

NS2024

POWER OF PARTNERSHIP

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Exploring AI Use Cases in Building Automation & Facility Management - Part 1

Tech Track Session 1

Michael Stabile, Tridium

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Transitioning from Smart to Intelligent Buildings

Use cases of AI and Extended Reality in facility management and building automation

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Jeff Kimmel

Co-founder, Elipsa



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Transitioning from Smart to Intelligent Buildings

*Practical Use Cases of Applied
Artificial Intelligence*

A photograph of a city street scene featuring several tall palm trees in the foreground and a multi-story building with a light-colored facade and green window frames in the background. The sky is a clear, bright blue. A string of small, white, globe-shaped outdoor lights hangs across the upper right portion of the image.

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What is AI?



AI is the future



**AI is a rabbit
hole**



AI is ChatGPT

What is AI?

AI is the Present

Auto-Tagging
Baselining
Digital Twins
Fault Detection and Diagnostic

What is AI?

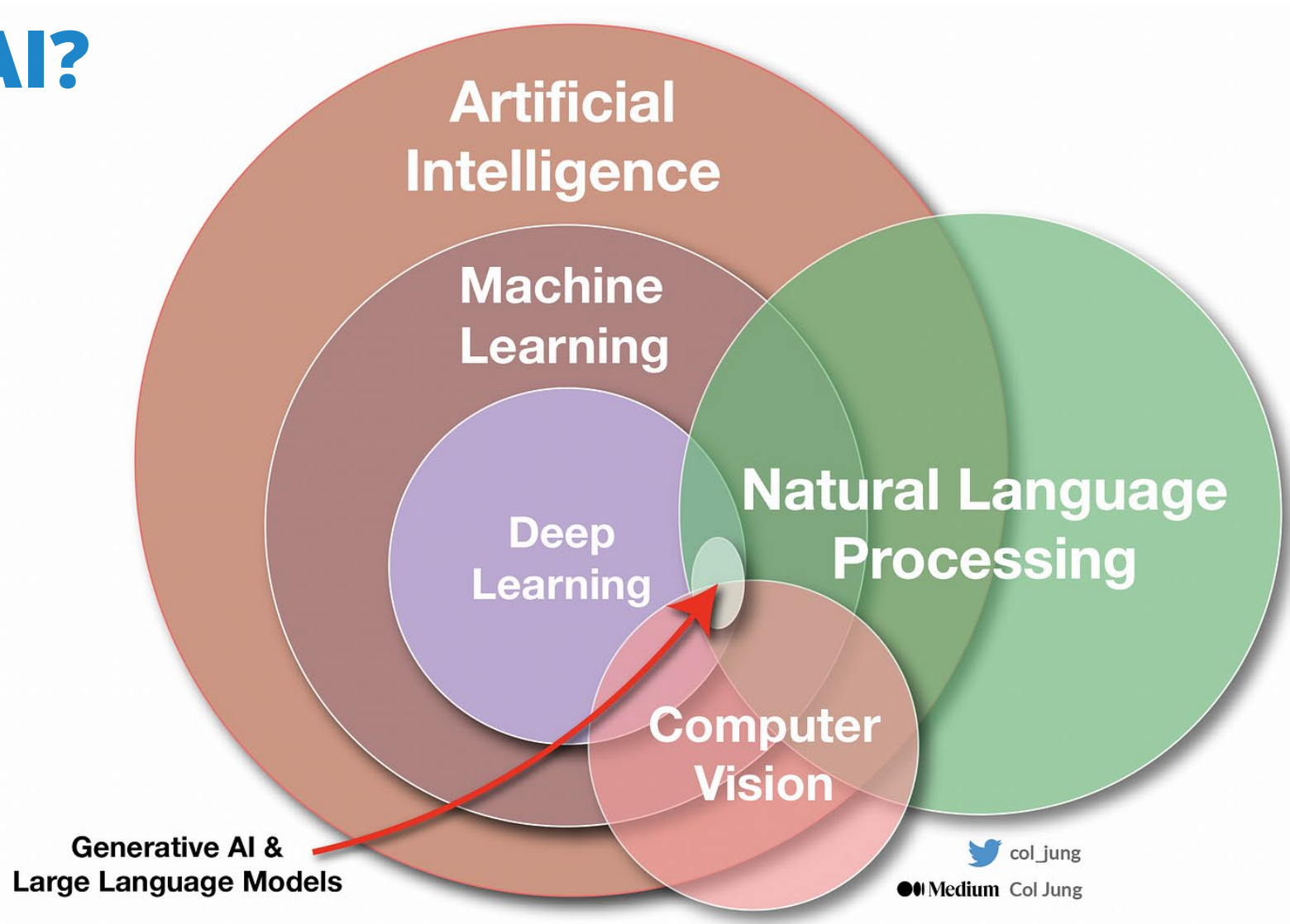


ChatGPT

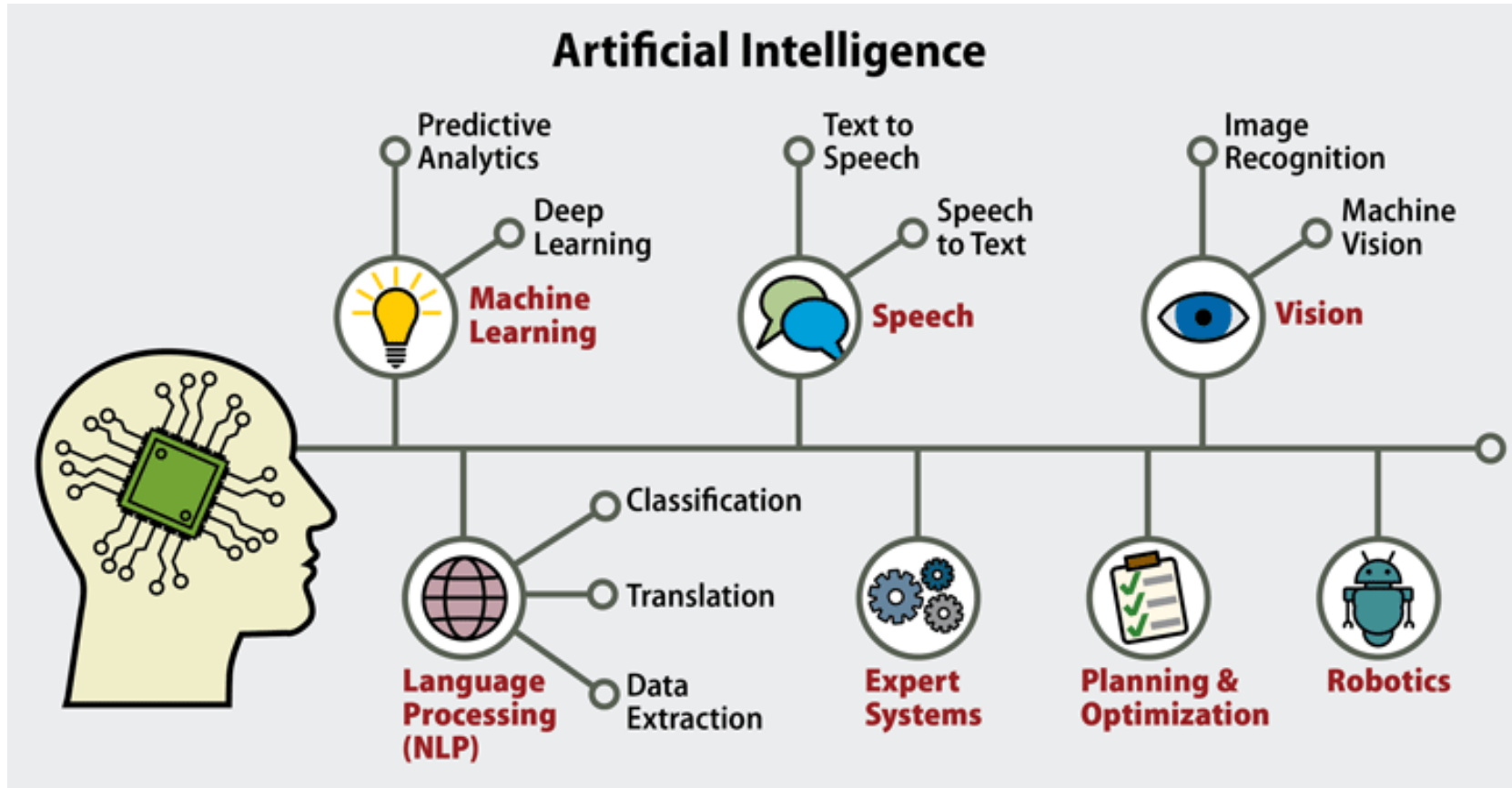
Credit: OpenAI

Gartner: A large language model (LLM) is a specialized type of artificial intelligence (AI) that has been trained on vast amounts of text to understand existing content and generate original content.

What is AI?



What is AI?



<https://swisscognitive.ch/2020/11/24/artificial-intelligence-2/>

Misconceptions of AI

AI is too difficult and costly to implement

I don't have enough data

AI doesn't apply to me

**It can't scale across an entire building never
mind a portfolio of buildings**

AI is only valuable to a building owner not an SI

AI must reside in the cloud

Misconceptions : Difficult and Costly to Implement

- Gather, Transform, Format and Split Data
- Choose Appropriate AI Algorithm
- Train Models and Tune Parameters
- Deployment in a Real-Time Environment
- Ongoing Monitoring and Re-Training



Misconceptions : Data and Computing Power



Source: Disney

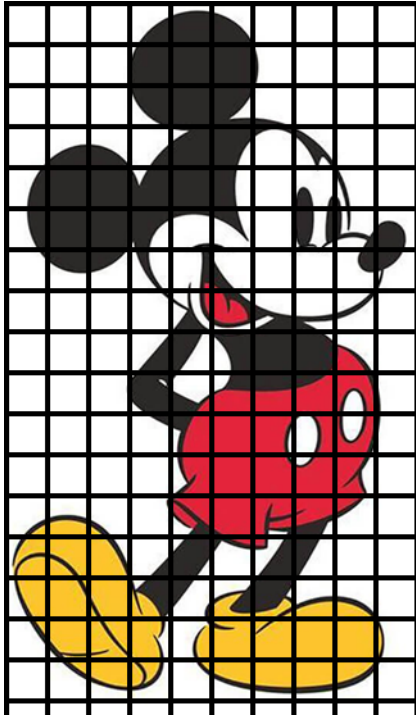


AI Example: Image Recognition

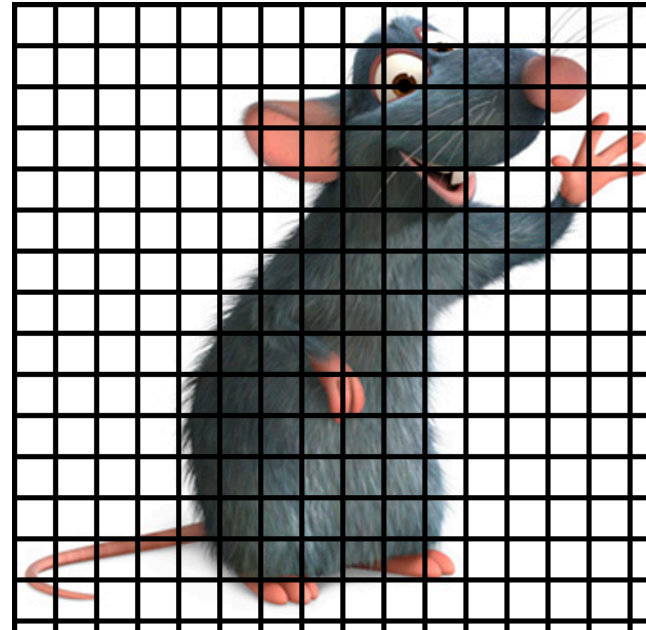
AI Needs Historical Data

Need hundreds of examples of labeled images for each “class” you are looking to classify

Misconceptions : Data and Computing Power



Source: Disney



Images and language get very complicated very quickly

Every pixel and every letter is a data point

Requires a lot of computing power typically only found in the cloud

Misconceptions : Data and Computing Power



Source: Carrier

Leverage the data that you already have

Historical data is generated as the machine runs

	Per Day	Per Week	Per Month
Every 15 Minute	96	672	2,688
Every 5 Minute	288	2,016	8,064
Every 1 Minute	1,440	10,080	40,320

Much more simplified data sets

Models can train and run on hardware as small as a raspberry pi

Unlock the Value Beneath Your Data



Source: AI



Source: Tridium

How?

Misconceptions : AI doesn't apply to me

Auto-Tagging
Baselining
Digital Twins
Fault Detection and Diagnostic

AI Applied

Auto-Tagging

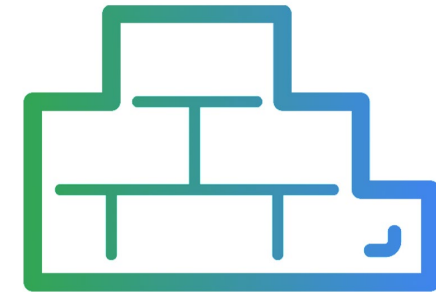
Auto-Tagging

Contextualized data unlocks the power of your building's data

Enables easy integration with advanced analytics

Shortage of Labor/Shortage of Time: not enough time to take on the job of tagging results in settling for the status quo

Hard to see to see the ROI

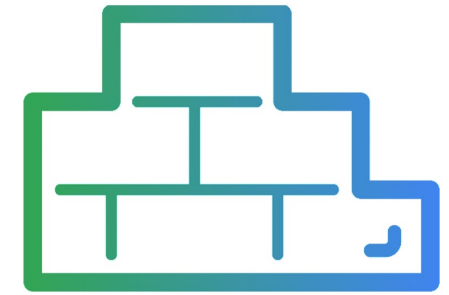


Brick Schema

Auto-Tagging

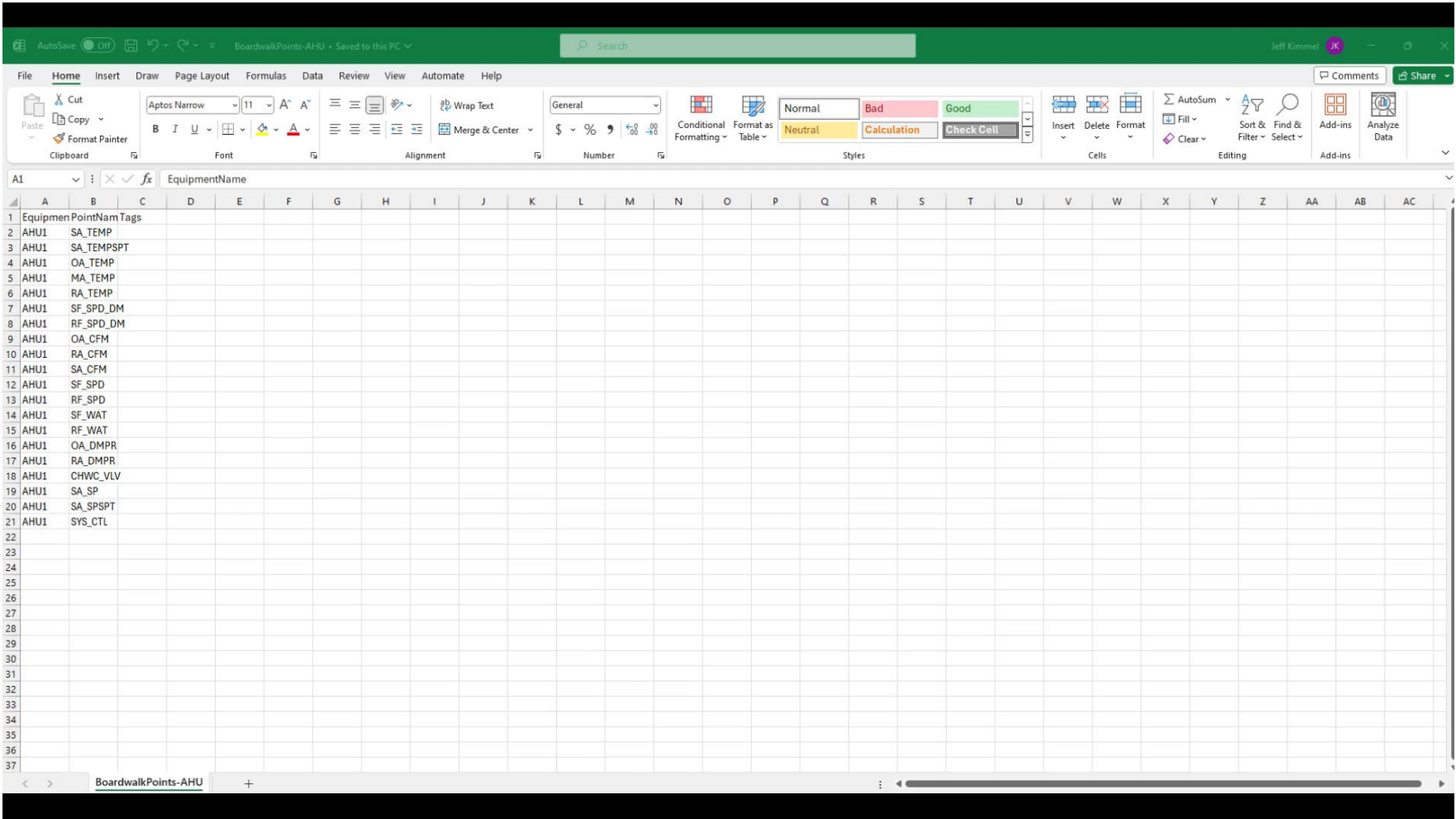
Elipsa Auto Tagging:

- Ingests equipment and point names
- Uses AI to suggest the equipment type and Elipsa point name
- Automatically applies tags to enable Elipsa advanced functionality while also exportable to update third party systems



Brick Schema

Auto-Tagging : AI to Unlock AI



The screenshot shows a Microsoft Excel spreadsheet titled "BoardwalkPoints-AHU". The spreadsheet has columns A through AC and rows 1 through 37. The data is organized into two columns: "EquipmentName" in column A and "PointNam Tags" in column B. The equipment names listed are AHU1, and the tags are various system parameters like SA_TEMP, SA_TEMPSPT, OA_TEMP, MA_TEMP, RA_TEMP, SF_SPD_DM, RF_SPD_DM, OA_CFM, RA_CFM, SA_CFM, SF_SPD, RF_SPD, SF_WAT, RF_WAT, OA_DMPR, RA_DMPR, CHWC_VLV, SA_SP, SA_SPSPPT, and SYS_CTL.

EquipmentName	PointNam Tags
AHU1	SA_TEMP
AHU1	SA_TEMPSPT
AHU1	OA_TEMP
AHU1	MA_TEMP
AHU1	RA_TEMP
AHU1	SF_SPD_DM
AHU1	RF_SPD_DM
AHU1	OA_CFM
AHU1	RA_CFM
AHU1	SA_CFM
AHU1	SF_SPD
AHU1	RF_SPD
AHU1	SF_WAT
AHU1	RF_WAT
AHU1	OA_DMPR
AHU1	RA_DMPR
AHU1	CHWC_VLV
AHU1	SA_SP
AHU1	SA_SPSPPT
AHU1	SYS_CTL

AI Applied

Baselining

Baselining

Establish a baseline of how a building or equipment has historically behaved in order to compare to ongoing operation.

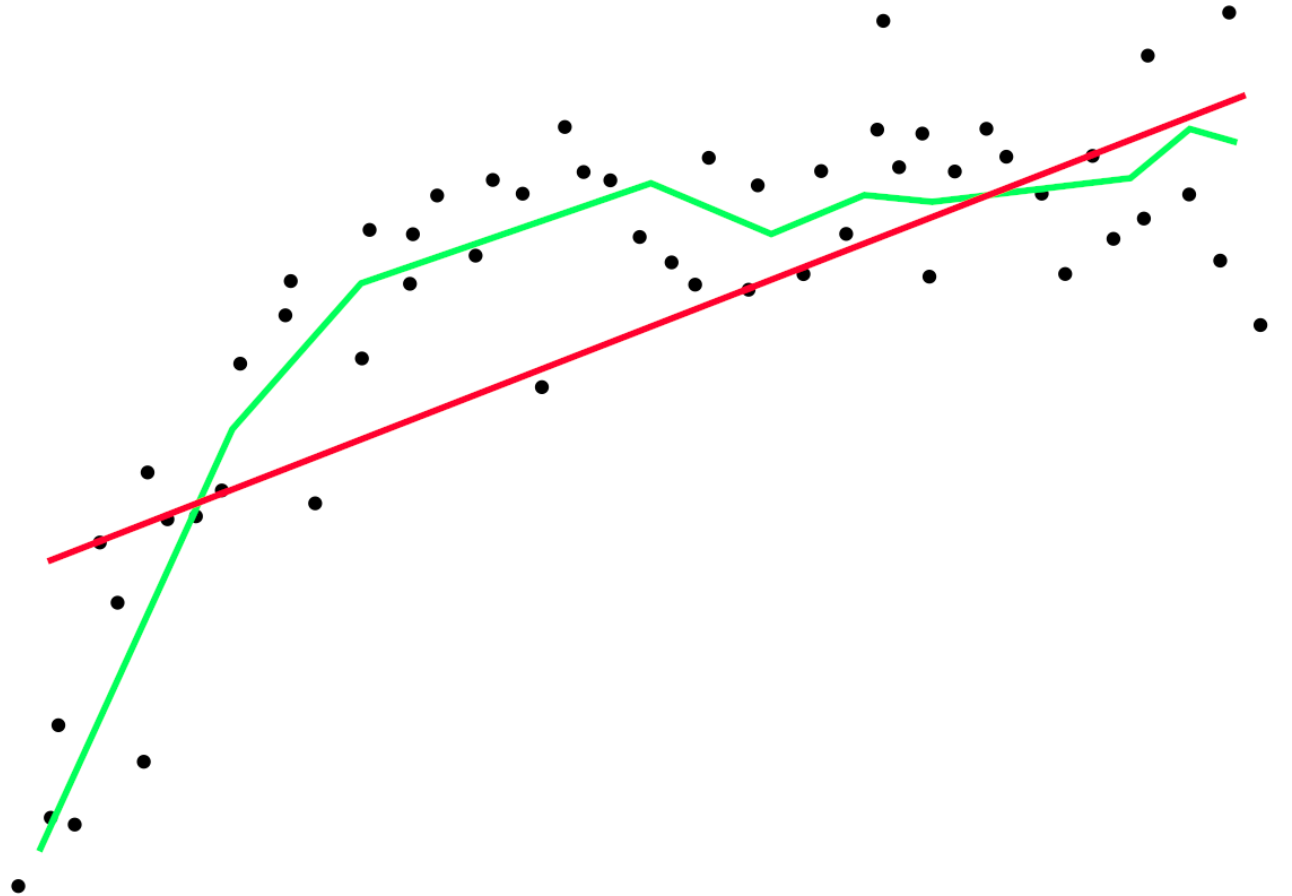
- Unit Testing for Commissioning
- Measurement and Verification for Sustainability:
 - Retrofits (installation of VFD or Economizer)
 - Change of Control Sequence
- Ongoing monitoring of building trends

Baselining : Why AI?

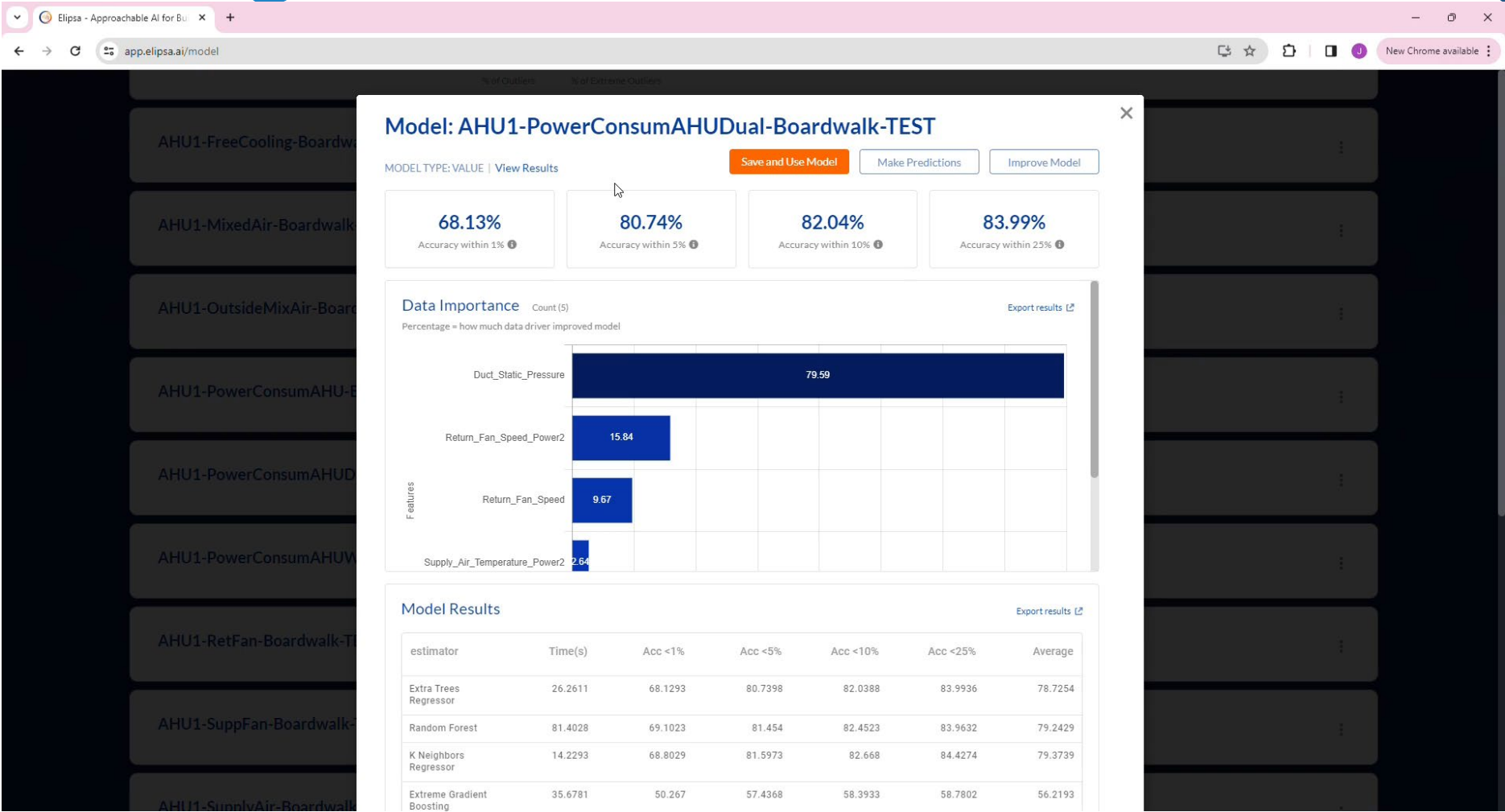
Baselining software traditionally utilizes Linear Regression formula.

Misconceptions of AI:

- Too difficult to implement
- Not repeatable
- Not enough data



Baselining : Automated Machine Learning



Baselining : Automated Machine Learning

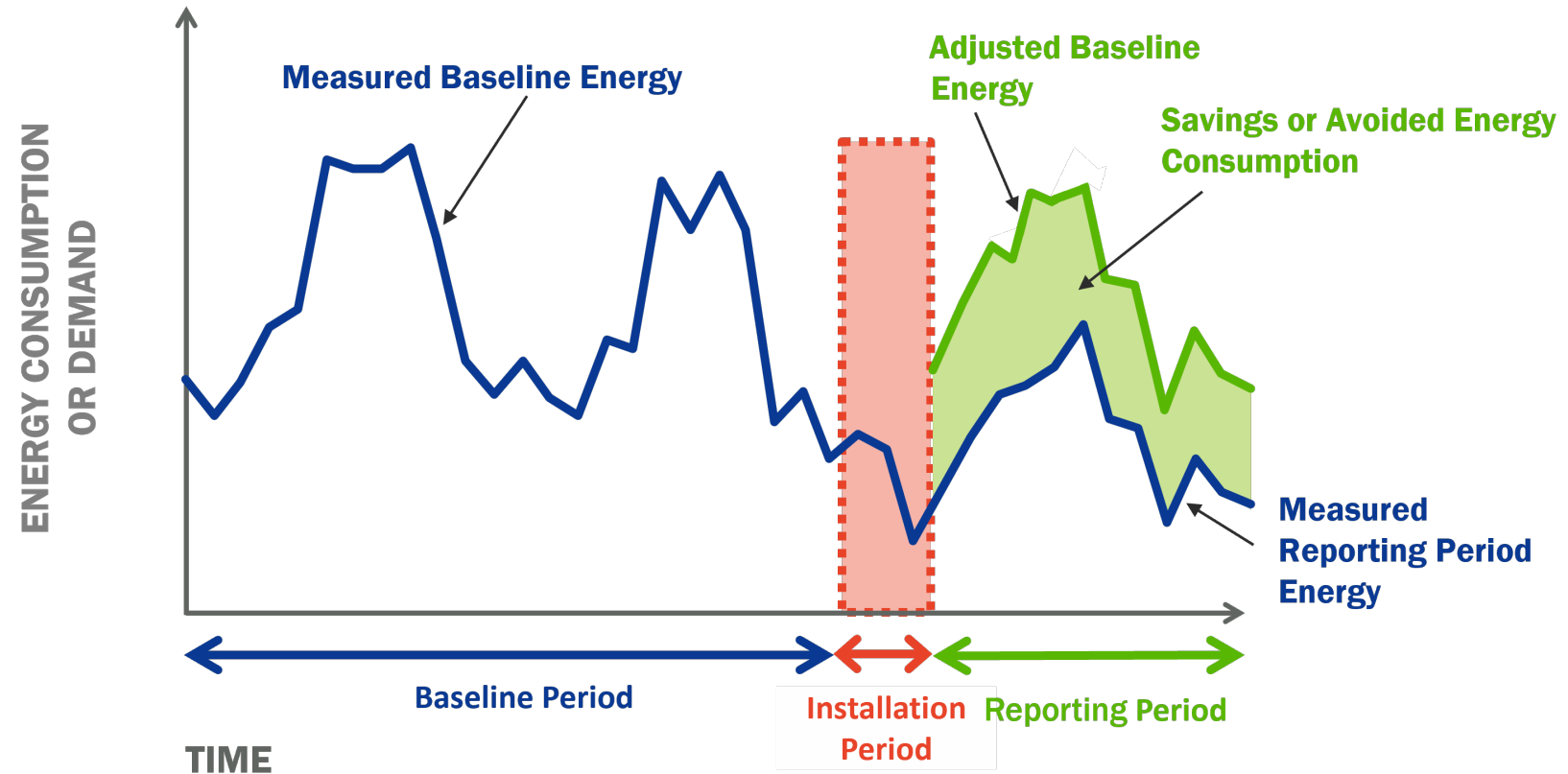
Average Prediction Accuracy

Extra Trees Regressor

98.73%

Linear Regression

33.73%



AI Applied

Functional Digital Twins

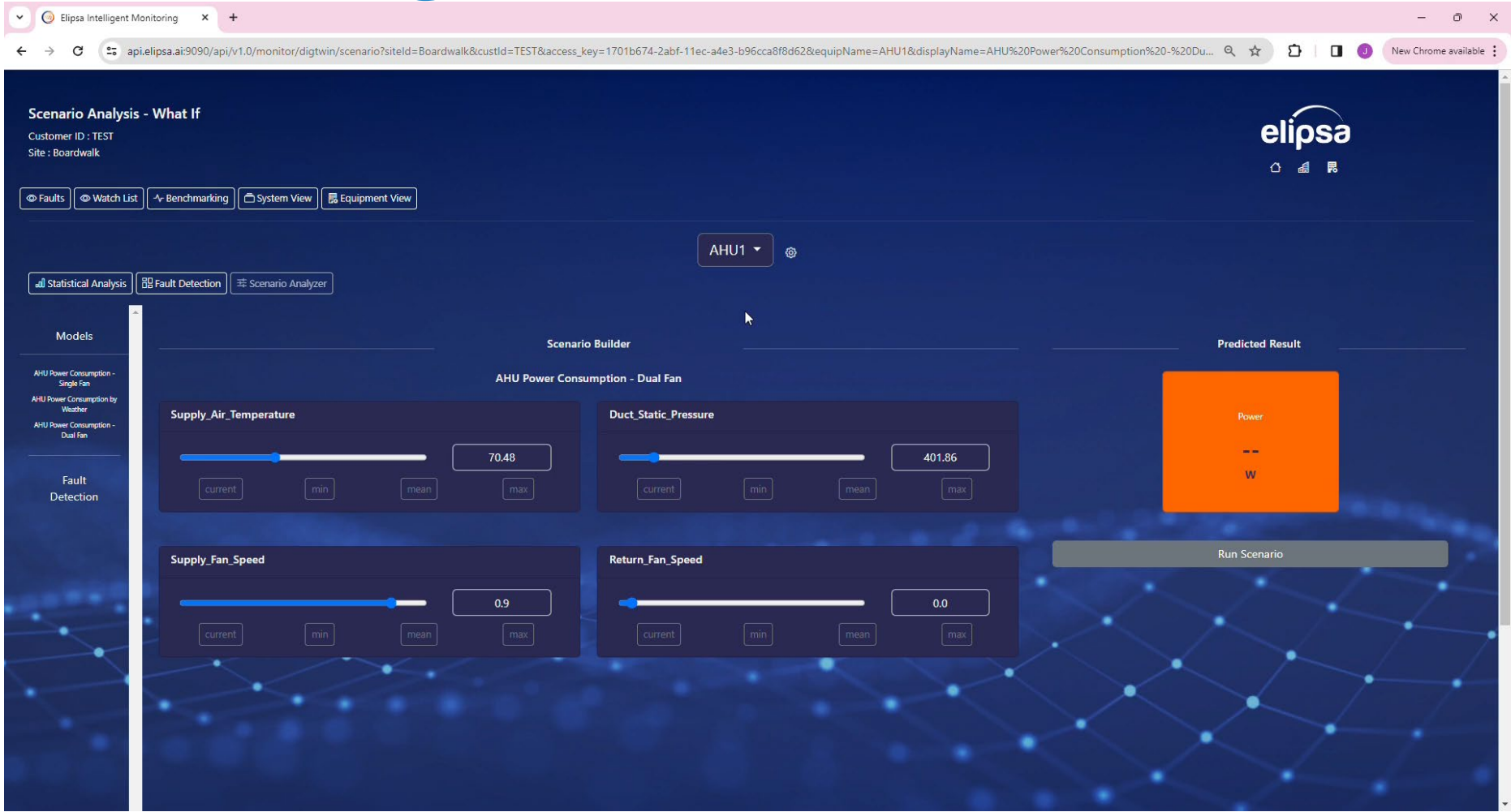
Functional Digital Twins

Real-time representation of your building's state coupled with AI to predict the future state of equipment under a given scenario

- Predict future values such as energy consumption, temperatures, etc.
- Stress test your system to how equipment will perform

Virtual Sensors

Functional Digital Twins



AI Applied

Fault Detection and Diagnostics (FDD)

Fault Detection and Diagnostics (FDD)

FDD systems utilize data from critical equipment to analyze performance patterns and detect abnormalities that may indicate faults or inefficiencies.

FDD helps optimize system operation, improve energy efficiency, and reduce maintenance costs while enhancing occupant comfort and safety.

Traditionally implemented via rules/thresholds

Why AI?

- Learns behavior of individual pieces of equipment. Finds the appropriate threshold
- Reduces implementation time
- Adjusts to changes in behavior over time

Result of AI Combined with Rules

- More accurate monitoring with less setup time

Fault Detection and Diagnostics (FDD)

Equipment Deployment Templates

Best of breed rules and automated AI offer the best of both worlds

ASHRAE 36 Rules

Automated implementation of ASHRAE
Automated Fault Detection rule sets

Start monitoring within one hour of setup

AI-Based Anomaly Detection

Based off of ASHRAE standards, models
monitor individual system components,
learning patterns of normal behavior to
monitor for abnormalities

Reduces the amount of data needed for
model training:

- Can be utilized for commissioning as well as ongoing monitoring

Fault Detection and Diagnostics (FDD)

Elipsa Intelligent Monitoring

api.elipsa.ai:9090/api/v1.0/monitor/equipment/edit?siteId=Boardwalk&custId=TEST&access_key=1701b674-2abf-11ec-a4e3-b96cca8f8d62&equipName=AHU1

New Chrome available

Elipsa Platform Configuration

Customer ID : TEST
Site : Boardwalk

elipsa

Edit Equipment
AHU1

Faults

Watch List

Benchmarking

System View

Equipment View

Equipment Details:

Name: AHU1 (hs:ahu, hs:hvac, hs:equip.)

Type: AHU

Add AHU1 To Equipment In

Equipment In:

Equipment Out:

Sub-Equipment:

Sub-Equipment Of:

Save Equipment

Points

Models

Rules

Point Names: Enter comma separated list of point names to add...

Equipment Name: AHU1

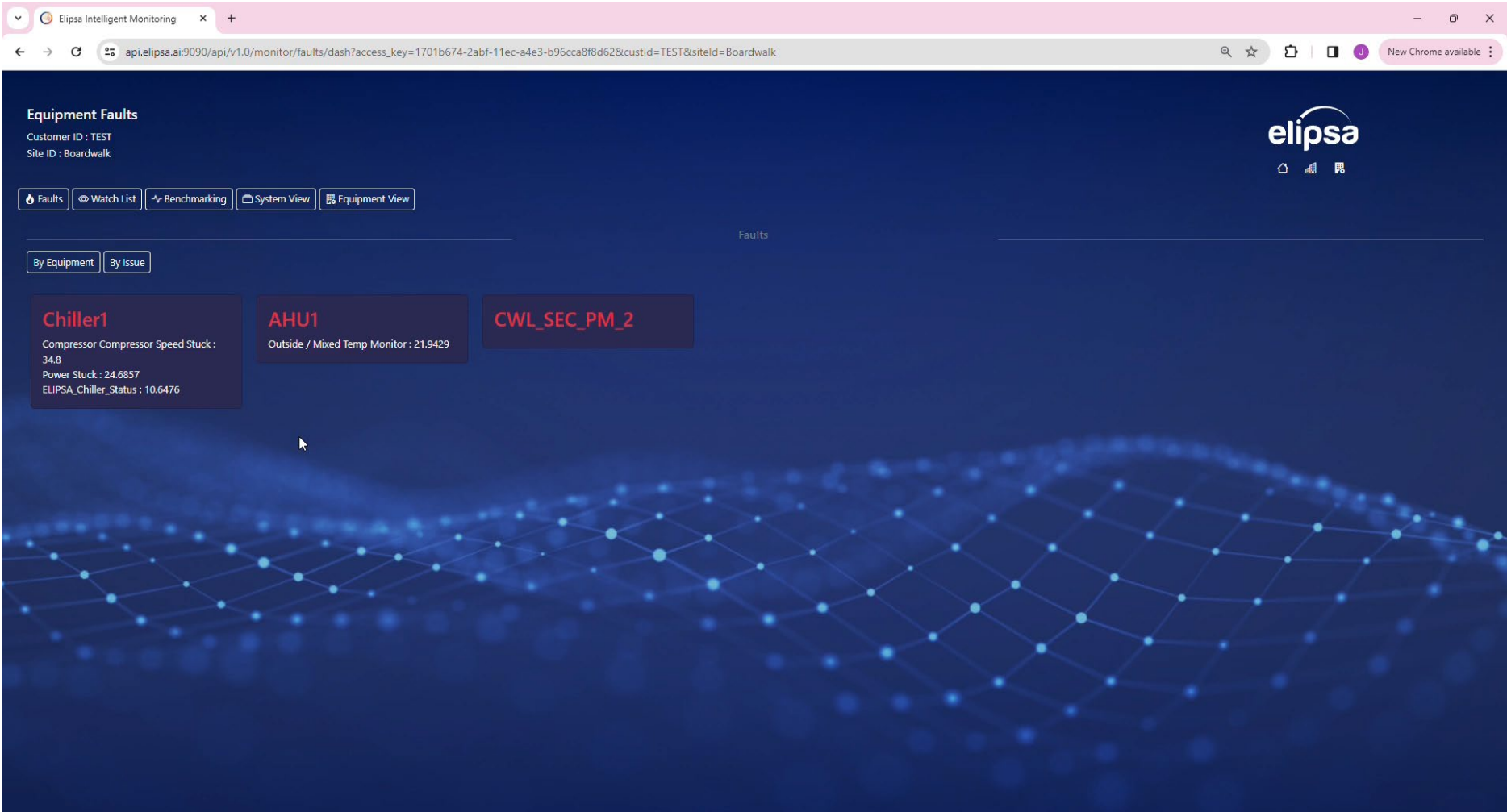
Add Points

Equipment Point Details

Fault Detection and Diagnostics (FDD)

Real-Time Monitoring

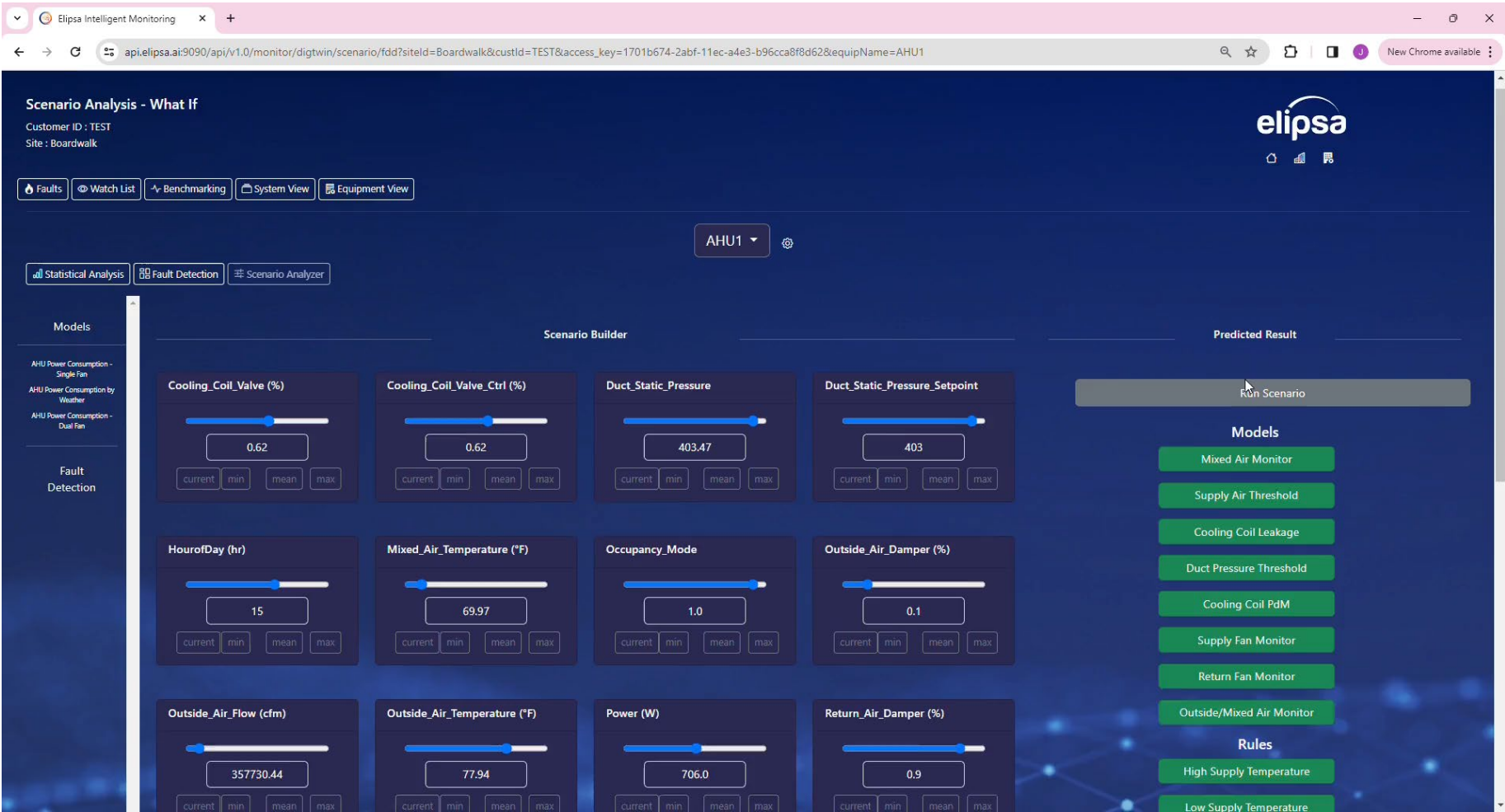
Fault Detection and Diagnostics (FDD)



Fault Detection and Diagnostics (FDD)

Unit Testing / Stress Testing

Fault Detection and Diagnostics (FDD)



AI is not just the future it is the present

Auto-Tagging
Baselining
Digital Twins
Fault Detection and Diagnostic

Transitioning from Smart to Intelligent Buildings

- AI use cases to help drive better decision making
- Leverage the data that you already have
- Automated Machine Learning to eliminate the complexities and increase speed to insights



SCAN ME

<https://www.elipsa.ai>

info@elipsa.ai

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Michael Mitchell

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Cochrane Supply*



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TechXR

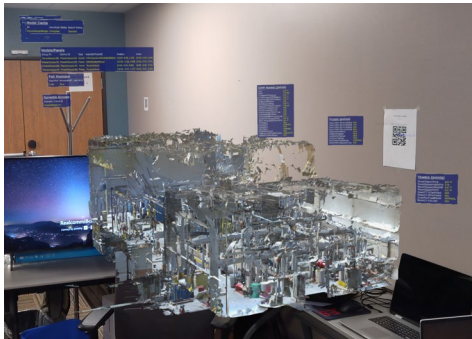
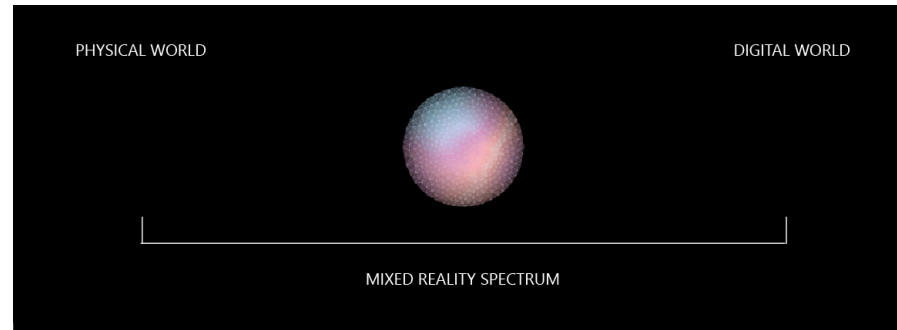


Visualizing your control system and AI via Niagara 4 and the HoloLens 2

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What is Mixed or Augmented Reality?

- A blending of your view of the digital and physical worlds. Software and devices that do this overlay added information to your view of the physical world around you.



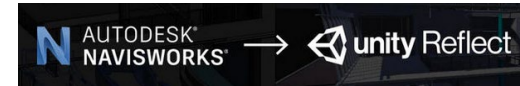
What is the Hololens 2 device?

- The latest version of a Mixed Reality-providing device presented by Microsoft. It leverages the latest in Mixed Reality software and works with great development platforms based on industry standards. Development platforms include Visual Studio, Unity, Blender, Revit, 3dStudio, NavisWorks, and many others.
- Key difference from other platforms – it doesn't obscure your regular vision, its just like wearing very light sunglasses!



What advantages does it give my business?

- Visualize building control spaces, with real time data, hands free
 - From small zone controllers to enormous control plants/systems/buildings
 - BIMS style coordination for equipment placement
 - Live data! Sourced from your friendly neighborhood Niagara 4 Station!
- Remotely communicate, hands free, tech-to-tech, or tech-to-support
 - It's an expert on your shoulder for:
 - support, maintenance, repairs, inspection, training
- Create Impactful Education/Training
 - Procedures for wiring up panels, controllers
 - Equipment testing procedures
 - Familiarization with Control Systems
- Great Apps Already Exist
 - Two apps from Microsoft – Remote Assist and Guides
 - One app from Cochrane Supply – TechXR!



Microsoft Dynamics 365 Remote Assist

- A HoloLens App that allows remote expertise to be available to onsite technicians for diagnosis of building issues. Remote technicians can “see through the eyes” of the onsite crew, superimposing holographic whiteboard information and documents to assist in maintenance and troubleshooting.



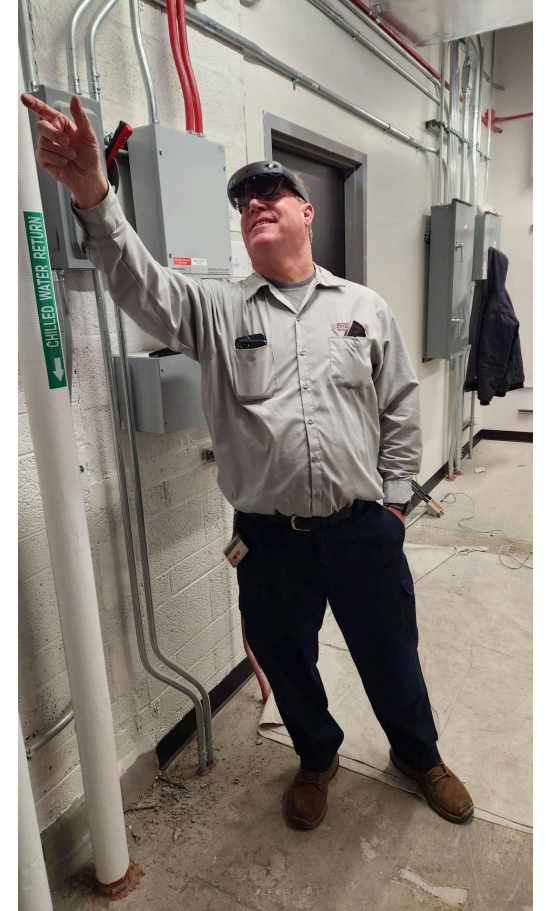
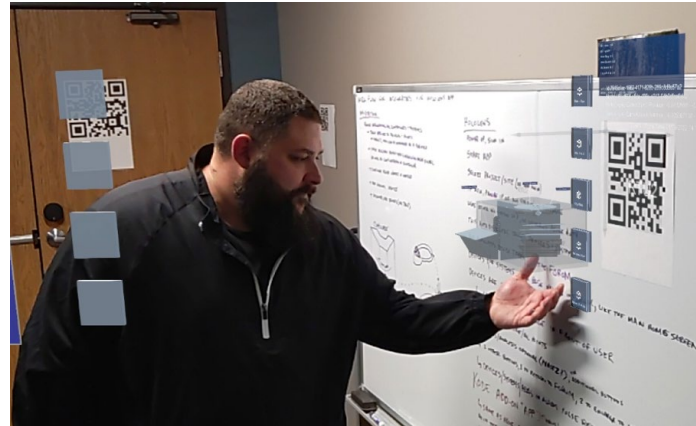
Microsoft Dynamics 365 Guides

- Allows the integrator to create holographic building information like **user training, maintenance steps, equipment path finding**, and easy access documentation such as: as-builts, installation guides, and manufacturer documentation. Author and Operator roles can be the domain of building owners, service personnel, integrators, or Cochrane Technical support staff.



TechXR

- It's a combination of a *Hololens 2 App* that connects to a *Niagara 4 Service*!
- The **TechXRService** in your Niagara 4 station advertises data and 3d models to a Microsoft Hololens 2 device app.
- The **TechXR Hololens app** presents live Niagara 4 Station data!
- It also can include web links to other sites (*Elipsa AI!*), 3D representations of devices, floor plans, duct work, piping layouts, building or campus renderings, as-builts, installation guides, and any other important information for the site.



TechXR – Niagara 4 Module

- The TechXR Module contains all the station objects you'd need to define your project.
- Data Models are created that define scopes of data points – from a simple Zone Controller space to an overview of an entire plant or campus.
- Dynamic Groups use the Data Models to present your selected 3d models, panels of live data, and hyperlink buttons to open other sites, defined by a QR Code!

The screenshot displays the TechXR Niagara 4 module interface, showing the configuration of a TechXRService. The interface is divided into several panes:

- Nav Pane:** Shows the project hierarchy. The 'Station (UTX_Jace01)' is selected, and the 'TechXRService' is highlighted under the 'Services' folder.
- Property Sheet:** Displays the configuration for the 'TechXRService (Tech X R Service)'. The 'Status' is set to '{ok}', 'Enabled' is 'true', and 'Is Master Station' is 'false'. The 'Models' section shows a 'Tech X R Model Container' with 'HeatPump' and 'AllHeatPumps' devices. The 'Dynamic Groups' section shows a 'Tech X R Dynamic Group Container' with 'HeatPumpDG' and 'FloorplanDG' definitions. The 'Object Definitions' section shows a 'Tech X R Dynamic Object Container' with 'AllHeatPumps' definition. The 'Panels' section shows a 'Tech X R Dynamic Panel Container' with 'HeatPumpPanel1' through 'HeatPumpPanel4' and 'ButtonsPanel' definitions.
- Device List:** A table listing devices added to the service.
- Device Info:** A pane showing details for a selected device, including a QR code.
- Slots:** A table showing the resolved points for the devices.

ID	Added?	Name	Device Type	Slot Path	Manage
UTX_Jace01:28f41	✓	BspBacknetNetwork	AllHeatPumps	/Drivers/BspBacknetNetwork	
UTX_Jace01:27664	✓	HP01	HeatPump	/Drivers/BspBacknetNetwork/HP01	
UTX_Jace01:28563	✓	HP02	HeatPump	/Drivers/BspBacknetNetwork/HP02	
UTX_Jace01:28591	✓	HP03	HeatPump	/Drivers/BspBacknetNetwork/HP03	
UTX_Jace01:28548	✓	HP04	HeatPump	/Drivers/BspBacknetNetwork/HP04	

Name	Originator	Ord	Resolved Point	Present Value	Manage
Heat1	AllHeatPumps	heat1:techxr:heat and techxr:enable and is parent is parent is name=HP01 single	HP01/points/heat	blue (faultable) @ def	
Heat2	AllHeatPumps	heat2:techxr:heat and techxr:enable and is parent is parent is name=HP02 single	HP02/points/heat	blue (faultable) @ def	

TechXR – Hololens 2 App

- View the 3d Models and data by glancing at a QR Code
 - These can be mass printed from a view on the TechXR Service, or even viewed from a browser on PC/Laptop or Cell Phone
- Each QR Code defined can display multiple types of views of the same devices
 - Example: An Air Handler that we'd like to show as a small scale 3d model, with a couple of data panels and links around it; then, another view of it that shows the life-size actual positions of the air handler components and sensors, including ductwork and floorplan, in order to visualize the zones that the air handler serves
- Niagara Station connections are defined in the Station Manager



Thank You!

*Visit us at Booth
#312!*

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