DIMETRA APPLICATION PROGRAMMING INTERFACE (API) TRAINING

Dimetra Subscriber Interface

GPS

Course Structure

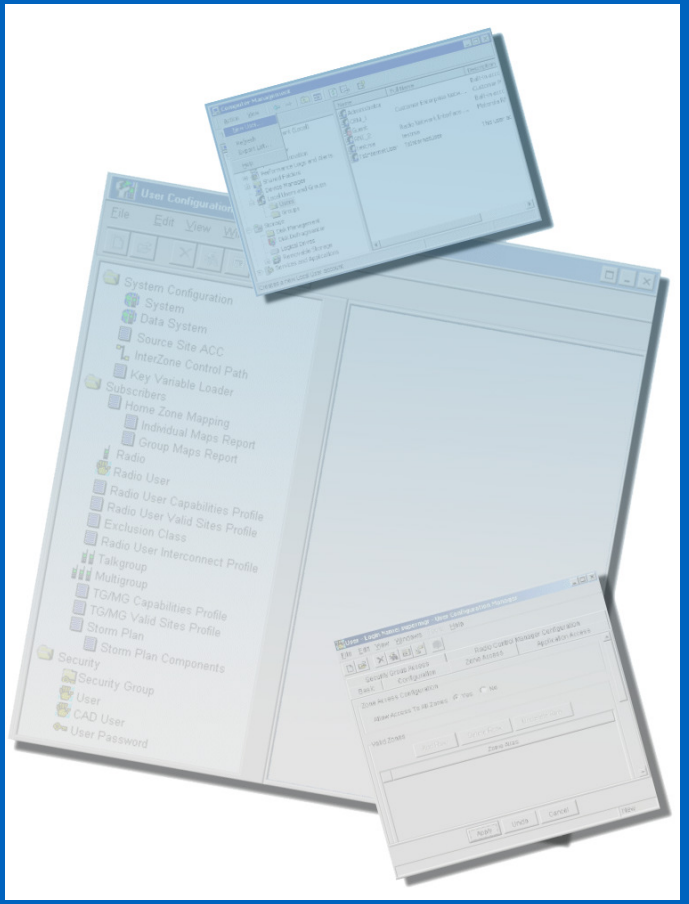
Module 1 - Course Introduction

Module 2 – LRRP Protocol

Module 3 – LIP Protocol

Module 4 – Examples

Module 5 - Course Summary



Overview

Dimetra System support GPS feature

No extra GPS equipment needed

Radio should be GPS enabled

2 protocols avail:

- LRRP
- LIP

LRRP

LRRP

Based on:

- Wireless Access Protocol Location Protocol (WLP)
- Location Interoperability Forum Mobile Location (MLP)

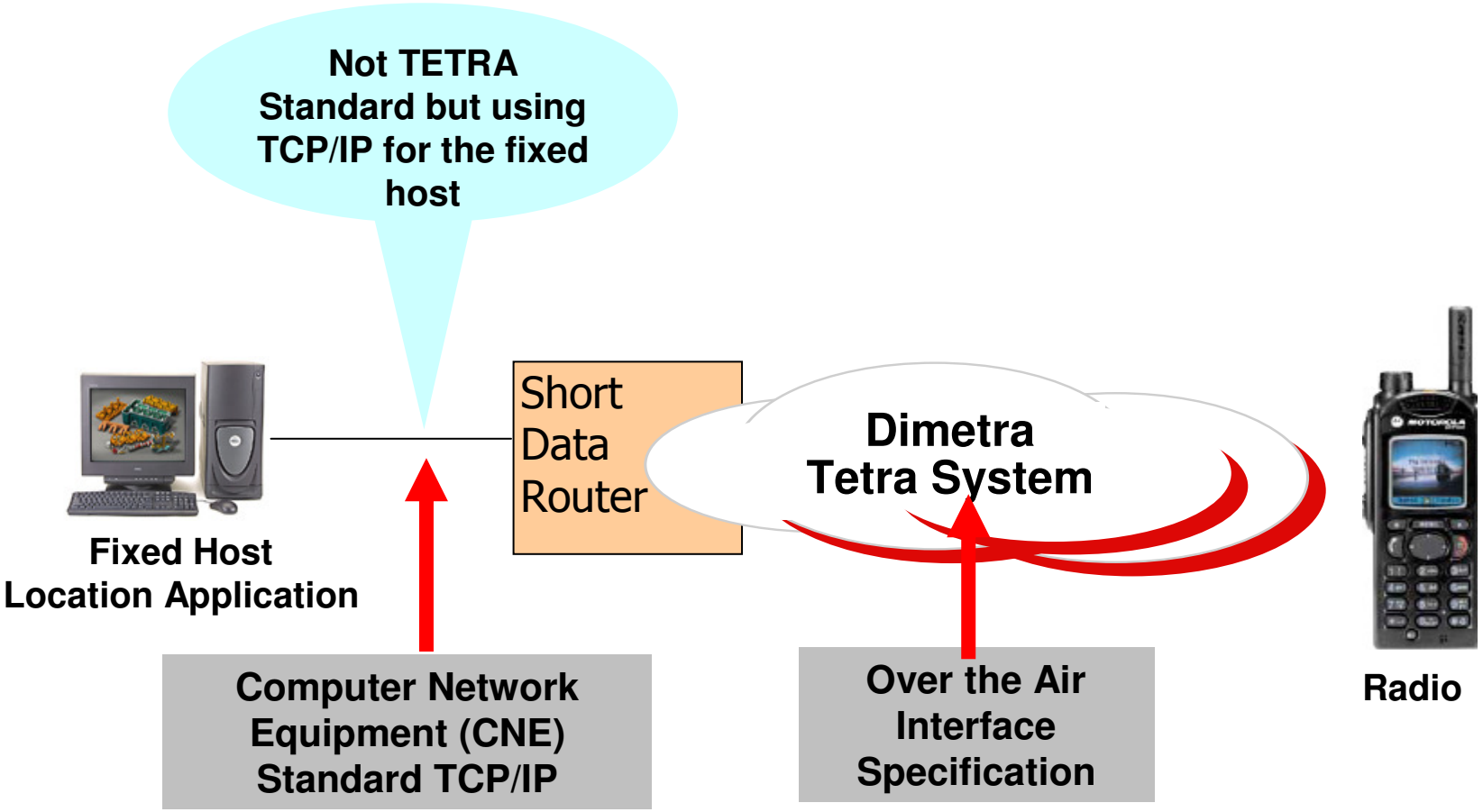
Designed to:

- Allows easy translation of WLP & MLP
- Allows translation for future definitions of WLP & MLP

LRRP Messages Based on MBXML:

- Encoding efficiency
- Easy XML conversion used by WLP & MLP

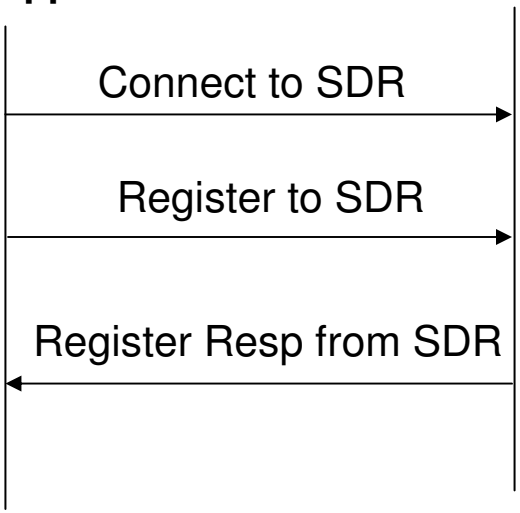
Network Entities



Connection to SDR

Fixed Host Location Application

Short Data Router



TCP/IP Connection

IP Address & Port

Connection to SDR & Register

Message Exchange:

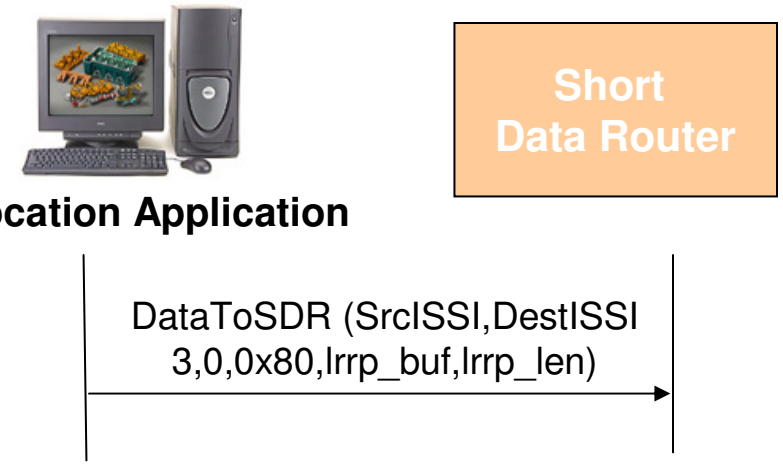
- SDS w/o TL
- SDS w TL

Message Exchanged

Methods:

- Message exchanged using SDS with TL
  - PI = 131
- Message exchanged using SDS without TL
  - PI = 3

Message Sending using SDS without TL



Using the function DataToSDR
The following parameters are set:

SrcISSI:	The ISSI of the Location Application
DestISSI:	The ISSI of the receiving radio
Protocol Identifier:	Set fixed to 3 for SDS without TL service
DeliveryFlags:	Set fixed to 0, but ignored for SDS without TL service
Application Protocol Identifier:	Set fixed to 0x80
LRRP Message Buffer:	Buffer containing the LRRP message
LRRP Message Length:	Length in bytes of the LRRP message

Message Receiving using SDS without TL

Location Application

Short Data Router

DataFromSDR(DestISSI, SrcISSI, 3,lrrp_buf,lrrp_len)

Using the function DataToSDR
The following parameters are set:

DestISSI:	**The ISSI of the receiving radio**
SrcISSI:	**The ISSI of the Location Application**
Protocol Identifier:	**Set fixed to 3 for SDS without TL service**
LRRP Message Buffer:	**Buffer containing the LRRP message**
LRRP Message Length:	**Length in bytes of the LRRP message**

Message Sending using SDS with TL

Location Application

Short Data Router

Data to SDR (SrcISSI,DestISSI,PI, flags,0x80,lrrp_buf,lrrp_len)

DataFromSDR (DestISSI,SrcISSI,PI,szText, szLen)

If delivery received report requested

Data to SDR (DestISSI,SrcISSI, PI, szText, szLen)

If delivery consumed report requested

Flags:

- **#define DELIVERY_REQUEST_RECEIVED ((unsigned char) 0x80)**
- **#define DELIVERY_REQUEST_CONSUMED ((unsigned char) 0x40)**
- **#define DELIVERY_REQUEST_STORAGE_ALLOWED ((unsigned char) 0x20)**

The responses will receive only if they are requested

Protocol Identifier is 131 for SDS service with TL

Message Receiving using SDS with TL

Location Application

Short
Data Router

DataFromSDR(DestISSI, SrcISSI,
PI,lrrp_buf, lrrp_len)

Same parameters as for SDS without TL

PI = 131

LRRP Services

Unsolicited Location Report Service

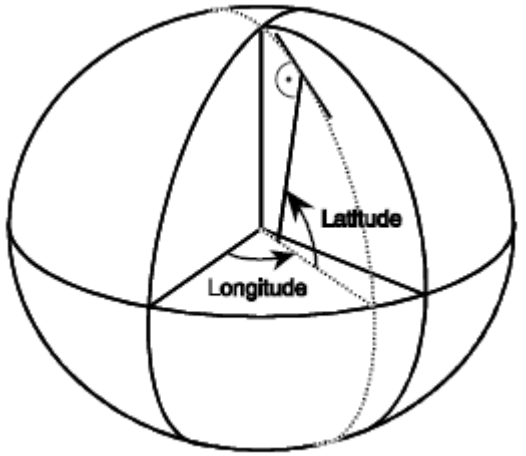
Immediate Location Service

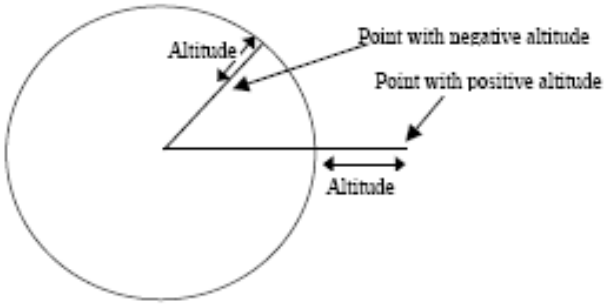
Triggered Location Service

Location Protocol Version Service

Unsolicited Location Reports

```
<Unsolicited-Location-Report>
   <request-id>2F</request-id>
   <info-data>
      <info-time>20060314014635</info-time>
      <shape>
         <point-3d>
            <lat>5.297691</lat>
            <long>0.291702</long>
            <altitude>-19</altitude>
            <altitude-acc>31</altitude-acc>
         <point-3d>
      </shape>
      <speed-hor>0</speed-hor>
      <direction-hor>53</direction-hor>
      <lev-conf>67</lev-conf>
   </info-data>
</Unsolicited-Location-Report>
```





Immediate Location Requests

```
<Immediate-Location-Request>
   <request-id>50</request-id>
   <query-info>
   <request-prio request-prio-type="NORMAL"/>
      <ret-info ret-info-time="YES"/>
      <request-altitude/>
   </query-info>
</Immediate-Location-Request>
```

This leads to the following MBXML notation:

Octet Stream	Description
05	Document Identifier: Immediate Location Request
05	The number of octets in the tokenised immediate location request document
22	Start of request-id element, indicating that opaque data follows
01 50	One octet, request-id value = "50"
	Start of query-info element (not encoded)
	Request-prio normal is not encoded (default)
52	Ret-info element associated attribute is 54 that means ret-info-time = "YES"
54	Request-altitude

Immediate Location Report

```
- <Immediate-Location-Report>
    <request-id>50</request-id>
    <info-data>
       <info-time>20041119093123</info-time>
       <shape>
          <point-3d>
             <lat>12.345278</lat>
             <long>0.331388</long>
             <altitude>32</altitude>
          <point-3d>
       </shape>
    </info-data>
  </Immediate-Location-Report>
```

- A radio responses to an immediate location request with an immediate location report.
- In the immediate location request the timestamp of the location fix and the altitude was requested. Therefore in the immediate location report the timestamp and the altitude, as part of a point 3D element is included

Octet Stream	Description
07	Document Identifier: Immediate Location Report
12	The number of octets in the tokenised immediate location report document
23	Start of request-id element, indicating that one octet is following
50	one-octet,request-id value = 0x50
	Start of infodata element (not encoded)
34	Start of info time element
1F 52 E6 97 D7	Info time
67	Start of point 3D element
11 8E C7 49	Latitude: North 12 Degrees 20 Minutes 43 Seconds
EE 75 37 61	Longitude: West 24 Degrees 40 Minutes 7 Seconds
20	Altitude value

Triggered Location Request/Report

Used for a request of the position of a MS under trigger conditions

MS send Triggered Location Report when triggered condition occurs

Request-id is included to be able to stop the trigger

Triggered Location Request

```
<Triggered-Location-Request>
   <request-id>8888</request-id>
   <query-info>
   <request-prio request-prio-type="NORMAL"/>
      <request-altitude/>
   </query-info>
   <periodic-trigger>
      <start-time>20060314014300</start-time>
      <stop-time>20060314015900</stop-time>
      <interval>3</interval>
   </periodic-trigger>
</Triggere
```

- Request is a periodic trigger with the interval value 3 seconds. This means the response will be

Octet Stream	Description
09	Document Identifier: Triggered Location Request
14	The number of octets in the tokenised triggered location report document
22	Start of request-id element,indicating that opaque data follows
02 8888	Two octets,8888
	Start of query-info element (not encoded)
54	Request-altitude
34	Start of periodic trigger element
46	Start of start time element
1F58DC1AC0	Start time
48	Start of stop time element
1F58DC1EC0	Stop time
31	Start of interval element
03	Value of interval element

Triggered Location Answer

```
<Triggered-Location-Answer>
   <request-id>8888</request-id>
   <result result-code="0"></result>
</Triggered-Location-Answer>
```

Octet Stream	Description
0B	Document Identifier: Triggered Location Answer
05	The number of octets in the tokenised triggered location answer document
22	Start of request-id element,indicating that opaque data follows
02 8888	Two octets,8888
38	Start of result element, indicating that the result-code attribute is specified with the value of 0, and no more attributes are specified.

Table 4: Result Codes and their Meaning

result-code	Definition	Description
0	SUCCESS	No error occurred while processing the request. This result can only be returned by an Answer message.
1	SYSTEM FAILURE	The Provider is unable to provide the required information because of a general problem in the server or the underlying network.

Triggered Location Answer (Cont)

result-code	Definition	Description
10	QUERY INFO NOT CURRENTLY ATTAINABLE	The Provider is temporarily unable to provide the required information specified in a query-info.
11	REPORTING WILL STOP	A triggered request has been cancelled, and further reports will not be produced.
12	TIME EXPIRED	The start time or stop time of a triggered request has expired, or the required response timer specified in query-info has expired.
13	DISALLOWED BY LOCAL REGULATIONS	The request is disallowed by local regulatory requirements.
14	NO QUERY INFO FOR ANY REQUESTED ITEM	No required information item was specified in query-info, at least one implementation-specific item as requested, and none of the implementation-specific requested items could be provided. In cases where only a single implementation-specific item was requested (and the information could not be provided), the Responder may use other error codes instead of this one to better specify the reason for not being able to provide the information (e.g., QUERY INFO NOT CURRENTLY ATTAINABLE).
15	NO SUCH REQUEST	No pending request identifiers match the request identifier specified for a Triggered-Location-Stop-Request message.
16	DUPLICATE REQUEST ID	A Query request message contains the same request identifier as in a previously received and uncompleted Query request message.

Triggered Location Report

```
<Triggered-Location-Report>
   <request-id>8888</request-id>
   <info-data>
      <shape>
         <point-3d>
            <lat>5.297573</lat>
            <long>0.291840</long>
            <altitude>3</altitude>
            <altitude-acc>0</altitude-acc>
         <point-3d>
      </shape>
   </info-data
</Triggered-Lo
```

Octet Stream	Description
0D	Document Identifier: Triggered Location Report
0F	The number of octets in the tokenised triggered location report document
22	Start of request-id element,indicating that opaque data follows
02 8888	Two octets,8888
	Start of query-info element (not encoded)
68	Start of point 3D element
07 88 C9 99	Latitude : 5.297573
47 51 92 7D	Longitude: 0.291840
03	Altitude value
00	Altitude accuracy

Triggered Location Stop Request/Answer

```
<Triggered-Location-Stop-Request>
   <request-id>8888</request-id>
</Triggered-Location-Stop-Request>
```

Octet Stream	Description
0F	Document Identifier: Triggered Location Stop Request
04	The number of octets in the tokenised triggered location stop request document
22	Start of request-id element,indicating that opaque data follows
02 8888	Two octets,8888

```
<Triggered-Location-Stop-Answer>
   <request-id>8888</request-id>
  <result result-code="0"></result>
</Triggered-Location-Stop-Request>
```

Octet Stream	Description
11	Document Identifier: Triggered Location Stop Answer
05	The number of octets in the tokenised triggered location stop answer document
22	Start of request-id element,indicating that opaque data follows
02 8888	Two octets,8888
38	Start of result element, indicating that the result-code attribute is specified with the value of 0, and no more attributes are specified.

Location Protocol Request

```
<Location-Protocol-Request>
   <request-id>ABCDE</request-id>
   <request-protocol-version>2</request-protocol-version>
</Location-Protocol-Request>
```

Octet Stream	Description
14	Document Identifier: Location Protocol Request
09	The number of octets in the tokenized location protocol request document
22	Start of request-id element, indicating that opaque data follows
05 41 42 43 44 45	Five octets, "ABCDE"
3F	Start of request protocol version element
02	Request protocol version value

Location Protocol Response

```
<Location-Protocol-Request>
   <request-id>4142434445</request-id>
   <request-protocol-version>1</request-protocol-version>
</Location-Protocol-Request>
```

Octet Stream	Description
15	Document Identifier: Location Protocol Response
09	The number of octets in the tokenized location protocol response document
22	Start of request-id element, indicating that opaque data follows
05 41 42 43 44 45	Five octets, "ABCDE"
36	Start of protocol version element
1	protocol version value

MBXML

- Motorola Binary Extensible Markup Language (MBXML)
- Compact Binary representation of the Extensible Markup Language (XML)
- Reduce the transmission size of XML documents
- Allows more effective use bandwidth-limited communication channels
- MBXML encodes the structure and content of XML documents
- Data Types Definitions

Documentation

LRRP Specification

MBXML Encoding Specification

Technical Guides

Location Interface Protocol (LIP)

LIP

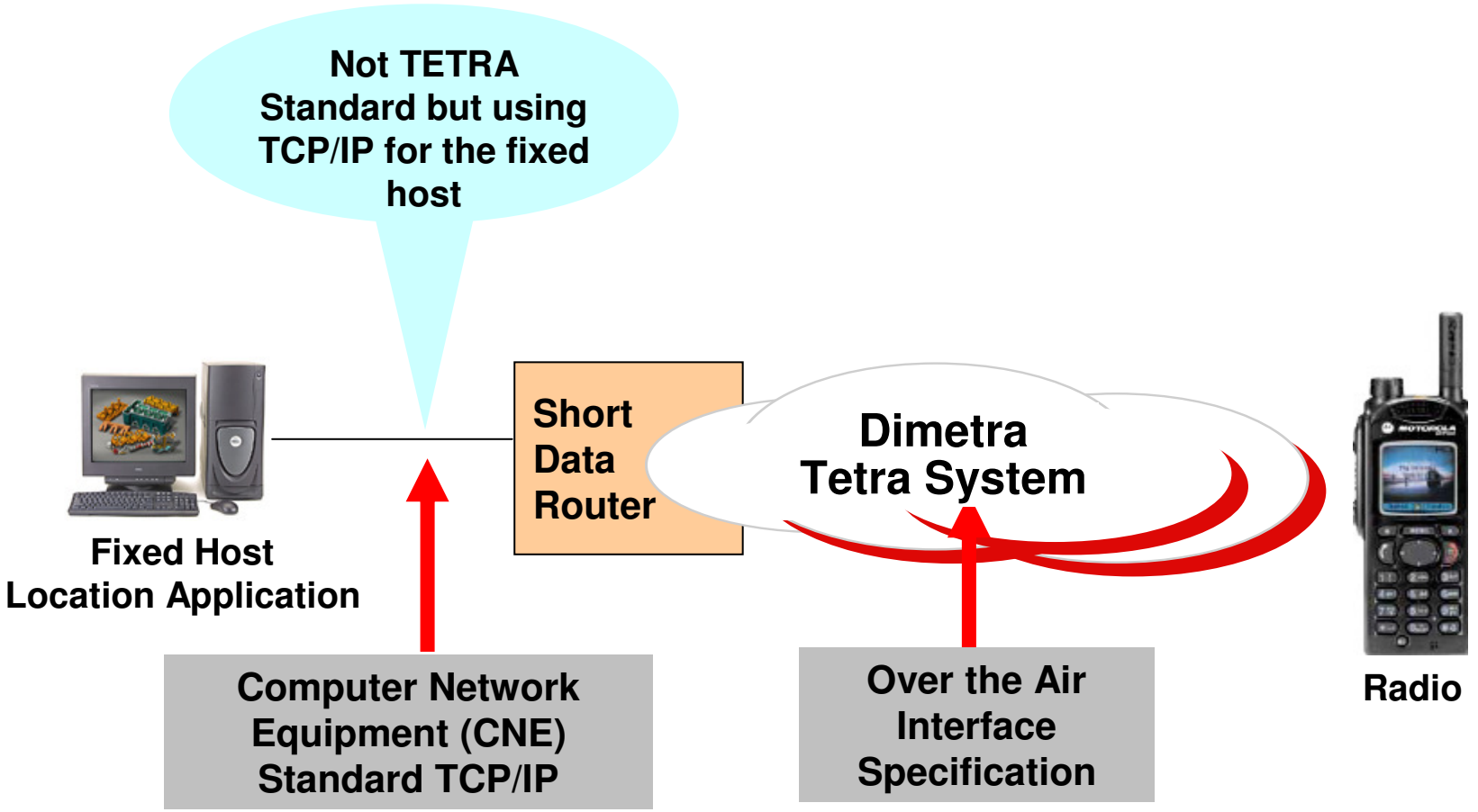
TETRA air interface optimized

- Message size
- Number of messages (location reporting)

May use SDS-TL Service at SDS-TL SAP

May use Packet Data at SNDCP SAP (depends on MS Version)

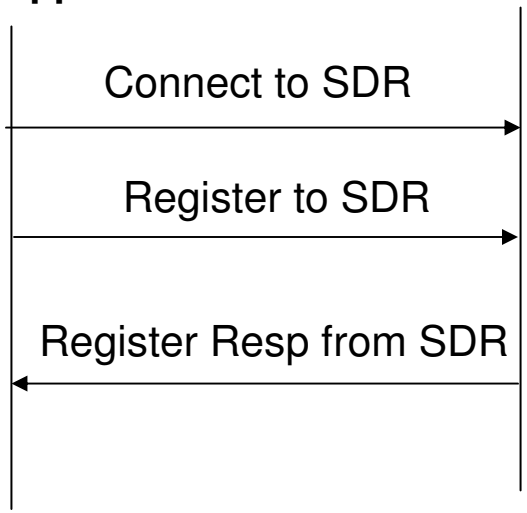
Connection to SDR (D)



Connection to SDR (T)

Fixed Host Location Application

Short Data Router



TCP/IP connection

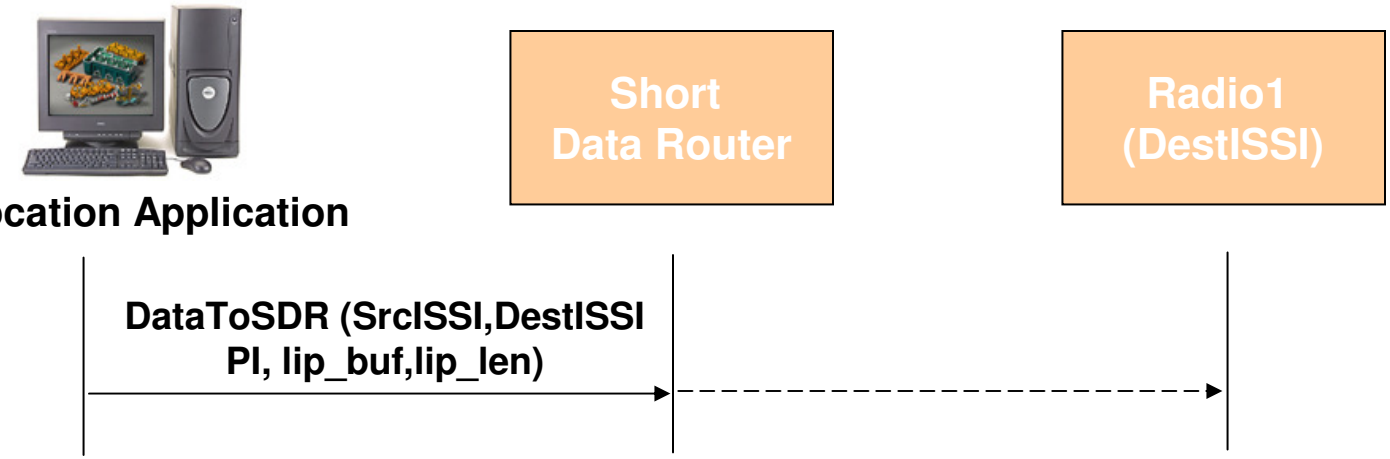
Host Name, Host PassNumber, ISSI, Port Number (6006) for SDR configuration

Register to SDR

Message containing location information can be exchanged by SDS services:

- SDS without TL

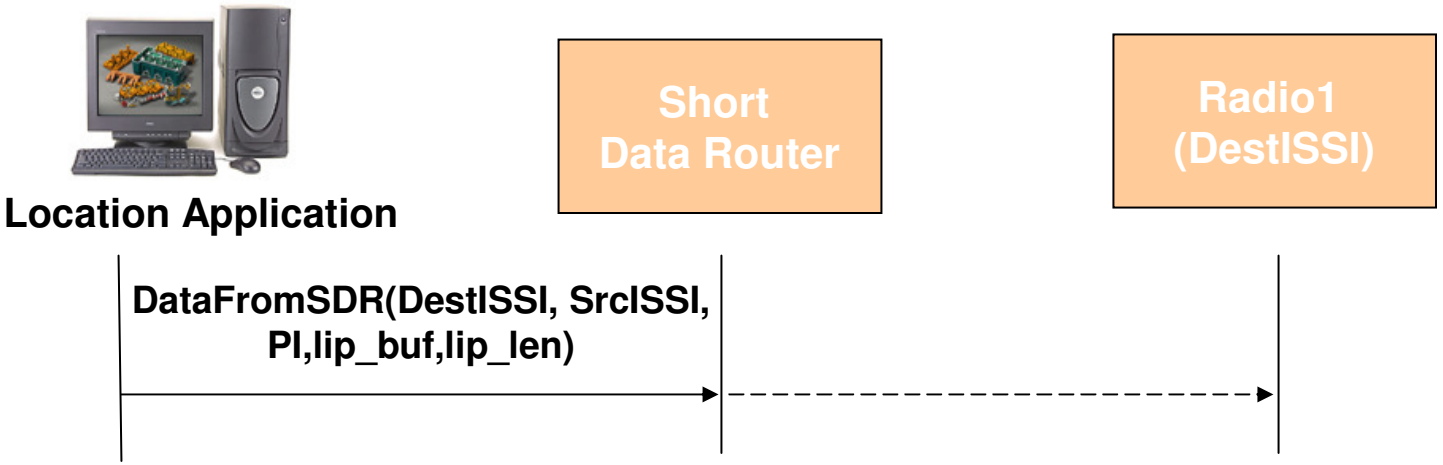
Message Sending using SDS without TL



Using the function DataToSDR()
The following parameters are set:

SrcISSI:	**The ISSI of the Location Application**
DestISSI:	**The ISSI of the receiving radio**
Protocol Identifier (PI):	**Set to 10**
LIP Message Buffer:	**Buffer containing the LIP message**
LIP Message Length:	**Size in bytes of the LIP message**

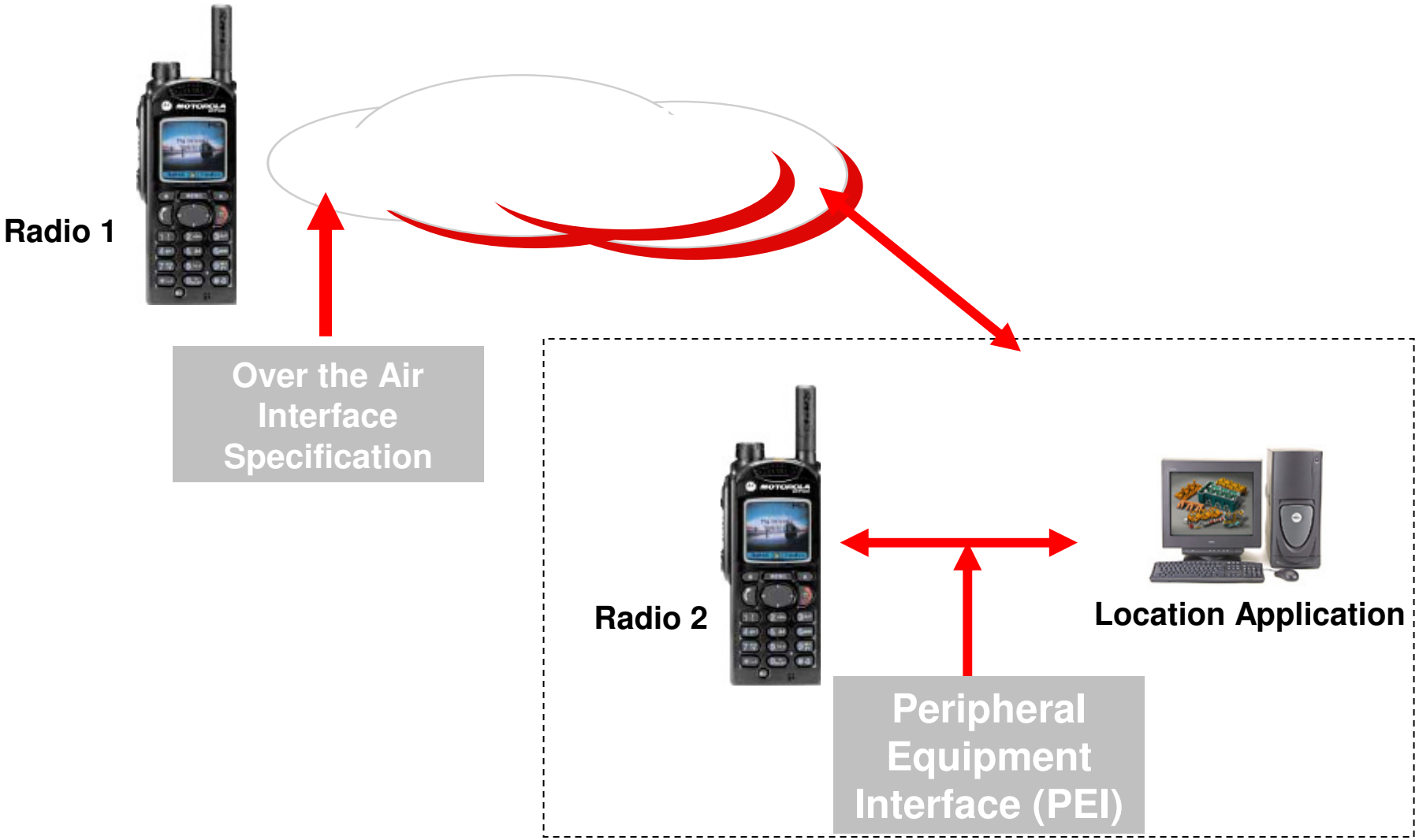
Message Receiving using SDS without TL



Using the function DataToSDR()
The following parameters are set:

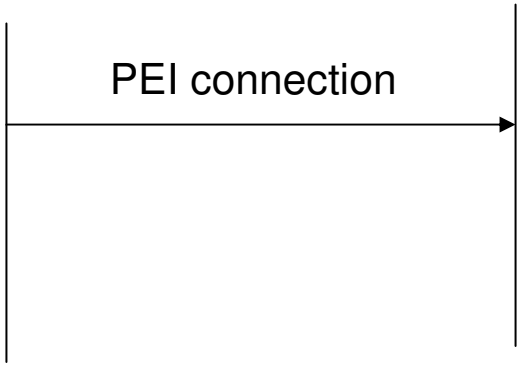
DestISSI:	**The ISSI of the receiving radio**
SrcISSI:	**The ISSI of the Location Application**
Protocol Identifier:	**Set to 10**
LIP Message Buffer:	**Buffer containing the LIP message**
LIP Message Length:	**Length in bytes of the LIP message**

Connection via MT



Connection via MT (Cont)

Location Application



The interface between location application and Radio is a PEI connection

LIP PI, ISSI for PEI connection

Radio should not enabled for LIP

Message containing location information can be exchanged by SDS services:

- SDS without TL

Location Information Protocol Services

Unsolicited Reporting

- Location Information source sends location reports as defined by pre-programmed, without any request

Immediate Reporting

- Location Information requester asks
- Sends location report immediately

Triggered Reporting

- Location information requester sends trigger definitions
- Sends location report as invoked by the defined trigger

LIP Messages

Documentations for references:

ETSI EN 300 392-2 V+D Air Interface, Version 2.5.2

ETSI TS 100 392-18-1 Location Information Protocol, Version 1.3.1 (2007-04)

Supported PDUs

Short Location Report PDU

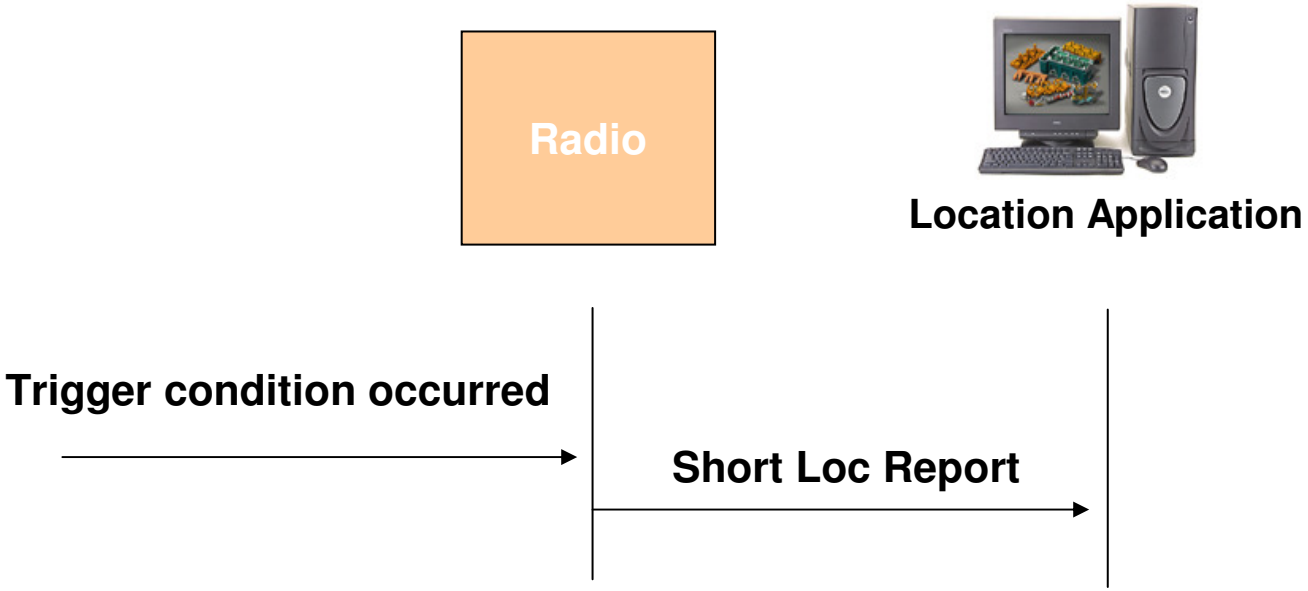
Long Location Report PDU

Location Reporting Enable/Disable Request PDU

Location Reporting Enable/Disable Response PDU

Immediate Location Report Request PDU

Unsolicited Location Report



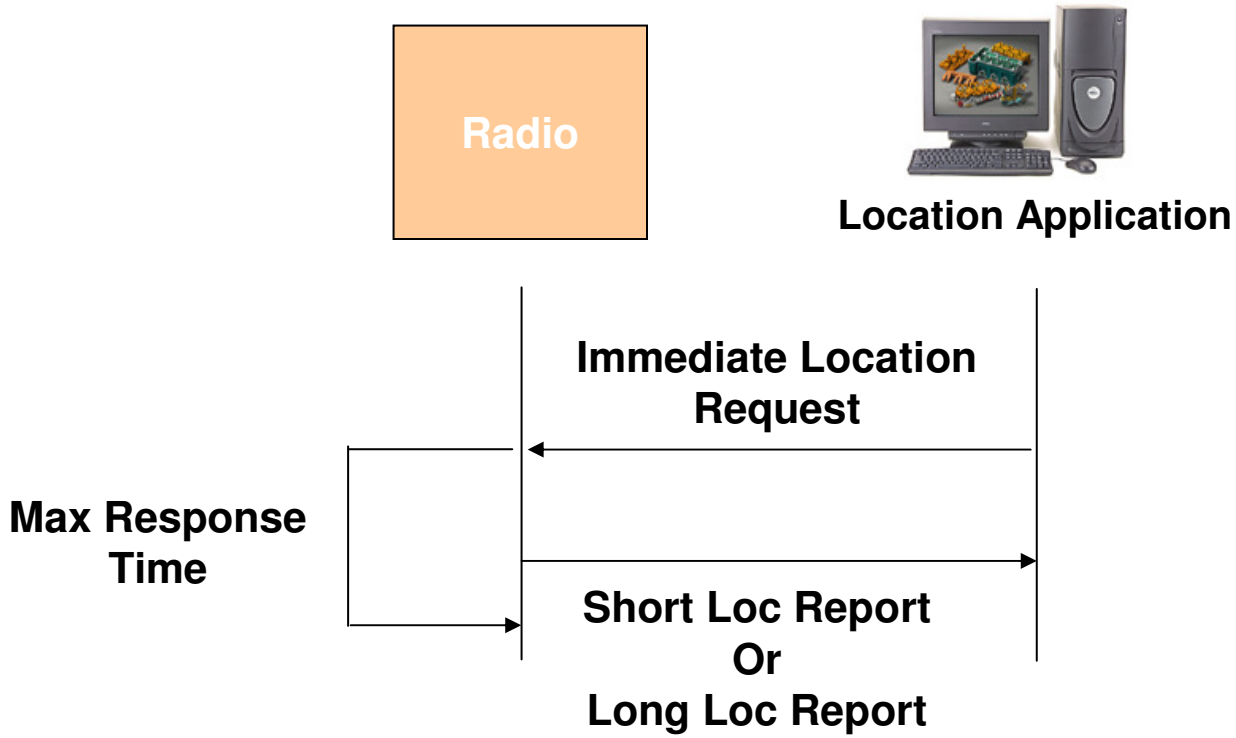
Triggers pre-programmed in the radio

Eg. Short Location Report PDU

PDU: 0x00972842564542FFE81

Information Element	Bit Length	Value	Meaning
PDU Type	2	0	Short Location Report
Time Elapsed	2	0	Position acquired less than 5 seconds ago
Longitude	25	1238280	13.285303
Latitude	24	4901032	52.582369
Position Error	3	2	Less than 200m
Horizontal Velocity	7	127	Horizontal speed is not known
Direction of travel	4	15	337.5 or direction of travel is unknown
Type of additional data	1	0	Reason for sending is included
Reason for sending	8	129	Maximum reporting interval

Immediate Location Request Report



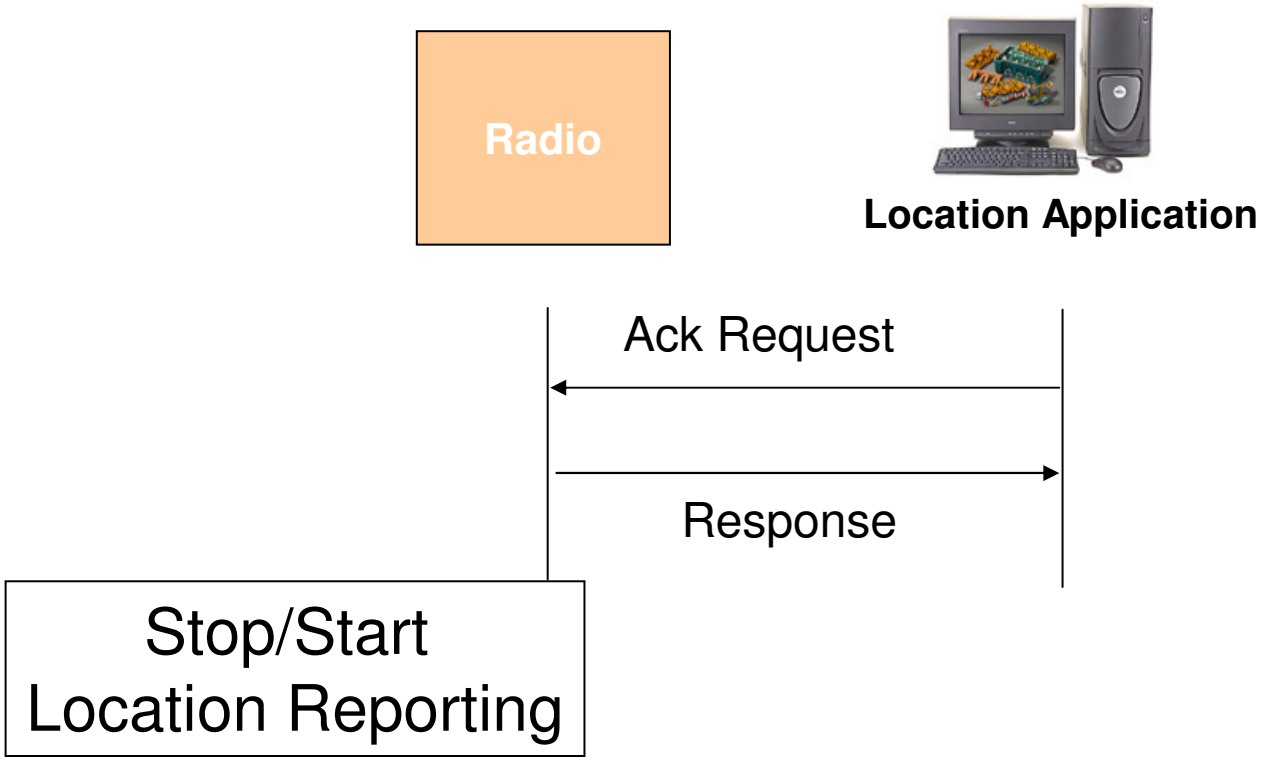
Location Application request an Immediate Location Report

Eg. Immediate Location Report Request PDU

PDU: 0x44CE3A340E14

Information Element	Bit Length	Value	Meaning
PDU Type	2	1	Long location message
PDU Type Extension	4	1	Immediate location report
Request/Response	1	0	Request
Report Type	2	3	Short Location Report Preferred
Max information age			
Type 5 element identifier	5	7	Maximum information age
Type 5 element length	6	7	7 bits
Max information age	7	35	1minute
Maximum response time			
Type 5 element identifier	5	8	Maximum response time
Type 5 element length	6	7	7 bits
Max response time	7	5	10 seconds

Location Reporting Enable / Disable Request / Response



Documentation

Short Data Programmers Guide

ETSI TS 100 392-18-1 V1.3.1 Terrestrial Trunked Radio (TETRA); Voice plus Data (V+D) and Direct Mode Operation (DMO); Part 18: Air interface optimized applications; Sub-part 1: Location Information Protocol (LIP)

LRRP vs LIP

LRRP	LIP
Based on Wireless Access Protocol Location Protocol (WLP) and Mobile Location Protocol (MLP)	Flexible feature set for Location Server and MS
Uses XML optimized for limited bandwidth usage (MBXML) but not TETRA specifically	Emphasize on minimizing the TETRA Air Interface between location server and MS
Allows any simultaneous Location Servers to communicate with MS	Allows one location server to communicate with MS at a time
More flexibility for defining triggers and handling multiple location servers at MS Level	More functionality and optimized for TETRA Air Interface

Summary

Summary

What is LRRP and LIP

LRRP configuration

LRRP service types

LIP configuration

LIP Request/Response Type

LIP PDU data construction

THANK YOU...