A New System Architecture for a New Generation of Air Traffic Control

Northrop Grumman’s Nodal Switch is the first truly distributed ATC communications system. Legacy systems simply distribute the voice and data control processing throughout a centralized switching system. The Nodal Switch uses intelligent end-points, or nodes, each containing all of the needed audio and data processing resources. Legacy systems transport audio from source to destination via channel-limited proprietary busses. The Nodal Switch uses standard Ethernet links and switches to transport communications.

No Compromise Needed

The Nodal Switch eliminates the need for customers to compromise functionality and flexibility for performance and reliability. The Nodal Switch offers significant reductions in size, operating costs and complexity while simultaneously increasing deployment flexibility and interoperability, without sacrificing performance and reliability. Nodal Switch audio quality is far superior to that of legacy TDM systems with their analog links to radios and control communications are up to five times faster.

Increased System Port Capacity

The new IP-based architecture eliminates the hard channel capacity limitations of TDM-based systems. Each node contains the needed processing, switching, and audio summing resources. The Nodal Switch is designed to be scaled from 2 ports to as large as 64,000 ports.

Deployment Flexibility

Using a standard Ethernet network to interconnect the nodes of the Nodal Switch eliminates many of the problems and costs associated with centralized systems. Nodal Switch interfaces may be co-located with the communications assets they are interfacing with; telephone interfaces with telephone equipment and radio interfaces with radio equipment. Regardless of each node’s physical location, as long as they are interconnected by an Ethernet network the nodes function as if they were all in the same equipment rack.

Asset Sharing

The interconnecting networks of two or more Nodal Switches allow direct communications between users and shared access to all communications assets. Built-in security features control access rights and automatically detect and report unauthorized communications access.

Interoperability

The Nodal Switch is fully interoperable with other Voice over IP communications systems conforming to the Session Initiation Protocol (SIP) such as most modern PABX systems.
Field-Proven Heritage
The Nodal Switch software is based on the field proven Enhanced Terminal Voice Switch (ETVS) software. This approach yields two major benefits:

• Low Risk – The ETVS software has over 23 million operational hours of field operation and has undergone multiple refinements over the years to best meet the needs of our customers.
• User Familiarity – The Nodal Switch uses the same graphical user interfaces as ETVS, giving it the same look and feel to the users and minimizing training requirements.

Standards-Based Architecture
Saying that the Nodal Switch is based on a standards-based architecture means that the underlying fabric of the system is based on the use of industry-standard communications protocols and hardware. This standards-based approach allows the Nodal Switch to use standard commercial Ethernet switching equipment rather than proprietary hardware. This standards-based approach allows direct connectivity to wide area networks without the need for gateway devices. This standards based architecture ensures low life-cycle costs and interoperability.

The Port Engine – The Fundamental Building Block of the Nodal Switch
Simply put, the Port Engine is a versatile and powerful signal processing card. The Port Engine performs the IP signal processing and audio summing tasks of its node. The Port Engine achieves TDM-like performance, far superior to traditional IP systems by implementing in specialized hardware processes traditionally performed by software running on generic platforms. In addition to its Nodal Switch applications, the Port Engine has also been employed as:

• Gateway Device – allowing legacy systems to be coupled by means of standard Ethernet links.
• Gateway Translator – performing the protocol conversions needed to couple legacy systems together via standard Ethernet links. This would include applications such as direct links and asset sharing between ETVS and RDVS communications systems.
• VoIP Protocol Conversion – serving as a bridge between VoIP systems utilizing differing protocols such as SIP and H.323.
• Redundant Network Interface – coupling mission critical systems to redundant networks in a manner that is totally transparent to the host system.

Scalable Redundancy
Each Nodal Switch Node contains fully redundant Ethernet communications ports. These ports may be connected to two independent Ethernet switches which in turn may be connected to independent wide area networks to provide both hardware and network redundancy. To protect against risks such as fires or explosions, the redundant network hardware can be located in different parts of the facility. For applications not requiring a high level of redundancy, the system can be configured to use a single wide area network or even a single Ethernet switch.

The Nodal Switch is a proven solution. Systems are now in production and in the field.

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