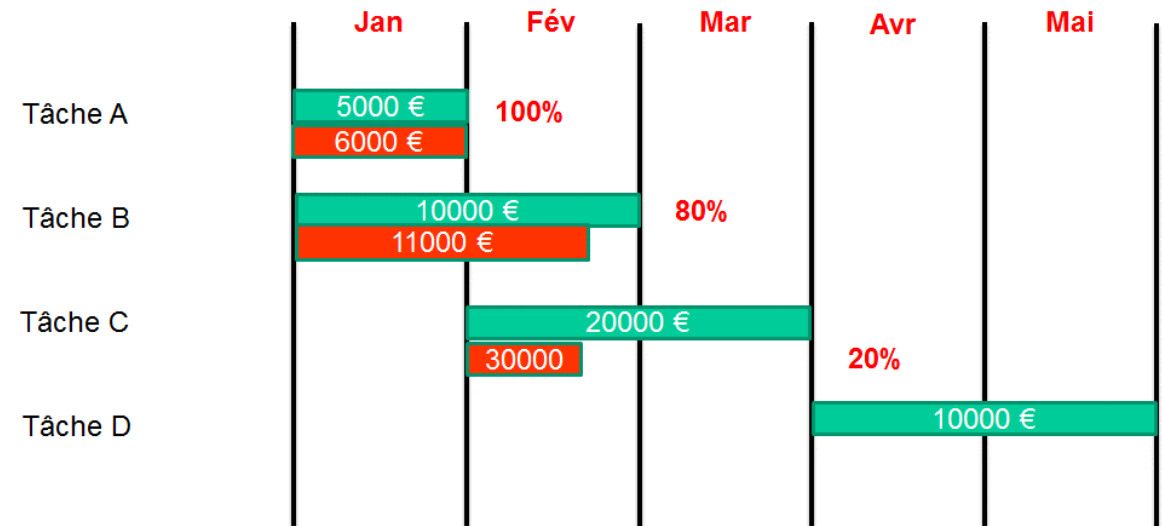
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Another exercise



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- End of February, we had planned
 - $5000 + 10000 + 1/2 * 20000 = 25000$
 - This is what we had planned
- We spent
 - $6000 + 11000 + 3000 = 20000$
- BUT TO DO WHAT ?
- We have earned in value
 - $100\% * 5000 + 80\% * 10000 + 20\% * 20000 = 17000$



Planned Value	25000 €
Actual costs	20000 €
EARNED VALUE	17000 €

EARNED VALUE Technique

- **Project performance management technique that takes into account : content, time, and cost elements**
- **Comparison of actual situation (content, costs and time) versus a baseline**
 - **Baseline: Approved Schedule + Approved Changes**

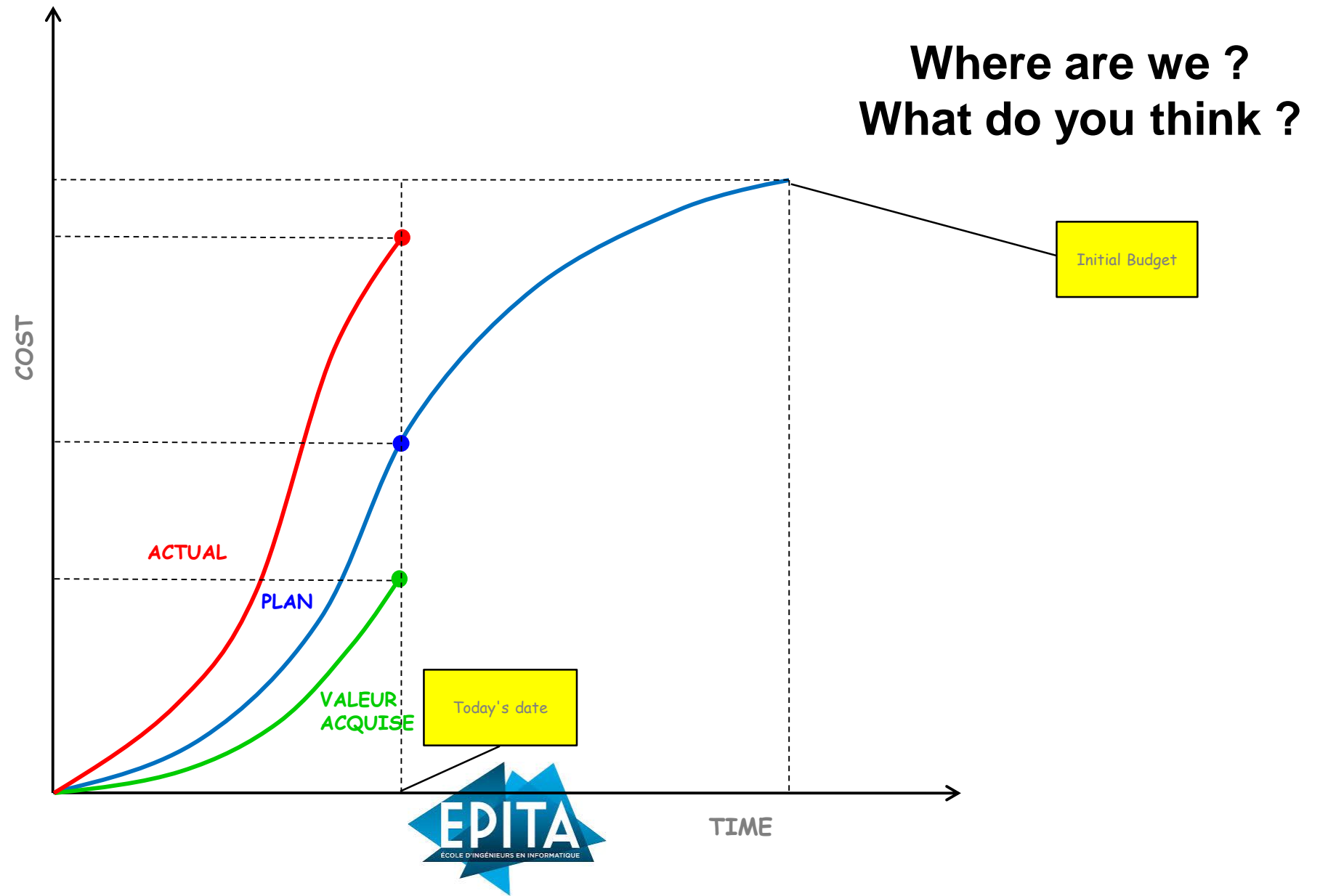


Three basic values

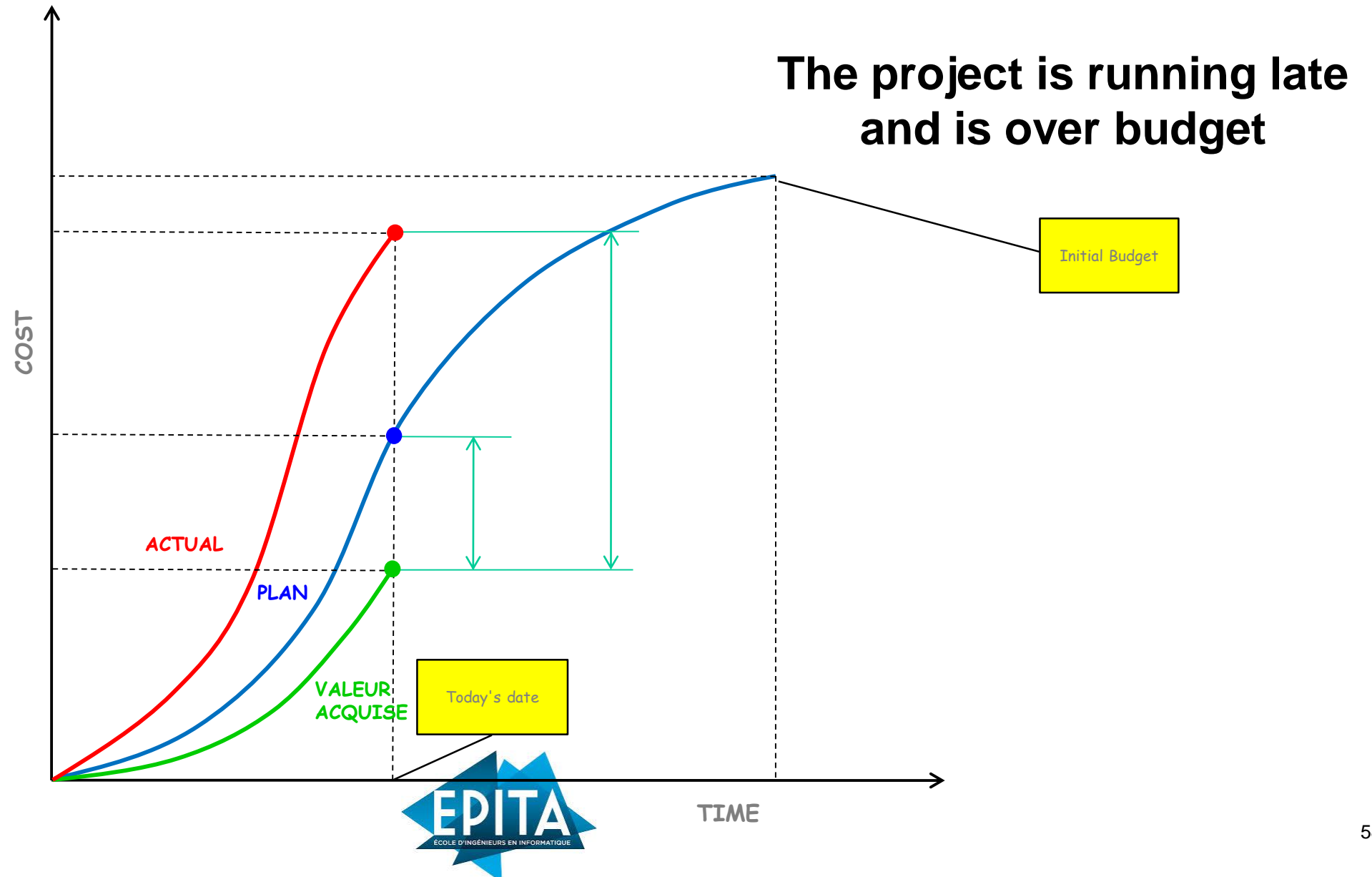
- **Planned value:** budgeted amount to complete an activity
 - Total budget for an activity
 - Cumulative budget for an activity at a given time
- **Actual cost:** Actual cost to perform the work
- **Earned Value :** The amount of budgeted work actually done for a task in a given period.
 - Calculation: $\text{Planned value} * \text{percentage of completion}$



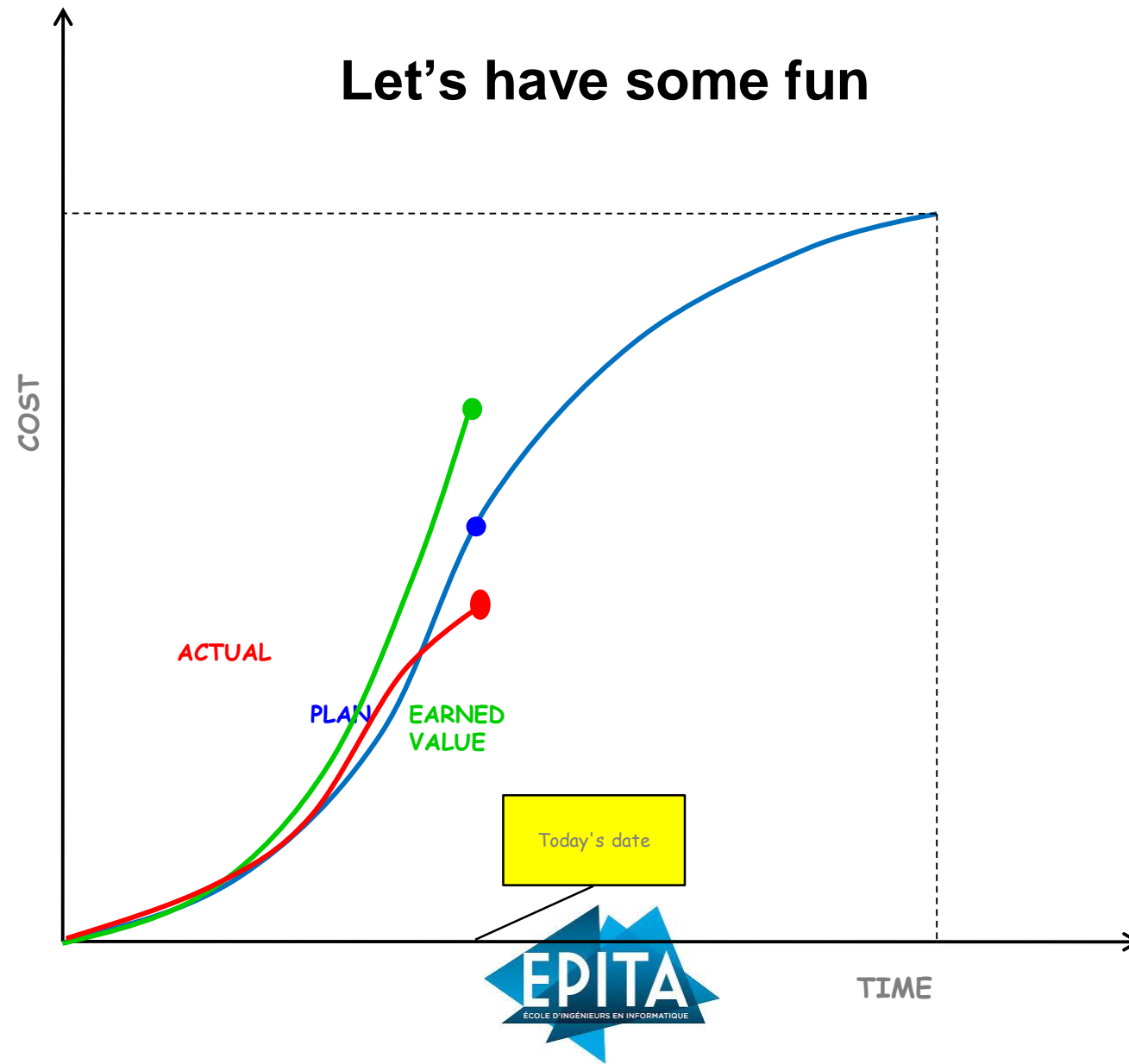
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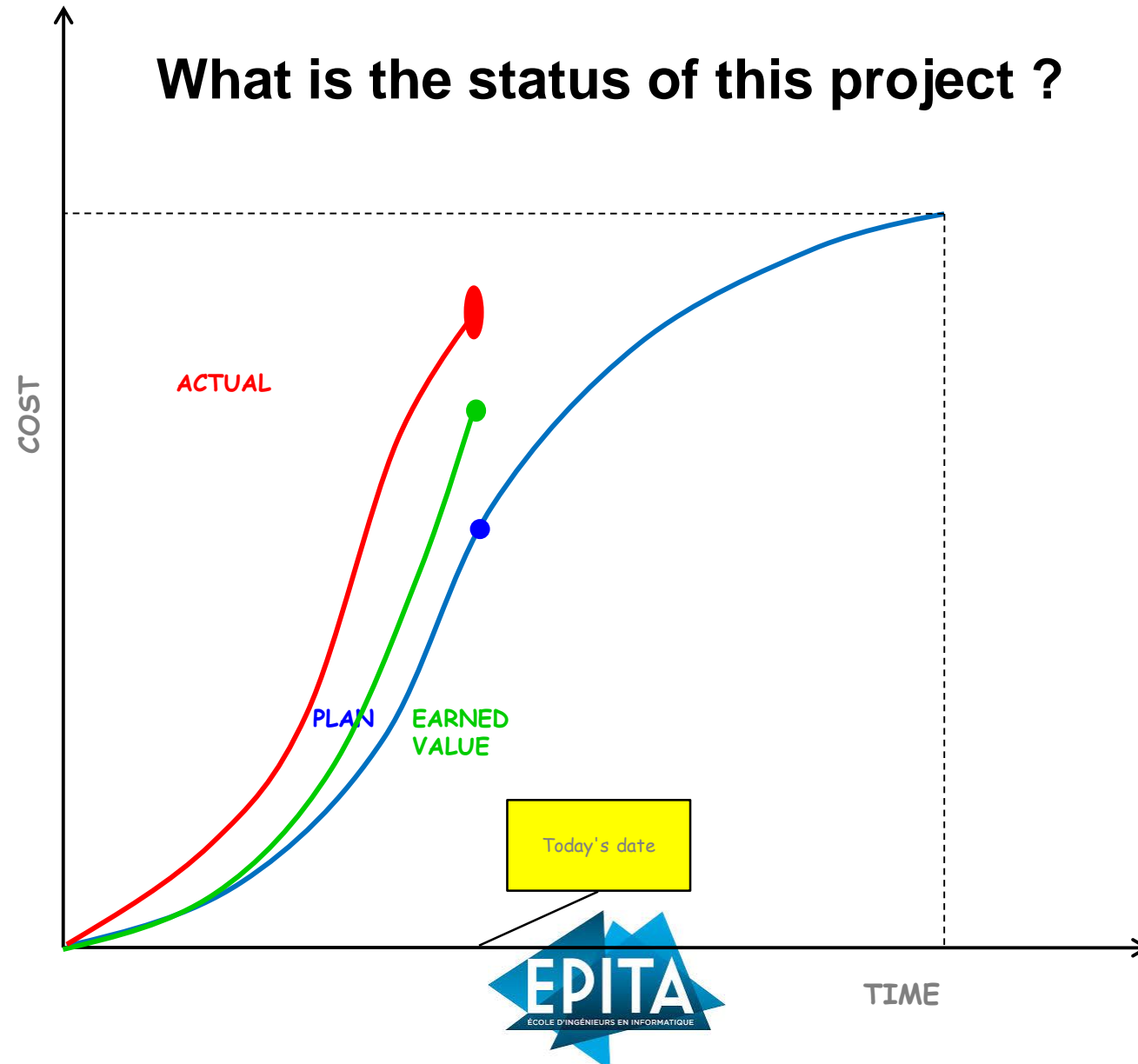
Gestion de Projet



Gestion de Projet



Gestion de Projet



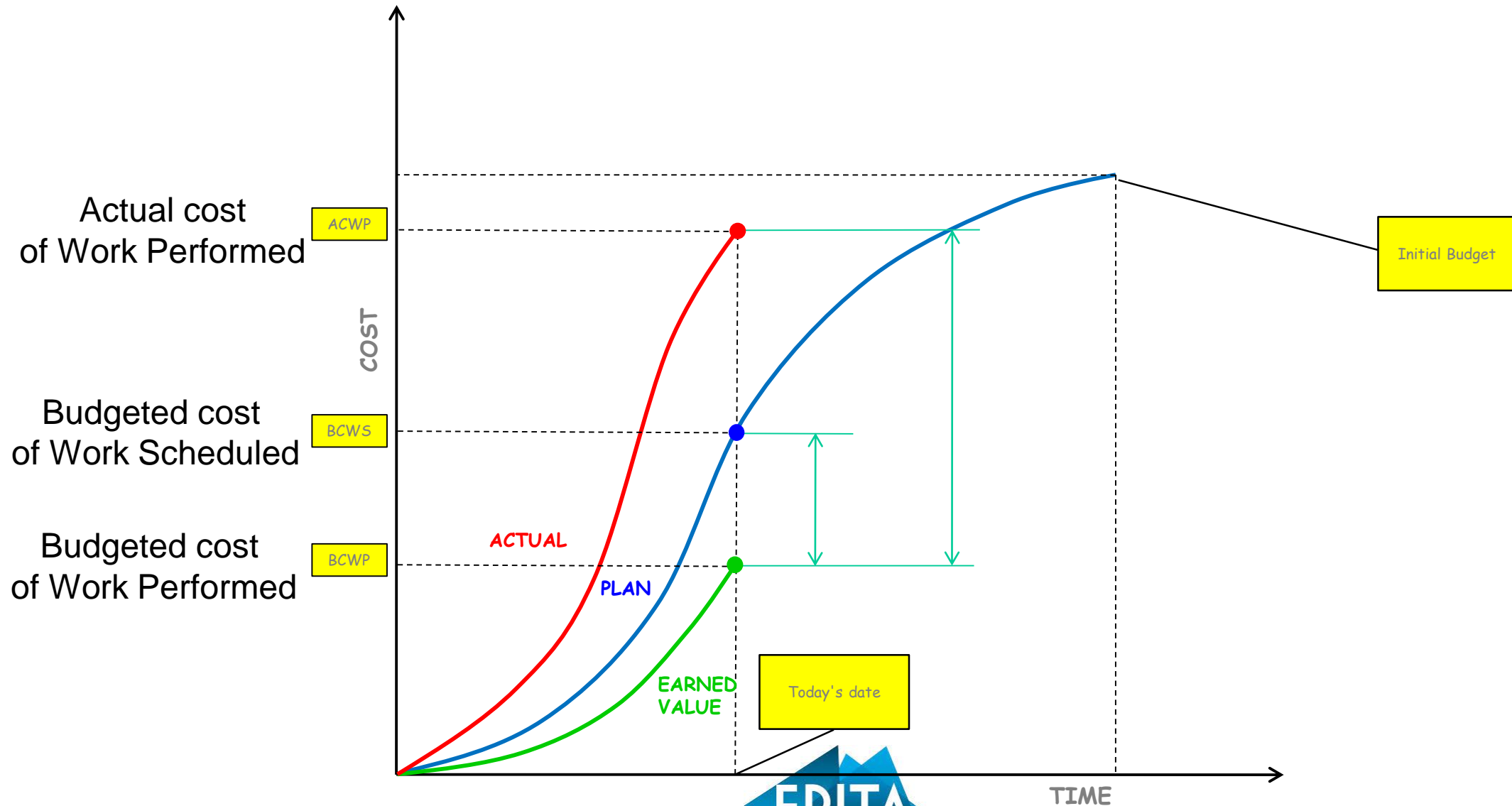
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Terme	Signification	Définition
BCWS	Budgeted cost of Work Scheduled	This is the expected cost of the project corresponding to the expected progress. It is determined at the beginning of the project.
ACWP	Actual cost of Work Performed	This is the actual cost. This is the actual cost of the project applied to the progress made on a given date. This cost shows what really happened on the project.
BCWP	Budgeted cost of Work Performed	It is the budgetary value of the realized or the projected cost of the project applied to the progress made at a given date.

Now let's put these terms on the graph



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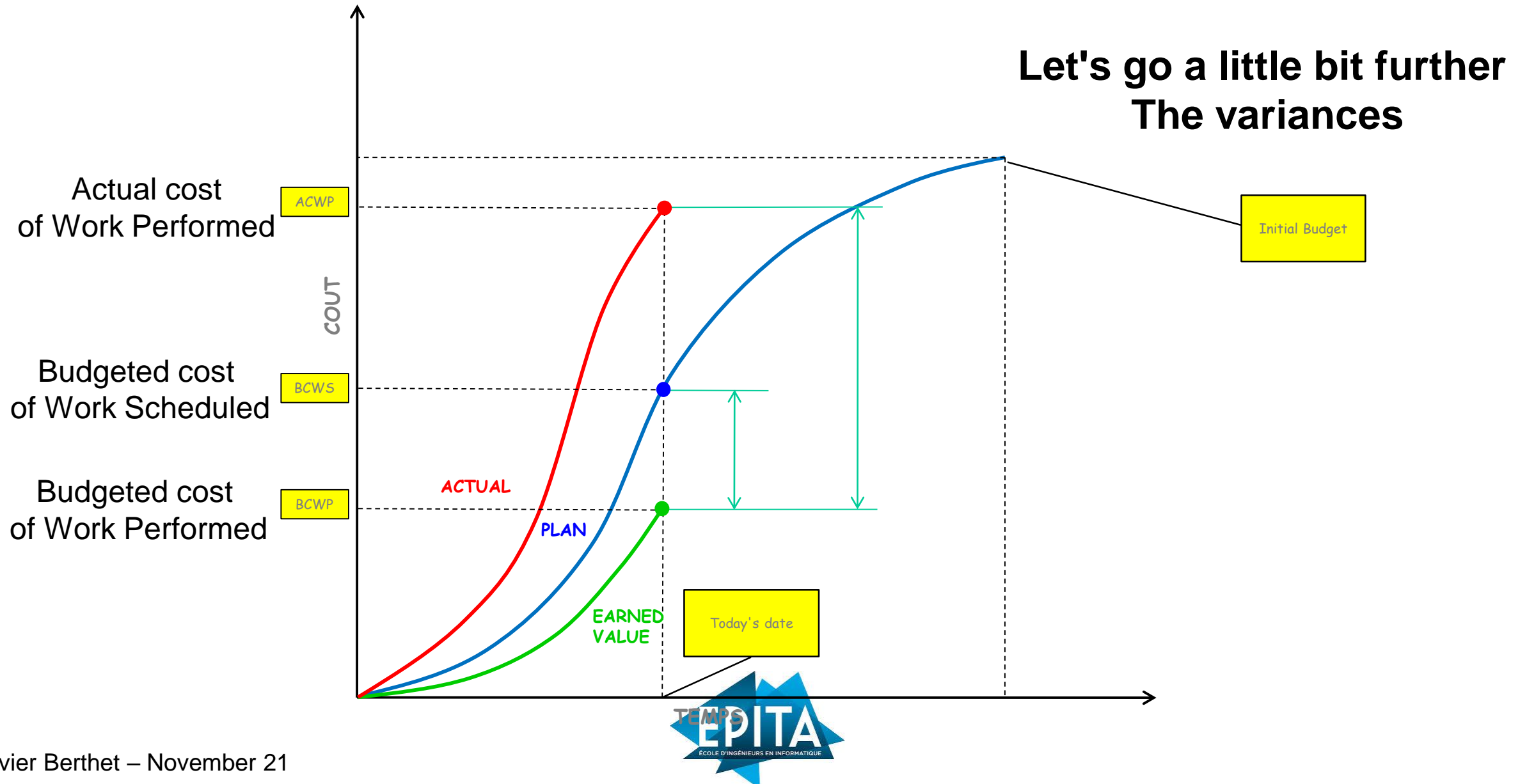


Terminology

Acronym	Meaning	Abbreviation	Signification
BCWS	Budgeted cost of Work Scheduled	PV	Planned Value
ACWP	Actual cost of Work Performed	AC	Actual Cost
BCWP	Budgeted cost of Work Performed	EV	Earned Value



Gestion de Projet



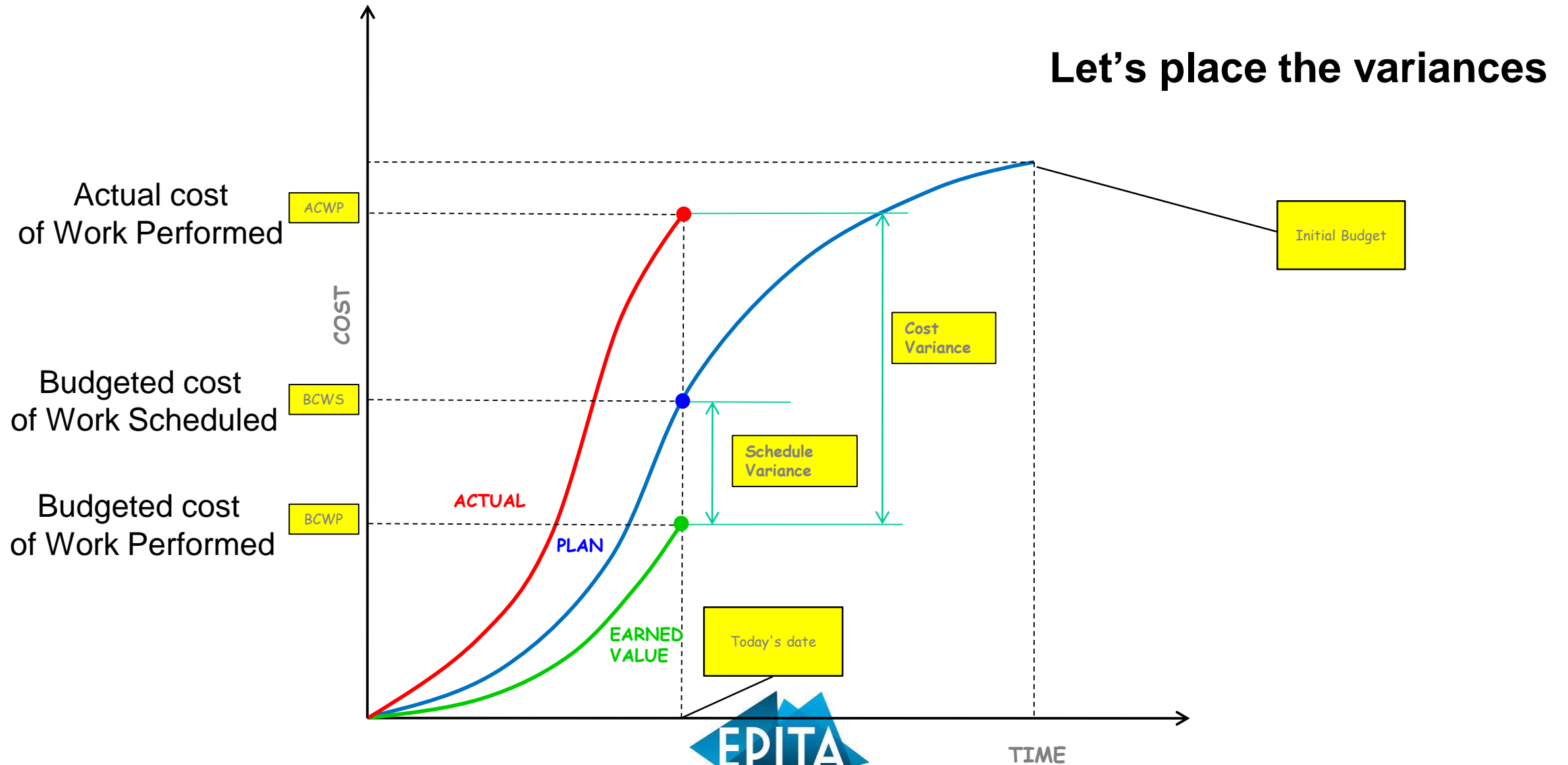
Gestion de Projet

Les Variances

Terme	Signification	Formule	Définition
CV	Cost Variance	$= BCWP - ACWP$	The ACWP and the BCWP have the same basis of physical advancement: the work actually done. For this work actually done, it cost more or less to do what we got. The cost difference if there is one, is explained by the cost of the tasks performed.
SV	Schedule Variance	$= BCWP - BCWS$	The BCWP and the BCWS are calculated on the same basis: the Budgeted cost. The difference can only be explained by the difference in physical progress: more or less tasks were measured in value. But the difference can also be converted into deadlines: number of days, weeks

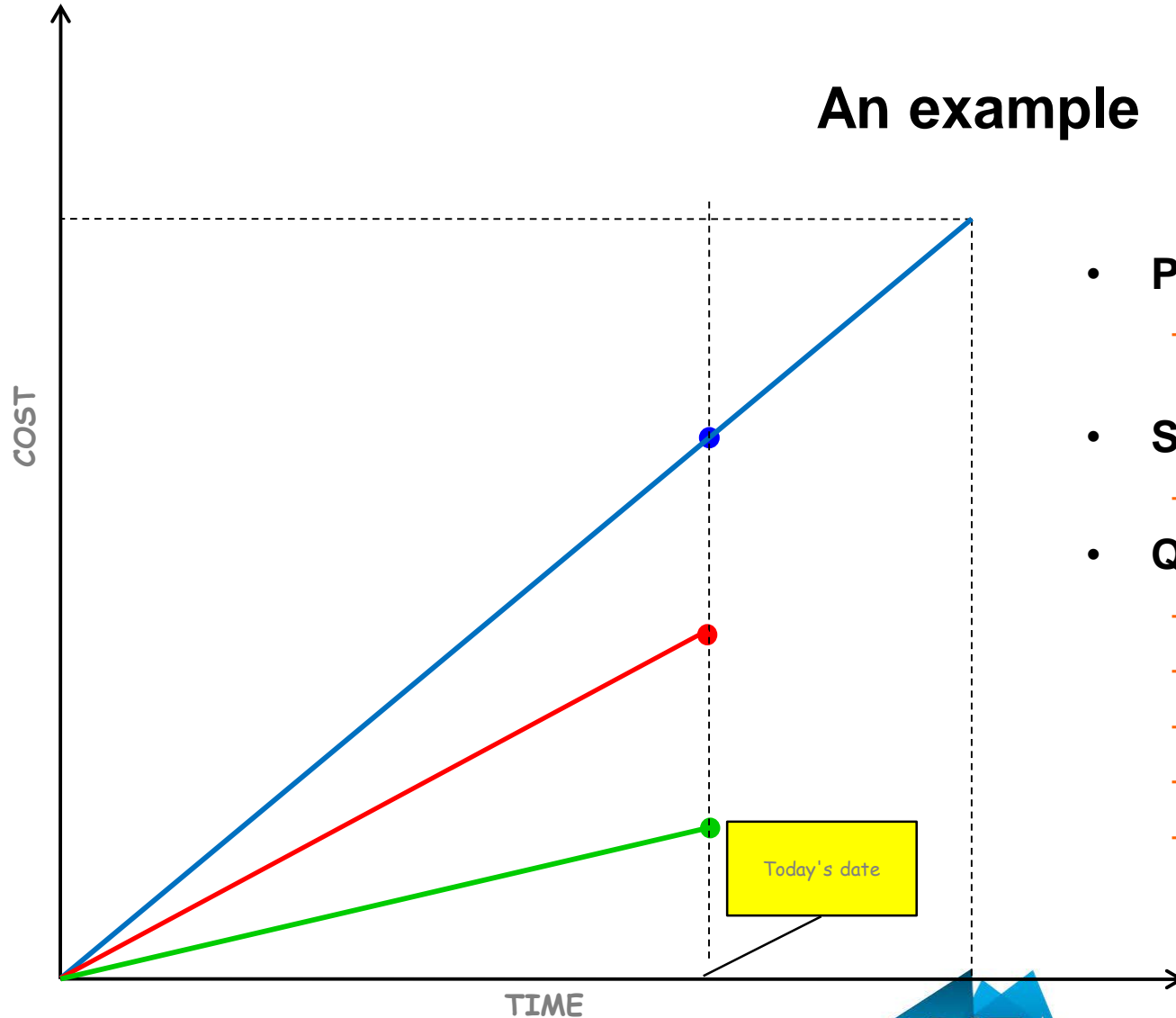


Gestion de Projet



Gestion de Projet

An example

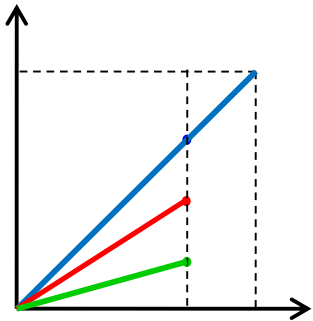


- **Project**
 - Budget 400 k€, Duration 4 mois, Linear planning
- **Situation after 3 months**
 - Actual cost 200 k€, Work completed 100 k€
- **Questions**
 - BCWS
 - ACWP
 - BCWP
 - SV
 - CV

An example

- **Project**
 - Budget 400 k€, Duration 4 months, Linear planning
- **Situation after 3 months**
 - Actual cost 200 k€, Work completed 100 k€

Terme	Signification	Calcul
BCWP	Budgeted cost of Work Performed	100 k€
BCWS	Budgeted cost of Work Scheduled	300 k€
ACWP	Actual cost of Work Performed	200 k€
EC	Ecart de coûts = $BCWP - ACWP$	-100 k€
EP	Ecart de prévisions ou retard = $BCWP - BCWS$	-200 k€



Do we continue ? Performance indicators

- The status of the work done is also indicated by two performance factors:
 - **CPI (« Cost Performance Index », Efficiency) = What we did / What we spent = $BCWP / ACWP$**
 - **SPI (« Schedule Performance Index », Effectiveness) = What we did / What we should have done (at that date) = $BCWP/BCWS$**
- The coefficient of efficiency, if less than 1, indicates that the value of Work Performed is less than the money spent. The project could exceed its budget.
- The coefficient of effectiveness, if less than 1, indicates that the work done is less than the planned work. The project is late.
- These indicators give an idea of the delay and the final cost, if the project continues at the same pace as until the measurement date.



Gestion de Projet

Variances

Terme	Signification	Formule
CV	Cost Variance	$= BCWP - ACWP$
SV	Schedule Variance	$= BCWP - BCWS$

Indicators

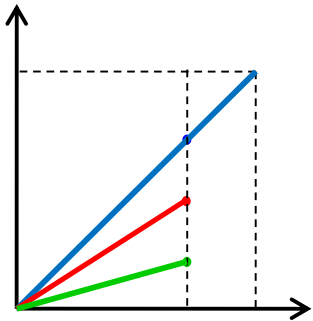
Terme	Signification		Formule
CPI	Cost Performance Indicator	Efficiency	$= BCWP / ACWP$
SPI	Schedule Performance Indicator	Effectiveness	$= BCWP / BCWS$



Avec les indicateurs

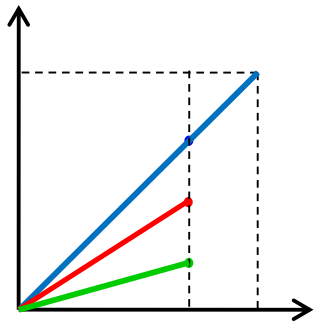
- Project
 - Budget 400 k€, Duration 4 months, Linear planning
- Situation after 3 months
 - Actual cost 200 k€, Work completed 100 k€

Terme	Signification	Calcul
BCWP	Budgeted cost of Work Performed	100 k€
BCWS	Budgeted cost of Work Scheduled	300 k€
ACWP	Actual cost of Work Performed	200 k€
EC	Ecart de coûts = $BCWP - ACWP$	-100 k€
EP	Ecart de prévisions ou retard = $BCWP - BCWS$	-200 k€
CPI	Efficienne	50%
SPI	Efficacité	33%



Reposons nous les bonnes questions

- **Project**
 - Budget 400 k€, Duration 4 months, Linear planning
- **Situation after 3 months**
 - Actual cost 200 k€, Work completed 100 k€



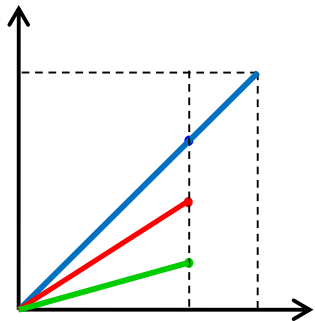
Terme	Signification	Calcul
BCWP	A la date d'aujourd'hui quelle est la valeur estimée du travail réellement effectué ?	100 k€
BCWS	A la date d'aujourd'hui quelle est la valeur du travail qui avait été prévu d'être fait ?	300 k€
ACWP	Actual costof Work Performed ?	200 k€
EC	Ecart de coûts = $BCWP - ACWP$	-100 k€
EP	Ecart de prévisions ou retard = $BCWP - BCWS$	-200 k€
CPI	Efficiencie	50%
SPI	Efficacité	33%

Gestion de Projet

Revised Duration

Initial Duration / Effectiveness ou SPI

$4/0.33 = 12$ mois



Terme	Signification	Calcul
BCWP	At today's date what is the estimated value of the work actually performed?	100 k€
BCWS	As of today what is the value of the work that had been planned to be done?	300 k€
ACWP	Actual cost of Work Performed ?	200 k€
CV	Cost Variance = $BCWP - ACWP$	-100 k€
SV	Schedule Variance = $BCWP - BCWS$	-200 k€
CPI	Efficiency	50%
SPI	Effectiveness	33%



Earned Value Method

- Method for measuring project performance on content, time, and cost
- Performance interpretation using CPI and SPI indicators

Performance Measures		Schedule		
		$SV > 0 \text{ \& } SPI > 1.0$	$SV = 0 \text{ \& } SPI = 1.0$	$SV < 0 \text{ \& } SPI < 1.0$
Cost	$CV > 0 \text{ \& } CPI > 1.0$	Ahead of Schedule Under Budget	On Schedule Under Budget	Behind Schedule Under Budget
	$CV = 0 \text{ \& } CPI = 1.0$	Ahead of Schedule On Budget	On Schedule On Budget	Behind Schedule On Budget
	$CV < 0 \text{ \& } CPI < 1.0$	Ahead of Schedule Over Budget	On Schedule Over Budget	Behind Schedule Over Budget

Improvement actions

- **Gain in Productivity:** resources are now trained before tackling the last 3 faces
- **Automation of processes**
- **Increased number of resources to catch up**



Now let's look to the future

- What does the EARNED VALUE method tell us about the end of the project ?



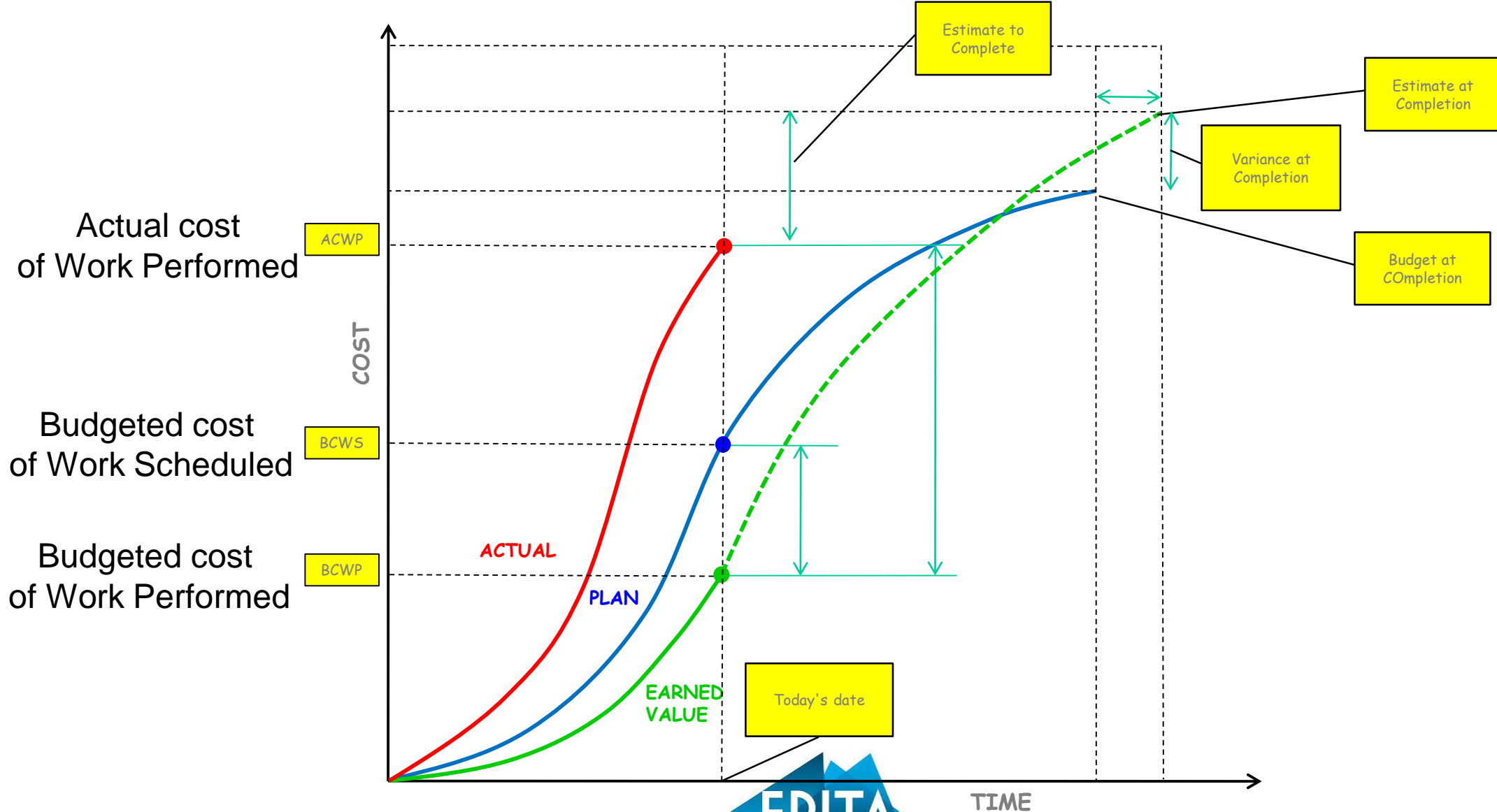
Forecast values

Terme	Signification	Formule	Définition
BAC	Budget At Completion		The initial total cost budgeted
EAC	Estimate at Completion	$= BAC / CPI$	The expected forecast of the revised total cost
ETC	Estimate to Complete	$= EAC - ACWP$	Revised total cost minus the cost of Work Performed
VAC	Variance at Completion	$= BAC - EAC$	Difference at the end of the project between the final cost and the budget

EAC Estimate at Completion or the Final cost



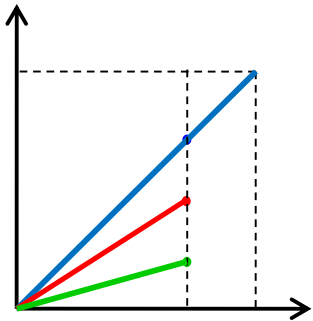
Gestion de Projet



Exercise

- **Project**
 - Budget 400 k€, Duration 4 months, Linear planning
- **Situation after 3 months**
 - Actual cost 200 k€, Work completed 100 k€

Terme	Signification	Calcul
BCWP	Budgeted cost of Work Performed	100 k€
BCWS	Budgeted cost of Work Scheduled	300 k€
ACWP	Actual cost of Work Performed	200 k€
CPI	Efficiency	50%
SPI	Effectiveness	33%
BAC	Budget at Completion	400 k€
EAC	Estimate at Completion	800 k€
ETC	Estimate to Complete	600 k€
VAC	Variance at Completion	400 k€



It's your turn to play - Exercise



- Your project is to build a box. The box has six faces
- Each face takes a day to build. Each face is budgeted at 1000 €
- Faces must be built one after the other
- Today we are at the end of the 3rd day, Your team reports you the following situation

Tâche	Progrès	Coût ACTUAL
Tâche 1	<div><div></div></div> 100%	€1,200
Tâche 2	<div><div></div></div> 100%	€1,000
Tâche 3	<div><div></div></div> 75%	€750
Tâche 4	<div><div></div></div> 50%	€500
Tâche 5	<div><div></div></div> 0%	€0
Tâche 6	<div><div></div></div> 0%	€0



Gestion de Projet

- Using the following table, calculate the parameters and give your interpretation of the project's performance

Parameter	Calculation	Result
BAC		
BCWP		
BCWS		
ACWP		
CV		
SV		
CPI		
SPI		



It's your turn to play - Exercise



- Your project is to build a box. The box has six faces
- Each face takes a day to build. Each face is budgeted at 1000 €
- Faces must be built one after the other
- Today we are at the end of the 3rd day, Your team reports you the following situation

Tâche	Progrès	Coût ACTUAL
Tâche 1	<div><div></div></div> 100%	€1,200
Tâche 2	<div><div></div></div> 100%	€1,000
Tâche 3	<div><div></div></div> 75%	€750
Tâche 4	<div><div></div></div> 50%	€500
Tâche 5	0%	€0
Tâche 6	0%	€0

Parameter
BAC
BCWP
BCWS
ACWP
EC
EP
CPI
SPI

Gestion de Projet



Parameter	Calculation	Result
BAC		
EAC		
ETC		
VAC		

