

**MOTOROLA  
DIMETRA  
TETRA SYSTEM  
CENTRALISED  
ARCHITECTURE  
ADVANTAGES**

# INTRODUCTION

This paper describes the advantages of the Centralised Architecture which forms the basis of the Motorola Dimetra TETRA System. In addition other Dimetra features are described which further enhance the effectiveness of the TETRA system.

The Motorola TETRA Dimetra system has been continuously developed over more than 15 years to meet the needs of all types of TETRA users, from nationwide network operators to users in industrial situations with small systems. Numerous special features have been developed during that time which are available in the latest software loads. In addition the virtualised core ensures ease of upgrade to take advantage of developments and cost savings in the IT industry.

The following section refers to the specific advantages of the Centralised Architecture.

# CENTRALISED ARCHITECTURE ADVANTAGES

## PERFORMANCE AND EFFICIENCY

- Higher performance – one device, the Zone Controller, tracks the location of all MSs, groups and channels, and so can decide within a few milliseconds where and how a call should be set up. A fully distributed solution needs the base stations to negotiate between themselves, which will take longer.
- More scalable, and so much better performance in larger networks – the link from base station to Zone Controller only carries information relating to subscriber mobility and call information related to that one site, no matter how big the network grows. A distributed architecture needs information related to all sites to be sent to every site.
- More efficient link bandwidths – because of the previous point, much lower bandwidths are needed on links in larger networks to carry control and call traffic.
- More efficient use of radio channels – because the Zone Controller knows where every radio and every group is located, it only sets up a call on sites where users are present. Distributed architectures can sometimes set up calls on sites where there are no users, or to miss sites out where users were present.
- Optimum performance for critical communications – if one or more sites is busy where there are users that need to hear a call, the Zone Controller can queue a call until all sites have channels available. Everyone hears the entire call. In a distributed system, call set up is often a 'best effort' service – so some users may join the call late, and some users may miss the call entirely.

## RESILIENCE

- Centralised architectures with server redundancy and redundant links and routing paths provide a full set of services even under failure conditions. All wide area TETRA services are provided by the central control site. In a distributed system, if essential services such as data and telephony require links to a specific base station, there is a danger that the services are lost across the entire system if the base station fails, or becomes isolated due to link failure.

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### SECURITY

- The centralised architecture stores all authentication keys centrally. Real time authentication is carried out in the Zone Controller using session keys. The root authentication keys are stored in a separate Authentication Centre with a custom cryptographic card for key storage. Authentication keys and authentication session keys are never sent to base stations. A fully distributed architecture must store authentication keys at base station sites – which leads to a much greater risk of compromise. Base stations are in less secure locations, and there are more of them, increasing the risk of break in and theft.
- Encryption keys are only sent to sites where they are needed. Compromise of a site risks the minimum number of keys to exposure. Distributed architectures may require the duplication of all keys in all sites – so compromise of one site compromises the system.
- All interfaces to the network from external devices – IP packet data applications, short data applications, telephone gateways (PABX or PSTN) – are connected to the central location. The central location has a complete set of security defences, such as firewall, providing a strong single point of defence against attacks. A distributed architecture must duplicate these defences in every location.
- Failures of links to base stations can be detected more quickly and signalled to system operators more quickly – the base station only needs to send link checking signalling to one device (the Zone Controller). A distributed system needs to send link checking signalling between every sites and every other sites – the overhead that this causes means that it cannot be sent as frequently.

## OTHER ADVANTAGES OF THE MOTOROLA DIMETRA SYSTEM

### PERFORMANCE AND EFFICIENCY

- Proven, stable software – the same software is used whether a system has a few sites or has thousands of sites. The software has been proven – stress tested – in the largest TETRA system in the world (with over 3500 base stations).
- Experience – Motorola have been designing trunked radio systems since the late 1970s. There is a real depth of understanding of the features needed, and the interactions between features, and between radios and infrastructures.
- Depth of features – Dimetra systems have many configuration possibilities. Customers are different and the way that they need to operate is different. For example group calls may have configuration options such as:

Valid sites – where the group can and cannot be carried

All start or fast start – should the call start immediately, even if some sites have no free channels, or should it wait until all channels are free.

Critical sites – where the call has to be carried

Group priority – to determine channel access when sites are busy

Associated broadcast group (multigroups)

Dynamic regrouping capability – can the group be patched using DGNA

Emergency calls – with overriding priority

Pre-emption – can one user pre-empt another in mid call

And others...

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The configuration options determine the way that calls are handled – the air interface is unaffected, and so other manufacturers' subscribers can be used.

- Best data feature set of any manufacturer
- Status and Short Data Service
- Single slot and multi-slot packet data service – Motorola offer both, and were the first manufacturer in each case to do so
- Dynamic and static data channels – static channels can be much more efficient with typical short, bursty data applications
- Bandwidth on demand – the multi-slot channel can expand or contract according to voice and data demands on the site
- Data prioritisation – allows some users priority in sending data traffic
- TEDS – high speed data – without needing major infrastructure modifications.
- Use of best in class industry standard servers and networks equipment to construct the network – industry performance roadmaps, and reduced spares holding as one server can be configured to fulfil several different roles.
- Best in class base station, with best coverage of any TETRA supplier.
- Proven interoperability with other vendors' terminals, even in the largest and most complex nationwide networks.
- Complete set of End to End encryption products working together as a system, including radios, dispatchers, Key Management Facility and Key Variable Loader; all using high security module with key protection with tamper response
- Network resilience – duplication of all major components to ensure speech and data service maintained even during component failures
- Link duplication allows all services to be supported in full wide area mode even if a link fails
- Resilience – many options for full resilience in disaster recovery situations
- Fall back master site option
- Geographical redundancy option – on line fallback servers in a different location to provide seamless service even during catastrophic loss of one master site location
- Fully resilient databases
- Fallback options including Local Site Trunking, maintaining full set of trunked group and emergency call services including encryption
- Full set of link redundancy options, making use of resilient nature of IP – redundant links, alternate paths, duplicated links to base stations, ring configurations for base station links
- Fully redundant base station
- Best coverage performance of any supplier
- High power base station – 75W transmitter, providing 25W after 4 channel combiner
- Best receiver performance in the industry – over 7dB better than ETSI specification
- Triple diversity to provide balanced receive path
- Base station performance makes best use of portable station power to achieve coverage, leading to longer battery life

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### MOTOROLA DIMETRA TETRA SYSTEM CENTRALISED ARCHITECTURE ADVANTAGES

#### MOTOROLA ENHANCED FEATURES

- Group patch and Multiselect (broadcast) – make use of TETRA standard Dynamic Group Number Addressing service with temporary groups to provide the ability to patch groups together on the same channel for intercommunication and broadcast calls.
- Dynamic Regrouping – uses the TETRA standard DGNA service to add and remove groups to and from terminals without needing to recall them for programming.
- Storm Plans – allows the system planner to decide in advance which users need to communicate together in temporary groups in the event of a particular type of emergency. If the emergency event occurs, the operator launches the relevant Storm Plan which automatically sends the correct groups into the correct terminals using the TETRA DGNA service. Communication can be pre-planned, rather than risking errors in communication by changing groups reactively when a disaster occurs.
- Priority levels including automatic Recent User Priority algorithm – allows users who have recently finished talking to have increased priority on their next call, to give better call continuity – provided by infrastructure processing and does not affect TETRA air interface
- Announcement groups – uses radio talkgroup scanning in conjunction with infrastructure control of groups to provide a pre-configured broadcast group service. The infrastructure clears calls in progress, and starts the announcement group call when a broadcast is needed.
- Priority monitor – uses radio talkgroup scanning in conjunction with prioritisation in the infrastructure, such that calls in a priority group are signalled on all traffic channels at a base station, allowing users to leave an ongoing call and to join the priority group.
- Integrated voice and data – allows a user to be called when in the middle of a data transaction on a data channel, and to move into a priority voice call.
- Simultaneous voice and data – uses all control channels including the Association control channels on a traffic channel to send and receive Short Data, so that a user can send and receive SDS during a voice call.

## SUMMARY

Motorola Solutions is the leading supplier of TETRA to public safety customers. We have won the majority of recent nation-wide public safety TETRA contracts. In parallel Motorola Solutions is supplying TETRA systems to airports, Metro operators, Oil and gas companies and many other industrial organisations. The advantages of the centralised architecture together with other powerful features are available to all types of operator and end user.

The Motorola Solutions portfolio of TETRA terminals has expanded with the addition of the MTP3000 and MTP6000 handsets as well as a range of MTM5000 mobiles. With TEDS capability in many of these as well as the imaging solution in the MTP6750, Motorola Solutions offers the most compelling terminal solution set in the industry.

With a full range of service solutions, application partners, and local representation Motorola Solutions is uniquely placed to supply and support the roll-out of TETRA service for all types and sizes of operator and end user.

For more information on the full range of our solutions, please visit us on the web at:  
[www.motorolasolutions.com/TETRA](http://www.motorolasolutions.com/TETRA)