



# ***SCADA, Smart Grid and Telemetry***

TETRA and its use in the SST sector

TETRA + Critical Communications Association



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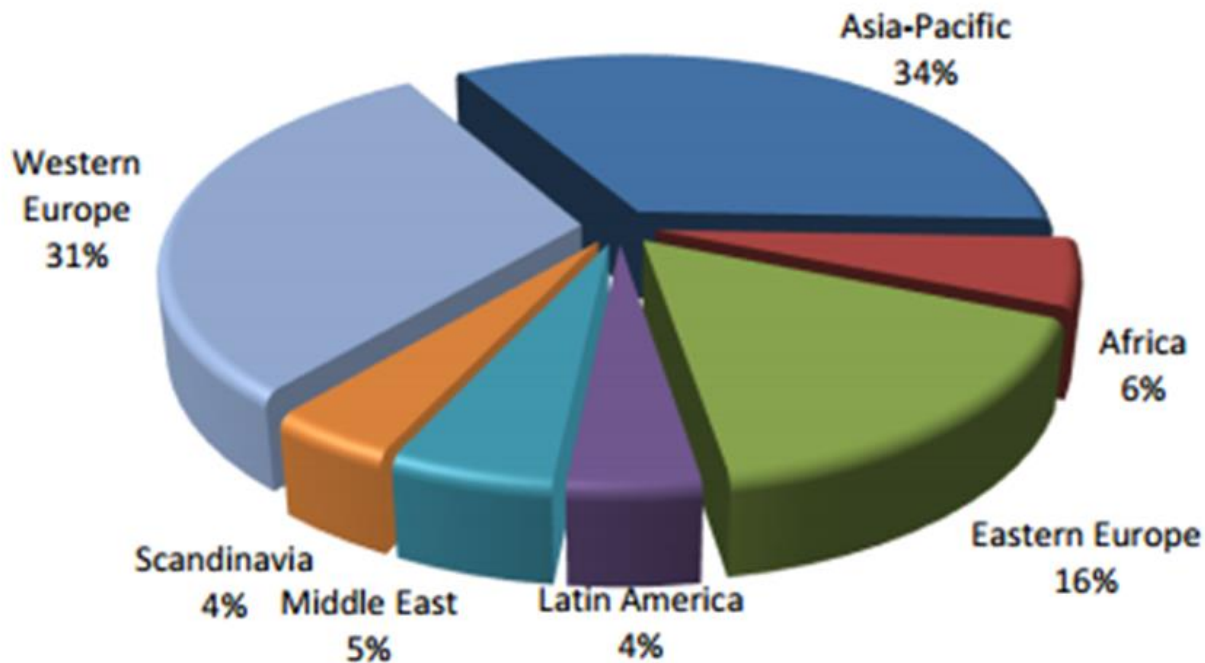


# *What is TETRA?*

- **TErrestrial Trunked RAdio (TETRA)** is an open digital trunked radio standard, which is defined by the European Telecommunications Standards Institute (ETSI) to meet the needs of demanding professional mobile radio users
- The TETRA + Critical Communications Association supports the development of interoperable TETRA solutions through the IOP process
- Enhancements of TETRA have now being standardised. These include a high speed data capability (known as TETRA Enhanced Data Services (TEDS)).



# *TETRA countries*

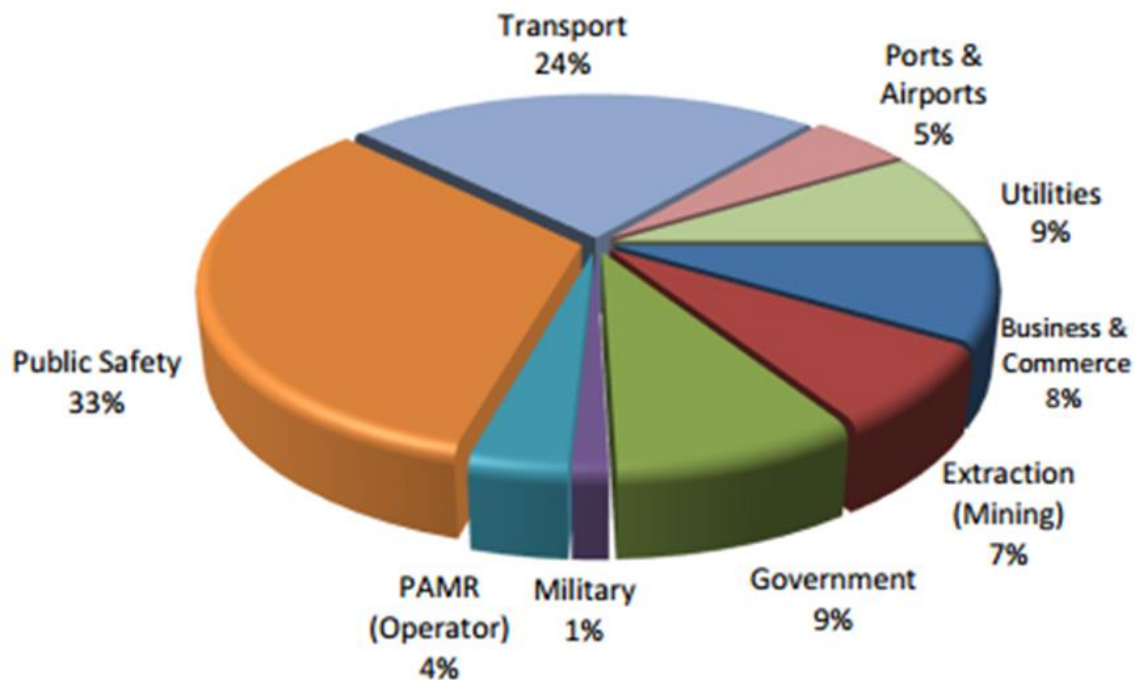


**Contracts by Region  
2010**



# TETRA markets

Contracts by Sector  
2010



# Main TETRA applications

## Public safety



## Transport



## SST Sector

Utilities, Oil and gas,  
Mining, Waste water





# TETRA *features*

- First real open standard in digital mobile radio tailored for 'Professional Users\*'
  - *'Professional Users' require Guaranteed Access, fast call set up, resilient network, talk-group facilities*
- Voice and data capabilities with four traffic channels in 25kHz channel spacing:
  - *concurrent voice and data*
  - *full-duplex voice call with simplex radios*
  - *data rates up to 28.8kbit/s (theoretical value with no error correction)*
  - *Raw TEDS data rates to 100kbit/s*
- Air interface encryption and end-to-end encryption
- Standard interfaces for connection of data terminals
- Call Set Up Time: typically from 300 ms

\*The specification was drafted in the first instance by public safety and PAMR users



# ***TETRA data capabilities***

TETRA provides a range of data services

- Status
- Short Data
- Circuit Mode data (limited number of suppliers)
- Single slot IP data
- Multi-slot IP data
- TEDS
  - *In 25kHz and 50kHz channels initially (but standard allows 100kHz and 150kHz)*





# ***TETRA data service***

- Status (system dependent but typically more than 28,000 available user status messages- on control channel
  - *Fast access for reporting of alarms + simple control*
- Short Data (typically 130 bytes without concatenation) - on control channel
  - *Alarm and information reporting + control*
- IP data uses dedicated packet data channels
  - *IP can be single slot (typically 3kbit/s) or multi-slot (up to four slots used)*
  - *Radios can demand an IP context, and then access the packet data channel when required*
- Circuit mode service is up to 4.8kbit/s with low error protection, but limited support by suppliers



# TEDS Data service

- TEDS uses QAM and wider RF channels to achieve higher data rates
  - 25kHz and 50kHz channel widths are specified in interoperability tests
  - 100kHz and 150kHz possible in the future
  - Higher data rates usually mean smaller coverage areas
- TEDS has two variants, Normal and Direct Access

<b><i>Normal access</i></b>	<b><i>Direct access</i></b>
<ul style="list-style-type: none"><li>▪ Uses existing TETRA1 control channel plus TEDS carriers</li></ul>	<ul style="list-style-type: none"><li>▪ Integral TEDS control channel</li></ul>
<ul style="list-style-type: none"><li>▪ Logical upgrade for fully integrated voice with overlaid high-speed data network</li></ul>	<ul style="list-style-type: none"><li>▪ Main control channel can be up to four slots wide</li></ul>
<ul style="list-style-type: none"><li>▪ Equipment available</li></ul>	<ul style="list-style-type: none"><li>▪ Can offer more flexibility in deployment (e.g. single carrier sites, data-only cells)</li></ul>



# TETRA and TEDS data rates

<i>Carrier</i>	<i>Type</i>	<i>Approx. speed</i>	<i>Polled application</i>	<i>Report by exception</i>	<i>Comment</i>
TETRA1	SDS	1–2 SDS/sec <sup>2</sup>	No	Yes	Depend on MCCH loading/capacity Messages for > $\cong$ 130 bytes need concatenation
TETRA1	Packet data (four slot)	12kbit/s	Yes	Yes	Theoretical data rate
TETRA1	Circuit mode data (four slot)	19kbit/s	Yes	Yes	Including error protection, but without protocol overhead
TEDS 25kHz	4 QAM1/2– 64 QAM 2/3	7kbit/s <sup>1</sup> to 31kbit/s <sup>1</sup>	Yes	Yes	Rate depends on signal quality
TEDS 50kHz	4 QAM 1/2– 64 QAM 2/3	19kbit/s <sup>1</sup> to 80kbit/s <sup>1</sup>	Yes	Yes	Rate depends on signal quality

*Note 1: Polled/ Report by exception is a general guide and will in practice depend upon the actual implementation/protocol*

*Note 2: Rates given in the table represent the typical application bandwidth available (allowance of 20% for application protocol over raw TEDS payload)*

*Note 3: Assumes voice and data network. Data only network could have more capacity*



# *Alternative technologies for SST*

- FM VHF and UHF radio
- GPRS/ 3G
- Satellite
- Mesh



# *FM VHF and UHF radio*

- Analogue radios operating in 12.5kHz channels, in point to point and multipoint configurations
- Used for SCADA and Telemetry
  - *Can be high technology devices, with serial and IP connectivity, and security/encryption*
- Are usually proprietary radio hardware, although standard applications can be used over the RF



# ***GPRS and 3G***

- Big market in Machine to Machine (M2M) communications, for SCADA and telemetry
- Advantage of low cost and an existing backhaul network to get the data to the control centre
- No control on the coverage, or availability of the service at geographically remote monitor and control points
- For power utilities, will network continue to operate when there is an widespread power failure?



# *Satellite and Mesh*

- VSAT commonly used for SCADA networks with remote outstations
- Can provide connectivity when there is no other telecoms coverage
- High cost, obstructed path and sun outages (solar radiation interference) are disadvantages
- Mesh can work well in urban environments, with many nodes providing resilience
- Low RF power of mesh devices will hamper its use over long distances



# ***SCADA, Smart Grid and Telemetry (SST) schemes***

Types of schemes include:

- SCADA
- Telemetry
- Telecontrol
- Smart grid
- Smart City
- Smart Metering





# *Traditional applications*

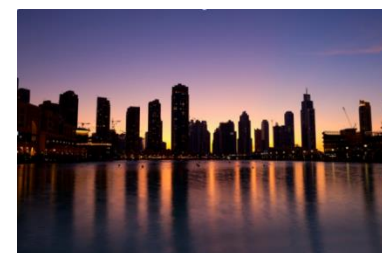
- **SCADA:** Supervisory, Control and Data Acquisition
- **Telemetry:** the remote measurement and reporting of information, from remote sensors, meters etc.
- **Telecontrol:** the remote control of equipment such as power switches and breakers, including load control/  
load shedding, valves and actuators
  - *telecontrol systems normally include telemetry functions in order to report back the current status*





# Emerging applications

- **Smart grid**: as part of an electricity power system can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to deliver sustainable, economic and secure supplies
- **Smart city\***: smart buildings and integrated city services, utilities, waste management, lighting, heating, transport etc.
- **Smart meter\***: typically includes two-way communication to the energy supplier, real-time consumption/billing information to consumer and load management capability (electricity).



\*Not currently the focus of the SST Group