

Upgrading to Trunked DMR

Strategies for
successful migration

White Paper

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Upgrading and migrating a PMR network can be a major headache for network operators - this is not an everyday occurrence. Each migration presents unique challenges to operators, integrators, vendors and users. While larger networks present greater challenges, even modest networks require a large degree of experience, flexibility and diligent, upfront planning to ensure success.

When moving from analog to DMR there are a number of possible strategies for a smooth migration, avoiding the expensive “forklift upgrade” often required with Tetra. DMR can optimize the upgrade investment and maximize the re-use of existing equipment.

This white paper introduces migration planning principles that ensure your organization will not experience service interruption during network upgrade or migration transitions.

We will consider the following topics:

- ▶ Essential principles for migration success,
- ▶ ten steps to plan a successful migration,
- ▶ instant or gradual site switchover,
- ▶ choosing equipment for a simpler, smoother migration,
- ▶ support for your stakeholders to ensure their positive engagement,
- ▶ a migration sequence to illustrate key principles.

NETWORK MIGRATION: THE ESSENTIAL PRINCIPLES

Even before selecting the technology for your communications network, you and your communications advisor should seek to understand what is important to your business and what can be achieved. From the choice of AVL application, to network design and capacity demands, the better the understanding you have of the possibilities and implications, the more successful your implementation will be.

In depth understanding and thorough planning significantly increase the likelihood of a successful migration outcome. The following principles can help you to minimize the risk of disruption to your business:

- ▶ Put migration to the forefront of your planning, even before selecting which technology you will migrate to. Any network migration could negatively impact your end users enormously, and if not sufficiently considered will have a negative effect on your business operations as well.
- ▶ Seek expert advice from trusted professionals with network migration experience in your chosen technology. A network migration is not an everyday occurrence and few organizations have sufficient resource or expertise to manage it alone.
- ▶ Up front management of stakeholder expectations is vital. Ensure network operational goals are well understood and there are no unaddressed expectations. Clearly and accurately communicate what users should expect before, during and after the migration.

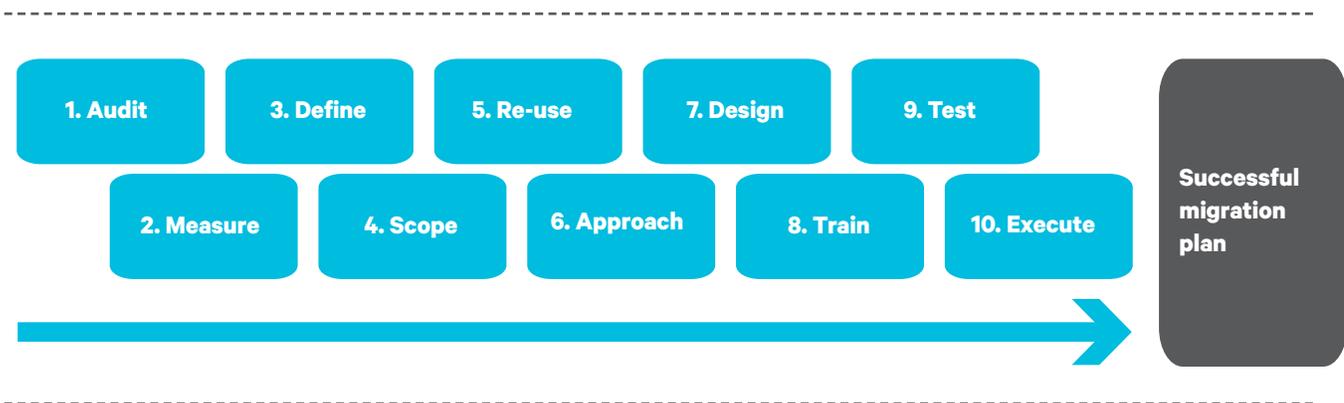
“...even modest networks require a large degree of experience, flexibility and diligent, upfront planning to ensure success.”

- ▶ Understand the advantages, implications and risks associated with each of your choices – for example contrast an overnight switchover, compared with a scenario where both networks operate for a controlled period of time.
- ▶ Leave nothing to chance. Always pre-test or validate every stage before it is rolled out and develop a rollback plan for unforeseen events. The upfront time and effort that should be applied is proportional to the size, importance and complexity of your network.

TEN STEPS TO A SUCCESSFUL MIGRATION PLAN

Network migration requires methodical engineering that is based on sound system engineering principles and processes. Many networks have evolved over time and have customized equipment which substantially increases the complexity of a migration project. You will most likely engage a professional integrator or vendor to provide specialized expertise and perform much of the upfront engineering work.

However you approach your migration project, there are some specific steps that you and your communications partners should follow:



1. Audit

Before you can identify where your network is heading, you need to be clear about where you are now. An audit will detail all your network assets, both hardware and software. Fully understanding the important features, functionality and performance of your current network is essential.

2. Measure

You need to understand usage data on your existing network, including geographical profiling of calls and peak loading characteristics, with particular attention to performance. Clarify any outstanding legacy network issues that also need to be addressed.

3. Define

Now that you have a clear picture of your existing network; it is time to define requirements for the future. Do you have specific coverage requirements that are not currently being met? Will you take advantage of added capacity and

incorporate more users on your network? What digital solutions will make your operations more efficient? What new developments will keep your workers safer? How will you communicate with other organizations in your region? How will you ensure your new network will meet increased demand?

4. Scope

Once you understand the performance of your existing network and what you need from your new network, you can scope the iterations that will transition you from your old to new network. Will you initially implement a voice system and progressively add data services? How - and when - will you integrate with your applications? How will you handle security requirements?

5. Re-use

What equipment do you intend to re-use in your new trunked DMR network? You may be able to re-use site antenna and combining equipment with no negative impact. Your current network may have dispatchers, phone connections and voice recorders which support both analog and digital interfaces. If you intend to re-use equipment, consider whether it will be a temporary measure to spread the migration cost, or a permanent feature of the new DMR network. Fully understanding the implications of this decision is key to ensuring that your migration runs smoothly, and that your equipment will meet your demands, now and in the future.

6. Approach

Which migration approach is most appropriate for your needs? Is an overnight migration best, or will your legacy and trunked DMR networks inter-connect and share calls in parallel? Deciding how you will approach your migration is equally important as the technology you choose.

“Which migration approach is most appropriate for your needs?”

7. Design

Using your audit and measurement data, and with a clear understanding of trunked DMR capability, you can design and plan a process that supports your organization during migration. There will always be some level of change that must be managed, such as conventional systems channel change processes are natively supported by trunked DMR technology. Other migration considerations include:

- ▶ What dual mode capabilities are required of the terminals
- ▶ Should a site be completely swapped out in one visit or operate in parallel with the legacy network?
- ▶ What features must be supported across the inter-network interface?
- ▶ If CTCSS or DCS tone signaling was used to change legacy network behavior, how should this be implemented on the new network, using digital signaling?
- ▶ What calling mechanisms do you use today, and what will your new DMR talkgroup dialing mechanisms look like?
- ▶ How will group and call information be extracted, shared and used during migration?

- ▶ Can your current data applications support multiple network interfaces, interconnecting to a trunked DMR data gateway and the legacy network at the same time?
- ▶ Does your legacy network use leased lines? These are becoming costly to maintain and difficult, if not impossible, to obtain additional capacity on.
- ▶ Have you considered upgrading your inter-site linking to provide IP-based backhaul interconnectivity for your new digital network?

A trusted partner can help create various scenarios, and factor in risks, regulatory requirements and safety concerns around the new network and the migration. With all the information at your fingertips, you can safely make a fully informed decision.

8. Train

Before your solution is rolled out, engaging and training key people will speed up acceptance and adoption of the new network. As DMR champions, they will understand the benefits of your solution and can help manage expectation post roll-out.

9. Test

A small scale trial system should be used to test all migration capabilities and processes to your satisfaction before deploying on a live system.

10. Execute

Finally, execute the migration process in an orderly and logical way, according to your plan.

COST VERSUS RISK VERSUS IMPACT: WEIGHING IT UP

In any complex project, decision makers must weight up their priorities, and understand the consequences of every decision. Obviously, an unlimited budget will overcome virtually any issue, but this is rarely a commercial reality. Most decisions carry an element of risk – is this an acceptable level, or is the potential cost too high? What is the impact of the decision? Reducing the risk to an acceptable level may cause cost overruns or delays in your implementation. What is the impact of a delay on your business?

For example, a site equipment migration typically follows either an overnight switchover, or operates parallel networks for a period of time. Network operators must weigh up the cost versus risk versus impact of these two approaches:

OVERNIGHT SWITCH-OVER

This approach involves switching off one system or site completely and transferring all capacity to the new network as quickly as possible. To minimize network disruptions it typically occurs at night, to avoid peak network demand.

- ▶ An advantage is that there is no need for inter-network calls as all call activity is only ever on one network.



- ▶ It requires a large management overhead and is not recommended for medium to large network configurations.
- ▶ It is logistically impractical to update all terminals at the same time if the new terminals do not support dual-mode.

PARALLEL NETWORKS

As part of a managed migration plan, parallel networks factor in real-world limitations such as staff resource availability and equipment installation timeframes. Continuity of service is provided while terminals are gradually swapped out. The two most common variations are:

- ▶ Switch over all channels on a site at the same time. This approach requires only a single site visit and saves a considerable amount of OPEX.
- ▶ Switch over site channels on a channel-by-channel basis and allow both networks to operate on one site at the same time. This allows a gradual swap out of terminals. This may require multiple site visits.

Parallel network capacity is essential where the new DMR terminals do not support the legacy system and the terminals on a site cannot be changed out to DMR all at the same time.

SELECTING EQUIPMENT FOR A SIMPLER, SMOOTHER MIGRATION

When making decisions about equipment for the new network, it is worth considering these specific capabilities to support the transition.

DUAL-MODE TERMINALS THAT SIMPLIFY RADIO USE

The benefit of dual-mode terminals is a simpler, more consistent user experience requiring less re-training. Terminals that can access and operate on both the legacy analog and new trunked DMR network can communicate right across the network coverage area, regardless of whether individual sites have been upgraded or not. When the terminal detects it is within a DMR site coverage area, it will access the DMR network as a higher priority over the legacy network.

It is important to clarify that your chosen terminals can operate with your legacy equipment. Dual-mode capability may not be possible if your old network uses proprietary technology or is heavily modified.

DISPATCHER EQUIPMENT CAN PROVIDE INTER-NETWORK DUAL MODE CONNECTIVITY

For simple, flexible inter-network call management during migration, some dispatch equipment offers multiple network connectivity options. In your selection process, consider a dispatcher that can connect to both legacy and IP-based DMR networks. Dispatchers can set up 'patches' between the two networks to create a multi-network call that can be controlled via the dispatcher manually or automatically. Dispatch equipment typically provides 'wireline' connection into radio network

interfaces. There are various standards-based or proprietary interfaces supporting serial or IP-connectivity for dispatch interfacing. Some dispatch vendors also provide 'wireless' network connectivity that leverages legacy network mobile terminals to provide another option for inter-network connectivity.

SITE REGISTRATION MECHANISMS CONTROL TERMINAL MIGRATION AND NETWORK LOADING

Network overloading during migration can give users the perception of poor network reliability. This can be overcome by managing the volume of inter-network calls and controlling terminal migration so that the dual mode terminals cannot access both networks. Even one member of a group on the old network will generate inter-network calls that waste network resources by attempting to access both.

The DMR network (and ideally the legacy network) can control a terminals' ability to access or register on the DMR network. A common strategy is once all terminals have been changed, migrate then in groups onto the new network, so that they can only access one network at any time.

LEGACY NETWORK INTERFACES FOR INTER-NETWORK CONNECTIVITY

Inter-network call handling during migration requires a suitable legacy network interface as terminal registration, call setup and progress details are passed across the interfaces. Call setup information means the interface can be dynamically assigned on a call by call basis, rather than requiring one interface per talkgroup.

Legacy interfaces can provide alternative, low cost, inter-network interface alternatives. Interface functionality, scalability and RF site channel loading aspects do need to be considered for these interface scenarios. Most legacy mobile terminals provide audio line interfaces enabling 'wireless' connectivity scenarios to be considered. Legacy audio interface support provided directly by the DMR network enables further flexibility for the network engineer to consider.

IDENTIFY AND SUPPORT YOUR KEY STAKEHOLDERS

Migration has wide implications, including for those who may be only indirectly involved, and it is critical that they are kept informed of your project status. Understanding the needs of network users and other key stakeholders is critical for successful migration. Stakeholders to consider include:

- ▶ users who rely on your communications network to manage the tasks and duties that deliver service to your customers,
- ▶ the operations manager who requires service continuity throughout the migration phase, to minimize potential business impacts,
- ▶ external organizations who may be the end customers of your PMR radio users, financial controllers who need confidence of completion within budget, regulatory authorities.

Including these stakeholders will speed up acceptance and adoption of the new technology, by demonstrating that your decisions and efforts are focused on maintaining PMR service continuity. A clear and visible migration process helps to manage expectations and reduce potential dissatisfaction.

Migration may be tied to improved workforce management, so it is important to clarify why and how changes will impact radio users. Change often uncovers latent operational or organizational issues. Involving these stakeholders early in the process provides an opportunity to recognize, clarify and resolve workforce procedures beyond radio usage.

Managing resistance to change is vital. Each stakeholder group must understand why the changes are being made and what advantages they will experience from a trunked DMR network. Radio users in particular will benefit from pre-migration training to show how their day-to-day tasks will differ – for example in the way talk groups are selected, or how call queuing is used.

To reduce confusion and resistance amongst your stakeholders, you should clearly identify and communicate any short-term constraints that they may experience during migration.

“Each stakeholder group must understand why the changes are being made and what advantages they will experience from a trunked DMR network.”

GETTING DOWN TO BUSINESS – MAKING IT HAPPEN

Although each network and each migration is individual and unique, every successful network migration is progressive and systematic. While your migration plan depends on your priorities, timeframe, budget and risk management, typical migration tasks are:

UPGRADE TERMINALS TO DUAL MODE

New terminals must support essential legacy functions and operate correctly on the legacy network. This may mean DMR capability might be provided at a later stage, via software and firmware update.

- a.** Plan the terminals rollout
- b.** Train users on the new terminals.
- c.** Swap out legacy terminals for new DMR-capable terminals to plan.

INSTALL DMR NODE EQUIPMENT

This phase ensures that the inter-site WAN network is correctly integrated with the DMR network and is performing as expected.

- a.** Install a trunked DMR node. Prepare and test all inter-network connections and node to site connections.
- b.** Install new dispatch equipment (if required).
- c.** Test all inter-network connections supported by the dispatcher.
- d.** Test and validate all legacy-to-DMR inter-system equipment settings and operations.

UPGRADE A SITE TO SUPPORT DUAL NETWORK CAPABILITY

Initially, all dual-mode terminals are barred from accessing the trunked DMR network.

- a. Once a significant number of terminals have been updated, change one legacy base station channel to trunked DMR.
- b. Update terminal network registrations progressively and systematically, so the terminals migrate to the trunked DMR network without overloading capacity.
- c. Migrate remaining base station channels to trunked DMR as required.

CONTROLLED TERMINAL MIGRATION

Leverage registration management capabilities of both the new network infrastructure and terminals to control the network the new terminals operate on. Multi-mode DMR-capable terminals should be initially barred from registering on the new DMR network.

- a. Once an entire terminals group have been updated, update the network registration privileges for the entire group, all at once. Performing this action centrally, at a network management level, provides valuable time and effort benefits.
- b. Understanding the geographical site usage of a terminals group is very important and having this information can significantly improve network performance during the migration phase.
- c. Select terminal groups to migrate to minimize the amount of inter-network calls. As a goal inter-network calls should be avoided, though this is not always possible or practical.

Repeat the steps above for each site and talkgroup of the network being upgraded.

SUMMARY

When migrating to a new digital DMR network, the list of tasks and considerations is extensive and can be overwhelming. Few organizations have all the expertise and resource in-house to undertake a project on this scale.

While this paper provides some guidance and recommendations that a network operator should consider, it is important to seek expert advice and support from a reputable, trusted PMR provider. Working in partnership with professionals who understand your business concerns and challenges, who can tailor a solution to your precise requirements, and can demonstrate substantial experience in migration to digital technology will give you the greatest chance of a successful migration.

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