ADVANTAGES OF AN INTEGRATED AUDIO TRANSPORT SYSTEM

STEVE EDIE & ONALDA MARTINEZ
HARRIS CORPORATION,
BROADCAST COMMUNICATIONS DIVISION
MASON, OHIO

CHALLENGE

The word "interoperability" is always at the center of discussions about the design and integration of digital broadcast systems. With the explosion of technology options and accompanying business plans for audio distribution in the broadcast radio industry, engineers are increasingly faced with the challenge of building flexible, efficient and future-compliant audio transport systems. The complexity increases when multiple service or multi-point distribution is required. During the system design and review, engineers will be faced with the choice of either building a "spider-on-the-wall" system that comprises boxes from multiple vendors, or choosing an integrated network access system from a single source.

IT'S A MATTER OF CHOICE

When embarking on selecting an audio transport system for multi-channel and multi-point contribution/distribution over IP, the engineer will engage in an analysis of the challenge at hand. Once the engineer reconciles his or her technical requirements with the business requirements, a feature vs. cost analysis is conducted. Whether a broadcast entity is relocating its studio or transmission facilities or expanding into several markets, the short term and long term business goals play an important part in the decision process. Included in this process is planning for HDRadio™, DBM, program sharing, and alternative distribution models as far as the budget and your imagination allows. The need for additional services such as voice, data, control systems and backup systems must also be considered. Of course this assumes that the engineer has enough time to conduct the analysis and implement the solution. In some cases, the engineer has not been given any notice to add the three new stations that need to be on the air by the following week!

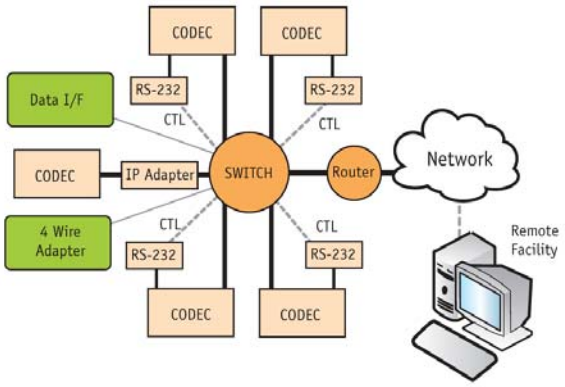
Along came the Spider

There are two architecture options available to the engineer when choosing an audio transport system. The first is a solution that comprises several offerings from more than one vendor. Typically, the engineer can build or expand the system by introducing a number of network appliances from several manufacturers to an already populated rack location. This will involve the installation of the audio, voice, data codecs and other network devices such as control and monitoring tools, voice over IP adapters, multiple 4-wire adapters for RS-232 interfaces, Ethernet switches, additional cabling and other "glue" infrastructure. In choosing this first option, the engineer must research algorithm and standards compatibility, basic setup and maintenance, control and backup options.

Once the engineer has done this homework, detailed design, installation and testing begins. The time investment required to perform this type of system integration can become substantial. The design phase must include a detailed analysis of interfaces and functions for each of the units to be integrated. As additional channels/services or locations are added to the network, the complexity of the system architecture increases. The engineer would then need to perform several tests as part of the integration process. Signal quality testing should be conducted to ensure that the audio performance requirements of the existing system are fully met. System stability tests would also be conducted over a period of time to ensure reliability and some level of resiliency when a variety of failures are introduced throughout the system. Control or status testing should be conducted to ensure that each unit in the system is equipped with the right alert mechanism that is consistent with operations flow.

If remote monitoring is desired, the new system must provide the same types of traps, closures, or control signals to allow a remote facility to observe and appropriately act in the case of a system level failure. With multi-vendor systems, the notion of having a seamless operation is typically hampered by the number of layers between the monitoring and control application and the reporting device. Essentially, there are more points of failure or levels of inaccurate reporting introduced into the system. *See Figure-1*.

Figure #1 Multi-Vendor Approach



The growth of a broadcast entity via additional services and locations will eventually fuel the need for a common monitoring system, thus requiring a seamless integration of disparate devices into one system. As most of us know, this is much easier said than done. The addition of channels or services via the multi-vendor devices raises concerns with respect to flexibility, management, interoperability and support.

Integrated Solution

The second option available to the broadcaster is an integrated IP audio and services transport solution. When choosing an integrated audio transport system, the engineer is engaging in a long term solution strategy that provides the operation with system uniformity and efficient control. Depending on the existing infrastructure, investment in an integrated audio transport system can result in a compact, easy to use, controllable, cost-effective and future-proof solution.

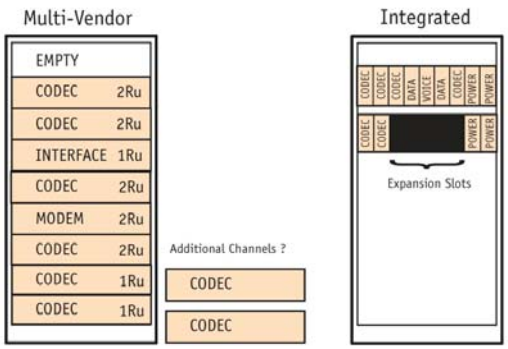
ADVANTAGES

Space

Whether expanding the existing Studio-to-Transmitter Link or Studio-to-Studio system by adding another set of stereo pairs of audio with auxiliary data or embracing new technology, there may arrive a time when an engineer requires a solution that will fit into the confines of his or her technical environment.

An advantage of using an integrated audio transport system is the efficient use of space. Many of us have encountered the problem of fitting ten pounds of equipment into the proverbial five pound rack. The solution is typically to locate the new codec(s) into a non-transmission related rack or piece of furniture. For some, it may mean reorganizing the entire rack to make additional room. An integrated audio transport system allows engineers to save time and space by consolidating their equipment into a hardware platform that can take up to 3-6 rack units (RU) worth of rack real estate for multiple channels or services. Depending on the architecture of the system and the encoding algorithms involved, codecs with a height of 1RU to 2RU's supporting more than 24 stereo pairs worth of audio can easily take up 12RU to 24RU's worth of rack space. Using an integrated system would mean that expansion does not have to involve adding another rack, console, electrical service etc. *See Figure-2*.

Figure #2 Rack & Space Efficiency



Remote Management

With web based browsers and SNMP based reporting, the management of remote devices from one or more locations is becoming the standard rather than the exception. Today, remote management is necessary to communicate with multiple transmitter sites, studios and markets within a city or region. From a general manager's perspective, it cuts down on manpower and other associated expenses. From the engineer's perspective, it can present itself as either a godsend or a curse. Typically, remote management tools are designed to provide status, diagnostics and control. The control infrastructure required to support remote management may take various levels of interface equipment, adapters and software tools to account for "out-of-band" communications. With an integrated IP audio transport system, both in and out of band communications are supported with little to no investment in additional interface hardware.

An integrated system with built in SNMP capability offers system coherence, provides SNMP MIBs and simplifies configuration and operation of the SNMP network monitoring system. An integrated system also provides a single consistent graphical user interface for control of all system elements. This would eliminate the need for the operator to learn multiple interfaces. In addition to remote monitoring and control, bandwidth management and quality of service prioritization may become necessary to efficiently distribute multiple services. An integrated

system can easily provide effective prioritization of inbound and outbound LAN, voice and audio traffic for one or all systems deployed across a distribution network. *See Figure-3*.

Figure #3 Ease of Management

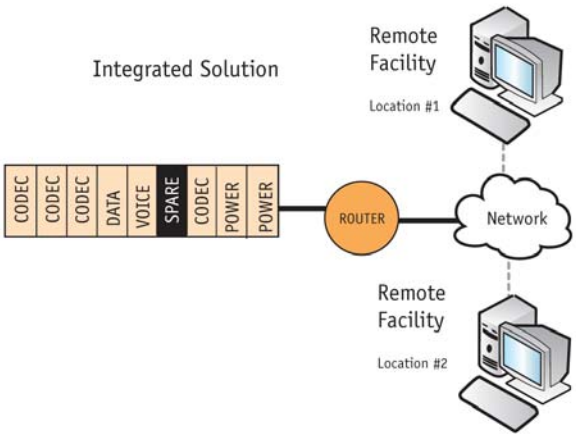
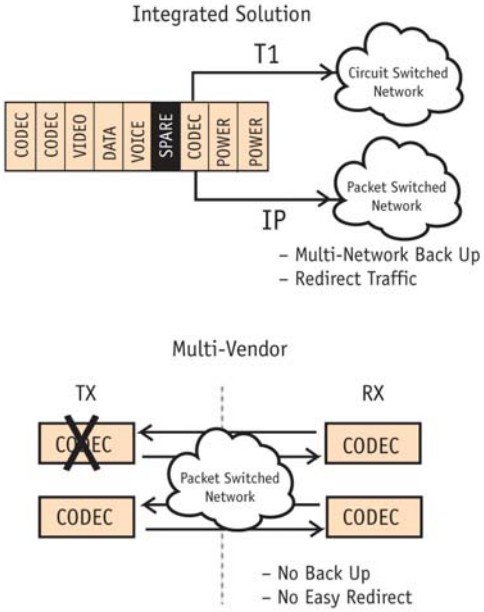


Figure #4 Protection/Redundancy



Redundancy

By using a modular transport system, redundancy can be achieved by populating the systems with backup hardware such as power supplies, extra codecs, system controllers, and if necessary, standby spares. If desired, one could achieve both connectivity and stream redundancy within the same foot print. In the event of power supply, interface or communications failure, an integrated audio transport system will recover and provide status on system level failures with virtually no downtime. Should an entire system fail, the configurations of one system can be easily downloaded to another for restoration purposes. As another level of backup, an integrated audio transport system that can simultaneously support both circuit and packet switched networks is the best choice. The T1 connection can be used as the primary connection while the IP connection can serve as the backup. This is especially true for organizations that are in the process of migrating from T1 to an IP based network. *See Figure-4*.

Product Support and Maintenance

Another advantage of using an integrated audio transport system is dealing with one source for parts, technical, warranties and maintenance issues. Multi-vendor solutions can often present obstacles when an emergency situation arises. With multiple devices, interfaces and other periphery equipment, it may take multiple calls and hours of troubleshooting over the phone to resolve critical problems. Product upgrades can be applied easily in an integrated system rather than dealing with different manufacturers. The amount of paperwork associated with tracking firmware or software upgrades can be reduced. Having one source for software version tracking and troubleshooting allows an engineer to concentrate on the more important aspects of his/her job—staying on the air.

Compatibility

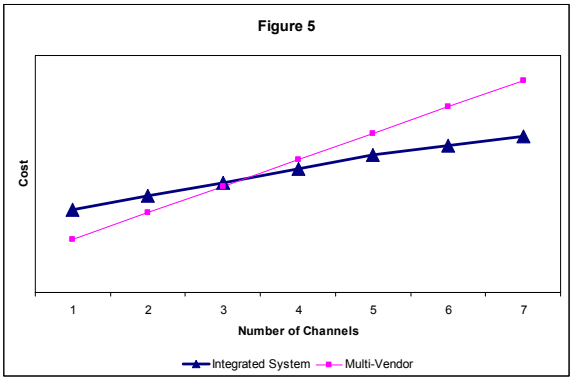
Generally speaking, another advantage of the integrated audio transport system is the level of seamlessness. Using devices that were designed to work as part of a common platform rather than using disparate systems provides the engineer with piece of mind with regard to electro-mechanical requirements, control and data communications. The time involved in the setup and configuration of separate IP codecs with varying software operating systems, configuration sequences, IP addresses, power and cooling requirements, etc., is reduced by using an integrated system with common architecture.

For some, the migration from T1 circuits to IP presents another set of compatibility issues. The

challenge is to maintain revenue generating operations while migrating to a new technology without substantial new investment. The question is how to re-purpose existing assets and have them transport audio over IP? In some cases, the engineer is faced with using T1 to IP adapters and switches which add yet another layer or point of failure to the system. A backward-compatible integrated system reduces the need for a significant quantity of new assets and will lessen the need to involve outside resources such as the IT department or the equipment manufacturer.

Cost

As previously discussed, long term cost savings is a significant advantage of using an integrated audio transport system. In the long run, the costs associated with selecting and installing an integrated audio transport system for multiple channels/services can prove to be low. The savings can be categorized as implementation and operational. For example, say an engineer needs to transport more than four channels of audio plus auxiliary data. Assuming an initial investment of approximately twelve thousand dollars for an integrated system and six thousand for a pair of audio codecs, additional channels or services would require either incremental increases or a duplication of costs per end. In the case of multiple codecs providing the same functionality, the expense for each stereo pair could mean another six thousand dollars per set while the investment for an integrated system's pair could result in half that amount. As shown on *Figure-5's* analysis of cost per channel, the cost benefits at implementation are most apparent with three or more channels.



However, the additional costs in pursuing such an approach can be found in the implementation details. These costs include cabling, additional backup infrastructure per unit, control/communication interfaces, licensing, and of course, the labor costs involved with making the entire infrastructure work as one system. In addition, the system may require the purchase of external multiplexing equipment that would allow the separate audio and POTS codecs to use the same T1/E1 circuit, or lease another circuit to accommodate the additional services.

With an integrated system, the engineer would simply add the hardware module or interface required to expand the system. This plug and play approach will not only save on installation time but will also save on the number of interfaces required to monitor and control the system. The costs involved would simply reside in the additional encoding/decoding hardware.

Operationally, costs can present themselves in any number of ways. When using several manufacturers, the time involved in training operations personnel, managing spares and tracking the different warranties and maintenance plans can become significant. Not only does a common modular platform save time in an emergency situation, but it can cut down on the confusion across the entire operation. A common platform used across multiple locations, areas or sites allows for common knowledge and internal technical support when system level issues arise and extensive troubleshooting is required.

CONCLUSION

In essence, the advantages of investing in and using an integrated audio transport system far outweigh the effort involved in planning and implementing a system of disparate devices. The issue is whether or not a broadcaster can afford the logistics behind the installation and operation in the long run. An investment in time that includes a comprehensive evaluation of costs, current infrastructure and ultimate goals will prove invaluable when decision time arrives. However, the advantages explained in-depth over the course of this paper essentially prove that the benefits of migrating toward an integrated transport system are worth the challenges that will be met along the way.