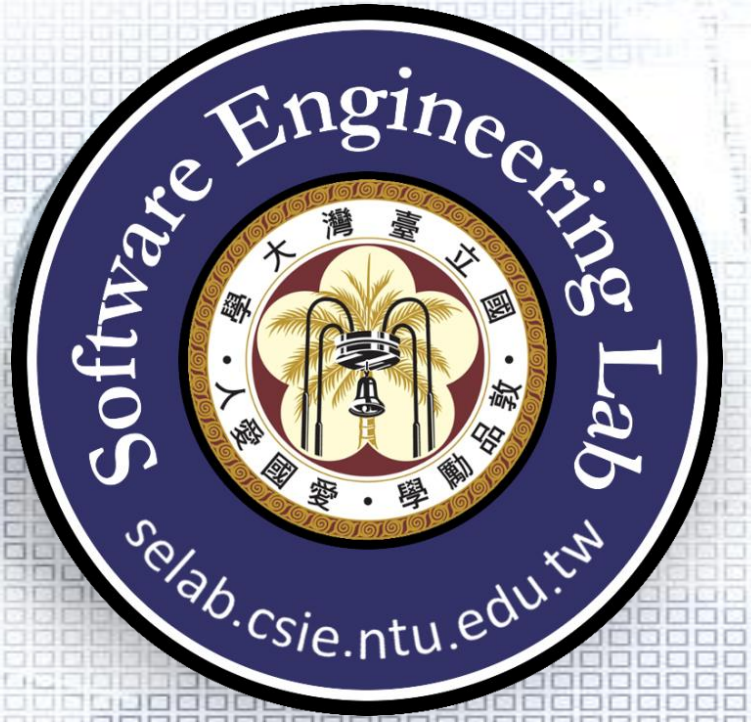

Software Projects Management (WBS and Meeting Minutes)

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What is Project?

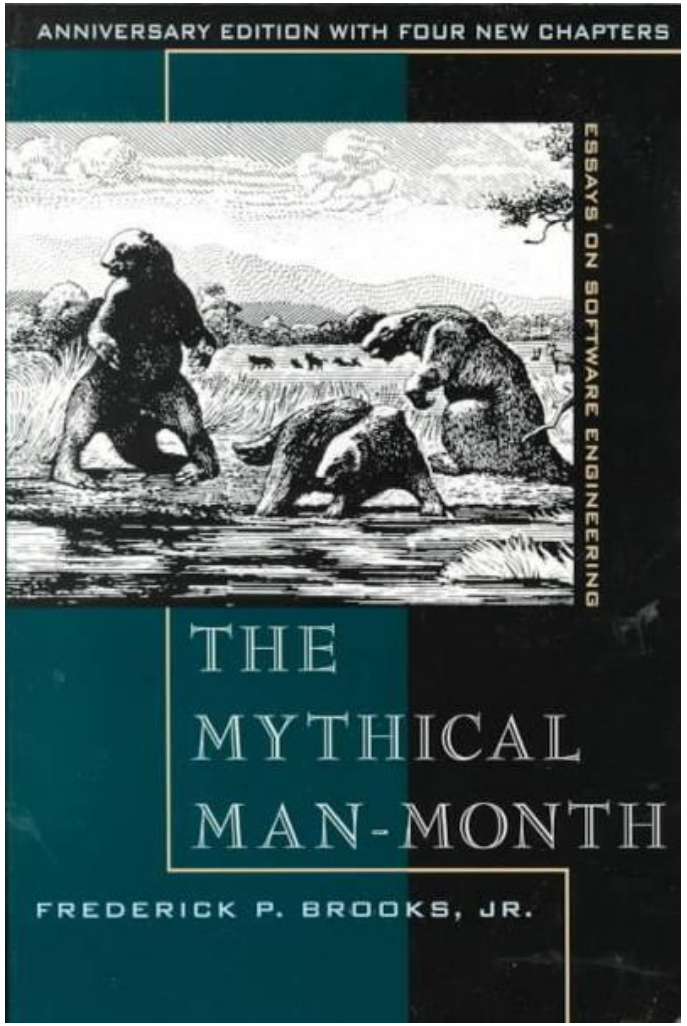
- Project – an endeavor undertaken to create a **unique** product or service
  - Has a definite beginning and end and interrelated activities
  - Cease when declared objectives have been attained
- Projects are unique – characteristics are **progressively elaborated**
- Scope of project should remain **constant**

What is Project Management?

- Project Management: the application of knowledge, skills, tools and techniques to **project activities** in order to meet or exceed stakeholder's needs and expectations from a **defined project** (a defined beginning and end, a defined scope and resources) – balancing the following:
  - **Scope, time, cost, and quality**
  - Requirements (needs) vs. unidentified requirements (expectations)
- Project Activities: perform tasks or actions in WBS and meeting minutes, and identify and solve issues in meeting minutes, and monitor and control the progress of a project.

The Mythical Man-Month: Fred Brooks

- A classical book by Fred Brooks on Software Engineering and Project Management, first published in 1975.
- Central theme: **Adding manpower to a late software project makes it later.**



Work Breakdown Structure (WBS)

- Scope
  - Use WBS to establish a project's scope
- Estimation
  - Estimate required staff, budget, and time based on WBS
- Scheduling
  - Develop project schedule based on WBS
- Teamwork
  - Assign tasks to team members based on WBS
- Project Monitoring and Control
  - Monitor project progress based on WBS
  - Control action items generated from WBS

What is WBS?

- Work Breakdown Structure (WBS) is a **deliverable-oriented** grouping of project assignments that organizes and defines the scope of a project
  - Each descending level represents further detail; smaller and more manageable pieces
  - Work products (deliverables) should also be explicitly described in the work package.
- WBS is a graphical picture of the **project hierarchy** of tasks.
- WBS was first introduced by Department of Defense (U.S.) in 1957.

How to Divide the Work?

- Usually, first level is commonly the same as the processes as the domain involved in the project, for example, software lifecycle in developing a software system: requirements analysis, software design, coding, and testing.
- Each level of the WBS is a smaller segment of the level above
- Break down project into **tasks (lowest-level element)** that
  - Are realistically and confidently **estimable**
  - Can be **completed** under 80 person-hour rule of thumb, that is, 10 person-day (two weeks).
  - Have a meaningful conclusion and **deliverable.**
  - Work assignments, tasks, and action items usually refer to the same concept.

Work Package

- A task is described by a Work package, including
  - Task name
  - Description of work to be done
  - Preconditions for starting
    - Other Work packages that need to be completed before this task can be started
  - Duration
  - Required resources
  - Work product to be produced
  - Involved Risks
- Work package usually is the lowest level of WBS and corresponds to well defined work assignment for one worker for a week or two (80 person-hour).

Work Package Example

WBS #:	2.1	Task:	Develop Project Plan
Est. Level of Effort:	20 hrs	Owner:	Project Manager
Resources Needed:	Subject Matter Experts	Work Products:	Project Plan
Description of Task:	Development of a detailed project plan that lists all key resources, tasks, milestones, dependencies, and durations.		
Input:	• Approved Project Charter		
Dependencies:	• Approval of Budget		
Risk:	• Changes to IT Apps plans and deliverables • IT Apps implementation releases, which conflict with implementation		

A WBS Example

WBS with Estimation

名稱	工時
Meeting Scheduler	993
Survey	60
專案規劃	30
發展WBS	10
發展專案計畫書	20
需求分析	338
需求擷取	25
訂定目標	20
定義角色	15
發展使用案例	166
發展Data Dictionary	21
發展系統架構	21
撰寫需求文件	70
M1：需求文件產出	
系統設計	257
系統實作	210
系統測試	95
M6：驗收測試	

Effort Estimation

WBS with Schedule

名稱	工時	期間	起始日期	結束日期
Meeting Scheduler	993	304	2011/10/18	2012/12/15
Survey	60	30	2011/10/18	2011/11/29
Goal-driven	25	5	2011/11/22	2011/11/29
Meeting Scheduler Spec.	20	4	2011/10/18	2011/10/22
現有Meeting Scheduler系統	15	5	2011/10/24	2011/10/29
專案規劃	30	285	2011/11/14	2012/12/15
發展WBS	10	12	2011/11/14	2011/11/30
發展專案計畫書	20	272	2011/12/1	2012/12/15
需求分析	338	42	2011/10/24	2011/12/21
需求擷取	25	5	2011/10/24	2011/10/29
訂定目標	20	4	2011/11/29	2011/12/3
定義角色	15	3	2011/10/24	2011/10/27
發展使用案例	166	28	2011/11/3	2011/12/13
發展Data Dictionary	21	21	2011/11/14	2011/12/13
發展系統架構	21	21	2011/11/14	2011/12/13
撰寫需求文件	70	14	2011/11/29	2011/12/17
M1：需求文件產出		1	2011/12/20	2011/12/21

Task Schedule

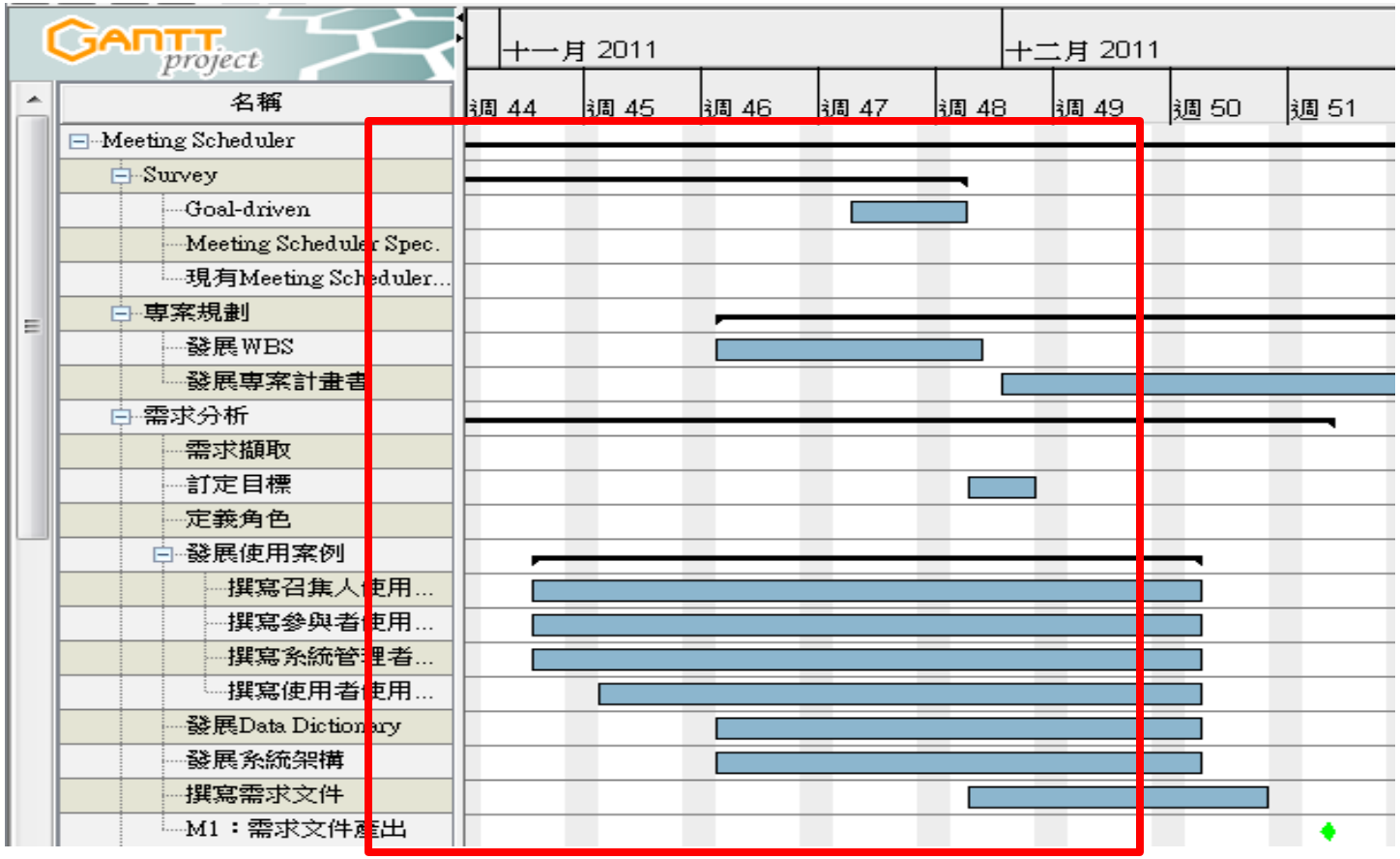
WBS with Assigned Responsibility

名稱	工時	期間	起始日期	結束日期	協調者
Meeting Scheduler	993	304	2011/10/18	2012/12/15	吳彥諄
Survey	60	30	2011/10/18	2011/11/29	吳彥諄
Goal-driven	25	5	2011/11/22	2011/11/29	吳彥諄
Meeting Scheduler Spec.	20	4	2011/10/18	2011/10/22	吳彥諄
現有Meeting Scheduler...	15	5	2011/10/24	2011/10/29	鄭聖翰, 洪東昇
專案規劃	30	285	2011/11/14	2012/12/15	陳石佳
發展WBS	10	12	2011/11/14	2011/11/30	陳石佳
發展專案計畫書	20	272	2011/12/1	2012/12/15	陳石佳
需求分析	338	42	2011/10/24	2011/12/21	吳彥諄
需求擷取	25	5	2011/10/24	2011/10/29	吳彥諄
訂定目標	20	4	2011/11/29	2011/12/3	吳彥諄
定義角色	15	3	2011/10/24	2011/10/27	吳彥諄
發展使用案例	166	28	2011/11/3	2011/12/13	吳彥諄
撰寫召集人使用...	56	28	2011/11/3	2011/12/13	吳彥諄, 丘偉廷
撰寫參與者使用...	56	28	2011/11/3	2011/12/13	鄭聖翰, 洪東昇
撰寫系統管理者...	28	28	2011/11/3	2011/12/13	陳石佳
撰寫使用者使用...	26	26	2011/11/7	2011/12/13	丘偉廷
發展Data Dictionary	21	21	2011/11/14	2011/12/13	鄭聖翰
發展系統架構	21	21	2011/11/14	2011/12/13	吳彥諄
撰寫需求文件	70	14	2011/11/29	2011/12/17	吳彥諄
M1：需求文件產出		1	2011/12/20	2011/12/21	

Responsibility

Gantt Chart

- Gantt Charts is used to visualize task dependency, schedule and responsibility.



Project Monitoring and Control

- The project manager should monitor actual performance and progress of the project against the project plan (WBS is the core)
  - Progress review
  - Milestone review

Progress Review

- Periodically review the project's progress, performance, and issues.
  - Regularly communicate status on assigned activities and work products to relevant stakeholders.
  - Review the results of collecting and analyzing measures for controlling the project.
  - Identify and document significant issues and deviations from the plan.
  - Document change requests.
  - **Track action items to closure.**

Milestone Review

- Review the accomplishments and results of the project at selected project milestones.
  - Conduct reviews at meaningful points in the project's schedule, such as the completion of selected stages, with relevant stakeholders.
  - Review the **commitments**, plan, status, and risks of the project.
- Milestones can be event based or calendar based.
  - If the duration between two event-based milestones is too long, calendar-based milestones can be inserted to enhance the effect of project monitoring.

Meeting Minutes

- Meeting Location
- Meeting Start Time and End Time
- Attendance
- Agenda: Including **Issues** and **risks**
- Action Items
- Decisions Made
- Next Meeting

Issue

- Issues are major questions to be resolved
- Examples of issues to be gathered include the following:
  - Issues discovered when performing technical reviews, verification, and validation
  - Significant deviations in project planning parameters from estimates in the project plan
  - Commitments (either internal or external) that have not been satisfied
  - Significant changes in risk status
- Can be managed by Issue Tracking System
  - Redmine, BugZilla, Trac, Mantis, etc. (Homework: survey one of the above issue tracking system).

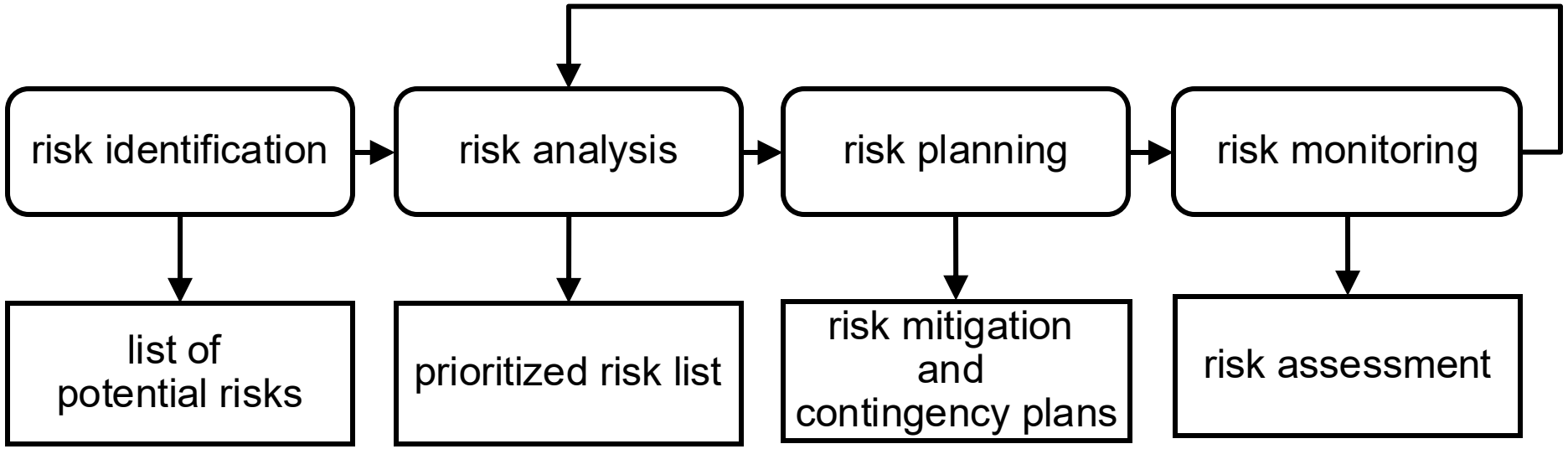
Risk Management

- Risk
  - The potential problems which may hinder the development of project.
  - The probability that some adverse event will occur.
    - Project risks affect schedule or resources;
    - Product risks affect the quality or performance of the software being developed;
    - Business risks affect the organization developing or procuring the software.
- Risk management: identify risks and draw up plans to minimize their effects on a project.

Risk Management Process

- Risk identification
  - Identify project, product and business risks
- Risk analysis
  - Assess the likelihood and consequences of these risks
- Risk planning
  - Draw up plans to avoid or minimize the effect of the risk
- Risk monitoring
  - Monitor the risks throughout the project

Risk Management Process



Risks Identification

Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project **before it is finished**.
Management change	Project	There will be a change of organisational management **with different priorities.**
Hardware unavailability	Project	Hardware that is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule
Size underestimate	Project and product	The size of the system has been underestimated.
Performance bottleneck	Project and Product	Slow response time
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

Risk Analysis

- Assess **probability and seriousness of each risk.**
  - Probability may be very low, low, moderate, high or very high.
  - Risk impacts (effects) might be catastrophic, serious, tolerable or insignificant.
  - Risk exposure is the product of risk probability and risk impact

$$R = \sum_{i=1}^{n} P_i \times I_i$$

R is the total risk exposure
P_i and I_i are the probability and the impact of an identified risk, respectively

Risk Examples

Risk	Probability	Impacts
It is impossible to recruit staff with the skills required for the project.	High	Catastrophic
Software components that should be reused contain defects which limit their functionality.	Moderate	Serious
Changes to requirements that require major design rework are proposed.	Moderate	Serious
The time required to develop the software is underestimated.	High	Serious
The organisation is restructured so that different management are responsible for the project.	High	Serious

Risk Planning

- Consider each risk and develop mitigation and/or contingency plans to manage the risks.
- Mitigation plans
  - Avoidance strategies
    - The probability that the risk will arise is reduced
  - Minimization strategies
    - The impact of the risk on the project or product will be reduced
- Contingency plans
  - If the risk arises, contingency plans are plans to deal with that risk

Risk Monitoring

- Assess each identified risk regularly to decide whether or not it is becoming less or more probable.
- Also assess whether the effects of the risk have changed.
- Each key risk should be discussed at progress review meetings.

A Risk Exposure Table

Impact levels \ Probability levels	Very Likely	Probable	Improbable
catastrophic	High	High	Medium
critical	High	Medium	Medium
marginal	High	Medium	Low
negligible	Medium	Medium	Low

High	Medium	Low

Threshold for triggering mitigation plans: Medium

Action Item

- Action Item: a task assigned to a person to be done by a certain time
  - What?, Who?, When?
  - Heuristics for Duration: be done within one week or two weeks
  - Generated from WBS or raised in the progress review meeting
  - Including corrective actions to address issues
- Action items should be tracked by the project manager

Action Item Tracking

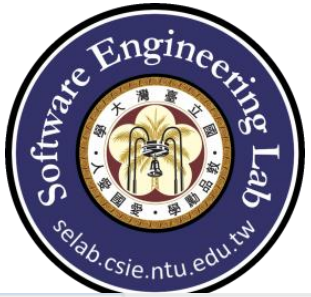
Action Item 後續處理項目					
編號	處理動作	負責人員	處理期限	狀態	備註
1	Meeting Scheduler Spec. Survey	吳彥諄	2011/10/22	**Closed 10/22**	
2	現有 Meeting Scheduler 系統 Survey	鄭聖翰, 陳石佳	2011/10/29	**Closed 10/29**	
3	發展 WBS	洪東昇	2011/11/30	**Closed 11/30**	
4	發展專案計畫書	洪東昇	2011/12/15	**Closed 12/15**	
5	寄出公司參訪感謝函及簡報	陳石佳	2011/12/29	**ongoing**	
6	企業參訪投影片製作	全體人員	2011/12/26	**Closed 12/26**	
7	編寫追蹤矩陣	鄭聖翰	2011/12/19	**Closed 12/19**	預計於 12/19 晚上整合完畢並審查
8	Goal-Driven Use Case 召集人、使用者 撰寫	丘偉廷 吳彥諄	2011/12/12	**Closed 12/12**	

From WBS

Raised in Meetings

WBS Template for Homework (3-1)

名稱	工時	期間	起始日期	結束日期
Meeting Scheduler	993	232	2011/10/3	2012/8/22
專案規劃	5	1	2011/10/3	2011/10/4
Survey	60	30	2011/10/18	2011/11/29
Goal-driven	25	5	2011/11/22	2011/11/29
Meeting Scheduler Spec.	20	4	2011/10/18	2011/10/22
現有Meeting Scheduler系統	15	5	2011/10/24	2011/10/29
技術學習	28	14	2012/2/1	2012/2/21
需求分析	338	42	2011/10/24	2011/12/21
需求擷取	25	5	2011/10/24	2011/10/29
訂定目標	20	4	2011/11/29	2011/12/3
定義角色	15	3	2011/10/24	2011/10/27
發展使用案例	166	28	2011/11/3	2011/12/13
撰寫召集人使用案例	56	28	2011/11/3	2011/12/13
撰寫參與者使用案例	56	28	2011/11/3	2011/12/13
撰寫系統管理者使用案例	28	28	2011/11/3	2011/12/13
撰寫使用者使用案例	26	26	2011/11/7	2011/12/13
發展Data Dictionary	21	21	2011/11/14	2011/12/13
發展系統架構	21	21	2011/11/14	2011/12/13
撰寫需求文件	70	14	2011/11/29	2011/12/17
M1：需求文件產出		1	2011/12/20	2011/12/21
系統設計	257	46	2012/2/21	2012/4/25
使用者介面設計	15	15	2012/2/21	2012/3/13
會議排程模組設計	84	42	2012/2/21	2012/4/19
註冊、登入、驗證模組設計	15	15	2012/2/21	2012/3/13
管理模組設計	9	9	2012/2/21	2012/3/3
同步模組設計	8	8	2012/3/5	2012/3/15
會議模組設計	12	12	2012/3/13	2012/3/29
使用者模組設計	12	12	2012/3/13	2012/3/29
訊息管理模組設計	12	12	2012/3/29	2012/4/14
設計測試案例	90	18	2012/3/29	2012/4/24
M2：設計文件產出		1	2012/4/24	2012/4/25
系統實作	210	55	2012/4/25	2012/7/11
系統環境建置	4	4	2012/4/25	2012/5/1
使用者介面實作	44	44	2012/4/25	2012/6/26
會議排程模組實作	44	44	2012/4/25	2012/6/26
註冊、登入、驗證模組實作	15	15	2012/5/1	2012/5/22
管理模組實作	11	11	2012/4/25	2012/5/10
同步模組實作	8	8	2012/5/10	2012/5/22
會議模組實作	15	15	2012/5/1	2012/5/22
使用者模組實作	9	9	2012/5/22	2012/6/2
訊息管理模組實作	10	10	2012/5/1	2012/5/15
M3：模組驗收		1	2012/6/26	2012/6/27
系統整合	25	5	2012/6/26	2012/7/3
整合測試	25	5	2012/7/3	2012/7/10
M4：系統原始碼產出		1	2012/7/10	2012/7/11
系統測試	95	23	2012/7/17	2012/8/17
系統測試及除錯	95	19	2012/7/17	2012/8/11
M5：測試文件產出		1	2012/8/16	2012/8/17
M6：驗收測試		1	2012/8/21	2012/8/22



WBS Template for Source Code Tracing (3-2)

Project	Subproject	LoC	Effort Estimation (man-hrs)	Period (days)	Actual Effort (man-hrs)	Expected Start Date	Expected End Date	Actual Start Date	Actual End Date	Responsibility
Total										
Survey	***subtotal***									
	Spring Boot module distribution	NaN	4 * 7 = 28	4	2 * 7 = 14	2023/09/22	2023/09/25	2023/9/22	2023/9/25	All members
Preparation	***subtotal***		28	4	14					
	Create WBS	NaN	2	2	2	2023/9/25	2023/9/27	2023/9/25	2023/9/27	陳可瀚
Code Tracing	***subtotal***		30	6	16					
	Group1 (/context)									葉晟育、陳可瀚
	context\annotation event loggin metrics	967	8	10	9.5	2023/9/28	2023/10/7	2023/9/28	2023/10/11	葉晟育
	context\config	3008	26	35	23.5	2023/10/8	2023/11/11	2023/10/10	2023/11/14	葉晟育
	context\properties (.java files)	1442	12	15	15	2023/11/12	2023/11/26	2023/11/14	2023/11/29	葉晟育
	context(.java files)	419	5	6	3	2023/11/26	2023/12/1	2023/11/30	2023/12/6	葉晟育
	contex\properites\source*.java	2316	24	28	3 + 5 + 8 + 6 = 22	2023/09/28	2023/10/25	2023/9/28	2023/10/22	陳可瀚
	context\properites\bind*.java	2969	30	35	1.5 + 7 + 4 + 5 + 5 + 8 = 30.5	2023/10/26	2023/11/30	2023/10/23	2023/11/29	陳可瀚
	Group2 (/web /webservice)									吳東鴻、鄭佳渝
	\web\reactive\	649	5	8	6.5	2023/11/24	2023/12/1	2023/11/24	2023/11/29	吳東鴻
	\web\embedded\	5278	40	56	48	2023/9/28	2023/11/23	2023/09/28	2023/11/23	吳東鴻
	\web\client\	770	10	6	8	2023/9/29	2023/10/4	2023/9/29	2023/10/3	鄭佳渝
	\web\codec\ & \web\context\ & \web\error\ & \webservices\client\	641	8	3	8	2023/10/5	2023/10/7	2023/10/5	2023/10/7	鄭佳渝
	\web\server\	1116	16	11	6+4 = 10	2023/10/12	2023/10/25	2023/10/12	2023/10/25	鄭佳渝
	\web\servlet\ & \web\reactive\context\ReactiveWebServerApplicationContext.java\	3275	36	32	6+4+4+7+8+8 = 37	2023/10/26	2023/11/26	2023/10/27	2023/12/6	鄭佳渝
	Group3 (others)									陳詠君、Joselyn、謝承恩
	admin & ansi & availibility & security	663	6	7	7	2023/9/28	2023/10/4	2023/9/28	2023/9/30	陳詠君
	builder & cloud	650	6	7	7	2023/10/5	2023/10/11	2023/10/8	2023/10/9	陳詠君
	diagnostics	1212	11	14	8	2023/10/12	2023/10/25	2023/10/12	2023/10/14	陳詠君
	info & origin	776	6.5	7	2.7	2023/10/26	2023/11/1	2023/10/20	2023/10/22	陳詠君
	json & jackson	739	6.5	7	4.5	2023/11/2	2023/11/8	2023/10/23	2023/10/28	陳詠君
	rsocket & system	731	6	7	5	2023/11/9	2023/11/15	2023/11/3	2023/11/4	陳詠君
	task	666	6	7	2	2023/11/16	2023/11/22	2023/11/4	2023/11/4	陳詠君
	util & validation	535	6	7	6.5	2023/11/23	2023/11/29	2023/11/11	2023/11/21	陳詠君
	logging	3405	16	35	26.5	2023/9/28	2023/11/2	2023/9/28	2023/11/1	康甜甜
	env	1309	6	11	11.5	2023/11/3	2023/11/13	2023/11/1	2023/11/14	康甜甜
	convert & reactor	1263	5	10	9.5	2023/11/14	2023/11/23	2023/11/14	2023/11/29	康甜甜
	database: operation (jdbc, jooq, sql)	1722	15	17	20	2023/9/28	2023/10/14	2023/9/28	2023/10/18	謝承恩
	database: version control & others (liquibase, flyway, orm, r2dbc)	642	5	7	6	2023/10/19	2023/10/25	2023/10/21	2023/11/29	謝承恩
	ssl, type, jms	1038	8	11	9	2023/10/26	2023/11/5	2023/10/28	2023/11/29	謝承恩
	remaining java files	2569	22	25	23.5	2023/11/6	2023/12/1	2023/11/8	2023/12/13	謝承恩
		40770								