DIMETRA APPLICATION PROGRAMMING INTERFACE (API) TRAINING

Dimetra Data Services API

SDTS

Course Structure

Module 1 - Course Introduction

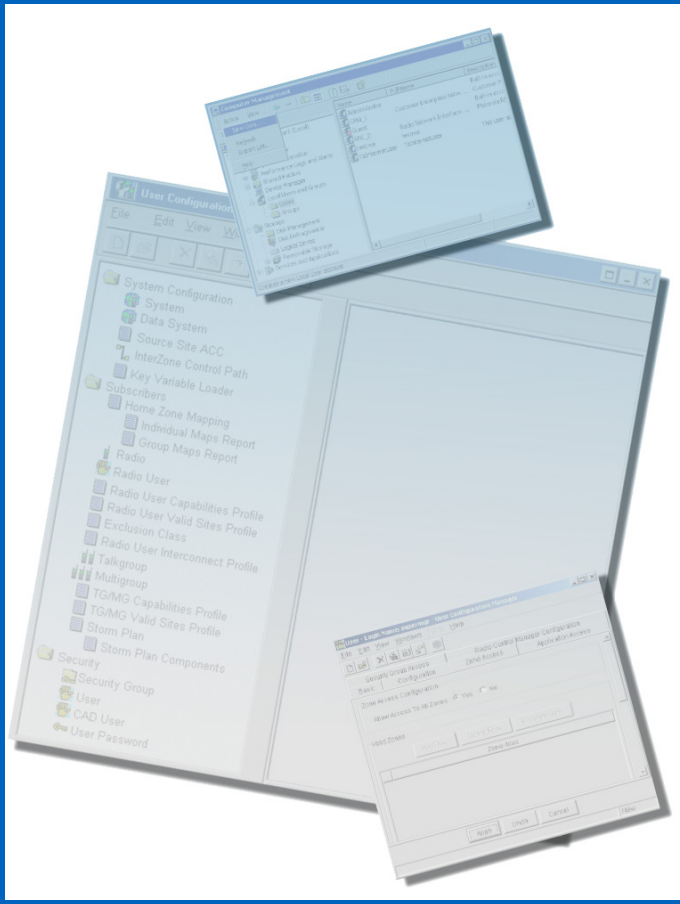
Module 2 – Dimetra Data Service Overview

Module 3 – Short Data Transport Service

Module 4 – SDTS Access Methods

Module 5 – Protocol Headers

Module 6 - Course Summary



Dimetra Data Services Overview

Short Data Transport Services

- PEI SDTS Access Point
- CNE SDTS Access Point
- New Feature in D6.2
- MS Internal Applications

Overview

Dimetra offers two Data Services

- Short Data Transport Services (STDS)
- Packet Data Service (PDS)

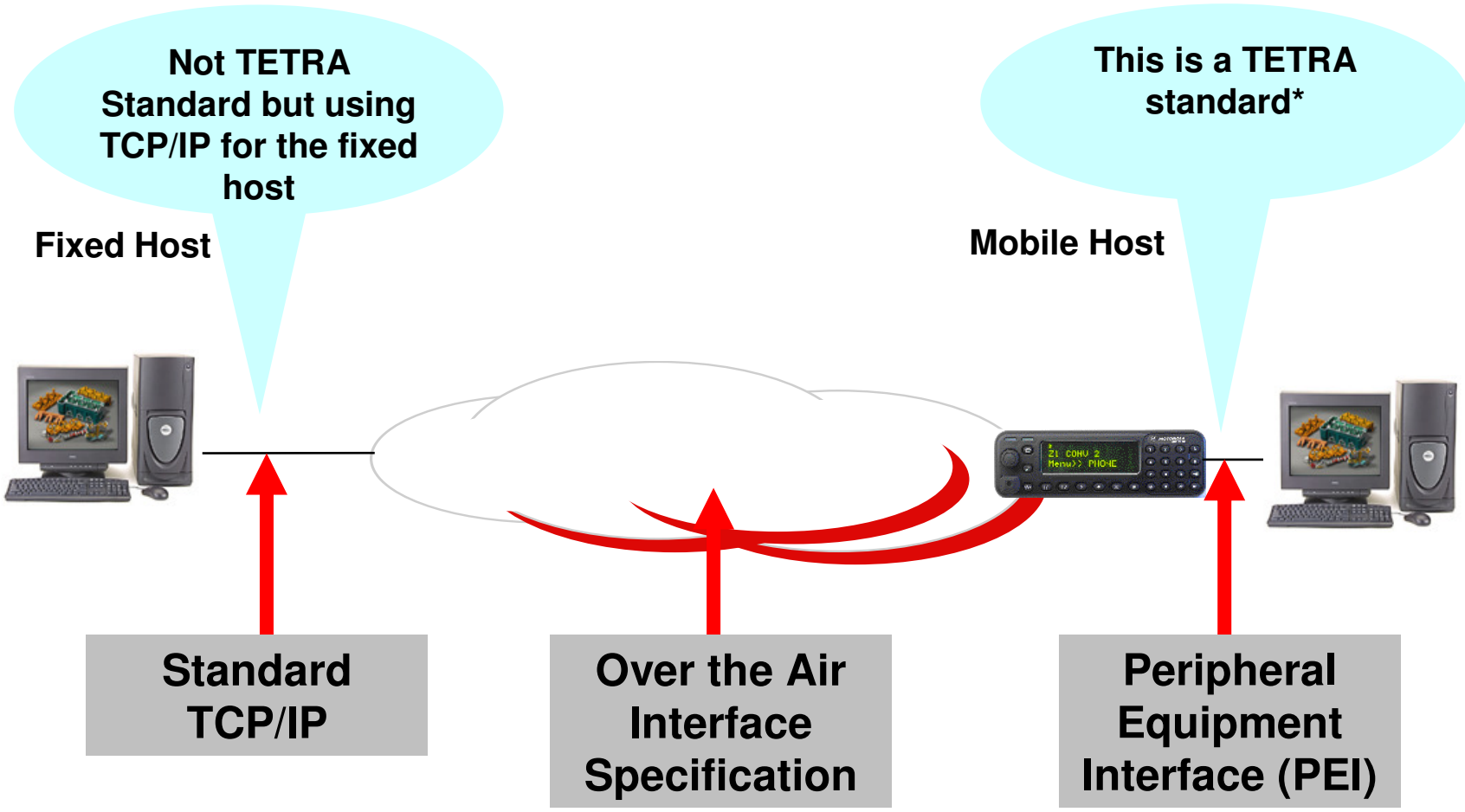
Uses TETRA AIR Link

- to send data from a data server over the Dimetra Infrastructure to/from a subscriber or between two subscribers

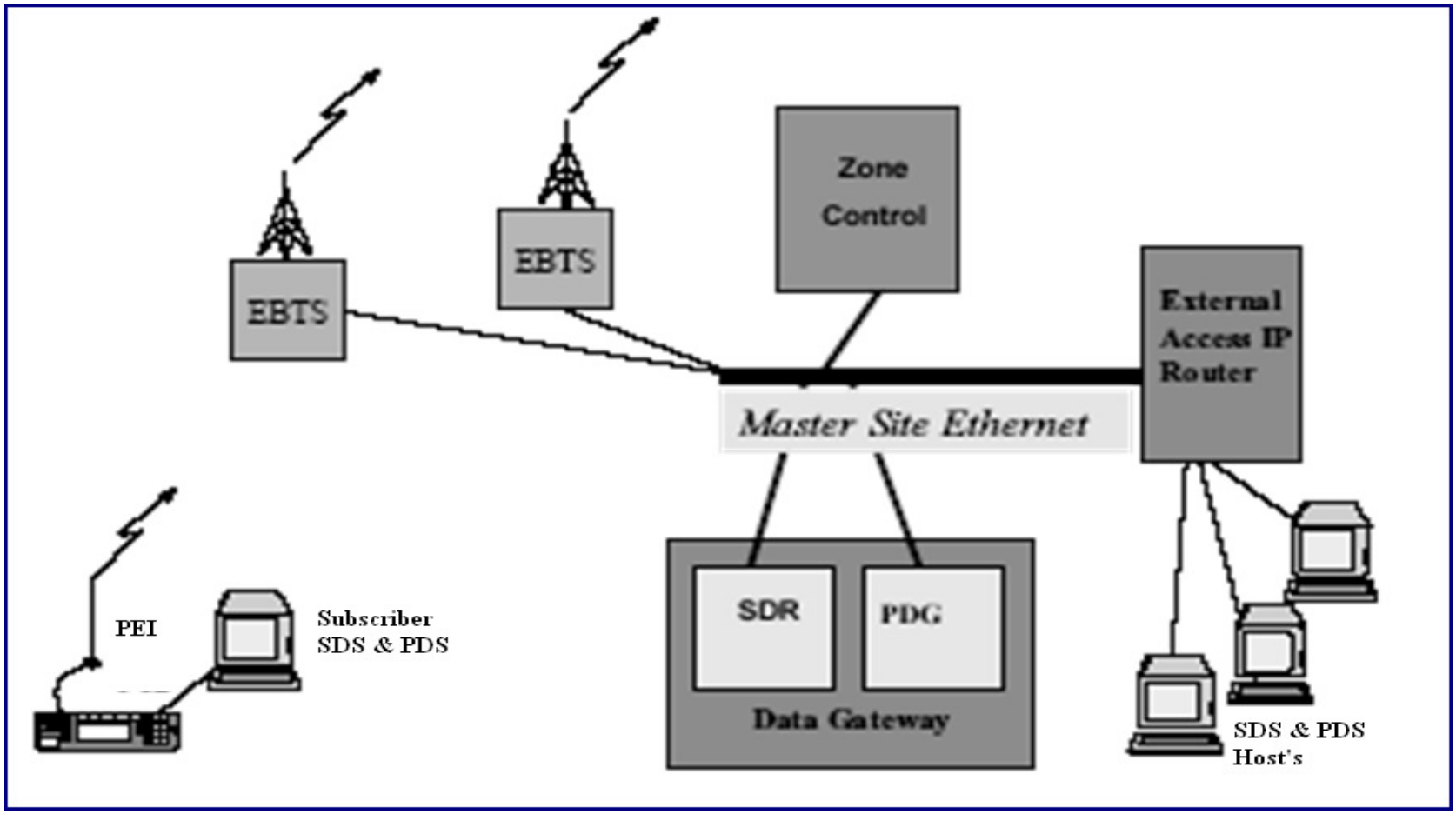
Both services supported by Dimetra Data Gateway

- Short Data Router for SDTS
- Packet Data Gateway for PDS

How to Access Data Services?



Dimetra Data Architecture



Short Data Router

Short Data Router Features

Local Host application

- SDR routes text messages across network based on SSI and GSSI defined in the UCM

CEN host application

- SDR maps TETRA addressing to an IP address and forwards the short data to the host via IP

Mobile station

- SDR directs the messages to the appropriate RF Site

Short Data Transport Service (SDTS)

Short Data Transport Services

TETRA SDS type 4 layer 3 service and TETRA SDS-Transport Layer (SDS-TL) layer 4 service

Point-to-point and point-to-multipoint access

Supports concurrent voice and data operation

Delivered via MCCH or ACCH

Supports up to 140 bytes per message

Short Data Transport Services (cont.)

Service can be accessed on two different access points

- Peripheral Equipment Interface (PEI) in the mobile
- Computer Network Equipment (CNE) on the LAN

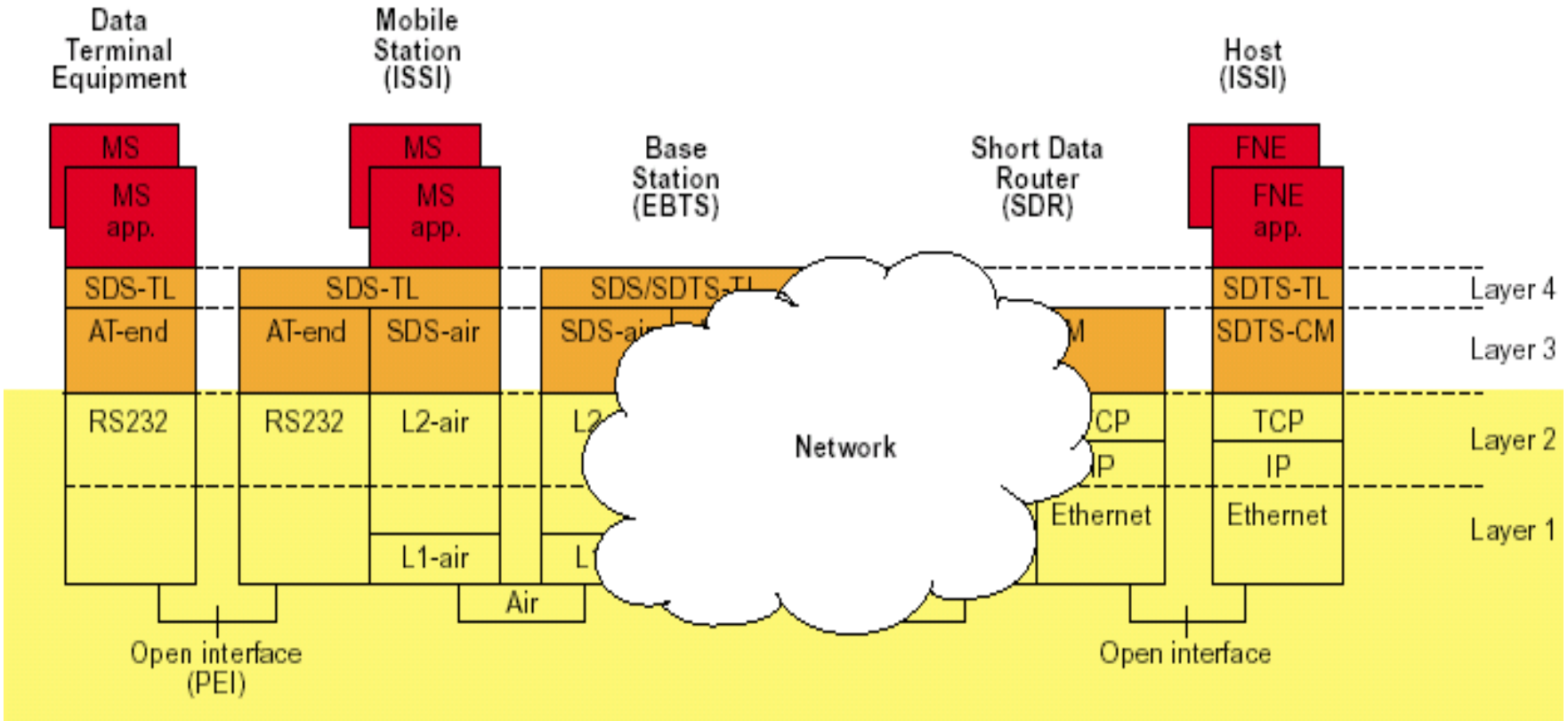
PEI

- An extended AT command set + SDS-TL transport layer sitting on top

CNE

- SDTS-CM + SDTS-TL transport layer

SDTS Protocol Stack Diagram



Sample SDTS Applications

Small scale Automatic Vehicle Location

Fleet management

Messaging

Database inquiry

Advantages of SDTS

Provide data service without requiring any additional channels

Allows distribution of message to user groups

Messages can be sent during voice services

SDTS Operation

Short data message packets received by the system are sent to SDR

The SDR will then route the messages to the correct subscriber/ host based on the ISSI

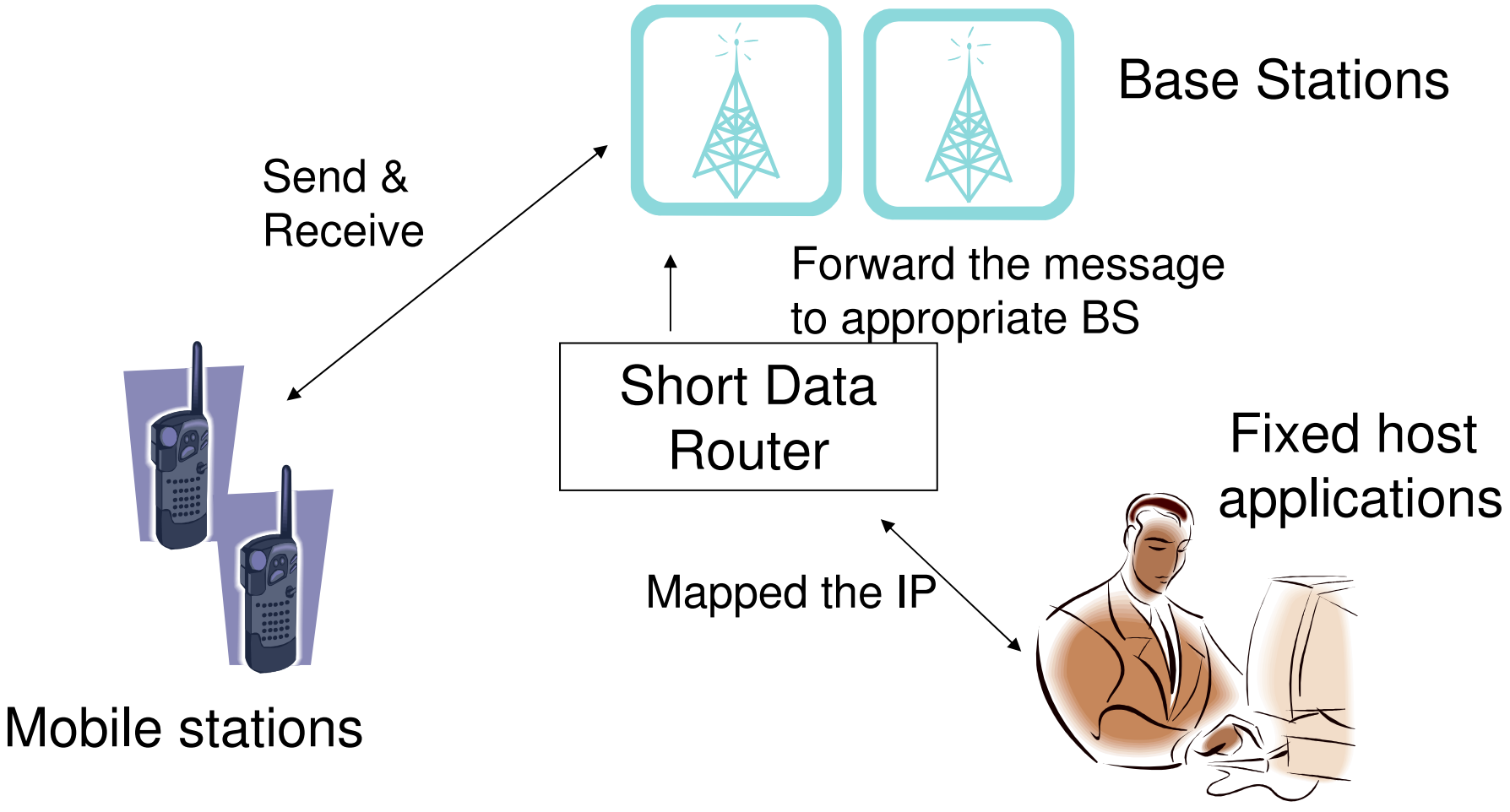
Message to PEI access point

- SDR route the short data message to appropriate EBTS to deliver to Mobile Station (MS) and Terminal Equipment (TE)

Message to fixed host (CNE)

- SDR maps the ISSI to the IP address and forward to host using TCP/IP

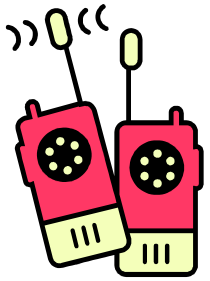
Diagram Flow



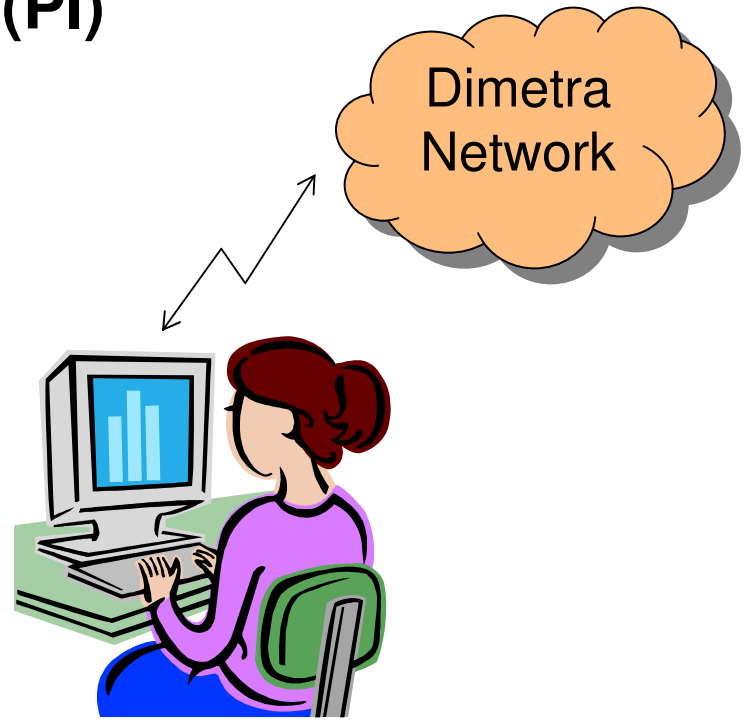
How system identify the endpoint location

Addressing scheme that is TETRA ISSI (a 24-bits number)

SDS-TL layer's Protocol Identifier (PI)



ISSI
PI



ISSI
Passnumber
PI

Protocol Identifier (PI)

Routing of messages to correct peer application done by use of PI of transport layer

PI is a network wide entity

Each endpoint must associate the PI with the same application

Protocol Identifiers range:

- 0 to 127 used by application with no SDS-TL layer. SwMI will carry messages to applications transparently. No reports will be generated in case message can not reach
- 128 to 255 will have SDS-TL header. SwMI will generate TL layer error reports if transmission fails

PI to be used must be allowed to be configured by SDTS application

Possible PI Values

Value	Remark
0 – 127	The SDS-TL Protocol Header shall not be used for this Protocol Identifier
127 - 129	Reserved
130	Text Messaging
131	GPS
132	Wireless Datagram Protocol WAP
133	Wireless Control Message Protocol WCMP
134	M-DMO (Managed DMO)
135 – 191	Reserved for future standard definition

Possible PI Values

Value	Remark
195	Call - Out
192 –194 196 – 219	User application definition
220	Home-mode Display
230	Pre-defined Templates
240	Message with User Data Header

Message Reference

Message reference number must be assigned to each message to uniquely identify it

Message reference value range is from 0 to 255 (00 to FF)

The originator must thus hold the message reference for each destination to which it has sent a message

Once an acknowledgement is received, the message reference is then incremented for the next message

How to use Message Reference

SDTS Host application

- combination of message number, source address and destination address
- Originator stores the message number for each destination it has sent

PEI application

- combination of the message reference number and source address
- originator keeps counter for each destination sent
- recommendation: 100000002 - 111111112

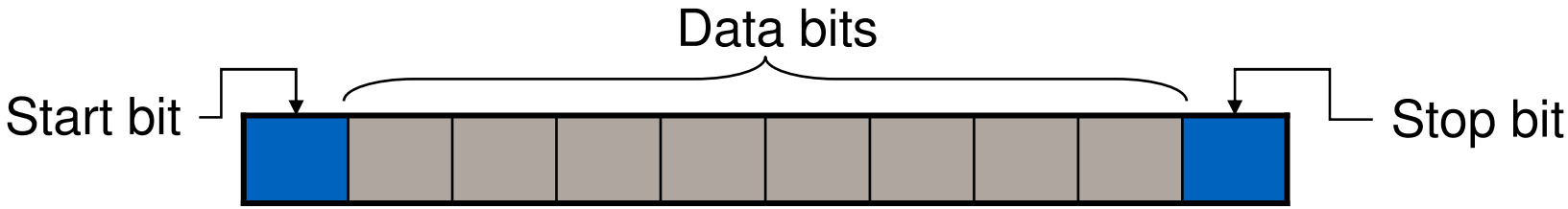
Short Data Transport Service
PEI Access Point

RS 232 Connection

A standardized RS 232 connection to the mobile

5-wires connection with TXD,RXD,DTR,CTS and RTS

TXD and RXD to carry data between MS and TE at baud rate 9600bps, 1 start bit, 8 data bits and 1 stop bit.



DTR, CTS and RTS are for the flow control between MS and TE

AT Commands

AT Commands is a rich set of commands. Those commands supported by Dimetra are specified in Programmer's Guide

Some commands are specific for SDTS to send and receive messages

AT Commands (cont)

AT implementation in SDTS has few limitations

- Only one AT command must present per line and concatenation of “;” is not supported
- No control characters must be present in data portion of any AT command (e.g. <CR> or <ESC>)
- Max length of a single line is 400 characters

Some of the commands for SDTS operation will be discussed in the following slides

AT Commands for SDTS Operations (1.1)

- Advisable to check whether SDTS is supported on PEI each time the TE application is launched
- Confirmation can be done through AT command set
- MS is first queried if it supports AT commands by the following command. If it supports, the response is ‘OK’
- MS is then queried for the SDTS service supported

```
Request:   AT<CR>
Response: <CR><LF>OK<CR><LF>
```

```
Request: AT+CSDS=?<CR>
Response:
        <CR><LF>+CSDS:_(0)<CR><LF>
        <CR><LF>OK<CR><LF>
```

0=SDTS type 4 supported

AT Commands for SDTS Operations (1.2)

If command is not supported by any SDTS type, it will respond with an 'error' message

```
Request:   AT+CSDS=?<CR>
Response: <CR><LF>+CME_ERROR:_4<CR><LF>
```

Select type 4 SDTS to start sending messages

```
Request: AT+CSDS=0<CR>
Response:
        <CR><LF>+CSDS:_1,1<CR><LF>
        <CR><LF>OK<CR><LF>
```

Service is supported both for mobile terminated and mobile originated messages.

AT Commands for SDTS Operations (1.3)

Log from serial port monitoring:

Request:07/25/02 11:33:22.622521664 (+0.4005760000 seconds)

```
41 54 2B 43 53 44 53 3D 3F 0D                    AT+CSDS=?.
```

Query for SDTS supported

Answer:07/25/02 11:33:22.822809664 (+0.2002880000 seconds)

```
0D 0A 2B 43 53 44 53 3A 20 28 30 29 0D 0A 0D 0A  ..+CSDS: (0)....
4F 4B 0D 0A                                      OK..
```

Response from query of SDTS supported

Request:07/25/02 11:33:23.223385664 (+0.4005760000 seconds)

```
41 54 2B 43 53 44 53 3D 30 0D                    AT+CSDS=0.
```

Select type 4 SDTS service

Answer:07/25/02 11:33:23.423673664 (+0.2002880000 seconds)

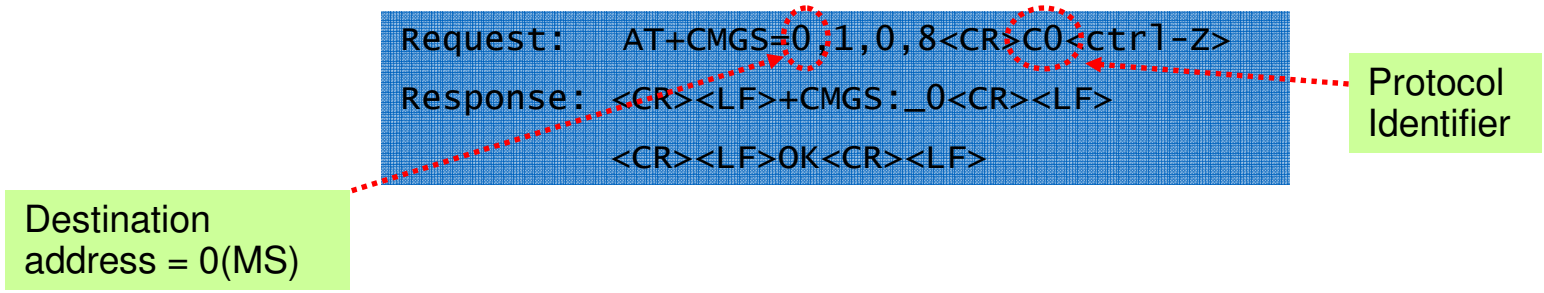
```
0D 0A 2B 43 53 44 53 3A 20 31 2C 31 0D 0A 0D 0A  ..+CSDS: 1,1....
4F 4B 0D 0A                                      OK..
```

Response from the SDTS type 4 service selection

AT Commands for SDTS Operations (2.1)

Application needs to be registered with MS before it can be used

To register, the application sends an empty packet that contains only protocol identifier to MS ISSI address or address 0



AT Commands for SDTS Operations (2.2)

Log from serial port monitoring:

Performing SDTS registration to SDR

Request:07/25/02 13:32:40.021629364 (+0.4106191000 seconds)

```
41 54 2B 43 4D 47 53 3D 30 2C 31 2C 30 2C 38 0D   AT+CMGS=0,1,0,8.
43 30 1A                                          C0.
```

Answer:07/25/02 13:32:40.211916264 (+0.1902869000 seconds)

```
0D 0A 2B 43 4D 47 53 3A 20 30 0D 0A 0D 0A 4F 4B   ..+CMGS: 0....OK
0D 0A                                             ..
```

Response from query of SDTS Registration

AT Commands for SDTS Operations (3.1)

Sending a Short Data, application must

- fill in the SDS-TL header and
- packed with the data into single packet before sending to MS via RS 232 and AT command set

AT Commands for SDTS Operations (3.2)

```
Request:  AT+CMGS=<da>,1,0,<length><CR><data><ctrl-Z>
Response: <CR><LF>+CMGS:_0<CR><LF>
          <CR><LF>OK<CR><LF>
```

<da> - representation of ISSI of destination. Value 0 is to the MS itself and value ranging 1 to 16777215 is to another MS or fixed host PC

1 - type destination address (1 for ISSI)

0 - area selection (0 for area not define)

<length> - length of <data> in bits (value range from 8 to 1144)

<data> - hex user data with SDS-TL protocol header

AT Commands for SDTS Operations (3.3)

Log from serial port monitoring:

Request:07/29/02 10:42:51.772505664 (+19.2777200000 seconds)

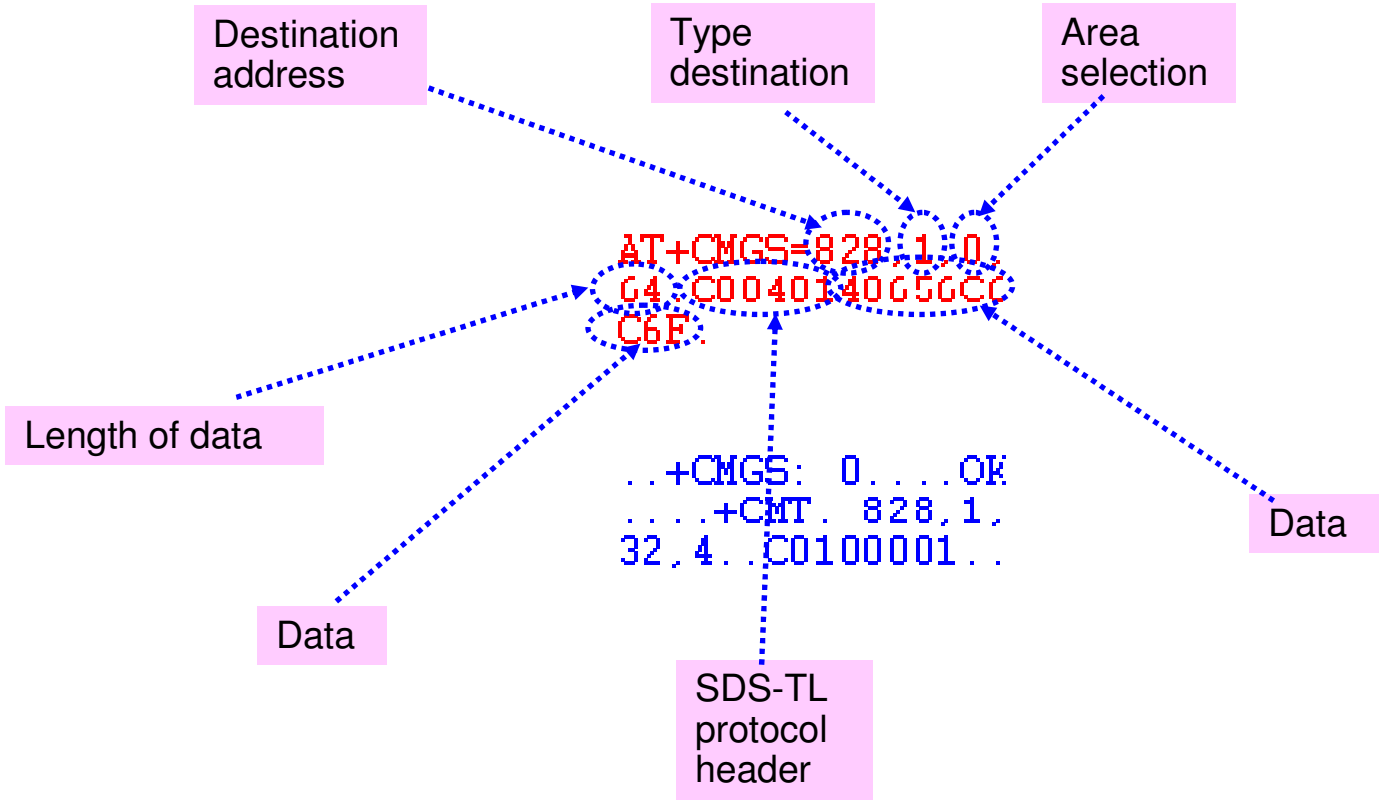
```
41 54 2B 43 4D 47 53 3D 38 32 38 2C 31 2C 30 2C   AT+CMGS=828,1,0,
36 34 0D 43 30 30 34 30 31 34 38 36 35 36 43 36   64.C00401486 56C6
43 36 46 1A                                       C6F.
```

Answer:07/29/02 10:42:52.123009664 (+0.3505040000 seconds)

```
0D 0A 2B 43 4D 47 53 3A 20 30 0D 0A 0D 0A 4F 4B   ..+CMGS: 0....OK
0D 0A 0D 0A 2B 43 4D 54 3A 20 38 32 38 2C 31 2C   ....+CMT: 828,1,
33 32 2C 34 0D 0A 43 30 31 30 30 30 30 31 0D 0A   32,4..C0100001..
```

AT Commands for SDTS Operations (3.4)

Explanation from the monitoring:



AT Commands for SDTS Operations (4.1)

MS will forward the received message to the PEI application immediately in the format as below:-

```
Indication:
<CR><LF>+CMT:_,<oa>,1,<length><CR><LF><data><CR><LF><CR><LF>
```

<oa>- ISSI of message originator. Value ranging 1 to 16777215

1 - type of originating address (1 for SSI)

<length> - length of <data> in bits (value range from 8 to 1144)

<data> - hex data with SDS-TL protocol header

AT Commands for SDTS Operations (4.2)

Log from serial port monitoring:

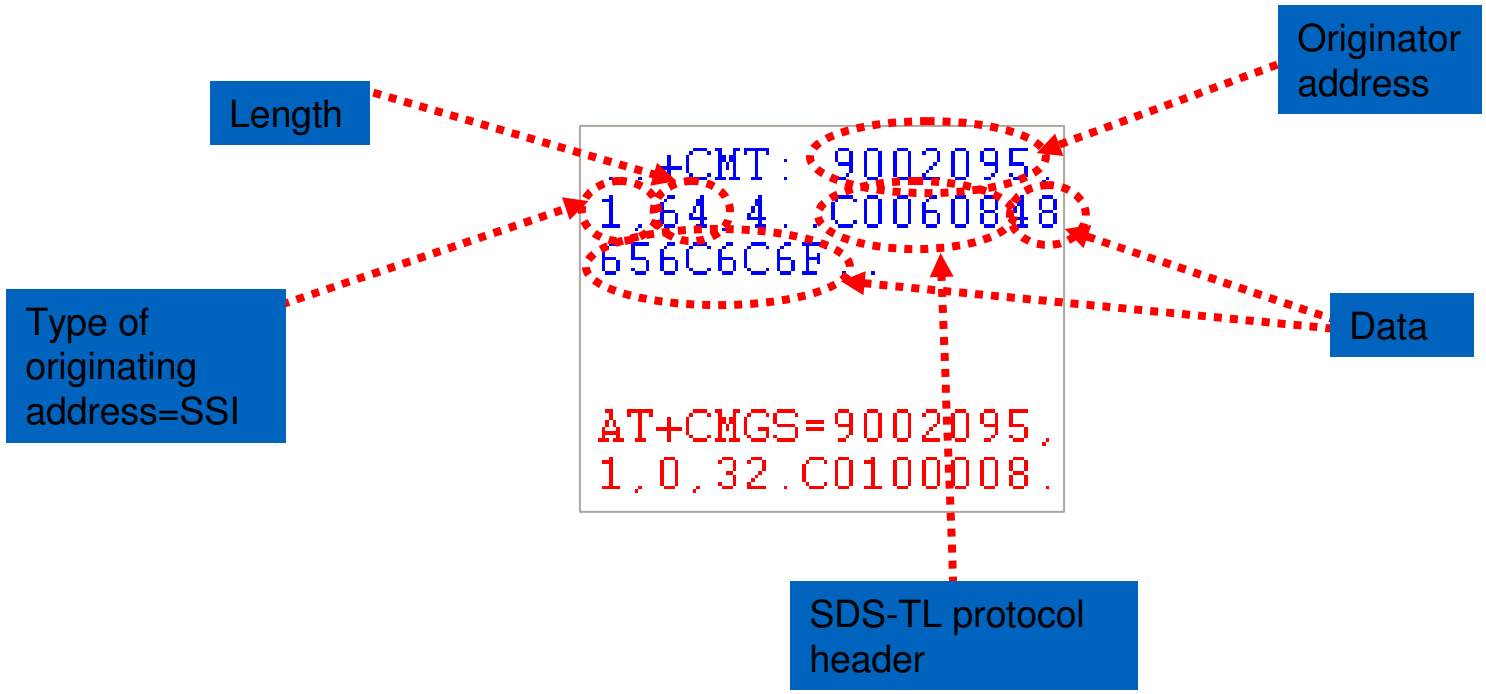
```
0D 0A 2B 43 4D 54 3A 20 39 30 30 32 30 39 35 2C   ..+CMT: 9002095,
31 2C 36 34 2C 34 0D 0A 43 30 30 36 30 38 34 38   1,64,4..C0060848
36 35 36 43 36 43 36 46 0D 0A                     656C6C6F..
```

Request:07/25/02 19:44:58.390308364 (+0.0300459000 seconds)

```
41 54 2B 43 4D 47 53 3D 39 30 30 32 30 39 35 2C   AT+CMGS=9002095,
31 2C 30 2C 33 32 0D 43 30 31 30 30 30 30 38 1A   1,0,32.C0100008.
```

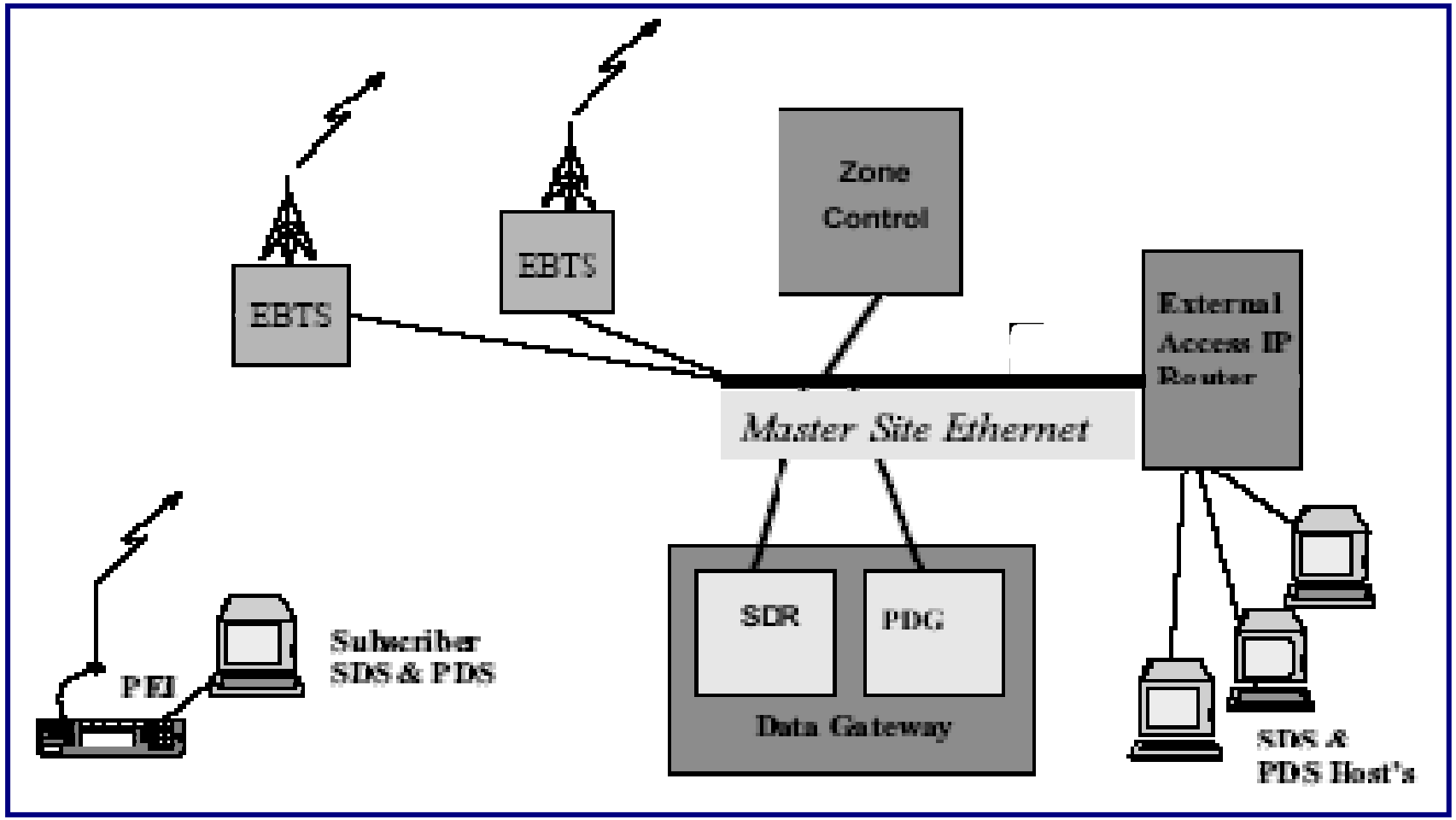
AT Commands for SDTS Operations (4.3)

Explanation from the monitoring:



Short Data Transport Service
CNE Access Point

Dimetra Data Architecture



LAN Access Point

- SDTS host application that has IP connectivity to the SDR
- Assign an ISSI (24 bits) to a SDTS host by network operator before it can be registered to the system to send packets
- Pass Number is to provide extra identification of the host when connecting to SDR
- Connection to SDR is done by opening TCP/IP connection and specifying the IP address and TCP port number of SDR (refer to network operator for port number)

SDTS CNE Operation Flow (1.1)

- Registration from the SDTS Host is needed so that SDR knows this is a valid host
- Host then registers its ID on the open connection by sending SDTS-CM-REGISTER message to SDR
- SDR will response with “address registered” or “registration not available”
- Make sure the sdts host information set in SDR are correctly input in the sdts host application

SDTS CNE Operation Flow (1.2)

The registration value to be sent to SDR:

0009020A01E9BABEF800

Field	Length	Value
Adaptation layer (9 bytes)	2	0009
PDU type (SDTS-CM-REGISTER)	1	02
PassNumber	4	0A01E9BA
Tetra ISSI	3	BEF8
Reserved	1	00

SDTS CNE Operation Flow (1.3)

The registration response value sent from SDR:

0009030A01E9BABEF80000

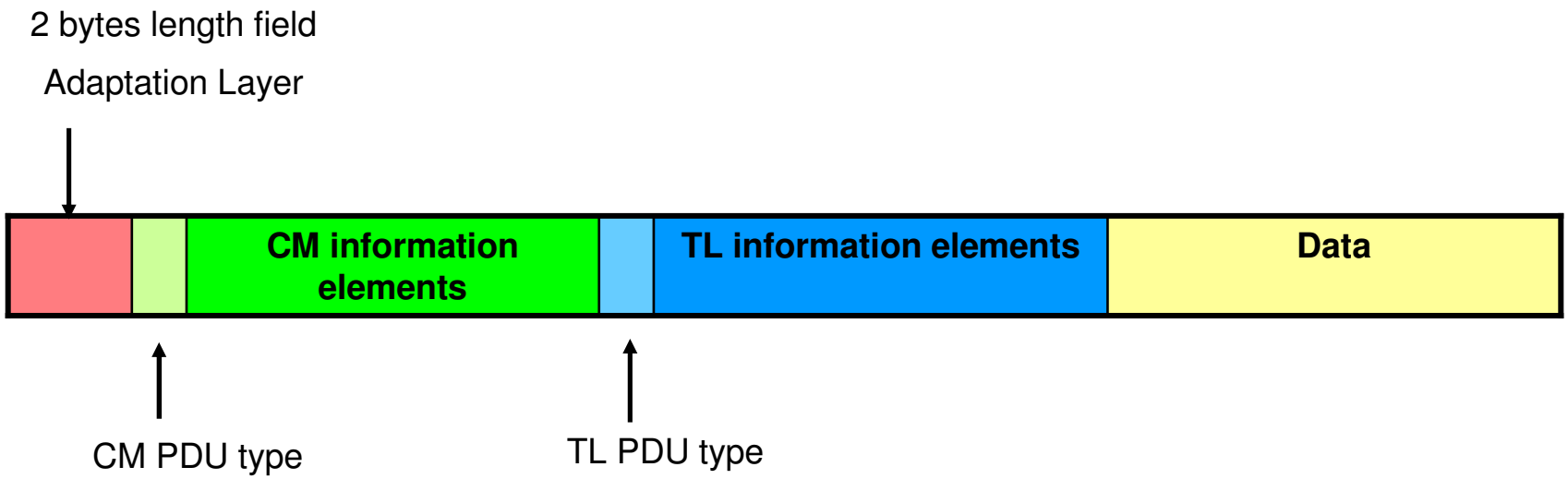
Field	Length	Value
Adaptation layer (10 bytes)	2	000A
PDU type (SDTS-CM-REGISTER)	1	03
PassNumber	4	0A01E9BA
Tetra ISSI	3	BEF8
Reserved	1	00
Status	1	00

SDTS CNE Operation Flow (2.1)

Sending a message

- packed with SDTS-CM and SDTS-TL headers and
- sent to the SDR on the open TCP/IP connection

Both header and data are packed into a single packet prefixed by a 2 bytes length field



SDTS CNE Operation Flow (2.2)

Data to be sent to SDR:

001600BEF8264A8260000000480080000000006161263

Field	Length	Value
Adaptation layer (22bytes)	2	0016
CM PDU Type (SDTS-CM-DATA)	1	00
CM Source Addr	3	BEF8
CM Dest Addr	3	264A
CM PI	1	82
CM flags	1	60
CM Msg Ref	1	00
CM Area Selection	1	00
CM TL Length	2	0048
TL PDU Type (SDTS-TL-DATA)	1	00
TL flags	1	80
TL validity period	1	00
TL Fwd Addr	3	000000
User data (abc)	3	616263

SDTS CNE Operation Flow (3.1)

For receiving short data:

- SDR automatically forwards the messages addressed to registered host application
- Packet received is similar as the sent packet ie. the SDTS header and data packed into single packet
- Host required to read message as quickly as possible else SDR may consider host unreachable
- Application can first read the 2 bytes length field and then read the number of remaining bytes
- Headers will then be decoded and message data can be extracted

Summary of Protocol Headers

SDS-TL – standard TETRA Over The Air protocol for SDS. It defines the number of Protocol Data Units (PDUs) along with the information elements and their values

SDTS-CM and SDTS-TL – used to carry user data and convey end-to-end acknowledgment information

For SDS-TL, SDTS-CM and SDTS-TL header elements and details, please refer to SDTS Programmer's Guide available in Motorola Online

New Features in D6.2

Store N Forward

Call - Out

Store N Forward

Store N Forward

What is Store N Forward?

- Is a feature introduced in Dimetra R6.2
- Allows SD sent via SnF Server (when MS is temporary unreachable):-
  - Store the message and retry sending at certain time interval
    - Successfully delivered
    - Msg validation period expired
    - System has notified of permanent failure

Where is it?

- Is co-located in SDR

Store N Forward (cont)

How it works

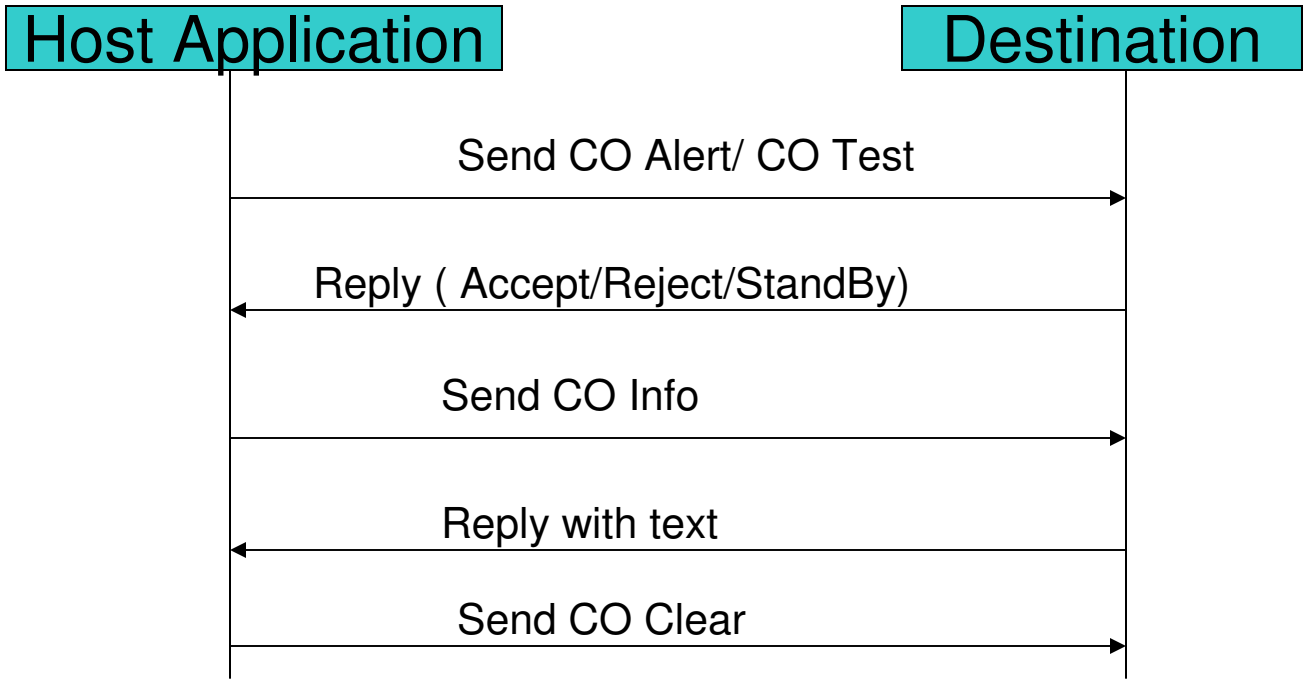
- Specify if to be stored in SnF Server if destination not reachable
- If originator requested a message received/message consumed confirmation, storage report will be received
- If SnF receives permanent failure report, it will be sent to the host and then discard

Call Out

Call Out

- Allow a call out alert to be sent to individual addressed (ISSI) or sent as a group addressed (GSSI) in text message
- A high priority message to alert user which requires immediate attention
- Audible message without user intervention
- MS send acknowledgement upon receiving the call out message
- Host application in SwMI or host application connected to the SwMI to send Call-Out alert message to MS user

Functional Operation



Call - Out Function

CO Alert

- Severity, CO Number, Talkgroup Number and Talkgroup Control

CO Info

- CO Number

- Only able to send through when Subscriber during CO Mode

Call - Out Function

CO Clear

- CO Number

- Only able to send through when Subscriber during CO Mode

CO Test

- The dispatcher will have the ability to send a Test Call-Out

SDTS Protocol Headers

SDS-TL

SDTS-CM-COM

SDTS-TL

Enhancements on D6.2

SDTS-CM layer PDU

- Calling & Called Party ID

SDTS-TL layer PDU

- Forwarding address

Flexible header structure

- SDTS-CM header length is specified separate
- Type of the next protocol/extension PDU specified in the header

SDTS-CM-DATA and SDTS-CM-BROADCAST PDU ➔ SDTS-CM-COM-DATA PDU

- Handled by control flags (Region Valid, Channel Selection Valid)

SDTS-CM-COM PDU

SDTS-CM-COM

- used to carry user data of two ends
- will carry SDTS-TL PDU
- SDTS-CM-COM-DATA Request
- SDTS-CM-COM-REPORT

SDTS Internal Application

SDS Text Messaging

- Allows to send and receive SDS text messages up to 140 bytes
- SDS text messages send to the MS will be stored in the inbox of the MS
- MS sends a delivery report indicating success when the sender has requested received confirmation report
- User of the MS is notified about the reception of a new SDS text message
- MS sends a consumed report if the sender has requested this when user selects message from the inbox
- SDS text messaging uses PI = 130

Home Mode Display

Allows displaying a certain SDS text message to the user when the MS has not been used for 5 sec

The MS does not change its current state when display changes to Home Mode Display text

Home Mode Display allows max of two lines with 12 characters per line

Format to transfer the text is the same as it is for SDS text messages. The default PI used is 220

When Home Mode Display text message received is too long for the MS to display, it will be rejected with deliver status: “ Message Too Long For Gateway or Destination” (0x4D)

Message with User Data Header

Transmits all kinds of information such as concatenated text messages using SDTS protocol

MS internal application supports only reception of Concatenated Text Messages, not transmission of Concatenated Text Messages using the MMI of MS

Nevertheless an application connected to the PEI could also support transmission of Concatenated Text Messages

Concatenated Text Messages

MS internal application supports only reception and recombination of long text messages up to 1000 bytes length

Each long text message is identified by a Message Reference Number to enable a receiving application to identify which segments belonging to the same long text message

16 bit Message Reference Number is recommended in a system with high message traffic

Predefined Templates

- Allows only sending pre-defined SDS text messages of a special format
- This format includes a prompt ID (not shown to the user), a prompt text (not editable) and an editable text field
- MS can store several pre-defined templates loaded using the customer programming SW (CPS) of the mobile
- The pre-defined template is the user data part of the SDTS-TL-DATA
- That feature uses an own PI (default is 230, configurable in the MS)

Demo

Short Data (LAN & PEI)

Call Out

THANK YOU...