CONNECTING
THE WORLD

Specifying Analytics

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Introduction

Who are the presenters?

Tom Lohner, PE, CxA

Experience

- 34 Years of mechanical, energy and building automation engineering experience
- LONMARK Director; 1996 -1999
- CABA Integrated and Intelligent Building Council (IIBC) Chair; 2004 – 2009
- Formed and managed exp Energy Solutions – 1994 – 2016
- Engineered first multi-vendor – interoperable building in 1996 using LONMARK products
- Defined the roles and responsibility of the “Master Systems Integrator”

Jon Christopher Larry, PE, CxA, LEED AP, CEM

Experience

- 30 years of comprehensive experience on energy-efficient high performance buildings
- Design-build expertise specializing in unique HVAC control solutions which solve problems, improve comfort, and reduce consumption.
- Named “Energy Engineer of the Year 2000” by the Association of Energy Engineers (AEE)
- Chairman of Technology, Energy and Governmental Activities, Chapter Technology Transfer Committees for ASHRAE.
- Chairman of Building Intelligence Quotient and Zero Energy Consortium Committees for CABA.

Journey Williams

Experience

- Vice President: Smart Building Technologies, 2013- Present
- Project Feasibility and Technical Support Consultant, 2012-2013
- Sales Service Engineer: Advanced Power Control, Inc., 2008-2012
- Sales Engineer: United McGill Corporation, 1999-2007
- BS In Mechanical Engineering: Clarkson University, 1999

Optimizing the Building

*Control *more things* in *smarter ways**

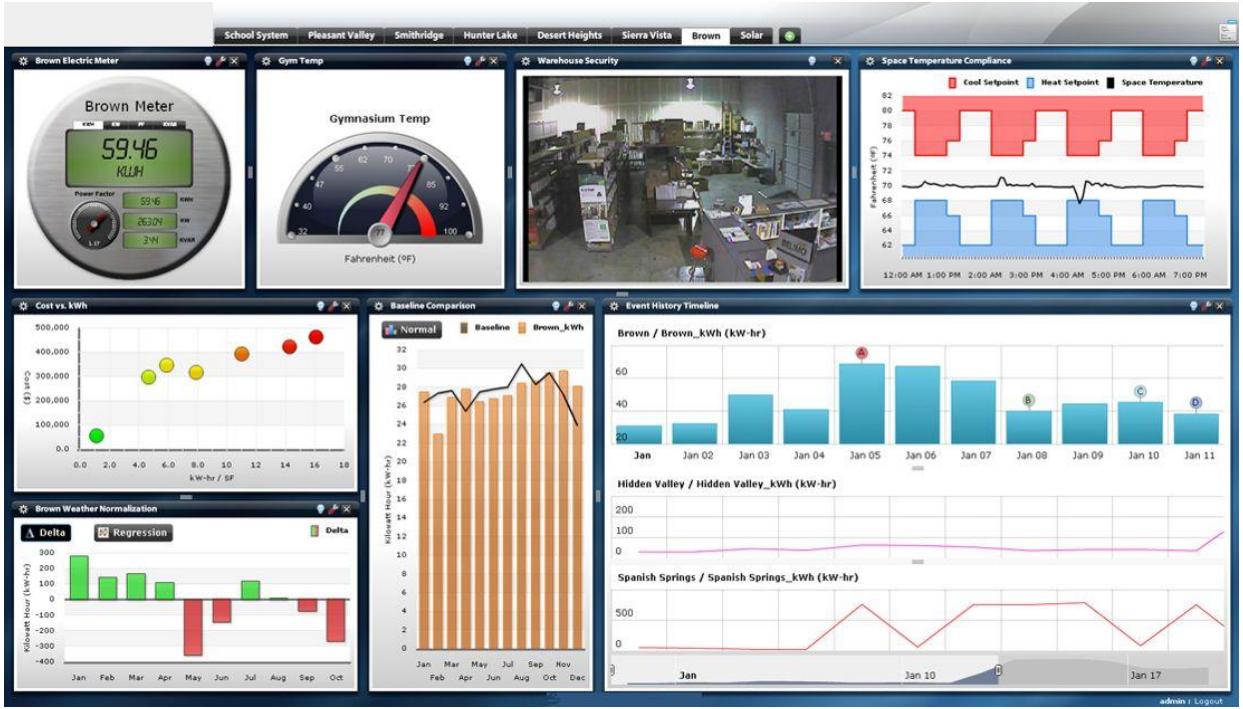
What is Analytics?

- Building systems generate vast amounts of information (data).
- Analytics algorithms scan and filter data to find patterns, trends and problems that would otherwise be missed or overlooked by the O&M staff.
- These algorithms can create action items (work orders) for the O&M staff.
- These analytics make it easier to manage operations and achieve energy goals. Benchmarks and key performance indicators can be developed.
- Fault detection and diagnostics, or FDD, another type of analytics, can let facility mangers know when a system or piece of equipment isn't functioning as it should, so facility managers can quickly correct the problem.
- Analytics can increase building performance and reduce the cost of operating a facility by making O&M staff more efficient and increasing system life.

Building Analytics

- Browser-based dashboard application monitors multiple facilities in real time
- Presents volumes of data in a clear, visual way, allowing users to quickly identify issues, assess relationships, and take action
- User-centric interface is highly intuitive and configurable

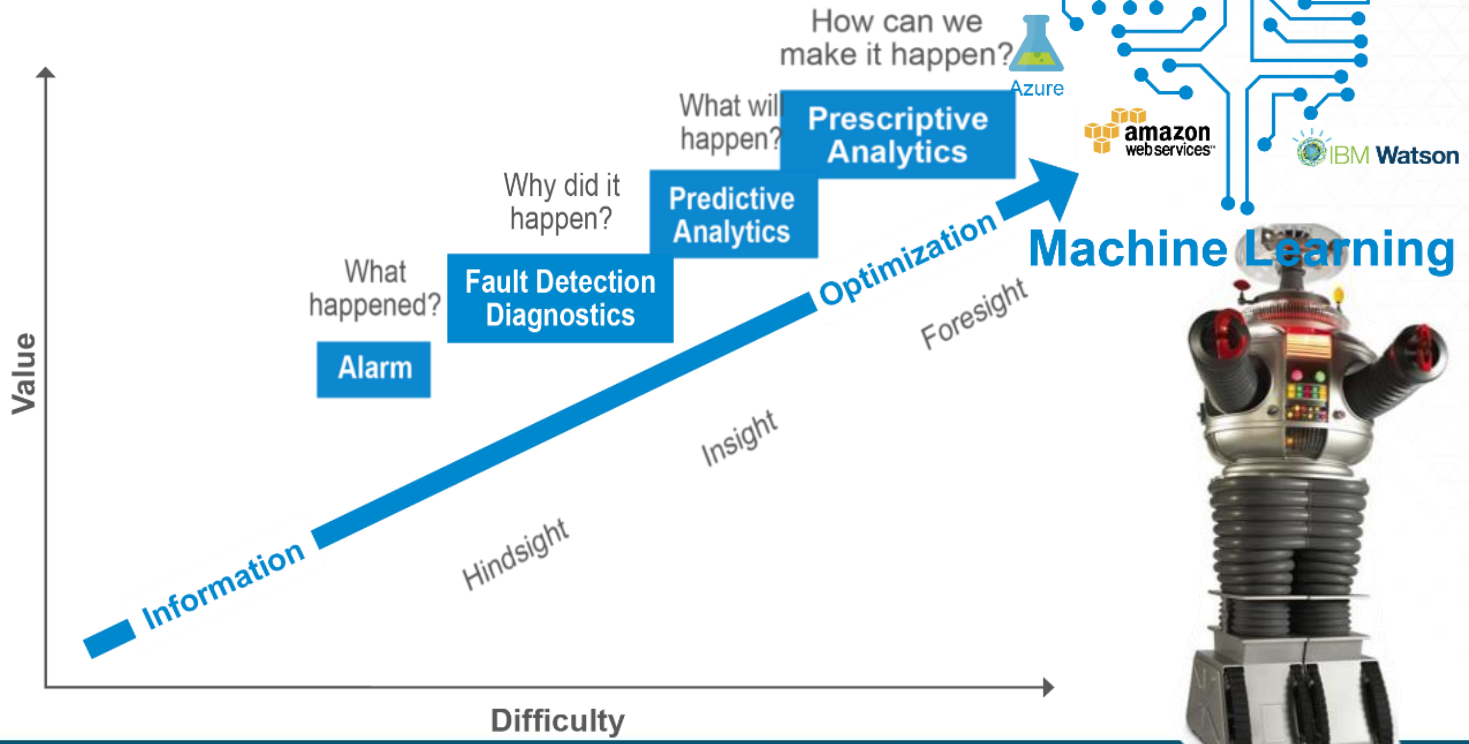
Analytics Dashboard (examples)



Types of Building Analytics

- Alarms
- Conditional Alarms (Fault Detection and Diagnostics)
- Predictive Analytics
- Prescriptive Analytics

Analytics Maturity



Alarms

- 1st Generation - Automatic Temperature Controls
  - Analog and electric devices (Freeze stats, pressure switch, current switches etc.)
- 2nd Generation - Direct Digital Controls
  - Analog Temperature and Pressure - Hi and Low Limits
  - Filter pressure set-point alarm
  - Equipment dry contact and soft alarms
  - Electrical Demand alarms
  - Current set-point alarms

Conditional Alarms (3rd Generation)

- A.K.A. – Fault Detection and Diagnostics (FD & D)
- Can Eliminate ‘False Positives’
- Utilizes Real Time Data
- Utilize Boolean Logic to add ‘conditions to the alarm’
  - If, Then, Else, Or, And, etc., statements
  - IF the DAT exceeds 60 deg. F AND the AHU-1 SAF status is TRUE AND the Chiller status is TRUE AND OA Temp EQUAL 55 deg. F THEN ALARM AHU-1
- Utilize Totalized Equipment Runtime and Energy
- Apply Rate of Rise to Analog Points

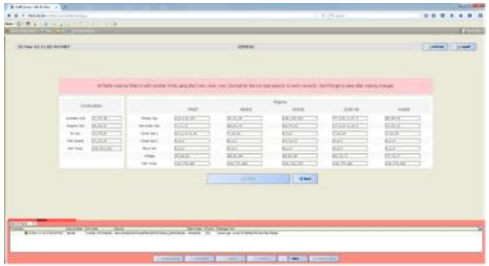
Predictive Analytics (4th Generation)

- Sometimes referred to as Predictive Maintenance
- Utilizes Historical data to Predict a Fault or a Maintenance Work Order
- Compare Rotating Equipment vibration today to yesterday, last week and same time last year.
- Electrical Signature Analysis
  - Compare Rotating Equipment Amps, KVAR and Waveforms to Commissioned Baselines
- Implement a Regression Analysis on a Group of Historical Data Points
- Most Predictive Analytics require Big Database and Application Servers (SaaS model)

Prescriptive Analytics (5th Generation)

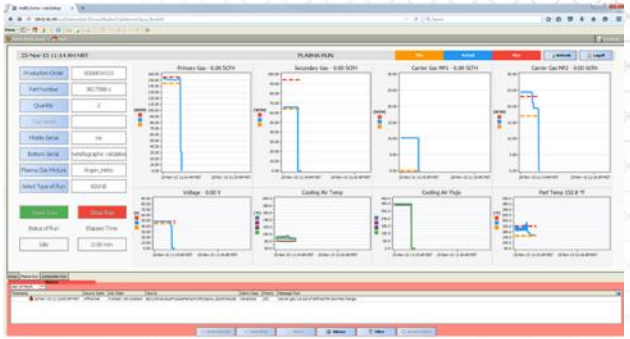
- Bypasses the Alarm or Fault and Utilizes AI to Address the Problem
- N4 and Niagara Analytics is Prescriptive Analytics Capable
  - Faults Detected
  - Control Logic Applied to Rectify Fault
- Example – WHEN Electrical Demand EQUAL 95% of ElecDemandLimit THEN OVERRIDE AHU-1 and AHU-2 DAT SP to 62 deg F AND Lighting Groups 1, 2, 3, 4, 5 Lux SP to 250 LUX

Screen Shots

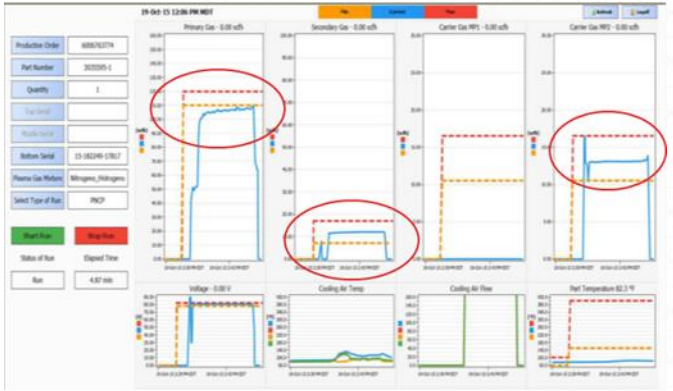


Batch Recipe Configuration

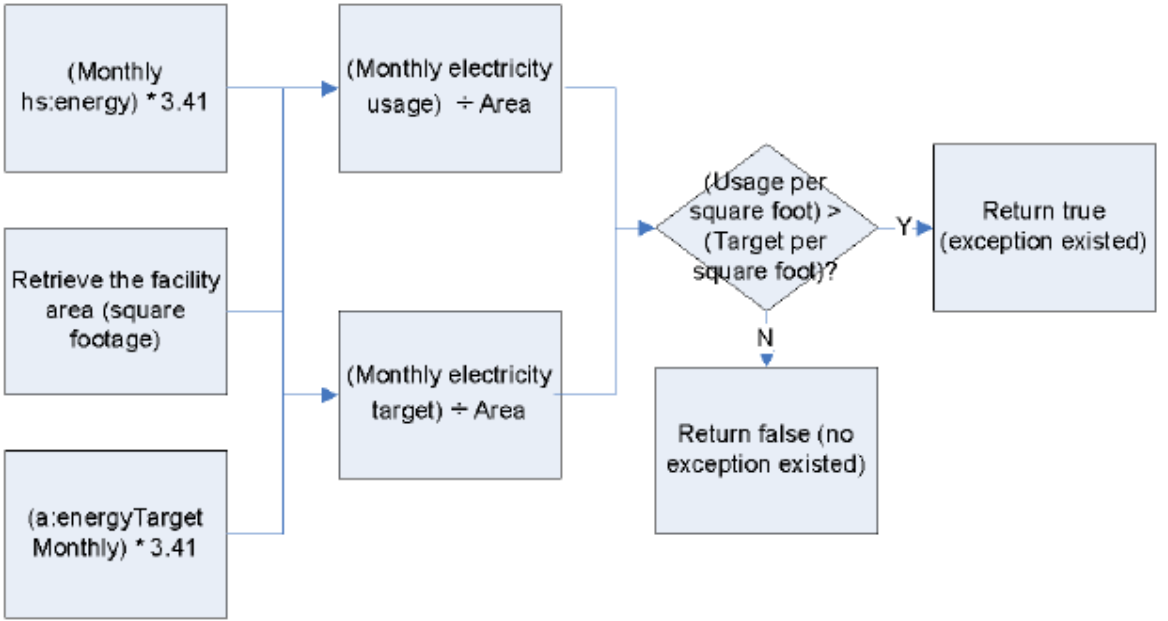
Batch Order Configuration

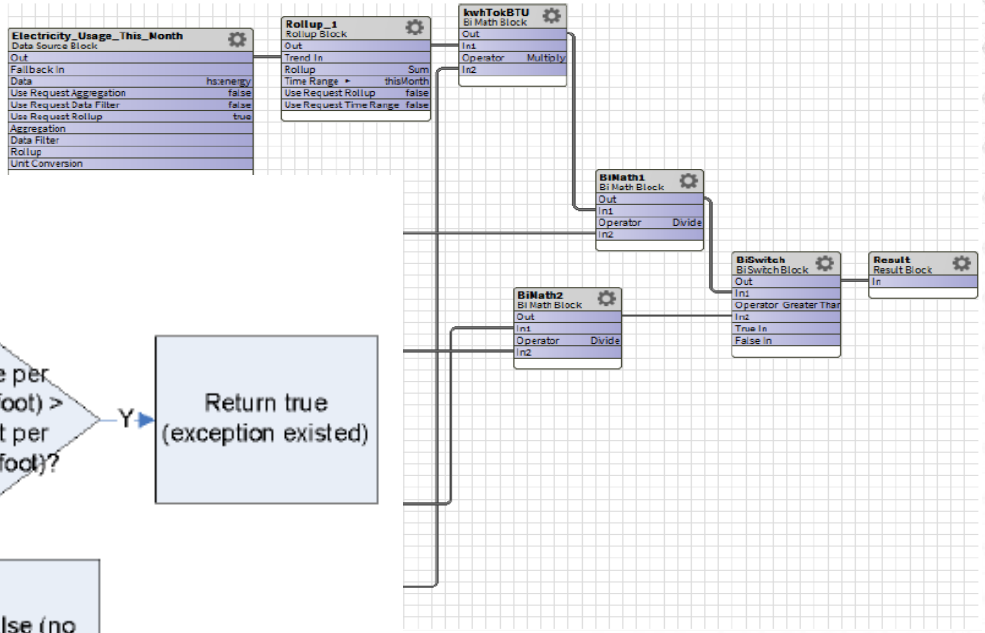


Running Batch Operator View



Rules and language



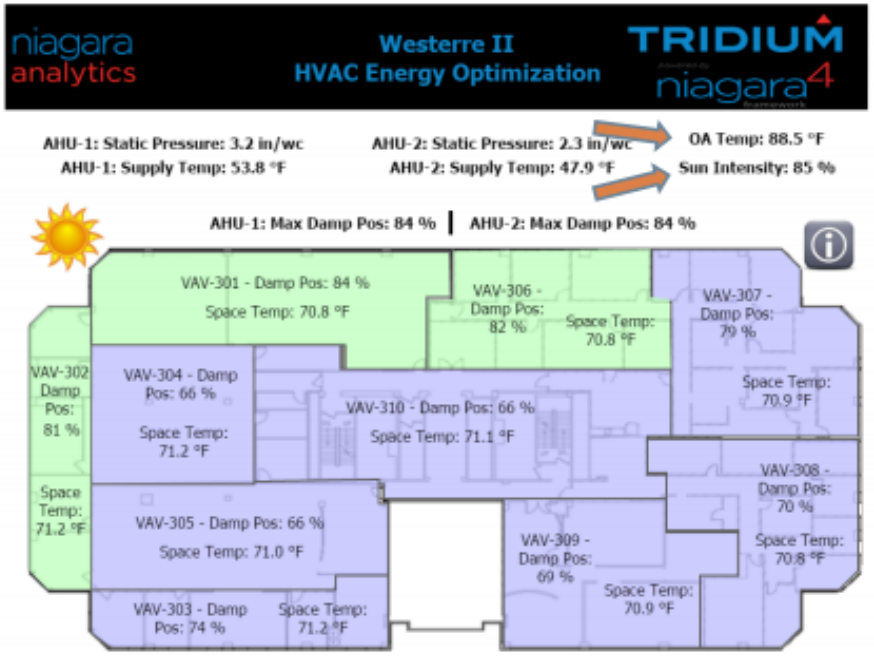


Point and Tag Definition

Point Name	Description	Actual IAS Point Name (typ.) - Site-Name_Building#._Build-ingWing_Floor_Equipment	BACnet Ob-ject Type (typ.)	IAS Gra phic	F D D	D R	Trend
STPT	Set point (Zone Temperature Set point)	XXXX_XXXX_XXXX_RTU#_STPT	Analog Value (2)	x	X	x	x
UNOCC	Unoccupied Mode	XXXX_XXXX_XXXX_RTU#_UNOCC	Multi-state Value (19)	x			x
FCUs:							
AMP	Amperage	XXXX_XXXX_XXXX_FCU#_AMP	Analog Input (0)				x
CLT	Cooling (Coil) Leaving Tem-perature	XXXX_XXXX_XXXX_FCU#_CLT	Analog Input (0)	x			x
CO2	(Space) Carbon-Dioxide	XXXX_XXXX_XXXX_FCU#_CO2	Analog Input (0)	x			x
DAT	Discharge Air Temperature	XXXX_XXXX_XXXX_FCU#_DAT	Analog Input (0)	x		x	x
KW	Kilowatts	XXXX_XXXX_XXXX_FCU#_KW	Analog Input (0)				x
KWH	Kilowatt Hour	XXXX_XXXX_XXXX_FCU#_KWH	Analog Input (0)				x
RH	(Space) Relative Humidity	XXXX_XXXX_XXXX_FCU#_RH	Analog Input (0)	x	X		x
VLT	Voltage	XXXX_XXXX_XXXX_FCU#_VLT	Analog Input (0)				x
ZNT	Zone or Space Temperature	XXXX_XXXX_XXXX_FCU#_ZNT	Analog Input (0)	x	X	x	x
ALM	Alarm - General Alarm or Fault	XXXX_XXXX_XXXX_FCU#_ALM	Binary Input (3)	x	X		x
FLTR	Dirty Filter Alarm (via Differen-tial Pressure Switch)	XXXX_XXXX_XXXX_FCU#_FLTR	Binary Input (3)		X		x

Automatic actions based upon analytic alarms

The Floor Plans demonstrate how Niagara Analytics running in a JACE-8000 can optimize the AHU Supply Temperature setting. By changing either the Outside Air Temp, or Sun Intensity, the user can show how the AHU Static Pressure Setpoint will respond accordingly to maintain a Maximum VAV Damper Position in between 80% and 85%.



Niagara Analytics

How do I specify Analytics for my project?

- There are two (2) ways to contract for and therefore design Integrated Automation into a project:
- 1. Using the BAS contractor to install Integrated Automation, for this you would use the Division 23 sections in the CSI format specifications.
- 2. Using the Integrated Automation contractor to install the IAS, you would use the Division 25 sections in the CSI format specifications.
- The key here is to ensure the architect, owner and GC understand the subcontractor requirements for Analytics.
- To program Analytics, the contractor needs data from multiple systems, so the other contractors need to work to coordinate the points on their systems to connect and share data with the IAS.

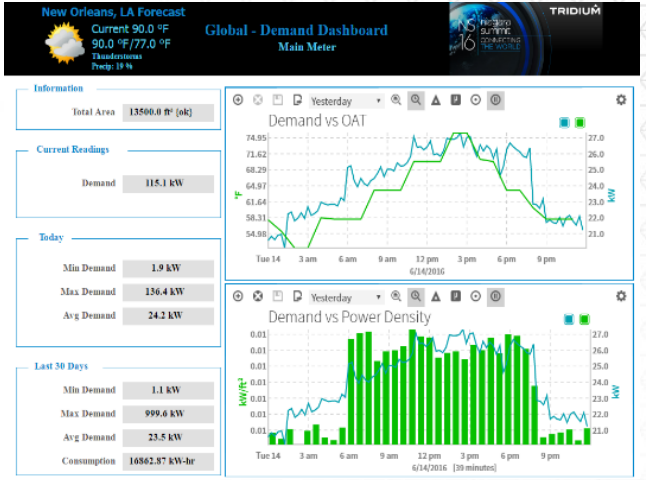
Designing the Analytics install for my project?

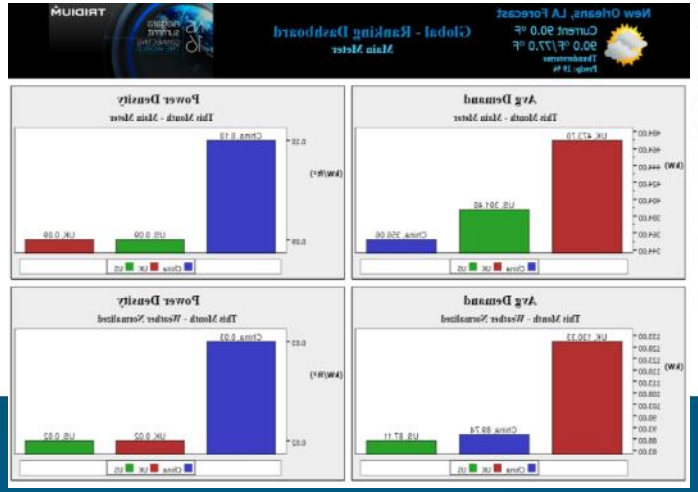
- There are two (2) ways to design and install Analytics into a project:

  1. Analytics can be purchased as software and installed in a server similar to other BAS software.
  2. Analytics can be **purchased integral with a JACE 8000 similar to other BAS hardware. The** hardware specification needs to be augmented with the analytics software so the contractor understands the installation and how the software is purchased.

- The key here is to ensure the contractor understands how the software and hardware is purchased and installed.

Dashboard On Demand





Different project types:

- How we design analytics is mostly the same, but it depends on:
  - The size of the project. 100,000 sf or 1,000,000 sf.
  - The number of points, tags and registers.
  - Single building, campus or portfolio.
  - The number and types of systems being analyzed.
  - The number and type of equipment being analyzed.
- The hardest thing about this is understanding what the owner wants.
- Often the people who will use this system have not even been hired yet.

Sample Specification for your project.

- Tridium has provided sample specifications for your use in designing your Analytics project:

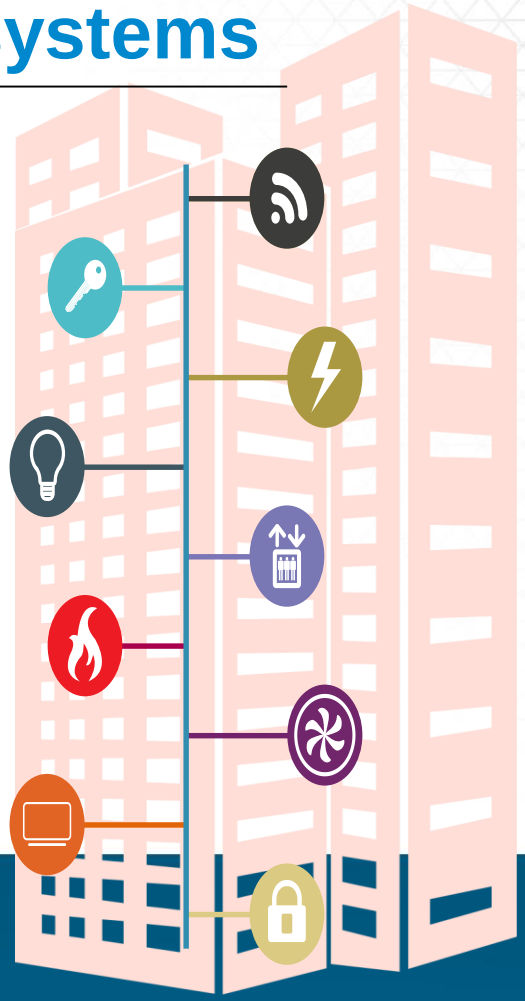
  1. Analytics can be purchased as software and installed in a server similar to other BAS software. Usually as part of Division 25.
  2. Analytics can be purchased integral with a JACE 8000 similar to other BAS hardware. The hardware specification needs to be augmented with the analytics software so the contractor understands the installation and how the software is purchased. Usually as part of Division 23.

- The sample specification is in CSI format with design notes and hints to assist in the writing of the specifications.
- The thing you need to know is; the systems, equipment and rules you want to include in the analytics.

Typical SMART BUILDING systems

NEW! Integrated Systems
Common Building Network,
Shared Data

- Integrated building network
- System optimization
- Data and analytics
- Web-based access and control
- Open protocol



Things to think about

- How will the analytics be installed
- Where will analytics software be installed?
- Where will the analytics data be stored?
- How long will the data be saved in the controllers?
- How long will the data be saved in analytics?
- How will all the systems be connected to share data?
- How will the faults be communicated?
- What kinds of graphics will be provided?

Future of Analytics

What to expect

Future items

- **Sample template for specifications for analytics.**
- **Analytics user group**
- **Sample rules and tools**
- **Additional rules outside of standard HVAC….**

Questions?

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