This presentation was live at:

Smart Buildings SHOW

18-19 October 2023 • ExCel London

bcia
the building controls industry association

BCIA Young Engineers Network

presents

CPD Accredited Understanding Smart Communication Using BACnet

https://www.linkedin.com/showcase/bcia-young-engineers-network/

- The Building Controls Industry Association is the unified voice of the UK Building Controls Industry,
- We represent 158 members across the UK, our role includes: policy & advocacy; skills development and promotion of the sector as a career of choice; raising understanding of the fiscal and softer benefits of Building Controls; enable collaboration and best practice,
- Our career of choice activity includes the development of a suite of technical training courses; development of a level 4 BEMS Controls Engineer Apprenticeship; promotion of the sector to attract and retain talented people and courses to aid workforce development,
- BCIA also deliver the successful Young Engineers Network aimed at engineers under the age of 35. The YEN provides events, study visits and learning and provides access to a network that enables peer-to-peer support and career development.

BCIA Young Engineers Network

Greg
EON Controls

Chair

Ryan
Sontay Ltd

South

Yousaf
Sontay Ltd

North-Mids

Lucy
Schneider Electric

Engage-ment

Our YEN Leaders

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Topics covered in this presentation:

- What is smart communication?
- Why choose BACnet?
- What is BACnet?
- Network Architecture
- BACnet Devices
- BACnet Objects
- BACnet Services
- BIBBs
- Device Profiles
- Conforming to The BACnet Standard
- The BTL Mark
- An Example Device

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What is smart communication?

"Smart" communicating products differ from conventional HVAC products in that they transfer measurement values as data rather than as analogue signals.

Examples of smart communications are:

- **Modbus**
- **M-Bus**
- **LonWorks**
- **BACnet**

LonWorks

Modbus

M-Bus

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Why Choose BACnet?

- International Standard maintained by ASHRAE,
- First considered in 1987 - adopted in 1995,
- Standard is constantly evolving,
- Adopted as ISO Standard (ISO 16484-5) in 2001.

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Why Choose BACnet?

- Standard has been adopted worldwide,
- European Group - BACnet Interest Group Europe,
- BACnet is supported by all major manufacturers,
- Protocol supported across multiple media types,
- BACnet is a constantly evolving protocol.

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What is BACnet?

BACnet is an acronym for:

- **B**uilding
- **A**utomation and
- **C**ontrol
- **net**work

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What is BACnet?

- Provides interoperability between different vendors' equipment,
- BACnet is a method for modelling B.A.S. information so that it is viewable across a network,
- Protocol for standardisation of:
  - Commands and Services,
  - Encoding of Data,
  - Network Independent Communication.

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What BACnet is not

- Does not provide direct digital control,
- It’s not a programming or control definition language,
- BACnet compliance does not imply a “single device fits all” solution.

Where to Obtain The Standard

- The standard can be purchased as a download from a number of sources,

- Primarily it is available at:

  https://www.ashrae.org

  https://www.iso.org

Network Architecture

- **BACnet operates across multiple media types:**
  - Ethernet: BACnet Ethernet and BACnet IP
  - EIA-485 (RS-485): BACnet MS/TP
  - EIA-232 (RS-232): BACnet PTP
  - Lonworks Networks
  - Arcnet
  - Zigbee Wireless Networks

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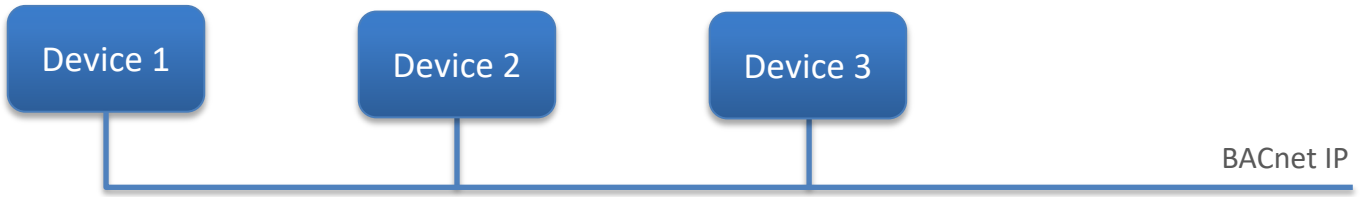
Network Architecture



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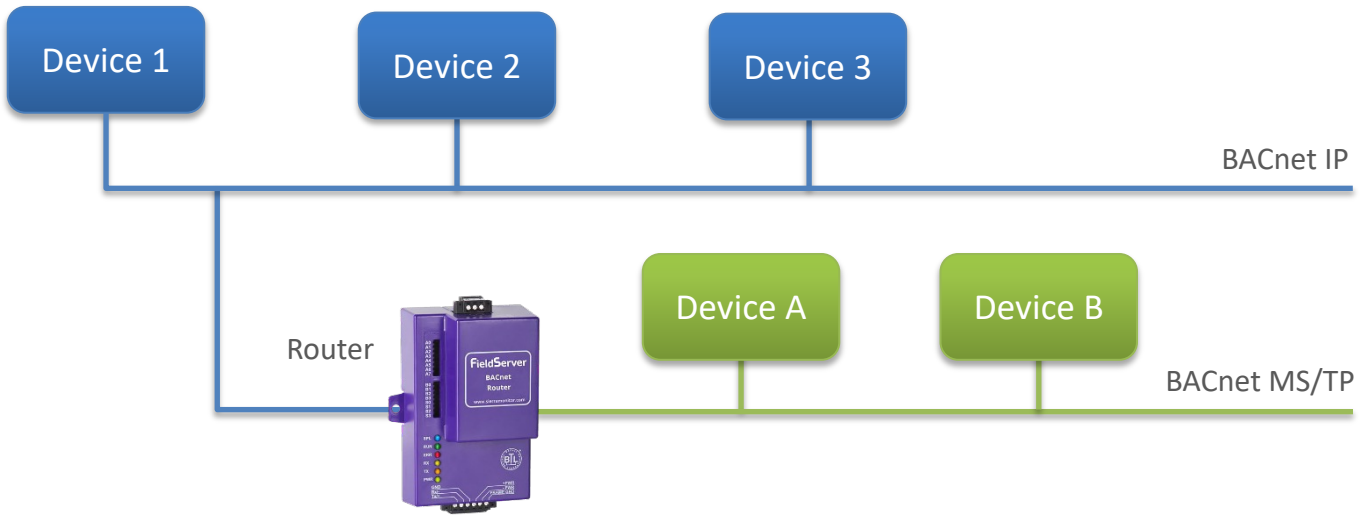
Network Architecture



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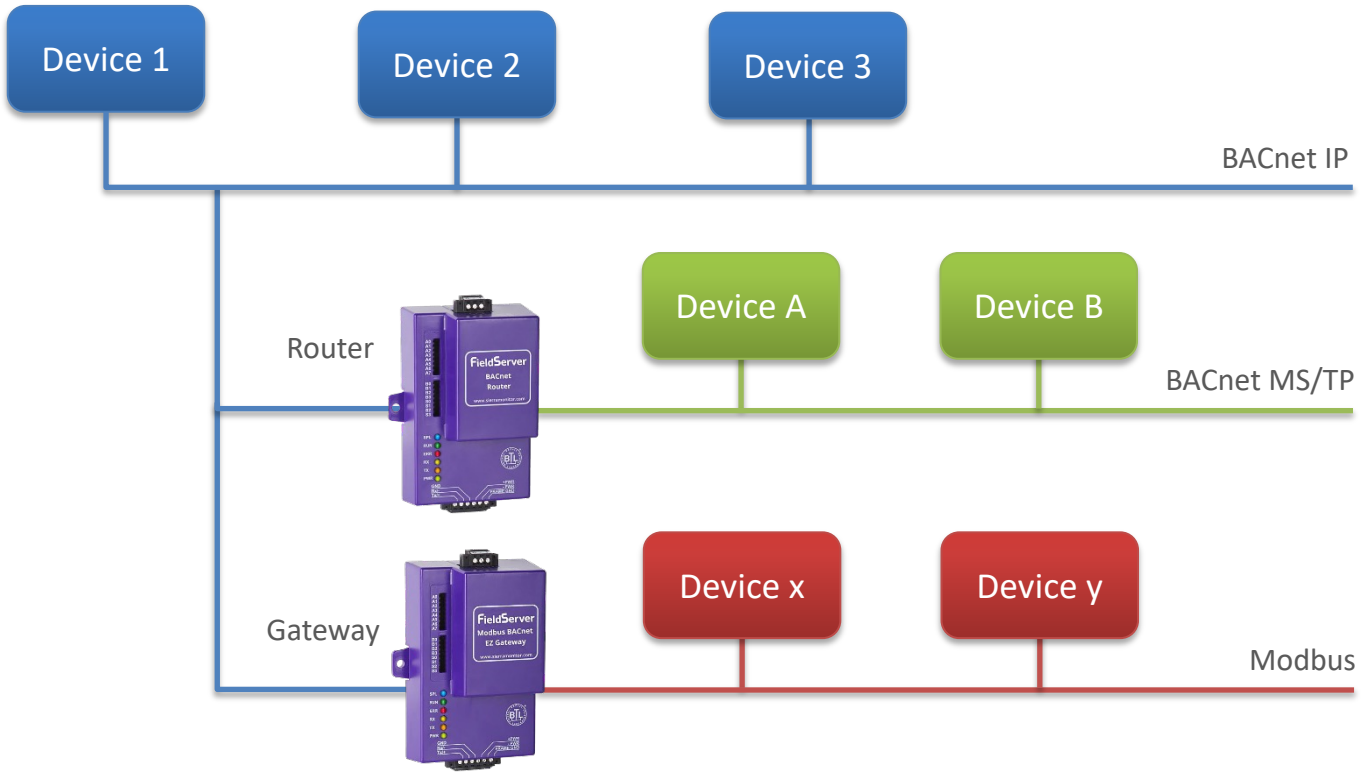
Network Architecture



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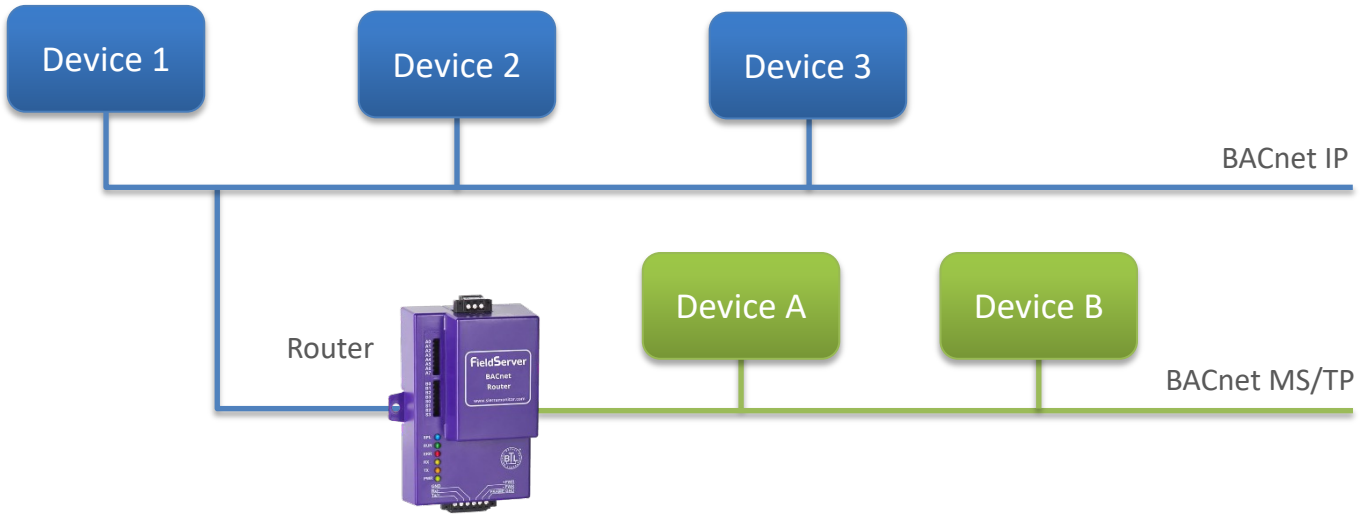
Network Architecture



Native BACnet Network

A BACnet building control network devoid of gateways

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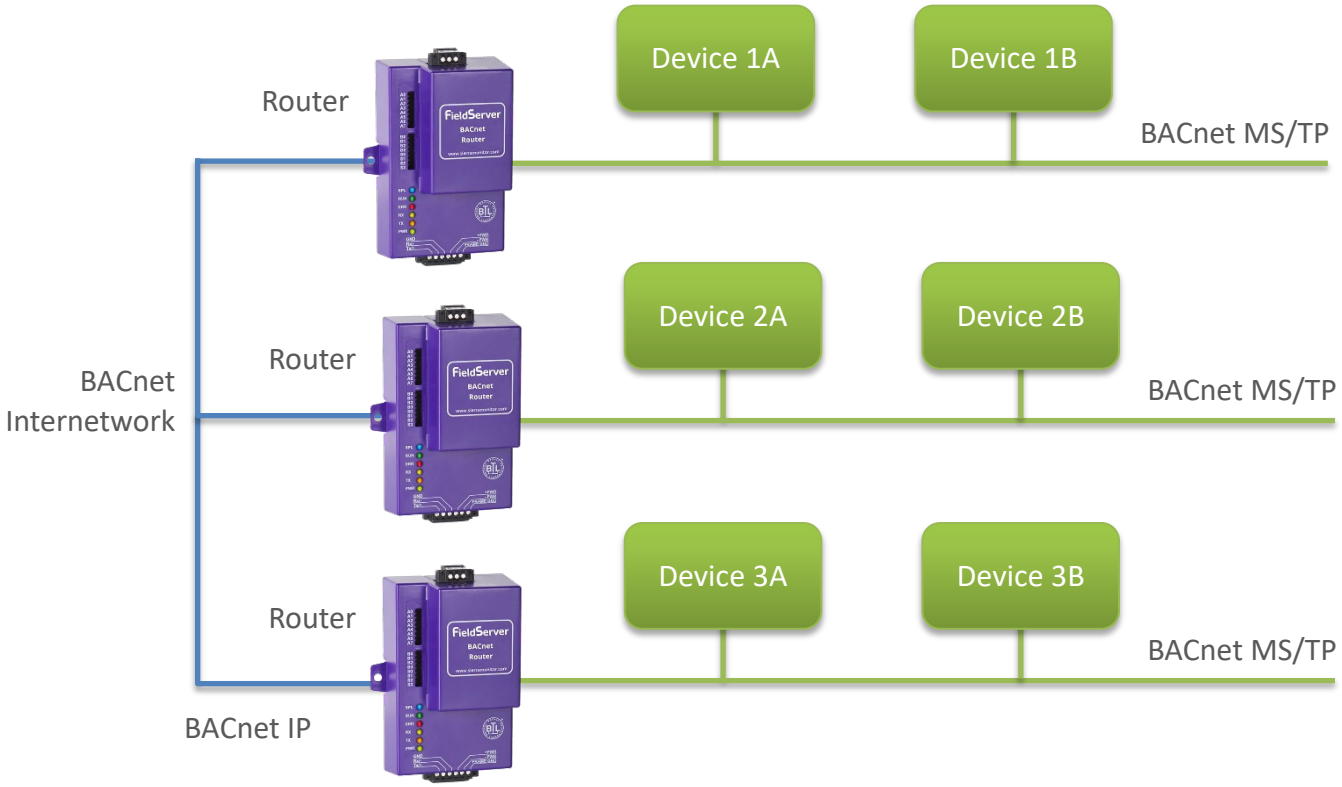
Network Architecture



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Network Architecture

- **BACnet hierarchy consist of:**
  - Network
    - Devices
      - Objects
        - ✓ Properties
        - ✓ Services

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BACnet Devices

- The components connected to the BACnet network,
- An abstract model consisting of objects, properties and services,
- *Example BACnet devices are:*
  - Supervisor Workstation
  - Unitary Field Controller
  - Smart Sensors
  - Smart Actuators.

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BACnet Devices

- Must be auto-discoverable,
- Must be able to list all objects when queried,
- Must have a unique address on the BACnet internetwork,
- Must have a device object defined.

BACnet Objects

- Objects present the modelled device data in a standard format,
- The BACnet standard defines different object types,
- *Example objects are:*
  - Analogue Input
  - Binary Output
  - Multi-state Value
  - Schedule
  - Calendar
  - Device Object

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BACnet Objects

- Each object type has a defined set of properties,
- Properties represent the functionality of an object,
- *Example properties are:*
  - Object Name
  - Present Value
  - Units
- Property values can be assigned and read across the network.

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BACnet Objects

As a minimum a device needs to have 1 object:

The Device Object

The device object is mandatory and contains all the necessary properties to identify the device on the network. *For example:*

- Device Name
- Device Type
- System Status
- List of Objects

BACnet Services

- Object types support various services,
- Services are commands for accessing and manipulating information via the network,
- *There are 5 categories of service:*
  - Alarms and Events
  - Fire Access
  - **Object Access**
  - Remove Device Management
  - Virtual Terminal Services

BACnet Services

- Services are requested via a client/server arrangement,
- A client requests a service and the server responds,
- *Example request:*
  - Operator Workstation (client) request values from smart sensor to display on graphic page.
  - Smart Sensor (server) responds with requested value.

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BACnet Services

- Some services require acknowledgement, others do not,
- Messages have a priority of 1 to 16,
- Lower numbers have higher precedence,
- *Services provide the interoperability required for:*
  - Data Sharing
  - Alarm and Event Management
  - Scheduling
  - Trending
  - Device and Network Management

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BACnet Services

- “WHO_IS” and “I_AM” Service is used to identify devices on the network,
- Can be explicitly addressed or sent by a client as a broadcast message,
- Is the only service which can be initiated by a server,
- A device is permitted within the standard to announce itself through a broadcast “I_AM” message when powered on.

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BIBBs

- **B**ACnet **I**nteroperability **B**uilding **B**locks,
- BIBBs are groups of services designed to give engineers a quick method of ascertaining the type of functionality offered by a device,
- *A BIBB consists of three parts:*
  - Category
  - Request Type
  - Direction of Data Exchange

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BIBBs

- There are 5 categories of BIBB
  - **DS** - Data Sharing
  - **AE** - Alarm and Event Management
  - **SCHED** - Scheduling
  - **T** - Trending
  - **DM** - Data and Network Management
- Examples of request type are
  - **RP** - Read Property
  - **WPM** - Write Property Multiple
  - **COV** - Change Of Value

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BIBBs

- Direction of Data Exchange
  - **A** - Uses Data
  - **B** - Supplies Data

So a BIBB may take the form DS-RP-B – Meaning that the device is capable of supplying information using the read_property service.

If the above example was a smart sensor and we wanted to bind it to a controller, we would select a controller which supports the DS-RP-A BIBB.

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Device Profiles

- Used to characterise devices based on a minimum number of BIBBs,
- Allows devices to be placed into one of eight categories based on a standard set of BACnet functionality:

- **B-AWS** - Advanced Operator Workstation
- **B-OWS** - Operator Workstation
- **B-OD** - Operator Display
- **B-BC** - Building Controller
- **B-AAC** - Advanced Application Controller
- **B-ASC** - Application Specific Controller
- **B-SA** - Smart Actuator
- **B-SS** - Smart Sensor

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Device Profiles

	B-AWS	B-OWS	B-OD	B-BC	B-AAC	B-ASC	B-SA	B-SS
Data Sharing	DS-RP-A,B	DS-RP-A,B	DS-RP-A,B	DS-RP-A,B	DS-RP-B	DS-RP-B	DS-RP-B	DS-RP-B
	DS-RPM-A	DS-RPM-A		DS-RPM-A,B	DS-RPM-B			
	DS-WP-A	DS-WP-A	DS-WP-A	DS-WP-A,B	DS-WP-B	DS-WP-B	DS-WP-B	
	DS-WPM-A	DS-WPM-A		DS-WPM-B	DS-WPM-B			
	DS-AV-A	DS-V-A	DS-V-A					
	DS-AM-A	DS-M-A	DS-M-A					
Alarm & Event Management	AE-N-A	AE-N-A		AE-N-I-B	AE-N-I-B			
	AE-ACK-A	AE-ACK-A		AE-ACK-B	AE-ACK-B			
		AE-INFO-A		AE-INFO-B	AE-INFO-B			
		AE-ESUM-A		AE-ESUM-B				
	AE-AS-A	AE-AS-A						
	AE-AVM-A	AE-VM-A						
	AE-AVN-A	AE-VN-A	AE-VN-A					
	AE-ELVM-A2							
Scheduling	SCHED-AVM- A	SCHED-A or SCHED-VM-A		SCHED-E-B	SCHED-I-B			
Trending	T-AVM-A	T-VMT-A T-V-A		T-VMT-I-B				
		T-ATR-A		T-ATR-B				
Device & Network Management	DM-DDB-A,B	DM-DDB-A,B	DM-DDB-A,B	DM-DDB-A,B	DM-DDB-B	DM-DDB-B	DM-DDB-B1	DM-DDB-B1
	DM-ANM-A							
	DM-ADM-A							
	DM-DOB-B	DM-DOB-B	DM-DOB-B	DM-DOB-B	DM-DOB-B	DM-DOB-B	DM-DOB-B1	DM-DOB-B1
	DM-DCC-A	DM-DCC-A		DM-DCC-B	DM-DCC-B	DM-DCC-B		
	DM-MTS-A	DM-TS-A DM-MTS-A		DM-TS-BorDM-UTC-B	DM-TS-BorDM-UTC-B			
		DM-UTC-A						
	DM-OCD-A							
	DM-RD-A	DM-RD-A		DM-RD-B	DM-RD-B			
	DM-BR-A	DM-BR-A		DM-BR-B				
	NM-CE-A	NM-CE-A		NM-CE-A				

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Conforming to The BACnet Standard

- In order to claim that a device conforms to the BACnet standard there are a number of criteria which must be met:
  - A Protocol Implementation Conformance Statement (PICS) must be produced for the device,
  - The device must be tested and test data recorded,
  - The device must be capable of communicating using recognised BACnet data-link and physical layer technology,
  - All minimum object/property/service requirements are met.

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BTL Mark

- BACnet devices can be tested for compliance at a registered **B**ACnet **T**esting **L**aboratory,
- If certified as compliant with the BACnet standard then the product is permitted to display the BTL Mark,
- BTL testing is a certificate of compliance but is not mandatory.

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Are There Disadvantages?

- Commercial argument against open protocols,
- Network Security,
- Changes required skills to engineer a BAS.

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Thank You

Questions

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We look forward to seeing you in 2024