Jet Propulsion Laboratory Download Manager
(JPLDM)

CS496 Senior Design

Functional Requirements and Design Document

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List of TBD Items

Page	Item	Description	Status
Section 4	Detailed Design	Level 2 DFDs	TBC Winter Quarter 2016
Section 5	Implementation	Coding	TBC Winter Quarter 2016
Section 6	Test Plan	Testing Plan	TBC Spring Quarter 2016

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None.

1.0 Introduction

1.1 Purpose

The purpose of this document is four-fold:

a. Define a full set of requirements for JPLDM.
   These sections correspond to a Software Requirements Document (SRD)

b. Define the design for JPLDM.
   These sections correspond to a Software Design Document (SDD).

c. Define the implementation of JPLDM. These sections correspond to a Software Implementation Document (SID) and will be partially completed during a subsequent Software Engineering class.

d. Define the Test Plan for JPLDM. These sections correspond to a Software Test Plan (STP) and will be partially completed during a subsequent Software Engineering class.

The complete definition of all JPLDM requirements provides the requirements to be used in the subsequent software subsystem documents.

1.2 Scope

This documentation was developed as part of Senior Design CS496. Implementation will be continued in the Winter Quarter 2016 and Spring Quarter 2016.

The scope of this document includes the following:

- All functional and nonfunctional requirements. These requirements are organized by key JPLDM functional units shown on the Level 1 DFD given in section 2.0.
- A trace matrix, relating all JPLDM functional requirements to functional subunits as expanded in lower level DFDs. Higher level DFDs will be provided next quarter as part of the design in section 4.0.
- General descriptions of hardware necessary for implementation of JPLDM
- A matrix of testing methods used to validate and verify each of the functional requirements.

1.2.1 Document Organization

The organization of this document provides a natural 'flow' or allocation of requirements to each succeeding section. Details regarding the overall document structure are discussed in sub-section 1.4.

1.2.2 Relationship to Other Documents

The JPLDM SRD/SDD/STP/SID is a complete self-contained document. Some relationships to other documents in the literature are indicated below in sub-section 1.5.

1.3 JPLDM Architecture

1.3.1 Context Diagram (DFD Level 0)

JPLDM's architecture is summarized in the Context Diagram (DFD Level 0) given below. A more detailed Functional Description is given in Section 2 of this document.

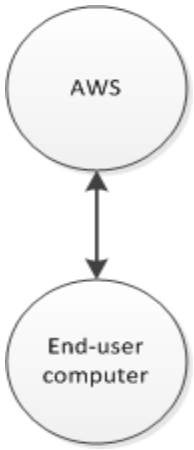

Figure 1-1: Level 0 DFD

1.3.2 Description and Major Functions of JPLDM

JPLDM will provide a user friendly interface for browsing, searching, downloading and uploading data to the JPL LMMP database.

1.3.3 Hardware and Software Considerations

JPLDM requires fully provisioned AWS infrastructure, and a client computer running Windows, Linux, or OSX with sufficient disk space for the data requested.

1.4 Documentation of the Development Process

JPLDM's detailed functional description is documented in section 2.0. Section 2 is a succinct software description document. The overall detailed functional description is based on higher level DFDs (above level 1). All major functional units are described in detail in this part of the document.

Requirements for JPLDM are captured in Section 3.0 of this document. This section includes both functional and non-functional software requirements, supplemented with more detailed information when necessary.

Section 4, JPLDM's detailed Design Description Document (SDD), will be completed in Winter Quarter 2016.

Section 5, JPLDM's Software Implementation Document (SID), will be completed in Winter and Spring Quarter 2016.

Section 6, JPLDM's Software Test Plan (STP), will be completed in a subsequent Spring Quarter 2016.

1.5 References

All references used in the creation of this document are listed below.

1.5.1 Controlling Documents

There is no other document controlling this document.

1.5.2 Applicable Documents

No additional applicable document has been used in the production of this document.

1.5.3 Standards

No standard has been used in the creation of this document. However, some Standards described in textbooks have been examined as a reference.

2.0 DETAILED FUNCTIONAL DESCRIPTION OF JPLDM

2.1 Detailed JPLDM Functional Description.

The major tool used to design JPLDM is the Data Flow Diagram, DFD. The rationale for the selection of DFDs as the preferred design tool is its simplicity and versatility. In the future additional tools may be used if a stronger correlation from Design to Requirement to Implementation and Testing is required.

2.1.1 Level 1 DFD

JPLDM's major functional subunits are shown in the DFD Level 1 shown below:

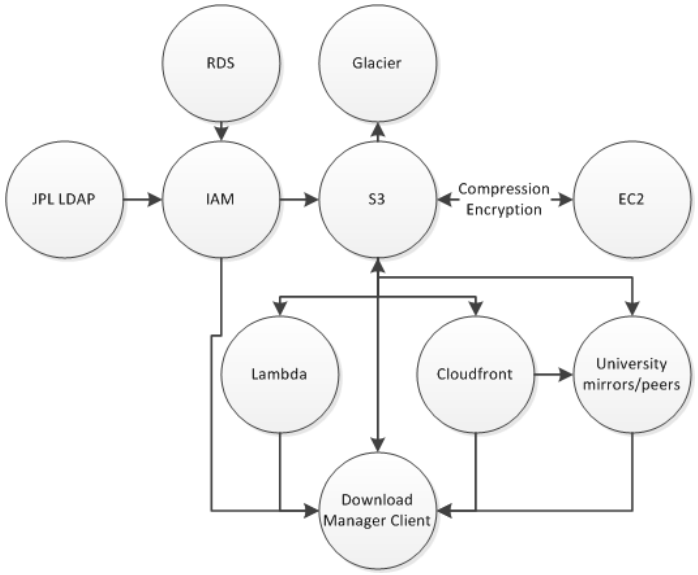

Figure 2.1: Level 1 DFD

2.1.2 Detailed Functional Description of JPLDM's Major Units

Storage - Module 2.1

AWS S3 will be the primary storage location of all LMMP data. Lifecycle rules will be defined to automatically archive infrequently-accessed data to AWS Glacier to reduce costs.

Authentication - Module 2.2

AWS IAM will manage user authentication, access to restricted files and their encryption keys, and administrative rights.

Distribution - Module 2.3

AWS CloudFront will be the the main exit point for users' downloads. It will be supplemented by university hosts to increase download speed and reduce AWS costs.

REST API - Module 2.4

AWS Lambda will service all REST requests as defined by the JPLDM API. This API exists both to support the Download Manager Client (module 2.6) and provide a scripting interface for users.

Data Processing - Module 2.5

AWS EC2 will be used to (de)compress, split, encrypt/decrypt, and generate previews of data.

Download Manager Client - Module 2.6

A downloadable graphical application that will allow end users to browse, select, download, and upload data to and from the LMMP database stored in AWS S3 (module 2.1).

3.0 JPLDM Requirements

3.1 JPLDM Functional Requirements

This Section lists JPLDM's functional requirements. This section includes the complete set of functional requirements, along with explanations for cases in which the statement of the requirement was deemed insufficient or requires additional clarification. All requirements relate to the design modules described in Section 2. An effort has been made to standardize the correlation between the design modules and the requirements to make access and organization more consistent. For example, requirement number "n" affecting module 2.1 will be labeled 3.1.n

Requirements Related to Design Module 2.1: Storage Module	
Requirement No.	**Requirement Description**
3.1.1	SM shall store LMMP data.
3.1.2	SM shall serve data to Distribution Module (2.3) as necessary.
3.1.3	SM shall store new data delivered by DMC (module 2.6).
3.1.4	SM shall move infrequently-accessed data from S3 to Glacier.

3.1.5	SM shall temporarily restore data from Glacier upon request.

Requirements Related to Design Module 2.2: Authentication Module	
Requirement No.	**Requirement Description**
3.2.1	AM shall manage user authentication.
3.2.2	AM shall allow access to restricted files.
3.2.3	AM shall allow access to decryption keys.
3.2.4	AM shall manage administrative rights.

Requirements Related to Design Module 2.3: Distribution Module	
Requirement No.	**Requirement Description**
3.3.1	DM shall provide users with access to stored data.
3.3.2	DM shall provide a content distribution network (CDN).
3.3.3	DM shall provide university peering.

Requirements Related to Design Module 2.4: Rest API	
Requirement No.	**Requirement Description**
3.4.1	RA shall service requests from DMC.
3.4.2	RA shall service requests from API-compliant scripts.

Requirements Related to Design Module 2.5: Encryption/Compression	
Requirement No.	**Requirement Description**
3.5.1	ECM shall provide decompression of data.
3.5.2	ECM shall provide compression of data.
3.5.3	ECM shall provide encryption of data.
3.5.4	ECM shall provide generation of data previews.

Requirements Related to Design Module 2.6: Download Manager Client (DMC)	
Requirement No.	**Requirement Description**
3.6.1	DMC shall allow the user to download data sets from LMMP.
3.6.2	DMC shall provide a way for the user to search for data using a keyword.
3.6.3	DMC shall provide a way for the user to filter the searched data sets.
3.6.4	DMC shall allow the user to upload data to LMMP.
3.6.5	DMC shall allow the user to preview data.
3.6.6	DMC shall allow the user to schedule, pause, resume, or cancel downloads.
3.6.7	DMC shall provide a way to view download status information.
3.6.8	DMC shall allow users to log in.
3.6.9	DMC shall allow users with appropriate permissions to

	download restricted/encrypted data.
3.6.10	DMC shall allow users with appropriate permissions to modify LMMP data.
3.6.11	DMC shall allow users with appropriate permissions to manage files, users, and permissions.

3.2 JPLDM Non-Functional Requirements

This Section collects all the JPLDM Non-Functional Requirements. All non-functional requirements are numbered “NF – n” where “n” indicates the n^{th} requirement.

NF - 1
JPLDM requires a fully provisioned Amazon Web Services account

3.3 JPLDM Hardware Requirements

This Section collects all JPLDM’s hardware requirements. All hardware requirements are numbered “H – n” where “n” indicates the n^{th} requirement.

H - 1 JPLDM will run on the Amazon Web Services cloud infrastructure.

H - 2 JPLDM Download Manager Client will run on a modern Windows, Linux, or Mac OS desktop or laptop computer.

A. ACRONYMS

AM	**Authentication Module**
AWS	**Amazon Web Services**
CDN	**Content Distribution Network**
DMC	**Download Manager Client**
DM	**Distribution Module**

ECM	**Encryption/Compression Module**
JPLDM	**Jet Propulsion Laboratory Download Manager**
RA	**Rest API**
SM	**Storage Module**
LMMP	**Lunar Mapping and Modeling Project**