



Radio Trunking

- **Trunking stands for sharing. Whenever resources are in short supply, they will have to be shared.**
- **In Radio Telephone Trunking System a fixed number of telephone lines and radio channels are installed in base and are shared by large number of remote/ mobile subscribers. This Radio Telephone Trunking System is commonly known as Radio Trunking System.**
- **First trunked radio standard introduced was analogue MPT 1327 from ROHDE & SCHWARZ**

Advantage of Digital Trunking System over Analogue Trunking System:

- More reliable
- Flexible
- Have connectivity with internet
- Low noise

Disadvantages of Digital Trunking System over Analogue Trunking System:

- Only disadvantage is that they have low coverage range as compared with Analogue Trunking System

What is TETRA ? TErrestrial Trunked RAdio

- Advanced Digital Radio Communications System for Public Safety Services, Utilities, Transport, Local Government, Military
- Operational throughout Europe, Asia-Pacific, Africa, South America and Middle East
- Standard promoted by ETSI
- Multi-vendor supply / interoperation

TETRA – The New European Standard for Digital Trunking

TETRA: TErrestrial TTrunked Radio

- It is the first truly open digital Private Mobile Radio (PMR) standard.
- The standard is defined by the European Telecommunications Standards Institute (ETSI).
- The essential parts of the TETRA standard have been approved in national votings at the end of 1995 (22 countries voted for the approval and none against it).
- Emergency Service users have contributed strongly in the creation of the standard.

FREQUENCY RANGE:

1. 400 MHz

380 - 400 MHz for public safety systems

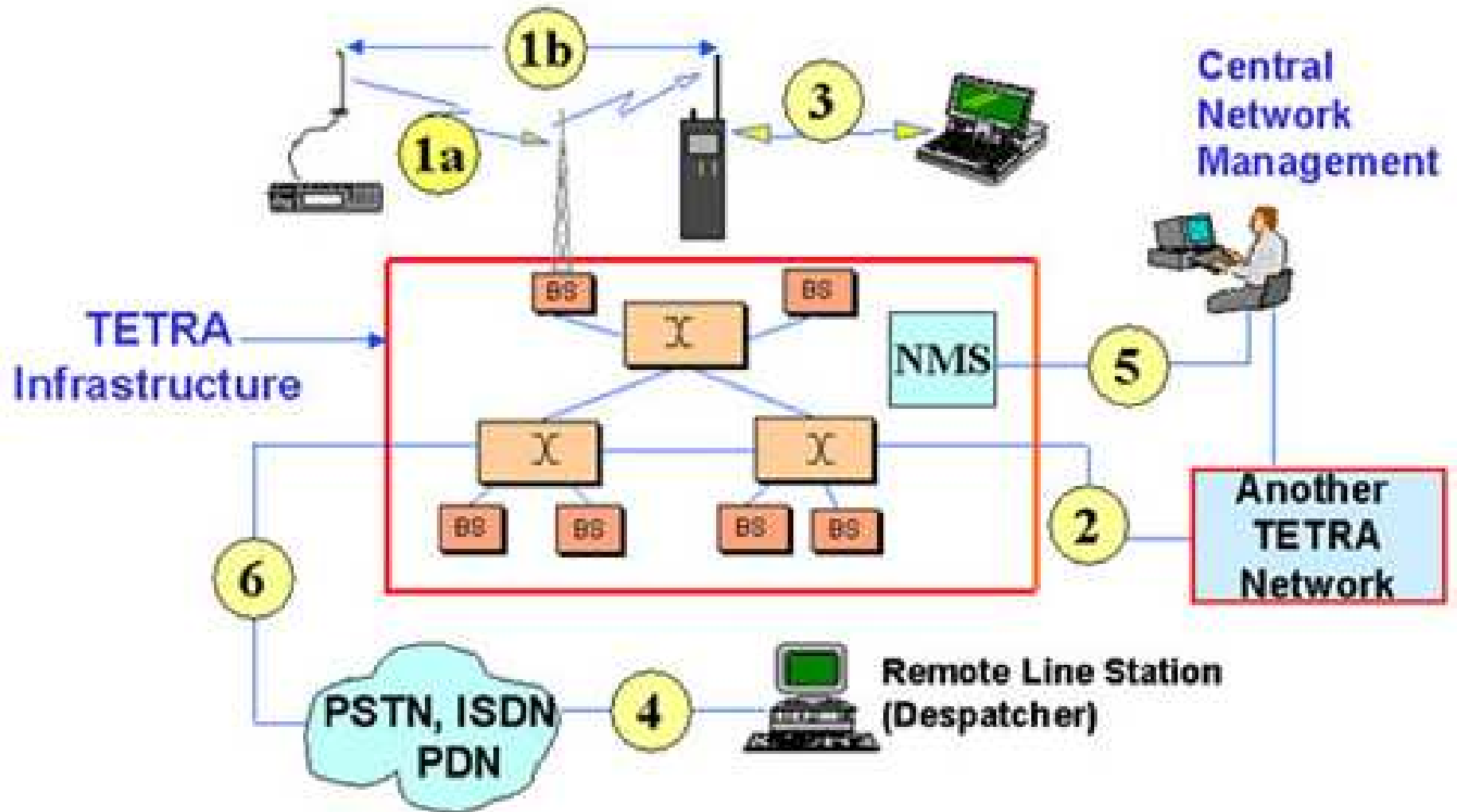
410 - 430 MHz for commercial applications

2. 800 MHz for commercial applications

Milestones in the TETRA standard

- 1990: standardisation start
- 1991: standard based on TDMA technology with 4 timeslot and 25 kHz band
- 1995: standard first phase completed
- 1996: frequency armonisation in Europe (CEPT/NATO)
- 1997: standard second phase completed
- 1998: first systems installation
- 2000: presence of 32 TETRA network in 21 countries

Typical TETRA Network



TETRA is superior PMR technology

- Individual and group communications
- Direct mode communication between radios
- Packet data and fast data transfer services
- Over-the-air programming of radios
- Frequency economy
- Fast call set-up time
- Security features
- Encryption

TETRA Voice + Data Services

- **Bearer services:**

- Circuit switched mode
- Connection oriented packet data
- Connectionless packet data

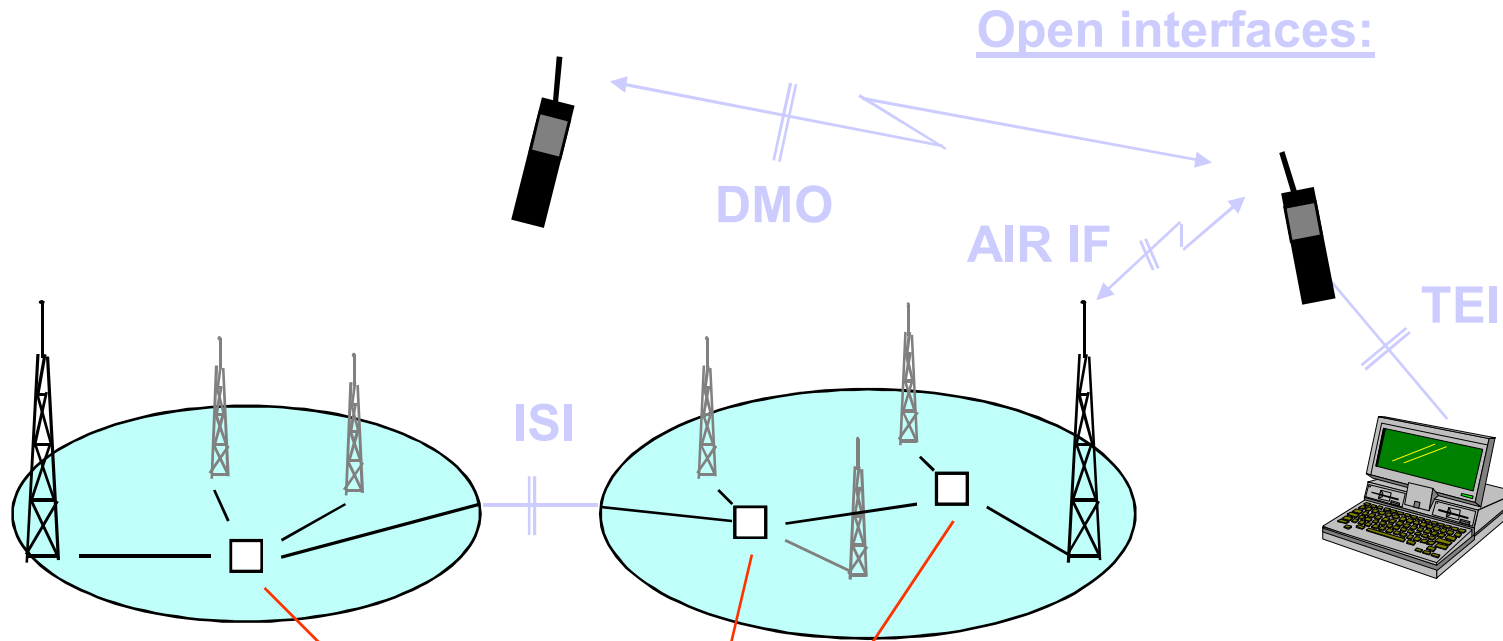
- **Teleservices:**

- Speech for individual call, group call, acknowledged group call, broadcast call

- **Status and short data messages**

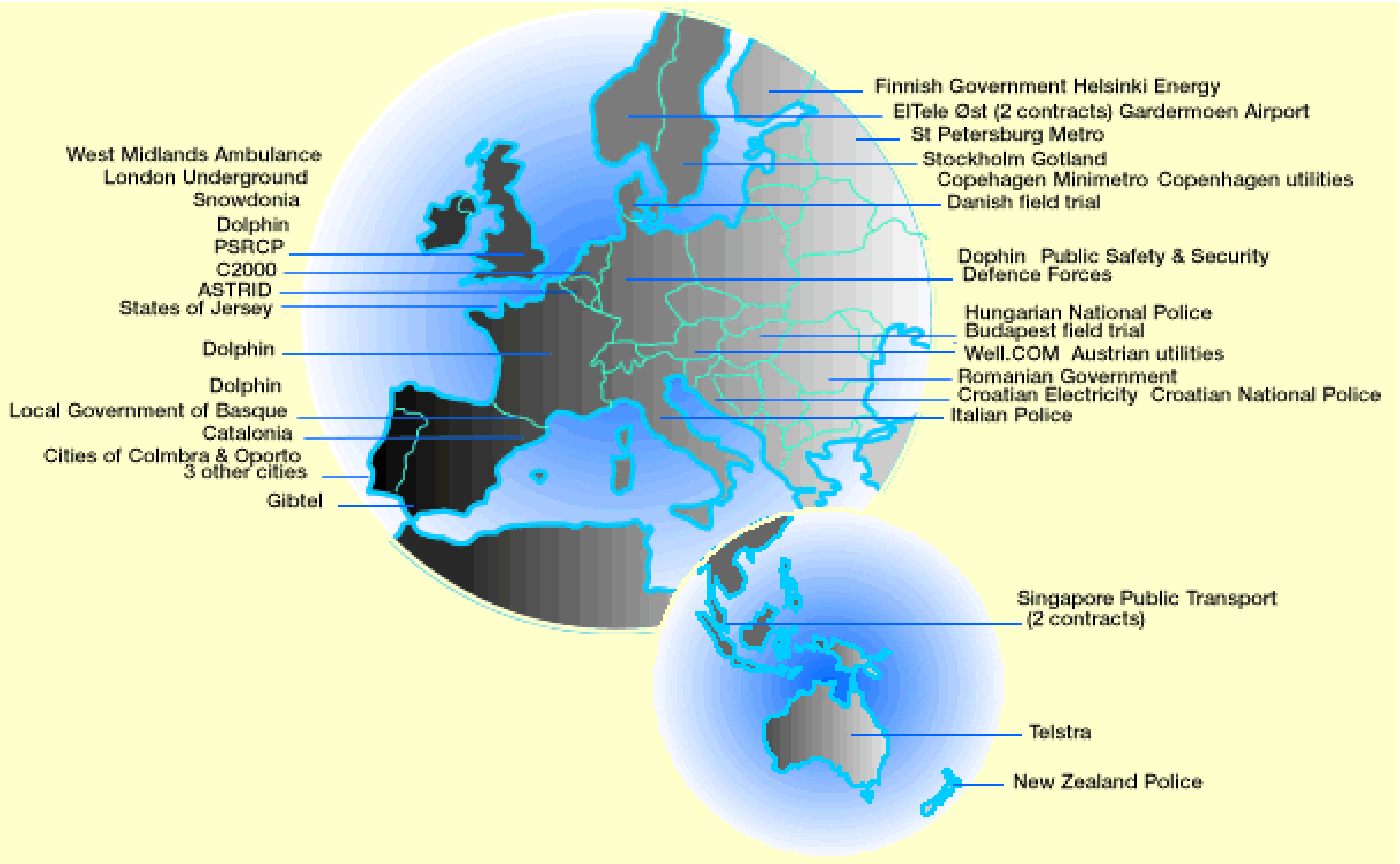
To ensure an open multivendor market, TETRA specifies the following essential interfaces:

- Air Interface ensure the interoperability of terminal equipment from different manufacturers.
- Terminal Equipment Interface (TEI) facilitates the independent development of mobile data applications.
- Inter-System Interface (ISI) allows the interconnection of TETRA Networks from different manufacturers.
- Direct Mode Operation (DMO) guarantees communication between terminals also beyond network coverage (Pl. refer next slide) in event of Base Station failure.



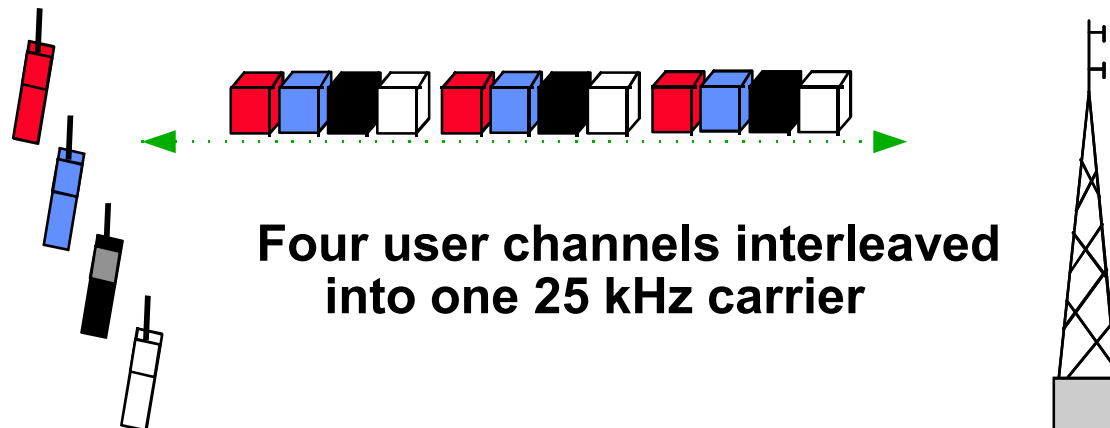
Infrastructure (Base Station, Switch, Base Station Controller etc.)

WORLD USAGE

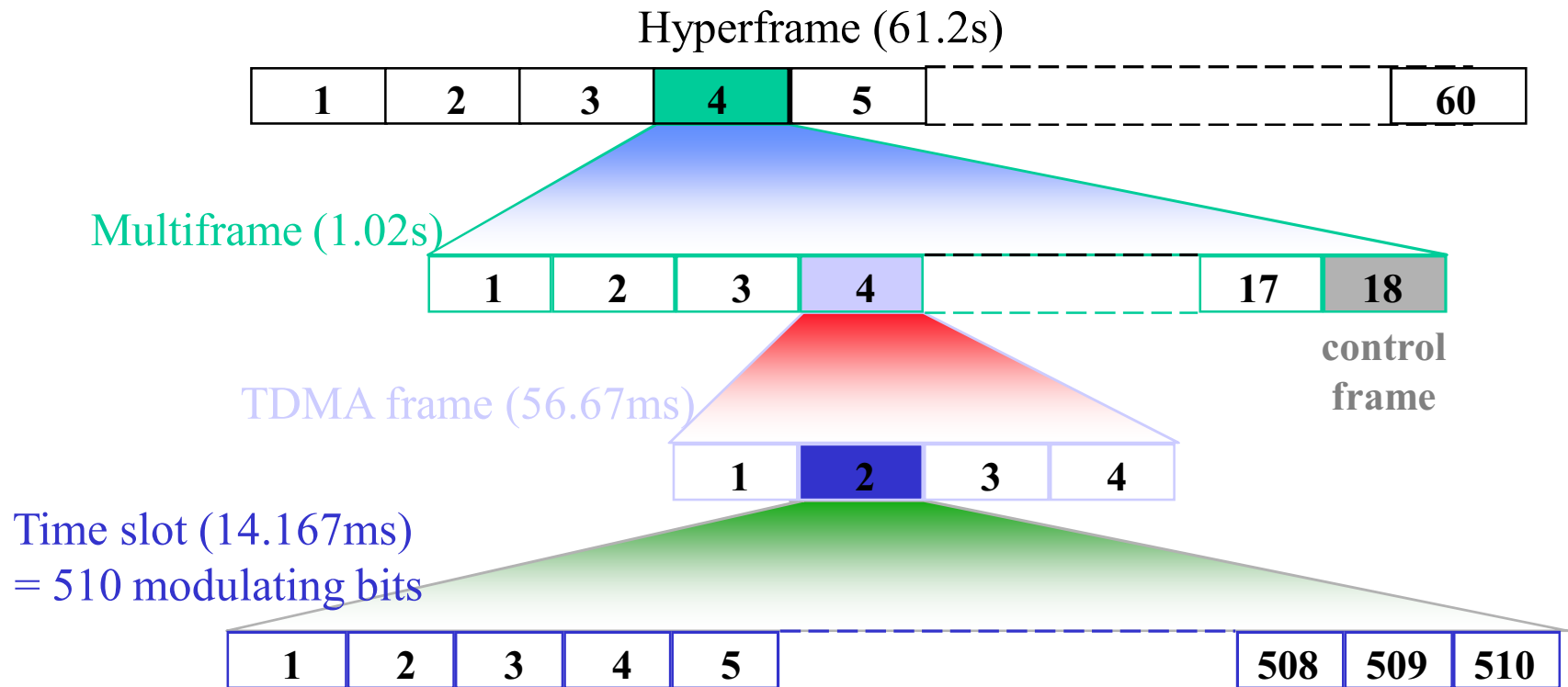


TETRA TDMA

- 4:1 TDMA (Time Division Multiple Access)
- 25 kHz carrier spacing
- Digital modulation, $\pi/4$ DQPSK at 36 kbits/s
- Speech calls use one channel
- Data calls can use up to 4 channels (Data transfer rates up to 7.2 kbit/ s per channel)

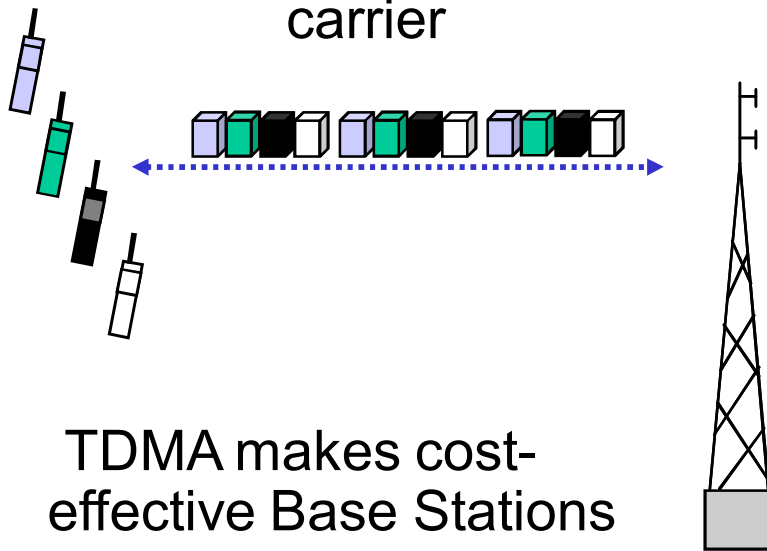


Air Interface - TDMA Illustrated



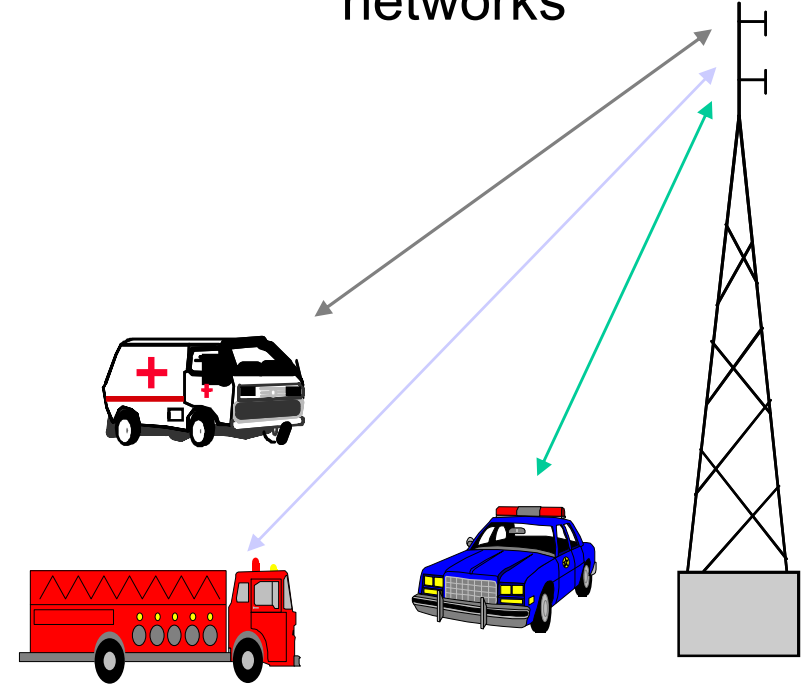
TETRA is the Cost - Effective Technology

Four-channel TDMA gives excellent spectrum economy - 4 channels in one 25 kHz carrier

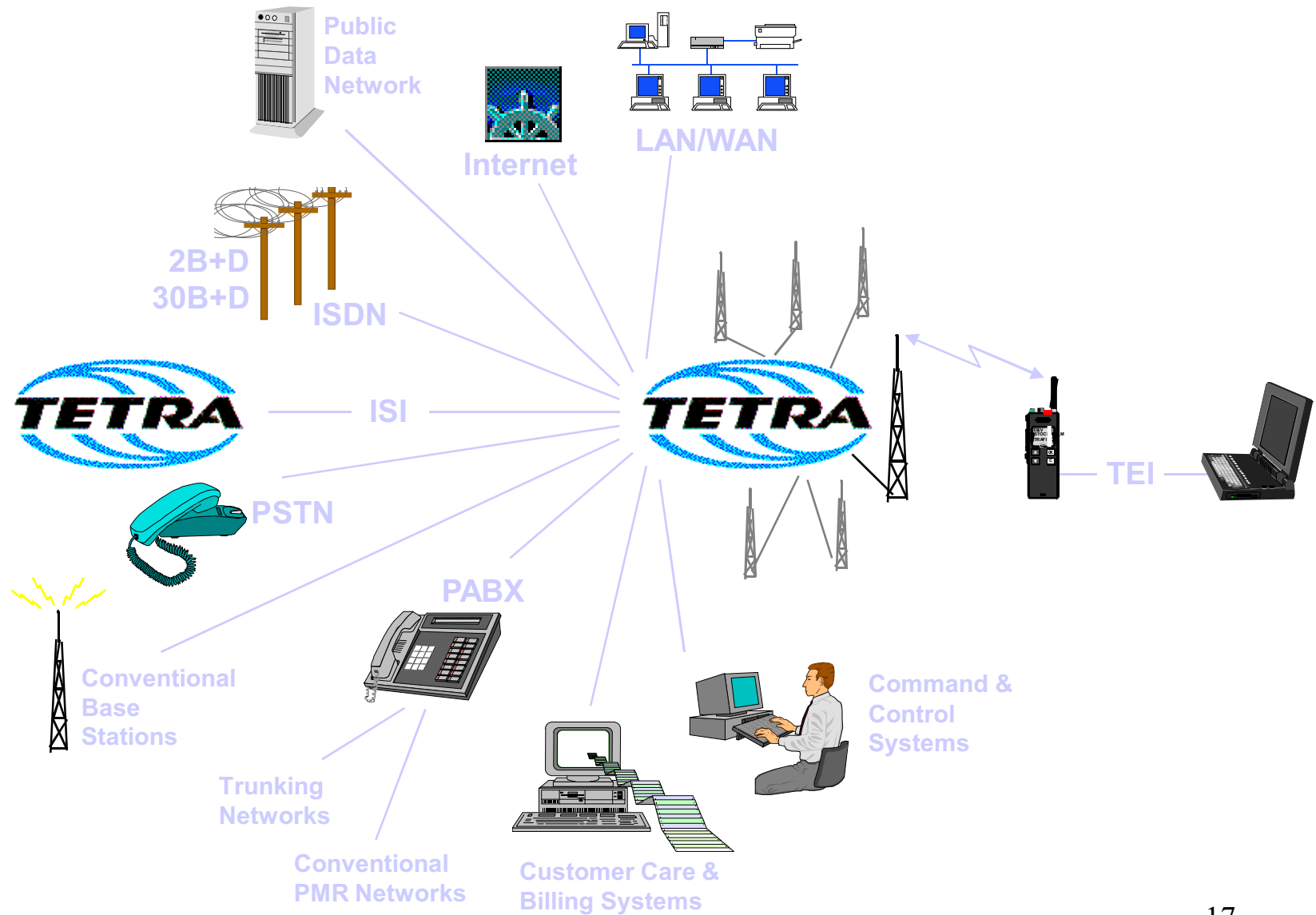


TDMA makes cost-effective Base Stations

Trunking technology supports controlled use of shared networks



TETRA Connectivity

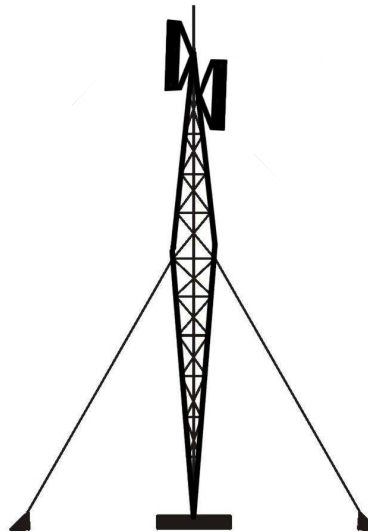


TETRA call types

- Private call (individual call)
- Phone call (PSTN or PABX call)
- Group call
- **Emergency call**
 - Any of the above types can be an emergency call
 - Highest level of call priority, may pre-empt other users
 - Call type and called party are pre-programmed
 - Operated by pressing dedicated **red emergency button**
 - Broadcast calls.

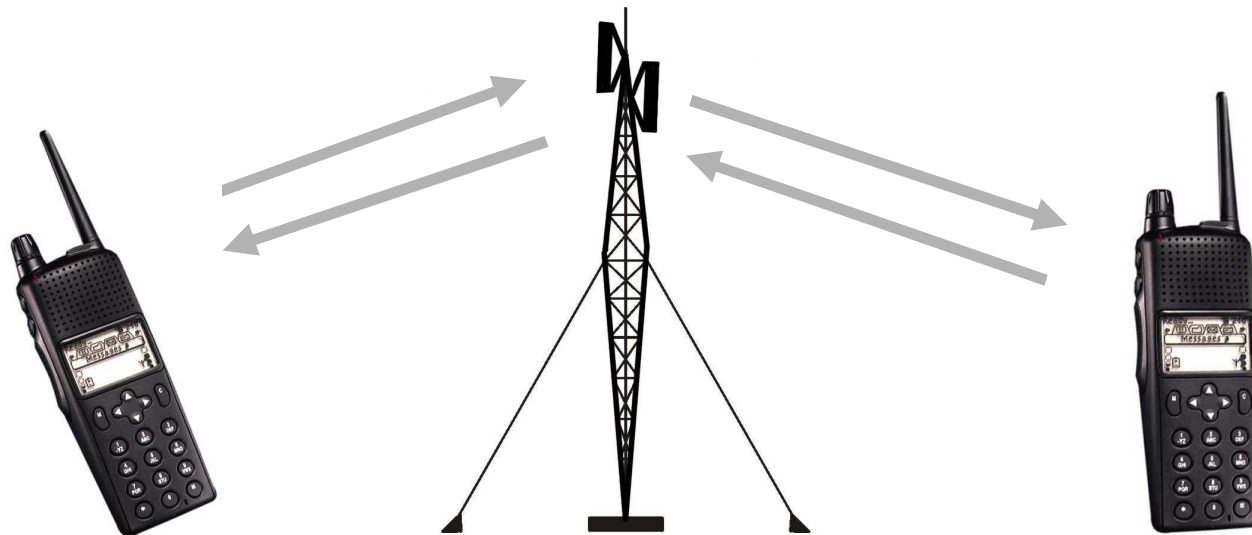
TETRA Traffic case - simplex calls

- Simplex Calls
 - Mobile is either transmitting or receiving
 - Requires operation of **PTT** switch (Push To Talk)
 - Talk time is usually limited, typically 1 minute maximum
 - Group calls are always simplex



TETRA Traffic case - duplex calls

- Duplex Calls
 - Mobile is transmitting and receiving (like GSM phone call)
 - Does not require holding PTT to continue transmission
 - Recommended for making **measurements** - no talk timer
 - Phone calls are usually but not always duplex



TETRA Traffic case - Trunking options

- Trunking options only apply to simplex calls
 - Applies to private simplex calls and group calls
 - Trunking type is controlled by the Base Station
- Message trunking
- Transmission trunking

Above cases explained in subsequent slides

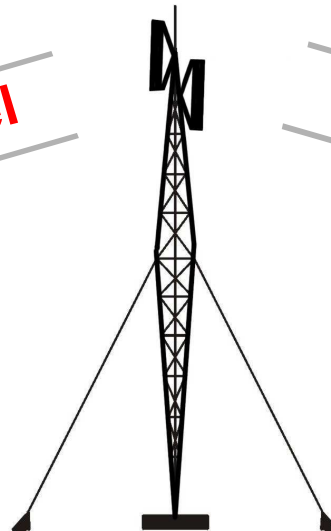
TETRA Traffic case - Message trunking

- A **traffic channel** is allocated for the duration of the call
- Bandwidth is being wasted when no-one is talking
- Guaranteed availability when someone wants to talk

Hello
Hello
Hello



traffic channel



traffic channel

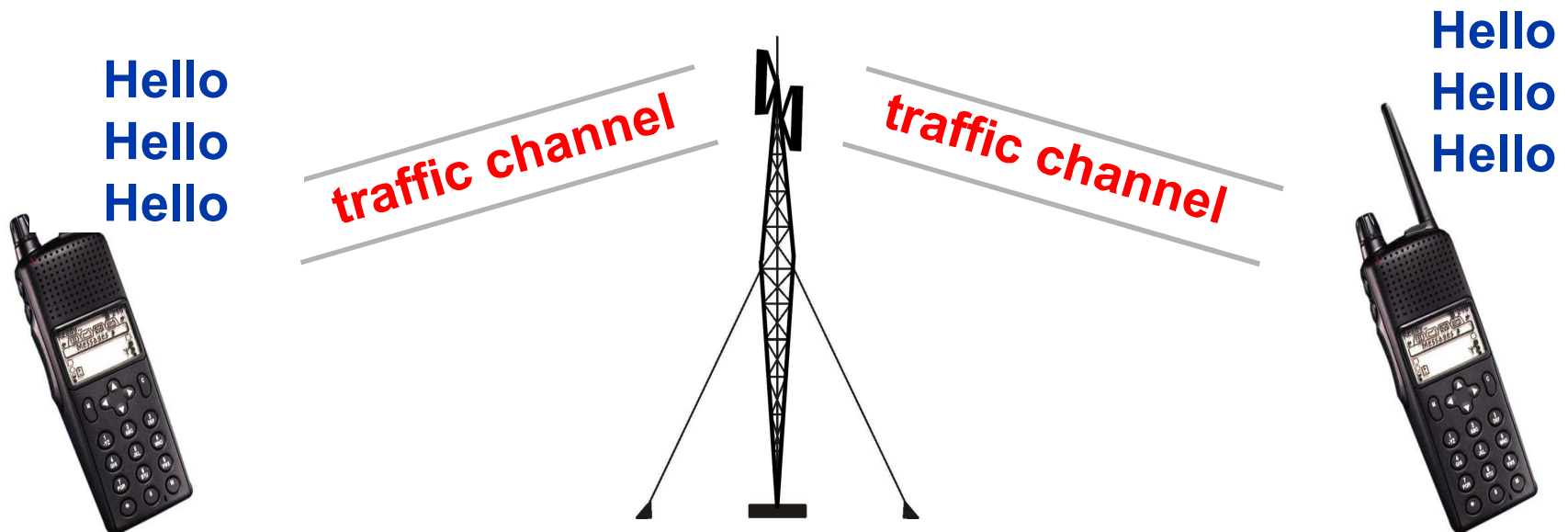


Hello
Hello
Hello

TETRA Base Station

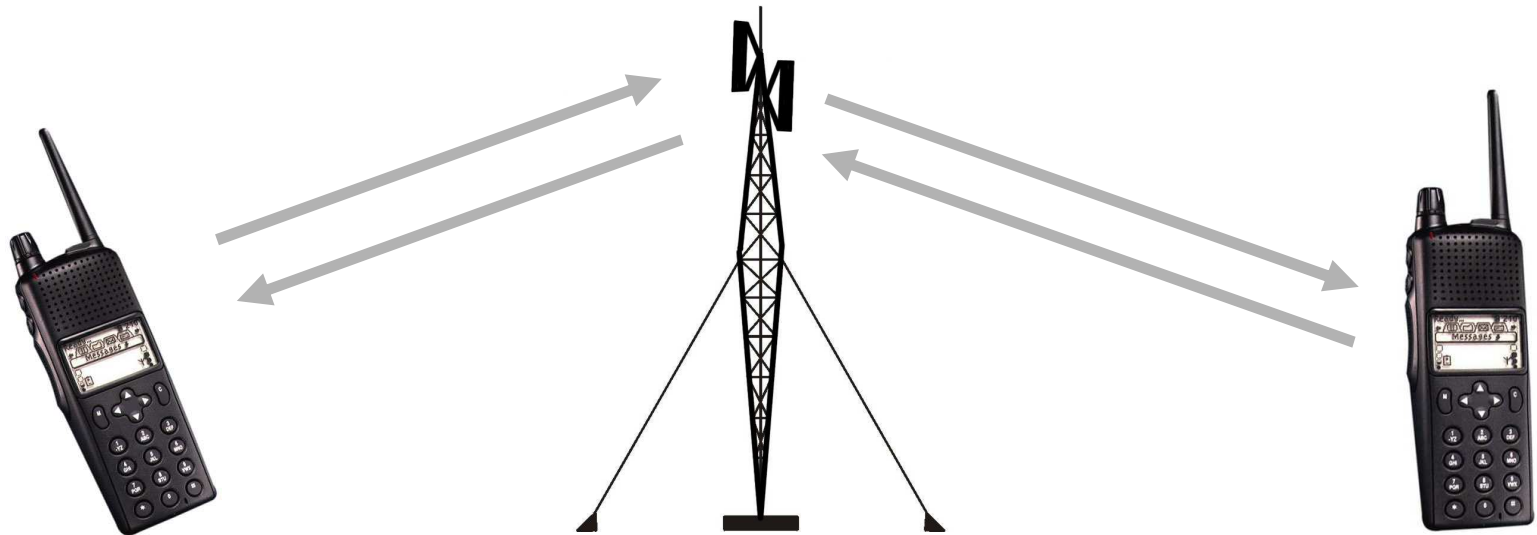
TETRA Traffic case - Transmission trunking

- A traffic channel is allocated on demand for each 'over'
- Mobiles return to the control channel after each 'over'
- Efficient use of bandwidth, channel available for re-use
- Channel availability on demand is not guaranteed



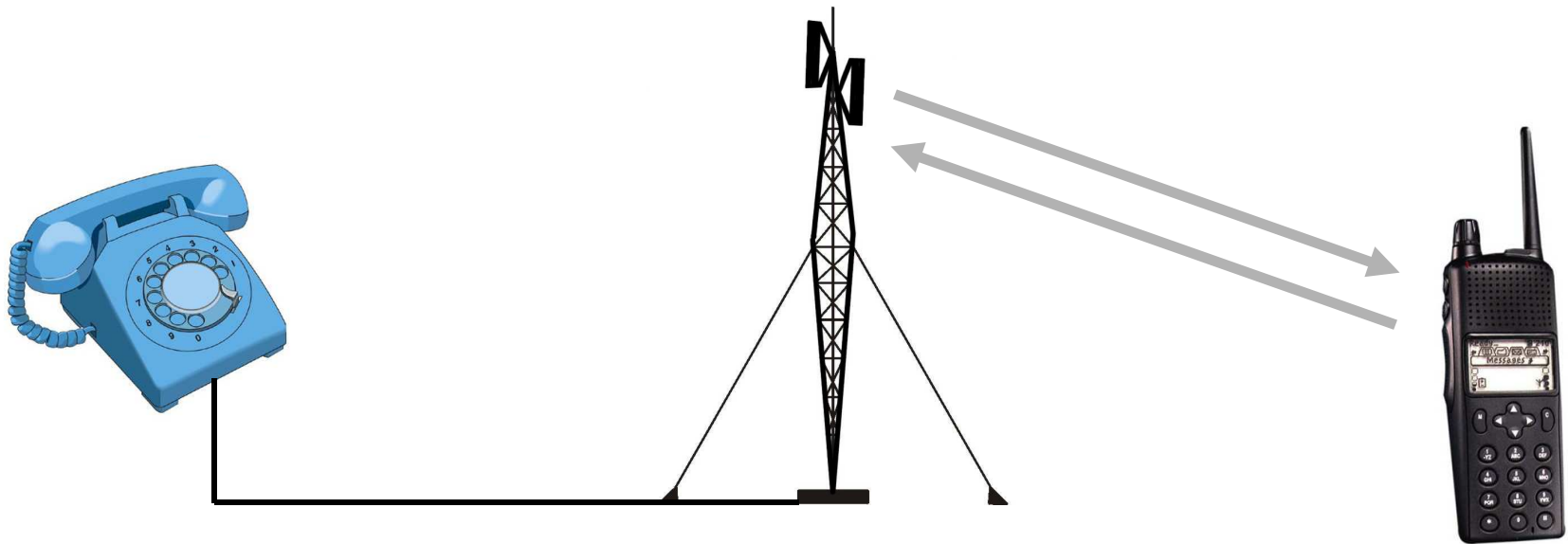
TETRA Traffic case - Private call

- Private call (individual call)
 - A call between 2 parties within the TETRA network
 - May be either simplex or duplex
 - May be either hook signalling or direct set-up
 - The mobile may reject or modify some combinations



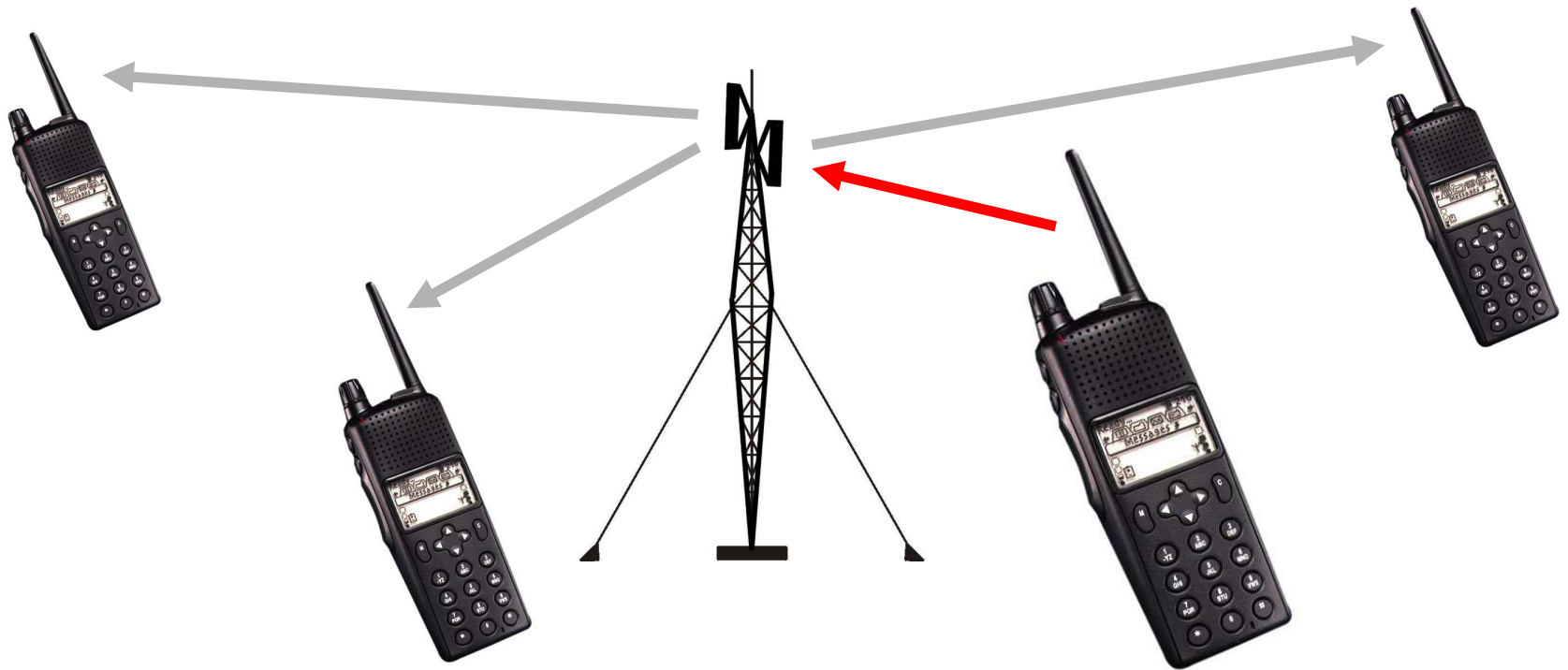
TETRA Traffic case - Phone call

- Phone call (PSTN or PABX call)
 - A call between a TETRA user and a fixed or mobile phone
 - Call is set up via the TETRA network's PSTN Gateway
 - Call is normally duplex, hook signalling
 - DTMF over dial for end to end signalling



TETRA Traffic case - Group call

- Group call
 - A call between more than 2 parties
 - Call is always simplex, direct set-up
 - Only possible if one or more groups have been attached



TETRA over IP (ToIP):

- **A new development in this field is TETRA over IP (ToIP) system.**
- **ToIP system has no central switch**
- **It has distributed intelligence at each Radio Site that can process and handle local calls.**
- **Set up inter-site calls and keep track of the registration locations of each subscriber.**

ADVANTAGES OF TETRA OVER IP

- **Future technology**: Industry Standard IP Hardware and Software. Multimedia technology, combining voice, data and images. Continuous performance improvements driven by IP market.
- **Efficiency**: Call processing is very efficient.
- **Flexibility**: Any combination of Star or Mesh network topology is allowed in order to balance traffic handling
- **Resilience**: Network elements and links can be duplicated for extra resilience.

Difference between GSM and TETRA System

GSM System	TETRA System
Designed for public cellular telephony.	Designed for professional mobile radio applications.
Based on Frequency Division Multiplication Access (FDMA)	Based on Time Division Multiplication Access (TDMA) – Economy on frequency spectrum
Not suitable for emergency services (Call set up time ~ a few seconds).	Suitable for emergency services due to very fast call set up time (300 ms)
Do not maintain privacy and mutual security.	Maintain privacy and mutual security.
Direct Mode Operation(DMO) is not possible.	Direct Mode Operation(DMO) is possible, which supports voice and data transmission without a Base Station between Radio Terminals.

THANK YOU