

# **Software Requirements Specification**

**for**

## **Location-based Intelligent Forwarding Strategy for NDN-WiFi**

**Version 2.0 approved**

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# Revision History

Name	Date	Reason For Changes	Version
Initial	9/25/17	Initial work	0.1
Submission	12/8/17	Completed sections	1.0
Final Submission	5/1/18	Updated for final specs	2.0

# **1. Introduction**

## **1.1 Purpose**

The purpose of this document is four-fold:

- A. Define a full set of requirements for the Location-based Intelligent Forwarding Strategy NDN-Wi-Fi (LIFS NDNW).  
(These sections correspond to a Software Requirements Document, SRD).
- B. Define the design for the LIFS NDNW  
(These sections correspond to a Software Design Document, SDD)
- C. Define the Test Plan for the LIFS NDNW  
(These sections correspond to a Software Test Plan, STP).
- D. Define/implement feasible modules for LIFS NDNW  
(These sections correspond to the Software Implementation Document, SID).

The complete definition of all LIFS NDNW requirements provides the source requirement inputs for the development of the subsequent supporting software subsystems documents.

## **1.2 Intended Audience and Reading Suggestions**

This documentations intended audience is to be used for future developers for understanding the LIFS NDNW project goal. Users and testers may use this document to verify that the project's requirements have been met according to this document and in the application.

## **1.3 Product Scope**

The LIFS NDNW project's scope is to create an Android application that can connect to other Android phones without the use of Wi-Fi or cellular service. These phones are to connect and relay information using the Wi-Fi direct interface. This will benefit users during natural disasters or in areas where cell and Wi-Fi service may be limited.

## **1.4 Definitions, Acronyms, and Abbreviations**

LIFS NDNW - Location-based Intelligent Forwarding Strategy NDN-Wi-Fi

## 1.5 References

None

## 2. Overall Description

### 2.1 Product Perspective

The LIFS NDNW relies on an Android App that can provide reliable and delay-tolerant Wi-Fi network services in challenged communication environments where the wireless signal is unreliable and intermittent, such as in U.S. national parks and post-disaster scenarios. More specifically, LIFS NDNW will run on Android smartphones and serves as a fine-grained and flexible “data mule” that store and forward data in an ad hoc manner. In this continuing project, we plan to develop a location-based intelligent forwarding strategy that can achieve an optimal performance in terms of bandwidth consumption and information retrieval latency.

This project is designed to be a stand-alone mobile application. This app receives data from other devices and satellites through various Android and Java APIs. It is dependent on Android and Java natively in order to run the various functions.

### 2.2 Product Functions

The application will have one several functions. The main function is to allow users to connect to other devices and share data. The modules that will help support the functions are:

- Main Module
  - The Main Module(MM) will provide linkability of data and other interactions between all other modules in the diagram
- Routing Information
  - The Routing Information Base Module(RM) is responsible for obtaining the Interest data, and process it to find the next hops for routing data. It is to receive the data from the (MM) and send back routing data back to the (MM).
- User Interface
  - The User Interface Module (UIM) is responsible for receiving user input and then displaying any of the information given in an easy to look at interface. The (UIM) is to develop the display that the user will be seeing and sending it back to the (MM).
- Network
  - The Network Module (NM) is responsible for sending the Interest with the correct Routing Information to the Network or Internet, then receive data back from the interest sent. Then send it back to the MM.

- Forward Information Based
  - The Forward Information Base Module (FIB) is responsible for storing a list of all routers it is connected too. Also (FIB) has to obtain the interest from the MM and return the list of routers it is connected to as data to the MM.
- Location
  - The Location Module is responsible for requesting location data from Satellites, and storing the information. As well as sending the data to the FIB and NM for further use.
- File Transfer
  - The File Transfer module is responsible for receiving files from other devices in both single-socket and multi-socket modes.

## **2.3 User Classes and Characteristics**

The LIFS NDNW application will be used by various types of users. The overall user should be able to use the application without any difficulty.

## **2.4 Operating Environment**

The LIFS NDNW application will be built for Android phones using Android Studio. The required operating system is Android 4.0+ (Ice Cream Sandwich or later). For developers, Android Studio will need to be up-to-date to avoid possible issues with versions.

## **2.5 Design and Implementation Constraints**

LIFS NDNW needs to be usable by Android smartphones and tablets. It needs to implement responsive design to make sure the application is usable without issues. It is currently is restricted to the Android operating system.

## **2.6 User Documentation**

One document will be released along with the LIFS NDNW project:

1. User Manual on how to use the application.

## **2.7 Assumptions and Dependencies**

None.

## **2.8 Apportioning of Requirements**

1. If the group leader's connection is lost, implement a feature to choose a new leader.
2. All devices shall be in the same group
3. There shall be 50 images of variable size for the destination



## 3. External Interface Requirements

### 3.1 User Interfaces

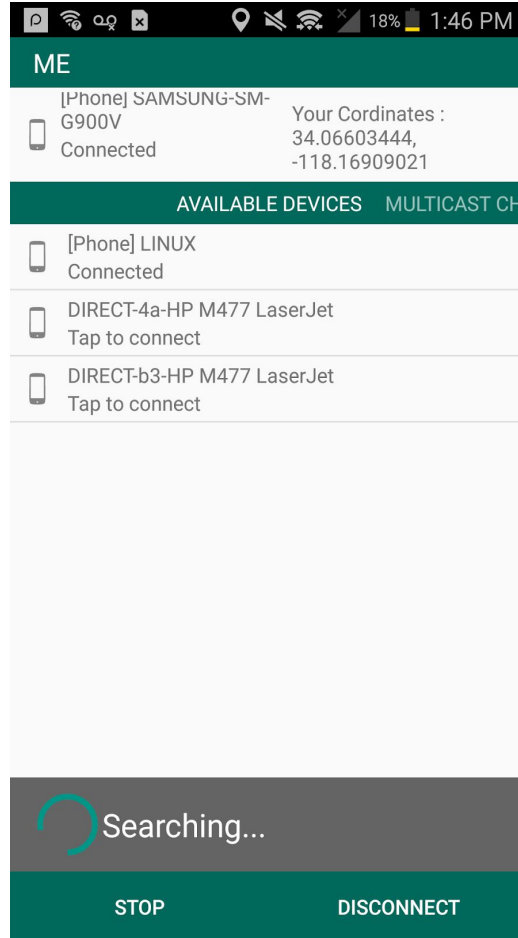


Fig. 1 Screenshot of Application

The UI will consist of a view with a couple of buttons and display information based on the phone's name, status, and location. The buttons will consist of a Search/Stop and Connect/Disconnect. The Search/Stop will search for other devices in the vicinity, while the Connect/Disconnect will allow the user to connect to the shown list of devices.

## **3.2 Hardware Interfaces**

This application shall be able on devices running the Android Operating System

## **3.3 Software Interfaces**

This application shall utilize the Android Operating System and its related libraries. The application will be in the most updated version of Java.

## **3.4 Communications Interfaces**

The LIFS NDNW will allow users to connect to other devices via Wi-Fi Direct. This shall handle the data that will be transferred and received.

## 4. Requirements Specification

### 4.1 Functional Requirements

Requirements for Design Module 4.2 Routing Information Base

Requirement No.	Requirement Description
4.2.1	The RM shall request from MM and send data
4.2.2	The RM shall produce routing information from data
4.2.3	The RM shall send back Routing data to MM

Requirements for Design Module 4.3 User Interface

Requirement No.	Requirement Description
4.3.1	The UIM shall receive user input from MM
4.3.2	The UIM shall receive data from MM
4.3.3	The UIM shall generate a display and send it back to the MM

Requirements for Design Module 4.4 Network

Requirement No.	Requirement Description
4.4.1	The NM shall accept input
4.4.2	The NM shall send back info.

Requirements for Design Module 4.5 Forward Information Base

Requirement No.	Requirement Description
4.5.1	The FIB shall receive data from the MM

4.5.2	The FIB shall return data based on the interest received to the MM
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#### Requirements for Design Module 4.6 Location

Requirement No.	Requirement Description
4.6.1	The Location shall use Android API to request coordinates of the user.
4.6.2	The Location shall receive the coordinates and relay them to the MM.

#### Requirements for Design Module 4.7 File Transfer

Requirement No.	Requirement Description
4.7.1	The user shall connect via single-socket to transfer files

## 4.2 External Interface Requirements

This section will go through the input/output of each module:

- Main Module
  - The main module will handle communication with all the other modules. It will receive input from the user interaction and output the received data to the user.
- Routing Information
  - This module will handle the multi and single socket connections to be made.
  - This module will send and receive incoming data inside the network.
- User Interface
  - The UI will be what the user will see when using the application.
  - User interaction will come from actions such as clicks and text entries.
- Network
  - This module will be central for the Wi-Fi direct connection.
  - This module will handle the group network address as well individual IP addresses.
- Forward Information Based
  - This module will determine the best route when sending data.
  - This module will rely on coordinates and using the Haversine formula to determine the angle and direction the user is going.
- Location
  - This module will request data via Satellites by calling the Android Location Manager.
  - Received data will be in longitude and latitude and be sent to the main controller to be shown to the user.
- File Transfer
  - This module will send and/or receive files by connecting to another device via private socket.
  - Received media shall be used to forward to other devices

## **4.3 Logical Database Requirements**

The LIFS NDNW will store data as an object created specifically for the application.

## **4.4 Design Constraints**

The application shall function correctly on the following devices:

- Android OS
  - Android 4.0+ (Ice Cream Sandwich or later)
- Permission Requests
  - Location permission for location discovery is to be granted by user

## **5. Other Nonfunctional Requirements**

### **5.1 Performance Requirements**

The application will support these performance requirements:

- The retrieval of coordinates shall be collected every 30 seconds.
- It shall support multiple users at the same time.
- Sending data to other phones shall be completed in no more than 5 seconds.

### **5.2 Safety Requirements**

LIFS NDNW does not have any safety requirements.

### **5.3 Security Requirements**

LIFS NDNW needs to handle various cases to function properly. It needs to receive the device's coordinates via satellite using the Android Location Manager. It needs to be able to connect to other phones to receive texts, files, and coordinates of other users.

### **5.4 Software Quality Attributes**

LIFS NDNW needs to be usable by Android smartphones and tablets. It needs to implement responsive design to make sure the application is usable without issues.

### **5.5 Business Rules**

None.

## **6. Other Requirements**

None.



# Appendix A: Glossary

FIB - Forward Information Based

LIFS NDNW- Location-based Intelligent Forwarding Strategy for NDN Wi-Fi

MM - Main Module

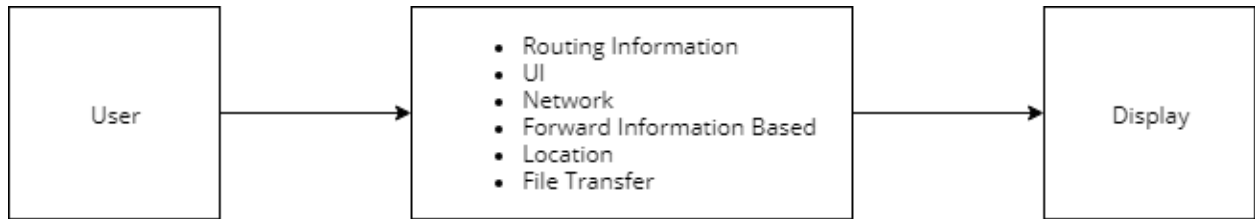
NM - Network Module

RM - Routing Information Base Module

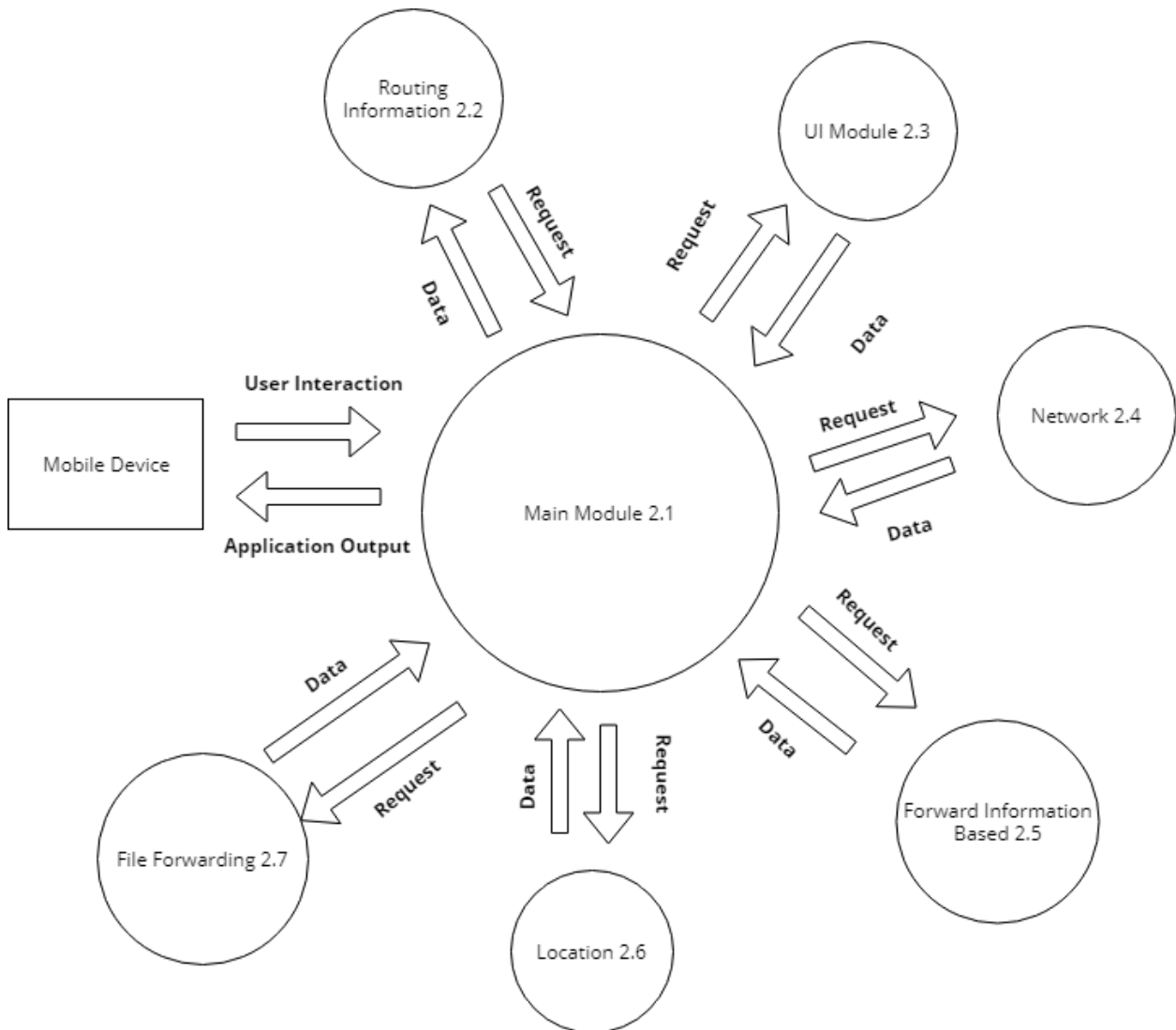
UIM - User Interface Module

## Appendix B: Analysis Models

Level 0 DFD



Level 1 DFD



# **Appendix C: To Be Determined List**

Refer to Section 2.8.