

Design of a Web-Based Services for Supporting AVL System

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Topics of Discussion

- Introduction
- Problem Statement and Solution
- System Design
- System Analysis
- System Integration and Testing
- Lessons Learned

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Introduction

- What is AVL?
- AVL and GPS
- How can AVL be used for fleet management?
- Zoom Information Systems
 - TerraFleet

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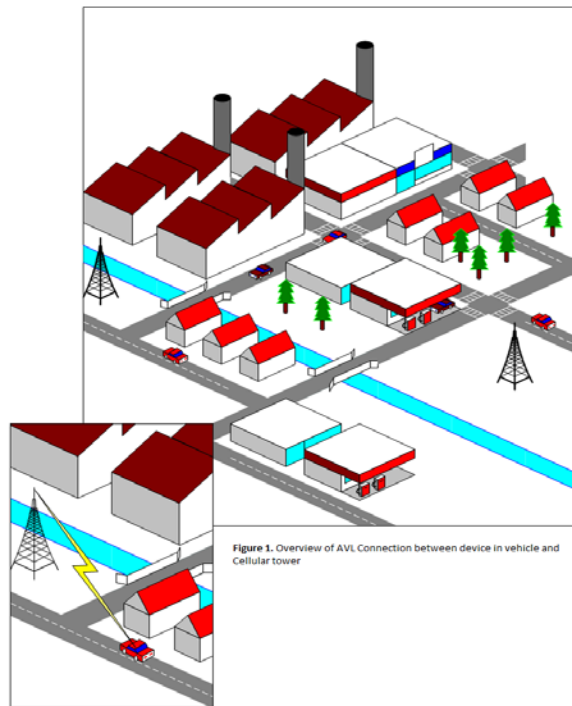


Figure 1. Overview of AVL Connection between device in vehicle and Cellular tower

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Problem Statement

- Problems with the current systems
 - Flexibility
 - Portability
 - Expandable

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Source: calamp.com

Solution

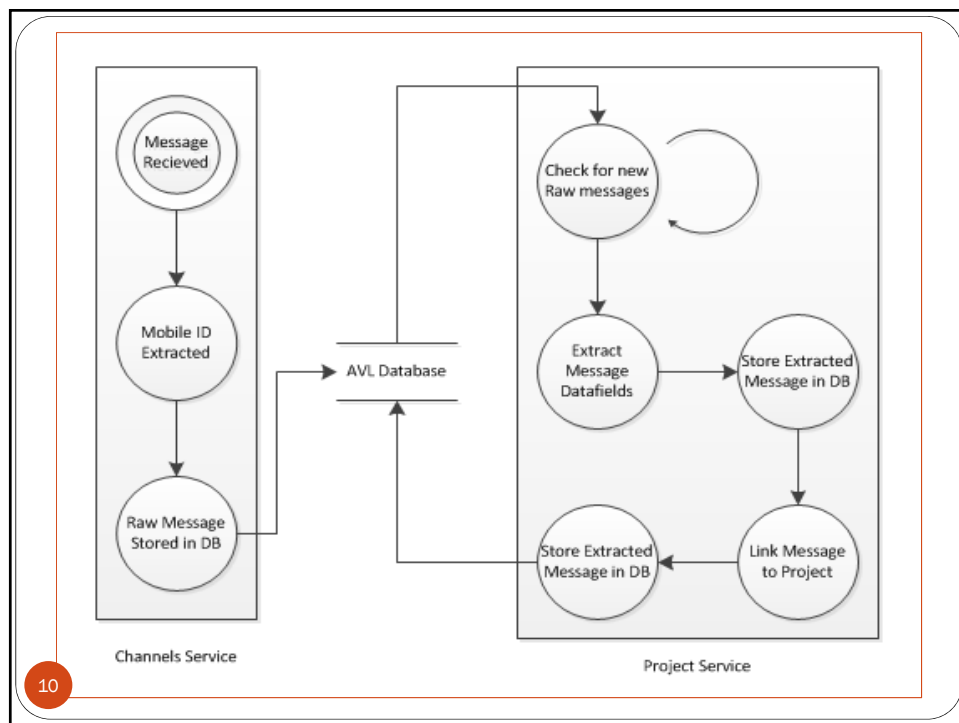
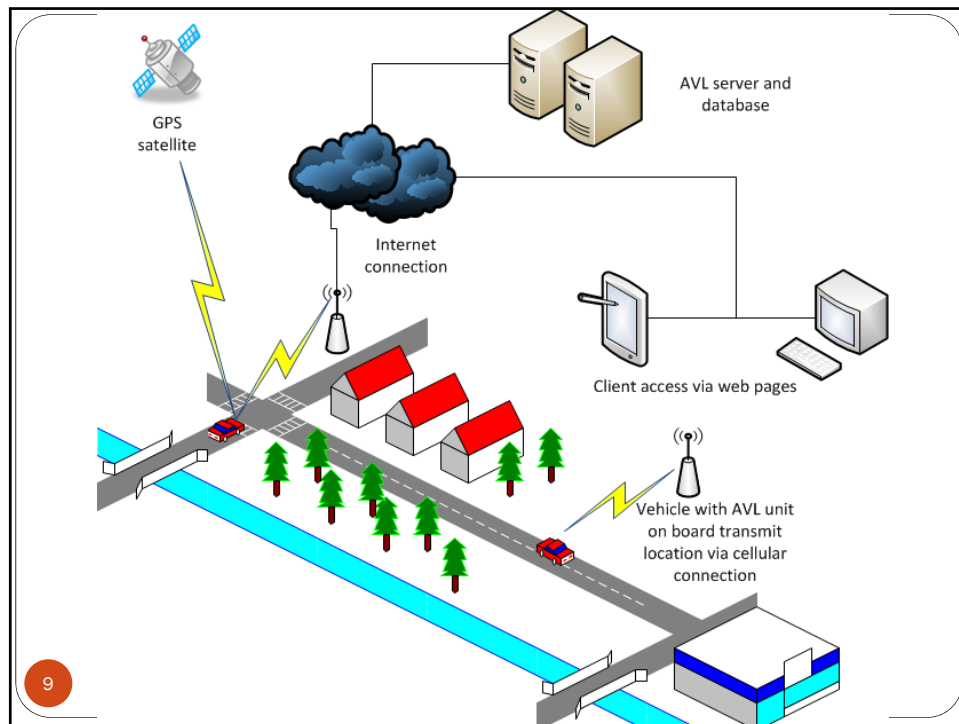
- Solution
 - Mobile devices
 - Elimination of dedicated hardware
- Added value to existing system
 - Android operating system
 - Integrated features

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System Design

- Critical enabling technology
 - Internet
 - Necessary for server service to store data
 - Cellular carrier networks
 - Necessary for transmission of tracking data
 - Global Positioning System
 - Necessary to perform all tracking
 - Zoom's TerraFleet
 - Existing AVL platform

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Message Formats

Field	Length (bytes)	Description
Message Header	2	Known bytes for error check
Mobile ID	16	Unique identifier of the device
Message Sequence	2	Unique message sequence number
Message Type	1	Type of message (see Message Type table)
Payload Length	2	Length of the message payload
Payload	Variable	Specific to message types
CRC	1	Least-significant byte of the sum of all message bytes excluding Message Header and CRC

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Message Types

Message Type Values		
Message Type	Value	Description
Acknowledgement (Ack)	1	Message acknowledgement
Negative Acknowledgement (Nack)	2	Signifies a problem with the message
User Data Message	4	User Information from QR code
Picture Message	9	Picture sent from Android device
Location Message	10	Generic location report

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Acknowledgement Message

Field	Length (bytes)	Description
Message Header	2	Known bytes for error check
Mobile ID	6	Unique identifier of the device
Message Sequence	2	Unique message sequence number
Message Type	1	Value of 1 for Ack message
Payload Length	2	Length of the message payload
Mobile ID	6	Same Mobile ID as the message replying to
Message Sequence	2	Same sequence number as the message replying to

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Complete Location Message Format

Field	Length (bytes)	Description
Message Header	2	Known bytes for error check
Mobile ID	6	Unique identifier of the device
Message Sequence	2	Unique message sequence number
Message Type	1	Type of message (see Message Type table)
Payload Length	2	The value of the length for the location message is 21 bytes
Timestamp	4	Offset in seconds from GPS epoch (January 1, 1970 00:00:00 UTC)
Longitude	4	Actual longitude * 10000000 Decimal degrees
Latitude	4	Actual latitude * 10000000 Decimal Degrees
Altitude	2	Actual altitude * 100 Meters above sea level
Heading	2	Actual heading * 100 Decimal degrees, 0 north increasing clockwise
Speed	2	Actual speed * 100 Meters per second
Distance	2	Actual distance * 100 Meters Distance accumulator from install time
GPS Quality	1	Indication of the strength of the GPS signal, 0, 1, or 2. 0 is worst.
14	1	Least-significant byte of the sum of all message bytes excluding Message Header and CRC

Complete Picture Message Format		
Field	Length (bytes)	Description
Message Header	2	Known bytes for error check
Mobile ID	6	Unique identifier of the device
Message Sequence	2	Unique message sequence number
Message Type	1	Type of message (see Message Type table)
Payload Length	2	The value of the length for the location message is variable
Chunk Number	2	Current piece of the image
Total Chunks	2	Total amount of pieces image has been split into
Image Chunk	Variable	Chunk of image bytes

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System Analysis

- Scope Definition
- Requirements analysis
- Logical design

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Scope

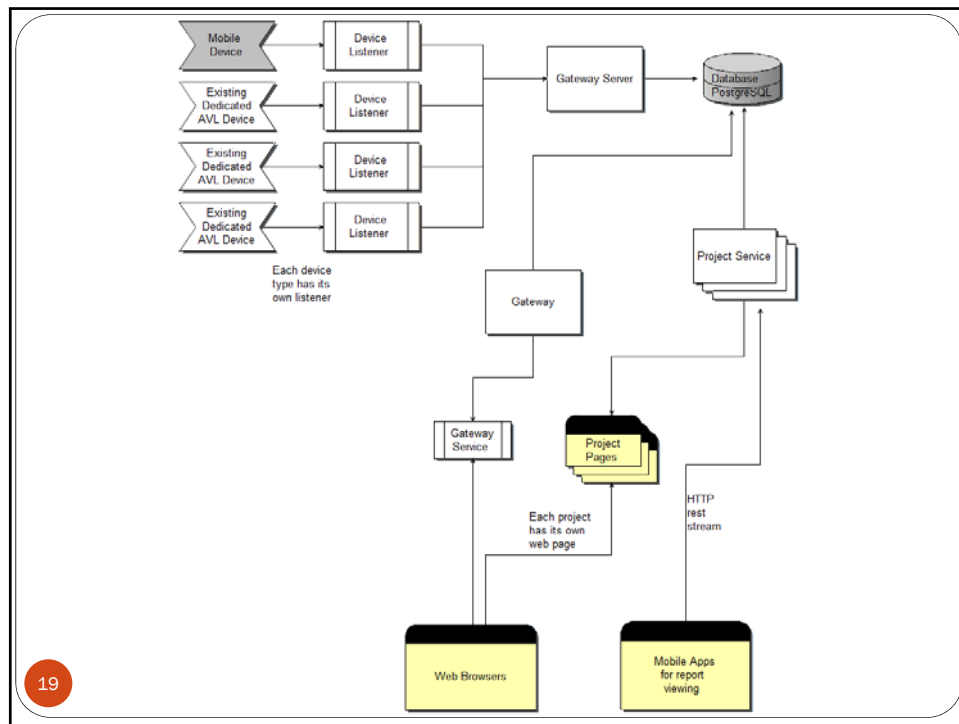
- The scope of this project will encompass the following:
 - Three additional class libraries to support the new protocol
 - Database modifications to allow for images

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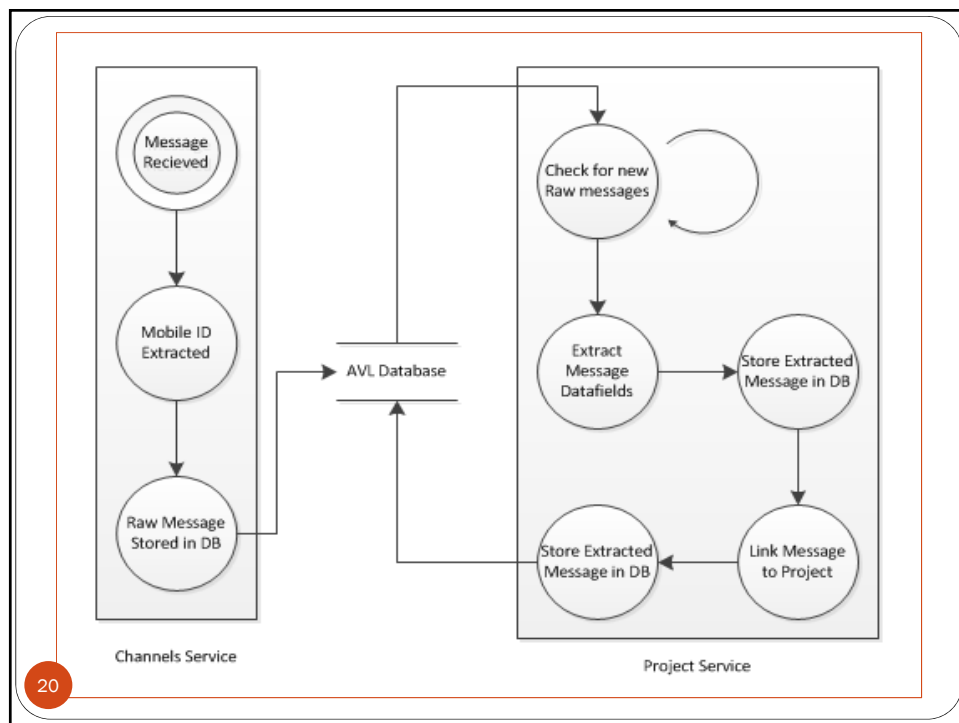
Key Requirements

- Project SHALL use message protocol established by Zoom
- Project SHALL integrate into existing TerraFleet software
- Project SHALL be compatible with existing AVL database

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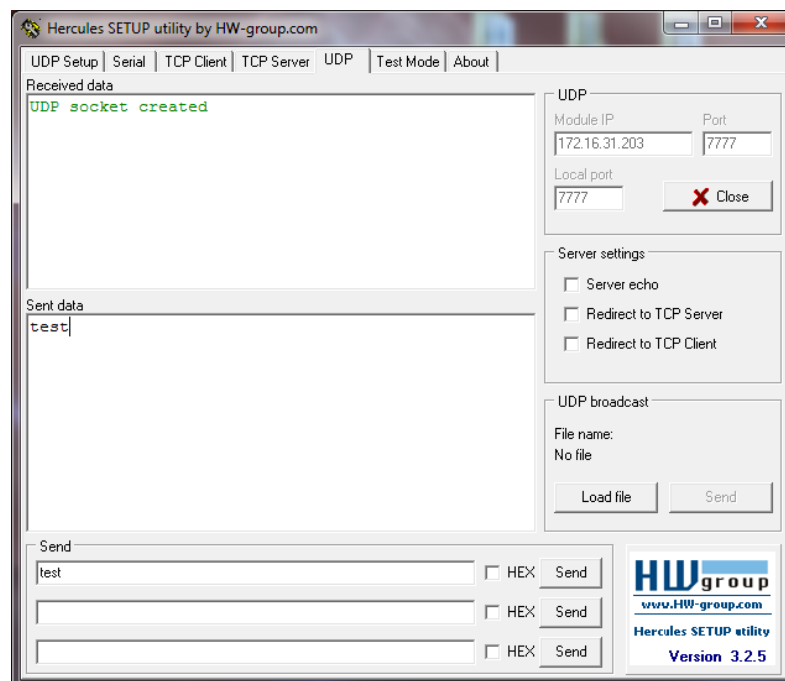


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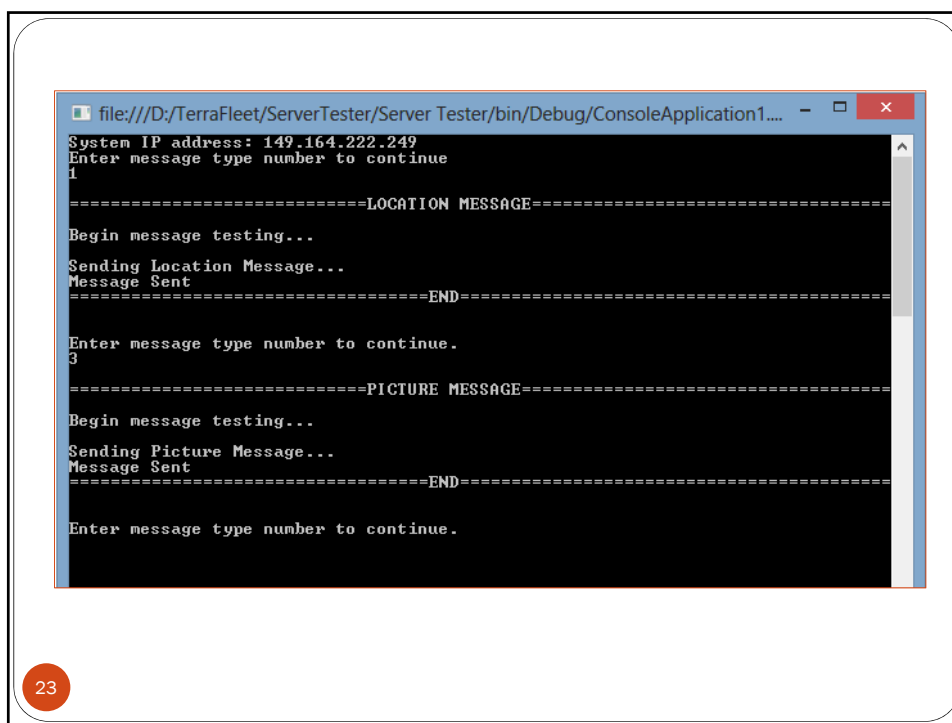
System Integration and Testing

- Testing Tools
 - Hercules SETUP Utility
 - ServerTester
 - Log2Console
- Testing Method

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2	22453485	7	17	736	2013-04-30	<AvlMessage
3	22453486	7	17	736	2013-04-30	<AvlMessage
4	22453487	7	17	736	2013-05-01	<AvlMessage
5	22453488	7	17	736	2013-05-01	<AvlMessage
6	22453489	7	17	736	2013-05-01	<AvlMessage
7	22453490	7	17	736	2013-05-01	<AvlMessage
8	22453491	7	17	736	2013-05-01	<AvlMessage
9	22453492	7	17	736	2013-05-01	<AvlMessage
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Lessons Learned

- Risk Assessment
- Schedule Monitoring
- Communication Protocols
- UDP vs TCP/IP

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Demonstration

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