



BACnet
北京论坛
2010

BACnet in China – Efficient system integration for green buildings

在中国 – 绿色建筑的高效集成系统

Building on BACnet

Connecting Devices to a
BACnet/IP Infrastructure

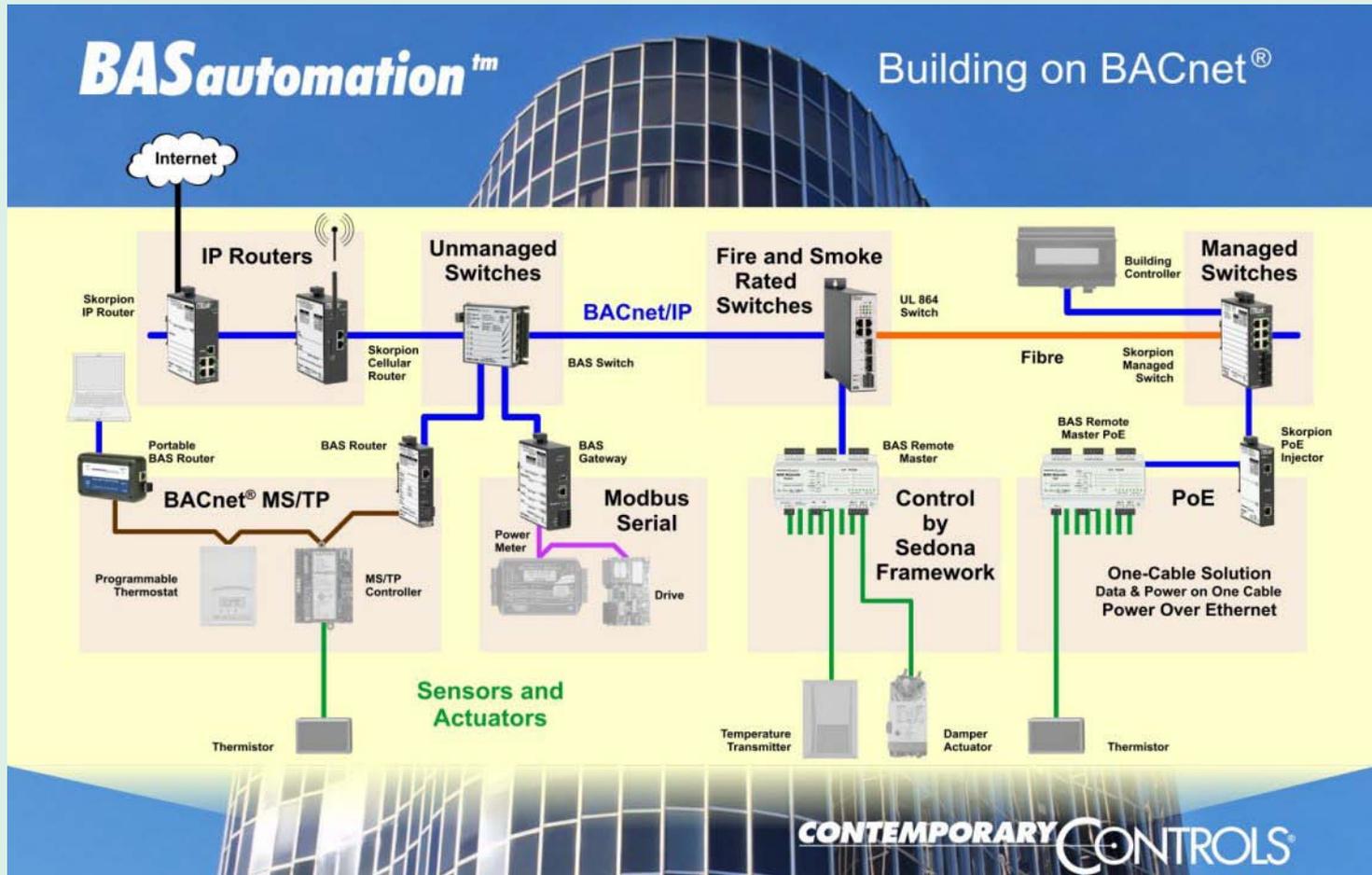


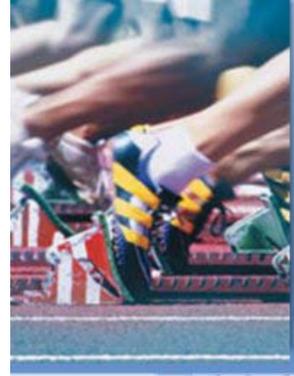
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Contemporary Controls

October 20th, 2010



Green buildings have many types of devices



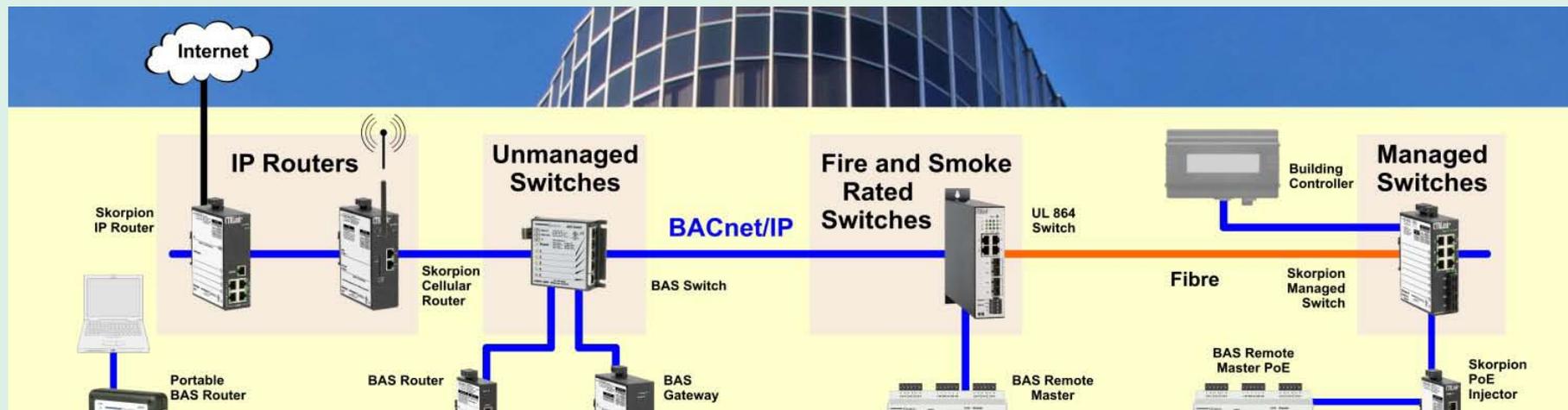


But not every device in a building is BACnet

- Wired IP routers that access the Internet
- Wireless routers that access the Cellular network
- Unmanaged Ethernet switches for simple device connections
- Fire & Smoke rated Ethernet switches for life-safety systems
- BACnet/IP building controllers that supervise the system
- BACnet/IP and BACnet MS/TP field controllers for local control
- BACnet/IP to BACnet MS/TP routers that interconnect networks
- Modbus devices such as energy meters
- Modbus serial to BACnet gateways for interfacing Modbus devices
- Sensors and actuators that attach to field controllers



However, BACnet/IP should be at the top

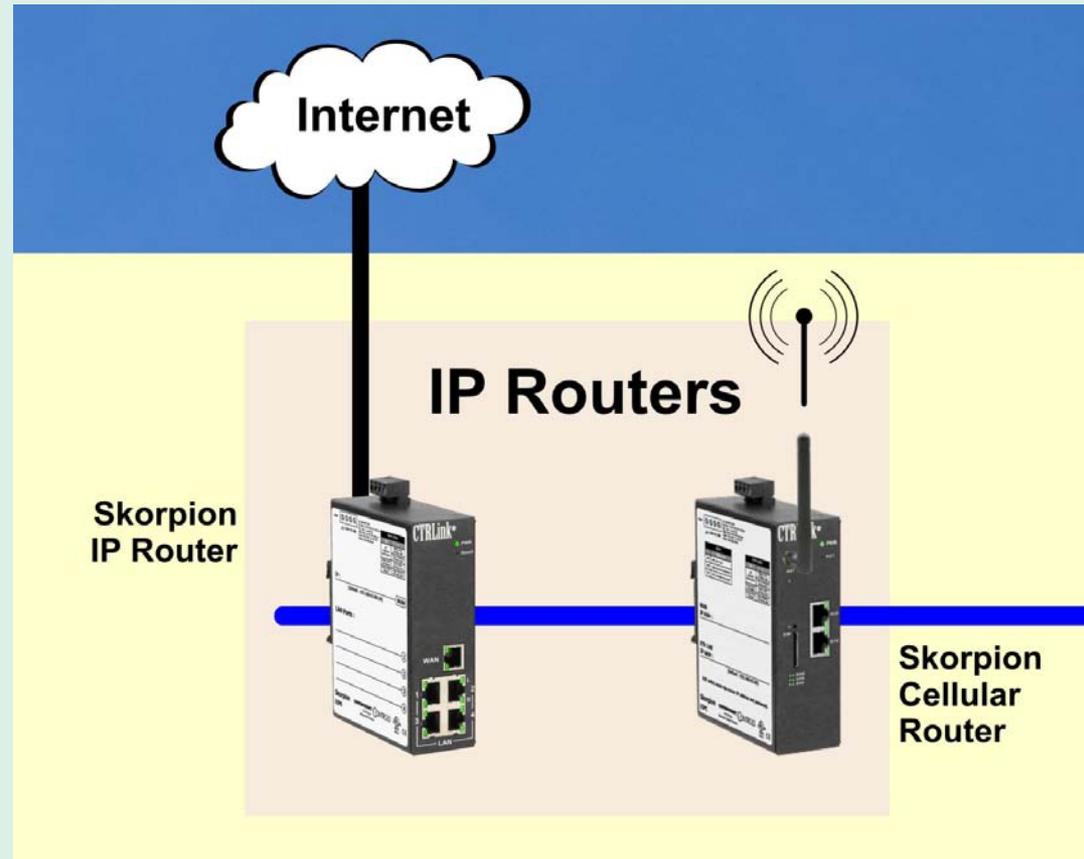


- BACnet at the highest level means the building is “BACnet compliant” regardless of the other technologies used within the building
- The Internet Protocol (IP) is the protocol of choice for green buildings
- Ethernet is everywhere especially with structured wiring systems
- Connection to the Internet is simplified when using IP networks



IP routers provide access to the Internet

- Wired IP routers provide access to the Internet via
 - External DSL modem
 - External cable modem
- Wireless IP routers such as a cellular router can do the same via
 - GSM/GPRS/EDGE
- An Internet connection to the building allows for
 - Remote supervision
 - Internet services for clients
 - Firewall for security

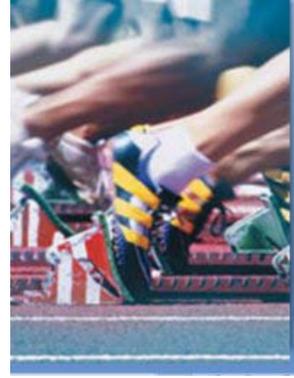




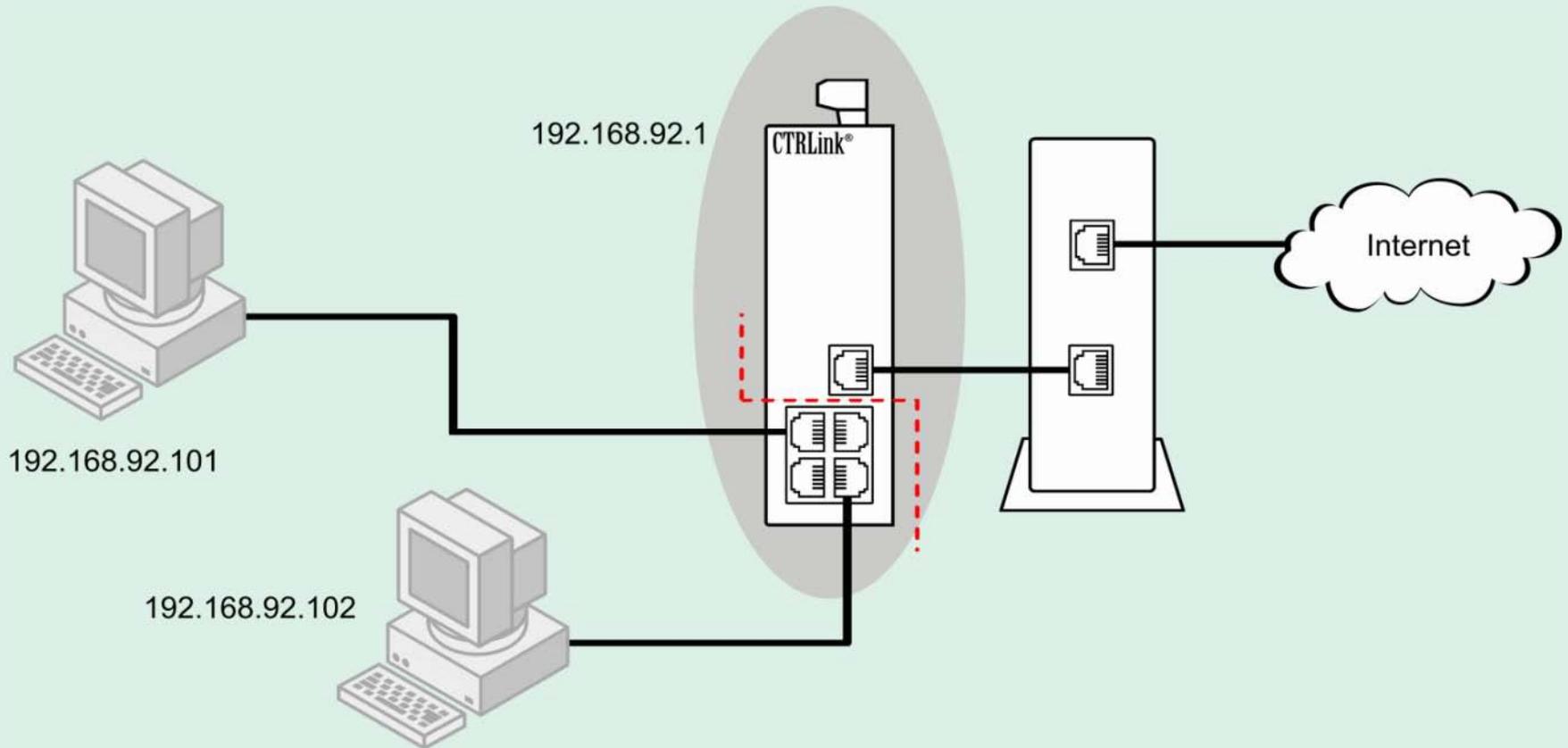
Skorpion IP Router

- Configurable by web browser
- 10/100 Mbps Ethernet WAN port
- 4-port 10/100 Mbps Ethernet LAN switch
- Port address translation, network address translation and port forwarding
- Stateful firewall
- DHCP client on the WAN side
- DHCP sever on the LAN side
- Supports external DSL or cable modem



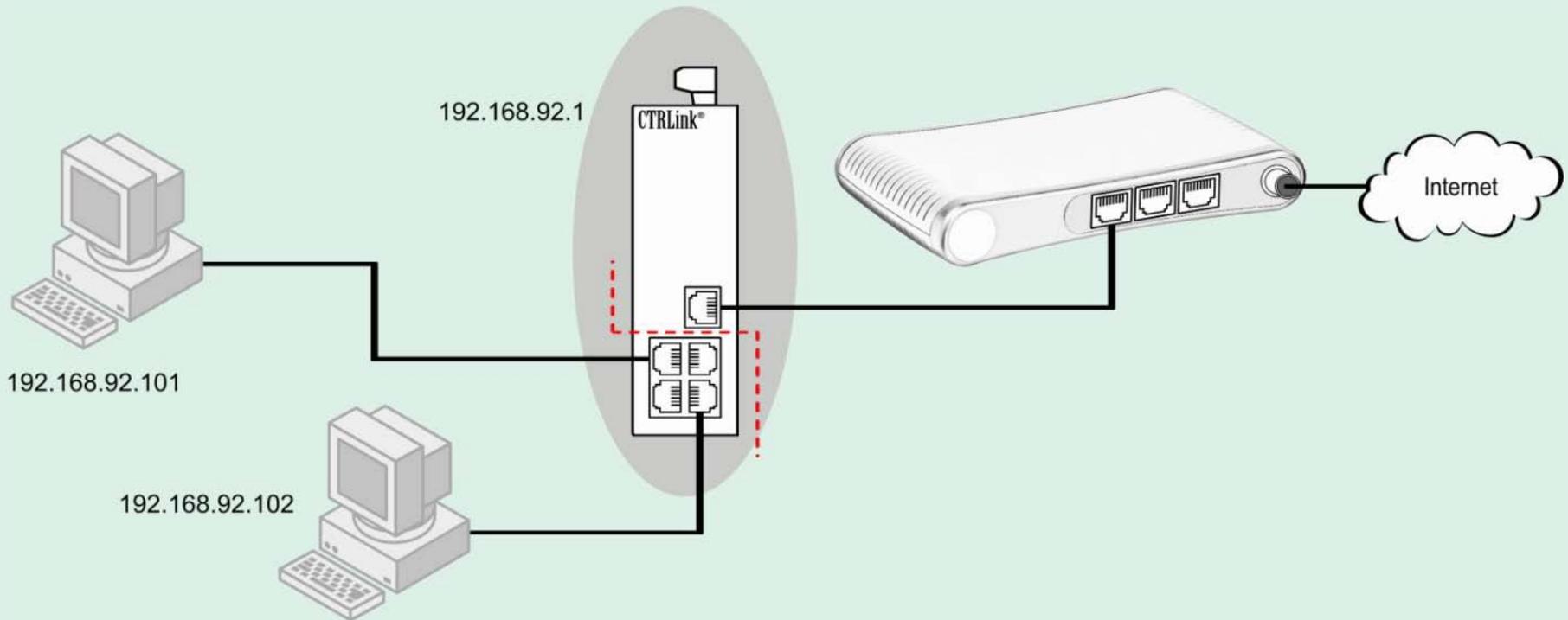


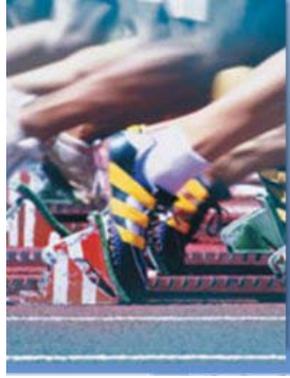
Internet access using a DSL modem



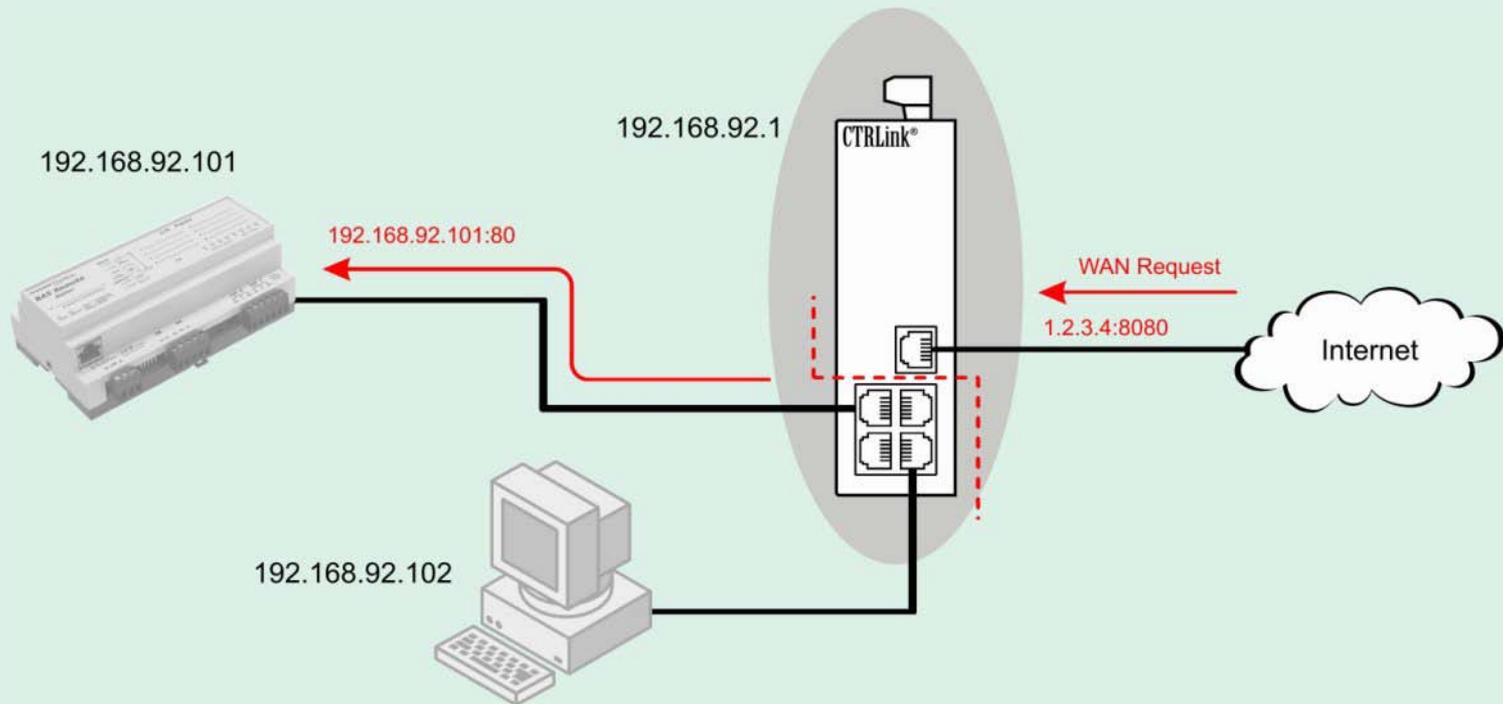


Internet access using a cable modem





Port forwarding allows for remote access



Internal IP Address	LAN IP Port	WAN IP Port	External IP Address
192.168.92.101/24	80	8080	1.2.3.4



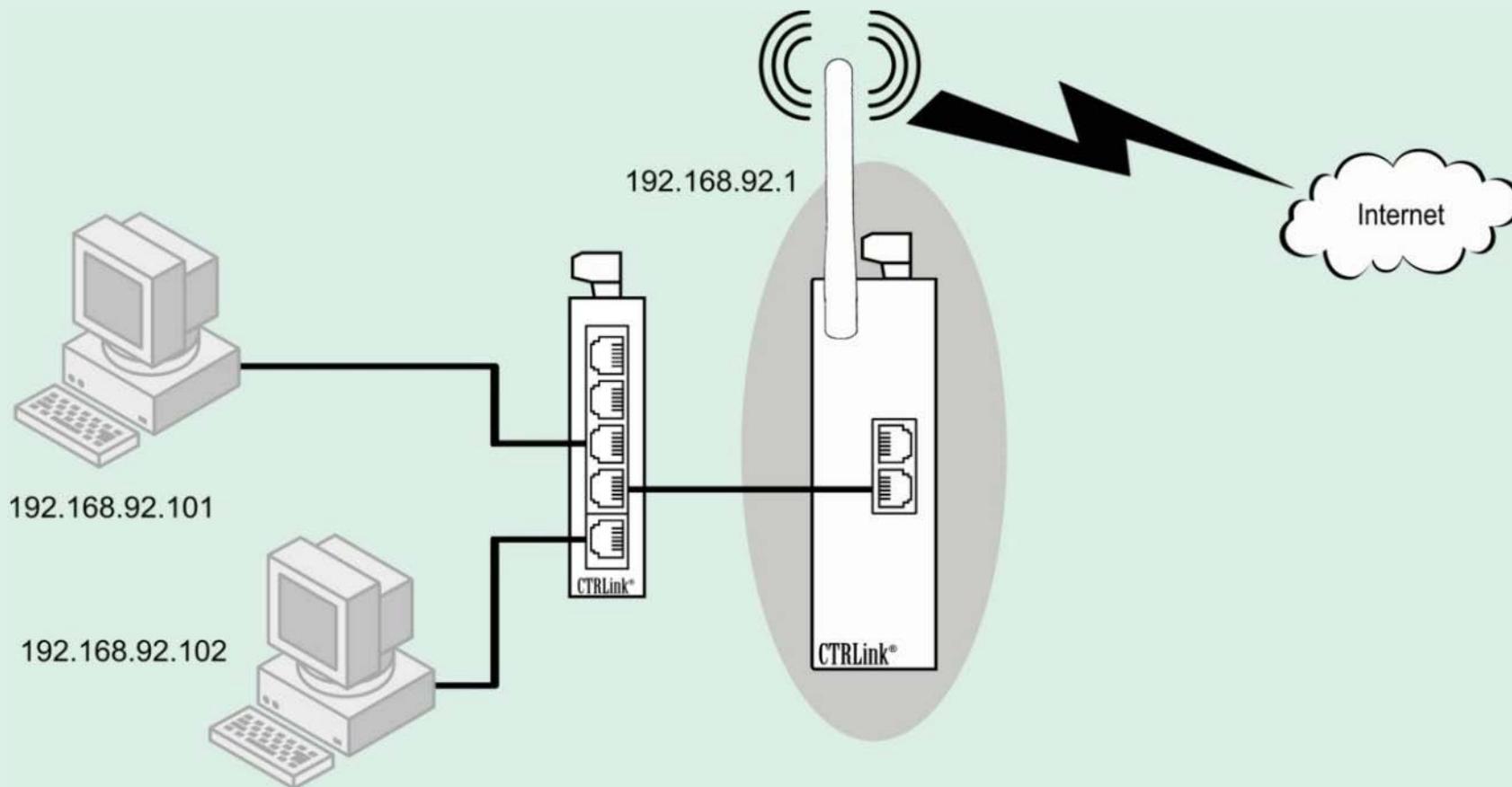
Skorpion Cellular Router

- Configurable by web browser
- GSM/GPRS/EDGE WAN port
- 10/100 Mbps Ethernet LAN port
- Virtual private network (VPN) tunneling
 - IPsec
 - OpenVPN
- Port address translation, network address translation and port forwarding
- Stateful firewall
- DHCP client on the WAN side
- DHCP server on the LAN side





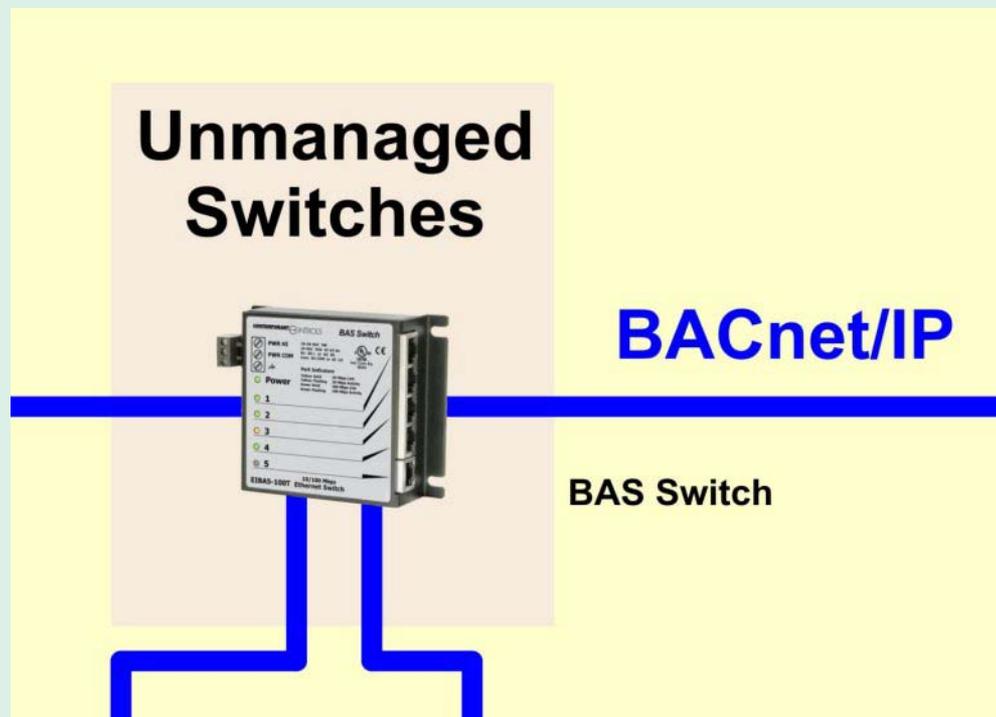
Internet access using a cellular network





Unmanaged Ethernet switches make it simple

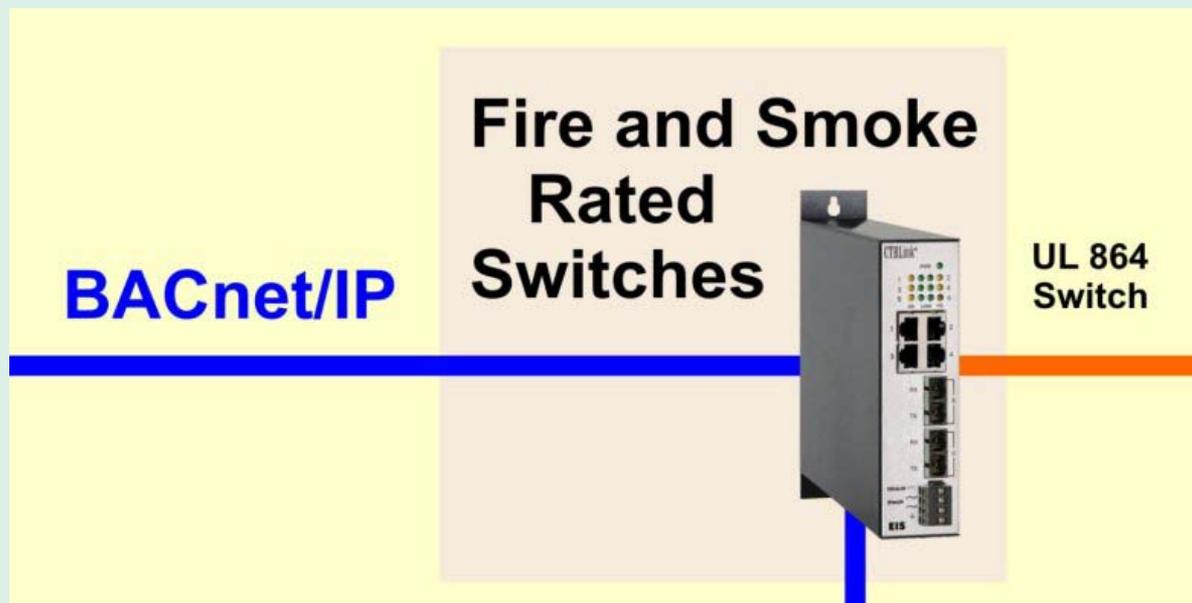
- Simple to use and to install
- Intended for mounting into control panels
- Low-voltage powered
- Auto-negotiation of data rate and duplex
 - 10/100/1000 Mbps
 - Half or full-duplex
- Auto-MDIX allows for either straight-through or crossover cables
- Cost-effective but professional installation





Fire & smoke rated Ethernet switches

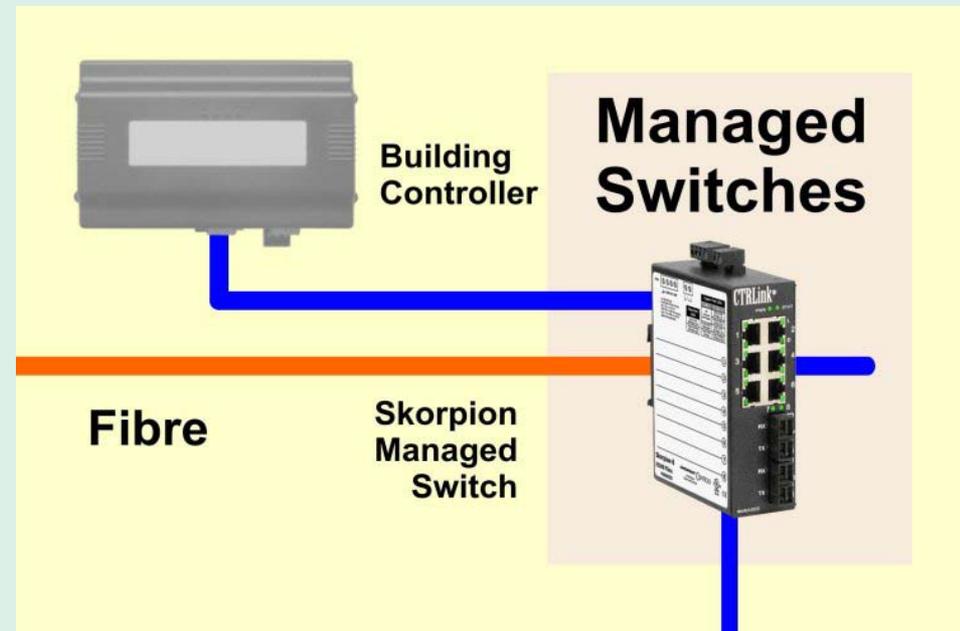
- UL 864 Control Units and Accessories for Fire Alarm Systems 9th Edition compliant
- 10/100 Mbps Fiber optic or copper connections





Managed Ethernet switches provide features

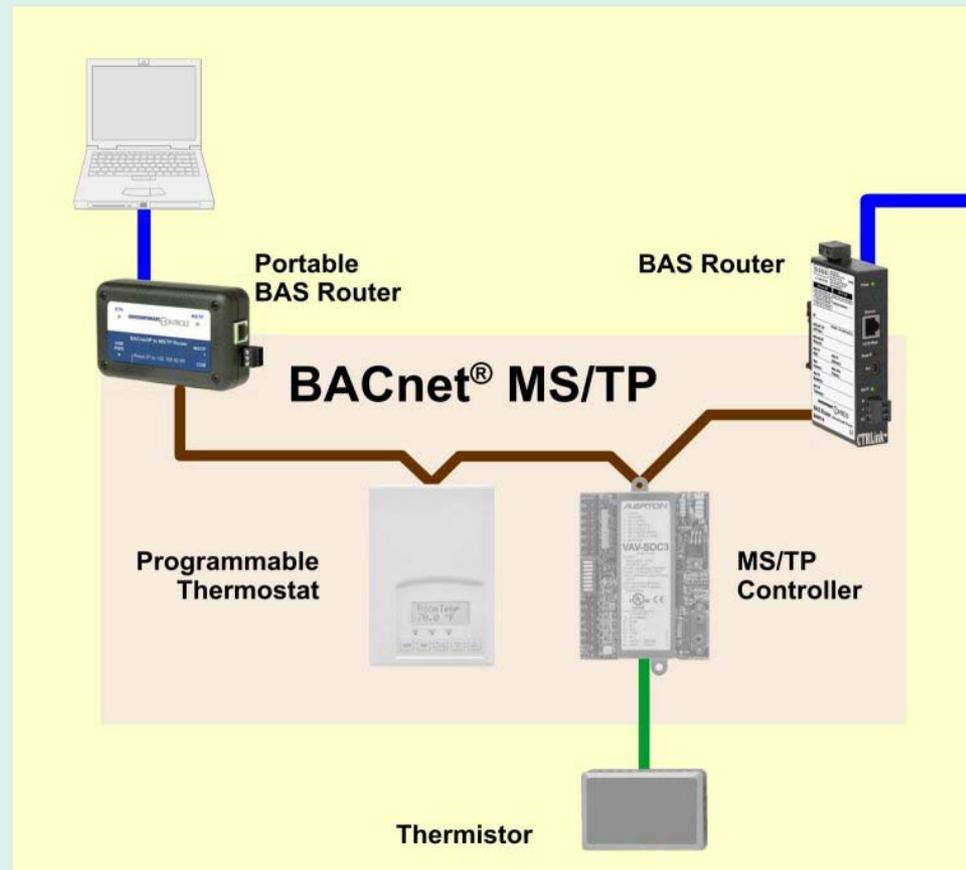
- Simple Network Management Protocol (SNMP) compliant
- Configurable by web browser
 - Virtual local area network (VLAN)
 - Quality of Service (QoS)
 - Port security, rate limiting and port mirroring
 - RSTP or RapidRing[®] cable redundancy
 - Programmable fault relay
- Single mode or multimode fibre optic option





BACnet MS/TP to BACnet/IP Routing

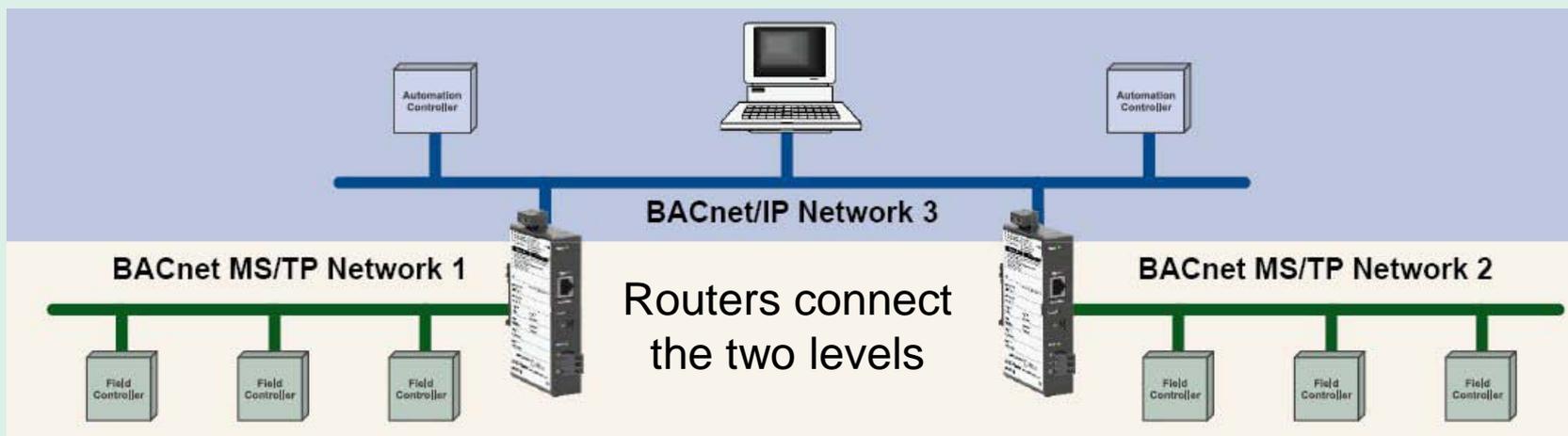
- Allows BACnet MS/TP devices such as servers to be accessed by BACnet/IP clients
- A portable router is used for commissioning devices from an Ethernet connected laptop
- A fixed router is used for permanent installations





Connecting BACnet MS/TP to BACnet/IP

- BACnet's advantage is that the same protocol can operate at multiple levels — from the *field*, to the *automation* and up to the *enterprise*
- At the automation level there are *operator workstations*, *building controllers* and *advanced application controllers* running BACnet/IP
- At the field level there are *smart sensors*, *smart actuators* and *application specific controllers* running BACnet MS/TP





BAS Router – BACnet multi-network router

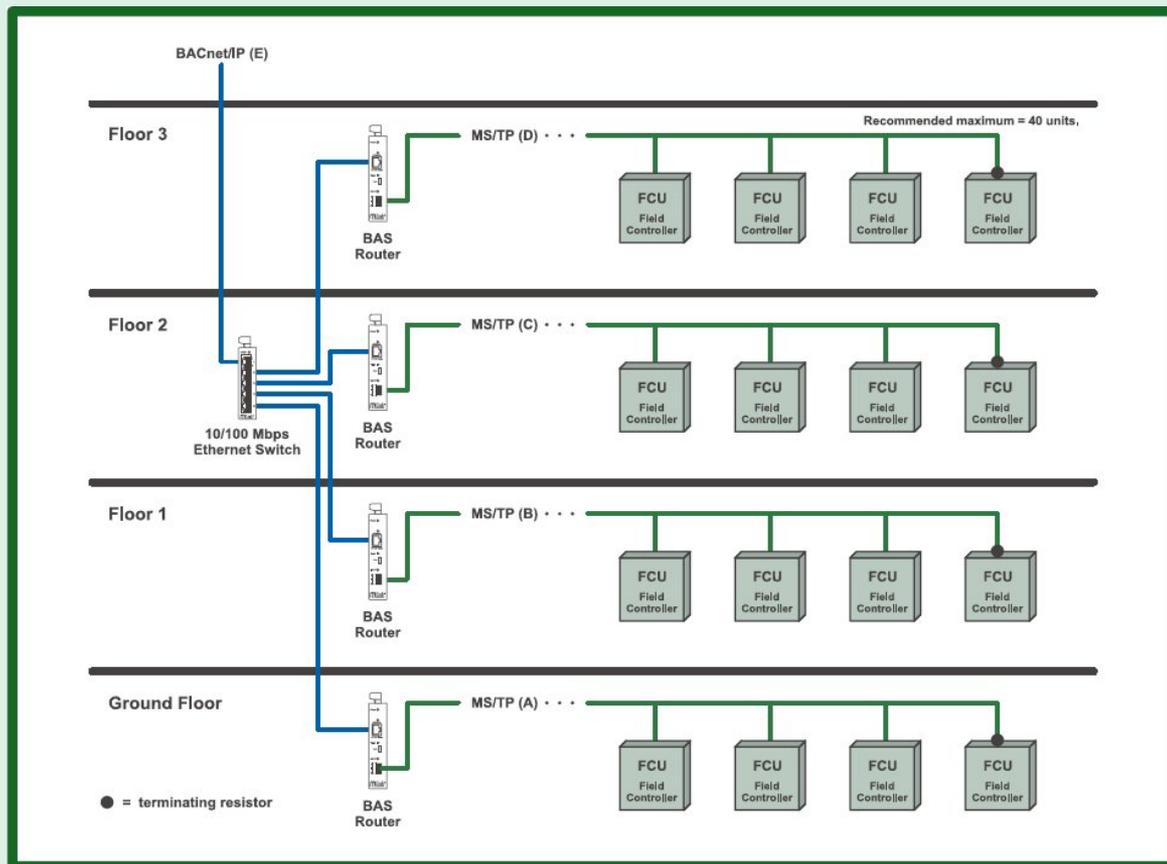
- Routing between ...
 - BACnet/IP and BACnet MS/TP
 - BACnet Ethernet and BACnet MS/TP
 - BACnet/IP and BACnet Ethernet
 - BACnet/IP and BACnet Ethernet and BACnet MS/TP
 - Two BACnet/IP networks
- Configurable by web browser
- 10/100 Mbps Ethernet port
- 9.6–76.8 kbps optically isolated MS/TP port
- BACnet/IP Broadcast Management Device (BBMD)





Assigning BAS Routers to each floor

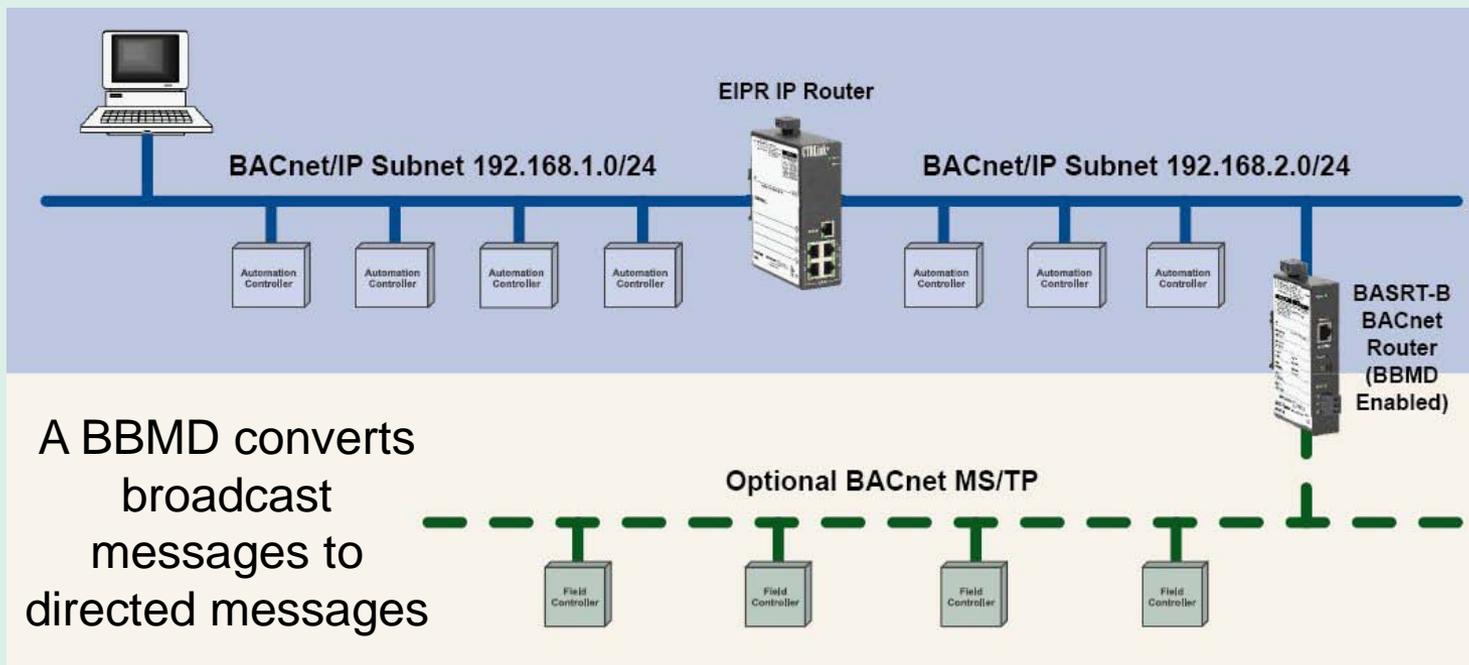
- BACnet MS/TP segments can be isolated by assigning a BACnet router to each floor
- With this approach, all riser wiring would be dedicated to Ethernet and BACnet/IP
- This approach makes troubleshooting easier while taking advantage of structured wiring





BACnet/IP Broadcast Management Device

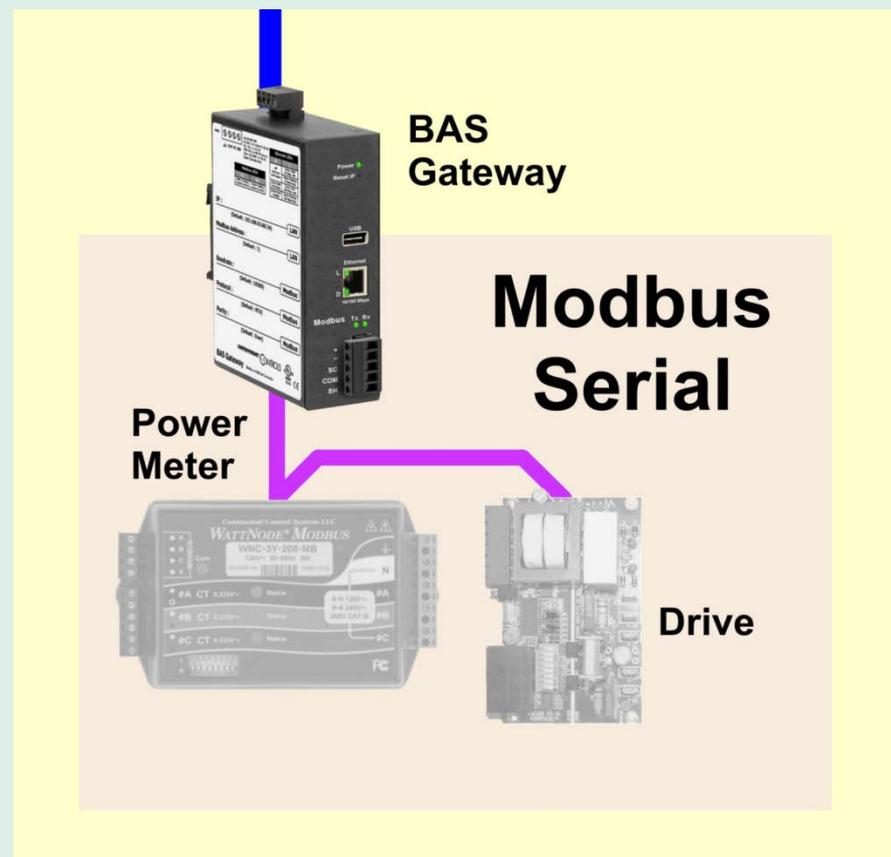
- BBMD required when operating over a sub-netted BACnet/IP network in order for broadcast messages to pass through IP routers
- Foreign devices (not on the local subnet) can register with a BBMD





Modbus serial devices are common

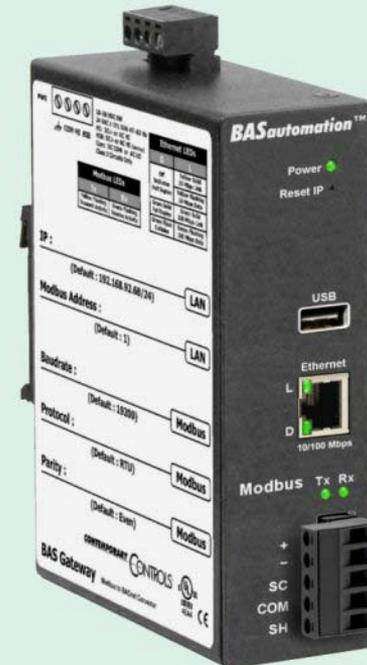
- Green buildings require the sub-metering of client loads so energy or power meters are needed in order to measure natural gas, water or electric usage via
 - Pulse output
 - Modbus serial
 - BACnet MS/TP
- Modbus devices are not BACnet compliant so a gateway is needed in order to map Modbus registers to BACnet objects





BAS Gateway – Modbus serial to BACnet/IP

- Gateway between BACnet/IP and ...
 - Modbus serial RTU
 - Modbus serial ASCII
- Configurable by web browser
- 10/100 Mbps Ethernet port
- 2.4–115.2 kbps isolated Modbus port
- Off-line Modbus mapping to BACnet object spreadsheet tool





Modbus register mapping to BACnet objects

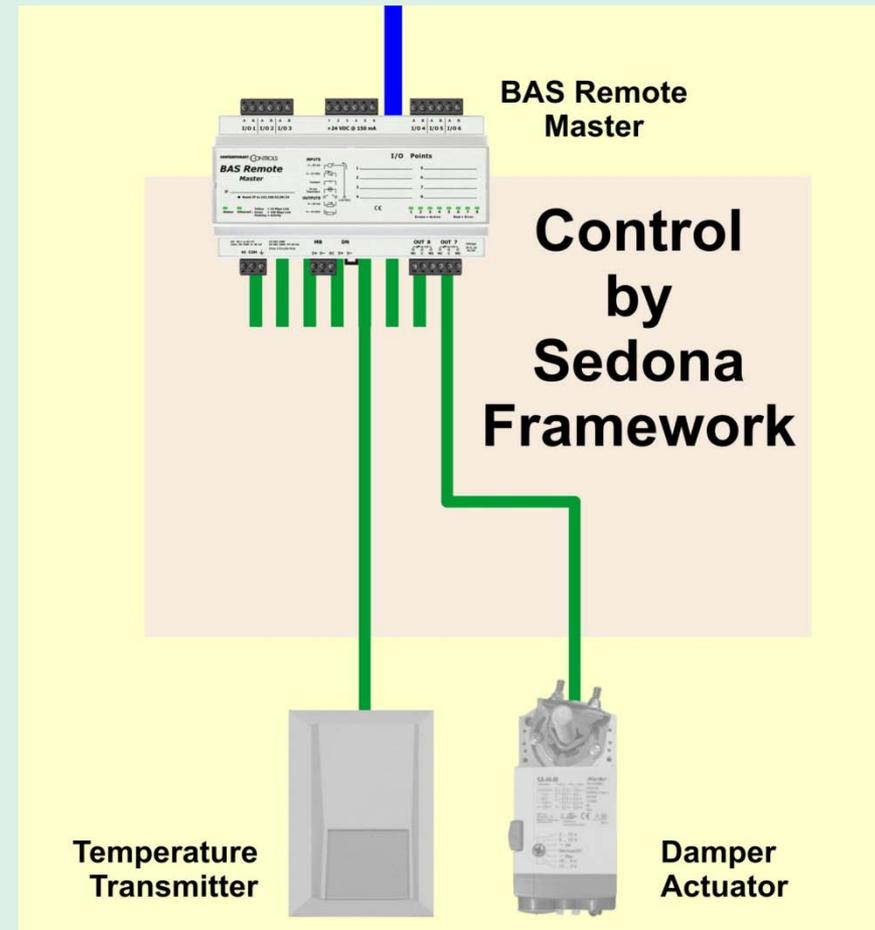
- Modbus register mapping to BACnet objects requires an off-line spreadsheet program
- BACnet objects are created corresponding to Modbus registers
- The advantage is that non-compliant BACnet equipment appear as standard BACnet devices — thereby creating a unified BACnet system

Project Name	Sample Project Name	CONTEMPORARY CONTROLS					Project Builder Modbus to BACnet	View BuiltProject
		Go To					View Documented Project	
							View Errors	
		Add Modbus Profile	Delete Modbus Profile	Edit Description Text	Edit Modbus ID	Edit Poll and COV on the worksheet	Build Project	
Double click on the column header text below for more information about the column. Columns with an * allow editing the information by double clicking on the selected cell.								
Device	Modbus Profile file location	Modbus Profile Name	Description Location *	Modbus ID *	Worksheet Name to Configure Poll/COVs *	Configured Polls/COVs		
1	C:\mapping\Final_09_04_09 M2B\Modbus P	Sample_PWR_Mtr	Roof Top Z1	10	Roof Top Z1 Sample_PWR_Mtr1	9 / 1		
2	C:\mapping\Final_09_04_09 M2B\Modbus P	Sample_AC_Driv	Utlity A11U	22	Utlity A11U Sample_AC_Driv22	5 / 0		
3	C:\mapping\Final_09_04_09 M2B\Modbus P	Energy Meter	Library	29	Library Energy Meter29	23 / 2		
4	C:\mapping\Final_09_04_09 M2B\Modbus P	Boiler Controller	Mech Rm 11	11	Mech Rm 11 Boiler Controller11	12 / 0		



BACnet field controllers for local control

- Field controllers can be BACnet/IP or BACnet MS/TP
- Sensors and actuators attach directly to the controllers
- BACnet device profiles such as B-ASC and B-AAC communicate the capabilities of the controller
- The equipment vendor decides what programming method to use





BAS Remote – versatile web appliance

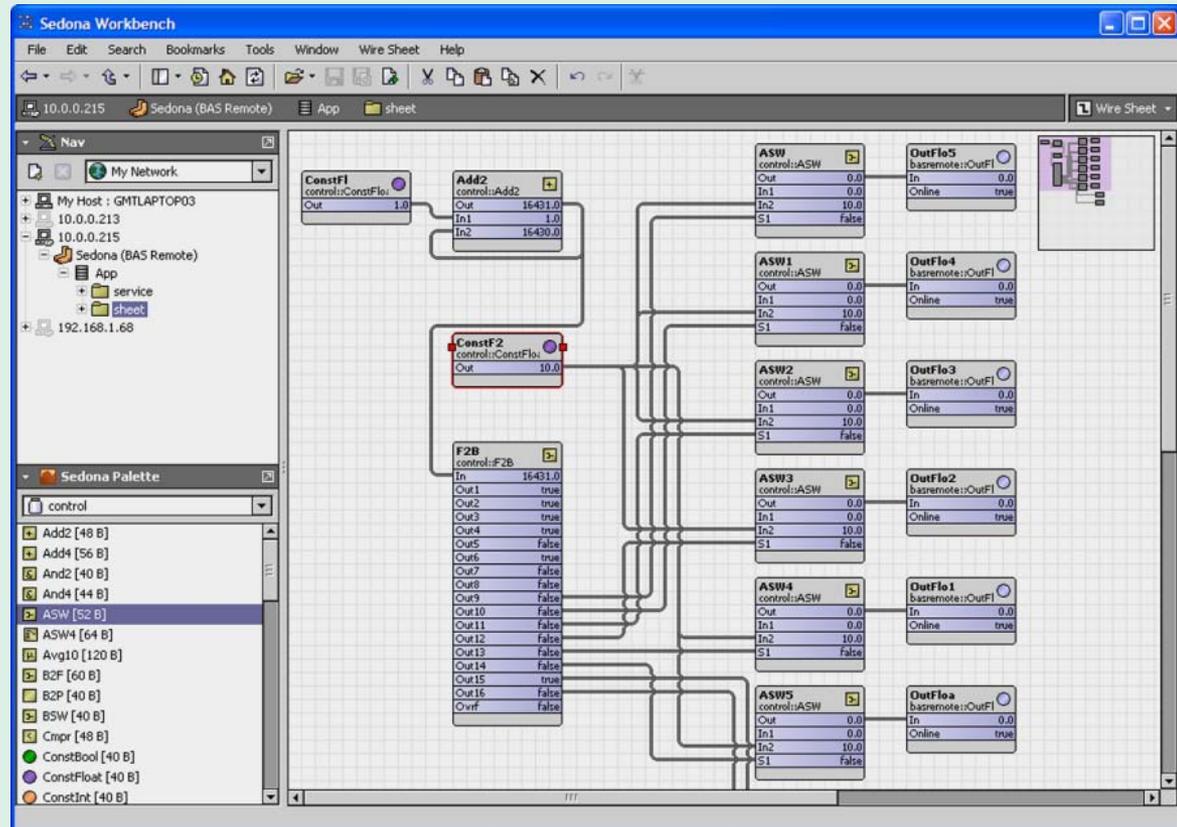
- Configurable by web browser
- BACnet/IP (B-ASC) compliant
- 10/100 Mbps Ethernet port
- *Powered by Sedona Framework controller*
- Modbus serial to BACnet gateway
- Power over Ethernet (PoE) option
- Six universal I/O points
 - Thermistor, voltage, current, contact inputs
 - Voltage and current outputs
- Two relay outputs





Drag-and-drop programming on a wire sheet

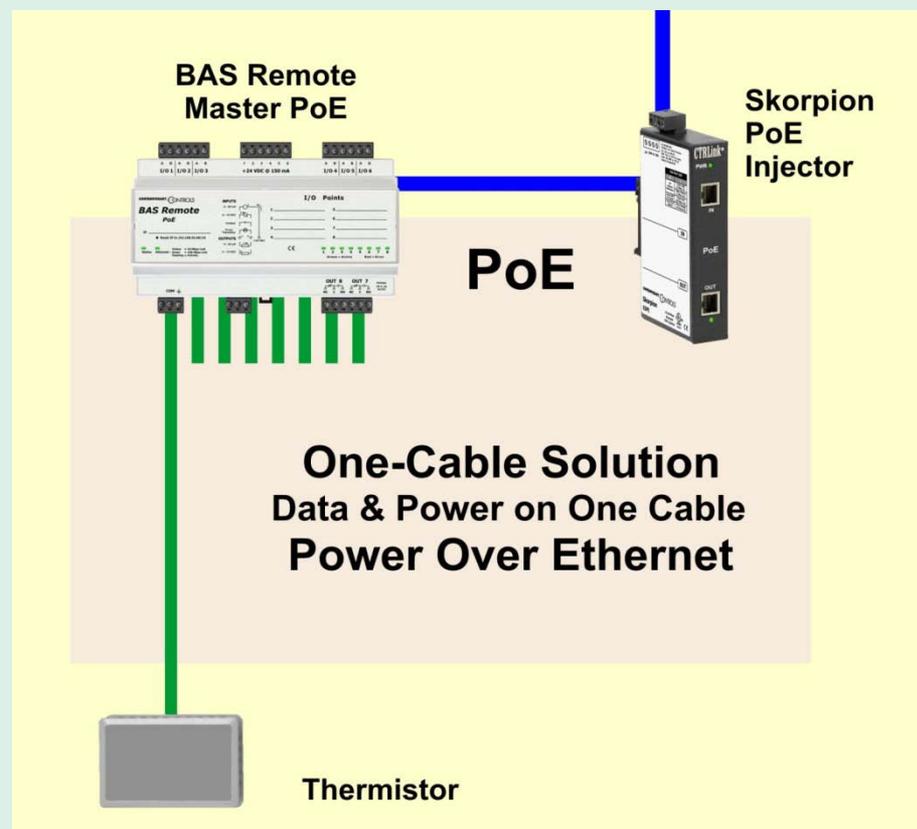
- Tridium's Sedona Framework assembles components onto a wire sheet
- It is possible to develop custom components for specific applications





Power over Ethernet – “One Cable Solution”

- IEEE 802.af Power over Ethernet (PoE) allows both data and power to be carried over one cable
- Excellent “green” strategy
 - Reduces the expense of the cable itself
 - Reduces installation expense
 - Consistent with structured wiring practice
- PoE is a good example why green buildings should embrace Ethernet communications





Thank You