CPD

ENGINEERS IRELAND
REGISTERED TRAINING PROVIDER 2022

Building Services Integration

BACnet and other options

Seamus Mac Lughadha , Sales Manager, Building Automation Solutions, Electrification ABB Ireland

 Document ID.: Rev.:

Well positioned across global markets

ABB is a leading global technology company that energizes the transformation of society and industry to achieve a more productive, sustainable future.

By connecting software to its **electrification**, **motion**, **process automation and robotics & discrete automation** portfolio, ABB pushes the boundaries of technology to drive performance to new levels.

Our Business Areas

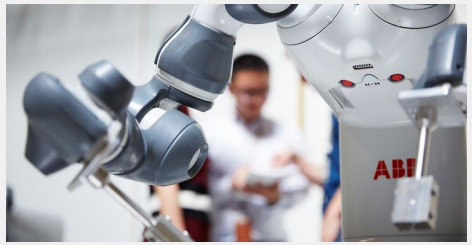
Electrification

Motion

Process Automation

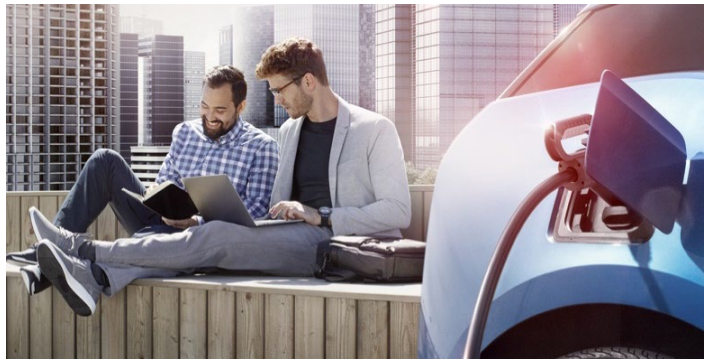
Robotics & Discrete Automation

Fully decentralized business model with 21 Divisions

BUSINESS AREA	Electrification	Motion	Process Automation	Robotics & Discrete Automation
				
DIVISION	Distribution Solutions	IEC LV Motors	Energy Industries	Robotics
	Smart Power	Large Motors & Generators	Process Industries	Machine Automation
	Smart Buildings	NEMA Motors	Marine & Ports	
	Installation Products	Drive Products	Turbocharging	
	Power Conversion	Systems Drives	Measurement & Analytics	
	E-mobility	Service		
		Traction		
		Mechanical Power Transmission		

Electrification Ireland

ELSP - Smart Power



Low voltage breakers & switches, enclosures, motor starter application, power protection, electric vehicle charging infrastructure & service

ELDS -Distribution Solutions

Medium and low voltage control & protection products, systems & switchgear, automation & services

ELSB -Smart Buildings

Miniature breakers, distribution enclosures, wiring accessories, building automation

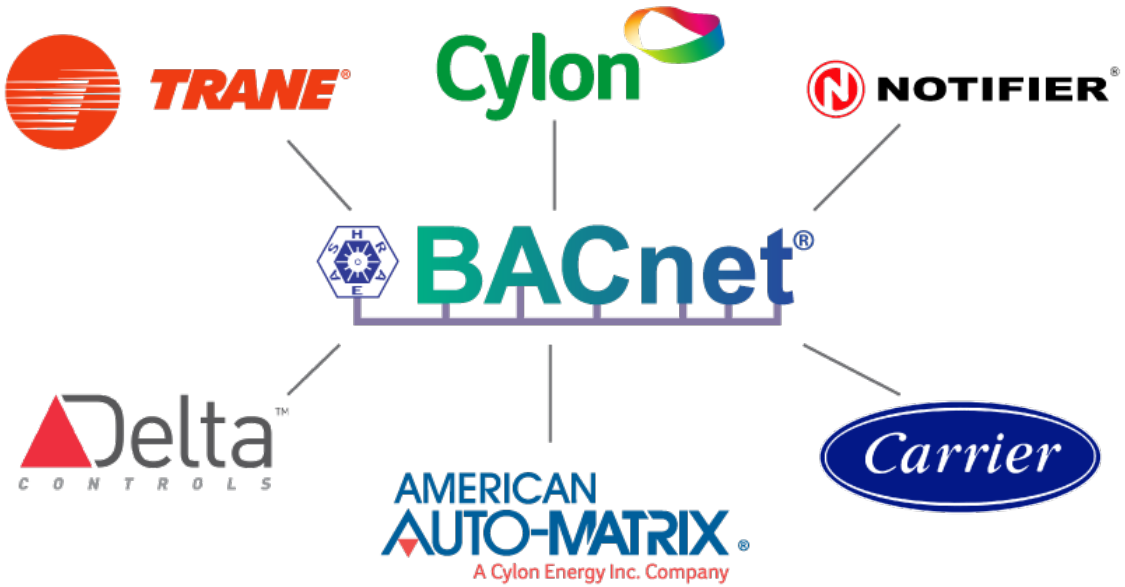
Proprietary Protocol Situation

Building Services Integration

- Building owners were frustrated by the lack of building automation standardization
- Buyers felt locked in by vendors when it comes to expansion if only single source
- Proprietary protocols often lead to higher installed costs with bespoke gateways to achieve integration
- Potentially multiple supervisor workstations for building automation projects
- From these frustrations & limitations 1995, ANSI/ASHRAE Standard 135 was published

Object of BACnet

- Building not dependent on one vendor
- Simple Interoperability between equipment
- One Operator workstation



About BACnet

BACnet = Building Automation and Control Network

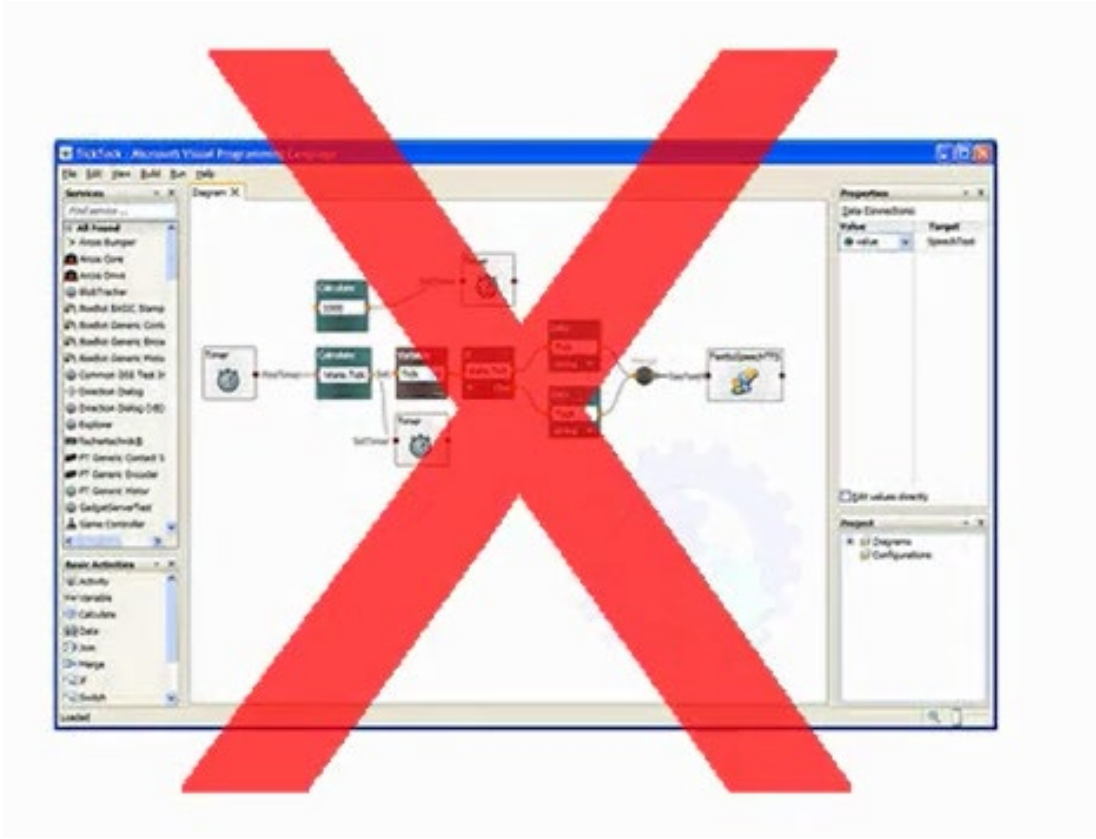
- Developed and supported by the ASHRAE
- First standard 1995
- BACnet was published in 2003 as ANSI/ASHRAE 135:BACnet – A Data Communications Protocol for Building Automation and Control Networks
- Adopted as International, European and British Standard BS EN ISO 16484-5 in 2005
  Now the leading open standard for building automation globally

What is BACnet?

- Data Communication Protocol (Language) supporting
  - Devices
  - Objects with predefined properties
  - Services
- Physical Device then supports standard objects (AI BV etc)
- Objects have predefined properties
- Services support messages
  - Services allow Devices to do something Alarms ReadProperty

BACnet is not

- Is not a Control Language
- Doesn’t provide Direct Digital Control of a Process
- Doesn’t provide Standardized Programming Language
- Doesn’t provide Standard Commissioning Features
- Doesn’t provide ability to swap devices between two vendors without any impact on system



BACnet Mature standard

- ASHRAE/ANSI Standard 135 in 1995
- European and ISO standard in 2005
- Over 1283 Vendor ID issues (Jan 2020)
- Standard continues to evolve
- Expanded from HVAC to include
  - Life Safety
  - Access control
  - Security
  - Wireless Communication
  - Energy utility/building

A Building Services Standard

Developed specifically for Building Services

- Trending
- Scheduling
- Limit processing
- Alarm and event processing
- Command prioritization & control logic

Scalable from smallest to largest installation

Peer-to-Peer basis.

Does not specify the system it provides for interoperability of different systems

Flexible network options

Network Independent

BACnet defines the protocol **not** physical network layer

Available over several physical networks

- Ethernet (Cat5 /6) TCP/IP
- MS / TP (master slave token passing)
- ARCnet
- LON
- Wireless

Majority of products today are now a mix of Ethernet & MS/TP

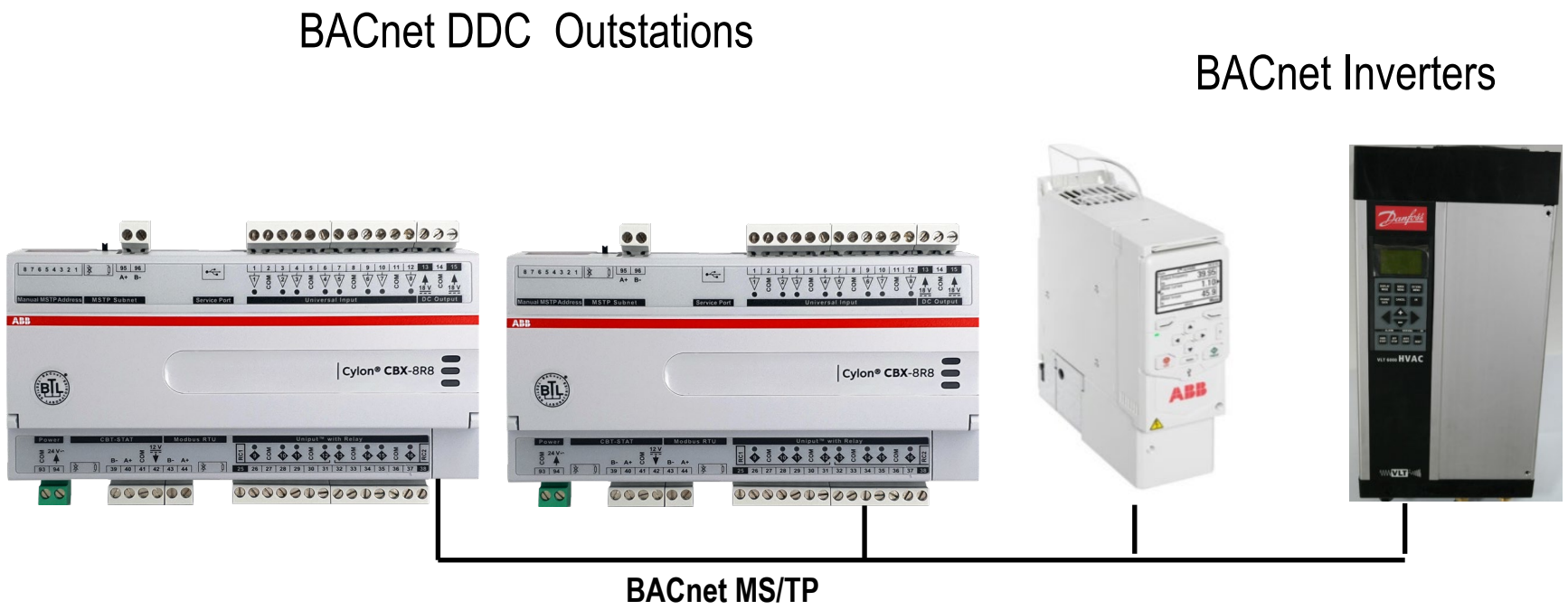
BACnet MS/TP

Single system on one network - Example 30 FCU Unit controllers

Multiple systems on network- Example DDC Controller & VSD

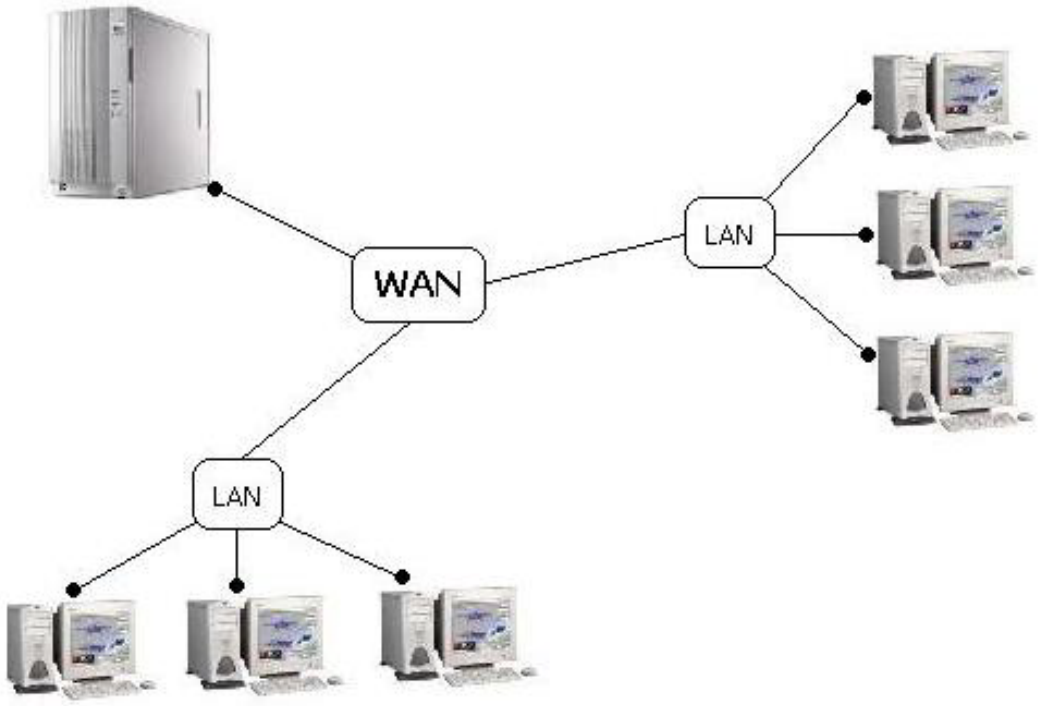
Simple low cost wiring

Routers to connect to BACnet IP

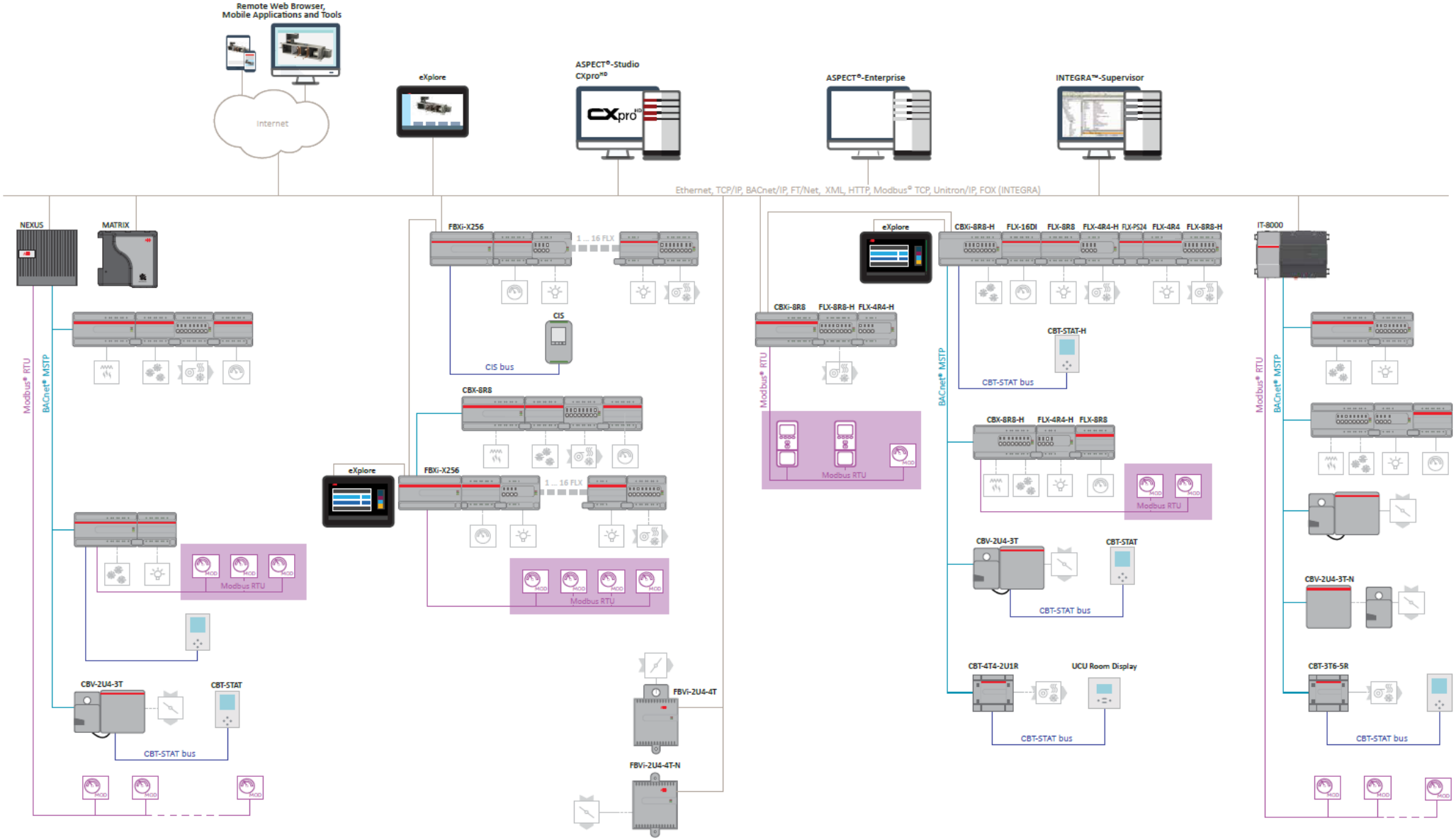


IP level integration a reality

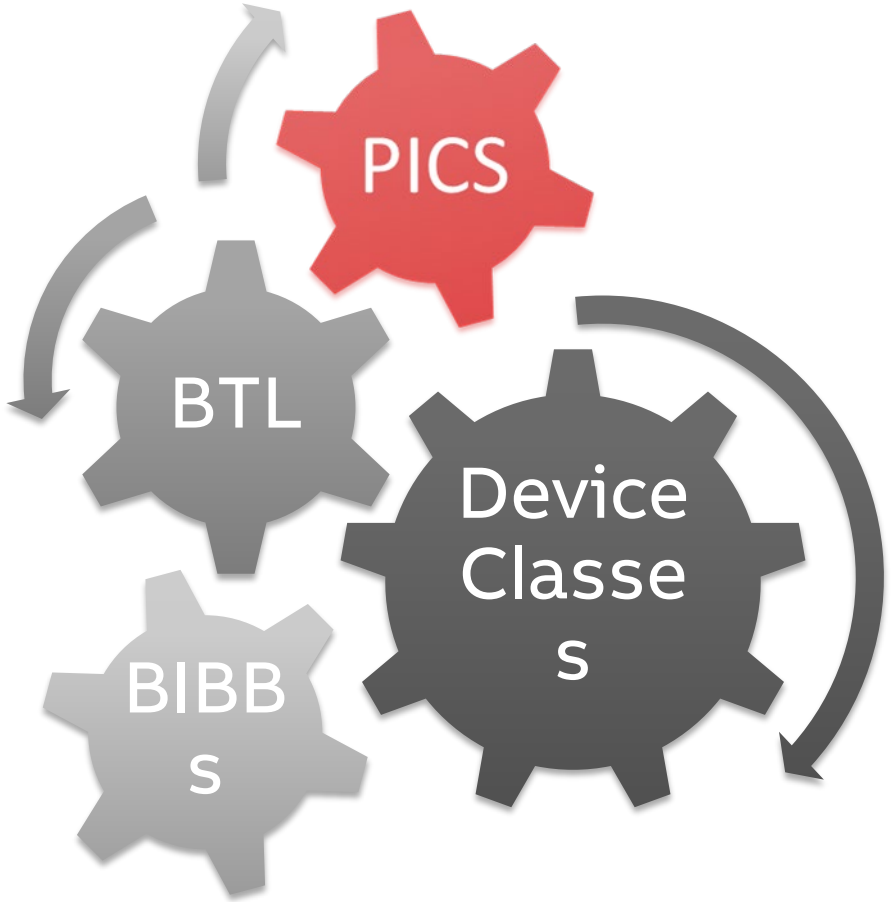
- BACnet/IP developed to allow the protocol use TCP/IP networks
- IP Connects sub systems HVAC to Access Systems
- Provides maximum flexibility of physical network choice.
- BACnet routers can transfer packets to different network types (MS/TP)
- Can be integrated into Enterprise Management Solutions



Sample Architecture

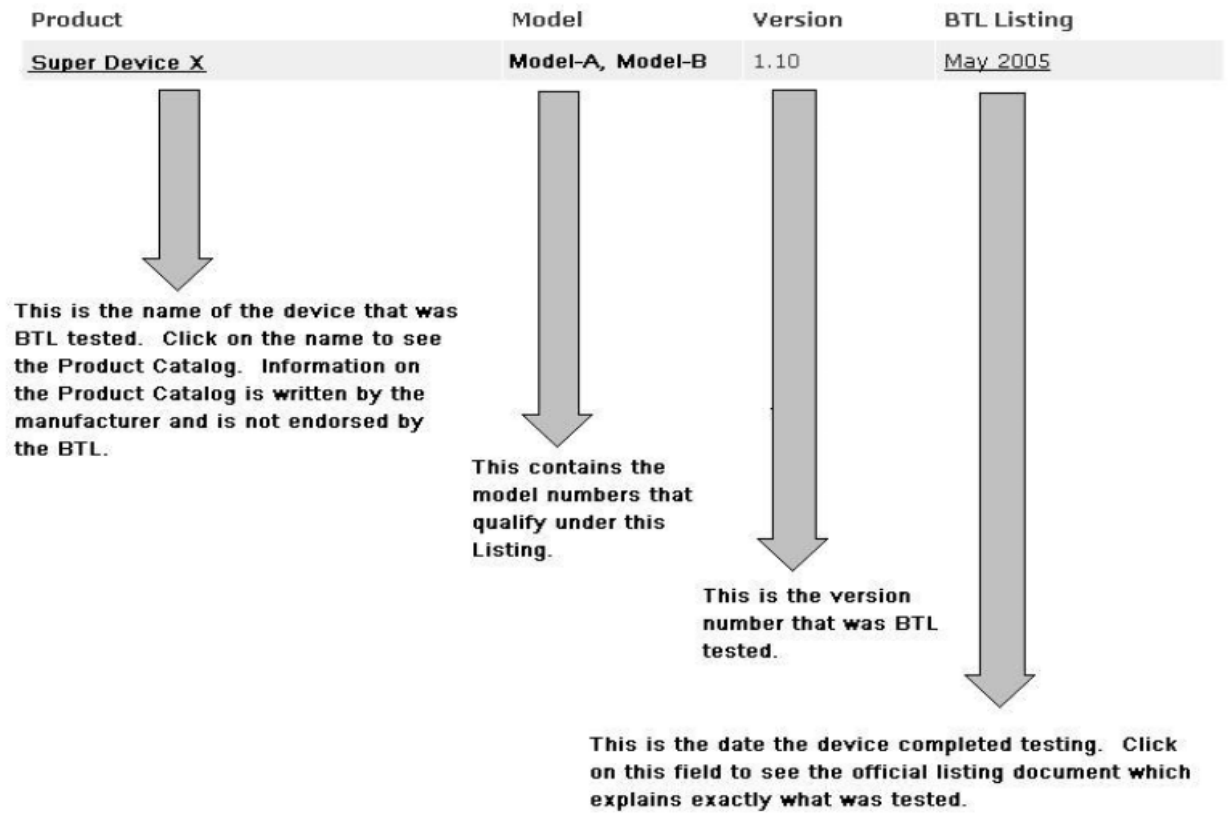


BACnet Terminology



How to read a BTL listing

BTL listings are written in standard format for all manufacturers and profiles. The graphic explains how to interpret each field



BLT Listing

BTL Approval

- Approved Testing Laboratories for BTL Testing – Independent
- Tests validate product correctly implements a specified set of BACnet features
- Listing shows approval rating achieved
  example BACnet Application Specific Controller (B-ASC)
- 2015 there were 642 active products from 108 distinct manufacturers.
- 2021 there are 1200 active products from 209 manufacturers
- Many products are not BTL approved so no guarantee compliance to the standard
- Devices may provide additional capabilities for the listed profile. Actual capabilities listed in the PICS

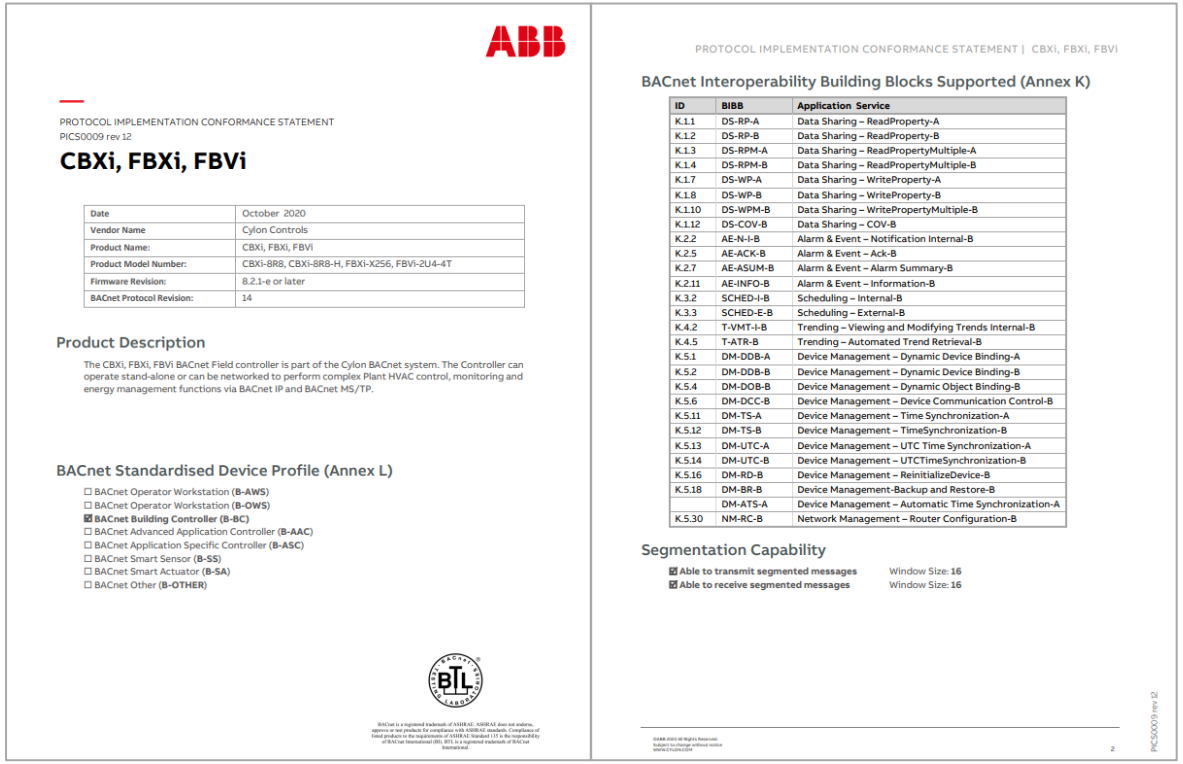
Protocol Implementation Conformance Statement PICS

- PICS - standard document describing the level of BACnet implementation in a device
- It is a statement from the manufacturer of the level of BACnet support
- Listing shows approval rating achieved
  example BACnet Application Specific Controller (B-ASC)

Sample PICS

Protocol Implementation Conformance Statement

A standard document describing the official level of BACnet implementation in a device.



PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT
PICS0009 rev 12

CBXi, FBXi, FBVi

Date	October 2020
Vendor Name	Cylon Controls
Product Name:	CBXi, FBXi, FBVi
Product Model Number:	CBXi-8R8, CBXi-8R8-H, FBXi-X256, FBVi-2U4-4T
Firmware Revision:	8.2.1-e or later
BACnet Protocol Revision:	14

Product Description

The CBXi, FBXi, FBVi BACnet Field controller is part of the Cylon BACnet system. The Controller can operate stand-alone or can be networked to perform complex Plant HVAC control, monitoring and energy management functions via BACnet IP and BACnet MS/TP.

BACnet Standardised Device Profile (Annex L)

- ☐ BACnet Operator Workstation (**B-AWS**)
- ☐ BACnet Operator Workstation (**B-OWS**)
- ☑ **BACnet Building Controller (B-BC)**
- ☐ BACnet Advanced Application Controller (**B-AAC**)
- ☐ BACnet Application Specific Controller (**B-ASC**)
- ☐ BACnet Smart Sensor (**B-SS**)
- ☐ BACnet Smart Actuator (**B-SA**)
- ☐ BACnet Other (**B-OTHER**)

BACnet is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to the requirements of ASHRAE Standard 135 is the responsibility of BACnet International (BI). BTL is a registered trademark of BACnet International.

BACnet Interoperability Building Blocks Supported (Annex K)

ID	BIBB	Application Service
K.1.1	DS-RP-A	Data Sharing – ReadProperty-A
K.1.2	DS-RP-B	Data Sharing – ReadProperty-B
K.1.3	DS-RPM-A	Data Sharing – ReadPropertyMultiple-A
K.1.4	DS-RPM-B	Data Sharing – ReadPropertyMultiple-B
K.1.7	DS-WP-A	Data Sharing – WriteProperty-A
K.1.8	DS-WP-B	Data Sharing – WriteProperty-B
K.1.10	DS-WPM-B	Data Sharing – WritePropertyMultiple-B
K.1.12	DS-COV-B	Data Sharing – COV-B
K.2.2	AE-N-I-B	Alarm & Event – Notification Internal-B
K.2.5	AE-ACK-B	Alarm & Event – Ack-B
K.2.7	AE-ASUM-B	Alarm & Event – Alarm Summary-B
K.2.11	AE-INFO-B	Alarm & Event – Information-B
K.3.2	SCHED-I-B	Scheduling – Internal-B
K.3.3	SCHED-E-B	Scheduling – External-B
K.4.2	T-VMT-I-B	Trending – Viewing and Modifying Trends Internal-B
K.4.5	T-ATR-B	Trending – Automated Trend Retrieval-B
K.5.1	DM-DDB-A	Device Management – Dynamic Device Binding-A
K.5.2	DM-DDB-B	Device Management – Dynamic Device Binding-B
K.5.4	DM-DOB-B	Device Management – Dynamic Object Binding-B
K.5.6	DM-DCC-B	Device Management – Device Communication Control-B
K.5.11	DM-TS-A	Device Management – Time Synchronization-A
K.5.12	DM-TS-B	Device Management – TimeSynchronization-B
K.5.13	DM-UTC-A	Device Management – UTC Time Synchronization-A
K.5.14	DM-UTC-B	Device Management – UTCTimeSynchronization-B
K.5.16	DM-RD-B	Device Management – ReinitializeDevice-B
K.5.18	DM-BR-B	Device Management-Backup and Restore-B
	DM-ATS-A	Device Management – Automatic Time Synchronization-A
K.5.30	NM-RC-B	Network Management – Router Configuration-B

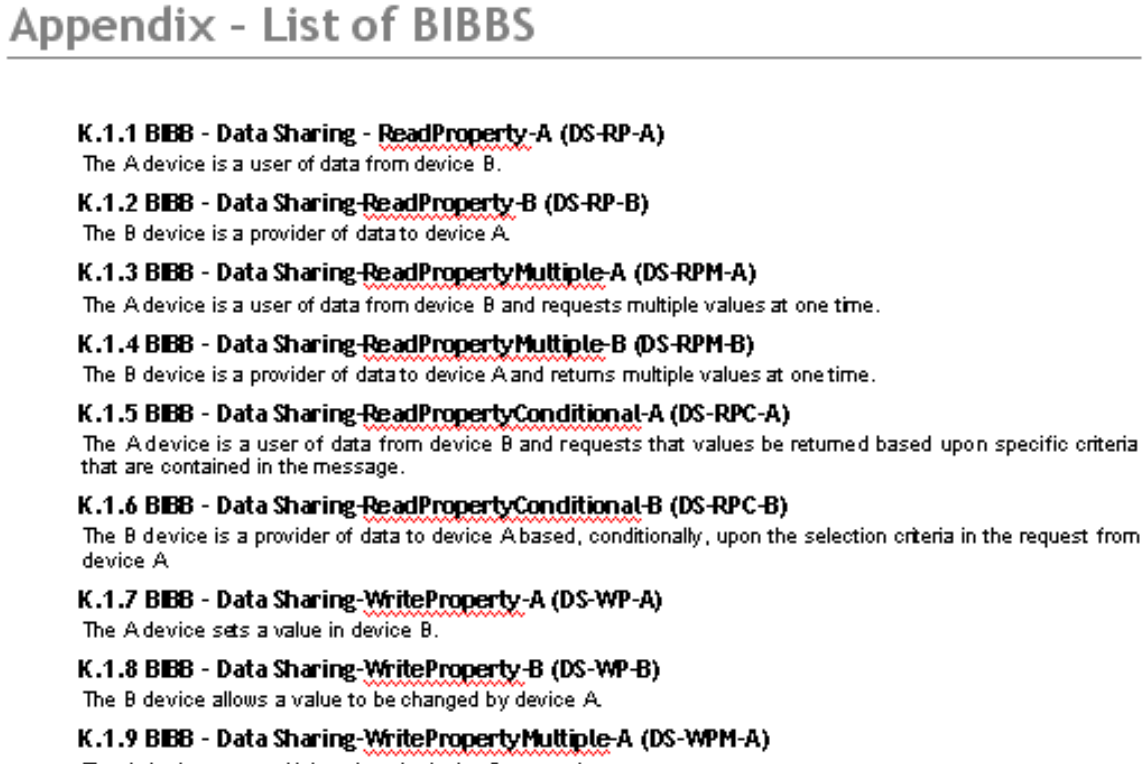
Segmentation Capability

- ☑ **Able to transmit segmented messages** Window Size: **16**
- ☑ **Able to receive segmented messages** Window Size: **16**

BIBBs

BACnet Implementation Building Blocks

a concise and detailed way of describing the BACnet functionality of a system.



Appendix - List of BIBBS

K.1.1 BIBB - Data Sharing - ReadProperty-A (DS-RP-A)
The A device is a user of data from device B.

K.1.2 BIBB - Data Sharing-ReadProperty-B (DS-RP-B)
The B device is a provider of data to device A.

K.1.3 BIBB - Data Sharing-ReadPropertyMultiple-A (DS-RPM-A)
The A device is a user of data from device B and requests multiple values at one time.

K.1.4 BIBB - Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)
The B device is a provider of data to device A and returns multiple values at one time.

K.1.5 BIBB - Data Sharing-ReadPropertyConditional-A (DS-RPC-A)
The A device is a user of data from device B and requests that values be returned based upon specific criteria that are contained in the message.

K.1.6 BIBB - Data Sharing-ReadPropertyConditional-B (DS-RPC-B)
The B device is a provider of data to device A based, conditionally, upon the selection criteria in the request from device A.

K.1.7 BIBB - Data Sharing-WriteProperty-A (DS-WP-A)
The A device sets a value in device B.

K.1.8 BIBB - Data Sharing-WriteProperty-B (DS-WP-B)
The B device allows a value to be changed by device A.

K.1.9 BIBB - Data Sharing-WritePropertyMultiple-A (DS-WPM-A)

BACnet Device Classes

B-OWS	**BACnet - Operator Workstation**
B-BC	**BACnet - Building Controller** *includes datalogs*
B-AAC	**BACnet - Advanced Application Controller** *includes Client functionality, Alarms and Time Schedules*
B-ASC	**BACnet - Application-Specific Controller** *points only*
B-SA	**BACnet - Smart Actuator**
B-SS	**BACnet - Smart Sensor**

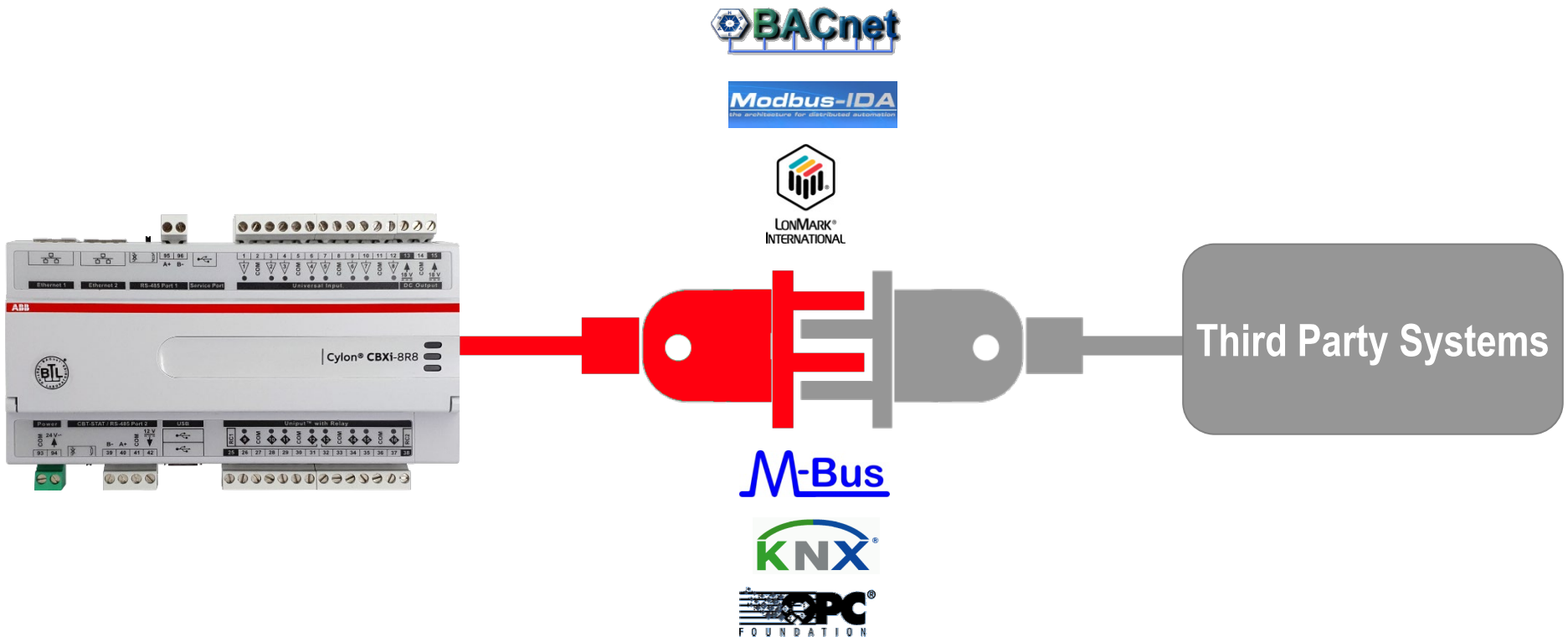
B-AAC – Sample Device

	B-OWS	B-BC	B-AAC	B-ASC	B-SA	B-SS	Optional
Data Sharing	**DS-RP-A,B**	**DS-RP-A,B**	**DS-RP-B**	**DS-RP-B**	**DS-RP-B**	**DS-RP-B**	
	DS-WP-A	**DS-WP-A,B**	**DS-WP-B**	**DS-WP-B**	**DS-WP-B**		
	DS-RPM-A	**DS-RPM-A,B**	**DS-RPM-B**				
	DS-WPM-A	**DS-WPM-B**	**DS-WPM-B**				
		DS-COVU-A,B					
Alarm & Event Management	AE-N-A	**AE-N-I-B**	**AE-N-I-B**				
	AE-ACK-A	**AE-ACK-B**	**AE-ACK-B**				
	AE-INFO-A	**AE-INFO-B**	**AE-INFO-B**				
	AE-ESUM-A	AE-ESUM-B					
Scheduling	SCHED-A	SCHED-E-B	**SCHED-I-B**				
Trending	T-VMT-A	T-VMT-I-B					
	T-ATR-A	T-ATR-B					
Device & Network Management	DM-DDB-A,B	DM-DDB-A,B	**DM-DDB-B**	**DM-DDB-B**			
	DM-DOB-A,B	DM-DOB-A,B	**DM-DOB-B**	**DM-DOB-B**			
	DM-DCC-A	**DM-DCC-B**	**DM-DCC-B**	**DM-DCC-B**			
	DM-TS-A	**DM-TS-B or DM-UTC-B**	**DM-TS-B or DM-UTC-B**				
	DM-UTC-A						
	DM-RD-A	**DM-RD-B**	**DM-RD-B**				
	DM-BR-A	DM-BR-B					
	NM-CE-A	NM-CE-A					
							DM-PT-A
							DM-PT-B

Benefits of BACnet

- Widespread manufacturer support
- Now the default integration standard in US and many international markets
- BACnet focuses on integration at the management and automation levels
- Ease of integration of external systems
- Standard support and openness
- Future proof

Integration Options



What is Modbus ?

Modbus Serial Communication

- **Support for RS232 (single device)**
- **Support for multiple device (100+)**

Developed by Modicon in 1979

Used extensively in PLC Industrial Automation

Simple and Robust

Limited overhead on device

Simple to deploy

What is Modbus used for?

- Electricity Meter Integration to BMS
- Integrating AC Split Systems
- Window Control – e.g. for naturally ventilated buildings
- Integrating Computer Room Units to Main BMS
- Integration to Industrial Process plant

What is KNX?

Originally 3 Separate Standards.

– **EIB** (European installation bus)
– **EHS** (European Home Systems Association) white goods
– **Batibus** (popular in France, Italy Spain)

Europe - EN 50090, CEN EN 13321-1

International ISO IEC 145-43-3

China - GB/Z 20965

KNX specification based on EIB, supplemented with configuration and communication mechanisms originally developed for EHS and Batibus.

- Comms Media TP, RF, PL, Ethernet

What is KNX used for?

- Lighting Control – e.g. switching, dimming, light scenes etc
- Blind and Shutter Control –e.g. Solar Shading
- Window Control – e.g. for naturally ventilated buildings
- Home Automation
- Security Systems
- Monitoring and Alarming – e.g. leak detection
- Audio and Visual Systems

KNX does not suit main plant control and therefore an interface between the KNX system and the BEMS system is often required

What is M-Bus

European standard for Heat-meters - Now industry standard

M-Bus meets EN 1434-3 standard,

- EN 13757-2 (physical and link layer)
- EN 13757-3 (application layer)

Remote readout of heat meters - location unimportant

Networking of devices - individually addressable

Single bus wiring

What is M-Bus used for?

- Heat Meters
- Electricity Meters
- Sensor devices and Actuators
- District Heating
- Centralised Plant
  - Internal utilities allocation,
  - Little interruption to multi-tenant scenario

Where does BMS and ABB Cylon fit into the ABB Smart Buildings portfolio

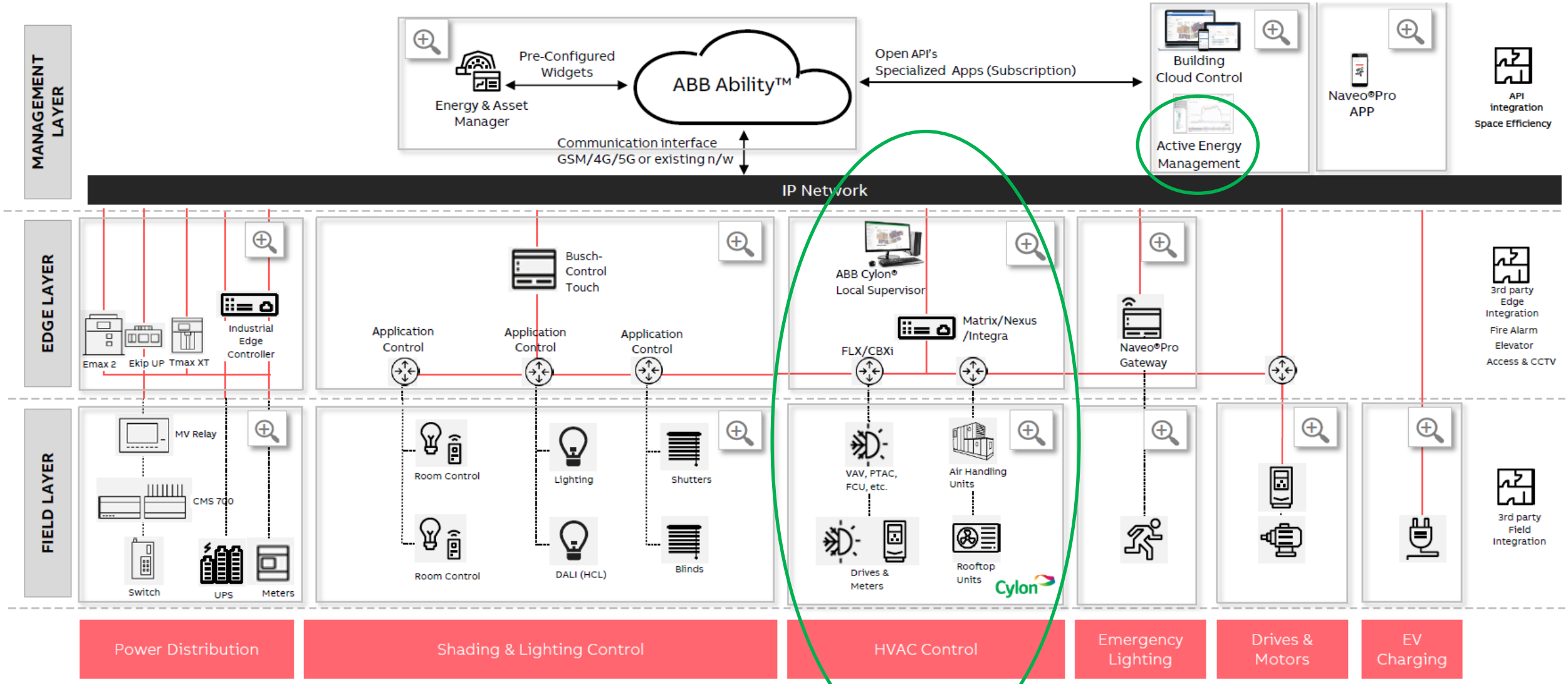


ABB in Ireland

At a glance

ENGINEERS IRELAND
REGISTERED TRAINING PROVIDER 2022

180

People work for ABB in Ireland

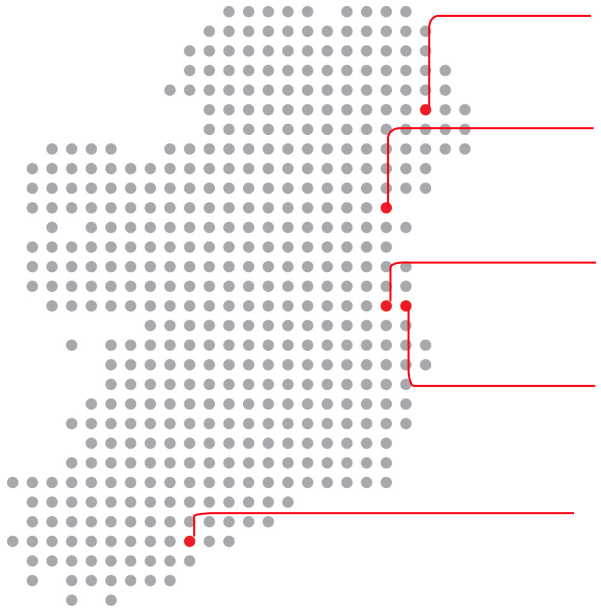
5

Sites where products are sold, serviced or engineered

Want to know more?

marketing@ie.abb.com

www.abb.ie



Lisburn, EL
Local regional office
EL Product supply & suppor

Dundalk, PAPI
IAPI QCS technology centre
R&D for QCS product line
Sales & marketing support

Dublin, HQ EL, PA, & MO
Automation, Power, Sales, Engineering, & Management

Dublin, Cylon Controls
Production & Service

Cork PAEN
Process Automation
Project delivery

Skilled and experienced Irish team, backed by global networks

ABB Ireland

Registered Training Provider with Engineers Ireland

ABB Electrification

1. Technical overview of LV Switchgear and Panel Selection.
2. LV Selectivity / Discrimination
3. IEC61439 Standard for Circuit Breakers & Assemblies
4. Arc Fault Detection Devices (New MCBs & RCBOs)
5. Electric Vehicle Charging Infrastructure
6. The Fundamentals & Principles of Building Energy Management Systems
7. Introduction to MV Switchgear
8. Building Services Integration BACnet and other options
9. IIoT for Electrical installations
10. Building Automation – KNX universal protocol & DALI

ABB Motion

1. Harmonics, VSDs & Mitigation technologies
2. IE5 Synchronous Reluctance Drive and Motor Package

Click here to view ABB offering on Engineers Ireland

seamus.maclughadha@ie.abb.com

Questions