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This series of articles is intended to provide a general conceptual understanding of Interoperable Communications as they pertain to Public Safety Communications and Emergency Management/Incident Response support.

The “Seven Levels of Interoperability”

The “Seven Levels of Interoperability,” as described by SAFECOM, refers to multiple methods of providing forms of Interoperable Communications. This article will examine the advantages and disadvantages of the different methods of Interoperability to enable the reader to recognize fiscal and physical advantages and disadvantages of each and how their usage fits into the “Seven Levels of Interoperability.”

Within the SAFECOM document, “The Seven Levels of Interoperability” are specified with detailed descriptions of the various assets used in each of the individual levels of Interoperability. We will discuss each of the listed levels and how they are presently being applied.

The “Seven Levels of Interoperability” are:

- Radio Swap
- Talk Around
- Mutual Aid
- Radio Frequency Gateway
- Network Gateway
- Common System Vendors
- Standards Based Environment

1.) Radio Swap is the trading of radios between agencies to facilitate communications. In most cases, when we swap radios we enable one agency to communicate with one other agency. This means that if four agencies need to communicate, everyone carries four radios.

- Radio Swap *is cost effective*. The cost of swapping or loaning radios to facilitate Interoperable communications is very low.
- Radio Swap *does provide practical implementation*.
- Radio Swap *does not provide reasonably effective communications* connectivity in any scenario other than the most basic requirement.
- Radio Swap *does not facilitate First Responder Transparency*. In the example above, it can be seen that carrying multiple radios is not conducive with maintaining transparency.
- Radio Swap *does utilize existing assets/resources*. Radio Swapping primarily revolves around swapping portable radios between agencies. Most agencies have reasonable amounts of spare portable radios; therefore there is no additional cost for assets to give to the different agencies.
- Radio Swap *does not provide a Practical Management Environment*. This form of communications Interoperability, though inexpensive, is not practical from a physical standpoint. It is difficult to carry more than one radio, along with all the other equipment a responder must carry. The other radio is another distraction while determining which agency has called.
- Radio Swap *does not provide effective multi-agency communications*. As is sited above, communications between any more than 2 agencies would be completely impractical to attempt.
- Radio Swap *does not require any special technology staffing*.

2.) Talk-Around is when an agency or group of agencies designates a simplex channel as a method of inter-communication. Talk-Around channels can be very effective for individual types of agencies and small local community situations.

- Talk-Around is cost effective. It is the use of “Simplex” channels to communicate in small areas. Those channels are usually already assigned to the given agency.
- Talk Around does provide practical implementation. Using 1 side of a licensed repeater pair and programming mobile and portable radios can implement it.
- Talk Around does not provide effective communications connectivity for more than a few agencies. In order for it to work at all, the other agencies must have the Talk-Around Channel programmed into their radios.
- Talk Around does not provide enough First Responder Transparency. Talk Around is only effective if the other agencies have the channel.
- Talk Around does utilize existing assets/resources. The use of a Simplex channel from a licensed pair only incurs the cost of programming the radios to use the channel.
- Talk Around is limited in the practical management environment. Like “Radio Swap”, Talk Around is really only effective with 1 other agency. It is unlikely that multiple local agencies would have the Talk-Around Channel in their radios unless the talk around channel was a designated mutual aid channel.
- Talk Around does not normally provide effective multi-agency communications for the reasons cited above.
- Talk Around does not require any special technology staffing.

3.) Mutual Aid is defined as a channel assigned by a state or federal agency to be used to tie several like agencies together. Mutual Aid is used as the State Fire Mutual Aid channel, which is used by fire departments to communicate with each other in large, multi-agency fires. There are various other Mutual Aid channels for Law Enforcement and EMS agencies.

- Mutual Aid *is cost effective*. It is normally either a simplex or repeated channel provided by the state or a Federal agency.
- Mutual Aid *does provide practical implementation*. The use of a designated Mutual Aid channel provides the ability for multiple agencies of the same type to communicate. An example would be the “State Fire Mutual Aid” Channel (154.280MHz) could be used by all Fire Departments that have VHF radio systems. It does not help Police Departments or Fire Departments on UHF or 800MHz.
- Mutual Aid *does not provide communication connectivity*. Mutual Aid channels normally support 1 type of agency on 1 radio band.
- Mutual Aid *does not provide First Responder Transparency*. This is primarily due more to the fact that the Mutual Aid channels have been used for many years, over their actual ability to provide connectivity to enough agencies to provide effective Interoperability.
- Mutual Aid *does utilize existing assets/resources*. Usually the agency using the mutual aid channel has only the cost of programming the channel into their radios.
- Mutual Aid *does not provide a practical management environment*. Mutual Aid channels tend to support 1 type of agency. Multiple Mutual Aid channels, used through other means of connectivity can provide an effective Practical Management Environment.
- Mutual Aid *does not require special technology staffing*. The channels are already available and in use. The use of the Mutual Aid Channel would require programming of the agency’s radios.

4.) A Radio Frequency Gateway is a system that can put together various radio systems into one usable system that will support all of the possible users. Radio Frequency Gateway is made up of an audio switch, various radios and some method of controlling the switch and radios.

- Radio Frequency Gateway *is relatively inexpensive* compared with the costs of future levels of Interoperability.
- Radio Frequency Gateway *does provide practical implementation* because it can provide communications connection between multiple agencies of multiple types with multiple communications infrastructures.
- Radio Frequency Gateway *does provide communications connectivity* for multiple networks in various kinds of events.
- Radio Frequency Gateway *does provide First Responder Transparency*. The purpose of the Radio Frequency Gateway is to allow each agency to use their own equipment while the gateway equipment acts as a connection point for the various systems.
- Radio Frequency Gateway *does utilize existing assets/resources*. As stated above the Radio Frequency Gateway utilizes existing radio assets to make the connections between agencies.
- Radio Frequency Gateway *can provide a limited practical management environment*. The Radio Frequency Gateway can select multiple agencies and enter them into networks, but this is accomplished manually and can be difficult to remember which network is which.
- Radio Frequency Gateway *does provide effective multi-agency communications*.
- With the use of management software that would provide event, agency, and network identification solutions, the Radio Frequency Gateway *does not require special technology staffing*.

5.) A Network Gateway is a gateway with similar functionality to the RF Gateway, but it utilizes computer networks to provide connectivity between the perspective agencies.

A Network Gateway accomplishes the task of interoperability by joining different agencies together through the use of VoIP technologies. This means that the ability to utilize VoIP phones or adapters would be required to use the Gateway.

- Network Gateway *does not provide a cost effective method* of Interoperability. At present there are too many pieces that need too much integration at too high a cost.
- Network Gateway, if purchased or modified from existing functional applications, *can be practical to implement.*
- Network Gateway *does not presently provide all the communications connectivity* that is required for Public Safety agencies to be effective.
- Network Gateway *does provide First Responder Transparency* if radio-to-VoIP technology is used.
- Network Gateways *can utilize existing infrastructures* both in the data and voice fields.
- Network Gateway *does not provide a practical management environment.* At present, there is no seamless management tool that would make a Network Gateway easy to operate for the Public Safety Sector.
- Network Gateway *does not provide effective multi-agency communications.* Since the Gateway usually depends on agencies to either have VoIP telephones or allow access to each other's networks. Since neither is universal, there are many obstacles to this type of Interoperability.
- Network Gateway *does require special technology staffing.* The use of VoIP systems and Internet/Intranet connectivity requires specialized technical support.

6.) A Common System Vendor is defined as a radio system that is proprietary to a particular vendor. A Common System Vendor can provide excellent service to its users. It is a very good method of providing Intra-Operability to medium and large-scale agencies. Unless every intended user has the same system, this level is not very helpful for interoperability.

- Common System Vendor does not provide a cost effective method of Interoperability. The use of a single vendor system means that the equipment associated with the system can only be purchased from the original vendor, thereby reducing open market competition. The vendor, being a sole source provider can charge whatever they deem as necessary and the customer has no alternative method of reducing cost.
- Common System Vendor does not provide practical implementation due the fact that a proprietary system inherently will not communicate with unlike systems.
- Common System Vendor does not provide communications connectivity. Connectivity to dissimilar system is not possible due to the proprietary nature of the system.
- Common System Vendor does provide First Responder Transparency for those agencies that are part of the system.
- Common System Vendor does not utilize existing assets/resources. Any agency that is not part of the proprietary system must purchase the necessary infrastructure to become Interoperable.
- Common System Vendor does not provide a practical management environment.
- Common System Vendor does not provide effective multi-agency communications.
- Common System Vendor does not require special technology staffing.

7.) A Standards Based Environment is defined as an accepted standard of operability and technology that can be provided by multiple vendors. This standard allows the customer to choose the best vendor, or group of vendors for their operational and financial situation. Standards Based Environment - Presently, the APCO P25 system is an example of a Standards Based Environment. The system is defined as a digital trunked radio system that can be utilized in the VHF, UHF, 700MHz and 800 MHz bands.

- Standards Based Environment does not provide a cost effective solution. In order to create a standards based environment, all agencies must operate from the same type of radio system. This issue creates a high cost of converting existing systems.
- Standards Based Environment does not provide practical implementation. The cost of equipment and training is prohibitive for any but the largest agencies.
- Standards Based Environment does not provide communications connectivity at a useable scale. If an agency that is not on the Standards Based System is needed, there is no method for that agency to communicate other than radio swap.
- Standards Based Environment does provide First Responder Transparency.
- Standards Based Environment does not utilize existing infrastructure. A new infrastructure must be installed in order to support the Standards Based Environment.
- Standards Based Environment does not provide a practical management environment. The Standards Based Environment requires that every responding agency be on the system. Achieving actual management will be extremely difficult.
- Standards Based Environment does not provide multi-agency communications. Quite the opposite.
- Standards Based Environment does not require special technology staffing. Once the system is installed and normal training is provided, the operation of the system is like any other communications infrastructure.

Today's government Administrators/Managers are involved in the administration of severely challenged First Responders. The Administrators and/or Managers must attempt to provide much needed Interoperability tools without the technical background to assure that what they need is what they are purchasing.

There are many solutions to choose from and large vendors with extensive sales forces provide many of them. These vendors may or may not have the appropriate solution, but they do have either large government contracts or an excellent reputation in the industry. This fact may skew the Administrator and/or Manager toward a less than optimum solution.

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