ISITEP
D4.5.2 - DEPLOYABLE GATEWAY DESIGN CAPABILITIES

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REVISION TABLE

Version	Date	Modified Pages	Modified Sections	Comments
1.0	15/04/2015	All	All	First issue

Publishable extended abstract

This project will provide a voice and data gateway between two tactical cell (TETRA / TETRAPOL) based on IDR for TETRAPOL part and TB3p for TETRA part.

Security Release Statement (by Etienne LEZAACK - Advisory Board Coordinator)

This document is classified as PUBLIC and there are no national security sensitive issues inside it.

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1. INTRODUCTION

1.1 Introduction

The goal is to provide a gateway between two tactical cells (TETRA/TETRAPOL). This gateway will interconnect voice, geolocation data and emergency information to manage, on the field, two fleets of users. Each fleet could be connected at its own regional network by a satellite link.

1.2 Normative reference

PAS 0001-19-2: "TETRAPOL Specifications: System Terminal Control Protocol".

TETRA Association; TETRA Interoperability Profile (TIP); Part 1: Core AT Commands

2. DESCRIPTION

2.1 TETRAPOL part

The radio coverage is provided by an IDR (Independent Digital Repeater) with voice and data features. The terminals will transmit on IDR mode and will be equipped with a GPS receiver.

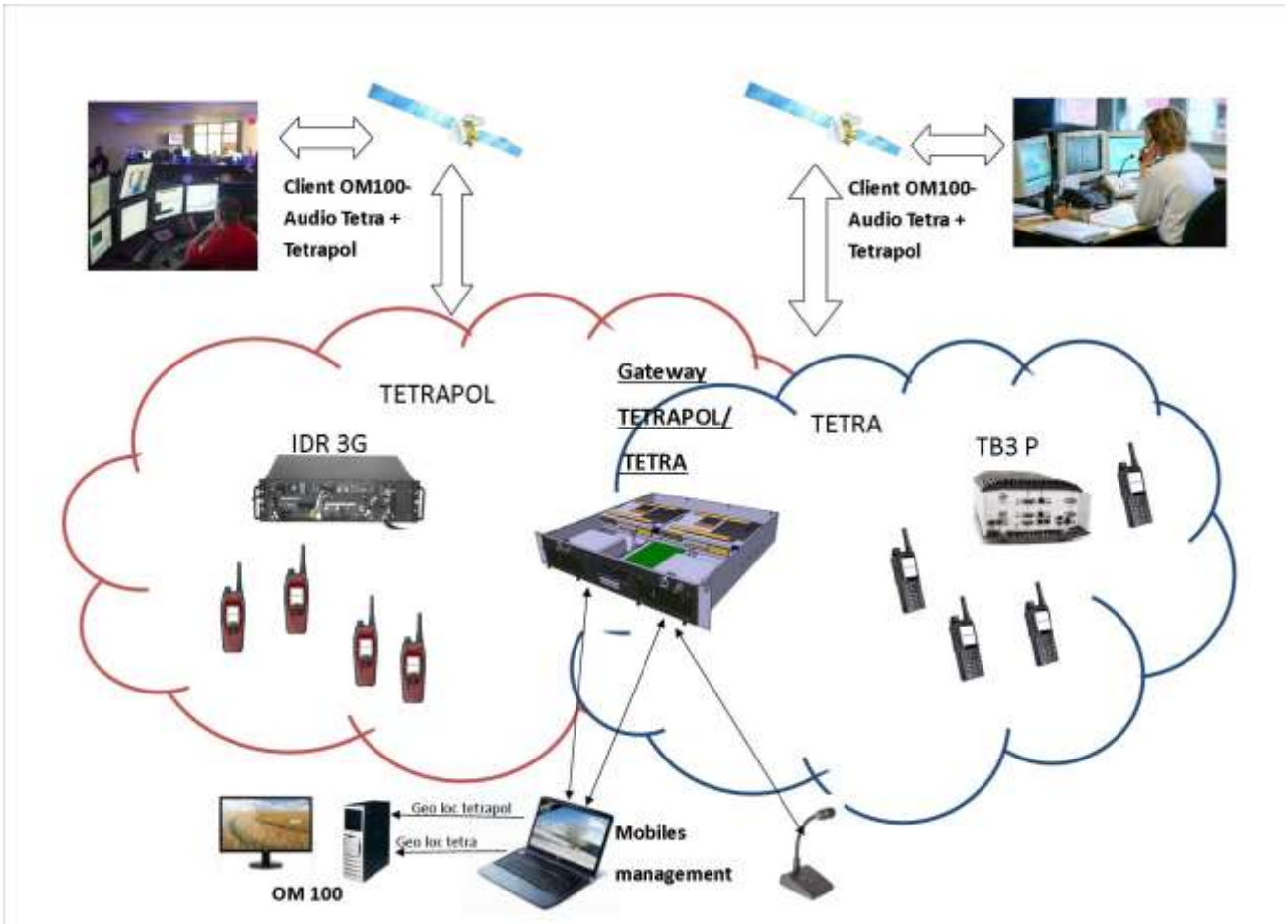
2.2 TETRA part:

The radio coverage is provided by an TB3p used in stand-alone mode. The terminals will transmit in their Talk Group and transmit their geolocation.

2.3 Gateway part:

The gateway is composed of one mobile of each fleet. The management of these mobiles (communication, data interface) is made by a PC. The audio and the I/O (PTT, receive activity) are crossed in the gateway. The PC is connected to an AVL server to provide the geolocation of the two fleet. All the geolocation will be display on the same screen. On parallel audio and geolocation data will be transmitted to the regional network by IP link (satellite, microwave).

2.4 Synoptic general:



3. DETAILED SPECIFICATIONS

3.1 Management gateway

3.1.1 Tetrapol terminal management

The hardware of the Tetrapol terminal is a standard mobile named B4M. The software used is radio access gate software and the protocol STCP (System Terminal Control Protocol). To manage this terminal a server with the Control Center API is needed. This API use STCP and allows to drive the terminal, to manage the communication and to route the geo location data to a geolocation server with the adapted format.

The terminal control interface between a System Terminal (ST) and a Terminal Control Equipment (TCE) shall enable the TCE to remotely control voice communications and status services through the ST.

The terminal control interface shall support an applicative protocol, STCP, that provides for:

- speech and encryption control;
- remote control of the system terminal in network connected mode;
- remote control of the system terminal in direct mode;
- status services;
- call advertising services;
- system monitoring;
- interface maintenance.

Here after several STCP command to manage the terminal arranged by family. The 2 first letters indicates the source of the command.

Speech and encryption remote control
- ST_ACTIVATION_IND
- ST_ENCRYPTION_MODE
- ST_RECEIVE_DETECTION
- ST_PTT_RELEASE_IND
- ST_PTT_REQUEST_IND
- ST_TRANSMIT_IND
- TCE_REMOTE_PTT_REQUEST
- TCE_PTT_PRIORITY_CHANGE_REQ
- TCE_PTT_RELEASE
- TCE_PTT_REQUEST
- TCE_SET_MANUAL_KEY
- TCE_USE_MANUAL_KEY

Remote control of the system terminal in network connected mode
- ST_ALERTING
- ST_CALL_REFERENCE
- ST_CALL_SUSPEND
- ST_CALL_SWITCH
- ST_COMMUNICATION_ENTER
- ST_CONNECT
- ST_DEFAULT_CALL_IND
- ST_END
- ST_INCOMING_GROUP_CALL
- ST_INCOMING_OBJECT_CALL
- ST_INCOMING_SETUP
- ST_DELIVERED_OBJECT_PER_ST
- ST_TRANSFER_IND
- TCE_CALL_ANSWER
- TCE_DEFAULT_CALL_ENTER

- TCE_DEFAULT_CALL_RESP
- TCE_DEFAULT_CALL_WITHDRAWAL
- TCE_DM_LISTEN
- TCE_ECH_RELEASE
- TCE_ECH_SETUP
- TCE_ECH_SETUP_DP_RESP
- TCE_FALLBACK_MOCH_ENTER
- TCE_INTRUSION
- TCE_MOCH_RELEASE
- TCE_MOCH_SETUP
- TCE_OUTGOING_GROUP_CALL
- TCE_OUTGOING_OBJECT_CALL
- TCE_OUTGOING_SETUP
- TCE_REMOTE_CALL_CLEARING
- TCE_SCAN_RESUME
- TCE_SET_DEFAULT_CALL
- TCE_OBJECT_INITIALIZATION
- TCE_TRANSFER
- TCE_WITHDRAWAL

Remote control of the system terminal in direct mode and IDR mode

- ST_DM_CALL_STATE_IND
- ST_DM_CONNECT
- ST_DM_DATA_IND
- ST_DM_DATA_CONF
- TCE_DM_DATA_REQ
- TCE_DM_ENTER
- TCE_DM_WITHDRAWAL
- TCE_DM_CHANNEL_LIST_REQ
- ST_DM_CHANNEL_LIST_IND

Short datagram and status

- ST_STATUS_CONF
- ST_STATUS_IND
- TCE_STATUS_REQ

Call advertising

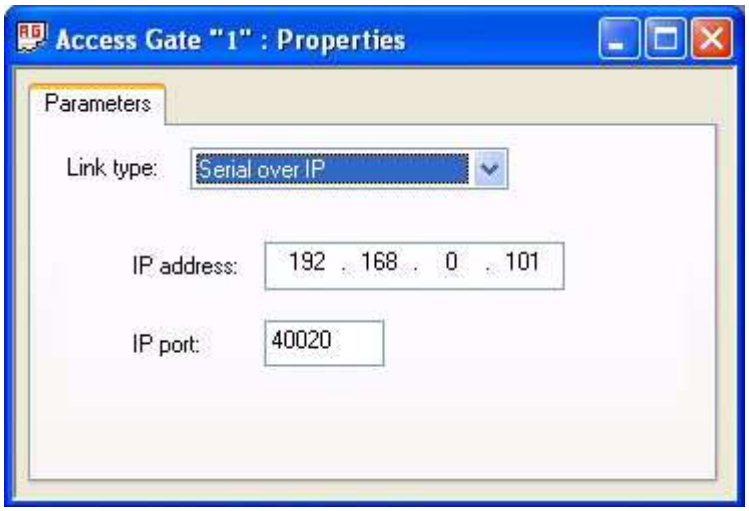
- ST_CELL_OG_ACTIVATION_IND
- ST_CELL_OC_ACTIVATION_IND
- ST_BROADCAST_CALL_NOTIFICATION
- ST_CALL_COMPOSITION_NOTIFICATION
- ST_CRISIS_NOTIFICATION
- ST_DM_ACTIVITY_NOTIFICATION
- ST_EMERGENCY_NOTIFICATION
- ST_HOOK_ON_INVITATION
- ST_OVERLOAD_NOTIFICATION
- ST_PRESENCE_CHECKING
- TCE_PRESENCE_CHECKING_RESP
- ST_DM_EMERGENCY_NOTIFICATION
- TCE_DM_EMERGENCY_RESP
- ST_TONE_GENERATION_REQ

System monitoring

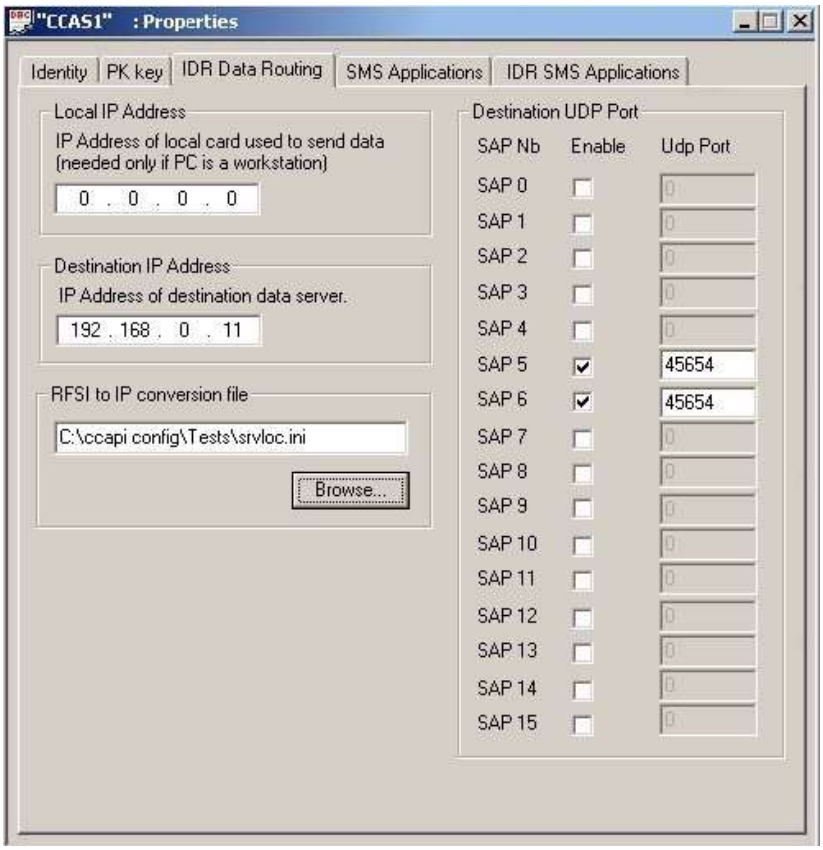
- ST_COV_PER_CELL
- ST_DELIVERED_OG_PER_ST
- ST_DELIVERED_TALKGROUP_PER_ST
- ST_ECH_PER_ST
- ST_MOCH_PER_ST

ST_TALKGROUP_PER_ST
Interface control
ST_PK_ACTIVATION_CONF
ST_ALARM_IND
ST_BANNED_TALKGROUP_CONF
ST_DEBUG_IND
ST_END_RESYNCHRO
ST_FORWARD_STATE
ST_INIT
ST_RADIO_FIELD_IND
ST_REGISTRATION_STATE
TCE_PK_ACTIVATION_REQ
TCE_ATTACH_REQ
TCE_BANNED_TALKGROUP_REQ**Errore. Il segnalibro non è definito.**
TCE_TALKGROUP_INITIALIZATION
TCE_CONFIG_ST
TCE_DEACTIVATE_REQ
TCE_FORCED_REGISTRATION
TCE_FORWARD_REQ
TCE_INIT_ST
TCE_LOUDSPEAKER_REQ
TCE_LOUDSPEAKER_VOL_REQ
TCE_MAINTENANCE
TCE_PRESENCE_ST
TCE_RESET
TCE_SUICIDE
TCE_TONE

Of course several parameters are mandatory in the configuration of the CC-API server. On first we need to program the IP address and the communication port of the terminal Access Gate.



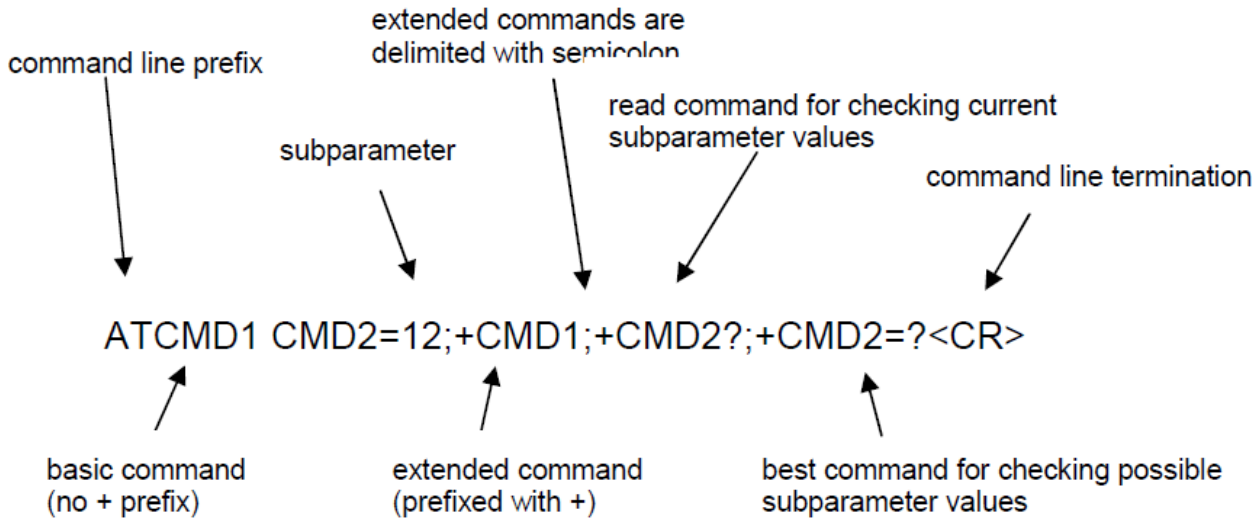
The server CC-API must route the geolocation data to the AVL server. We need to program the address of the AVL server in the interface of the CC-API like hereafter. The server CC-API must also transform the TETRAPOL address of the terminal to an IP address by a specific algorithm.



3.1.2 Tetra terminal management

The hardware and the software of the tetra terminal is a standard mobile. We use the AT Command to manage this terminal. Computers use AT commands to communicate with modems. Most communications applications, however, have a user interface that hides these AT commands from the user. You issue AT commands via your communications application. When the software in the product has received an AT command, it responds with a message that is displayed on the screen of the used device. A serial link supports this protocol at 9600bit/s.

The "AT" or "at" prefix must be included at the beginning of each command line. Several AT commands can be typed on the same line, and in such cases the “AT” or “at” prefix is needed only once, at the beginning of the command line.
AT commands may optionally be used in PEI for controlling MT functions and TETRA network services from a TE. These AT commands allow access to data services, SDSs, and MT2 parameters and information. AT commands are used to enter PPP mode.
Standardized basic commands are described in the ITU-T Recommendation V.250. TETRA commands use the syntax rules of extended commands. Each extended command has a test command (e.g. +CMD2=?), which can be used to test if the command is supported, and the format and type of its subparameters. Read commands (e.g. +CMD2?) are used to display the current value of subparameters.



This interface allows driving the terminal, managing the communication and routing the geo location data to a geolocation server with the adapted format

3.1.3 Audio gateway

On the field the analog voice is interconnected with the 4 wires interface. To cross the signals PTT and Squelch (receive activity) is necessary

3.2 Geo location

Tetrapol and Tetra do not use the same frame format. Two stages are necessary to merge the geolocation display. On first we must adapt to present the frame to the MDG (Media Data Gateway) of each standard. About OM100 application an adaptation must be done to display to two fleets.

3.3 Audio IP link

On each side (TETRA and TETRAPOL) audio is converted to G711 format (8 bits 8 kHz). In the control room the audio IP is converted to analog signal. The PTT and the transmit activity signal are also converted to the IP link. In the control room these signals are converted like I/O to allow the operator to push to talk. We use an AGR-IP equipment (Access Gate Radio IP) to transform the different flow. We must respect some specifications and performances on the IP link.

- ✓ IP network definition :

AGR IP: **AGR IP** VoIP is based on standard RTP protocol and G.711 PCMA for coding, and proprietary protocol for signalling, based on UDP and TCP.

Reservation: Our solution does not use a RSVP-type reservation protocol.

Encryption: Voice is not encrypted.

QoS: DiffServ marking is used to indicate the priorities for IP packets.

Voice is encapsulated in RTP packets. RTP traffic shall be assigned to the EF class of service and forwarded on the backbone with high priority.

IP traffic: The AGR-IP IP traffic is based on standard and proprietary UDP and TCP ports numbers.

HTTP traffic is used for monitoring and configuration of AGR IP. The traffic is established between the AGR IP and a computer when required.

RTP traffic is used to carry voice between AGR IP boxes.

Signalling traffic is used to manage voice flows between AGR IP boxes.

Signalling CC-API traffic is used between AGR IP box and associated dispatcher position.

Service	Protocol	Default Port Number	Port is modifiable	CoS
HTTP	TCP	80	Yes	BE
RTP	UDP	40050, 40060	Yes	EF
Signalling	TCP	40060	Yes	EF
Signalling CC-API	UDP	40010	Yes	EF

- ✓ IP network performance :

Listening latency parameter

AGR IP boxes handle latency and jitter thanks to an internal buffer

The table here-after gives the maximum latency authorized according to the **Listening Latency** parameter.

Listening Latency	Maximum latency authorised for G.711 (ms)
1	128
2	256
3	384
4	512
5	768

6	1024

Note1

The maximum jitter authorized is about half of the maximum latency authorized.

Note2

A **Listening Latency** value of 7 can handle a jitter of 1 second.

Direct Link

Listening latency should be set at 3

Maximum delay = 40 ms

Maximum jitter = 20 ms

Out of sequence packets = 0%

Maximum packet loss = 0% (service altered in case of loss)

Other IP backbone

Listening latency should be set at 3

Delay = 40ms

Maximum jitter = 80 ms

Out of sequence packets = 0%

Maximum packet loss = 0% (service altered in case of loss)

Satellite Link

Listening latency should be set at 5

Delay = between 500ms and 800ms

Maximum Jitter = 120ms

Out of sequence packets = 0%

Maximum packet loss = 0% (service altered in case of loss)

Bandwidth requirement:

Service	IP Network Level	Ethernet Network Level
HTTP	64 kbit/s	64 kbit/s
RTP	77.6 kbit/s	95.2 kbit/s
Signalling	5 kbit/s	5 kbit/s
Signalling CC-API	6 kbit/s	10 kbit/s

Notes

For RTP traffic, 20% of margin shall be taken for backbone dimensioning

Continuous monitoring of AGR IP via HTTP requires about 15kbit/s. It is not mandatory.

Signaling CC-API is just between the rack terminal and the server. It's a local network.

- ✓ AGR-IP configuration :

The setup of the access of the AGR-IP will be configured by HTML page and will look like here after.

We must configure the network parameters (adress, mask, gateway) the adress of the CC-API server and the adress of the other audio converter.

3.4 Detailed synoptic of the solution