APPLICATION NOTE

Reducing transmission system costs for increased ROI

Conventional Solutions vs. iTX

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IT in the Broadcast Workflow

The transformation of broadcasting from a process based on specialized hardware components to one based largely on generic information technology (IT) components has passed the milestone of feasibility to become the dominant force in the development of new broadcast products. Conventional hardware-based products are fast becoming obsolete in favor of software-based products on standard IT platforms.

While viewer demand for enhanced broadcast services is being driven by digital television, high definition and "new media" distribution, broadcast solution providers are responding with softwarebased products designed to support these services and their filebased workflows on standard IT hardware.

The adoption of IT as the default platform for new broadcast products has not only defined a new direction for broadcast products, but is changing the mix of solution providers as well. While established broadcast products companies like Sony and Grass Valley Group have moved rapidly to incorporate IT into their new products, so have established IT companies like HP, Microsoft, Cisco and Apple expanded their reach with new divisions targeting their products to broadcasters. Concurrent with these strategies by major broadcast and IT suppliers, a third group of companies with direct expertise in software solutions for broadcast applications, such as transmission automation and content management, are expanding the scope of their products to include software replacements for conventional broadcast hardware components. As a result, broadcasters today have a wider selection of products available, including conventional broadcast hardware, IT/softwarebased solutions, and hybrids that combine both technologies.

The trend toward ITbased solutions has navigated the broadcast workflow in a predictable way. Upstream processes such as content production provided a lower-risk opportunity for the introduction of the new filebased workflows with "all software" editing solutions operating on standard IT workstations. Filebased media management, a process inherently suited to IT, became another early target for new solutions. Scheduling (traffic) and program management systems followed their own parallel path, moving from older mainframe or minicomputer solutions to modern client-server architectures.

An obvious next step in the progression of IT within the broadcast workflow was content acquisition. The traditional methods of acquisition had long been delivery of tape or recording from satellite feeds, but the advent of filebased video servers and content delivery services opened the door to new solutions that leveraged existing IT tools for error-free file transfer. At the same time, software encoding on standard IT hardware provided a convenient solution for any remaining conventional ingest requirements.

These five processes – production, acquisition, media management, scheduling and program management – cover much of the broadcast workflow and all have been entirely or partially moved to ITbased solutions. The final two steps, transmission and distribution, are real-time processes and their transition to IT solutions requires software that utilizes the capabilities of the latest generation of processors and bus architectures. With the availability of multi-core processors, DSP extensions and enhanced PCI bus speeds, real-time, frame-accurate video/audio processing on standard IT hardware is well within reach. With these advances in IT hardware, transmission and distribution are now within range of softwarebased solutions.

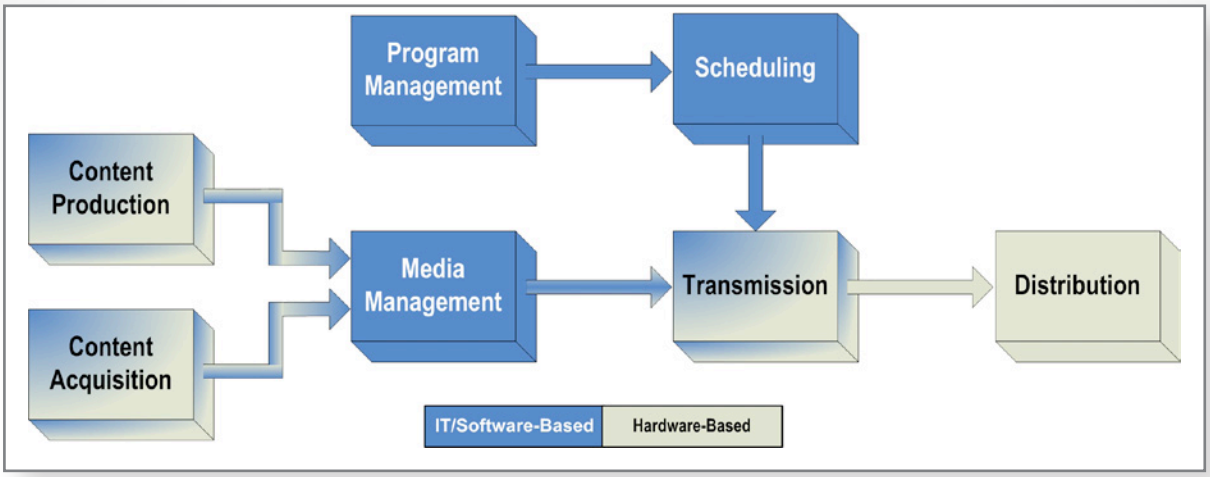

Figure 1: IT-Based Systems in the Broadcast Workflow

The current modes of broadcast distribution inherently define the required solution technologies. Over-the-air distribution requires a transmitter, whether analog or digital, and this hardware component is not replaceable by software alone. Stream multiplexing such as for ATSC or DVB distribution can be hardware or softwarebased, but at this time no standard IT/softwarebased solution is available for this process which relies instead on special purpose hardware. IPbased transmission for IPTV, web or mobile can be based on specialized hardware or on IT/softwarebased systems, with an apparent trend toward software solutions.

Regarding transmission (i.e. scheduled playout and mixing), broadcasters have been cautious in adopting any major technology changes for this unforgiving process on which their revenue depends. Simply stated, during transmission there are no “do overs”. A spot lost due to a transmission process failure is time and revenue that cannot be recovered. As a result, the transmission process is the last frontier for IT in the broadcast workflow. It is also the process that offers the most potential benefit from an IT/softwarebased solution.

Understanding the IT/SoftwareBased Transmission System

The introduction of OmniBus iTX in 2006 was a milestone in the progress of IT/softwarebased solutions for broadcast processes.

As the first “all-software” transmission and media management system operating on standard IT server hardware, the emergence of iTX resulted from the confluence of three factors:

- Advancement in the performance of IT processors resulting from “multi-core” technology
- Availability of software tools enabling the latest model of distributed objects technology known as “Service-Oriented Architecture”
- Development by OmniBus Systems of a software A/V playout and mixing engine capable of producing broadcast quality output at HD resolutions

The advantages of moving the video/audio processing performed by a conventional “transmission chain” of broadcast hardware to a consolidated software process are obvious and compelling. Most significant is the dramatic reduction in the complexity of the transmission system. This reduced complexity manifests itself in several ways:

- Fewer hardware components (“boxes”) requiring less rack space, power and cooling
- Fewer connections and communication among separate components, reducing possible points of failure
- A single point of configuration management for all transmission system functions
- Enhanced flexibility via software “plug-ins” and scalability via standard IT hardware as compared to special-purpose broadcast hardwarebased systems
- Enhanced integration with other ITbased systems in the broadcast workflow using standard technologies such as XML and web services
- Open platform with available software tools for implementation of required extensions or custom enhancements

This reduced complexity is clearly seen by comparing conventional and IT/softwarebased transmission systems for a single channel.

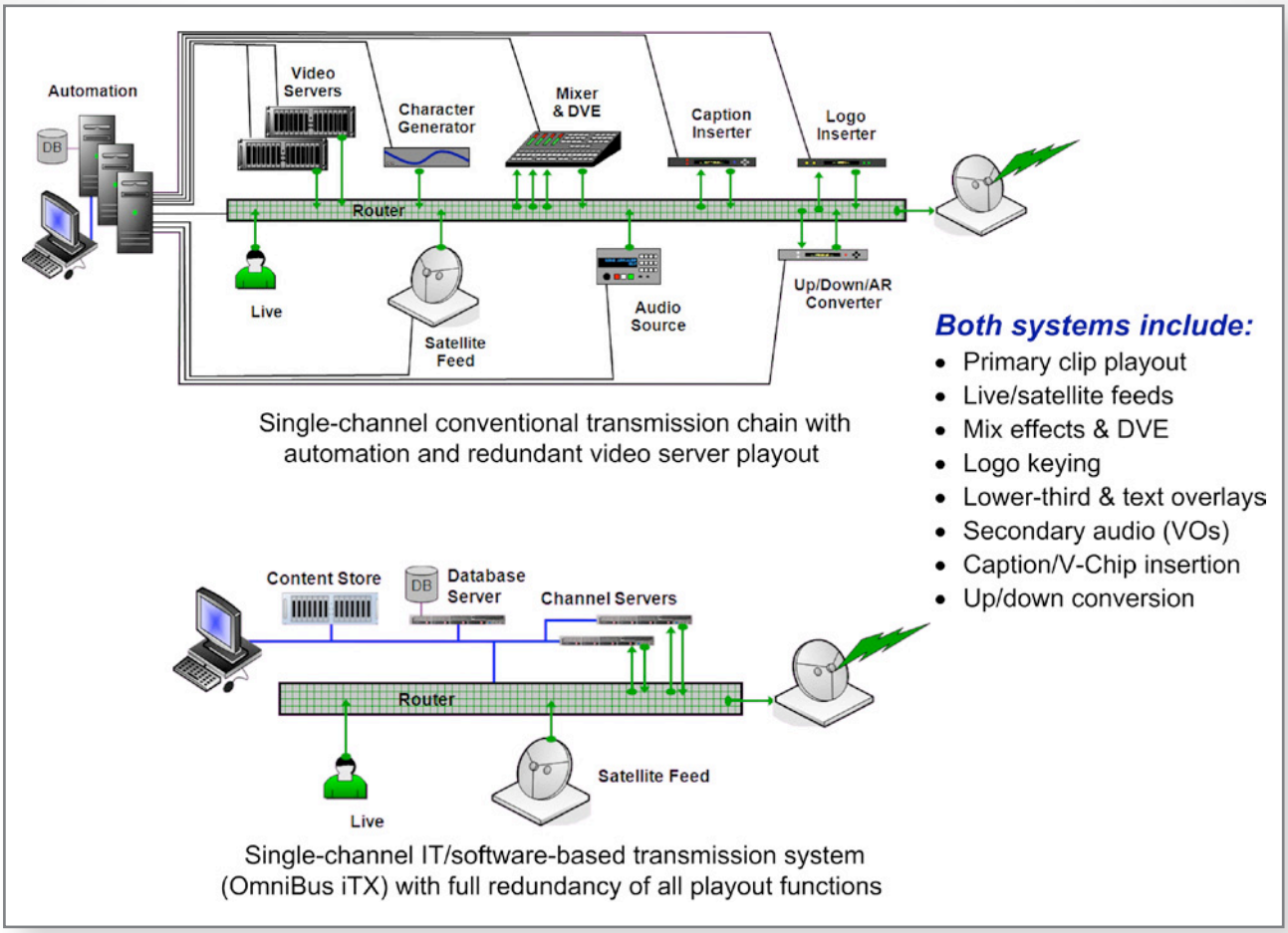

Figure 2: Single-Channel Transmission Systems

The Costs of Transmission

The costs of a transmission system include both initial and ongoing direct costs, as well as the potential costs of lost or gained opportunities for new business.

The initial cost of a transmission system includes capital costs for equipment and software, plus the cost of installation, staff training and possible parallel operation during transition. Most of these costs are well-defined or can be well-controlled with careful planning and execution.

Ongoing costs for transmission system operation include facility resource costs such as space, power and cooling, which are typically fixed operating costs. Human resources costs including operations, engineering and management are likewise predictable after the initial start-up period or transition. However, all of these operational costs are directly affected by the physical and operational complexity of the chosen transmission system.

Comparing both initial and ongoing costs for conventional vs. ITbased software transmission systems for a specific facility requires a detailed assessment of the capacity, redundancy and features required for the services to be hosted. How many channels? SD or HD? Full redundancy, N+1 or none? How much content must be stored and what is the volume of new content arrivals each week? Are satellite or live sources required for pass through feeds or local news? What graphics and branding are required? Are there requirements for Dolby or multi-language audio? What about closed-captions or subtitles?

Each of these capabilities requires associated hardware and/or software components in the transmission system. Moreover, the requirements may be different for each channel, even though all channels are to be hosted on the same multi-channel transmission system. As a result, the configuration and costing of a multi-channel transmission system is a complex process and one of the pitfalls in this process is that without benefit of a full analysis, selection of off-the-shelf solutions based on apparent low prices can result in costly, unanticipated add-ons or the inability to meet some essential requirements at all.

Despite the complexity of comparing the actual cost of alternative solutions for a specific facility, it is possible to compare the base (infrastructure) and incremental (per channel) costs of alternative solutions for a “typical” set of requirements. Such a comparison can provide the approximate relative costs of two solution alternatives and show how alternative solutions compare as additional channels are added.

For purposes of this comparison, we will define the requirements for a multi-channel transmission system to include the following capabilities for each channel:

- HD transmission (1080i or 720p)
- Redundant (mirrored) playout of (at least) primary video content
- Video mix effects (transitions)
- Two-dimension DVE (e.g. squeezebacks)
- Logo insertion with animation
- Text overlays and crawls
- Dolby-D audio (AC-3)
- Closed-caption or subtitle insertion

These requirements define reasonably “full featured” channels, although additional requirements such as multi-language audio, 3D graphics, and SCTE signaling are not uncommon.

Based on these stipulated requirements, we can compare the acquisition (initial) costs and operating (ongoing) resource requirements (space and power) for conventional broadcast hardwarebased and IT/softwarebased transmission systems. The conventional alternative utilizes current models of widely-used broadcast hardware products and multi-channel automation software. The IT/softwarebased alternative is based on the current released version of OmniBus iTX, operating on widely-used, standard IT-servers. To highlight the differences between these alternatives, transmission infrastructure and “per channel” components which are common to both alternatives are excluded from the comparisons (e.g. A/V routers, LAN, shared content storage, transmitters, etc.).

To project the comparative ROI of these alternative transmission solutions, the tables on the following pages detail the costs and resources required for the first channel within a multi-channel capable transmission system. These comparisons are then extended to 6, 12 and 24 channels to show the relative effect of the two alternatives on per channel costs in larger facilities.

Transmission System Alternatives - Acquisition Cost Comparison
Conventional vs. OmniBus iTX

Component	Conventional $	OmniBus iTX $
MULTI-CHANNEL TRANSMISSION SYSTEM - INFRASTRUCTURE COMPONENTS (Note 1)		
Infrastructure - Conventional		
Base Multi-Channel Automation System (Notes 2, 3)	105,000	
Database Server		
Control Client Workstation		
Traffic Interface		
Device Control Server		
Infrastructure - Conventional - TOTAL	**105,000**	
Infrastructure - OmniBus iTX		
Framework/Database Server		25,000
IT Server - Hardware		
IT Server - OS Software		
SQL Server Database Software		
iTX Framework Services - Software		
iTX Traffic Interface - Software		
Control Client Workstation		6,050
IT Workstation - Hardware & OS Software		
iTX Desktop Software		
Infrastructure - OmniBus iTX - TOTAL		**31,050**
MULTI-CHANNEL TRANSMISSION SYSTEM - PER CHANNEL COMPONENTS		
Per Channel - Conventional		
Automation Software - Conventional		
Primary Channel - Software	9,500	
Transmission Chain Hardware - Conventional		
HD Video Servers - 2 Outputs, 1TB Storage (Note 4)	53,850	
HD Video Server Expansion - Additional 2 Outputs, 1TB Storage (Note 5)	35,100	
Master Control Switcher / Mixer (Note 6)	16,000	
Multi-Function Branding Device (Note 7)	40,500	
Caption/V-Chip Encoder	5,500	
HD Up Converter	6,000	
First Channel - Conventional - TOTAL (Notes 4,5)	**185,200**	
Additional Channel - Conventional - TOTAL (Notes 4,5)	**166,450**	
Per Channel - OmniBus iTX		
Integrated Automation/Transmission - iTX (Note 8)		
Primary Channel Server		78,500
IT Server - Hardware w/1TB Storage		
IT Server - OS Software		
HD-SDI Video Card		
iTX Primary HD Channel - Software (Note 9)		
Backup Channel Server		44,750
IT Server - Hardware w/1TB Storage		
IT Server - OS Software		
HD-SDI Video Card		
iTX Backup HD Channel - Software (Note 10)		
Each Channel - OmniBus iTX - TOTAL		**123,250**
MULTI-CHANNEL TRANSMISSION SYSTEM - ACQUISITION COST TOTALS	**Conventional**	**OmniBus iTX**
(Note 11)	(Note 12)	(Note 13)
One (1) Channel - TOTAL	**$290,200**	**$154,300**
Cost Reduction - OmniBus iTX		**47%**
Six (6) Channels - TOTAL	**$1,216,200**	**$770,550**
Cost Reduction - OmniBus iTX		**37%**
Twelve (12) Channels - TOTAL	**$2,432,400**	**$1,510,050**
Cost Reduction - OmniBus iTX		**38%**
Twenty-Four (24) Channels - TOTAL	**$4,759,800**	**$3,020,100**
Cost Reduction - OmniBus iTX		**37%**

Notes:

(1) Excludes transmission infrastructure components required by both solutions (e.g. A/V router, LAN, shared storage, multiplexors/transmitters, etc.)
(2) Includes required IT hardware and all software
(3) First channel automation software normally bundled with conventional Base Multi-Channel Automation System has been priced separately
(4) Each conventional channel includes two (2) video servers with two (2) outputs each for mirrored playout and mix effects (transitions, DVE moves)
(5) For multiple conventional channels, each video server is expanded to four (4) outputs supporting two (2) channels
(6) Includes mix effects and DVE
(7) Includes logos, text and audio clips
(8) Each iTX channel includes primary and backup channel for full-mirroring of all functions (automation, playout, mix effects, branding, etc.)
(9) Each iTX channel includes automation with HD playout, mix effects, DVE, logos, stills, CGs, CC/V-Chip and live pass-through
(10) Software cost for iTX backup channel is 50% of primary channel
(11) All costs are based on current list prices typically subject to negotiated discounts
(12) Expansion beyond eight to twelve (8-12) channels with conventional automation requires additional, separate infrastructure (included in totals)
(13) Expansion beyond twenty (20) channels with iTX may require increased infrastructure capacity and redundancy (included in totals)

Figure 3: Conventional vs. OmniBus iTX - Acquisition Cost Comparison

Transmission System Alternatives - Space and Power Resource Comparison
Conventional vs. OmniBus iTX

Component	RUs	Power (Watts)	Conventional Devices	Conventional Space (RUs)	Conventional Power (Watts)	OmniBus iTX Devices	OmniBus iTX Space (RUs)	OmniBus iTX Power (Watts)
MULTI-CHANNEL TRANSMISSION SYSTEM - INFRASTRUCTURE COMPONENTS (Note 1)								
Infrastructure - Conventional								
Base Automation Server	4	500	1	4	500			
Device Control Server	4	500	1	4	500			
Control Client Workstation	2	250	1	2	250			
Infrastructure - Conventional - TOTAL			**3**	**10**	**1,250**			
Infrastructure - OmniBus iTX								
Framework/Database Server	1	500				1	1	500
Control Client Workstation	1	250				1	1	250
Infrastructure - OmniBus iTX - TOTAL						**2**	**2**	**750**
MULTI-CHANNEL TRANSMISSION SYSTEM - PER CHANNEL COMPONENTS								
Per Channel - Conventional								
HD Video Servers (Note 2)	2	475	2	4	950			
Master Control Switcher / Mixer	3	120	1	3	120			
Multi-Function Branding Device	1	150	1	1	150			
Caption/V-Chip Encoder	1	40	1	1	40			
HD Up Converter	1	30	1	1	30			
Per Channel - Conventional - TOTAL			**6**	**10**	**1,290**			
Per Channel - OmniBus iTX								
Channel Servers (Note 3)	1	500				2	2	1,000
Per Channel - OmniBus iTX - TOTAL						**2**	**2**	**1,000**

MULTI-CHANNEL TRANSMISSION SYSTEM - RESOURCE CONSUMPTION TOTALS

	Conventional (Note 4) Devices	Conventional Space (RUs)	Conventional Power (Watts)	OmniBus iTX (Note 5) Devices	OmniBus iTX Space (RUs)	OmniBus iTX Power (Watts)
One (1) Channel - TOTAL	**9**	**20**	**2,540**	**4**	**4**	**1,750**
Resource Reduction - OmniBus iTX					**80%**	**31%**
Six (6) Channels - TOTAL	**39**	**70**	**8,990**	**14**	**14**	**6,750**
Resource Reduction - OmniBus iTX					**80%**	**25%**
Twelve (12) Channels - TOTAL	**78**	**140**	**17,980**	**26**	**26**	**12,750**
Resource Reduction - OmniBus iTX					**81%**	**29%**
Twenty-Four (24) Channels - TOTAL	**150**	**260**	**33,460**	**52**	**52**	**25,500**
Resource Reduction - OmniBus iTX					**80%**	**24%**

Notes:

(1) Excludes infrastructure components required by both solutions (e.g. A/V router, LAN, shared storage, multiplexors/transmitters, etc.)

(2) Each conventional channel requires two video servers with two outputs each for mirroring and mix effects (transitions, DVE moves)

(3) Each iTX channel includes primary and backup Channel Servers for full-mirroring of all functions

(4) Expansion beyond eight (8) channels with conventional automation may require duplication of the infrastructure (included in totals)

(5) Expansion beyond twenty (20) channels with iTX may require duplication of the infrastructure (included in totals)

Figure 4: Conventional vs. OmniBus iTX – Operating Resource Comparison

While the comparisons above are generic and based on assumptions and requirements that will likely differ for any specific transmission facility, the resultant cost savings and operating resource reductions of IT/softwarebased transmission using OmniBus iTX as compared to a conventional, automated hardware transmission chain are substantial. Moreover, these benefits increase as the number of channels grows.

Adapting to New Requirements

Beyond these quantifiable initial and ongoing costs, one of the less considered, but potentially major cost implications of a new transmission system is its ability to support new or changed service requirements. These changes might include upgrades of existing channels from SD to HD, the addition secondary DTV, mobile or web distribution channels, or the addition of "regional breakaways" for increased spot sales. In each case, a low-cost expansion of your existing transmission system is the optimal solution, but limitations in system scalability, feature set or the requirement for costly new hardware can make this option infeasible.

The result of an inability to support new services with a cost-effective expansion of your current transmission system leaves only two options: installing a complete, additional transmission system dedicated to the new services, or cancelling plans for the new services and forgoing the potential revenue. Either of these less-than-optimal solutions to a need for new services can be viewed as an "opportunity cost" that you have incurred as a result of your transmission system choice.

While the need for specific new services may not be fully visible at the time you choose your transmission system, the competitive and market trends in this regard are clear. Therefore, without knowing exactly which new services may be required, adaptability should be a major consideration in choosing a new transmission system to enable your operation cost-effectively to deliver new services as they are required. In this context, IT/softwarebased transmission systems, and OmniBus iTX in particular, have inherent technology benefits that provide the flexibility to adapt to changed and new requirements more quickly and at less cost than conventional solutions. Among these benefits are:

- Adding a new channel requires only the addition of one or two (redundant) 1U devices (Channel Servers) with associated software. In general, no changes are required to the transmission system infrastructure (see Figure 3 – Note 13 for clarification) or to the ongoing operation of existing channels.
- An existing SD channel can be upgraded to an HD or streaming channel with simple reconfiguration. No additional software or new hardware is required.
- New features such as CG or DVE graphics and Dolby-D AC3 audio can be added to an existing channel simply by adding plug-in software components to an existing channel and without any additional hardware.
- There are no inherent limits to the scalability of the OmniBus iTX transmission system. New channels, additional Framework capacity and redundancy, additional control client workstations, increased storage, increased LAN bandwidth, and additional channel features can be added as needed to meet new requirements.

In the changing landscape of broadcasting and content distribution in general, the return on investment (ROI) for a transmission system must consider more than the basic costs of deployment and operation. As traditional ad revenues continue to dilute, broadcasters must find ways both to reduce costs and to enhance and expand services to maintain or increase profitability. The cost-effectiveness and adaptability of your transmission system are essential to this objective.

About Miranda

Miranda Technologies Inc. (TSX: MT) develops, manufactures and markets high performance hardware and software for the television broadcast industry. Its solutions are purchased by content creators, broadcasters, specialty channels and television service providers to enable and enhance the transition to a complex multi-channel digital and HD broadcast environment. This equipment allows customers to generate additional revenue while reducing costs through more efficient distribution and management of content as well as the automation of previously manual processes. Miranda employs approximately 550 people at its Montreal headquarters and in its facilities located in Wallingford (UK), Grass Valley (California, USA), Paris (France), Tokyo (Japan), Zaltbommel (Netherlands), Dubai (United Arab Emirates), Beijing (China) and Hong Kong. Miranda is listed on the Toronto Stock Exchange. For more information, please visit www.miranda.com.