Software Requirements Specification

for

Super Schlumberger Scheduler

Version 0.2

Prepared by Design Team A

Rice University COMP410/539

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1. **Introduction**

1.1 **Purpose and Product Scope**

Super Schlumberger Scheduler (henceforth referred to as S3) is a software system that is intended to facilitate the scheduling of maintenance work by providing real-time alerts when issues arise that impact schedule maintenance plans. The full system includes support for the creation and modification of route plans, flexibility to accept and process new data sources, coordination between route schedulers and field workers, and auditing capabilities. The system is designed to be secure, scalable, and extensible.

2. **Overall Description**

2.1 **Product Perspective**

Many factors, such as dangerous weather and resource availability, can cause safety concerns and delays when scheduling maintenance tasks. These factors cause inefficiencies when schedules cannot be adapted rapidly enough to changing conditions to fully utilize available resources. Currently, Schlumberger does have a cohesive solution to this issue. The goal of S3 is to pull data from a variety of sources into a central system that can be used to recognize and alert interested users about potential scheduling issues.

2.2 **Product Functions**

At a high level, S3 is based on a four-tiered publish-subscribe model

Tier 1: Processed-Data Creation  
- Topic-based model where the topic is the format of the raw-data.  
- Published: Raw-Data from Raw-Data-Sources  
- Subscribers: Processing-algorithms

Tier 2: Route-Alert Creation  
- Content-based model where locations-of-interest and maintenance-resources are the content.  
- Published: Processed-Data from publishing-algorithms  
- Subscribers: Route-Notifiers

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Tier 3: Route-Alert Distribution
  ● Topic-based model where the Route-plans are the topics
  ● Published: Route alerts from Route-Notifiers
  ● Subscribers: Route-plans

Route alerts are sent from route notifiers to route plans. Route plans can then be updated accordingly by the system.

Tier 4: Route-Alert Notification
  ● Topic-based model where route-plans are the topics.
  ● Published: Route-alerts associated with specific route-plans
  ● Subscribers: Users interested in specific route-plans

2.3 User Classes and Characteristics

**Analyst**
Person who creates algorithms to process data and create alerts.

**Auditor**
Person who reviews past actions taken by users in the system and the root causes of those actions. They can views all types of data in the system, although they cannot modify any of the data.

**Field-Worker**
Person who uses the route-plan to complete maintenance-tasks at locations-of-interest. They also update maintenance-tasks as they are completed

**Manager**
Person who monitors the efforts of a route-scheduler and resource-manager and adds locations-of-interest to the system

**Raw-Data-Source**
A source of stream of Raw-Data into the system.

**Resource-Manager**
Person who manages and updates the maintenance resources listed in the system.

**Route-Scheduler**
Person who is responsible for creating and editing route-plans, and modifying them when issues arise.

**System-Admin**
Person who monitors and runs the overall system, including managing system users and their permissions, as well as checking system analytics.
2.4 Assumptions and Dependencies

TODO: Fill in after Monday

List any assumed factors (as opposed to known facts) that could affect the requirements stated in the SRS. These could include third-party or commercial components that you plan to use, issues around the development or operating environment, or constraints. The project could be affected if these assumptions are incorrect, are not shared, or change. Also identify any dependencies the project has on external factors, such as software components that you intend to reuse from another project, unless they are already documented elsewhere (for example, in the vision and scope document or the project plan).

3. External Interface Requirements

3.1 User Interfaces

TODO: Fill in after Monday

Describe the logical characteristics of each interface between the software product and the users. This may include sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, and so on. Define the software components for which a user interface is needed. Details of the user interface design should be documented in a separate user interface specification.

3.2 Hardware Interfaces

TODO: Fill in after Monday

Describe the logical and physical characteristics of each interface between the software product and the hardware components of the system. This may include the supported device types, the nature of the data and control interactions between the software and the hardware, and communication protocols to be used.

3.3 Software Interfaces

TODO: Fill in after Monday

(The interface of the sensor data will probably go here, as the deployed sensors probably already send data in an established API that we must connect to.)

Describe the connections between this product and other specific software components (name and version), including databases, operating systems, tools, libraries, and integrated commercial components. Identify the data items or messages coming into the system and going out and describe the purpose of each. Describe the services needed and the nature of communications. Refer to documents that describe detailed application programming interface protocols. Identify data that will be shared across software components. If the data sharing mechanism must be
implemented in a specific way (for example, use of a global data area in a multitasking operating system), specify this as an implementation constraint.>

3.4 Communications Interfaces

TODO: Fill in after Monday
<Describe the requirements associated with any communications functions required by this product, including e-mail, web browser, network server communications protocols, electronic forms, and so on. Define any pertinent message formatting. Identify any communication standards that will be used, such as FTP or HTTP. Specify any communication security or encryption issues, data transfer rates, and synchronization mechanisms.>

4. System Features

Notes:
- Use case diagrams in this section only show interactions up to the database portion of the solution itself. Interactions between database elements are shown in the first diagram in Appendix B.
- Creations and deletions of objects are counted as modifications of those objects to streamline notifications

4.1 Data Management Features

4.1.1 Description and Priority

Data Management features center around adding new sources of data and processing and storing the incoming data.

Priority: Medium
Data Management features allows the customer to dynamically add new raw-data-sources and new processing algorithms to the system. However, this feature is of medium priority as the necessary raw-data-sources and processing-algorithms could be coded directly into the system.
4.1.2 Use Case Diagram

4.1.3 Functional Requirements

REQ-4.1-1: Add new raw-data-source
- Used by: System Admin
- Adds support for messages to be streamed in from a new raw-data-source.

REQ-4.1-2: Modify existing raw-data-source
- Used by: System Admin
- Modifies the raw-data source associated with the given raw-data-source stream.

REQ-4.1-3: Delete existing raw-data-source
- Used by: System Admin
● Deletes the support for data to be streamed in from the given raw-data-source.

REQ-4.1-4: Send Data

● Used by: Sensors

● Allows raw-data to be streamed to the endpoint associated with the data-source’s endpoint. This raw-data must be processed by all processing-algorithms subscribing to the format of the raw-data.

REQ-4.1-5: Add new Processing-Algorithm

● Used by: Analyst

● Adds a new Processing-Algorithm to process raw-data, including specifying the raw-data formats that the processing-algorithm accepts (will process).

REQ-4.1-6: Modify existing Processing-Algorithm

● Used by: Analyst

● Modifies the processing-algorithm and/or the raw-data formats that the processing-algorithm accepts.

REQ-4.1-7: Delete existing Processing-Algorithm

● Used by: Analyst

● Deletes the processing-algorithm.

REQ-4.1-8: Retrieve existing Processing-Algorithm

● Used by: Analyst

● Retrieves the existing processing-algorithm requested by the Analyst.

4.2 Route-Notifier Features

4.2.1 Description and Priority

Route-Notifier features center around updating route plans as new information comes into the system and alerting relevant users as route-plans are modified.

Priority: High

Without route-notifiers and route-alerts, the system does not solve the customer’s problem. Route-Alerts are core to S3’s ability to provide assistance when scheduling maintenance routes.
4.2.2 Use Case Diagram

4.2.3 Functional Requirements

REQ-4.2-1: Create Route-Notifier
- Used by: Analyst
- Adds a new route-notifier to the system.

REQ-4.2-2: Modify Route-Notifier
- Used by: Analyst
- Modify what processed-data sources the Route-Notifier subscribes to.

REQ-4.2-3: Remove Route-Notifier
- Used by: Analyst
- Deletes a Route-Notifier from the system.

REQ-4.2-4: Review Route-Alerts & their source

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4.3 Route-Plan Features

4.3.1 Description and Priority
Route-plan features center around creating, modifying, and managing route-plans.
Priority: High
Without route-plans it is impossible to receive alerts regarding when scheduling issues arise.

4.3.2 Use Case Diagram
4.3.3 Functional Requirements

REQ-4.3-1: Mark Maintenance Task Status
- Used by: Field Workers
- Modifies an existing route plan to indicate that an assigned task on the tasks list in the route plan has either been completed successfully or unsuccessfully.

REQ-4.3-2: Modify Route-plan
- Used by: Schedulers, Managers
- A new route-plan is created in the system with the modification made to the previous route-plan. The old route-plan is deleted.

REQ-4.3-3: Create New Route-plan
- Used by: Schedulers, Managers
- A new route-plan is created on the system.

REQ-4.3-4: Review Route-plan
- Used by: Schedulers, Managers, Auditors, Field Workers
- If the users has appropriate permissions, the system returns the queried route-plan for the users to review.

REQ-4.3-5: Delete Route-plan
- Used by: Schedulers, Managers
- The route-plan is deleted.
- All allocated and unused maintenance-resources are unallocated.

REQ-4.3-6: View Route-Plan Analytics (Low Priority)
- Used by: Scheduler
- View information regarding the effectiveness of previously planned route-schedules.

4.4 Resource Management Features

4.4.1 Description and Priority

The view is used for managing the maintenance-resources used in the maintenance-tasks. The primary goal is for all users to be up-to-date regarding the availability of resources.

Priority: Medium
These features enable our users to dynamically add maintenance-resources to assist in route planning.
4.4.2 Use Case Diagram

Resource Management Use Case

4.4.3 Functional Requirements

REQ-4.4-1: Add new Maintenance-Resource
- Used by: Resource-Manager, Manager
- Create a new maintenance-resource on the system

REQ-4.4-2: Update Maintenance-Resource Availability
- Used by: Resource-Manager, Manager
- Modify a maintenance-resource to indicate how much of the resource is available

REQ-4.4-3: Remove Resource
- Used by: Resource-Manager, Manager
- The maintenance-resource is deleted on the system.

REQ-4.4-4: View Maintenance-Resource Availability
- Used by: Resource-Manager, Manager, Route-Scheduler, Auditors
- The availability of the queried maintenance-resource is returned to the user.

REQ-4.4-5: View Maintenance-Resource-Analytics
- Used by: Resource-Manager, Manager
- Aggregated information about maintenance-resources is made available to the user.
4.5 Locations of Interest Features

4.5.1 Description and Priority

Locations-of-interest features are central to scheduling route-plan as route-plans comprise a sequence of locations-of-interest. This set of features allows managers to create, update, and remove locations-of-interest from the system.

Priority: High.
Route-planning cannot be performed without the ability to manage locations-of-interest.

4.5.2 Use Case Diagram

![Locations of Interest Use Case Diagram]

4.5.3 Functional Requirements

REQ-4.5-1: Add a location-of-interest
- Used by: Managers
- Create a new location-of-interest.

REQ-4.5-2: Update a location-of-interest
- Used by: Managers

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- Modify the metadata associated with a specific location-of-interest.

REQ-4.5-3: Remove a location-of-interest
- Used by: Managers
- Remove a location-of-interest from the system.

REQ-4.5-4: View locations-of-interest
- Used by: Managers, Auditors
- View the metadata associated with specific locations-of-interest.

### 4.6 System Analytics Features

#### 4.6.1 Description and Priority

System analytics features center around the ability of a system administrator to determine how well-behaved the system is, identifying the performance of data connections and databases in the system and viewing error and debugging logs.

Priority: Medium
System analytics features facilitate the identification of system issues and analysis of performance.

#### 4.6.2 Use Case Diagram

![System Analytics Use Case Diagram](image-url)
4.6.3 Functional Requirements

REQ-4.6-1: View System Performance
- Used by: System Administrator
- View statistics about system performance

REQ-4.6-2: Debug System
- Used by: System Administrator
- See any error and debug messages produced by the system, to diagnose errors or bottleneck issues.

REQ-4.6-3: Restart Database
- Used by: System Administrator
- Delete items in the database that are no longer needed.

4.7 Logging Features

4.7.1 Description and Priority

Logging features are used to ensure auditability and accountability within this system by recording the actions of various users interacting with the system.

Priority: Medium
Logging adds the ability to trace user actions for auditing purposes.

4.7.2 Use Case Diagram

![Use Case Diagram](image)

4.7.3 Functional Requirements

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REQ-4.7-1: Log Data Entry
- Caused by: Raw-data-source
- Records whenever data arrives from a raw-data-source, along with its appropriate tags such as timestamp and raw-data-source identification.

REQ-4.7-2: Log Modification of Route Plan
- Caused by: Route-scheduler
- Records whenever a route-scheduler modifies a route-plan, along with its appropriate tags such as the modification type, route-plan modified, the modification, timestamp and user identification.

REQ-4.7-3: Log Modification of Maintenance Resource
- Caused by: Resource-manager
- Records whenever a resource-manager modifies a maintenance-resource, along with its appropriate tags such as the modification type, maintenance-resource modified, the modification, timestamp and user identification.

REQ-4.7-4: Log Modification of Location-of-Interest
- Caused by: Manager
- Records whenever a Manager modifies a location-of-interest, along with its appropriate tags such as the modification type, location-of-interest modified, the modification, timestamp and user identification.

REQ-4.7-5: Retrieve Log of Raw/Processed Data
- Caused by: Analyst
- Retrieves the records for the raw/processed-data requested by the analyst in order to find patterns and develop new processing algorithms and filters.

REQ-4.7-6: Retrieve Raw-Data Resulting in Processed-Data
- Used by: Auditor
- Retrieves the records for all raw-data resulting in a piece of processed-data, for auditing purposes.

REQ-4.7-7: Retrieve Processed Data Resulting in Route Alert
- Used by: Auditor
- Retrieves the records for all processed-data resulting in a given route-alert for auditing purposes.

REQ-4.7-8: Retrieve Actions Taken by A User Related to Route-Plan
- Used by: Auditor
- Retrieves the records for all logged route-plans modified by any user for a given time period for auditing purposes.

REQ-4.7-9: Retrieve Data Seen/Available to User in Given Time Period
- Used by: Auditor
- Retrieves the records for all logged data visible by any user for a given time period for auditing purposes.

REQ-4.7-10: Retrieve Route Plans/Maintenance Resource Analytics
- Used by: Manager
- Retrieves the records for logged route-plans/maintenance records produced by route-schedulers and resource-managers for monitoring purposes.
4.8 User Management Features

4.8.1 Description and Priority

User management features center around the ability of a system administrator to create and manage user information and resource access permissions for each user.

Priority: High
User management is critical for S3 software system. Without proper permission management, users may maliciously access data they shouldn’t have access to.

4.8.2 Use Case Diagram

4.8.3 Functional Requirements

REQ-4.8-1: Add a new user
  • Used by: System-administrator
  • Add a new user to system, and set their permission to resources

REQ-4.8-2: Update user
  • Used by: System-administrator
  • Update current existing user’s information or permissions

REQ-4.8-3: Remove user

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- Used by: System administrator
- Delete a user’s information from the system

REQ-4.8-4: View user
- Used by: System administrator, Auditor
- View user information and permissions of queried user.

4.9 Authentication Features

4.9.1 Description and Priority

Authentication allows the system to recognize users and ensure that they have the proper permissions before allowing them to modify or access data.

Priority: High

Security is our client’s highest priority, and without a way to verify users before giving them access to data, S3 is a failure from a security standpoint.

4.9.2 Use Case Diagram

Authentication Use Case

4.9.3 Functional Requirements

REQ-4.9-1: Login
- Used by: All users

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● Users send their credentials to the system, allowing the system to determine which (if any) features they are allowed to access.

REQ-4.9-2: Logout

● Used by: All users
● Users notify the system that they have completed their session.

5. Other Nonfunctional Requirements

5.1 Security Requirements

TODO: Fill in after Monday

<Specify any requirements regarding security or privacy issues surrounding use of the product or protection of the data used or created by the product. Define any user identity authentication requirements. Refer to any external policies or regulations containing security issues that affect the product. Define any security or privacy certifications that must be satisfied.>

5.2 Performance Requirements

TODO: Fill in after Monday

<If there are performance requirements for the product under various circumstances, state them here and explain their rationale, to help the developers understand the intent and make suitable design choices. Specify the timing relationships for real time systems. Make such requirements as specific as possible. You may need to state performance requirements for individual functional requirements or features.>

5.3 Scalability Requirements

TODO: Fill in after Monday

5.4 Extensibility Requirements

TODO: Fill in after Monday

5.5 Reliability Requirements

TODO: Fill in after Monday
Appendix A: Glossary

User Role Definitions

Analyst
Person who creates algorithms to process data and create alerts.

Auditor
Person who reviews past actions taken by users in the system and the root causes of those actions. They can view all types of data in the system, although they cannot modify any of the data.

Field-Worker
Person who uses the route-plan to complete maintenance-tasks at locations-of-interest. They also update maintenance-tasks as they are completed.

Manager
Person who monitors the efforts of a route-scheduler and resource-manager and adds locations-of-interest to the system.

Raw-Data-Source
A source of stream of Raw-Data into the system.

Resource-Manager
Person who manages and updates the maintenance resources listed in the system.

Route-Scheduler
Person who is responsible for creating and editing route-plans, and modifying them when issues arise.

System-Admin
Person who monitors and runs the overall system, including managing system users and their permissions, as well as checking system analytics.

Item Definitions

Locations-of-Interest
A location involved in a maintenance task or route plan. Examples include well sites, maintenance-resource storehouses, route stops, etc.

Maintenance-Resources
People & objects allocated to complete maintenance-tasks. Examples include vehicles, raw materials, field-workers.
Maintenance-Resource-Analytics
Statistics and summaries of the usage and utilization of maintenance resources.

Maintenance-Task
A job to be completed at a location-of-interest along with the necessary associated maintenance-resources. These tasks can be assigned to field-workers.

Processed-Data
The result of processing raw-data using processing-algorithms.

Processing-Algorithms
Algorithms that convert raw-data to processed-data. These algorithms may make use of historical (previously computed and stored) data. These algorithms may have predictive elements. Examples include the impact of weather on locations-of-interest or the availability of maintenance-resources.

Raw-Data
External data added to the system. Examples include weather data, military activity, etc.

Route-Alert
Indications of a change in a status within a route plan. These are added by route-notifiers and are forwarded from route-plans to users. They includes a timestamp and a reference to the processed data that caused it to be generated.

Route-Analytics
Statistics and summaries of the effectiveness and accuracy of route-plans

Route-Notifier
Stream processor that modifies route plans by adding route alerts. Subscribes to processed-data associated with specific maintenance-resources or locations-of-interest.

Route-Plan
A sequence of scheduled maintenance-tasks and the locations-of-interest traveled to complete these tasks.

System-Analytics
Data about how well the system is performing. Examples include query times, db capacity, debug info, etc.
Appendix B: Analysis Models

DB Interactions Model:

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Overall system summary: