

4. Basic Concepts

This section describes the key basic concepts used in EPPORA, including user roles, generic labor categories, parent-child relationships, triggers, project selection criteria, productivity factor, average hourly salary, cost effectiveness, end-of-business day activities and attributes. It is part of the EPPORA User's Guide.

4.1 User Roles

The six different EPPORA user types are Administrator, Business Analyst, Executive, Project Manager, Project Portfolio Manager and Project Team Member. A user can serve multiple user roles. It is not uncommon in some organizations that the Project Manager is also the Business Analyst. In addition to the user types, each user except a select few has a designated "Supervisor" and each project has a designated "Sponsor." Figures 1 and 2 describe the relationship of the six user types.

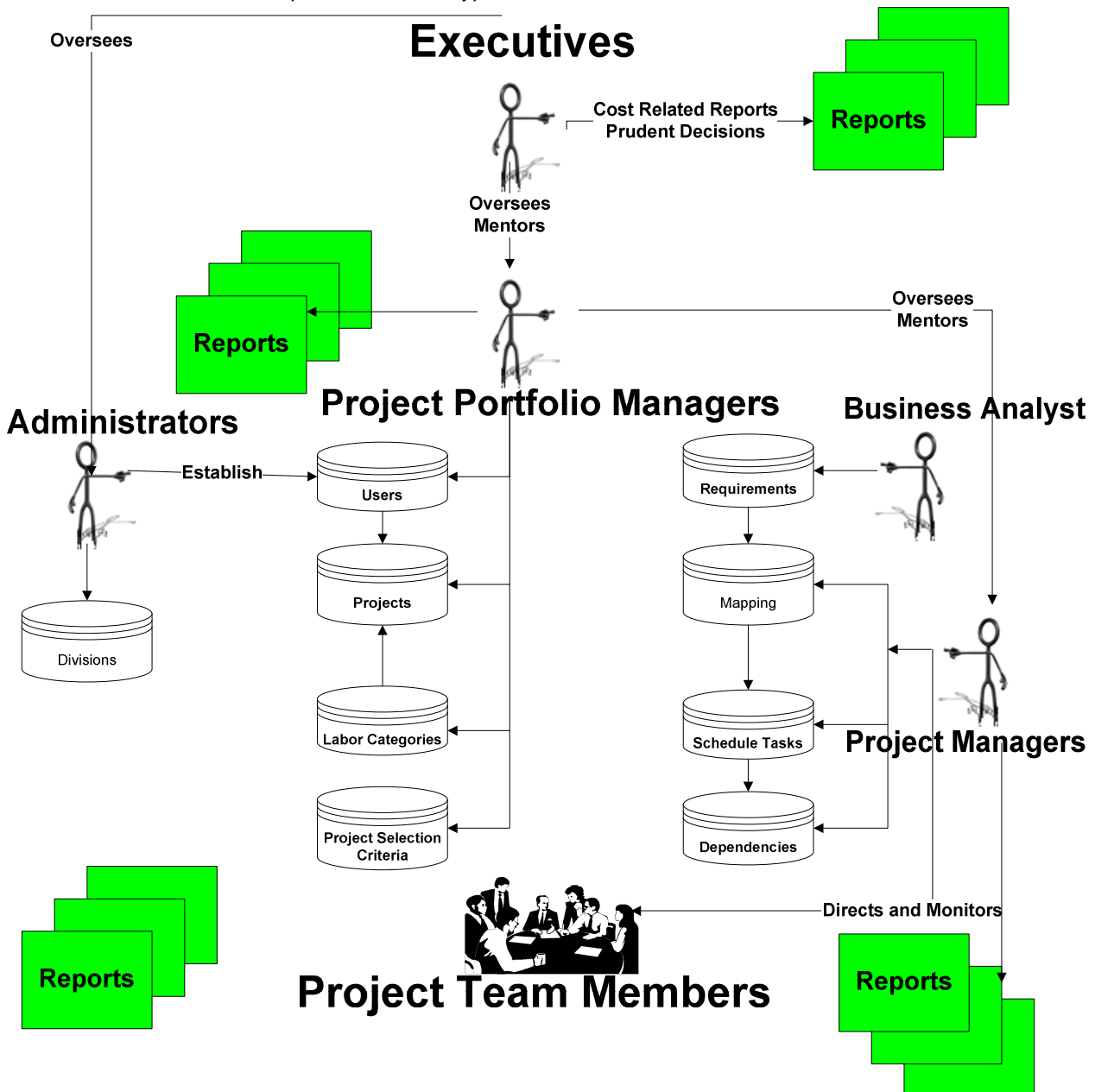


Figure 1—User Roles

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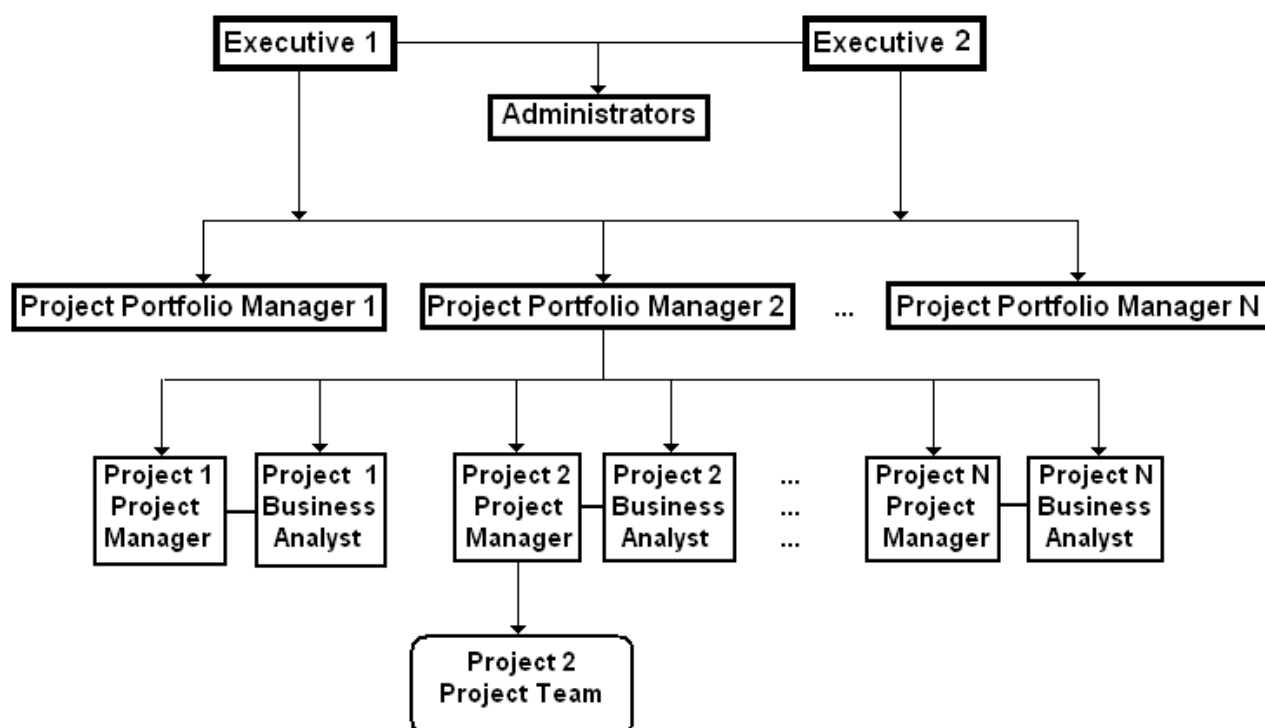


Figure 2—EPPORA User Staff Hierarchy

The following subsections describe the major roles of each user type.

4.1.1 Administrators

The primary responsibility of the Administrators is to establish the environment. Table 4 describes the key roles and responsibilities of Administrators. As shown in Figures 1 and 2, Administrators report to the Executives. An organization can have as many Administrators as necessary. It's recommended that there be a minimum of two Administrators and an Administrator for every 100-500 EPPORA users.

Activity	Role	When
Division	Create a new or delete an existing division for where users work.	When the organization has a new division or no longer has a division.
Project	Create an entry in the Project database structure that contains all the initial fields for a project. Deletes a completed project	Whenever a new project is approved for implementation.
Staff Member	Create an entry in the Personnel database structure that contains the initial fields. Deletes a user.	Whenever a new employee joins the organization that may possibly work on or need access to a project.

Table 4—Administrators Roles and Responsibilities

4.1.2 Business Analysts

The primary responsibility of a Business Analyst is to create and maintain the project's requirements. The Business Analyst reports to the Project Portfolio Manager. In most organizations there is a Business Analyst for each active project unless the Business Analysts roles are assumed by the Project Manager. In some organizations, a Business Analyst will be responsible for multiple projects. Table 5 describes the key roles and responsibilities of a Business Analyst.

Activity	Role	When
Gathering Requirements	Gather the requirements from end users, the customer, stakeholders, key developers and test engineers.	At project start and whenever new requirements occur or a requirement changes.
Create Requirements	Create the Requirements Specification for a new project.	Whenever a Business Analyst is assigned to a new project.
Maintaining Requirements	Adjust requirements for changes.	Whenever there is a requirement change to a project.

Table 5—Business Analysts Roles and Responsibilities

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4.1.3 Executives

The primary responsibilities of an Executive are reviewing, critiquing and mentoring their Administrators and Project Portfolio Managers. Executives use the EPPORA system to obtain key reports critical to assuring their organization's projects are within budget, on schedule and fulfill all requirements. Table 6 describes the key roles and responsibilities of Executives.

Activity	Role	When
Budget Analysis	Conduct continuous review of project costs and schedules to help improve key decisions.	Whenever a project's scope changes significantly and/or when the estimation of a task's cost is beyond the organization's threshold for being within budget.
Days Off	Approve vacation requests, personal and sick days for employees.	Whenever an employee requests or takes one or more non-working days off.
Salary Adjustment	Specify an employee's hourly salary.	Whenever a salary change occurs.
Management	Monitor, mentor, empower Project Portfolio Managers and Administrators.	Whenever a project's progress is behind what is expected or a new project is to be added.

Table 6—Executives Roles and Responsibilities

4.1.4 Project Managers

The primary responsibility of Project Managers is managing the project schedule to assure the project is delivered on time and within budget. In the EPPORA system, Project Managers reports to a Project Portfolio Manager. Project Managers are also responsible for their Project Team Members performance. In most organizations there is a Project Manager for each active project. In some organizations, Project Managers will be responsible for multiple projects. Table 7 describes the key roles and responsibilities of Project Managers.

Activity	Role	When
Create Schedule	Create schedules for new projects.	Whenever a Project Manager is assigned to a new project.
Maintaining Schedule	Add project tasks, assign resources, delete project tasks or change a project's task attributes including its percentage completion.	Whenever a new task is added, a task is deleted or the attributes of a task are changed.
Mapping	Map each low-level requirement to one or more low level schedule tasks on a percentage basis.	Whenever requirements and/or schedule tasks change.
Monitor/Mentor	Monitor project team's performance on assigned tasks. Mentor Project Team Members as needed.	Continuously throughout the project.

Table 7—Project Managers Roles and Responsibilities

4.1.5 Project Portfolio Managers

A Project Portfolio Manager's primary responsibilities within EPPORA are the reviewing/approving of the requirements and schedules created and maintained by their Project Managers and Business Analysts. Each Project Portfolio Manager reports to an Executive. Table 8 describes the key roles and responsibilities of Project Portfolio Managers.

Activity	Role	When
Criterion	Specify and/or modify the weight (importance) of each criterion used to determine the ranking of projects. Determine who shall evaluate each criterion for their division's projects.	Whenever a project ranking factor is determined to be of more or less importance than previously specified.
Requirements Review	Verify that the new or updated requirements satisfy/conform to industry and the organization's standards and then approve the requirements.	Whenever the Business Analyst changes the requirements specification.
Schedule Review	Verify that the new or updated schedules satisfy/conform to industry and the organization's standards and then approve the updated schedule.	Periodically whenever the Project Manager adjusts the schedule.
Triggers	Determine who should be notified for each trigger.	At trigger specification.
Salary Adjustment	Recommend salary adjustments for Project Team Members and Project Managers to the appropriate Executives.	Depends on organization's guidelines. Executives have the ability to alter the hourly salary, which usually occurs when a Project Portfolio Manager recommends an adjustment for his/her staff at a company specified date.
Labor Categories	Create new labor categories as needed by the projects. Assign labor categories to users. Delete labor categories that are not needed.	Whenever a new labor category is needed or an existing labor category is no longer needed.
Options	Specify default options that best serve the organization.	At EPPORA's installation and whenever a major change occurs to the project environment causing a more effective option being needed.

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Activity	Role	When
Productivity Adjustment	Adjust EPPORA's productivity calculations for a Project Team Member based on the quality of the result or the complexity of the project task.	Whenever extraordinary factors are involved with a project's task completion.
Managing Project Managers	Designate, mentor and monitor the Project Managers for multiple projects.	At project start, at the completion of milestones and/or deliverables, when a milestone or deliverable is late or when the Project Manager needs to make a change to accommodate special circumstances.
Managing Business Analysts	Designate, mentor and monitor the Business Analysts for a project.	At project start, at the completion of milestones and/or deliverables, when the Business Analyst needs to make a change to accommodate special circumstances.

Table 8—Project Portfolio Managers Roles and Responsibilities

4.1.6 Project Team Members

Project Team Members do not have any major responsibilities within the EPPORA system. The purpose of having a Project Team Member user class is for EPPORA to be able to automatically assign actual labor resources for generic labor resources to tasks during allocation. The Project Team Members report to their respective Project Managers. Their responsibility is to update their attributes whenever a change occurs, such as a new email address, and perform their assigned project tasks in a timely manner.

4.2 Privileges

As mentioned in Section 4.1 EPPORA supports six different user types, each with their own privileges. Table 9 shows which users can access the commands from each of EPPORA tabs.

Tab	Command	ADM	BA	EXEC	PM	PPM	PTM
Report	Budget		✓	✓	✓	✓	
	Cost Effectiveness			✓	✓	✓	
	Criteria		✓	✓	✓	✓	
	Division	✓	✓	✓	✓	✓	
	Inventory	✓	✓	✓	✓	✓	
	Issues	✓	✓	✓	✓	✓	
	Labor Categories		✓	✓	✓	✓	
	Log/Audit	✓	✓	✓	✓	✓	
	Missing Inventory	✓	✓	✓	✓	✓	
	Missing Labor Categories		✓	✓	✓	✓	
	Productivity		✓	✓	✓	✓	
	Project (s)		✓	✓	✓	✓	
	Project Ranking		✓	✓	✓	✓	
	Project Requirements		✓	✓	✓	✓	
	Project Requirements Analysis		✓	✓	✓	✓	
	Project Schedule		✓	✓	✓	✓	
	Project Schedule Analysis		✓	✓	✓	✓	
Project Team Assignment		✓	✓	✓	✓		
Triggers		✓				✓	
Users		✓	✓	✓	✓	✓	✓
Projects	Allocate					✓	
	Criterion Scoring	✓ ¹	✓ ¹	✓ ¹	✓ ¹	✓	✓ ¹
	Current Project		✓	✓	✓	✓	
	Project List		✓	✓	✓	✓	
Administration	Approve					✓	
	Calendar	✓					
	Dictionary	✓					
	Division	✓					
	Inventory	✓			✓	✓	
	Labor Category		✓		✓	✓	
	Options	✓				✓	
	Triggers	✓				✓	
Users	✓	✓	✓	✓	✓	✓	
Help	About	✓	✓	✓	✓	✓	✓
	Help Contents	✓	✓	✓	✓	✓	✓

Table 9 – User Privileges

✓¹ = if user is assigned to score one or more criteria.

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4.3 Generic Labor Categories

An important concept in EPPORA is that all low-level project tasks are initially assigned generic labor resources instead of actual staff members. When a project task becomes ready for execution (allocation period, see Section 4.13) then an actual Project Team Member is assigned responsibility for the project's task implementation. An organization can have as many "Labor Categories" as needed. The following are examples:

Software Engineer	Test Engineer
Programmer Level 1	Programmer Level 2
Project Management Office Director	Configuration Manager

Each "Labor Category" can have as many levels as needed. Each Project Team Member is assigned to one or more generic labor categories and has an assigned hourly salary. An average hourly salary for each labor category is automatically computed by EPPORA and continuously adjusted as project tasks are completed. Each generic labor category's average hourly salary is determined by multiplying the actual hours expended by individuals who belong to the generic labor category times their hourly salary, adding the results of all the individuals belonging to that generic labor category and then dividing by the total number of hours expended (see Section 4.9 for a more detailed explanation).

4.4 Parent-Child Task Relationship

EPPORA makes use of a concept much like the parent-child relationship that exists in our society for the tasks within project schedules and requirements. A parent schedule task consists of multiple subtasks. A major characteristic of a parent schedule task is that it does not directly have any resources assigned to it. Nor is it dependent upon other tasks. Children tasks that are themselves not parents can be dependent upon other tasks and must have generic labor resources assigned. They can also have inventory resources (supplies, equipment, etc.) assigned along with "Other" expenses (travel, per diem, etc.). EPPORA automatically calculates the following attributes of a parent task:

- Start Date (automatically calculated from children tasks)
- Finish Date (automatically calculated from children tasks)
- Level of Effort (automatically calculated from accumulation of low-level children tasks "Level of Effort")
- Cost (automatically calculated from sum of labor cost plus inventory and other cost)
- % Complete (automatically calculated from "Level of Effort" and "Work Accomplished")
- Flags (automatically determined from task's conditions)

The following snapshot of a schedule helps to illustrate the concept:

Task ID	Task Description	Effort	Start Date	Finish Date	Depends On	Flags	Resources
1	Conduct Example Project	200 hrs	11/13/06	12/4/06		P	
2	Perform Initiation Phase	200 hrs	11/13/06	12/4/06		P	
3	Conduct Survey	40 hrs	11/13/06	11/17/06		P	
4	Create Survey Form	8 hrs	11/13/06	11/13/06		LL	Business Analyst
5	Build List of Potential Responders	8 hrs	11/14/06	11/14/06	4	LL	Business Analyst
6	Send Out Survey	8 hrs	11/15/06	11/15/06	5	LL	Business Analyst
7	Analyze Result	8 hrs	11/16/06	11/16/06	6	LL	Business Analyst
8	Create Report	8 hrs	11/17/06	11/17/06	7	D LL	Business Analyst
9	Create Requirements Specification	128 hrs	11/20/06	11/29/06		P	
10	Build Outline	8 hrs	11/20/06	11/20/06	8	LL	Project Manager
11	Determine Features	8 hrs	11/21/06	11/21/06	10	LL	Project Manager
12	Create Features List	8 hrs	11/22/06	11/22/06	11	LL	Project Manager
13	Discuss and Document Benefits of Each Feature	24 hrs	11/23/06	11/23/06	12	LL	Project Manager, Sponsor, Executive, Project Portfolio Manager
14	Obtain Approval for Features	24 hrs	11/23/06	11/24/06	13	LL	Project Manager, Sponsor, Executive
15	Document Each Features Requirements	8 hrs	11/24/06	11/27/06	14	LL	Project Manager
16	Obtain Requirements Specification Approval	48 hrs	11/27/06	11/29/06		P	
17	Discuss Requirements	24 hrs	11/27/06	11/28/06	15	LL	Project Manager, Sponsor, Executive, Project Portfolio Manager
18	Get Signoff on Each Requirement	24 hrs	11/28/06	11/29/06	17	D LL	Project Manager, Sponsor, Executive
19	Conduct Audit of Initiation Phase	32 hrs	11/29/06	12/4/06		P	
20	Meet w/Project Manager Discuss Progress	16 hrs	11/29/06	11/30/06	18	LL	Project Manager, Project Portfolio Manager
21	Correct any Problems	8 hrs	11/30/06	12/1/06	20	LL	Project Manager
22	Obtain Signoff on Initiation Phase	8 hrs	12/1/06	12/4/06	21	LL M	Project Portfolio Manager

Table 10—Example Partial Project Schedule

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In the above example, the following tasks are parent tasks: 1, 2, 3, 9, 16 and 19 (denoted by the “Flags” field where a P indicates Parent). Note that parent tasks have no resources or dependencies directly assigned. However, the resources are indirectly assigned through their children tasks. The Project Manager does not assign the level of effort that is required to accomplish a parent task nor does the Project Manager assign the start and finish date, since EPPORA automatically calculates these values. For parent Task ID 1, Tasks 2-22 are its children, for parent Task ID 2, Tasks 3-22 are its children tasks and for parent Task ID 9, Tasks 10-18 are its children. Note also that the Project Manager has designated Task 22 as a milestone (see M in Flags field) and 8 and 18 as deliverables (see D in Flags field).

4.5 Requirements Matrix

The cornerstone of any project is its requirements. EPPORA uses a “Structured Tabular” method for specifying requirements (hereinafter called “Requirements Matrix”). The “Structured Tabular” method helps assure that each requirement is unique, understood the same by all project team members and stakeholders and can readily be tested and traced to other critical project entities. The following example shows the requirements for specifying Microsoft Word’s “Table Insert” command (most computer users are familiar with the functionality of this command). With the “Outline” method (what is commonly used to express requirements), one would expect to see the requirements specification of the “Table Insert Command” as:

Users shall be able to insert columns, rows and/or cells into a table prior, after, above or below an existing column, row or cell.

The following example illustrates the “Structured Tabular” format for specifying the requirements for Microsoft Word’s “Table Insert” command using EPS’s “Requirement Matrix” method. The technical barriers to be resolved are: (1) creating, designing and implementing a new method for specifying requirements and a set of complementary software tools that resolves requirements problems to the greatest extent possible and (2) assuring that the requirement testing is as comprehensive as possible. The difference between the two methods is subtle, but critical in assuring meaningful requirements. Each “Requirement ID” can have a level from zero to an ID that is one greater than the preceding level. If the following “Requirement ID” is greater than the current, then the current requirement is considered a “Parent Requirement ID” and is only used for clarification purposes.

Req't ID	Level	Title	Description
1	0	Inserting	
2	1	Column	
3	2	Left	User shall be able to insert a column to the left of an existing column.
4	2	Right	User shall be able to insert a column to the right of an existing column.
5	1	Row	
6	2	Above	User shall be able to insert a row above an existing row.
7	2	Below	User shall be able to insert a row below an existing row.
8	1	Cell	
9	2	Left	User shall be able to insert a cell to the left of an existing cell.
10	2	Right	User shall be able to insert a cell to the right of an existing cell.
11	2	Above	User shall be able to insert a cell above an existing cell.
12	2	Below	User shall be able to insert a cell below an existing cell.
13	1	Limitations	
14	2	Columns	EPPORA shall support a maximum of 1,000 columns.
15	2	Rows	EPPORA shall support a maximum of 1,000 rows.
16	2	Cells	EPPORA shall support a maximum of 10,000 cells.
17	1	Performance	
18	2	Columns	
19	3	1-333	The performance degradation as the columns increase from 1 to 333 shall be less than 2%.
20	3	334-666	The performance degradation as the columns increase from 334 to 666 shall be less than 5%.
21	3	667-1,000	The performance degradation as the columns increase from 667 to 1,000 shall be less than 10%.
22	2	Rows	
23	3	1-333	The performance degradation as the rows increase from 1 to 333 shall be less than 2%.
24	3	334-666	The performance degradation as the rows increase from 334 to 666 shall be less than 5%.
25	3	667-1,000	The performance degradation as the rows increase from 667 to 1,000 shall be less than 10%.
26	2	Cells	
27	3	1-3333	The performance degradation as the cells increase from 1 to 3,333 shall be less than 2%.
28	3	3,334-6,666	The performance degradation as the cells increase from 3,334 to 6,667 shall be less than 5%.
29	3	6,667-10,000	The performance degradation as the cells increase from 6,667 to 10,000 shall be less than 10%.

Table 11 – Requirements Matrix Example

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The title is indented 2 columns to the right for each level. Assume Word allows up to 1,000 columns, 1,000 rows and 10,000 cells in a table. Try to visualize the tests needed to verify the requirements for a “Table-Insert” command with the outline method, it is a daunting problem. If you do not think so, look back to the example of the outline format shown in the second paragraph of Section 4.4. Forget what you have seen in Table 11 and do not look ahead to Table 12 and make an estimate as to how many test cases would be reasonable. Whereas it is very straightforward for all stakeholders to determine what tests are required or missing as shown in Table 11 with the Structured Tabular requirements method representation.

Req't ID	Concatenated Title	Test ID	Description
3	Insert-Column-Left	T01	Verify that a column can be inserted to the left of the leftmost column.
		T02	Verify that a column can be inserted to the left of a middle column.
		T03	Verify that a column can be inserted to the left of the rightmost column.
4	Insert-Column-Right	T01	Verify that a column can be inserted to the right of the leftmost column.
		T02	Verify that a column can be inserted to the right of a middle column.
		T03	Verify that a column can be inserted to the right of the rightmost column.
6	Insert-Row-Above	T01	Verify that a row can be inserted above the top row.
		T02	Verify that a row can be inserted above the bottom row.
		T03	Verify that a row can be inserted above a middle row.
7	Insert-Row-Below	T01	Verify that a row can be inserted below the top row.
		T02	Verify that a row can be inserted below the bottom row.
		T03	Verify that a row can be inserted below a middle row.
9	Insert-Cell-Left	T01	Verify that a cell can be inserted to the left of the leftmost cell.
		T02	Verify that a cell can be inserted to the left of a middle cell.
		T03	Verify that a cell can be inserted to the left of the rightmost cell.
10	Insert-Cell-Right	T01	Verify that a cell can be inserted to the right of the leftmost cell.
		T02	Verify that a cell can be inserted to the right of a middle cell.
		T03	Verify that a cell can be inserted to the right of the rightmost cell.
11	Insert-Cell-Above	T01	Verify that a cell can be inserted above the topmost cell.
		T02	Verify that a cell can be inserted above a middle cell.
		T03	Verify that a cell can be inserted above the bottom cell.
12	Insert-Cell-Below	T01	Verify that a cell can be inserted below the topmost cell.
		T02	Verify that a cell can be inserted below a middle cell.
		T03	Verify that a cell can be inserted below the bottom cell.
14	Insert-Limitation-Column	T01	Verify that MS Word shall be able to support 999 columns.
		T02	Verify that MS Word shall be able to support 1,000 columns.
		T03	Verify that MS Word shall issue a diagnostic message when there are more than 1,000 columns.
15	Insert-Limitation-Row	T01	Verify that MS Word shall be able to support 999 rows.
		T02	Verify that MS Word shall be able to support 1,000 rows.
		T03	Verify that MS Word shall issue a diagnostic message when there are more than 1,000 rows.
16	Insert-Limitation-Cell	T01	Verify that MS Word shall be able to support 9,999 cells.
		T02	Verify that MS Word shall be able to support 10,000 cells.
		T03	Verify that MS Word shall issue a diagnostic message when there are more than a 10,000 cells.
19	Insert-Performance-Columns-1 to 333	T01	Verify that the performance degradation shall be less than 2% when the 333 rd column is inserted to a table.
20	Insert-Performance-Columns-334 to 666	T01	Verify that the performance degradation of MS Word shall be less than 5% when the 666 th column is inserted to a table.
21	Insert-Performance-Columns-667 to 1,000	T01	Verify that the performance degradation of MS Word shall be less than 10% when the 1,000 th column is inserted to a table.
23	Insert-Performance-Rows-1 to 333	T01	Verify that the performance degradation of MS Word shall be less than 2% when the 333 rd row is inserted to a table.
24	Insert-Performance-Rows-334 to 666	T01	Verify that the performance degradation of MS Word shall be less than 5% when the 666 th row is inserted to a table.
25	Insert-Performance-Rows-667 to 1,000	T01	Verify that the performance degradation of MS Word shall be less than 10% when the 1,000 th row is inserted to a table.
27	Insert-Performance-Cells-1 to 3,333	T01	Verify that the performance degradation of MS Word shall be less than 2% when the 3,333 rd cell is inserted to a table.
28	Insert-Performance-Cells-3,334 to 6,666	T01	Verify that the performance degradation of MS Word shall be less than 5% when the 6,666 th cell is inserted to a table.
29	Insert-Performance-Cells-6,667 to 10,000	T01	Verify that the performance degradation of MS Word shall be less than 10% when the 10,000 th cell is inserted to a table.

Table 12 – Test Matrix Example

The 1,000 maximum for rows and columns and the 10,000 for cells are just numbers selected for illustration purposes. Each requirement in the EPPORA method can have as many test cases as needed (T01 through Tnn). Each test becomes uniquely identifiable using the format of “Req’t-ID—Test ID.”

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The ID's make it easier to visualize what tests are missing, calculate the percentage of test coverage and obtain a clearer understanding of how the product will be verified. The Test Procedures provide the detailed step-by-step description of how each test will be run, the success criteria, test responsibility, etc. **The "Requirements Matrix" method allows non-technical project stakeholders the capability of determining the comprehensiveness of the testing activity. Additionally, the automated tools of EPPORA ("Requirements Analyzer) help to ensure that each requirement is unique and understood the same by all Project Members and stakeholders.** EPPORA has simplified a critical activity within a project, the verification of a deliverable satisfying its requirements. Part of the development team's tasks is to create a set of test cases to ensure that each deliverable's requirement can be verified prior to product acceptance. It should be noted that each deliverable can have any number of requirements. Likewise, the same requirement can appear for multiple deliverables. One of the major advantages of specifying the "Requirements Matrix" format is that it makes it very clear what tests need to be built to fully verify each requirement. The test case numbers, T01-Tnn identify each test as well as the specific requirement being verified. Each requirement can have as many tests as necessary to verify that the product satisfies the requirement. The "Requirements Matrix" method makes it far simpler to visually determine if the tests provided are comprehensive and/or what information is missing. Without using EPS's "Requirements Matrix" method, what most organizations end up with relative to their requirements can be summarized with the immortal words from the movie "Cool Hand Luke," "What we have here is a failure to communicate?" Fortunately, the use of EPPORA's "Requirements Matrix" method helps an organization eliminate communication dilemmas.

4.6 Triggers

EPPORA automatically monitors a set of possible conditions whose purpose is to warn key individuals (usually Executives and/or Project Portfolio Managers) of events that might affect the bottom line or a project's schedule, cost, scope or quality. These events, when they occur, are called "triggers" and they cause EPPORA to send out a message or optionally an e-mail to designated individuals notifying them of the event's occurrence. This allows management to have enough time to mitigate key issues.

4.7 Supervisors

Each staff member except those with a labor category of CEO has an assigned supervisor. An assigned supervisor is not a user type. It is used to notify the supervisor for individuals that they are responsible for when events occur (triggers, see Section 4.5), which may affect a project's success, such as approval of vacations.

4.8 Sponsors

Each project has an assigned sponsor. A sponsor is not a user type in that it does not imply any access rights. It is used merely to notify the project sponsor of critical events for his/her projects (triggers, see Section 4.5).

4.9 EOB (End of Business)

At the end of each business day EPPORA automatically performs a set of operations to verify that there are no critical issues that warrant an action from a Project Manager, Business Analyst, Project Portfolio Manager or Executive. When one of these events does occur, it is called a trigger (see Section 4.5). EPPORA commences making its checks at the designated end of business time (defaulted to 10 PM at organization's headquarters). A Project Portfolio Manager can change the default time.

4.10 Average Hourly Salary

In determining the average hourly salary for each labor category, EPPORA merely adds the salaries of all the individuals assigned the labor category and divides by the number users in the labor category. Assume the hourly salary for Jack is \$50, Cynthia is \$80, Marilyn is \$85, Tom is \$40, Shirley is \$45, and then the formula is:

$$\begin{aligned} \text{Average Hourly Labor Category}_i \text{ Salary} &= ((\text{Jack's Hourly Salary}) + (\text{Cynthia's Hourly Salary}) + \\ &\quad (\text{Marilyn's Hourly Salary}) + (\text{Tom's Hourly Salary}) + \\ &\quad (\text{Shirley's Hourly Salary})) / (\text{Number in Labor Category}) \\ &= (\$50+\$80+\$85+\$40+\$45) / (5) = (\$300)/(5)=\$60 \end{aligned}$$

The "Average Hourly Salary" used by EPPORA provides a clear picture of the average hourly salary paid for the labor category. This value is used by EPPORA in estimating the cost of a project and in calculating the cost effectiveness of each project team member for each labor category as they perform project tasks during the year. In order to allow individuals to improve their productivity each year, at the start of the year only a partial number of hours are used. The default is 100 hours; although if less than 100 hours is expended by an individual for a labor category, then the lesser amount is used. Thus the New Year begins relatively fresh using a small base for each labor category so each project team member's cost effectiveness starts relatively fresh annually. The 100 hours is the default and can be changed.

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4.11 Productivity Factor

A key factor in an organization's present and future success is how productive its staff members are in performing their jobs. Theoretically, an individual's productivity factor is defined by how efficiently (speed and quality) he/she is able to complete each assignment. Productivity should be one of the major factors in evaluating an individual's value to the organization and his/her compensation. Of course there are other factors such as synergy (does the individual improve the performance of other individuals), leadership and the ability to perform complex tasks. In almost every organization financial rewards such as compensation and bonuses are left to the discretion of a chain of command from the individual's boss to several levels of management to the Chief Executive Officer or President. EPPORA removes a significant percentage of subjective decision making in the process by scientifically keeping track of how well each individual performs in each of his/her labor categories. EPPORA does this by:

- Having Project Managers create schedules using generic labor categories for each task and assuming an average performer in each labor category when estimating the level of effort for each task.
- If the actual individual assigned to a task performs a task in the estimated effort, he/she is given a productivity factor of "1.0" for that task.
- If an actual individual assigned to a task performs a task in twice the estimated effort, he/she is given a productivity factor of ".5" for that task.
- If an actual individual assigned to a task performs a task in half the estimated effort, he/she is given a productivity factor of "2.0" for that task.
- Throughout the year for each completed task for each individual, EPPORA adjusts their productivity factor for each of their labor categories.

4.12 Cost Effectiveness

One would hope that if one individual in a labor category makes \$2 per hour and another individual is making \$1 per hour, that the individual making \$2 per hour is more productive, twice as productive, as the individual making \$1 per hour. EPPORA determines an individual's cost effectiveness by:

- Calculating the average hourly salary for all individuals belonging to a labor category (on a prorated basis using salary and hours expended). This becomes the hourly salary for the average individual in the labor category.
- Comparing the individual's actual hourly salary and "Productivity Factor" for each task they performed during the year with the labor category's average hourly salary.

4.13 Allocation Period

A unique feature of EPPORA is that it does not require allocation of actual labor resources for the entire project. In EPPORA Project Managers create their schedules using generic labor resources (labor categories). In real life, requirements, project resources, milestones and deliverable dates are always changing. Allocating resources for projects with more than six months duration remaining is difficult enough with an ideal work force that (1) never leaves the company; (2) is never sick; (3) does not take an unexpected vacation; (4) never has to make a change to a requirement; or (5) has no internal or external unexpected disruptions. The "Allocation Period" in EPPORA is three weeks. The allocation process is automated by EPPORA. It utilizes the ranking of projects within the portfolio and tasks within a project (critical path) to optimize the allocation. It also considers previous assignments, logistics, project synergy, etc. in allocating the most productive resources to the most important project tasks.

4.14 Baseline Considerations

EPPORA supports the ability to create and/or restore an unlimited number of baselines for each project. Whenever a Project Portfolio Manager creates a new baseline for his/her project, a new database entity is created containing the project's relevant baseline information. The new baseline is not used for allocation until the project's Project Portfolio Manager approves the "Edit Baseline." The following items should be considered when creating or retrieving a baseline:

- 1 The project's Project Manager is not saved.
- 2 The project's Business Analyst is not saved.
- 3 The project's Project Portfolio Manager is not saved.
- 4 The project's Sponsor is not saved.
- 5 The attributes for each requirement is saved.
- 6 The attributes for each schedule task is saved.
- 7 The attributes for each low-level requirement's mapping is saved.

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- 8 The attributes for each low-level requirement's test cases are saved.
- 9 Initial schedule and requirement specification dates are not saved.
- 10 Default scheduling display is not saved.
- 11 Each dependency list for the designated project is saved.
- 12 Labor Category information is not saved.
- 13 Division information is not saved.
- 14 Original estimated cost and hours are not saved.
- 15 Experience factor is not saved.
- 16 User information is not saved.
- 17 The user criterion scoring is not saved.
- 18 Inventory information is not saved.

4.15 Criterion Weight

Associated with each criterion is a weight signifying the relative importance of this criterion to other criterion? When the designated evaluators give a score for an assigned criterion, the selected score is multiplied by the weight to provide a "criterion result." The score is a value from 0 through 10, where 0 is the worst possible score and 10 is the best possible score. The weights are a value from -5 to 5. A negative weight signifies the criterion has an adverse effect on the project's selection, such as the "Cost" criterion, where the higher the cost, the less likely organizations will desire to implement the project. The sum of all the "criterion results" for each project determines a project's ranking. A weight of zero for a "Default Criterion" signifies that the criterion is not considered. A Project Portfolio Manager can change the default weight or create a new criterion. The default values for the built-in criterion are shown in the table below:

Criterion Name	Default Weight
Alignment Organization Goals	3
Alignment Project Goals	4
Available Expertise	2
Cash Flow	-3
Competitive Advantage	3
Conformance	2
Cost	-5
Enabler	2
External Contract	5
Financial Risk	-2
Government Regulations	2
Management Risk	-1
Negative Consequences	2
Project Enabler	2
ROI Year 1	5
ROI Year 2	4
ROI Year 3	3
Schedule Risk	-3
Security	4
Success Factor	3
Synergy with Organization	3
Synergy with Other Projects	3
Technical Risk	-4

Table 13 – Default Criterion Weights

4.16 Near Optimal Resource Allocation Process

EPPORA automatically allocates labor resources to the tasks scheduled for the allocation period. It accomplishes the allocation in the following order:

1. EPPORA allocates any pre-assigned resources to their designated tasks.
2. EPPORA allocates any partially completed tasks to the previously assigned resources.
3. EPPORA sorts the remaining tasks based on priority, from most important to the least important task.
4. EPPORA sorts the individuals supporting the needed labor categories for the tasks within the allocation period in productivity order, from the most productive resource to the least productive resource.
5. EPPORA adjusts the order of ranking for an individual if the project and/or task within the project for the designated individual has a "desirability" factor (see Section 4.17).
6. EPPORA assigns the most productive individual within a labor category to the most important task needing the aforementioned labor category.

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4.17 Project Lockout

4.17.1 PREAMBLE

No one ever wants to be working on the computer performing what seems like an everyday activity and all of sudden the computer seems to become Rip Van Winkle and falls asleep. When using the Internet or a network, one often thinks there is a virus or an extraordinary load on the system that is causing this major delay. Another possibility is that disk storage is nearly full so that the system is thrashing to find the necessary space to perform what are normally nanosecond functions.

EPPORA while concurrently supporting multiple projects could have a similar problem if we didn't prevent it. In EPPORA, a Project Manager links low-level requirements of a project to the low-level project schedule tasks to determine the costs of each requirement and the cost of the entire project. In addition, within a project schedule, EPPORA also links a schedule task to another schedule task (s) whenever there is a dependency. That is where one task's start or finish is dependent upon another task's start or finish. To further complicate these dependencies, the linking of a task can be to a foreign (different project) task. EPPORA also links each low-level requirement to a set of test cases. Both project schedule tasks and requirements are identified with a sequential number. They both start at one and go for as many requirements or project schedule tasks as there are in the project. When a requirement, a project schedule task or test case is inserted, then all the following requirements, project schedule tasks or test cases identification numbers are increased by one. Likewise when a requirement, project schedule task or test case is deleted, then all the following requirements, project schedule tasks or test case identification numbers are adjusted.

In EPPORA a project's assigned Business Analyst works on the requirements and a project's Project Manager works on the project schedule tasks and test cases. A project's Project Portfolio Manager can work on all three. The problem occurs when a project's requirements, a project's schedule tasks or test cases are being worked on at the same time. If a Business Analyst is updating the requirements and a Project Manager is updating the project schedule tasks for the same project, then the adjustment can not only be complex, it can be impossible. We now complicate this by allowing project schedule task dependencies to rely on foreign (other than the project currently being updated) projects.

4.17.2 WHAT TO DO

To resolve this dilemma, EPPORA does not allow simultaneous updating of a project's requirements, a project's schedule tasks or test cases within the same project. When a simultaneous attempt occurs, the second occurrence receives a message stating the name of the other person who is in the process of performing the update. To solve a complexity that rarely occurs, EPPORA keeps track of foreign projects that the current project links to project schedule tasks for costing or dependencies. Once again when this occurs, we lockout the second user and tell him/her which individual and project is causing this lockout.

4.17.3 WHAT HAPPENS IN EPPORA WHEN PROJECT REQUIREMENTS/SCHEDULE TASKS CHANGES

When a Business Analyst, Project Manager or Project Portfolio Manager updates (insert or delete) the requirements, project schedule tasks or test cases, EPPORA needs to:

1. Re-sequence the updated requirements, project schedule tasks or test cases
2. If a project schedule task, update the dependencies within this project
3. If foreign project's have project schedule tasks dependent upon this project, update the foreign project's schedule task dependencies accordingly
4. If a project schedule task, update the mapping definitions with the adjusted project schedule task identifiers
5. If a deletion, we need to assure there are no other projects referencing the deleted entities.

4.18 Divisions

Large organizations usually have multiple locations where they conduct business. Usually these different locations have different product lines. The projects within some organizations are often run as separate business entities with their own processes and procedures, being their separation by distance or product line. EPPORA supports this by having "Divisions" which are associated with projects, users and project selection criteria. EPPORA also uses Divisions as a search filter.

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4.19 Allocation

The major function of EPPORA is to help organizations obtain maximum ROI for their project investment. One of EPPORA's basic principles in attempting to achieve maximum ROI for an organization's project investment is to assign an organization's finest labor resources to its most important tasks. This is based on the assumption that organizations desire to have their most important tasks done prior to lesser important tasks.

To accomplish this EPPORA allows:

- A more objective and scientific method for ranking projects in their portfolio, thus determining the importance of each project.
- An organization to create as many labor categories as needed for the tasks in all their projects.
- Each staff member to support one or more labor categories.
- Project Portfolio Managers assign labor categories instead of actual staff members to schedule tasks.
- Adding an additional value to critical path tasks within a project, making their importance greater than non-critical path tasks in the same project.
- Project Portfolio Managers to override EPPORA's automatic assigning of labor resources during the allocation process by designating that an actual staff members as (1) "Assigned" to a specific task (this signifies that the designated staff member will be assigned to the task no matter what), (2) as being "Most Desirable" in a specific labor category for a specific task (this signifies that the designated staff member shall be assigned to the task if he/she is available), thus overriding the productivity ranking within the labor category, (3) as being "Least Desirable" in a specific labor category for a specific task (this signifies that the designated staff member will only be assigned to the task if there is no other resource available), thus overriding the productivity ranking within the labor category, and (4) as being "Never Assigned" in a specific labor category for a specific task or for a project (this signifies that the designated staff member shall never be assigned to the task or project).

When EPPORA allocates actual staff members to the tasks during the allocation period, it keeps track of the performance of the assigned staff member for each task as well as an accumulative performance for each supported labor category. Thus, for each labor category an individual supports, it keeps track of their performance (see Section 4.10 – Productivity Factor). If an individual has not supported any tasks for a labor category, then his/her productivity factor is 1.0. When performing the automated allocation of actual labor resources, EPPORA does the following:

Step	Description
1	Builds an ordered list of all tasks to be performed during the allocation period in ranking order.
2	Determines all the labor categories needed from Step #1.
3	Builds a list of candidate staff members for each labor category determined in Step #2 in productivity order.
4	Assigns those staff members designated by Project Portfolio Managers to their designated tasks from Step #1.
5	Assigns those staff members who have completed part of a task in Step #1 from preceding allocation periods.
6	Assign to tasks those individuals deemed "Most Desirable" to tasks not yet assigned from Steps #1-5.
7	Assign to tasks in the order of Step #1 the most productive project team member for the needed labor category unless: <ul style="list-style-type: none"> a. They are the "Least Desirable" and there are no other available resources for the needed labor category. b. They are "Never" to be assigned to this task no matter what. Then repeat step 7 for the next most productive project team member for the needed labor category.

Table 14—EPPORA Allocation Process

4.20 Analysis

EPPORA helps improve the quality of projects by performing analysis of users, projects, requirements and schedule at the time of definition and/or during the end-of-business processing. The messages are displayed at the end of the specification and/or at the end-of-business. Table 15 contains the analysis EPPORA performs to help Project Portfolio Managers, Project Managers and Business Analysts achieve successful projects.

Analysis Type	Verification of What	Message
Users	Email address	User xxx is missing or has an illegal email address.
	Supervisor	User xxx needs to have a Supervisor.
Projects	Sponsor	Project xxx is missing a Sponsor.
	Business Analyst	Project xxx is missing a Business Analyst.
	Project Manager	Project xxx is missing a Project Manager.
	Project Portfolio Manager	Project xxx is missing a Project Portfolio Manager.
	Project Approval	Project xxx has yet to be approved.

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Analysis Type	Verification of What	Message
Requirements	Adjectives	Requirement ID xxx in Project xxx description contains an adjective.
	Adverbs	Requirement ID xxx in Project xxx description contains an adverb.
	Conjunctions	Requirement ID xxx in Project xxx description contains a conjunction.
	Multiple sentences	Requirement ID xxx in Project xxx description contains multiple sentences.
	Commas	Requirement ID xxx in Project xxx description contains a comma.
	Semi-colons	Requirement ID xxx in Project xxx description contains a semi-colon.
	Colons	Requirement ID xxx in Project xxx description contains a colon.
	Lists	Requirement ID xxx in Project xxx description contains a list.
	Maximum description words	Requirement ID xxx in Project xxx description contains too many words.
	Maximum title words	Requirement ID xxx in Project xxx title contains too many words.
	Requirements description	Requirement ID xxx in Project xxx contains a description for a parent task.
Shall	Requirement ID xxx in Project xxx is missing the word "shall."	
Schedule	Verb	Schedule task ID xxx in Project xxx description does not start with a verb.
	Low-Level task maximum days	Schedule task ID xxx in Project xxx is a low-level task that exceeds the maximum days for a low-level task by xxx days.
	Low-Level task Labor Category	Schedule task ID xxx in Project xxx has a low-level task without assigned labor category.
	Fixed Dates	Percentage of tasks with fixed dates exceeds the limit. This will have major effects on creating accurate schedules.
	Description	Schedule Task ID xxx in Project xxx description contains too many words.
	Title	Schedule Task ID xxx in Project xxx title contains too many words.
	Recent Update	Project xxx's schedule has not been updated recently.
	Late milestone	Milestone schedule Task ID xxx in Project xxx is late.
	Late deliverable	Deliverable schedule Task ID xxx in Project xxx is late.
	Projected Late Milestone	Milestone schedule Task ID xxx in Project xxx is projected to be later than maximum allowable late days.
	Projected Late Deliverable	Deliverable schedule Task ID xxx in Project xxx is projected to be later than maximum allowable late days.

Table 15—EPPORA Analysis

4.21 Critical Path

As part of its allocation process EPPORA calculates the critical path for all approved projects. Critical path tasks are any task that has an effect on the project's completion date. The critical path is constantly changing as the project progresses. The critical path is calculated using the labor categories supplied for each low-level task and assumes each assigned labor category has a productivity factor of 1.0.

The critical path was developed in the late 1950s and is used by most popular scheduling tools. Each task within a schedule has three critical pieces of information relevant to critical path, which are the task's description, its duration and the task's dependencies. If a task has no dependencies, then it can start right away. On the other hand, if a task does have dependencies, then its start is dependent upon the dependency type, where:

<u>Dependency Type</u>	<u>Explanation</u>
Finish-to-Start	When the dependent task is finished, then this task can start (default type)
Finish-to-Finish	This task must finish at the same time as the dependent task
Start-to-Start	This task must start the same time as the dependent task
Start-to-Finish	This task must finish when the dependent task starts

EPPORA's algorithm used to compute critical path is based upon the following concepts:

ETT=Earliest time task can start

LTT=Latest time task can start without causing a delay in the project's completion

TFT=Total float for a low-level task is LTT-ETT

Thus the total float for a task is defined as the longest possible delay in the completion of the task that will not cause a delay in the completion of the project. This provides EPPORA with the intuitive notion that critical path tasks have a float equal to zero. To compute the critical path EPPORA needs to determine the float for each low-level task. All low-level tasks that have a float of zero are on the critical path. By identifying the critical path tasks, EPPORA is informing its allocator which task should possibly be considered more important than other tasks within the project, and thus receive preferential allocation consideration and likewise which tasks the Project Manager should emphasize when he monitors tasks that effect the project's timely completion.

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4.22 Issue Mitigation Strategy

EPPORA continuously monitors user's inputs and at the end of each business day makes a series of checks to help assure there are no open issues. When an issue occurs, EPPORA automatically sends an internal message to the appropriate individuals. The majorities of these issues concern projects and are shown in Table 16 below.

Requirements		Schedule Tasks	
Issue	Mitigation Strategy	Issue	Mitigation Strategy
Conjunction	Conjunctions make the testing of a requirement too complex. Remove conjunction (s) and make multiple requirements.	Verb	Change schedule task description to begin with a verb.
Lengthy Title	The requirement's title should be a cryptic description. The "Title Description" can be a more detailed description. Change "Title Description" to a few words.	Resource	Each low-level schedule task must have a resource assigned to it.
List	Lists make the testing of a requirement too complex. Remove the list and make it multiple requirements.	Fixed Dates	Too many fixed dates in a schedule defeat the purpose of critical path. Change your schedule to have minimum fixed dates. Ideally the only fixed dates should be the "Start Date" and any scheduled trips or meetings.
Minimum Words	The requirement description must exceed the specified minimum words for a requirement's description.	Missing Resource	During an allocation process a task needed a labor category and there were no available resources. Your organization should consider augmenting their staff, training existing staff in the expertise needed or hiring a consultant.
Shall	Every requirement description must contain the word "shall" as part of its text. Insert the word "shall" into the description.	Resource Assignment	High-level tasks do not need a resource. Remove the resource.
Adjectives	Adjectives make the requirement ambiguous. Remove the adjective or change it to something else.	Timely Schedule Update	The project schedule should be updated at the end of each working day every time there is a change to be made. Inform Project Manager that this is his job.
Adverb	Adverbs make the requirement ambiguous. Remove the adverbs or change it to something else.	Projected Late Milestone	Occurs when a task is projected to be later than one week from the last approved baseline. Management should consider hiring additional resources to assure the schedule is not shifted, especially if the milestone is on the critical path.
Mapping	Every low-level requirement needs to be mapped to one or more low-level schedule tasks. Determine which tasks are needed to implement this requirement and specify the mapping accordingly.	Projected Late Deliverable	Occurs when a "Deliverable" task is projected to be later than one week from the last approved baseline. Management should consider hiring additional resources to assure the schedule is not shifted, especially if the deliverable is on the critical path.
		Mapping	Verify that each low-level schedule task is mapped 100% to one or more requirements. If not adjust mapping so that the entire schedule task is mapped 100%.
		Late Deliverable	None needed.
		Late Milestone	None needed.

Table 16—EPPORA Issue Mitigation Strategy