SWEN90016

Software Processes & Project Management

Project Planning & Scheduling

2021 – Semester 2
Tutorial 5

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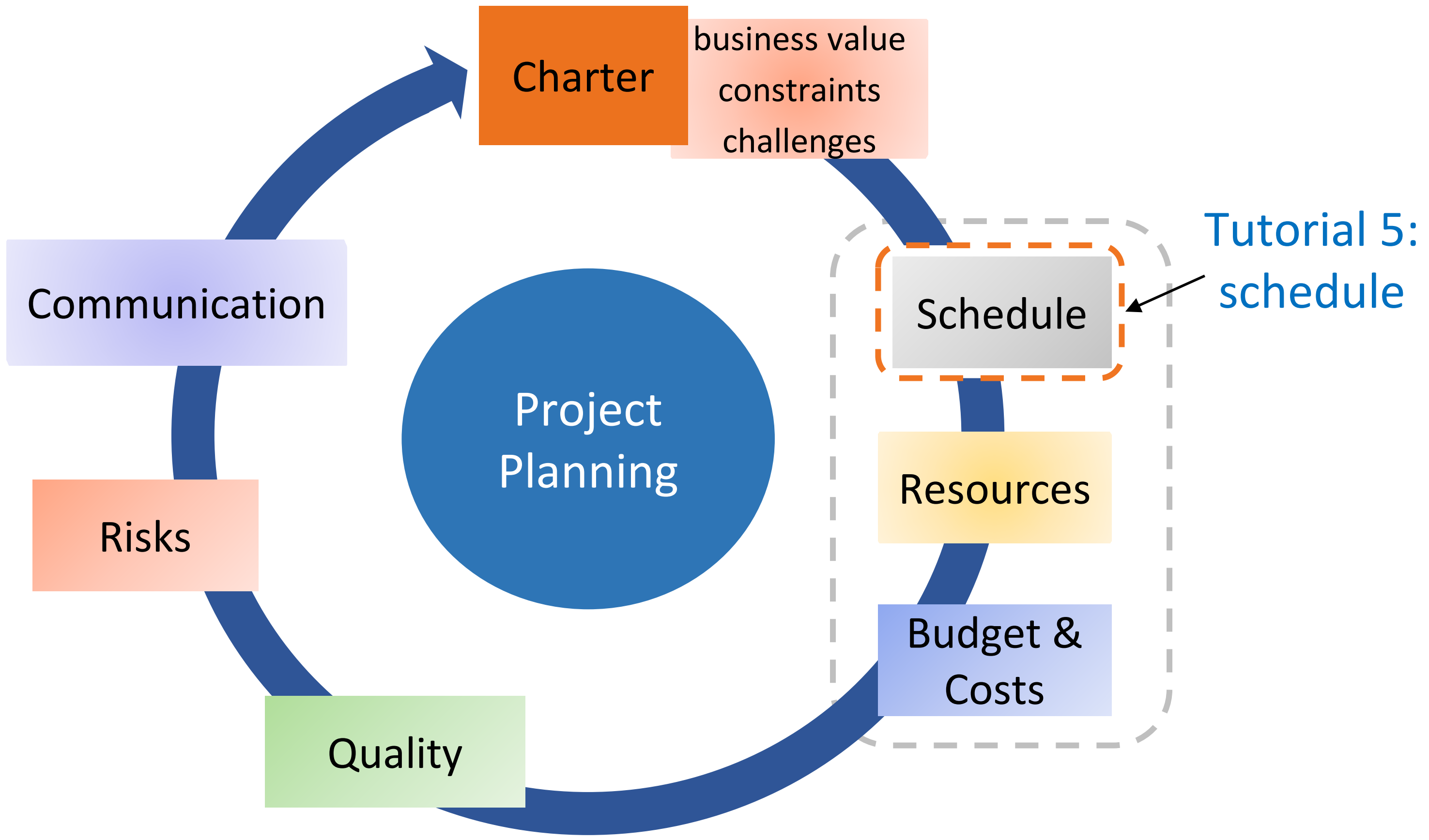
Formal approaches

Become familiar with

Scheduling – PERT and GANTT charts

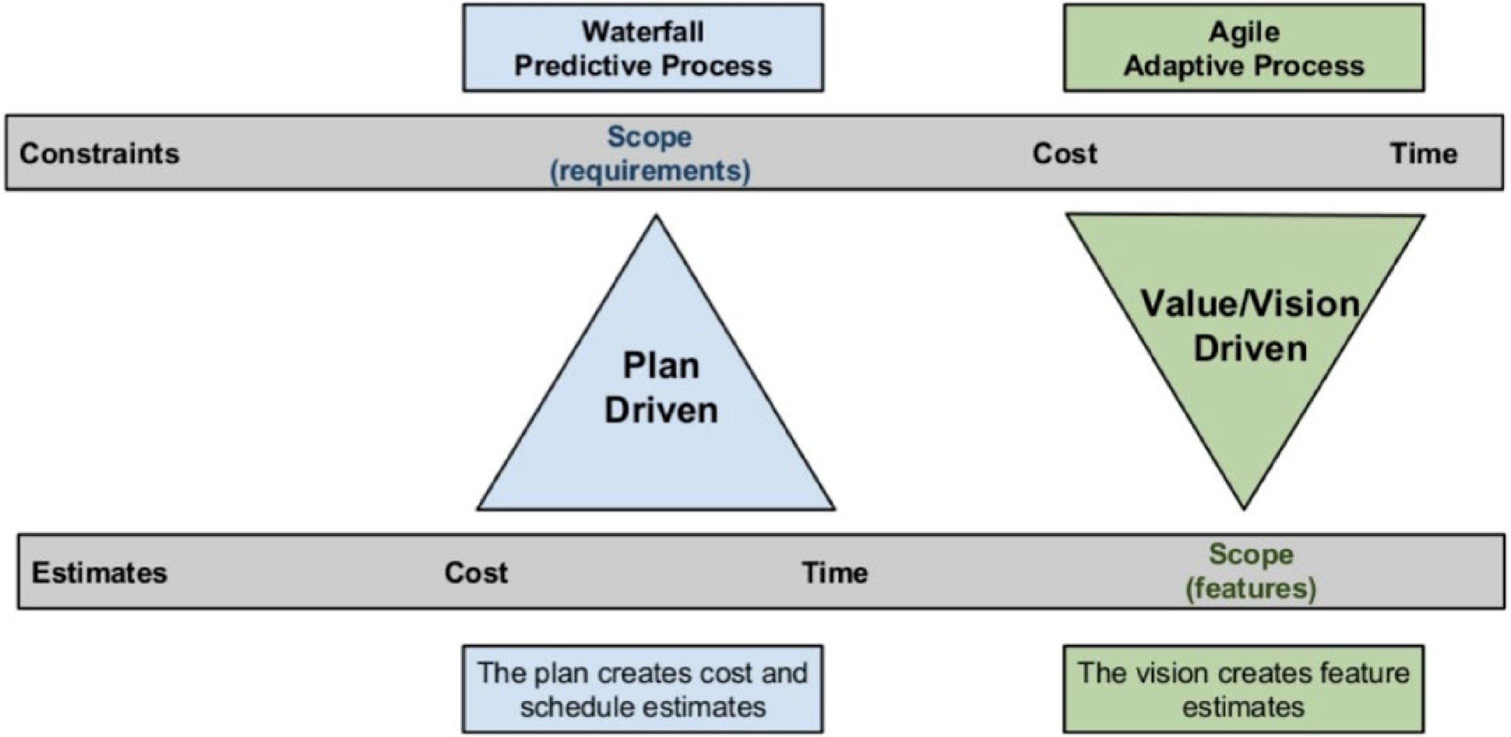
Function Point Analysis and COCOMO II

Project Initialization Phase



Today's aim

How to plan and control the schedule of software projects.



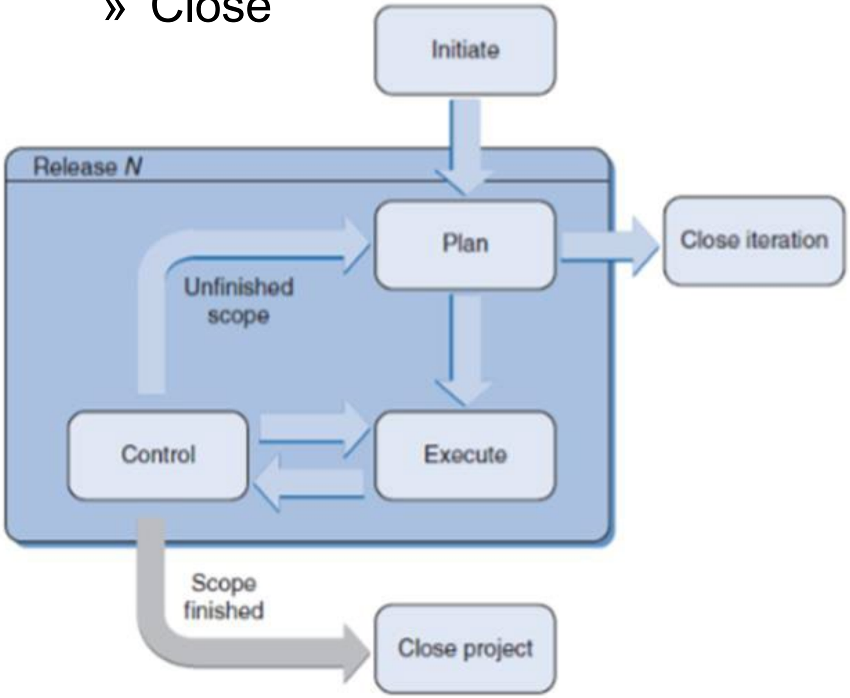
Software Projects

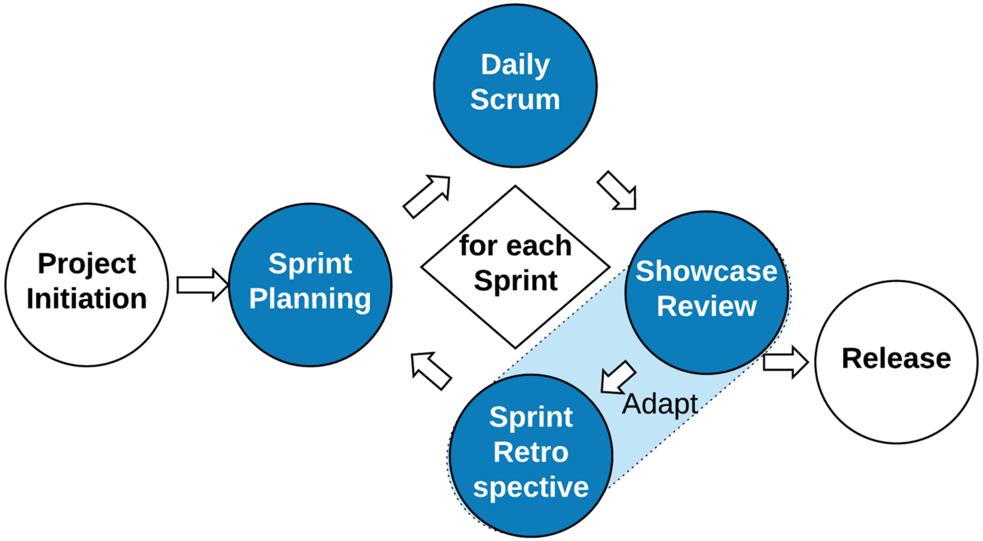
Formal PM Stages:

- Initiate
- Plan
- Execute
- Monitor & Control
- Close

Agile PM Stages:

- Initiate
- Sprint Plan
- Scrum (or Sprint)
- Review & Retrospective (or Adapt)
- Release

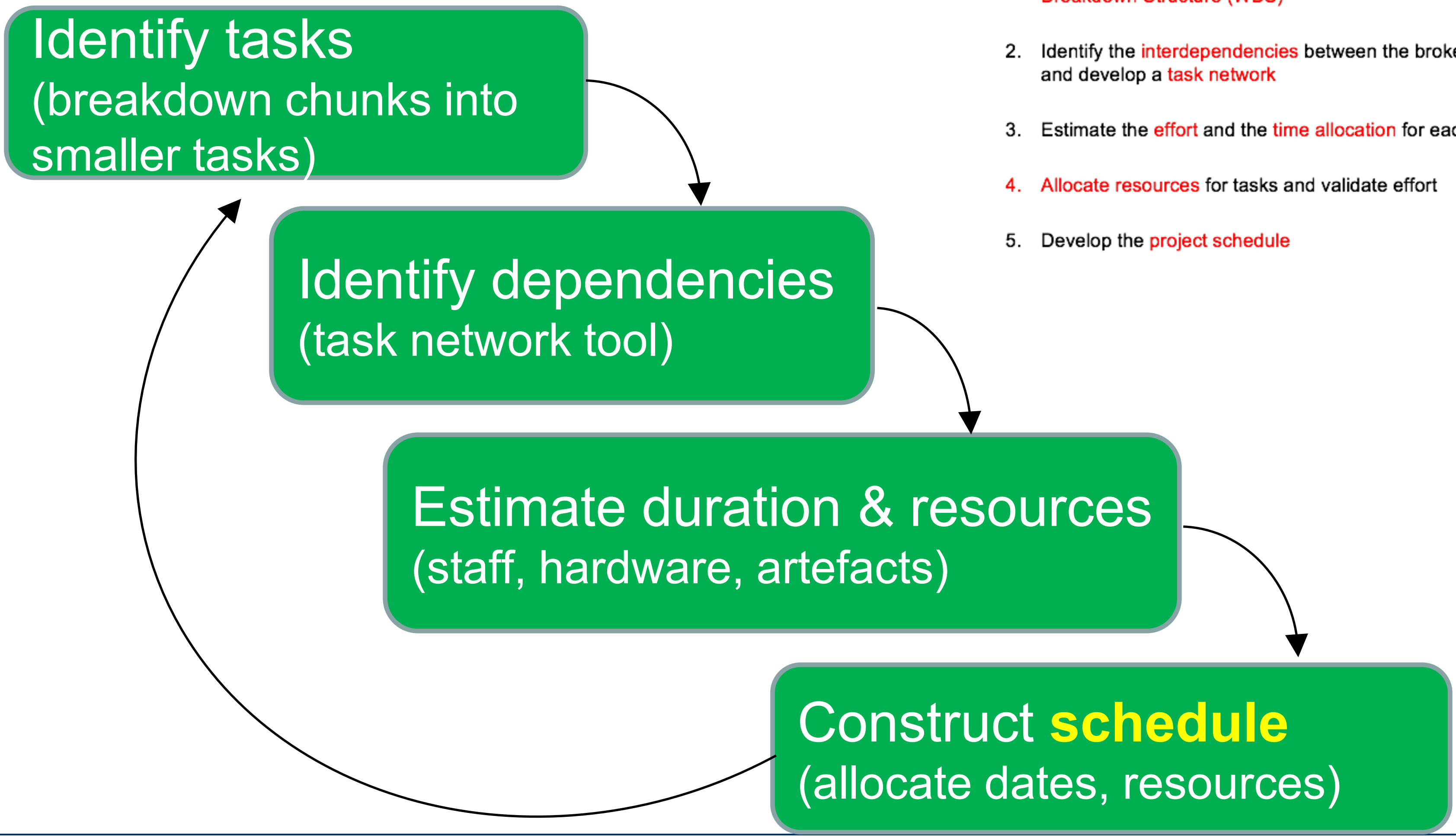




Formal Project Schedule

What steps are involved in developing a project schedule?

1. Breakdown the task into small chunks you can deal with – Work Breakdown Structure (WBS)
2. Identify the interdependencies between the broken down tasks and develop a task network
3. Estimate the effort and the time allocation for each task
4. Allocate resources for tasks and validate effort
5. Develop the project schedule



Identify tasks (breakdown chunks into smaller tasks)

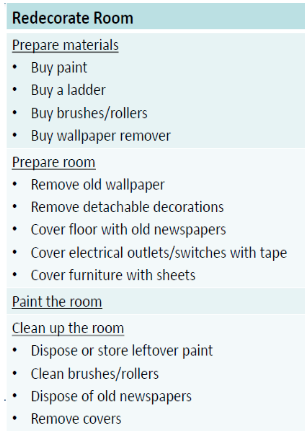
Identify dependencies (task network tool)

Estimate duration & resources (staff, hardware, artefacts)

Construct **schedule** (allocate dates, resources)

Formal Project Scheduling

1. Work Breakdown Structure



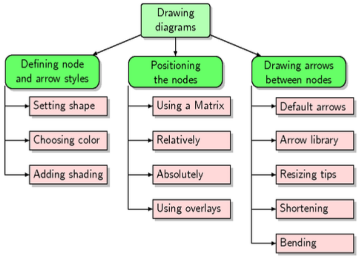
Redecorate Room

Prepare materials
- Buy paint
- Buy a ladder
- Buy brushes/rollers
- Buy wallpaper remover

Prepare room
- Remove old wallpaper
- Remove detachable decorations
- Cover floor with old newspapers
- Cover electrical outlets/switches with tape
- Cover furniture with sheets

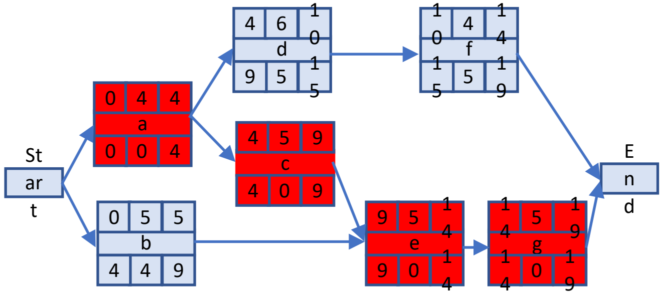
Paint the room

Clean up the room
- Dispose or store leftover paint
- Clean brushes/rollers
- Dispose of old newspapers
- Remove covers

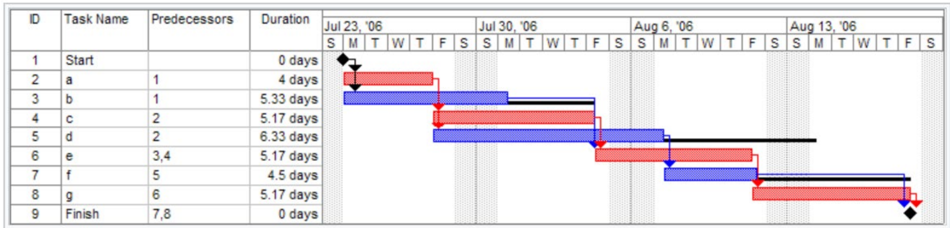


planning tools

2. PERT Chart



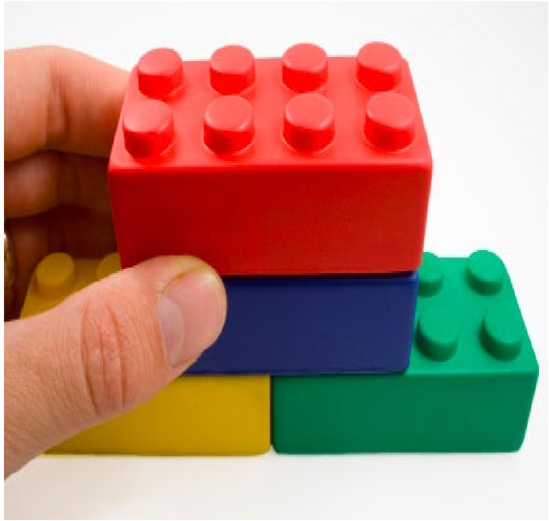
3. Gantt Chart

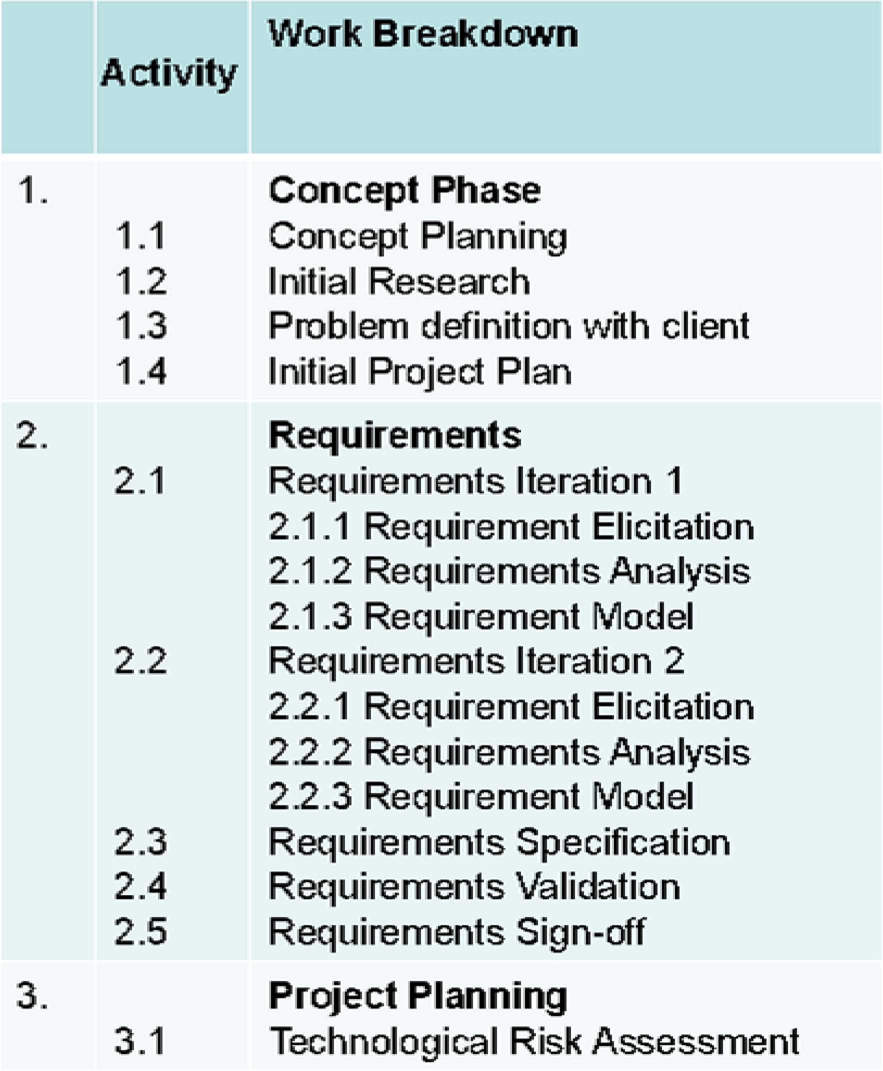


ID	Task Name	Predecessors	Duration
1	Start		0 days
2	a	1	4 days
3	b	1	5.33 days
4	c	2	5.17 days
5	d	2	6.33 days
6	e	3,4	5.17 days
7	f	5	4.5 days
8	g	6	5.17 days
9	Finish	7,8	0 days

A Gantt chart created using Microsoft Project (MSP). Note (1) the critical path is in red, (2) the slack is the black lines connected to non-critical activities, (3) since Saturday and Sunday are not work days and are thus excluded from the schedule, some bars on the Gantt chart are longer if they cut through a weekend.

Identify Tasks - Work Breakdown





	Activity	Work Breakdown
1.		**Concept Phase**
	1.1	Concept Planning
	1.2	Initial Research
	1.3	Problem definition with client
	1.4	Initial Project Plan
2.		**Requirements**
	2.1	Requirements Iteration 1
		2.1.1 Requirement Elicitation
		2.1.2 Requirements Analysis
		2.1.3 Requirement Model
	2.2	Requirements Iteration 2
		2.2.1 Requirement Elicitation
		2.2.2 Requirements Analysis
		2.2.3 Requirement Model
	2.3	Requirements Specification
	2.4	Requirements Validation
	2.5	Requirements Sign-off
3.		**Project Planning**
	3.1	Technological Risk Assessment

Identify Dependencies

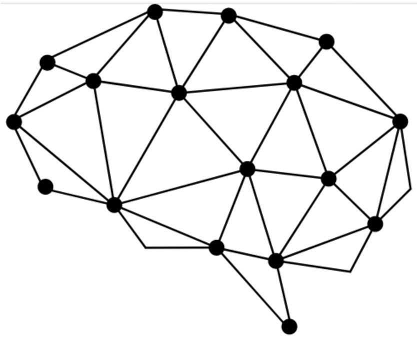
	Activity	Work Breakdown	Dependencies predecessor	Duration
1.		**Concept Phase**		
	1.1	Concept Planning		1
	1.2	Initial Research		4
	1.3	Problem definition with client		2
	1.4	Initial Project Plan	1.1, 1.2, 1.3	1
2.		**Requirements**		
	2.1	Requirements Iteration 1		
		2.1.1 Requirement Elicitation	1.4	2
		2.1.2 Requirements Analysis	2.1.1	3
		2.1.3 Requirement Model	2.1.2	3
	2.2	Requirements Iteration 2		
		2.2.1 Requirement Elicitation	2.1.2	3
		2.2.2 Requirements Analysis	2.2.1	3
		2.2.3 Requirement Model	2.2.2	4
	2.3	Requirements Specification	2.2.3	5
	2.4	Requirements Validation	2.3	4
	2.5	Requirements Sign-off	3.1, 2.4	4
3.		**Project Planning**		
	3.1	Technological Risk Assessment	2.1.2	4

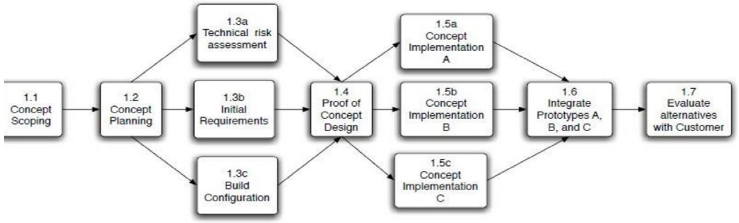
Identify Dependencies

Develop a task network

(activity on node)

given dependencies

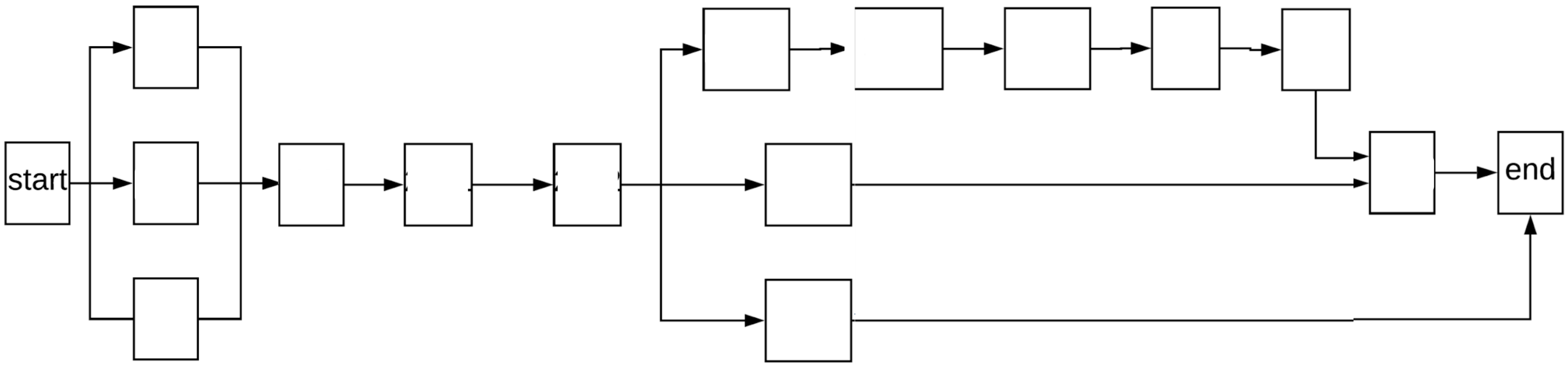



1.1 Concept Scoping
1.2 Concept Planning
1.3a Technical risk assessment
1.3b Initial Requirements
1.3c Build Configuration
1.4 Proof of Concept Design
1.5a Concept Implementation A
1.5b Concept Implementation B
1.5c Concept Implementation C
1.6 Integrate Prototypes A, B, and C
1.7 Evaluate alternatives with Customer

	activity	predecessor	duration
1	1.1		1
2	1.2		4
3	1.3		2
4	1.4	1.1 1.2 1.3	1
5	2.1.1	1.4	2
6	2.1.2	2.1.1	3
7	2.1.3	2.1.2	3
8	2.2.1	2.1.2	3
9	2.2.2	2.2.1	3
10	2.2.3	2.2.2	4
11	2.3	2.2.3	5
12	2.4	2.3	4
13	2.5	2.4 3.1	4
14	3.1	2.1.2	4

Identify dependencies (task network tool)

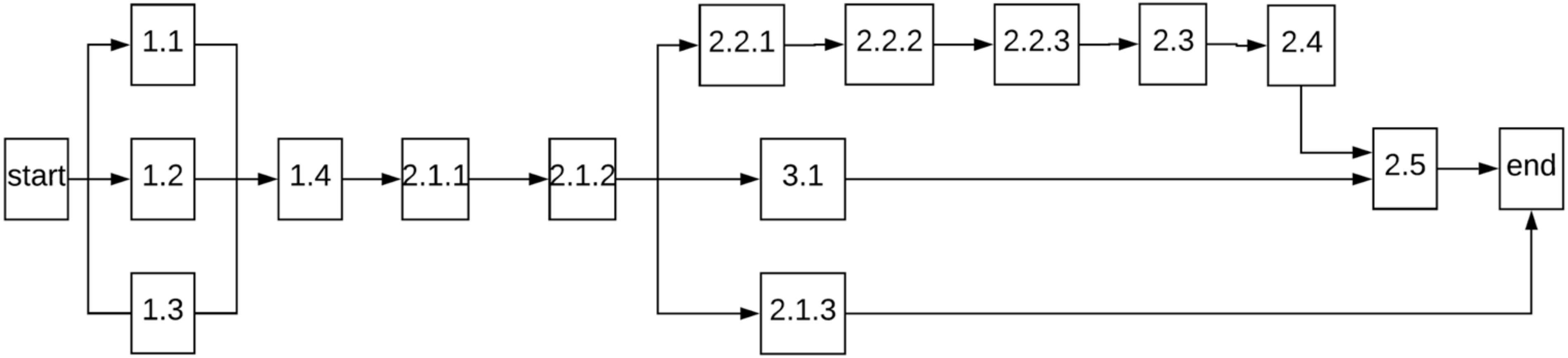
	activity	predecessor	duration
1	1.1		1
2	1.2		4
3	1.3		2
4	1.4	1.1 1.2 1.3	1
5	2.1.1	1.4	2
6	2.1.2	2.1.1	3
7	2.1.3	2.1.2	3
8	2.2.1	2.1.2	3
9	2.2.2	2.2.1	3
10	2.2.3	2.2.2	4
11	2.3	2.2.3	5
12	2.4	2.3	4
13	2.5	2.4 3.1	4
14	3.1	2.1.2	4



Task Network

Network Diagram

- Sequential nodes
- Few details



Pert Chart

PERT: **P**rogram **E**valuation & **R**eview **T**echnique

ES	**Duration**	**EF**
Task Name		
LS	**Slack**	**LF**

The activity node

Earliest start time (ES)
Duration in people days
Earliest finish time (EF)

Latest start time (LS)
Slack time
Latest finish time (LF)

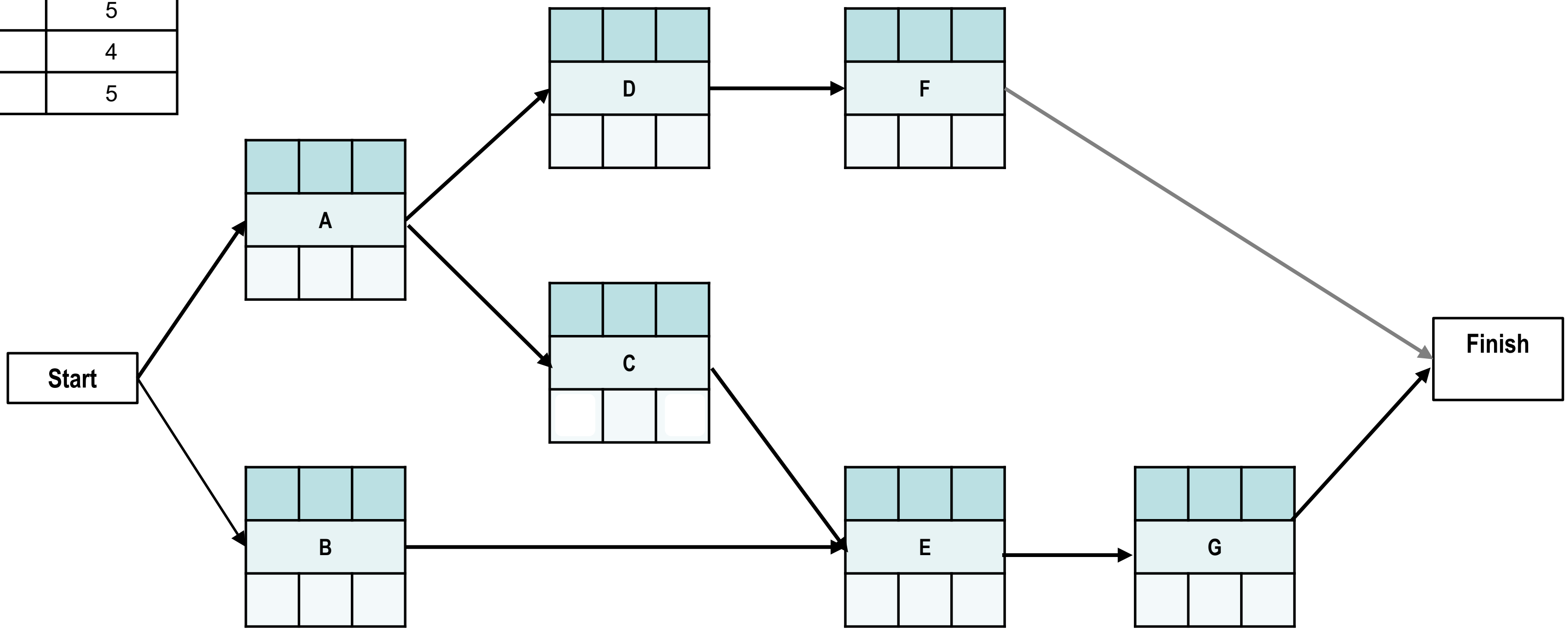
Pert Chart: example

Show a PERT chart: use task durations & task network diagram

Activity	Duration
A	4
B	5
C	5
D	6
E	5
F	4
G	5

ES	Duration	EF
Task Name		
LS	Slack	LF

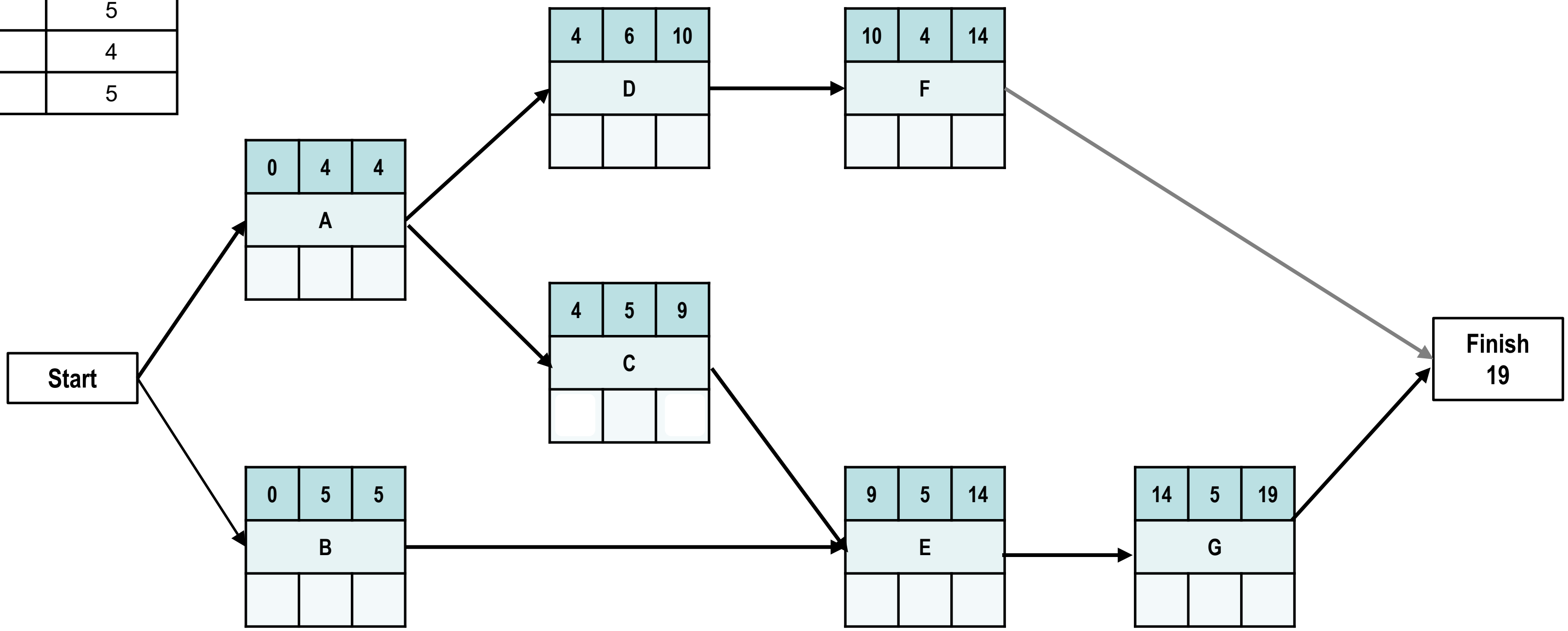
Task Network Diagram



Forward Pass

Activity	Duration
A	4
B	5
C	5
D	6
E	5
F	4
G	5

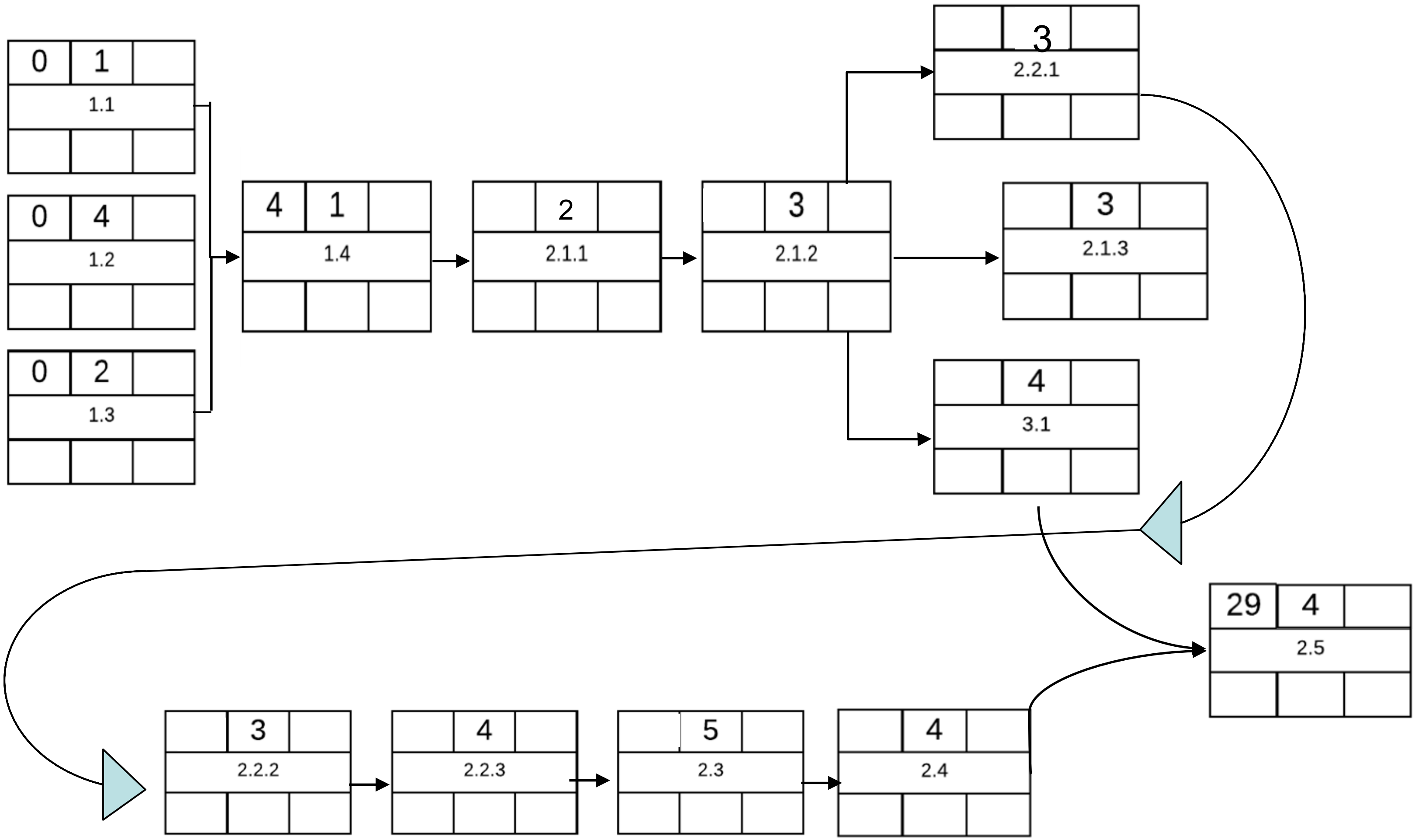
ES	Duration	EF
Task Name		
LS	Slack	LF



PERT Chart: activity

Use duration estimates & task network to construct PERT chart

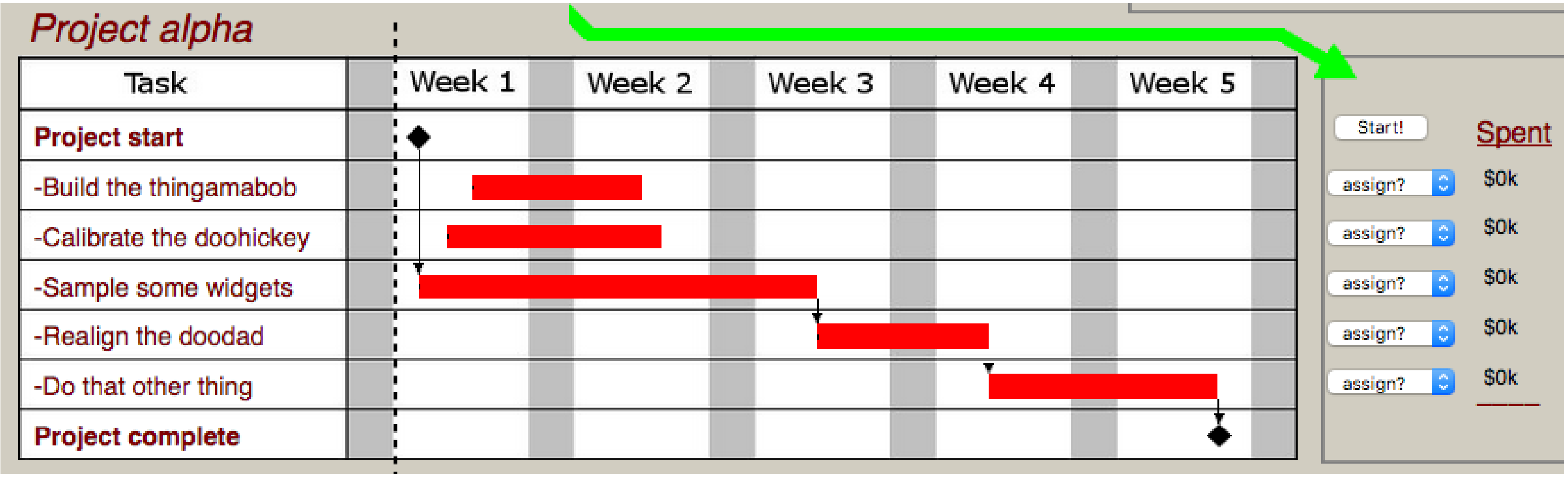
activ	durn
1.1	1
1.2	4
1.3	2
1.4	1
2.1.1	2
2.1.2	3
2.1.3	3
2.2.1	3
2.2.2	3
2.2.3	4
2.3	5
2.4	4
2.5	4
3.1	4



Construct Resource Schedule

Play the Project Management Game:

http://thatpmgame.com/



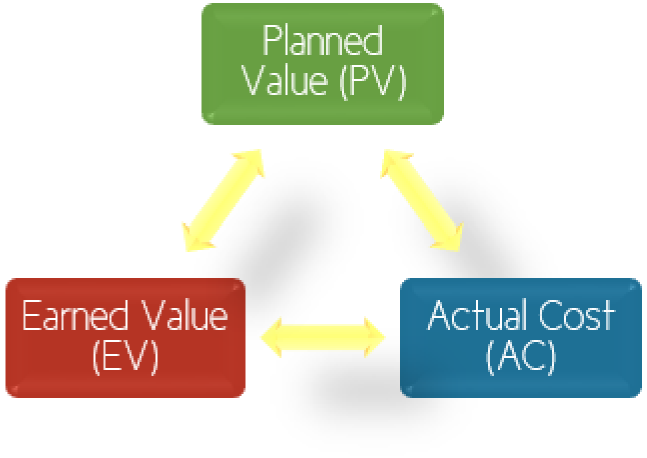
Project alpha

Task	Week 1	Week 2	Week 3	Week 4	Week 5		
Project start						Start!	Spent
-Build the thingamabob						assign?	$0k
-Calibrate the doohickey						assign?	$0k
-Sample some widgets						assign?	$0k
-Realign the doodad						assign?	$0k
-Do that other thing						assign?	$0k
Project complete							

Use a Gantt chart to assign staff to various tasks.

Is the project completed on time and on budget?

Monitoring and Control quiz



how to control

Planned Value
assignment Section 7= 120 marks

assigned *value* of activity

Earned Value
assignment neglected, …
- what is it worth ?

the *current value* of the work,
given 1) the expected work rate,
and 2) the work done up until now

Actual Cost ☹

final *actual value* of activity

Cost estimation (Formal)

Become familiar with

Formal

Function Point Analysis and COCOMO II

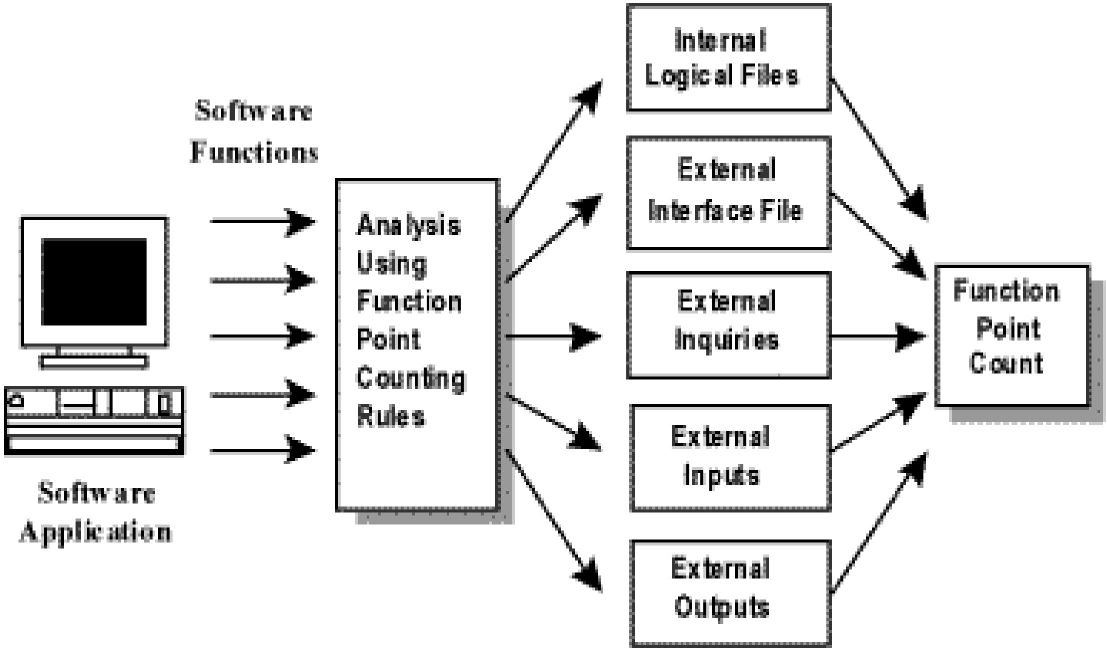
Functional Points

What are they?

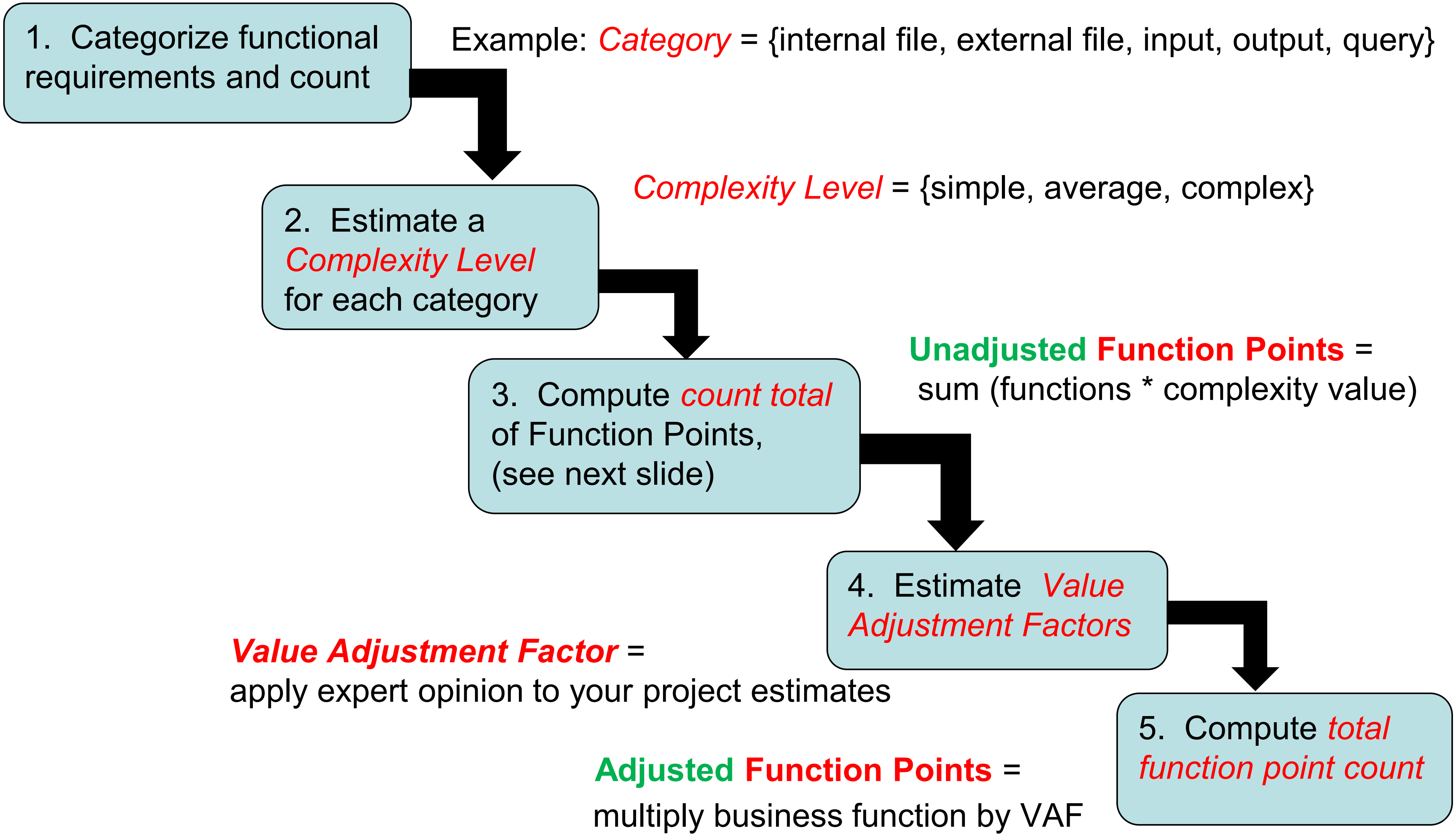
PMBOK

Historic Data

Done at any time in project lifecycle



FP Computation Steps



1. Categorize functional requirements and count

Example: *Category* = {internal file, external file, input, output, query}

2. Estimate a *Complexity Level* for each category

Complexity Level = {simple, average, complex}

3. Compute *count total* of Function Points, (see next slide)

Unadjusted Function Points = sum (functions * complexity value)

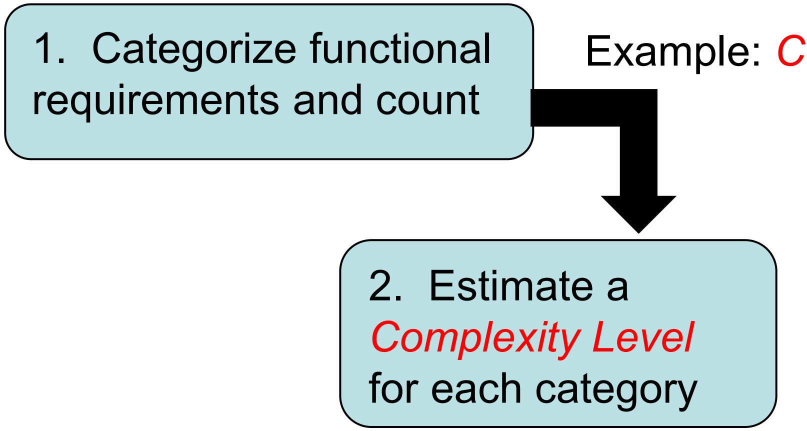
4. Estimate *Value Adjustment Factors*

Value Adjustment Factor = apply expert opinion to your project estimates

5. Compute *total function point count*

Adjusted Function Points = multiply business function by VAF

FP Computation Steps



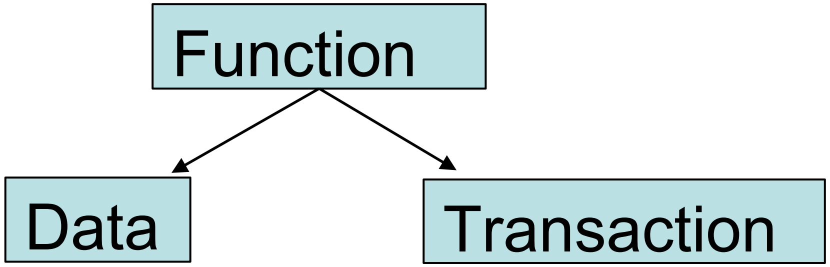
1. Categorize functional requirements and count

2. Estimate a *Complexity Level* for each category

Example: *Category* = {internal file, external file, input, output, query}

Complexity Level = {simple, average, complex}

Count functions from the Software Requirements Specification (SRS)



Data elements
Record elements

Data elements
File references

Step 2: Set Complexity Values

Historic Data

complexity values

Category	Simple Function Count	Weight	Average Function Count	Weight	Complex Function Count	Weight	Sub total
Internal Logical File	5	3		4	2	6	
External Interface File`		4		5	1	7	
External Input	2	3		4		6	
External Output	5	7	2	10	2	15	
External Inquiries/Queries	2	5		7		10	
Unadjusted Total							

Factors published from 2,192 recent Function Point projects

http://www.qsm.com/resources/function-point-languages-table

Step 3: Calculate Functional Points

Given the following business functions,

how many *Unadjusted* Function Points exist?

Fill in the table.

Category	Simple Function Count	Weight	Average Function Count	Weight	Complex Function Count	Weight	Sub total
Internal Logical File	5	3		4	2	6	
External Interface File`		4		5	1	7	
External Input	2	3		4		6	
External Output	5	7	2	10	2	15	
External Inquiries/Queries	2	5		7		10	
Unadjusted Total							

Step 4: Calculate VAF

Historic Data

Give the 14 system characteristics, estimate how relevant they are to your system, use the ***typical weights***

0 = no effect
1 = incidental
2 = moderate
3 = average
4 = significant
5 = essential

Total VAF = 40

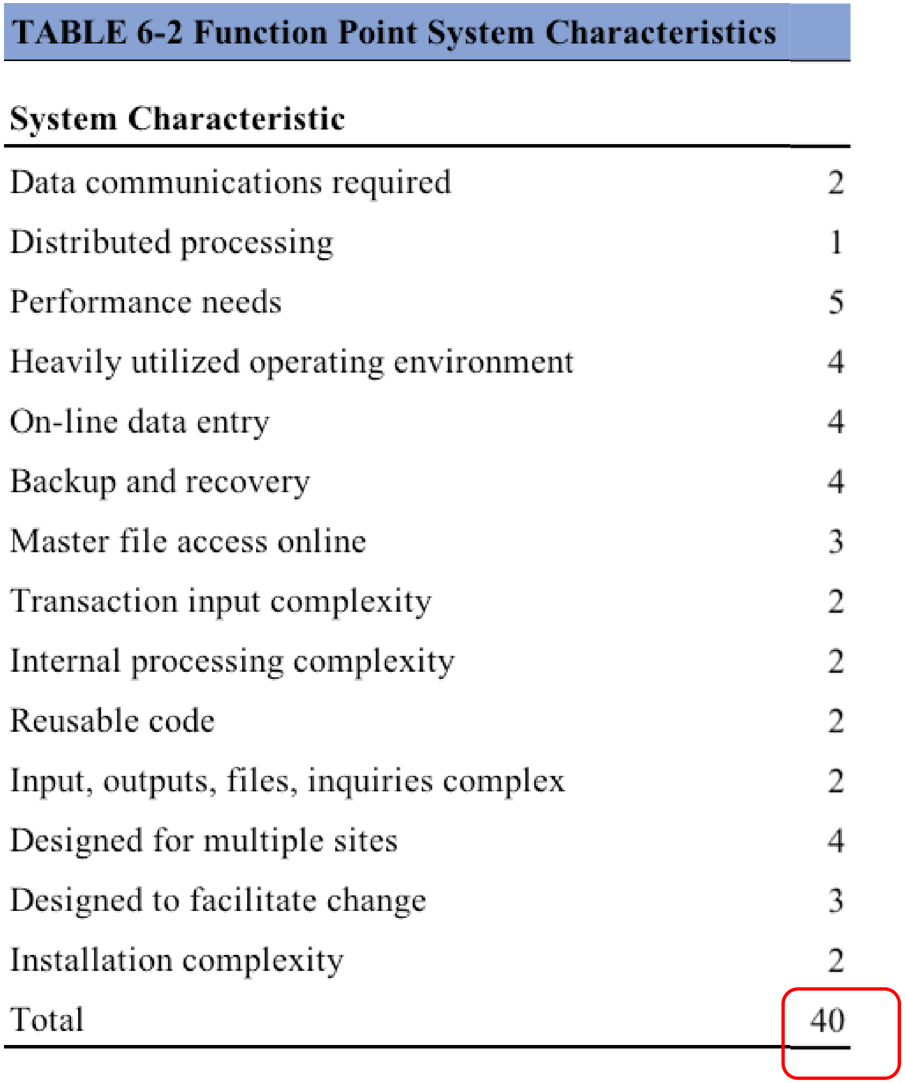


TABLE 6-2 Function Point System Characteristics

System Characteristic	
Data communications required	2
Distributed processing	1
Performance needs	5
Heavily utilized operating environment	4
On-line data entry	4
Backup and recovery	4
Master file access online	3
Transaction input complexity	2
Internal processing complexity	2
Reusable code	2
Input, outputs, files, inquiries complex	2
Designed for multiple sites	4
Designed to facilitate change	3
Installation complexity	2
Total	40

COCOMO II – another strategy

The Constructive Cost Model:

Here is a playpen to try: http://softwarecost.org/tools/COCOMO/

Fill in the details for the VR simulator (Medic case study)

Extra details to get started: let there be:

Sizing method: 135 Function Points

The Java development language

The cost per person-month is $1500

Thank You!