CxEnergy 2026

Digital Commissioning & Industry Evolution

Smarter Cx Workflows for Future-Ready Buildings

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acg AABC Commissioning Group

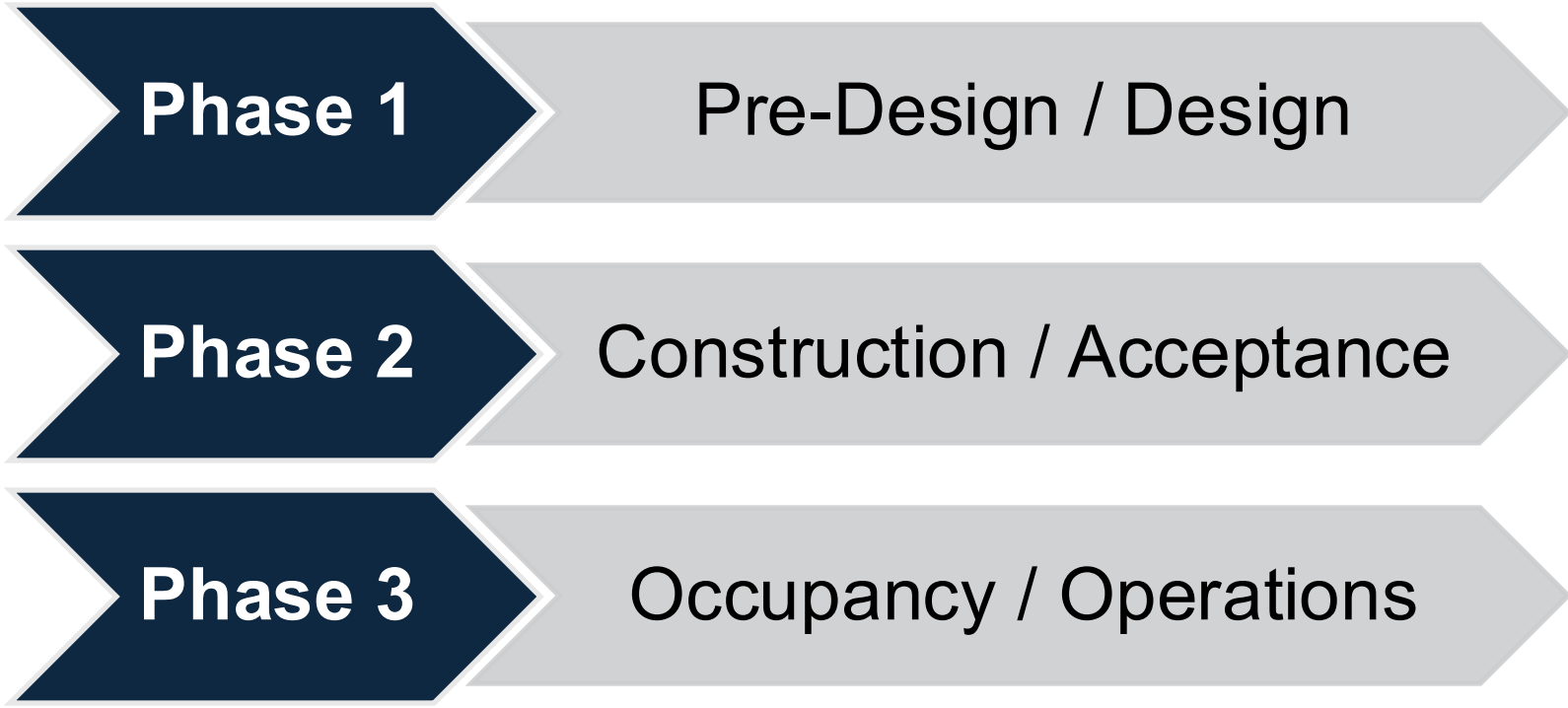
Learning Objectives:

1. Differentiate Digital Cx from Traditional Cx
2. Understand the different BACnet protocols and their Cx implications
3. Apply Digital Cx principles across project phases
4. Recognize the opportunities Digital Cx creates for commissioning professionals

What is Digital Commissioning?

The Digital Commissioning Process

Digital Cx applies across every phase:



What is Digital Commissioning?

- Use of digital commissioning tools across all phases and purposeful intent in the commissioning process to integrate and leverage
- Specific attention to defining requirements in Pre-Design
- Real-time validation of **BAS networks and digital systems**
- Bridges HVAC commissioning with IT/networking
- Fusion of traditional functional testing with data-driven testing
- Confirms **digital infrastructure** is built as scoped
- **Vendor-neutral:** process applies across protocols and platforms

DCx vs. Traditional Cx

- Manual testing process
- Paper-based checklists
- 'Batch' backward looking
- One-time verification
- HVAC-focused scope

Traditional Cx

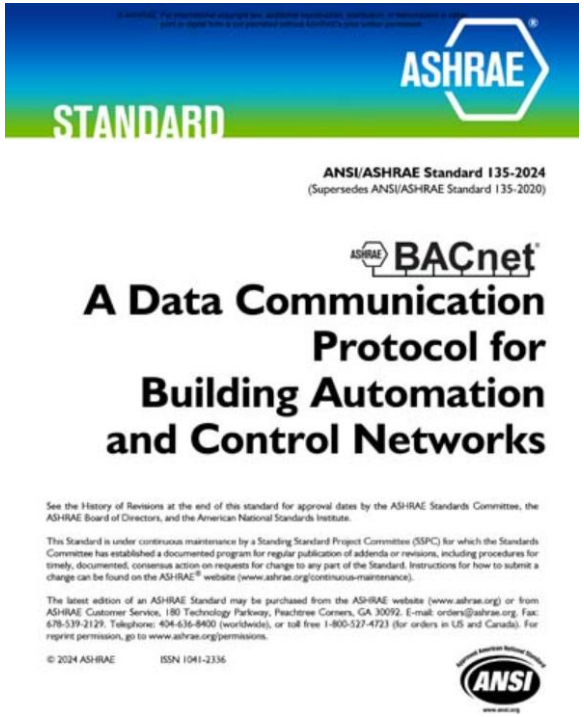
- Automated validation tools
- Cloud-based Cx processes
- Real-time data analysis
- Ongoing monitoring (MBCx)
- Cross-disciplinary scope

Digital Cx

Phase 1:
Pre-Design / Design

Specifying Digital Cx Requirements

- Digital Cx starts in the Design Phase
- Insufficient details in the OPR / contract requirements results in difficult to enforce in Cx
- Is specifying systems to be BACnet alone enough?
  - What to specify? How to specify?
  - “Provide BACnet compatible BAS”
- Drawing / Specifications detail level
  - What should be on drawings? What should be in specifications?



BACnet/IP vs. BACnet MSTP

BACnet/IP

- Standard Ethernet networks
- Higher bandwidth and speed
- Supports IT security practices
- Enables remote access
- Special attention to Subnetting for BACnet

BACnet MSTP

- Serial RS-485 Protocol
- Lower cost, simpler networks
- Limited bandwidth
- Requires IP router to bridge

- Protocol choice drives physical network design and installation

BACnet Secure Connect (BACnet/SC)

- TLS-encrypted BACnet over WebSockets
- Requires PKI: certificate provisioning and lifecycle management
- Hub-and-spoke topology replaces broadcast model
- Certificate management becomes a formal Cx and O&M requirement

And more...

- BACnet IP (T1L & T1S)

Interpreting OPRs: “Native BACnet”

- “Native BACnet” ≠ interoperable out of the box
- Which protocol? IP, MSTP, SC — each has different Cx needs
- Proprietary extensions can hide behind “native” claims
- What should Cx verify: data export capability, API access, multi-vendor interoperability
- Owner needs for usage of building data after occupancy?
- Does project / owner require a Division 25 contractor (S.I.)

Network Infrastructure Planning

- BMS contractor vs. structured cabling contractor installation responsibilities
- Managed vs. unmanaged switches: most enterprise owners require managed
- VLANs increasingly common for BMS network segmentation
- IT-managed vs. BMS contractor-managed infrastructure: define ownership early
- Plan remote access method for BMS systems during design
- Network riser diagram on controls design drawings

BMS Device and Point Naming

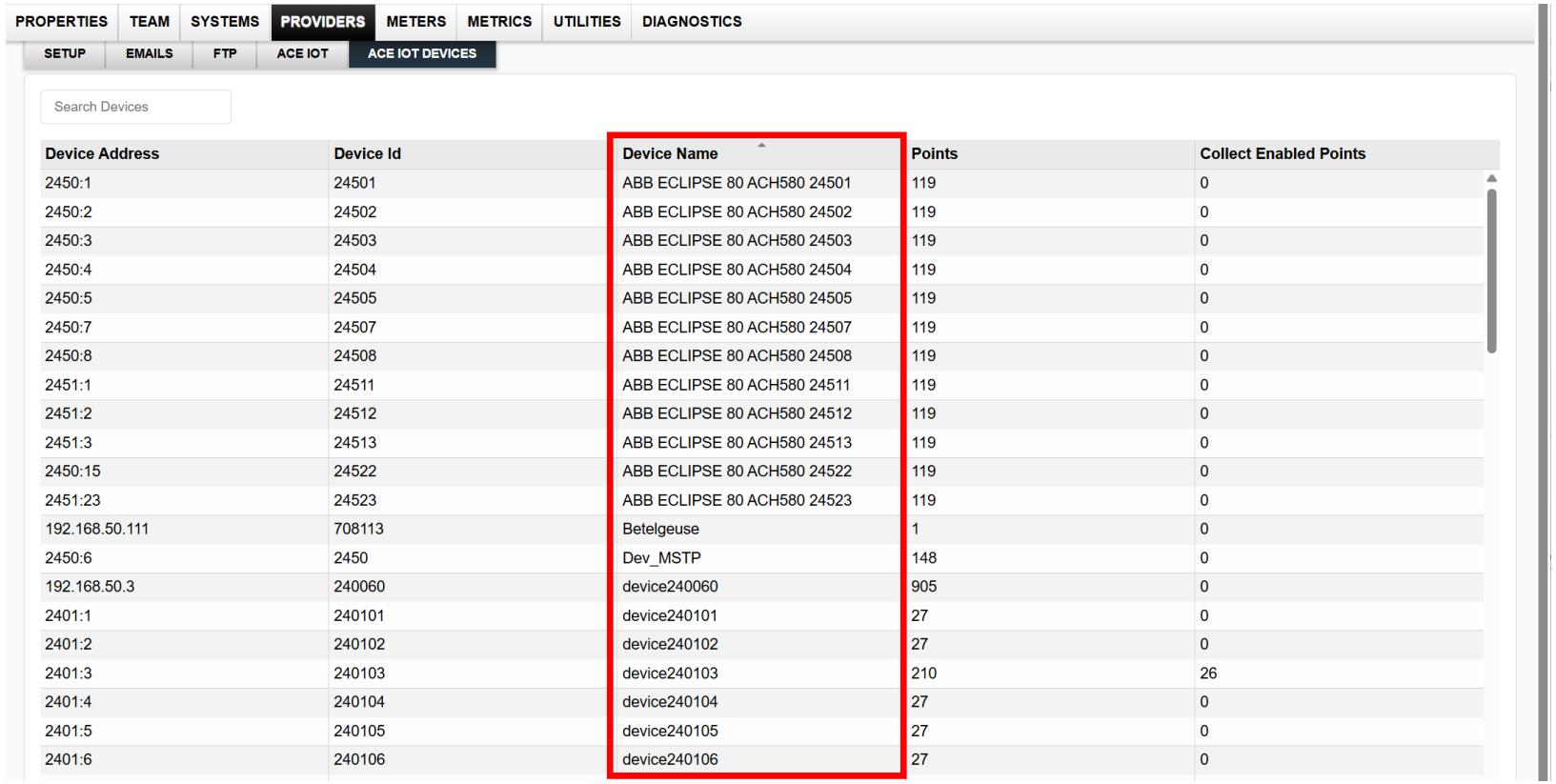
- Consistent / structured point naming conventions

  (SAT, Supply_Temp, SA_Tmp, Temp_Supply, SATemp, SupplyAirTemp,…)
- Naming for clarity and usability
- Making systems readable and maintainable
- Naming that supports troubleshooting
- Data consistency across systems
- Future-proofing the Owners BMS for new applications / upgrades
- Control point metadata requirements (naming, tagging, semantic model)

BMS Device and Point Naming

- Standardized device naming (using BACnet device object name value)

- Should not need a secret-decoder ring to determine what BACnet Device is what actual system / equipment!



Device Address	Device Id	Device Name	Points	Collect Enabled Points
2450:1	24501	ABB ECLIPSE 80 ACH580 24501	119	0
2450:2	24502	ABB ECLIPSE 80 ACH580 24502	119	0
2450:3	24503	ABB ECLIPSE 80 ACH580 24503	119	0
2450:4	24504	ABB ECLIPSE 80 ACH580 24504	119	0
2450:5	24505	ABB ECLIPSE 80 ACH580 24505	119	0
2450:7	24507	ABB ECLIPSE 80 ACH580 24507	119	0
2450:8	24508	ABB ECLIPSE 80 ACH580 24508	119	0
2451:1	24511	ABB ECLIPSE 80 ACH580 24511	119	0
2451:2	24512	ABB ECLIPSE 80 ACH580 24512	119	0
2451:3	24513	ABB ECLIPSE 80 ACH580 24513	119	0
2450:15	24522	ABB ECLIPSE 80 ACH580 24522	119	0
2451:23	24523	ABB ECLIPSE 80 ACH580 24523	119	0
192.168.50.111	708113	Betelgeuse	1	0
2450:6	2450	Dev_MSTP	148	0
192.168.50.3	240060	device240060	905	0
2401:1	240101	device240101	27	0
2401:2	240102	device240102	27	0
2401:3	240103	device240103	210	26
2401:4	240104	device240104	27	0
2401:5	240105	device240105	27	0
2401:6	240106	device240106	27	0

Integration Scope & Control Point Decisions

Should we "integrate" EVERYTHING available?

- Chillers, Boilers, VFDs, AMFS, Switchgear, Lighting, etc…
- Points, points, and more points!!!

Control point decisions – controlling with communicated points?

- Using BACNET points vs ‘hard-wired’ points for control
- Using hard-wired points increases control reliability

Quick Trivia Facts:

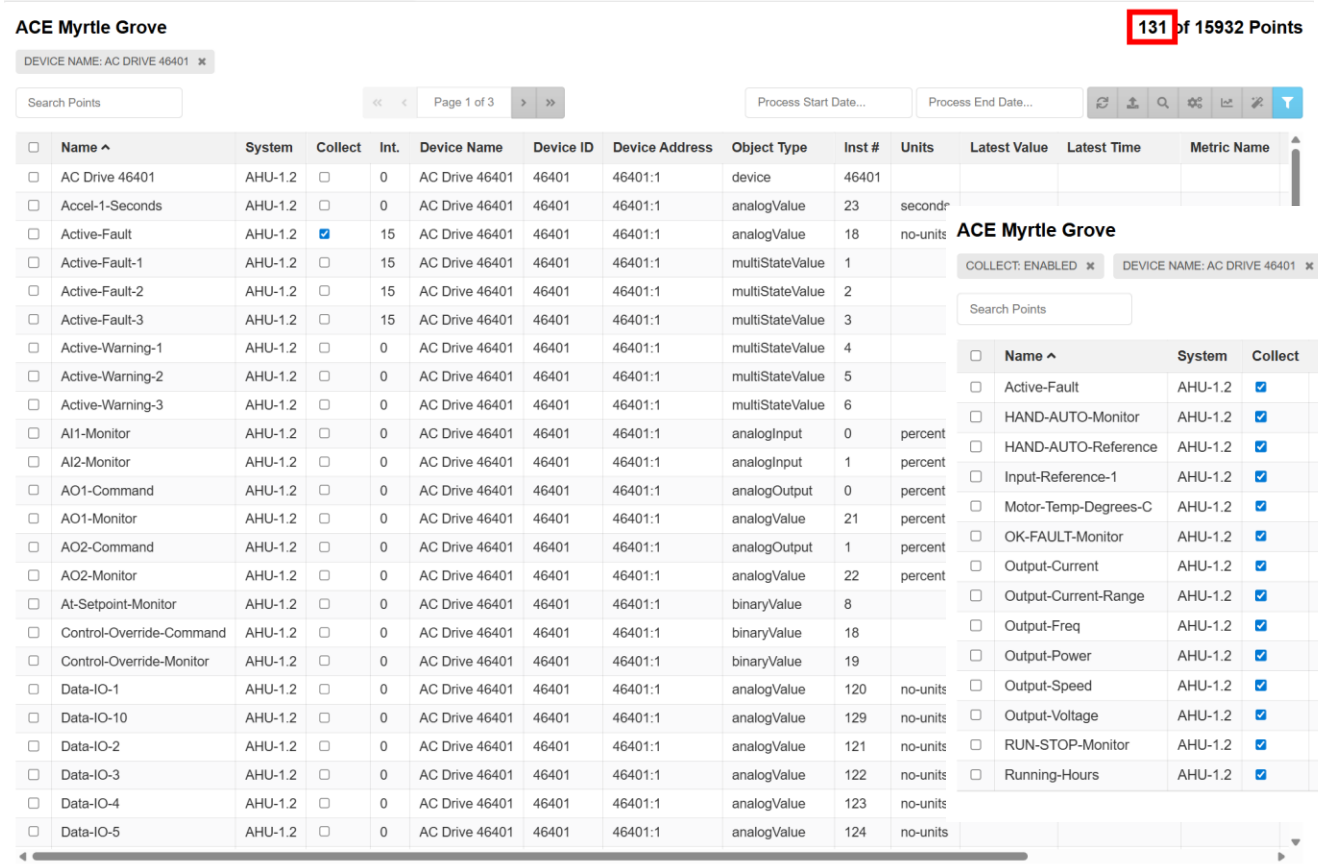
How many points are available from some common BAS manufacturers for VAV Air Terminal Units:

Trane – 133 points

Siemens – 325 points

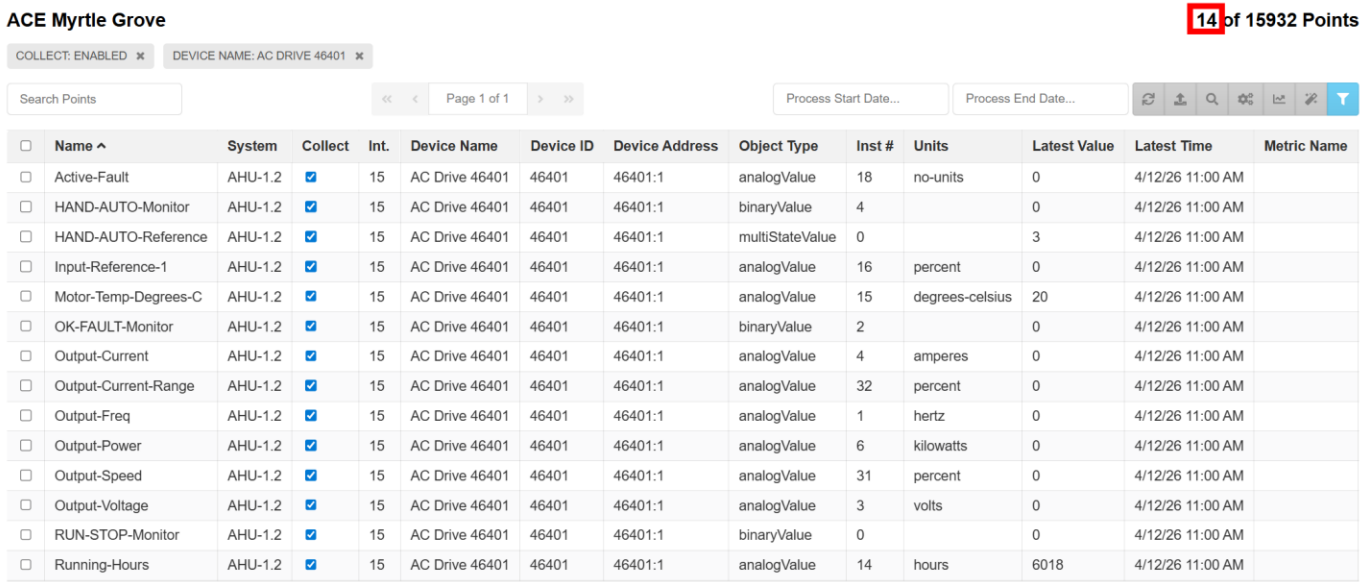
(squeeze-off reheat type)

Integration Scope & Control Point Decisions



AHU Fan ABB VFD Example – 131 points available!

We selected 'just' 14 points to collect data for



Phase 2:
Construction / Acceptance

How Digital Cx Has Evolved

Digital Commissioning used to just mean…

- Using a Cx software for ‘digital’ checklists / tests
- On-line Deficiency tracking in lieu of paper-based (or desktop software) for improved

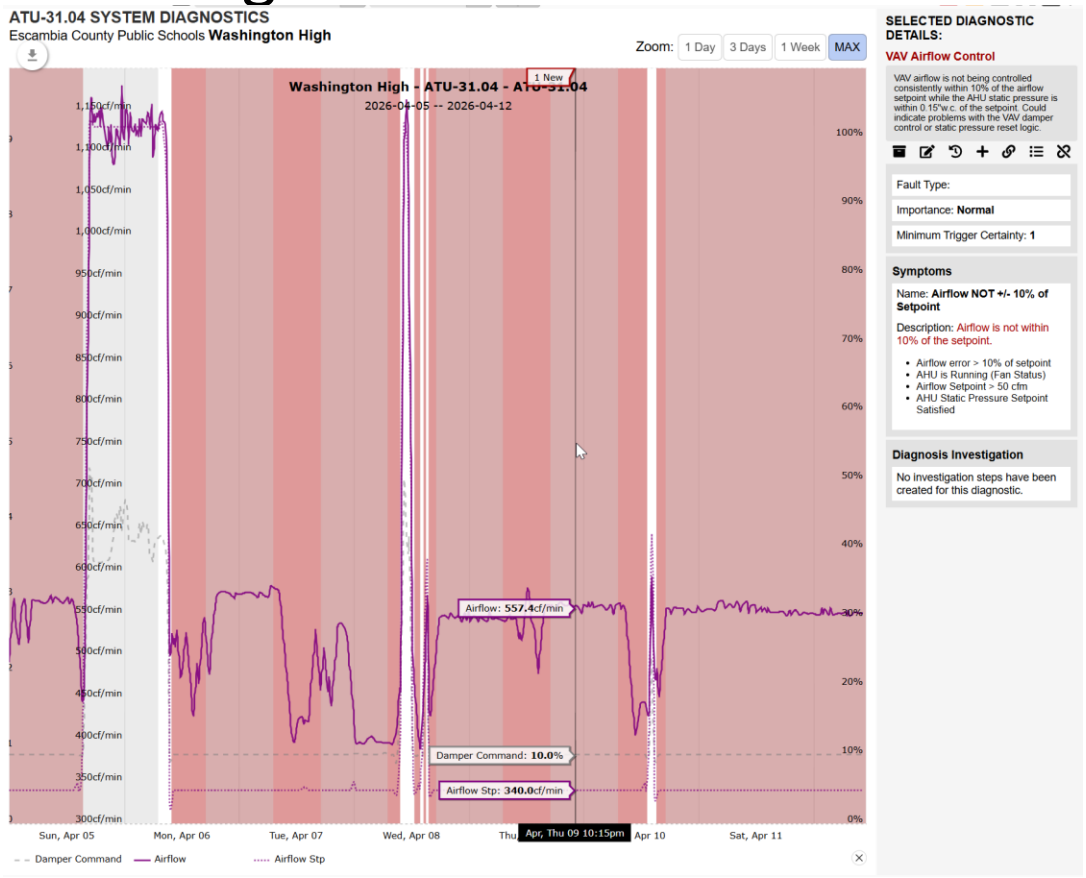
Digital Commissioning enabled by design choices is now…

- Assessing system readiness via earlier access to BMS data
- Trend data access during Cx Team Meetings
- Reduce time to assess trend data by cloud-based software tools
- Enhances functional testing by using real-time BACnet data to validate performance faster, more consistently, and with *less* manual effort.

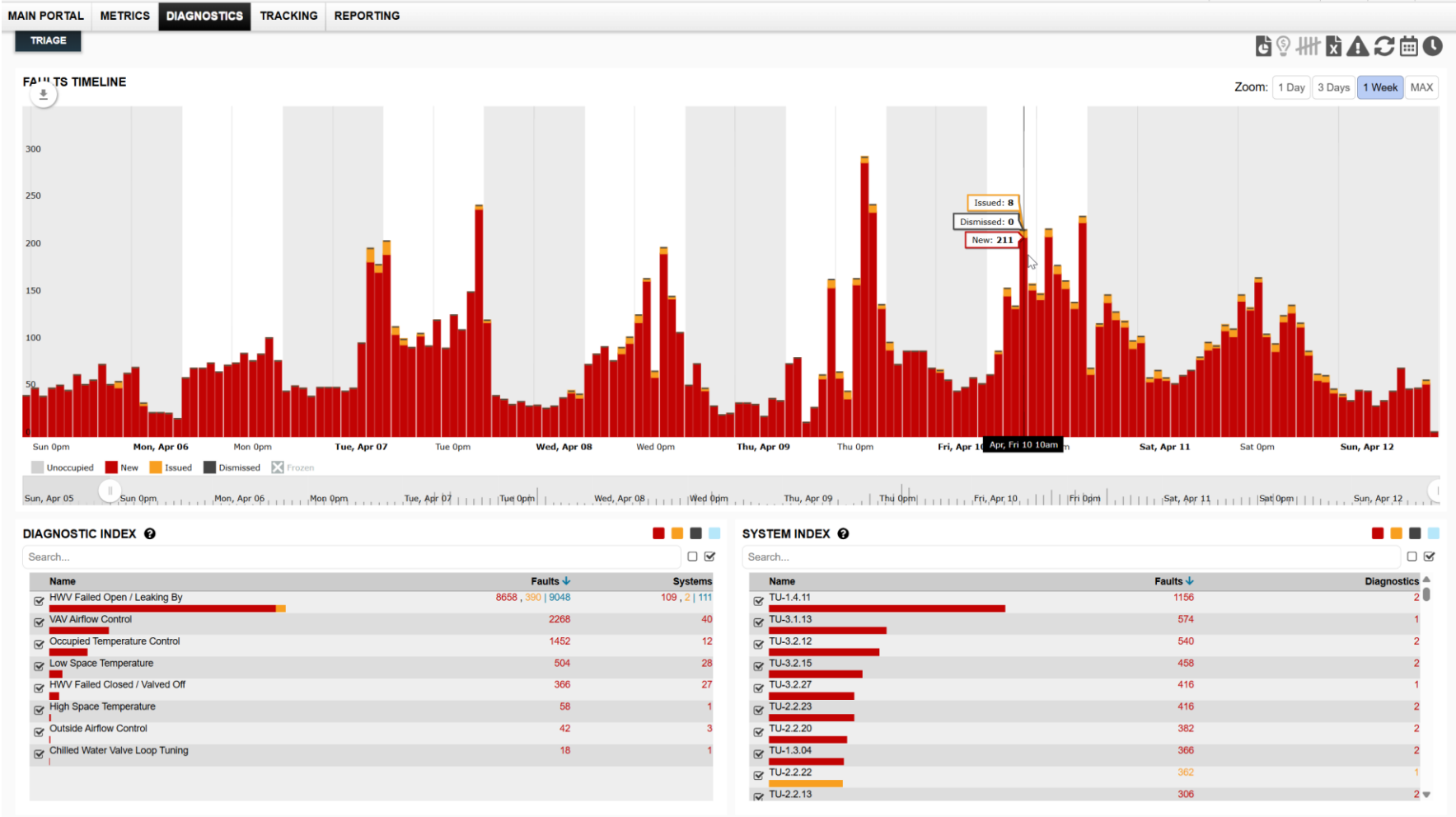
Data-Driven Functional Testing

Functional Testing evolving from Manual testing to Data Driven means:

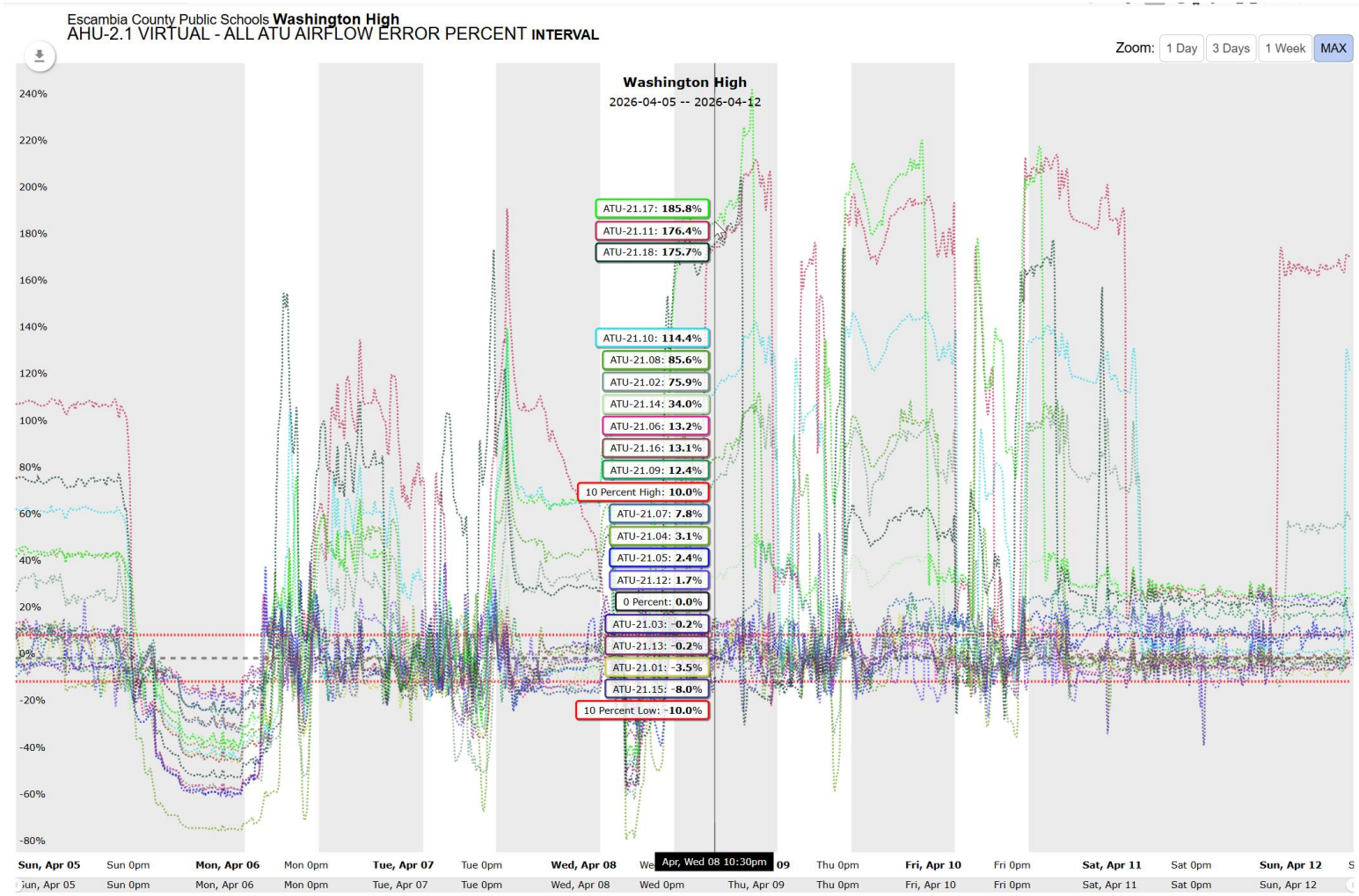
- Live BACnet data feeds directly into Cx software
- Logic / scripts evaluate system behavior
- Tools can flag failures or anomalies automatically
- Sample-based testing eliminated or reduced
- Construction progress independently verified
- AFDD possible PRIOR to Functional Testing
- Automatically refreshing system trend charts
- Data available to the entire Commissioning Team



Data-Driven Functional Testing



Data-Driven Functional Testing



Non-Traditional Scopes in Digital Cx

- Document the network set-up and confirm health
- More easily verify device and point naming compliance

ACE Myrtle Grove

COLLECT: ENABLED ✖ NAME: DISCHARGEAIRTEMP ✖ SYSTEM: AHU ✖

Search Points | Page 1 of 1 | Process Start Date... | Process End Date...

Name	System	Collect	Int.	Device Name	Device ID	Device Address
Drivers.NrioNetwork.AHU1_1_R34_1.points.DischargeAirTemp	AHU-1.1	☑	15	MyrtleGrove_AHU1_1_46100	46100	10.46.12.10
Drivers.NrioNetwork.AHU1_2_R34_1.points.DischargeAirTemp	AHU-1.2	☑	15	MyrtleGrove_AHU1_2_46400	46400	10.46.12.40
Drivers.NrioNetwork.AHU1_3_R34_2.points.ReHeatDischargeAirTemp	AHU-1.3	☑	15	MyrtleGrove_AHU1_3_46700	46700	10.46.12.70
Drivers.NrioNetwork.AHU1_3_R34_1.AhuLogic.DischargeAirTemperature	AHU-1.3	☑	15	MyrtleGrove_AHU1_3_46700	46700	10.46.12.70
Drivers.NrioNetwork.AHU1_3_R34_1.points.DischargeAirTemp	AHU-1.3	☑	15	MyrtleGrove_AHU1_3_46700	46700	10.46.12.70
Drivers.NrioNetwork.AHU1_4_R34_1.points.DischargeAirTemp	AHU-1.4	☑	15	MyrtleGrove_AHU1_4_46800	46800	10.46.12.80
Drivers.NrioNetwork.AHU2_5_R34_1.points.DischargeAirTemp	AHU-2.5	☑	15	MyrtleGrove_AHU2_5_461000	461000	10.46.12.100
Drivers.NrioNetwork.AHU2_6_R34_1.points.DischargeAirTemp	AHU-2.6	☑	15	MyrtleGrove_AHU2_6_461300	461300	10.46.12.130

ACE Myrtle Grove

COLLECT: ENABLED ✖ NAME: SPACE TEMPERATURE LOCAL ✖ DEVICE NAME: ATU ✖

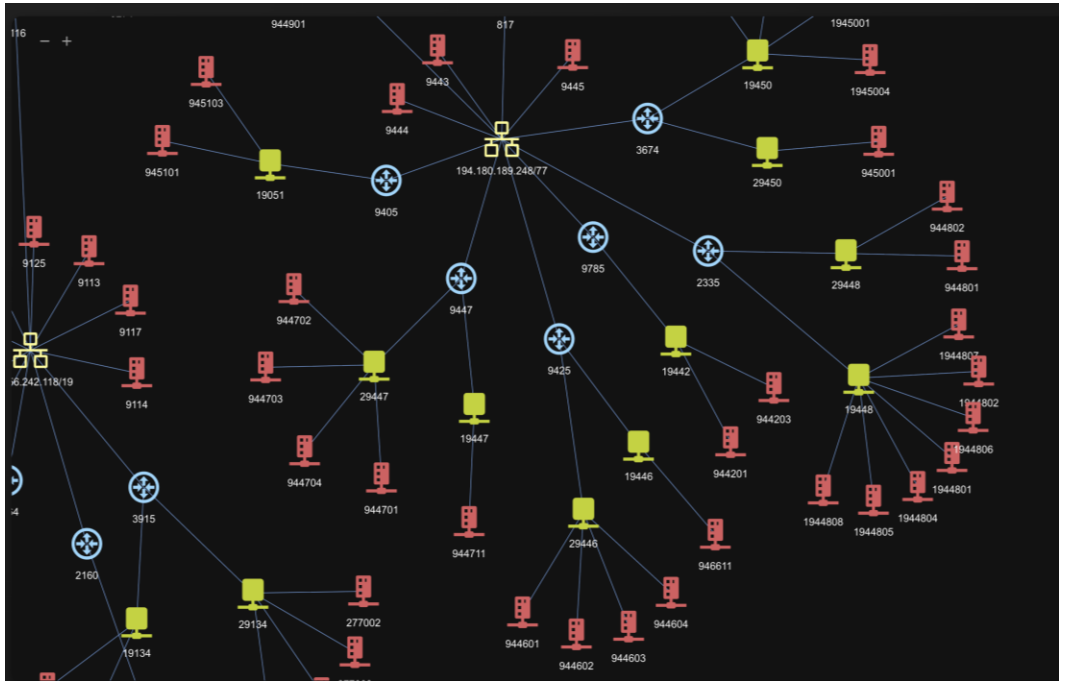
Search Points | Page 1 of 2

Name	System	Collect	Int.	Device Name	Device ID	Device Address
Space Temperature Local	ATU-1.1.01	☑	15	ATU-1.1.01	11	10.46.12.11
Space Temperature Local	ATU-1.1.02	☑	15	ATU-1.1.02	12	10.46.12.12
Space Temperature Local	ATU-1.1.03	☑	15	ATU-1.1.03	13	10.46.12.13
Space Temperature Local	ATU-1.1.04	☑	15	ATU-1.1.04	14	10.46.12.14
Space Temperature Local	ATU-1.1.05	☑	15	ATU-1.1.05	15	10.46.12.15
Space Temperature Local	ATU-1.1.06	☑	15	ATU-1.1.06	16	10.46.12.16
Space Temperature Local	ATU-1.1.07	☑	15	ATU-1.1.07	17	10.46.12.17
Space Temperature Local	ATU-1.1.08	☑	15	ATU-1.1.08	18	10.46.12.18
Space Temperature Local	ATU-1.1.09	☑	15	ATU-1.1.09	19	10.46.12.19
Space Temperature Local	ATU-1.1.10	☑	15	ATU-1.1.10	20	10.46.12.20
Space Temperature Local	ATU-1.1.11	☑	15	ATU-1.1.11	21	10.46.12.21
Space Temperature Local	ATU-1.1.12	☑	15	ATU-1.1.12	22	10.46.12.22
Space Temperature Local	ATU-1.1.13	☑	15	ATU-1.1.13	23	10.46.12.23
Space Temperature Local	ATU-1.1.14	☑	15	ATU-1.1.14	24	10.46.12.24
Space Temperature Local	ATU-1.1.15	☑	15	ATU-1.1.15	25	10.46.12.25
Space Temperature Local	ATU-1.1.16	☑	15	ATU-1.1.16	26	10.46.12.26
Space Temperature Local	ATU-1.1.17	☑	15	ATU-1.1.17	27	10.46.12.27
Space Temperature Local	ATU-1.1.18	☑	15	ATU-1.1.18	28	10.46.12.28
Space Temperature Local	ATU-1.1.19	☑	15	ATU-1.1.19	29	10.46.12.29
Space Temperature Local	ATU-1.1.20	☑	15	ATU-1.1.20	30	10.46.12.30
Space Temperature Local	ATU-1.1.21	☑	15	ATU-1.1.21	31	10.46.12.31
Space Temperature Local	ATU-1.1.22	☑	15	ATU-1.1.22	32	10.46.12.32
Space Temperature Local	ATU-1.2.01	☑	15	ATU-1.2.01	41	10.46.12.41
Space Temperature Local	ATU-1.2.02	☑	15	ATU-1.2.02	42	10.46.12.42

Network Infrastructure & Metadata Validation

- Architecture documentation
- Network topology verification
- Device addressing review
- Protocol compliance testing
- BACnet network numbers

  (1 – 65,534 are valid numbers)



Network Infrastructure & Metadata Validation

- Metadata levels:
  - Level 1: Naming conventions
  - Level 2: Tagging (Haystack, Brick)
  - Level 3: Semantic models
- Automated validation scripts

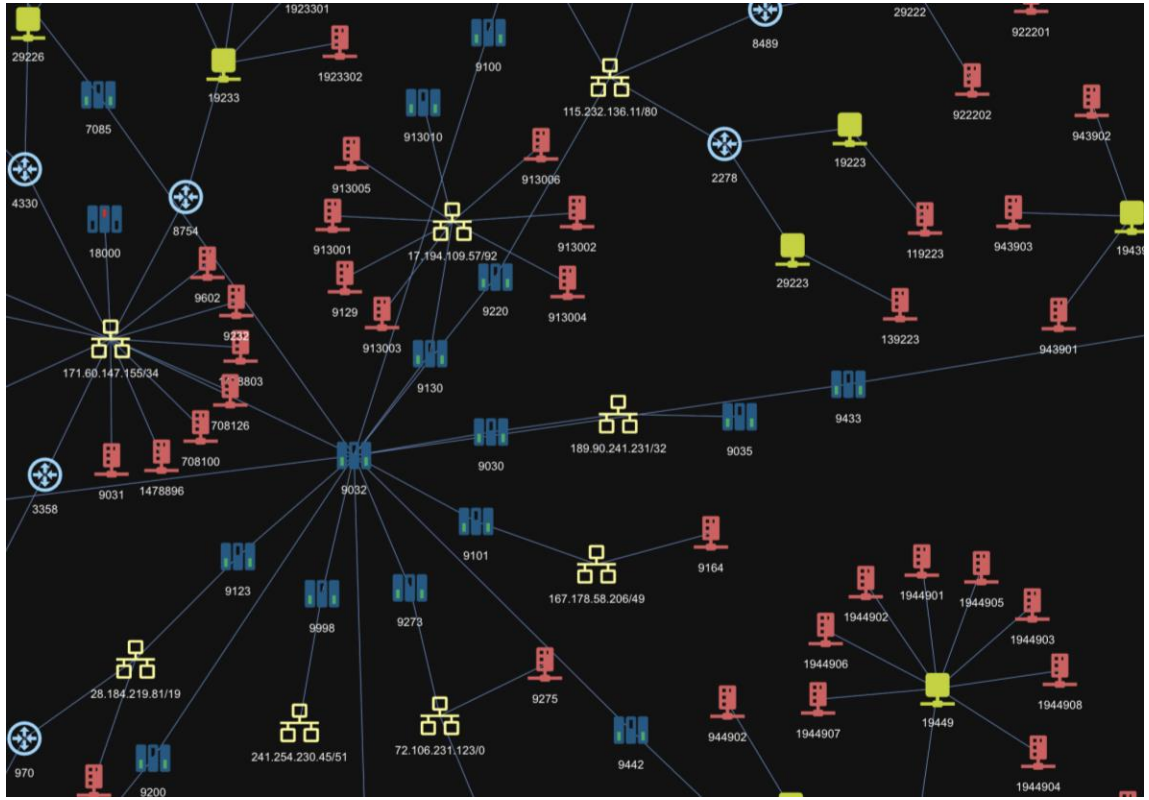
Cybersecurity & Data Accessibility

Cybersecurity

- Account management and MFA
- Network encryption (TLS 1.2+)
- Segmentation and VLANs
- BACnet/SC certificate lifecycle

Cybersecurity & Data Accessibility

- Data Accessibility
- Visualization performance
- Non-proprietary formats
- API and integration support
- Trend data retention



Phase 3:
Occupancy / Operations

Warranty Phase:
From Reactive to Data-Driven

- Digital Commissioning extends commissioning into the Warranty period through continuous data-driven performance validation
  - Enhances / extends business opportunities beyond construction timeline
  - On-going performance monitoring enabled as a standard service
  - At end of Warranty the monitoring is extended on an annual basis
  - Long-term client relationships and dependency
- Digital commissioning turns the warranty phase from a safety net into an active performance management period.

Warranty Phase:
From Reactive to Data-Driven

Traditional

- Complaint-driven
- Reactive, manual troubleshooting
- Limited access to trend data
- Delayed issue detection

Digital

- Continuous monitoring
- Automated fault detection
- Improved Contractor accountability
- Proactive, earlier issue resolution
- On-Going Optimization

Contractor Accountability and Issue Resolution

Improved Contractor Accountability

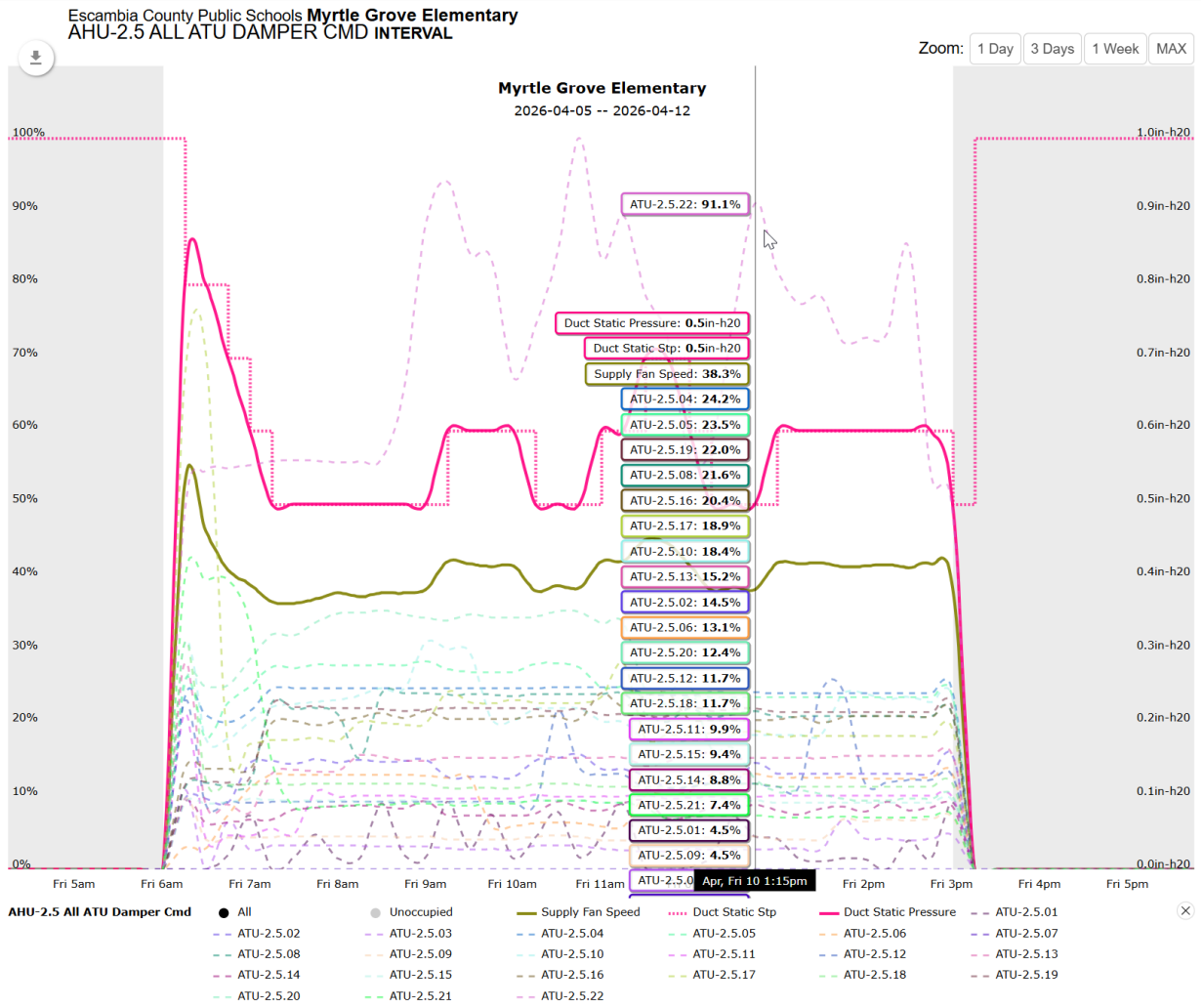
- Use data to objectively document issues
- Eliminate 'could not reproduce' scenarios
- Provide clear trend-based evidence
- Support warranty claims with data

Proactive, Earlier Issue Resolution

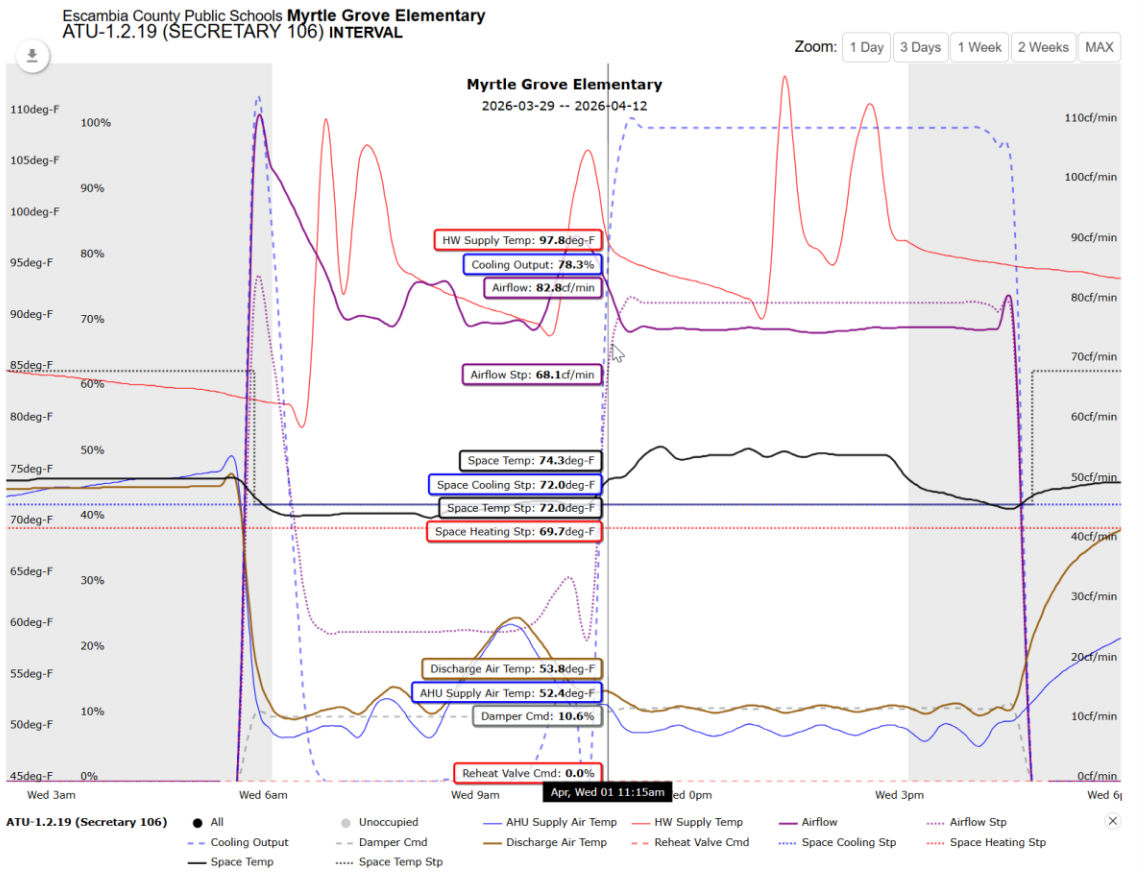
- Leverage historical trend data
- Understand system behavior patterns
- Reduce time to diagnose issues
- Improve response efficiency

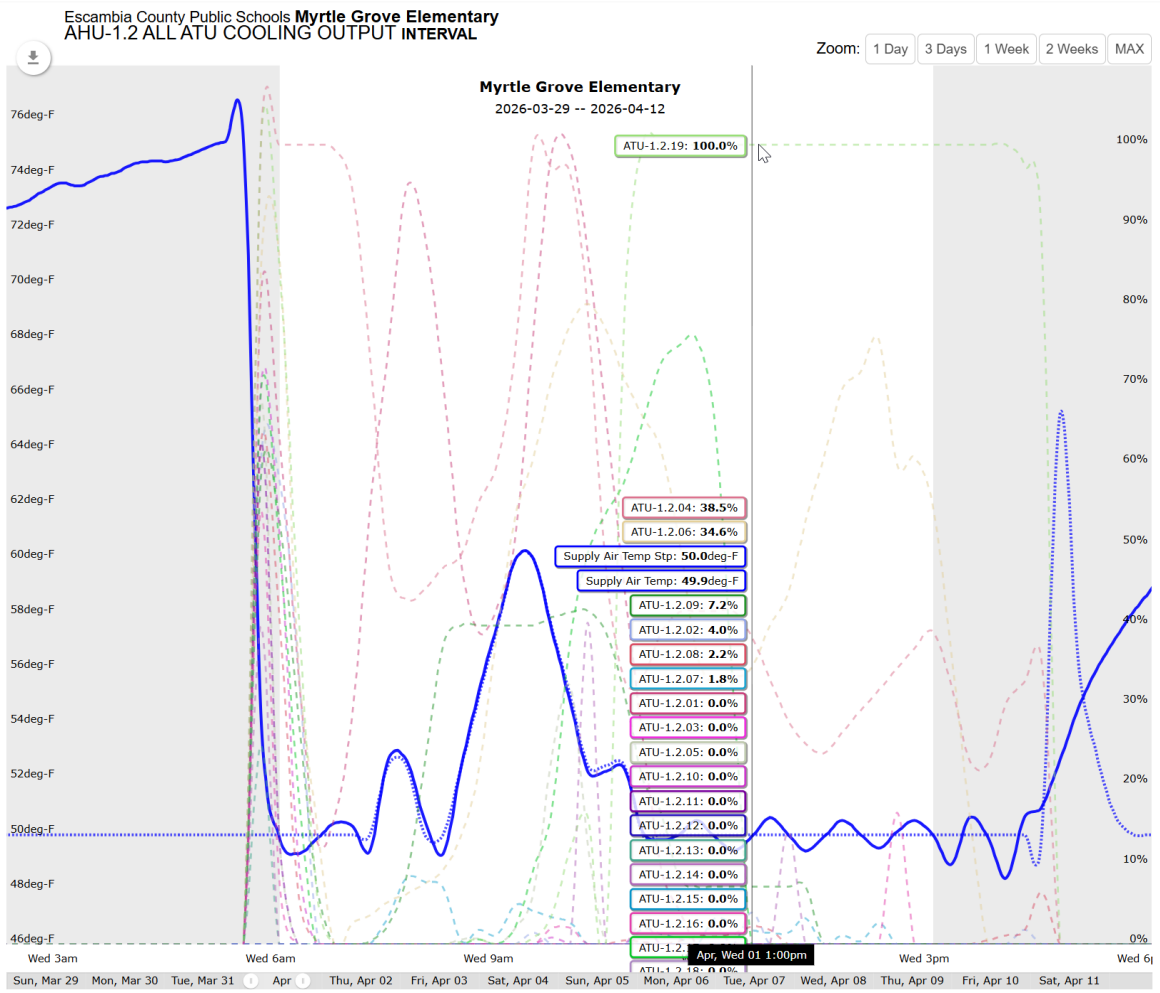
Ongoing Optimization

- Fine-tune control sequences
- Find system outliers
- Improve energy performance
- Adjust schedules and setpoints
- Turn warranty period into optimization period



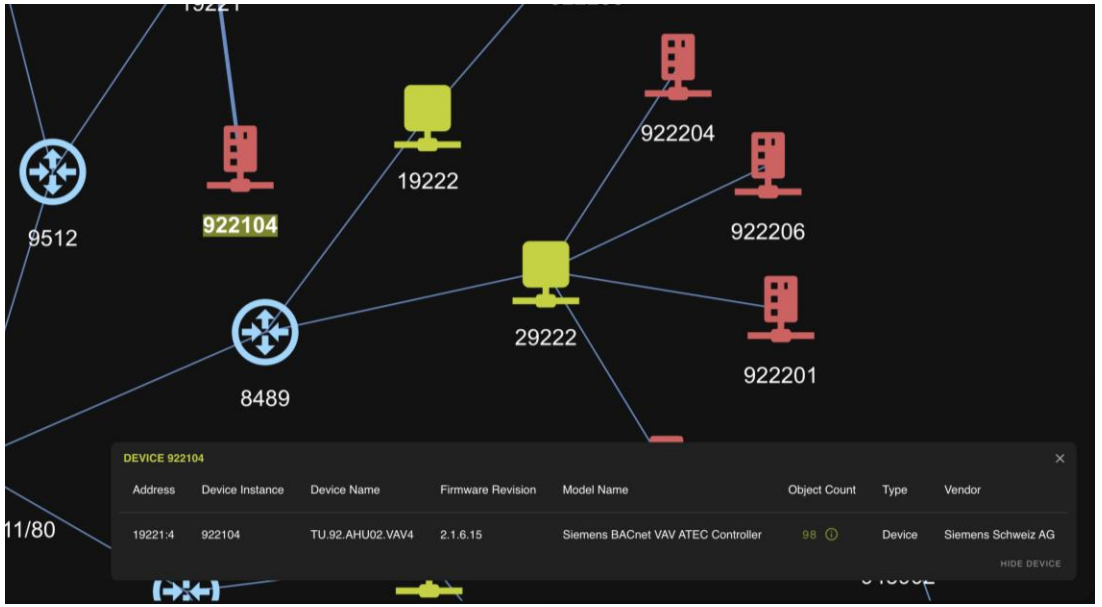
Ongoing Optimization





BACnet Data Access: The Foundational Enabler

- Direct access to system data is critical
- Enables monitoring and analytics tools
- Supports automation or hybrid execution of testing and diagnostics
- BACnet brings you the data, semantic model tells you what the data is
- Without open data access, digital Cx cannot function



Practical Digital Commissioning Adoption

Benefits of Adopting DCx

- Support owners with compliance and performance
- Technology-neutral workflows shorten project timelines
- Long-term client relationships and recurring revenue

New Business Models

New Services

- Network Audits
- Metadata Audits
- Cyber Audits

Recurring Revenue Streams

- MBCx creates ongoing service relationships
- One-year performance monitoring as a standard post-construction offering, extendable annually

The Corona Digital Cx Framework

Explore and Contribute to Corona:
github.com/ACE-IoT-Solutions/**corona-digital-cx**

- An open-source commissioning specification for BAS
- Licensed by CC BY-SA 4.0
- Defines the five validation areas that apply across all project phases

The Corona Digital Cx Standard

Explore and Contribute to Corona:
github.com/ACE-IoT-Solutions/**corona-digital-cx**

Five Validation Areas:

General Requirements	BACnet Networks	Integrated Systems	Metadata	Data Accessibility
Roles	Architecture	Lighting	Naming	Visualization
Coordination	Address	Metering	Tagging	Responsiveness
Cybersecurity	Protocol	Interfaces	Semantic Models	

The Corona Digital Cx Standard

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Get Involved:

- Open collaboration: issues, discussions, and pull requests welcome
- Join the Corona Digital CX Working Group
- Help shape the future of digital commissioning standards

Key Takeaways

- Digital Cx spans every project phase
- Pre-Design decisions drive Cx outcomes
- The warranty phase is a performance opportunity
- BACnet data access is foundational
- Establish company processes that support all phases
- Standardization is working

Thank You!

Andy Heitman, CxA, EMP, CEM - Building Energy Sciences / B.E.S. Plus Tech
Andrew Rodgers - ACE IoT Solutions