The S4 Open Product Family – White Paper No.1 Concepts

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Building Automation Systems Legacy

A building automation system, or BAS, optimizes the administration, operations, and performance of HVAC equipment and alarm systems with purpose built networks and protocols. Most readers are already aware that a BAS increases the interaction of mechanical subsystems within a building, improves occupant comfort, lowers energy use, and allows off-site building control. Modern building automation systems use computer-based monitoring to coordinate, organize and optimize building control sub-systems such as security, fire/life safety, elevators, etc. Over the years, several proprietary building automation network standards have evolved in the marketplace including Siemens' APOGEE® and Johnson Controls' Metasys®.

Proprietary solutions have generally permeated the non-residential HVAC market, limiting the upgrading of and expanding infrastructure to either off the shelf specific vendor compatible products or costly custom solutions. Vendor initiatives to publish their proprietary protocols resulted in one-way only open systems with the host system always playing the role of master.

Migration to Open Systems

Flexibility, scalability, and expandability are extremely important when selecting a BAS. The ability to reconfigure and monitor changes made to an automation system in real time is of tremendous importance to building managers. In recent years, open protocols like BACnet have been promoted and implemented as their system's primary protocol by companies such as Automated Logic, Alerton, Andover Controls, Advantech, Delta Controls, Reliable Controls, Richards-Zeta, and others as an alternative to proprietary vendor -specific protocols. More recently, the Continental Automated Buildings Association (CABA) has taken the lead in defining the industry directions for vendor independent open systems. Specifically, the oBIX initiative defines a XML based standard for the future

The S4 Group fully endorses these initiatives and our S4 Open product line offers an approach to migrating legacy Johnson Controls Metasys® installations to a truly open systems environment.

The S4 Group Inc, in a strategic partnership with Obermeier Software, has developed the S4 Open line of products that provide a bi-directional media and transport independent open systems interface at the N2 field bus level of the Metasys® system.

Summary of Product Features and Capabilities

Having the ability to implement best-of-breed solutions, utilize existing network infrastructure, and retain existing investments in field level gear provides building and system managers with many fiscally positive options that they never had before.

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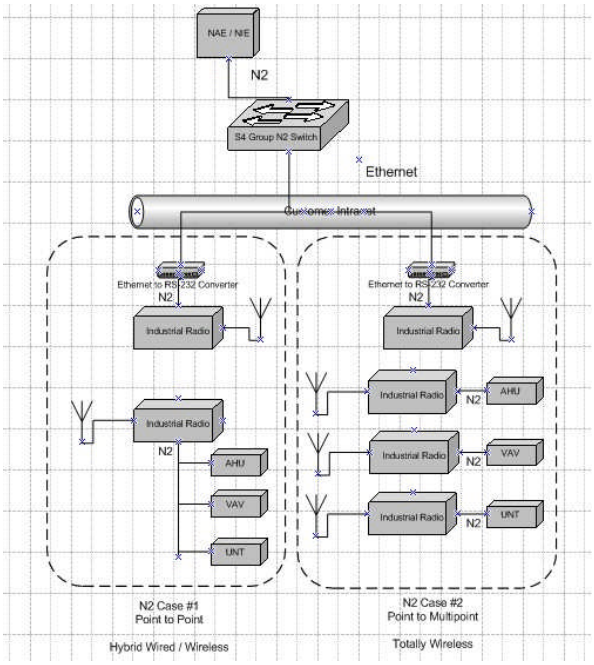
- Ability to transparently merge many legacy N2 buses in a large complex building into one virtual N2 bus
- Provides media and transport independence for the N2 field bus
- Acts as the bus master for each Downstream N2 Network and allows independent adjustment of parameters for each
- The Virtual N2 Network attaches to any Metasys® Supervisory Controller N2 interface
- Transparent to the existing Metasys® Supervisory Controller
- Standard vendor tools are used to configure N2 devices on each N2 bus
- Automatically locates and identifies new devices on the N2 bus
- Automatically probes N2 devices to identify addressable points
- Supports all Johnson Controls Metasys® N2 devices, 9100 series devices, VMA devices, and 3rd party N2 Open devices
- Automatically performs N2 address translation and mapping
- Provides statistics on N2 bus and system performance
- Remote configuration and administration via the S4 Open Console
- Delivered as a turnkey network appliance hosted on an industrial PC
- Available as a software-only product by special arrangement

Application

The following are representative applications for the S4 Open family of products. Each sample case study will highlight the tremendous flexibility the S4 Open appliances provide when retrofitting or enhancing an existing building automation network or leveraging existing infrastructure as a cost saving measure in a migration strategy.



Extending the N2 bus over an existing network infrastructure

Challenge

In a large corporation with a multiple building campus, a single automation network might be prohibited by either cost or physical constraints. Being able to centralize building operations in a single location for the entire campus, or company, is an effective way to cut costs and better manage operations.

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Solution

The S4 Open: N2 Switch allows for the extension of an N2 based building automation system over a standard Ethernet network. This opens up the possibility of reaching any location that is connected into the corporate Ethernet or WAN. In addition, for locations that would be difficult to link physically, wireless technologies can be employed as illustrated in the above diagram.

The S4 Open N2 Switch also allows for the merging of several N2 based networks into one virtual network, permitting the use of a single supervisory controller on multiple physical networks. This saves money on hardware and reduces the amount of separate infrastructure employed.

Enterprise system integration

Challenge

A large manufacturing corporation has established an Enterprise Management System (EMS) platform based on one of the major SNMP-based managers available on the market today. Since their product yield quantities and product quality are directly related to temperature and humidity variations during critical stages of the manufacturing process they need to bring their HVAC system under the umbrella of their EMS to ensure that the manufacturing process is as effective as possible.

Solution

The S4 Open: SNMP N2 Router publishes all relevant HVAC data to the EMS via its upstream SNMP interface. Bi-directional communications facilitates information exchange between the systems. The SNMP N2 Router can be configured to monitor thresholds on critical data points and generate SNMP traps warning the EMS when any critical parameter that could impact the manufacturing process is going out of specification.

This solution improves the overall quality of the manufacturing process and the resulting product. It also improves yields and minimizes loses due to HVAC related events.

Cost effective upgrades

Challenge

Upgrading existing systems often means replacing ageing technology with an equal amount of new technology. It is often a time consuming, costly, and complicated process. This is especially true when dealing with a building automation system.

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Solution

With the S4 Open: N2 Switch, it is possible to combine multiple legacy N2 buses into a single virtual N2 bus. This will allow the replacement of a number of less powerful Supervisory Controllers to fewer current generation Metasys systems. This approach drastically improves the economics of doing an upgrade by minimizing the number of newer, more powerful, Supervisory Controllers needed.

Overview of the S4 Open Appliance Architecture

S4 Open Appliances consist of two primary components, the N2 Router Windows CE.Net Service and the S4 Open Management Console which is based on Microsoft's Management Console (MMC) technology. The Windows Service is based upon the same core software framework upon which the Obermeier Software SNMP OPC Gateway products were developed. This is a field tested, mature set of code that provides the foundation of the product. It is implemented as a Windows Service for high reliability, good performance, immunity from traditional Windows applications, and a solid security implementation.

The S4 Open: N2 Switch

The entry level member of the S4 Open family is the N2 Switch. The name reflects the functionality provided by the device-- two, or more, legacy Downstream N2 Networks are "switched" onto one Virtual N2 Network. The N2 Router Auto Configure process identifies all devices on each Downstream N2 Network and maps the devices, and their associated points, onto the Upstream Virtual N2 Network. N2 Address translation is applied wherever necessary to avoid duplication of N2 addresses from legacy N2 networks. The Upstream Virtual N2 Network interface implements the N2 Slave protocol. Each of the Downstream N2 Network interfaces implements a N2 Master protocol and each can be configured independently to provide optimal performance.

The Downstream N2 Network interfaces are media and transport independent. You are no longer limited to serial cable for the N2 Network. The physical interface can be provided by traditional RS-485 capable I/O ports in the host system, by commercially available Ethernet to RS-485 terminal servers, or by Wireless interfaces. The N2 Switch core technology adjusts for latency and timing differences inherent in these interfaces to maintain a viable N2 session through the Virtual N2 Network port.

The software will scale to support any number of ports and N2 devices. However, the aggregate number of all N2 devices switched to the Virtual N2 Network cannot exceed the N2 name space. And, the aggregate number of points from all switched N2 devices

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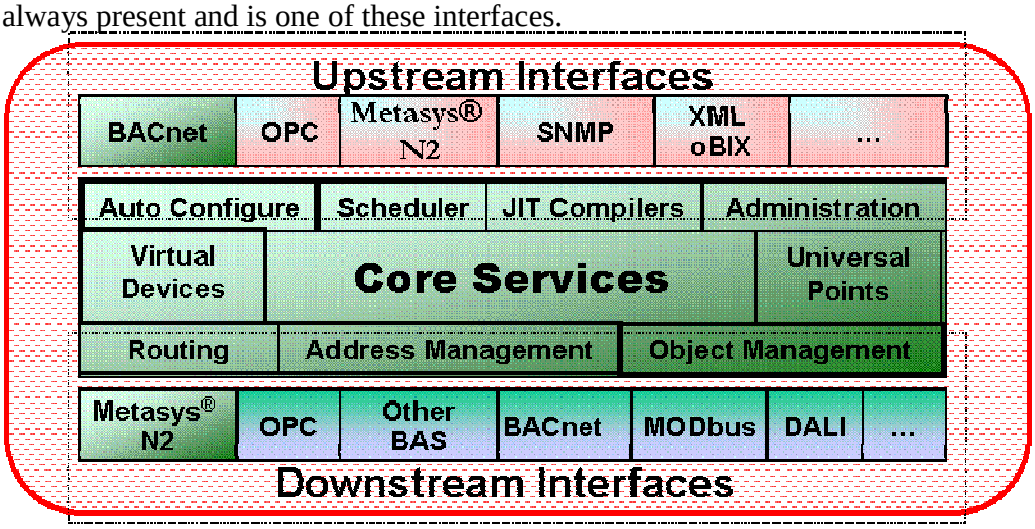
that are mapped in the supervisory controller cannot exceed Johnson Controls' engineering best practices for the model supervisory controller being deployed.

A standard Johnson Controls supervisory controller then attaches to the Virtual N2 Network. In normal operation the N2 Switch is completely transparent to the supervisory controller. What the supervisory controller sees on its N2 interface is the switched image of the sum of the N2 devices on all of the Downstream N2 Networks. It has no need to know what ports they were connected to, what media or transport was utilized, or if address translation was performed. As far as it is concerned it is looking at a normal, traditional, N2 field bus.

We did not duplicate the administrative and configuration tools that Johnson Controls and 3rd party developers have provided for their N2 devices. The N2 Switch is transparent to uploads, downloads, and configuration operations. Therefore, all existing vendor supplied utilities and configuration software will work identically to the way they would work in a traditional Metasys environment.

S4 Open Appliance Capability and Extensibility

Each subsequent member of the S4 Open family builds upon the base provided by the N2 Switch utilizing protocol and feature plug-ins in a Lego®-like fashion. The routing capability of the appliance allows you to selectively publish data from the Downstream N2 networks to two or more different upstream interfaces. The Virtual N2 Network is always present and is one of these interfaces.



Standard configurations are pre-packaged. However, any combination of the available or planned future, protocols may be utilized simultaneously.

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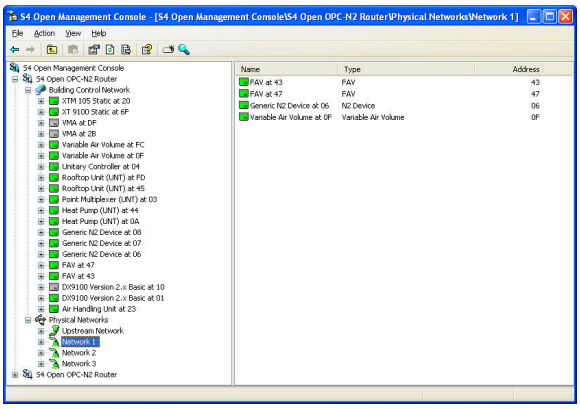
The S4 Open: OPC N2 Router

The OPC N2 Router adds an OPC DA Server interface as an additional upstream protocol. All Process Points from all N2 devices can be published to this interface at the same time that they are being published to the Upstream Virtual N2 Network. This OPC interface may by utilized to offload the Johnson Controls supervisory controller when a large number of read-only Process Points are present. The M-Series workstation would access any points not required by an automated control function in the supervisory controller through the OPC N2 Router's OPC DA Server saving memory, database, and CPU cycles in the supervisory controller.



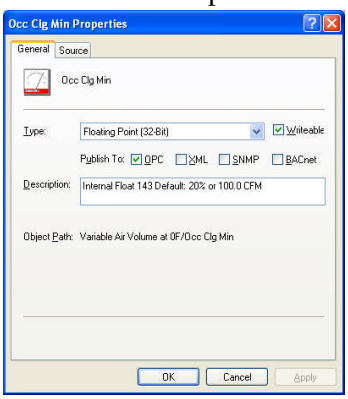
The OPC DA interface is fully compliant with OPC specifications so that any automation system or HMI needing access to data on the N2 bus can now treat it as part of the customer's corporate enterprise without jeopardizing ongoing Metasys® operations.

The S4 Open: BACnet N2 Router

The BACnet N2 Router adds a BACnet interface as the additional upstream protocol. This allows the Process Points from all N2 field devices to be routed to the BACnet interface and utilized by any BACnet compliant system.

The S4 Open: SNMP N2 Router and Future Directions

This same concept will be applied for SNMP, other protocols, and enhanced functionality as the product line expands and additional customer requirements are addressed. Multiple upstream protocols can be activated simultaneously. For instance a customer might need both an SNMP interface to an EMS and an OPC interface to a M-Series workstation to handle a large number of display-only Process Points.



We will provide more details on Intelligent N2 Device Profiles, Universal Points, Virtual N2 Devices, and other advanced features of the S4 Open product family in a future article.

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Benefit to Business

The S4 Group's family of N2 compatible products presents a tremendous benefit to any organization implementing these solutions. Being able to view the entire BAS as a whole, from one centralized location can reduce MTBF and lower overall operating costs. MTBF is reduced by providing EMS operators with information coming from attached devices concerning factors like temperature, downtime, and overall building performance. From one office, repairs and standard maintenance can be coordinated and dispatched throughout the entire organization.

Costs relating to upgrading are reduced by diminishing the number of physical controllers needed for the N2 network. Costs are also kept down by allowing the transport of the N2 field bus over existing Ethernet and WAN networks. Not having to lay new infrastructure is a boon to the bottom-line.

Where to purchase

The S4 Group's S4 Open Metasys® compatible line of products can be purchased by contacting The S4 Group, or visit our web site at www.TheS4Group.com for more information.

About the S4 Group

In January, 2002 The S4 Group, Inc. was formed with a charter to address the complex challenges associated with integrating legacy Building Automation Systems (BAS), Industrial Ethernet, Process Control, Factory Automation and Industrial Automation Systems into large enterprise customer IT network, management, and security environments, and to each other. The S4 Group, Inc. delivers the software tools and integrated systems to maximize customers' building efficiency, productivity, and profitability.