



# Intelligent Media Technologies

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## **SmartBuss<sup>®</sup>**

### **High Performance Private Multimedia Network**

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**Intelligent Media Technologies, Inc.** (IMT) designs, develops and markets private networks for high performance streaming multimedia applications. These audio-video-data networks are installed by Systems Integrators in environments where Quality of Service is required. **SmartBuss** is IMT's latest high performance protocol, implemented in single layer synchronous private network architecture with an asynchronous back-haul providing redundancy. Ring topologies form dual counter rotating networks that double the redundancy for mission critical applications. **SmartBuss** does not require IP managed infrastructure and is not susceptible to denial of service or malicious attacks ensuring predictable, fail-safe operations. Very low latency across the entire network fabric ensures the highest quality multimedia experience. Available services include NTSC & PAL composite video, analog audio, analog audio with DSP signal processing, AES/EBU digital audio, 2 wire intercom, contact closure sense & drive, RS232, RS422, RS485 slow scan data and 10BaseT Ethernet bridge.

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#### **The Multimedia Network**

Non-networked analog multimedia products require costly and dedicated infrastructure and the trend is to replace analog product with digital product using Ethernet IP networks for content delivery, appliance control and monitoring. It is estimated that 50-60% of a complete analog systems installation cost for items including CCTV coax bundles, CCTV Pan-Tilt-Zoom camera control wires, cabling for public address systems, alarm systems, slow scan RS232, RS422, RS485 data and contact closure wires can be eliminated by using ubiquitous Category 5/6 cables with a digital network. Wherever the network reaches there's an opportunity to replace analog product with converged digital product.

The Ethernet IP network is not always the optimum choice for every application. That's because when using the enterprise network to deliver multimedia services the system integrator often has to deal with a variety of IT configuration issues including bandwidth allocation, IP port mapping, firewall and virus program conflicts. Additionally, working with synchronous multimedia such as video reveals specific performance limitations of Ethernet IP networks that are characteristic of *asynchronous* architectures. Most notable are the delays introduced by the network which impact performance and a common example is a video presentation displaying inconsistent screen refreshing with audio that is not synchronized.

There are several Ethernet IP performance upgrades including traffic shaping, over provisioning or adding overlay networks that attempt to resolve these performance limitations by managing and prioritizing select traffic. These upgrades may be cost prohibitive, complex to configure and maintain and, ultimately they will deliver quality of service that's best effort and not guaranteed.

The fundamental performance contradiction remains: Ethernet IP implementations are *asynchronous* and often share infrastructure with other applications including enterprise email and web browsers. Secure, high quality streaming media applications require a *synchronous* network to deliver optimum performance.

## The SmartBuss Solution

**SmartBuss** is a superior solution for many multimedia applications, combining, formatting and transporting a variety of analog & digital services in a private network environment. Predictable performance results are achieved with all the benefits of physical redundancy and, as a private network you are not open to denial of service and other malicious attacks. **SmartBuss** is a second generation IMT product. All we do is design networks and the functionality that has been built into this product is the result of 20+ years of network development experience.

SmartBuss Network Highlights:

- Multiple Convergent Video-Audio-Data Services on private network infrastructure that easily scales up to add more analog or digital applications for future requirements.
- Standard connectivity using standard Category 5 cabling, 100m hops between devices. Optional gigabit fiber optics for increased bandwidth over wide areas. This hybrid approach ensures the most economical local implementations and flexibility to scale up for whole building or longer 10km node to node networks.
- Category 5 Time Domain Reflectometry (TDR) functionality is included to diagnose common cabling faults such as open and short circuits to reduce customer calls and service requests.
- High channel capacity (shown below) handles a variety of media services. There's a dedicated (12Mb/s) control channel for network communications.
- System latency is very low enabling live streaming applications that are typically not available with Ethernet IP solutions. Each **SmartBuss** node 155µ s data in to data out.
- **SmartBuss** can also replace 3<sup>rd</sup> party analog media switches because the network is a virtual matrix with add/drop granularity in single channel increments for any-to-any routing. There are no channel restrictions or bundling of channels to limit assignments or that require additional hubs.
- SmartBuss costs less than Ethernet IP solutions for complete network deployments while delivering superior performance. **SmartBuss** private networks do not require extensive IT knowledge to install or maintain.

## SmartBuss Capacity

Capacity Per Segment	Channels on Category 5 Cable	Channels on Single Mode Fiber
<b>Throughput</b>	<b>98.304Mb/s</b>	<b>983.04Mb/s</b>
<b>Audio @ 48kHz, 24 bit</b>	<b>70</b>	<b>838</b>
<b>Intercom 2 wire</b>	<b>70</b>	<b>838</b>
<b>Composite video @ 3Mb/s</b>	<b>26</b>	<b>314</b>
<b>Composite video @ 6Mb/s (D1)</b>	<b>13</b>	<b>157</b>
<b>Slow scan data @ 38.4kb/s</b>	<b>210</b>	<b>2514</b>
<b>Slow scan data @ 300kb/s</b>	<b>26</b>	<b>314</b>
<b>Ethernet 10BaseT</b>	<b>1</b>	<b>1</b>

Category 5 cabling infrastructures are typically used for short distance hops between SmartBuss devices and single mode fiber optics is used for increased capacity over wider areas. The capacity of Category 5 segments differs from single mode fiber optics as shown. For maximum performance and cost efficiency in larger systems use Local Category 5 tributaries combined with fiber optic trunks. Any combination of audio-video-data services in either

Category 5 or single mode fiber segments can be combined and IMT's bandwidth calculator is used to verify the requirements during the network design phase of the project.

## SmartBuss Components

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### AVIO 14 Hub

3 Rack unit high-capacity node accommodates the SB101 Network module and any combination of 13 media services modules. The System Hub provides connectivity for hundreds of video, audio and data I/O devices and may be commingled with AVIO 4 Hubs & AVIO Edge Servers on a common network.

### AVIO 4 Hub

1 Rack unit low capacity node accommodates the SB101 Network module and any combination of 3 media services modules.



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### AVIO 14 Hub & AVIO 4 Hub Media Services Modules



#### Audio

- ADAVIO** 4 port 2 Wire Intercom
- ADA424** 4 channel analog input, 24-bit
- DAA424** 4 channel analog output, 24-bit
- DAA424-DSP** 4 channel analog output with 24-bit DSP signal processing

#### AES/EBU Audio

- DIA424** Dual Stereo AES3 Input
- DOA424** Dual Stereo AES3 Output

#### Composite Video

- ADV264V** 2 Channel NTSC/PAL MPEG-2 Encoder (BNC)
- DAV264V** 2 Channel NTSC/PAL MPEG-2 Decoder (BNC)
- ADV264AV** 2 Channel NTSC/PAL MPEG-2 Audio/Visual Encoder (BNC)
- DAV264AV** 2 Channel NTSC/PAL MPEG-2 Audio/Visual Decoder (BNC)

#### Slow Scan Data

- SSD-002** RS232, RS422, RS485, 2 bi-directional I/O ports to 300K Baud.
- SSD-SC4** Switch Closure with 4 drive and 4 sense ports
- SSD-Enet** Ethernet bridge 10BaseT on Category 5 SmartBuss networks



**AVIO Audio Edge Server** includes a SmartBus Network Interface Module with line level audio input/output modules configurable as 4 in & 4 out, 8 in, 8 out. Network indicators provide clear and unmistakable verification of primary versus redundant buss operations and when configuration changes are uploading. Three separate signal level indicators are provided for each channel.

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### **OEM Network Interface Module (NIM)**

Available for OEM partners as a SmartBus network “drop in” module for evaluation or as a complete network interface used in production units.



### **OEM SmartBus Core**

This is the same network core used in IMT branded products and is available for OEM partners as a “Highly Embedded” network solution for their multimedia products.

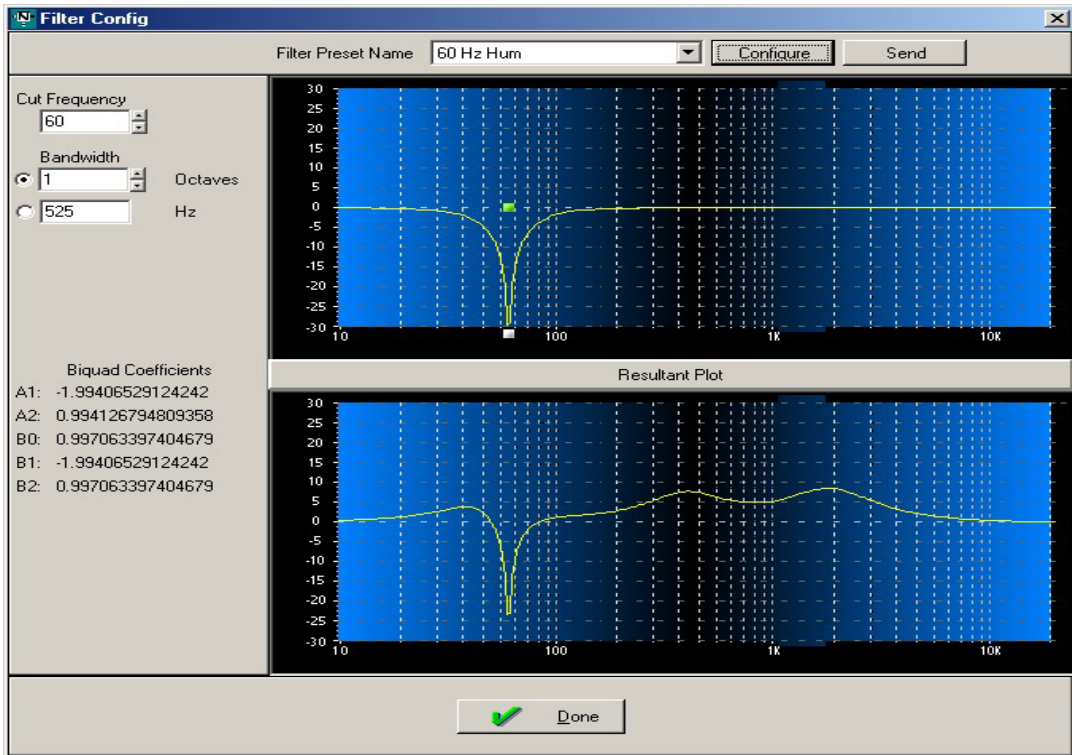
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## **PathMaster<sup>®</sup> Software Application**

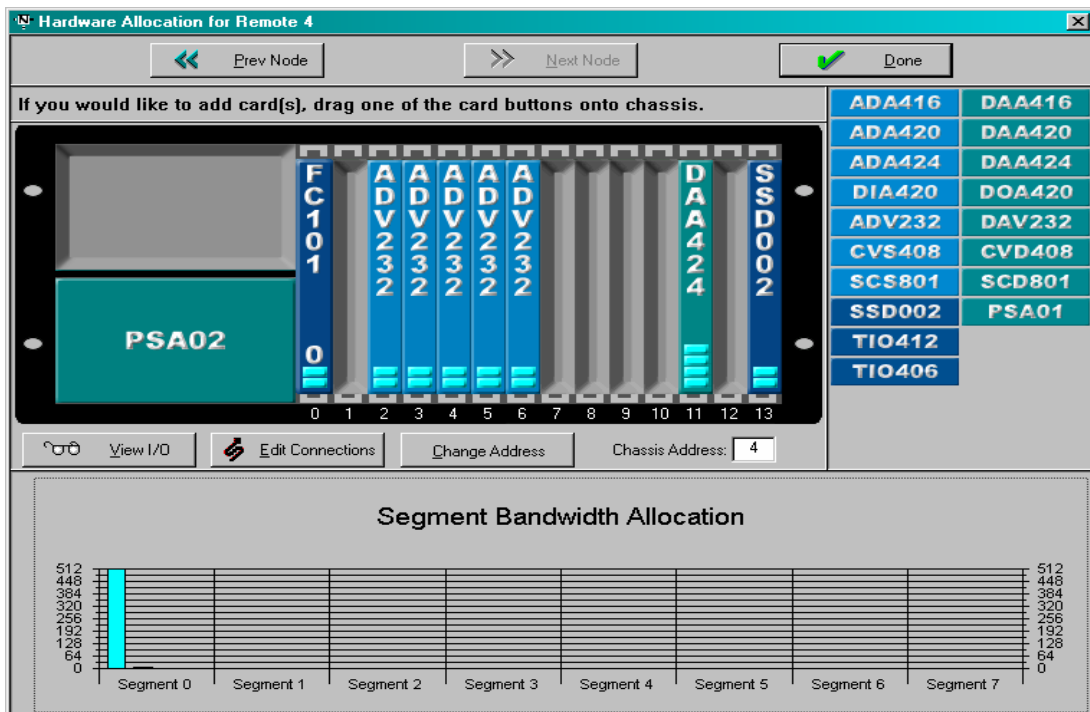
**PathMaster** is a Windows software application that enables real time network configuration and monitoring and is supplied free of charge with all **SmartBus** systems. **PathMaster** system level communications use a dedicated API channel that’s embedded within the **SmartBus** management architecture. Communications between the Windows PC and the **SmartBus** network is established using the Ethernet port (UDP) found on the front of the AVIO Edge Server or on the SB101 Network module used in AVIO 14 & 4 Hubs. Input and output assignments and I/O signal processing, matrix mixing, network monitoring, are standard operational features.

Networks using the audio output module with DSP (DAA424-DSP) include a suite of user functions featuring a coefficient-configurable, fixed-program, 24 bi-quad per channel architecture. Combinations of filter functions can be achieved using the bi-quads; for example, a 2nd order Butterworth low pass filter requires one bi-quad. The user configurable filters for each channel include: 12 band parametric EQ, high/low/band pass and notch filters, high and low shelving, signal delay (up to 1 second per channel), limiter-compressor and digital make up gain. These functions add significant value to the **SmartBus** network by positioning audio signal processing as a closely coupled unit between the network and the client appliances they serve.

OEM’s can create unique Graphical User Interfaces (GUI) using the supplied DLL to function as part of their control and management application. All **PathMaster** control and monitoring functions can be bolted on to the OEM application.



**PathMaster** DSP Configuration Screen



**PathMaster** Hub configuration with bandwidth allocations screen

## Example SmartBuss Applications

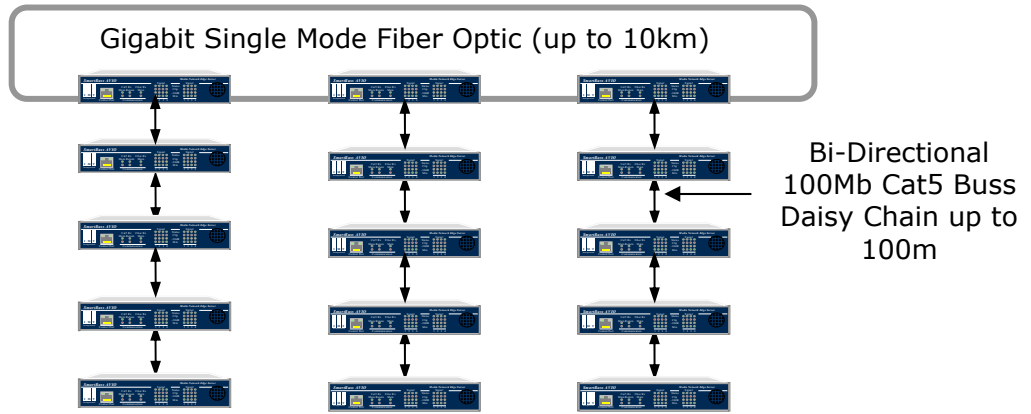
- Video Surveillance
- Sports venue multimedia distribution
- Presentation, security & CCTV systems
- Theme park presentation systems and point of purchase data
- Restaurant and club multimedia
- Commercial building "smart" infrastructure
- Residential FTTH local infrastructure

Market drivers for next generation presentation, entertainment, security and "smart" systems require a comprehensive network infrastructure to deliver the pervasive multimedia content and services that are being developed. The expanded functionality & utility of a converged network offering will be the cornerstone for future multimedia applications.

**SmartBuss** addresses these multimedia requirements and is targeted to applications where high performance, low implementation cost and the assortment of supported services provide clear advantages over IP solutions. There is a complete **SmartBuss** product catalog available for the System Integrator to select components to configure private streaming multimedia edge networks or to bridge with Ethernet IP networks forming multimedia subsystems.

For the OEM the added convergent services delivered by SmartBuss technology shifts the existing multimedia network market paradigm by embedding the network directly in the analog client. The SmartBuss peer-to-peer topology eliminates common IP bottlenecks and is an appropriate, cost effective and flexible digital network for OEM's, VAR's and systems integrators that are developing next generation Network Edge Appliances and applications.

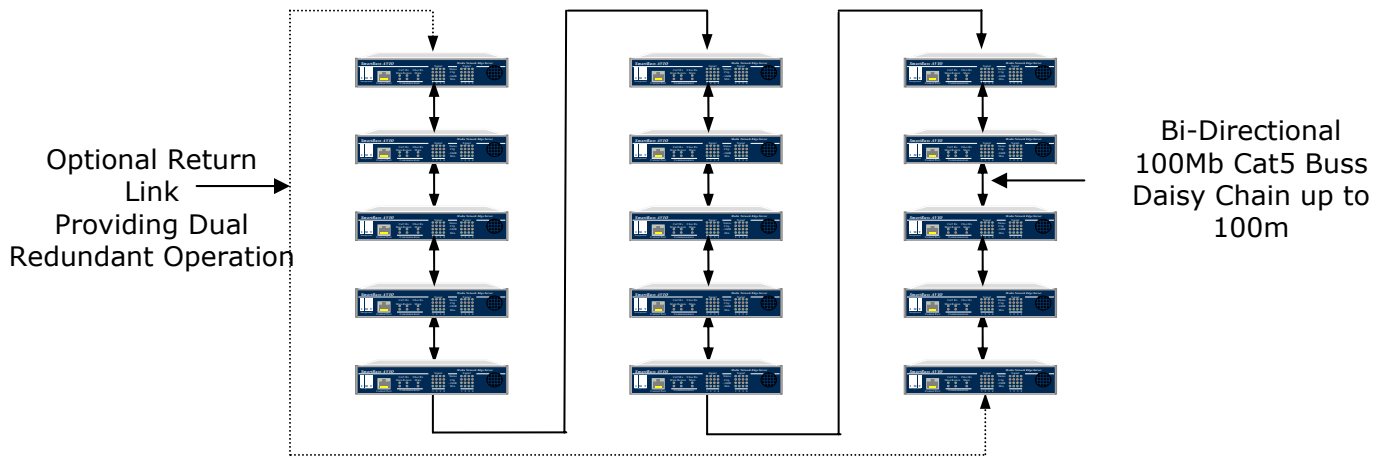
## Example SmartBuss Configurations



**Single mode fiber optic trunk and 100Mb Category 5 tributary busses.**

The combination of gigabit fiber optic trunk & 100Mb/s tributary provides the most economical and powerful **SmartBuss** networks.

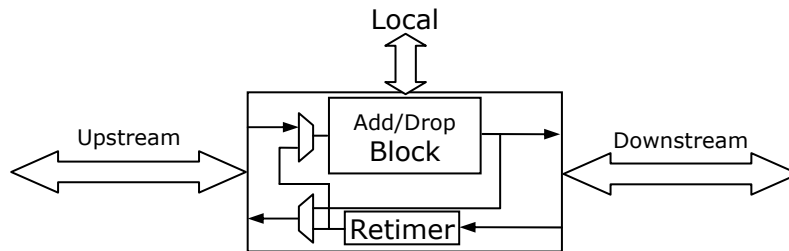
- **Category 5 Tributary Ethernet PMD** - daisy-chain to 100 meters each hop
- **Fiber Optic Trunk** Single-Mode - daisy-chain to 10km each hop



**100 Mb/s Category 5 network with dual redundant return link**

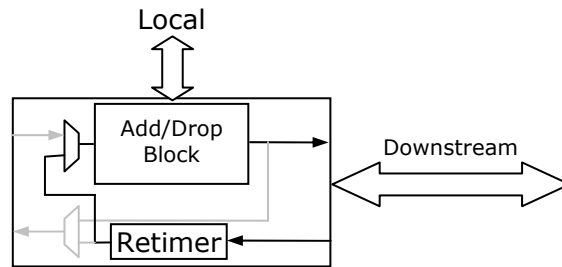
## SmartBuss Data Path

SmartBuss uses standard Ethernet Physical Media interfaces for its 100Mb communication although routing and buss management does not conform to the Ethernet protocol. The following block diagram illustrates the internal data pathways within the SmartBuss Core processor.

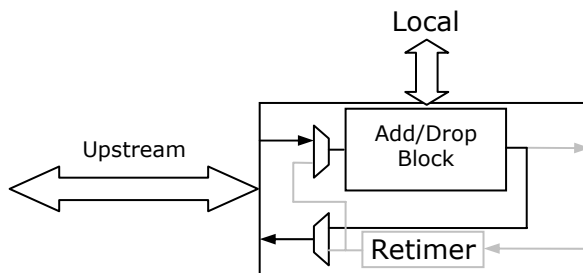


## SmartBuss Core Internal Data Paths

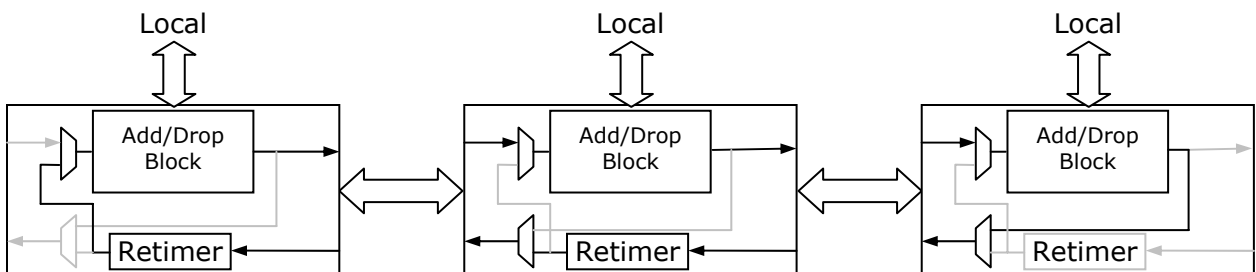
SmartBuss units are connected in a daisy-chain configuration. Data received from upstream nodes are processed and local I/O data is either read from, or written to the network data stream. In turn, this data is transmitted to the next node downstream where the process is repeated. Data arriving from the downstream node is re-clocked to remove jitter and is transmitted otherwise unprocessed to the upstream node. If any node detects that there is no upstream node transmitting it will switch over to the re-timed data from the downstream node.



Using the same method, if a node detects there is no downstream node transmitting, it will switch over to the upstream node from the internal add/drop processing block.

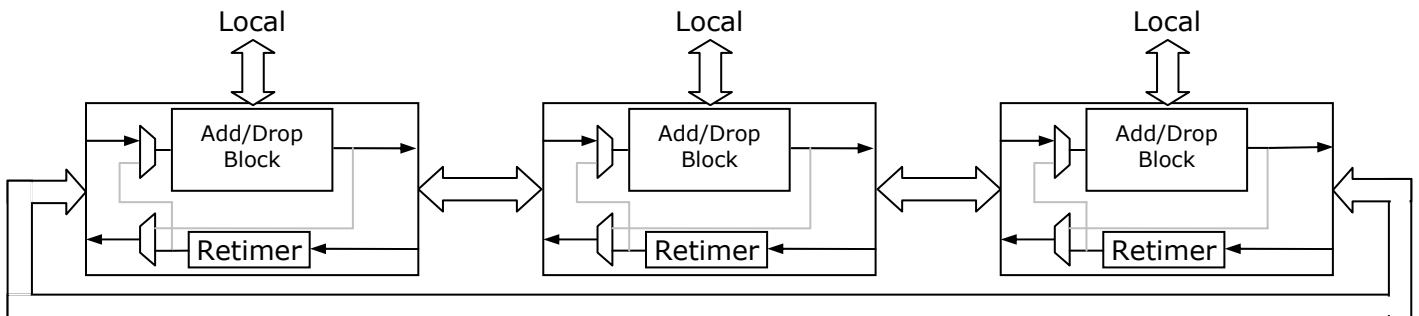


Although **SmartBuss** units are connected in a daisy-chain configuration, the automatic data path selection and routing creates "ring" architectures.



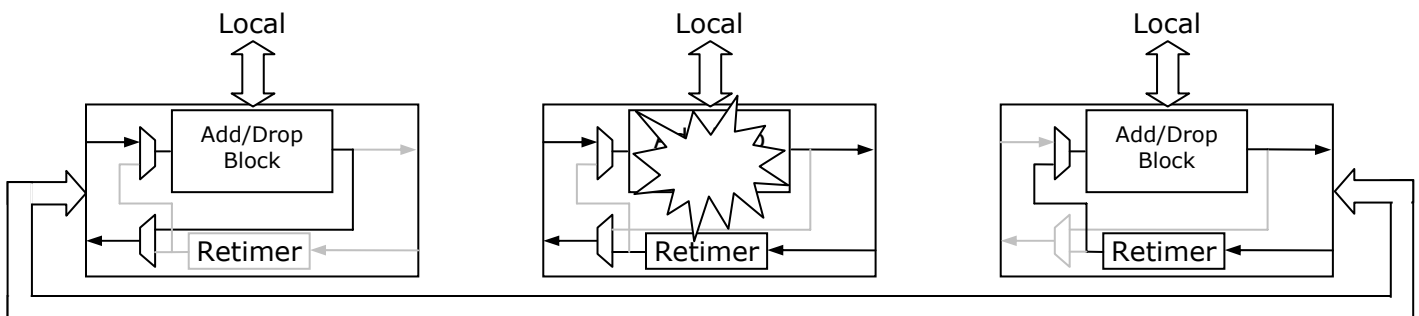
## Redundant Operation

When connecting the downstream feed of the last unit in the series back to the upstream feed of the first, a dual, contra-rotating ring is achieved.



**Dual, Contra-Rotating Ring Configuration**

If any unit or connection in the ring is lost, the downstream and upstream units will automatically re-configure to compensate. No functionality, other than that of the failed unit, will be lost. When the lost connection or failed unit is corrected, the system will restore to the original state automatically.



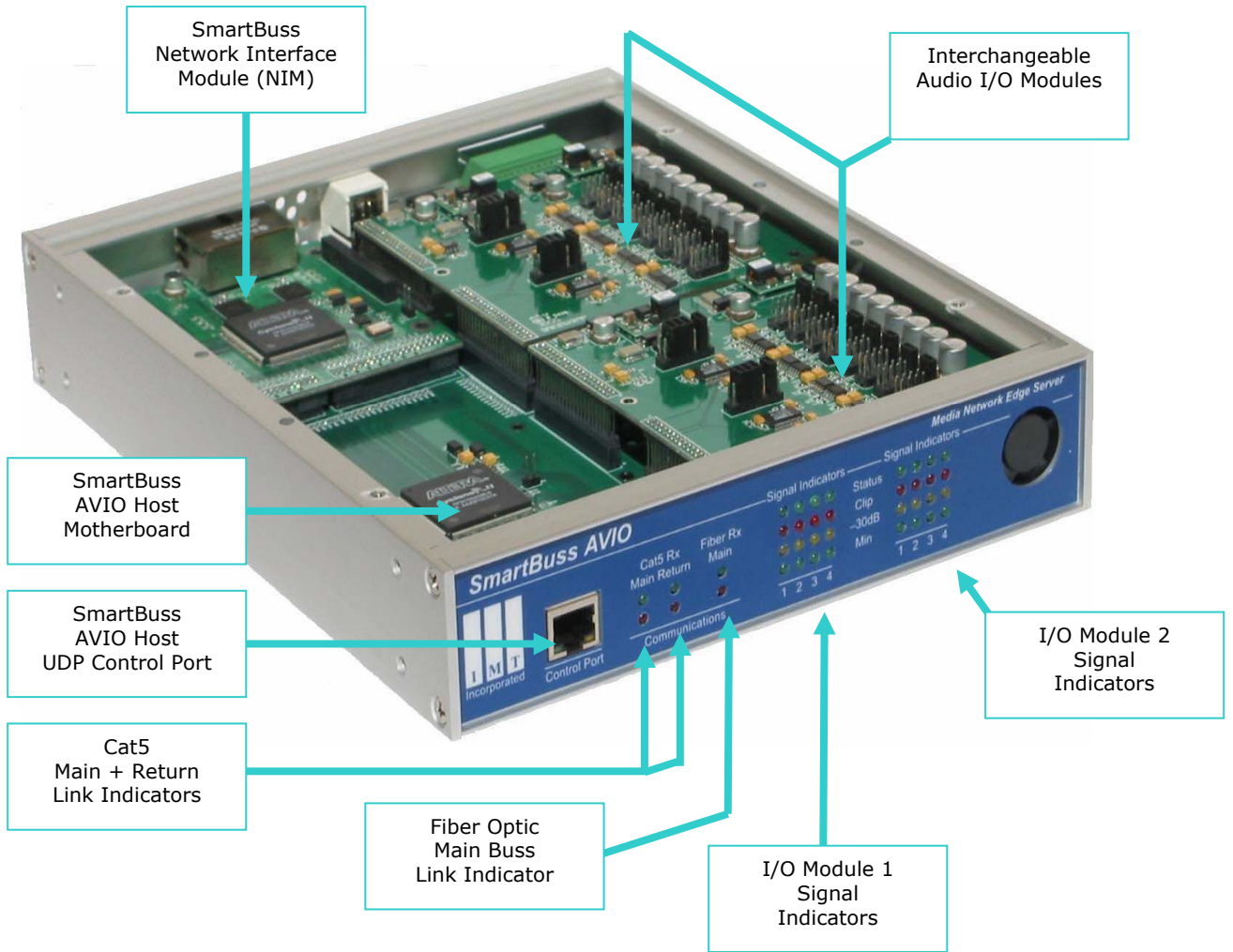
**Pathway reconfiguration on unit failure**

The combination of standard Ethernet Physical devices that inherently process multiple hops, and the SmartBus network management design structure that uses a synchronous downstream clock domain for the add/drop channel mapping, produces a stable and non-degrading clocking environment that is especially suitable for applications requiring very low jitter. A maximum of 256 hardware or 32,000 unique software addressed client devices may be configured on a single SmartBus network.

For more information regarding IMT's multimedia network solutions please contact us:

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### SmartBuss AVIO Audio Edge Server



### SmartBuss AVIO 14 Multimedia Hub

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