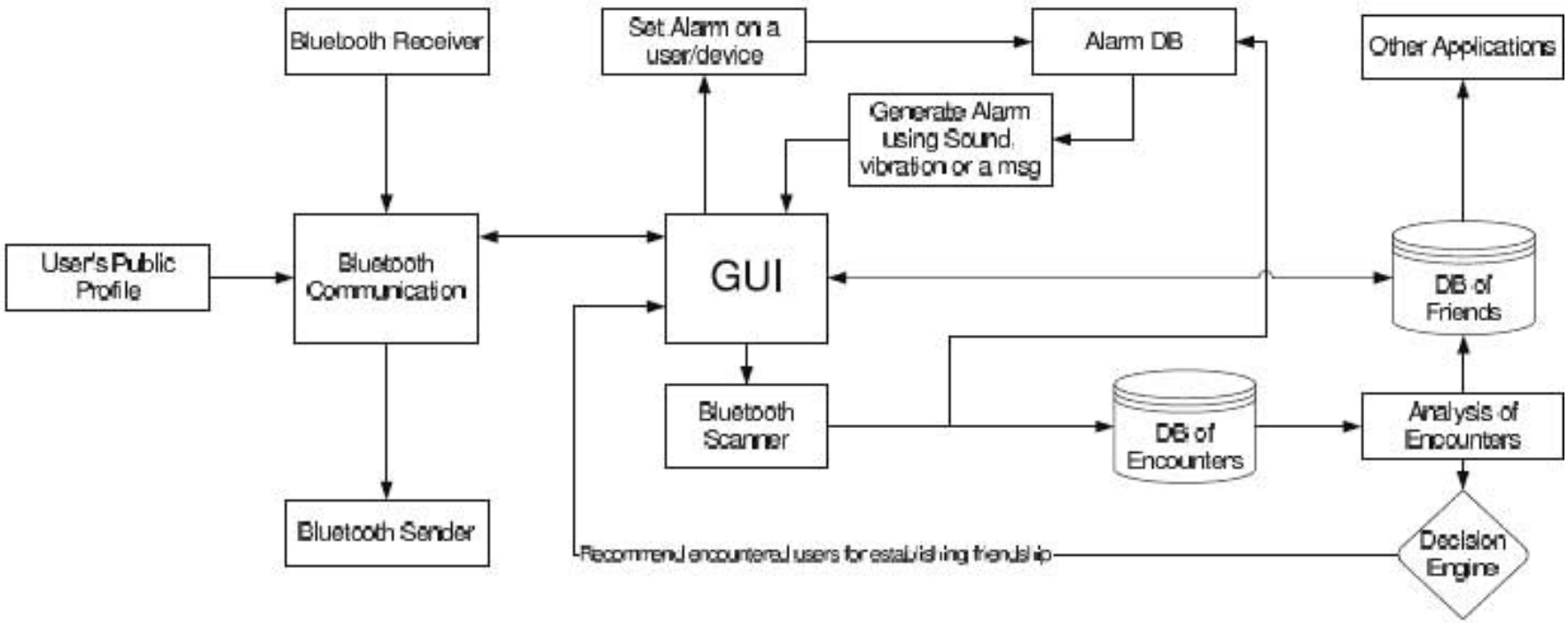
Mobile Networking Research Workshop

By:
Mobile Networking Laboratory (NOMADS group)

- Presentation Topics
  1. Friend Finder Application Architecture
  2. SOS – Emergency and Alert messaging system
  3. Trace Processing – How and possible Usage
  4. Profile-Cast Application architecture
  5. Google Earth Simulation of user Density Distribution on UF-Campus

Friend Finder Application Architecture


Bluetooth Receiver
Set Alarm on a user/device
Alarm DB
Other Applications
Generate Alarm using Sound, vibration or a msg
User's Public Profile
Bluetooth Communication
GUI
DB of Friends
Bluetooth Scanner
DB of Encounters
Analysis of Encounters
Bluetooth Sender
Decision Engine
Recommend encountered users for establishing friendship

Sending On-Demand Stress Signal
–
An On-Campus Emergency Alert Service

Motivation

- School and College campuses are facing a perceived threat of violent crime and abuse attacks.

- The current emergency, alert and public safety systems take **centralized approaches** and lack the essentiality to provide localized rescue services.

Motivation

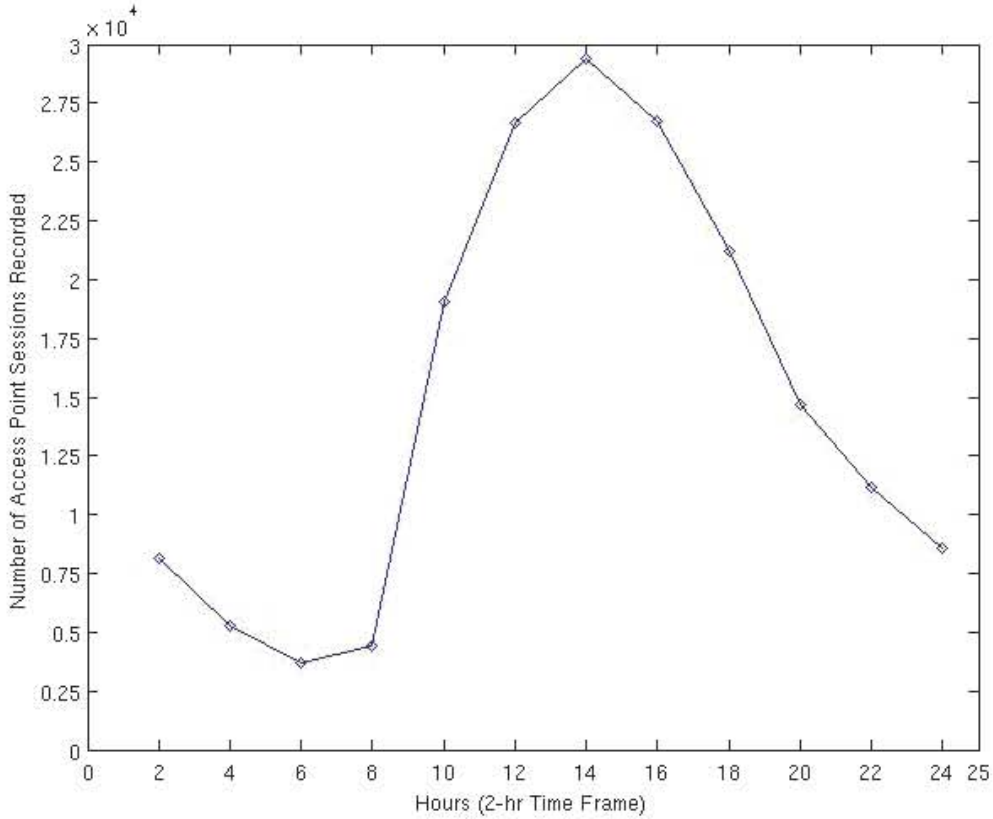
- Sending On-Demand Stress Signal (SOS) application as an on-campus emergency and alert service that relies on **localized responses.**

- This system sends distress signals to few trusted nodes using **Bluetooth and WiFi.**

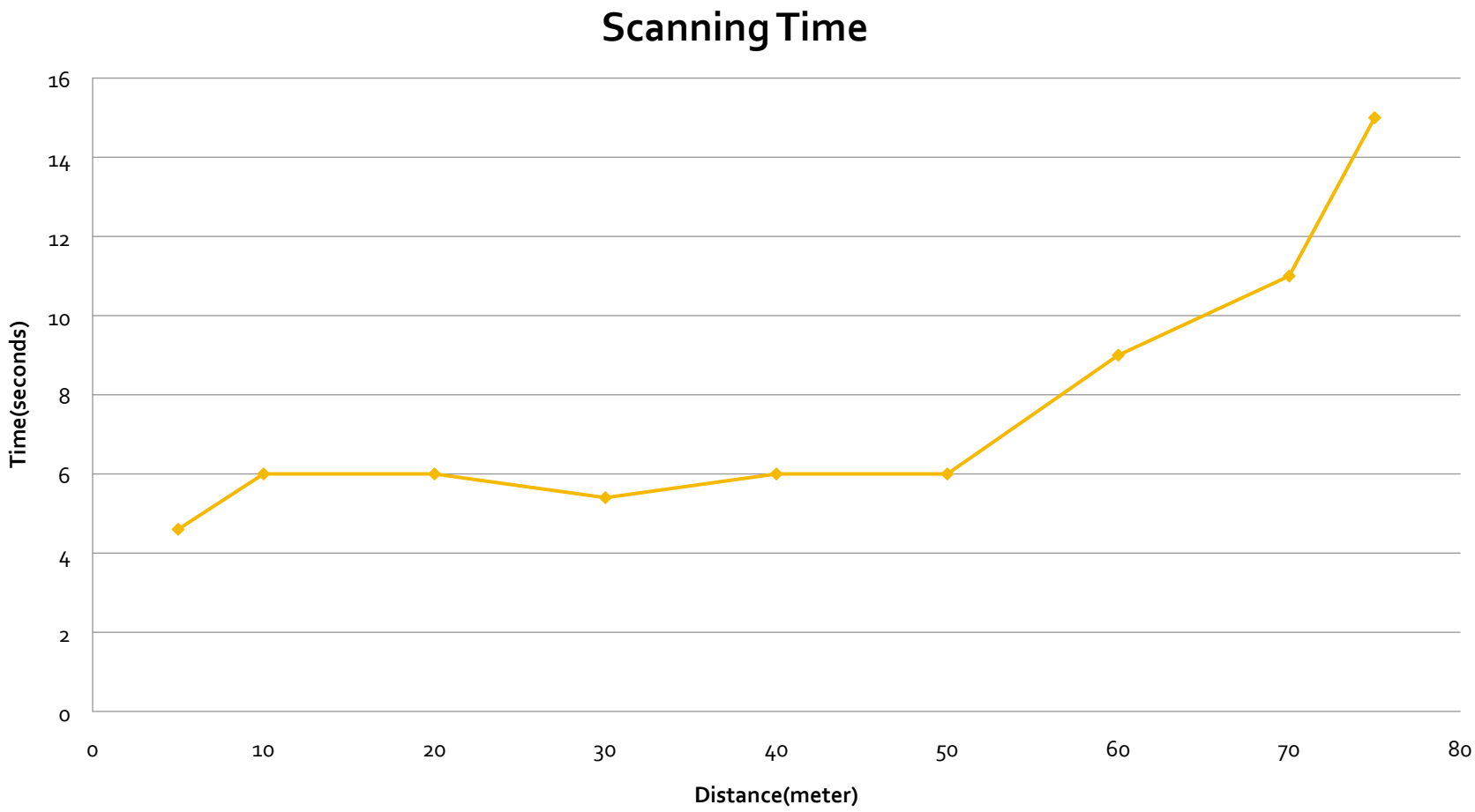
Solution

- Decentralized approaches of multi-sensor devices (like iPhones), which are capable to connect in more than just one ways
  - exploited for personal safety.
- Localized services based application.
  - tap local and surrounding help based on mutual trust and friend relationships

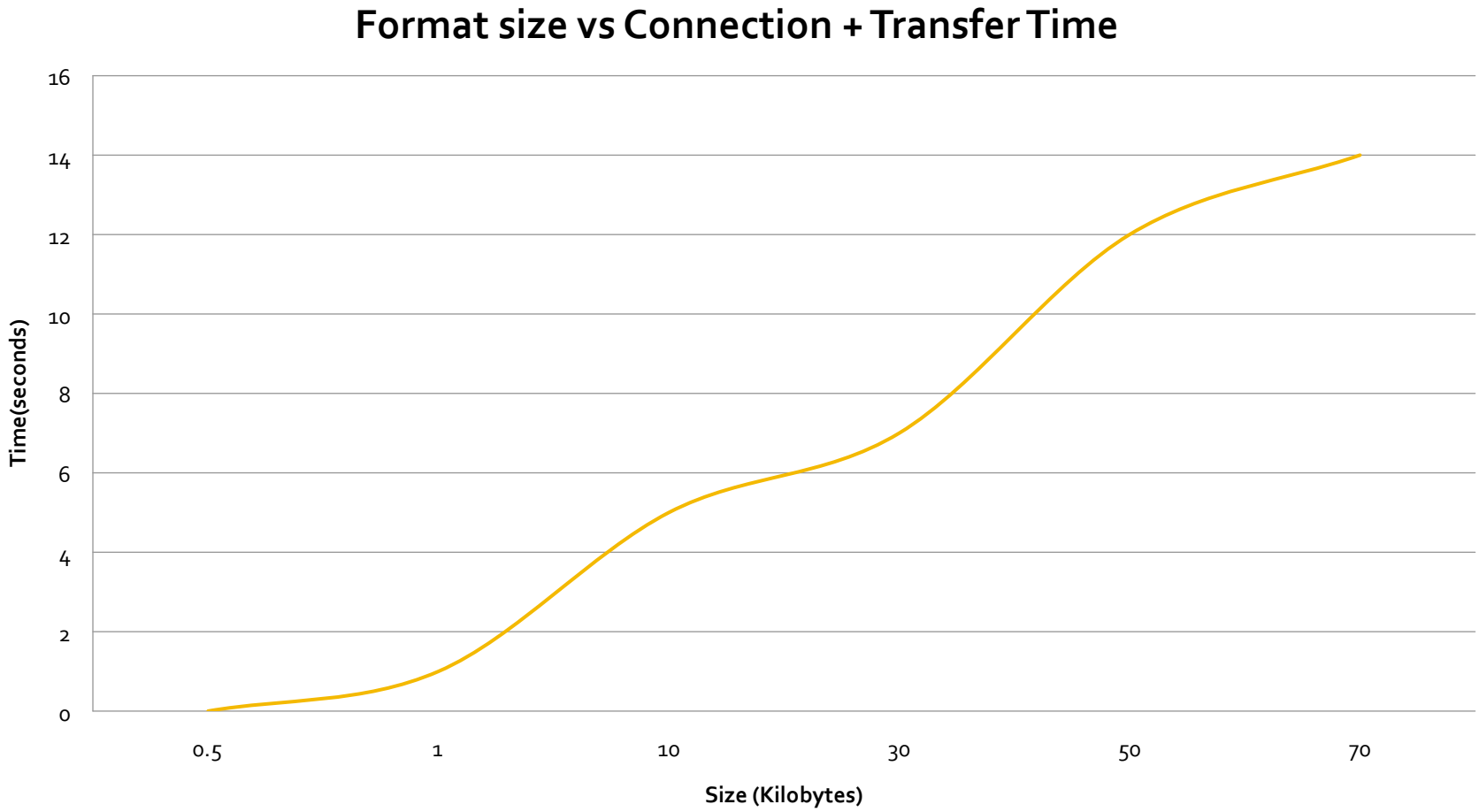
Login Patterns



Scanning Time



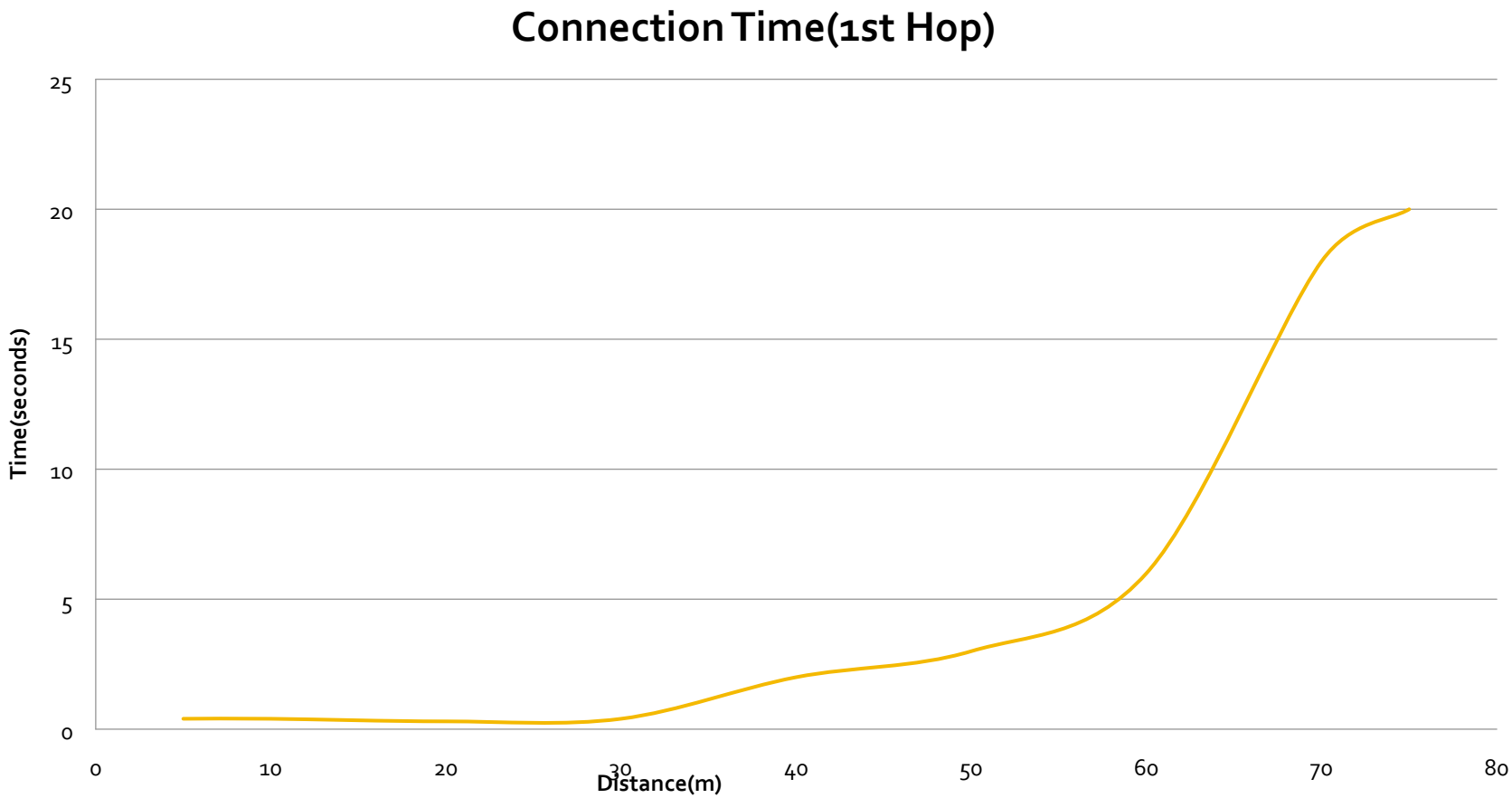
Message Size Delivery



Results

- As the message size increases. It takes longer to transfer the complete message
- We have established an SOS Message format which is 184 bytes in size, we have observed very low transfer times over a range of 0 – 60 meters.

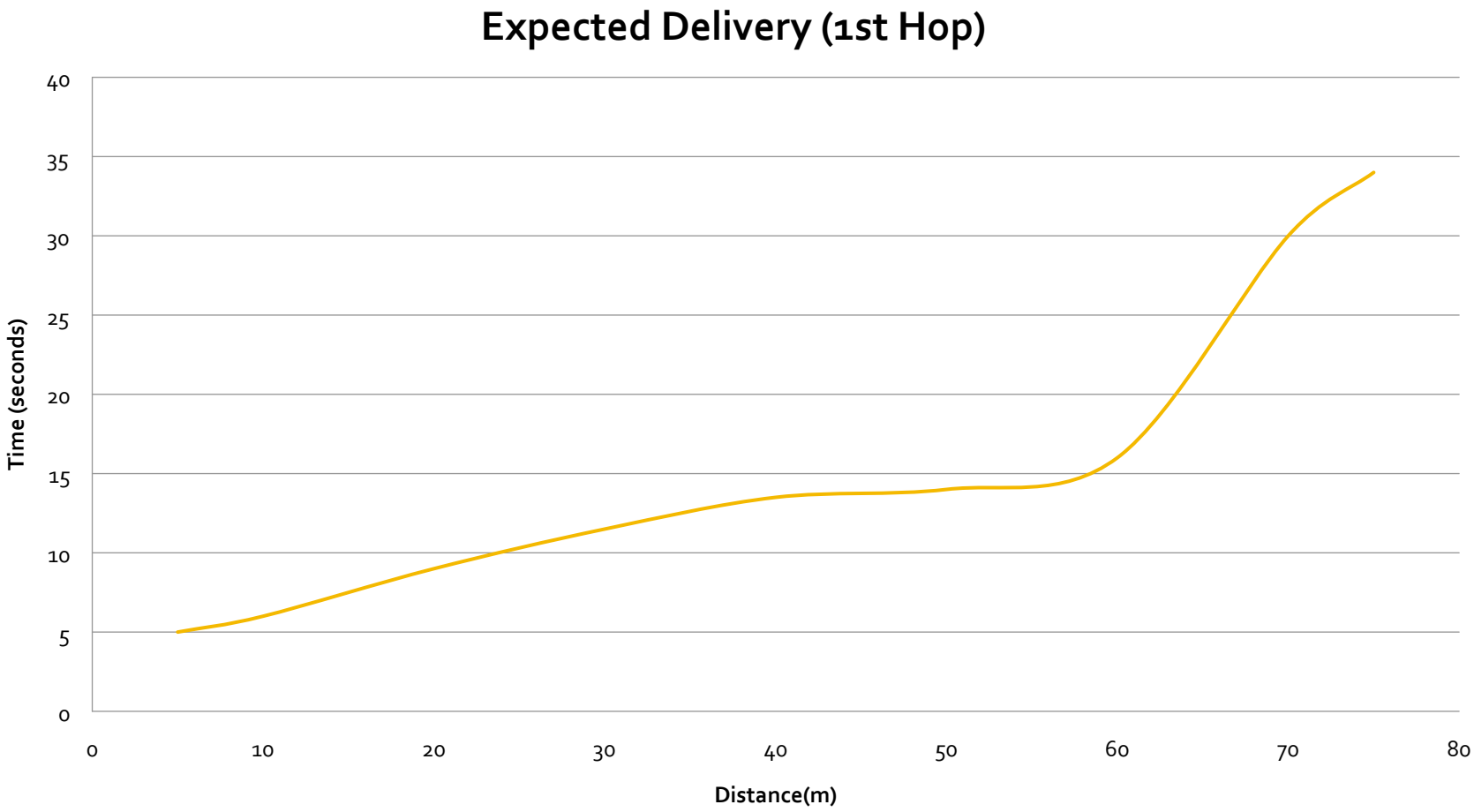
Connection Time



Result Analysis

- Successful transfer of SOS Message up-to 60 meters can be achieved in less than 5 seconds.
- Beyond 60 meters, the time taken to establish a connection increases a lot due to increased interference

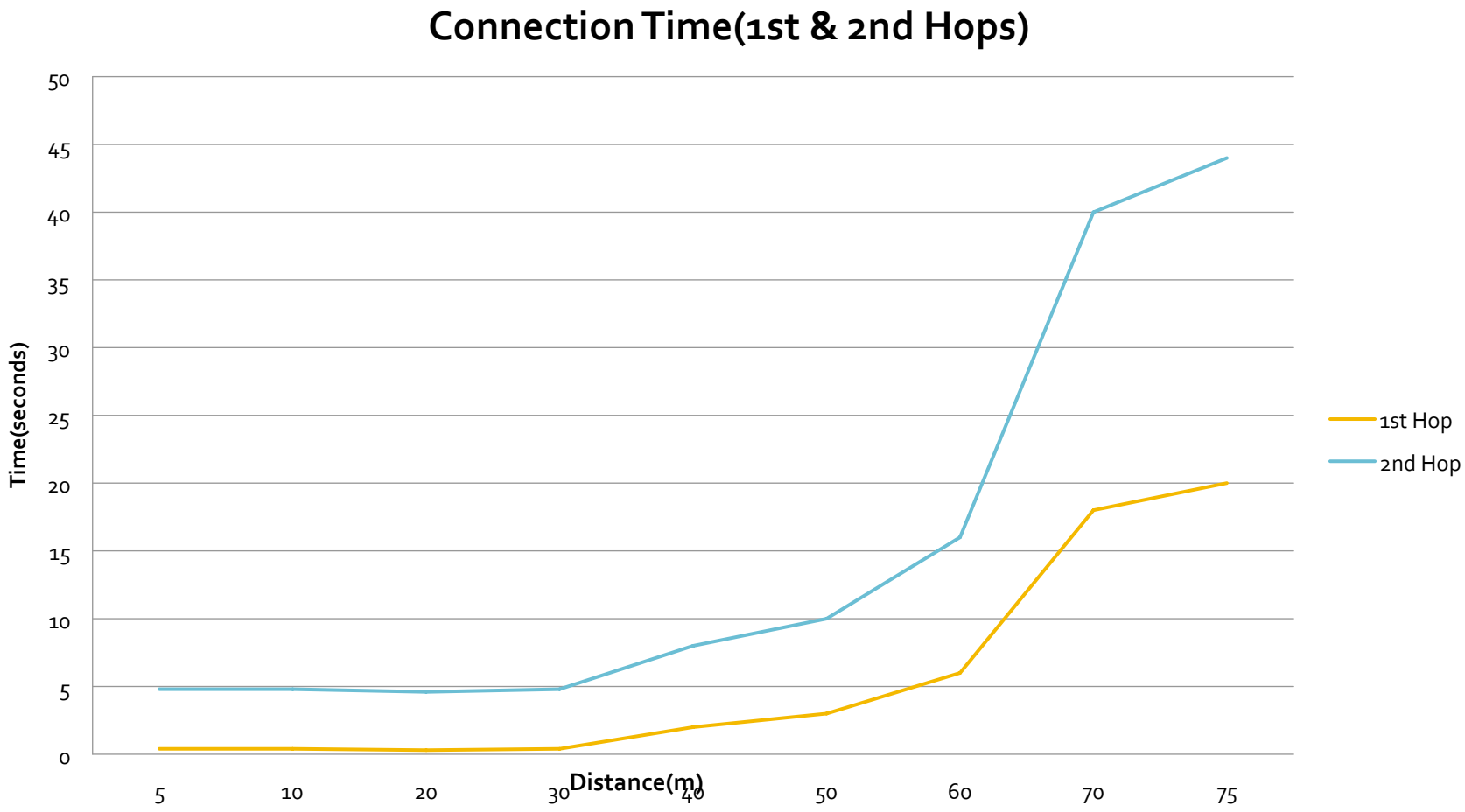
Expected Delivery Time



Result Analysis

- Up-to 60 meters, we can achieve successful communication within 15 seconds of time.
- Proposed application is efficient for SOS message transfer up-to 60 meter range.

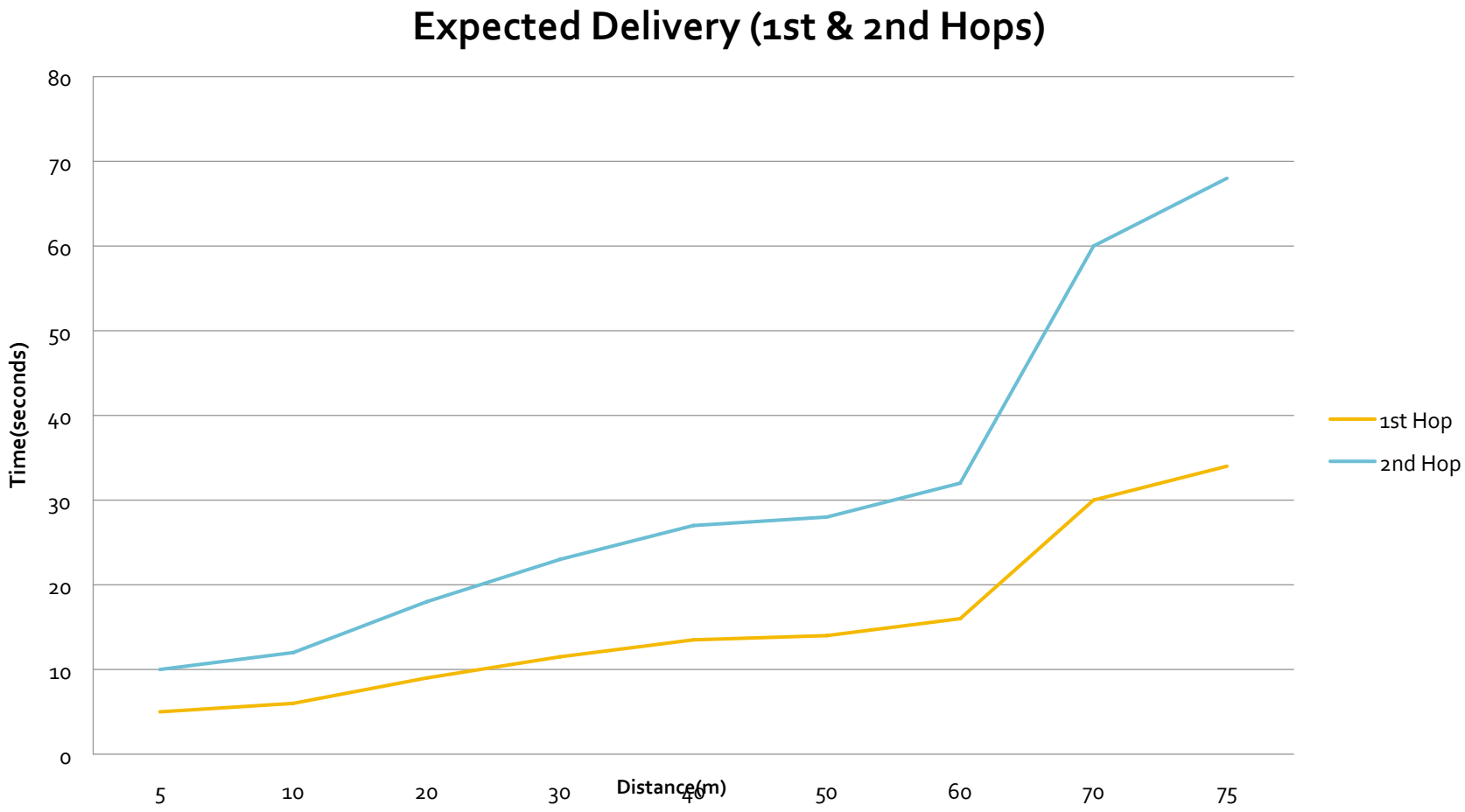
Connection Time



Result Analysis

- That basic metrics like scanning time etc., take the same time for both 1st and 2nd Hop.
- SOS Message up-to 60 meters can be achieved in less than 15 seconds

Expected Delivery Time

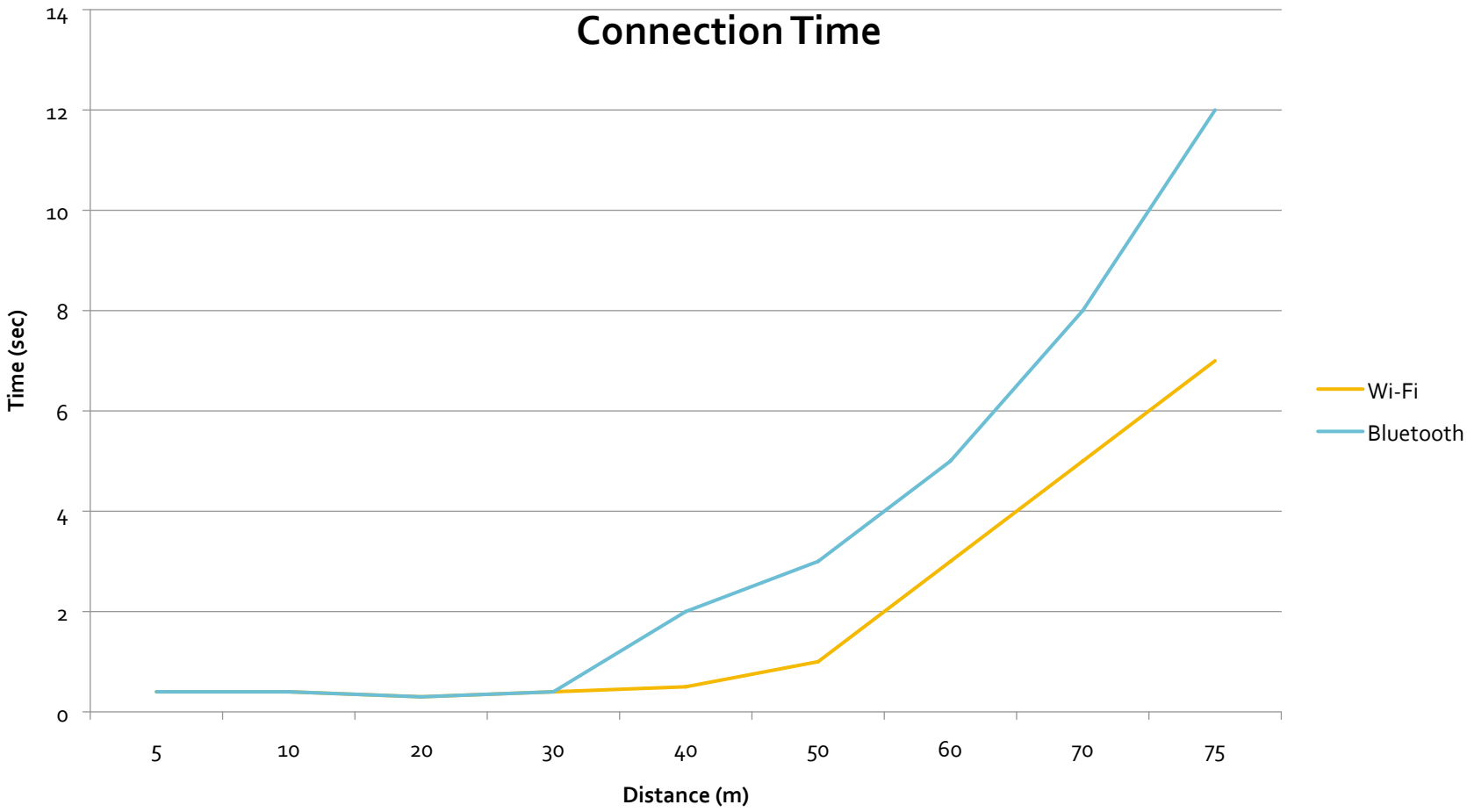


Result Analysis

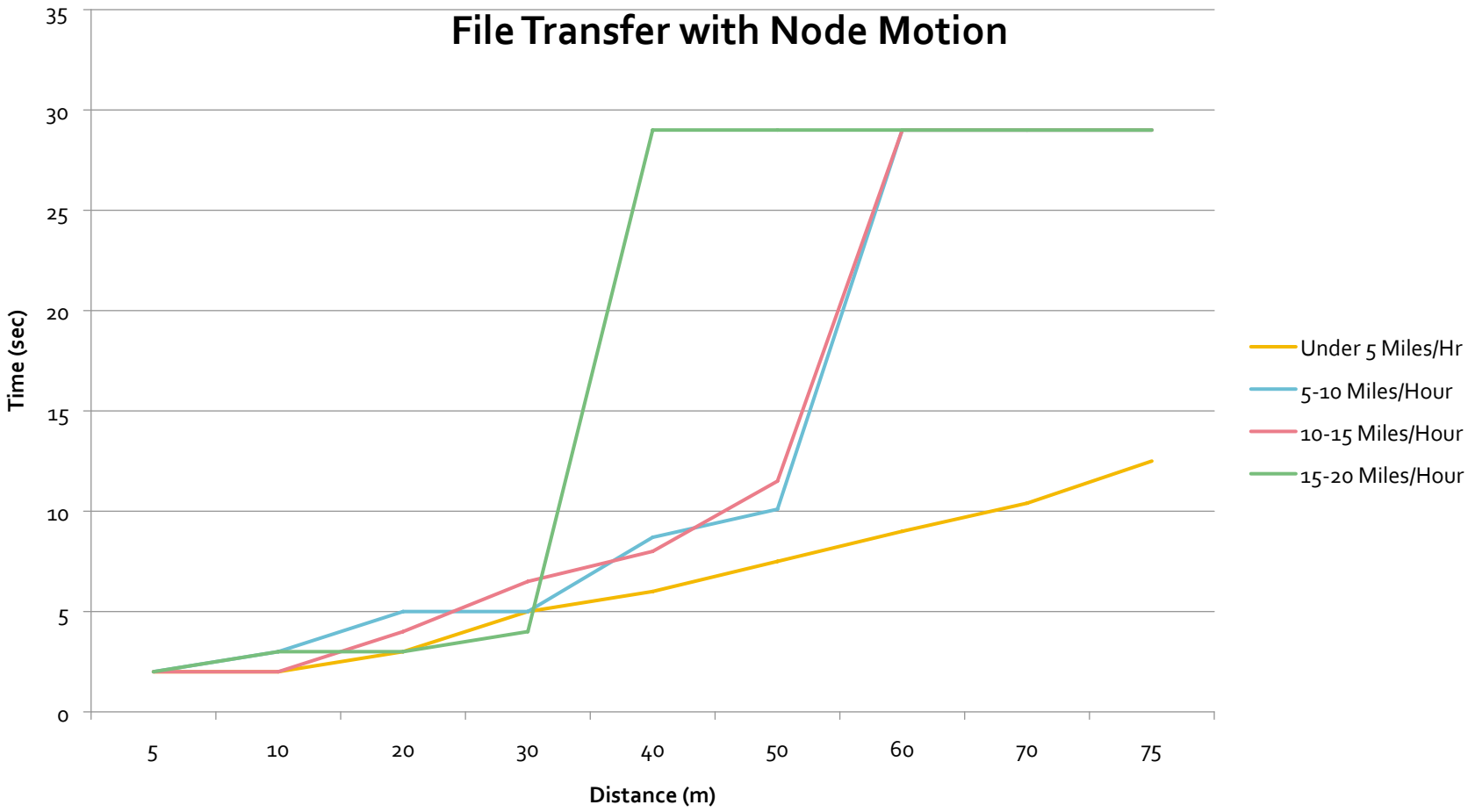
- overall increase in the delivery time from 1st Hop to 2nd Hop Delivery is almost double

- Up-to 60 meters, we can achieve successful communication within 25 seconds of time and thus, our application is efficient for SOS message transfer up-to 60 meter range.

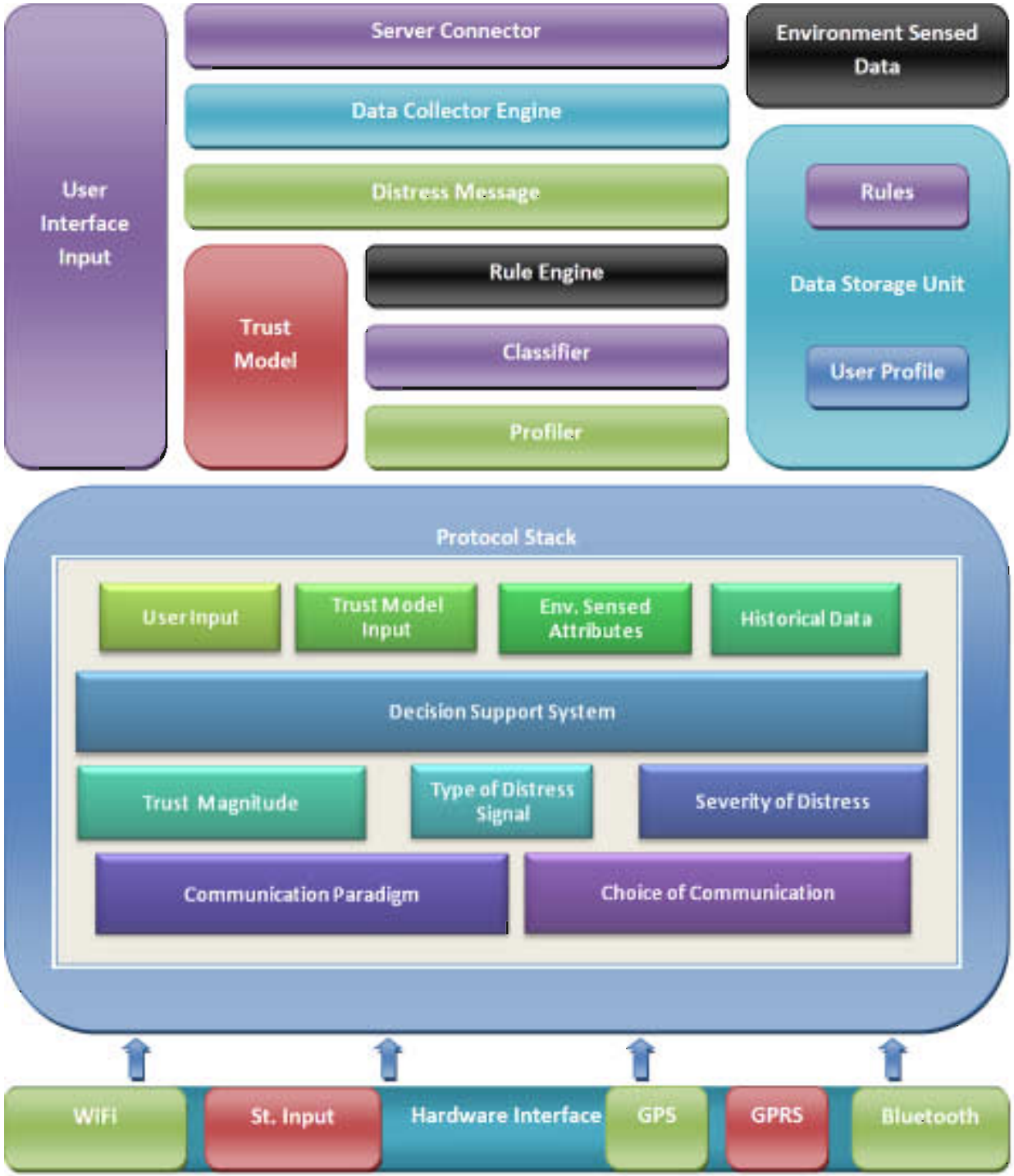
Bluetooth Vs. WiFi



File Transfer with Node Motion



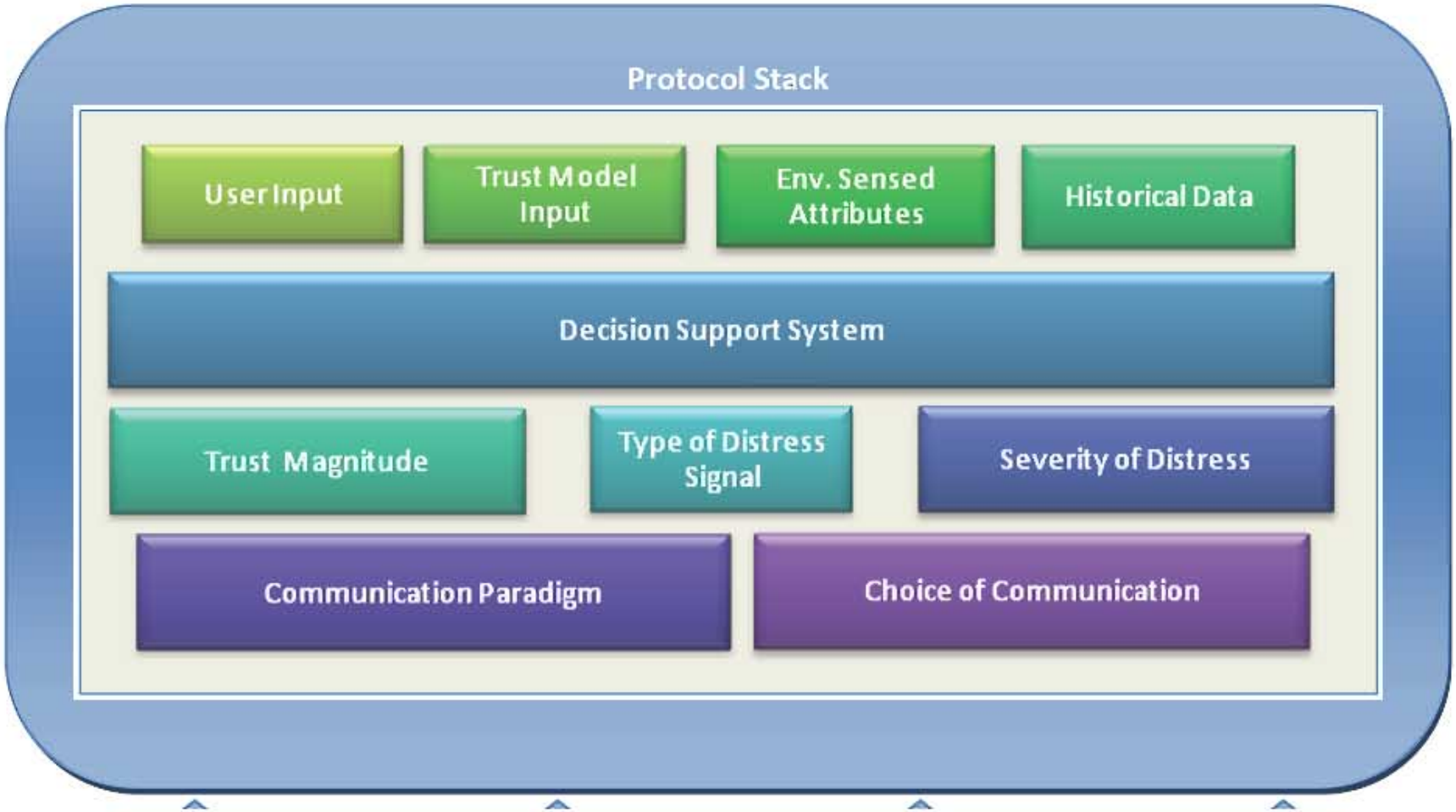
System Architecture of SOS Application


User Interface Input
Server Connector
Data Collector Engine
Distress Message
Trust Model
Rule Engine
Classifier
Profiler
Environment Sensed Data
Rules
Data Storage Unit
User Profile
Protocol Stack
User Input
Trust Model Input
Env. Sensed Attributes
Historical Data
Decision Support System
Trust Magnitude
Type of Distress Signal
Severity of Distress
Communication Paradigm
Choice of Communication
WiFi
St. Input
Hardware Interface
GPS
GPRS
Bluetooth

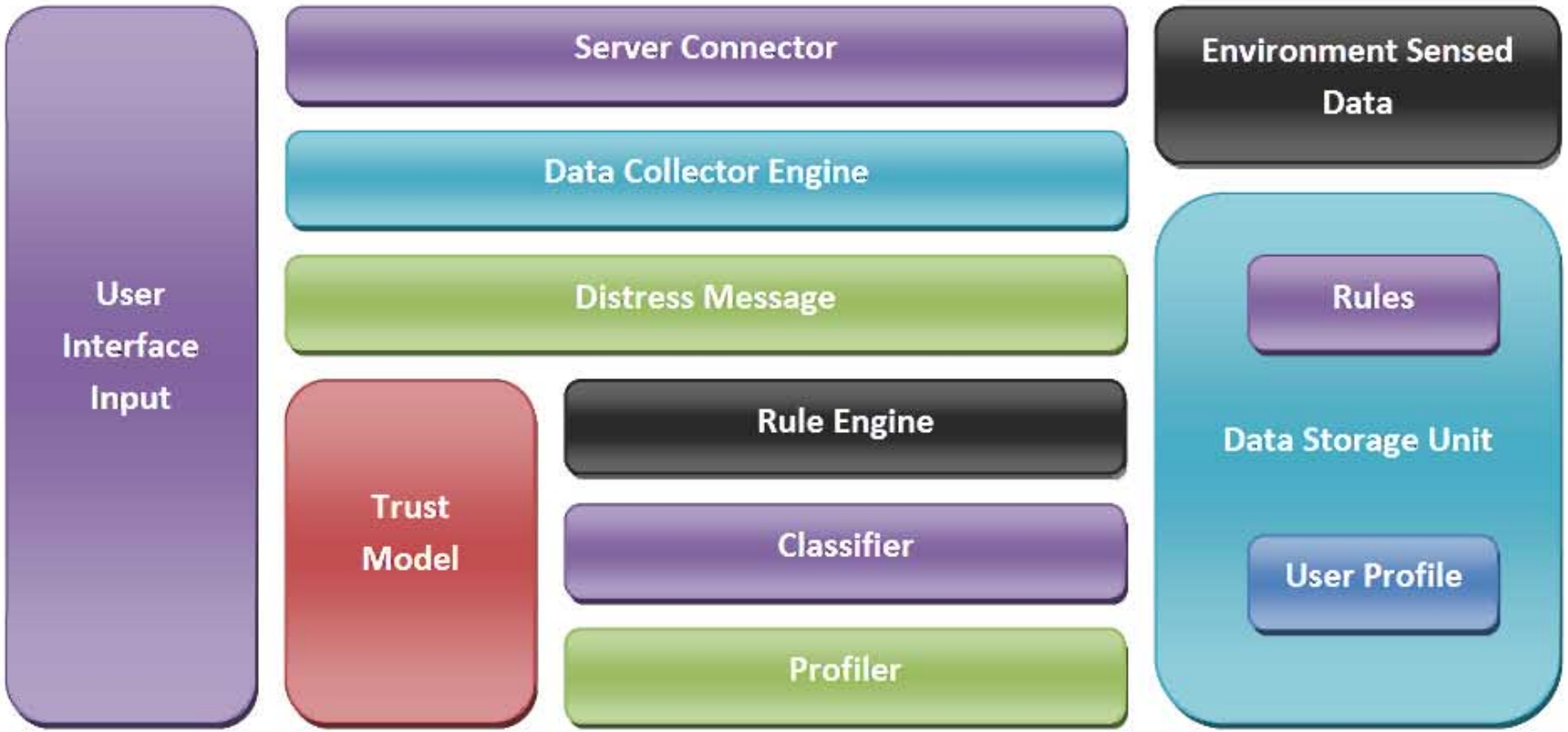
Hardware Interface

- The hardware interface provides connectivity with available radio technologies on the device.
- Current Implementation - Bluetooth

Protocol Stack



Profiler And Connectors



Trust Model

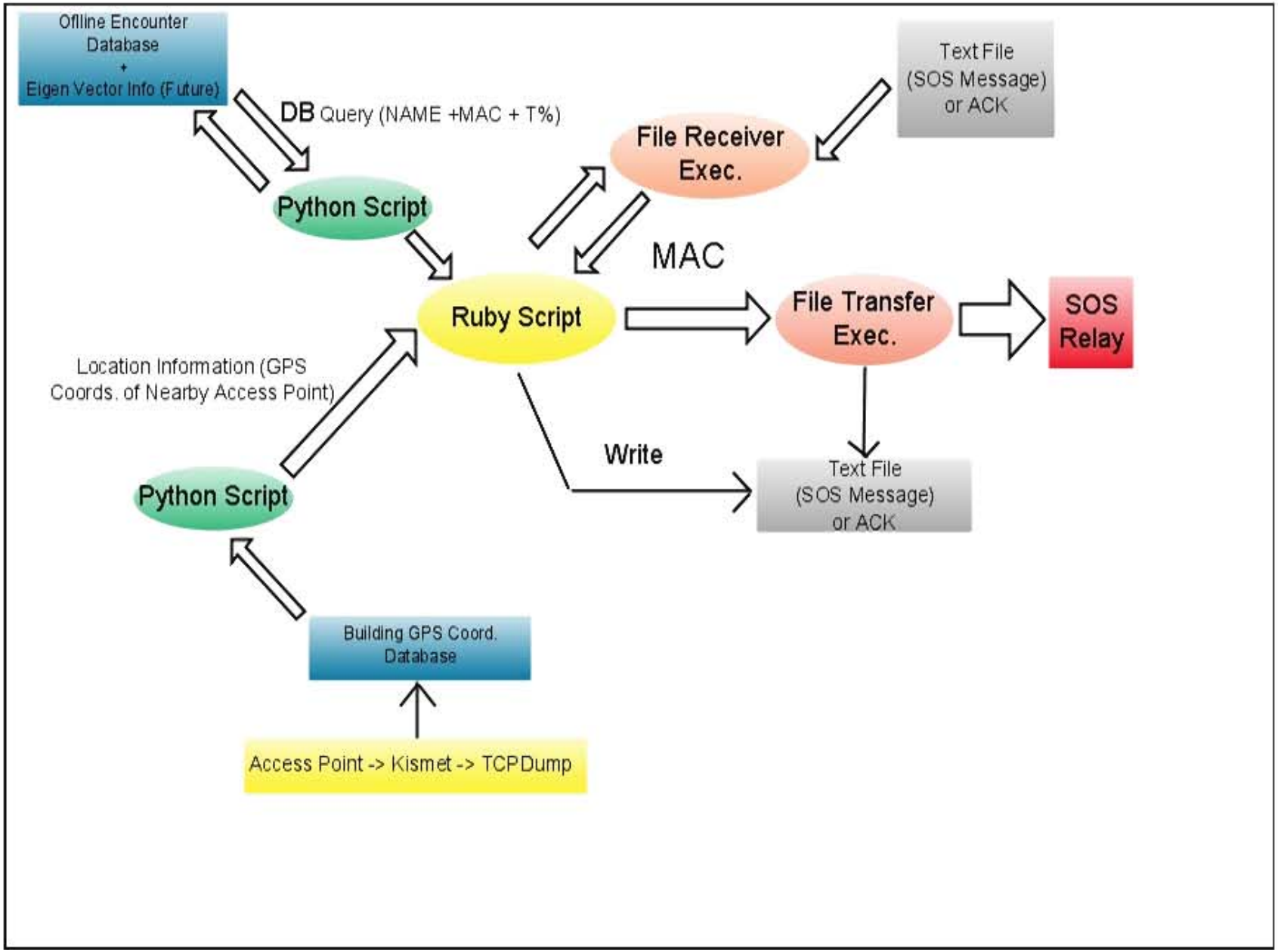
- Trust model is a rule-based classifier that recognizes Bluetooth encounter and assigns them into various classes of trust.

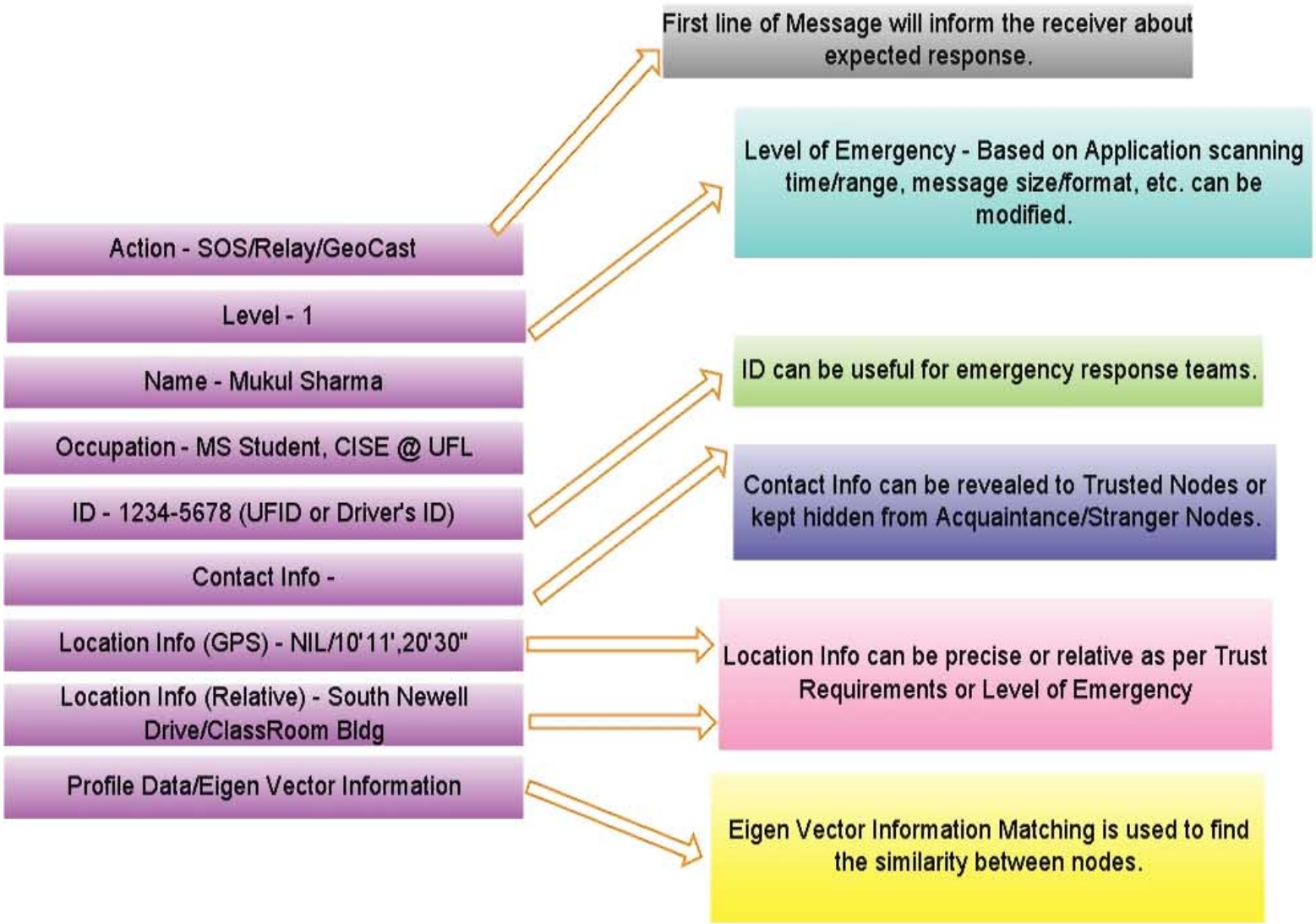
1. Location and vicinity information of Bluetooth encounter
2. Tags that define the level of trust with an encountered device. These tags are similar to ranks and status quo of a person, i.e. doctors, security personnel
3. Duration, frequency and clock time of the encounter
4. Devices encountered from the contact address books; and
5. Activity based encounters, which describes the circumstances when Bluetooth encountered happened.


12:41 PM
On-Campus SOS Service
Q1: Select Type of SOS Service
Emergency Help
Alert Help
Select
MENU


12:35 PM
On-Campus Emergency Type
Q1: Select Emergency Type and write Message?
Physical Harm
Burglary
Medical Emergency Help
-Optional Message-
Submit
MENU


12:36 PM
On-Campus Alert Type
Q1: Select Alert Type and write Message?
Hurricane Warning
Thunderstorms
Lightning
-Optional Message-
Submit
MENU


Offline Encounter Database + Eigen Vector Info (Future)
DB Query (NAME +MAC + T%)
Python Script
File Receiver Exec.
Text File (SOS Message) or ACK
MAC
Ruby Script
File Transfer Exec.
SOS Relay
Location Information (GPS Coords. of Nearby Access Point)
Write
Text File (SOS Message) or ACK
Python Script
Building GPS Coord. Database
Access Point -> Kismet -> TCPDump


First line of Message will inform the receiver about expected response.
Level of Emergency - Based on Application scanning time/range, message size/format, etc. can be modified.
Action - SOS/Relay/GeoCast
Level - 1
Name - Mukul Sharma
Occupation - MS Student, CISE @ UFL
ID - 1234-5678 (UFID or Driver's ID)
Contact Info -
Location Info (GPS) - NIL/10'11',20'30"
Location Info (Relative) - South Newell Drive/ClassRoom Bldg
Profile Data/Eigen Vector Information
ID can be useful for emergency response teams.
Contact Info can be revealed to Trusted Nodes or kept hidden from Acquaintance/Stranger Nodes.
Location Info can be precise or relative as per Trust Requirements or Level of Emergency
Eigen Vector Information Matching is used to find the similarity between nodes.

Trace Processing

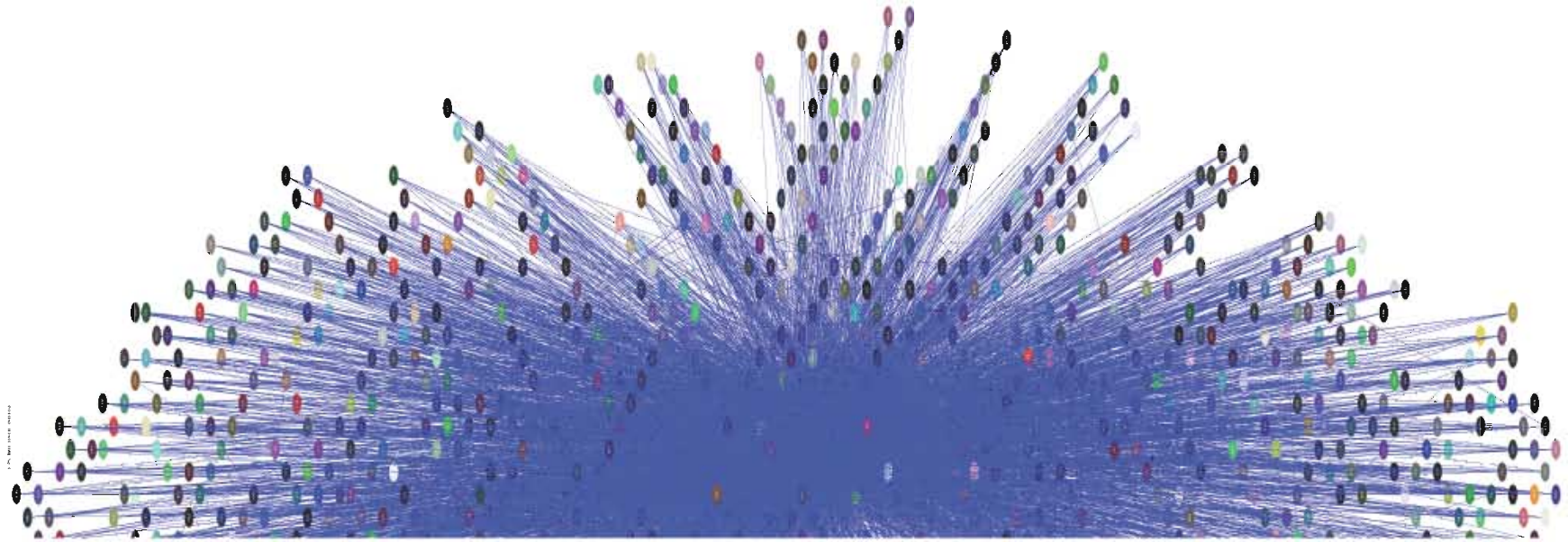
Typical Trace Structure

Start Time	Location/AP	Duration
306722	95	7404
314127	136	758
314885	2	1651
375121	57	8277
549427	57	5096
554523	95	3687
833145	147	4778
837923	57	1200
902333	109	1524
903857	126	4091
907948	57	3628
915513	69	1444

Possible Usages

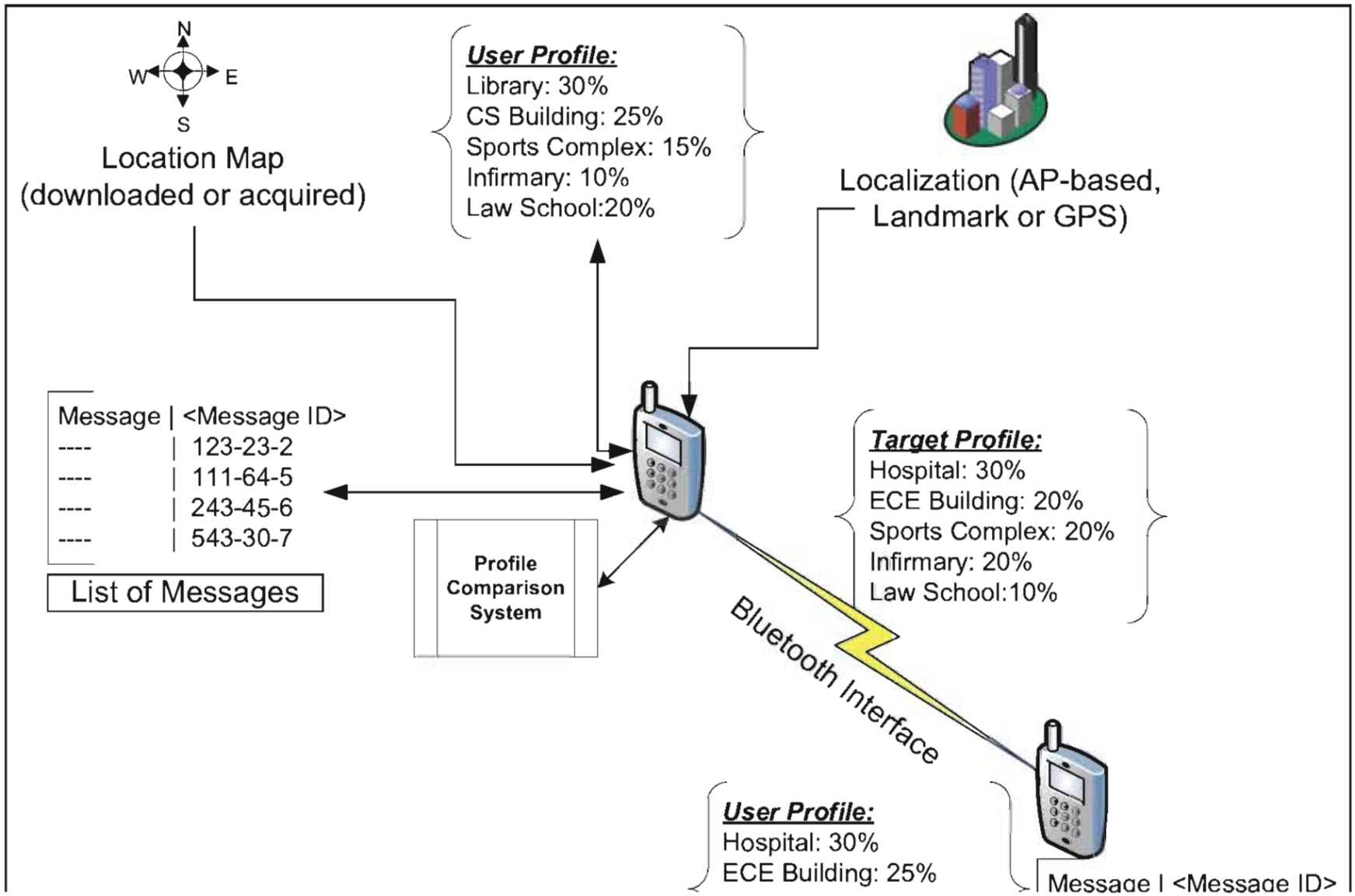
- Generating Association Matrix
- Encounter Matrix
- Google Earth Location Density Maps
- Hourly, Weekly, Daily… Usage of Users
- …..

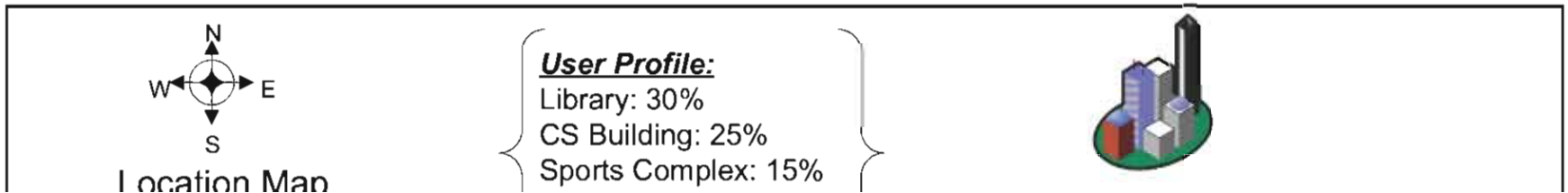
User Meetings in One Month - MIT



User Meetings in One Month - MIT

Profile-Cast Application Architecture


N
W
E
S
Location Map
(downloaded or acquired)
User Profile:
Library: 30%
CS Building: 25%
Sports Complex: 15%
Infirmary: 10%
Law School:20%
Localization (AP-based,
Landmark or GPS)
Message | <Message ID>
---- | 123-23-2
---- | 111-64-5
---- | 243-45-6
---- | 543-30-7
List of Messages
Profile
Comparison
System
Target Profile:
Hospital: 30%
ECE Building: 20%
Sports Complex: 20%
Infirmary: 20%
Law School:10%
Bluetooth Interface
User Profile:
Hospital: 30%
ECE Building: 25%
Message | <Message ID>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