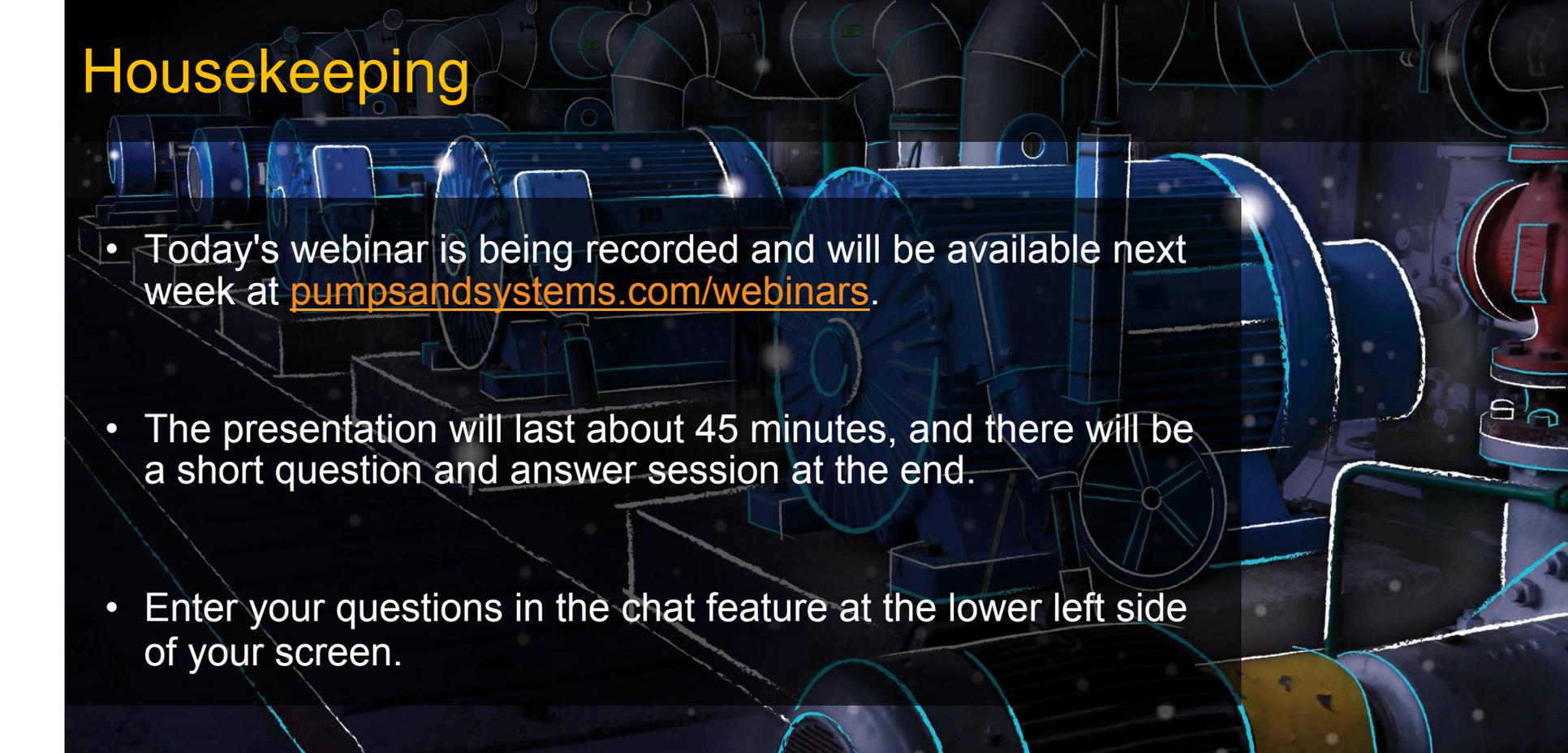




# How to integrate IoT & motors

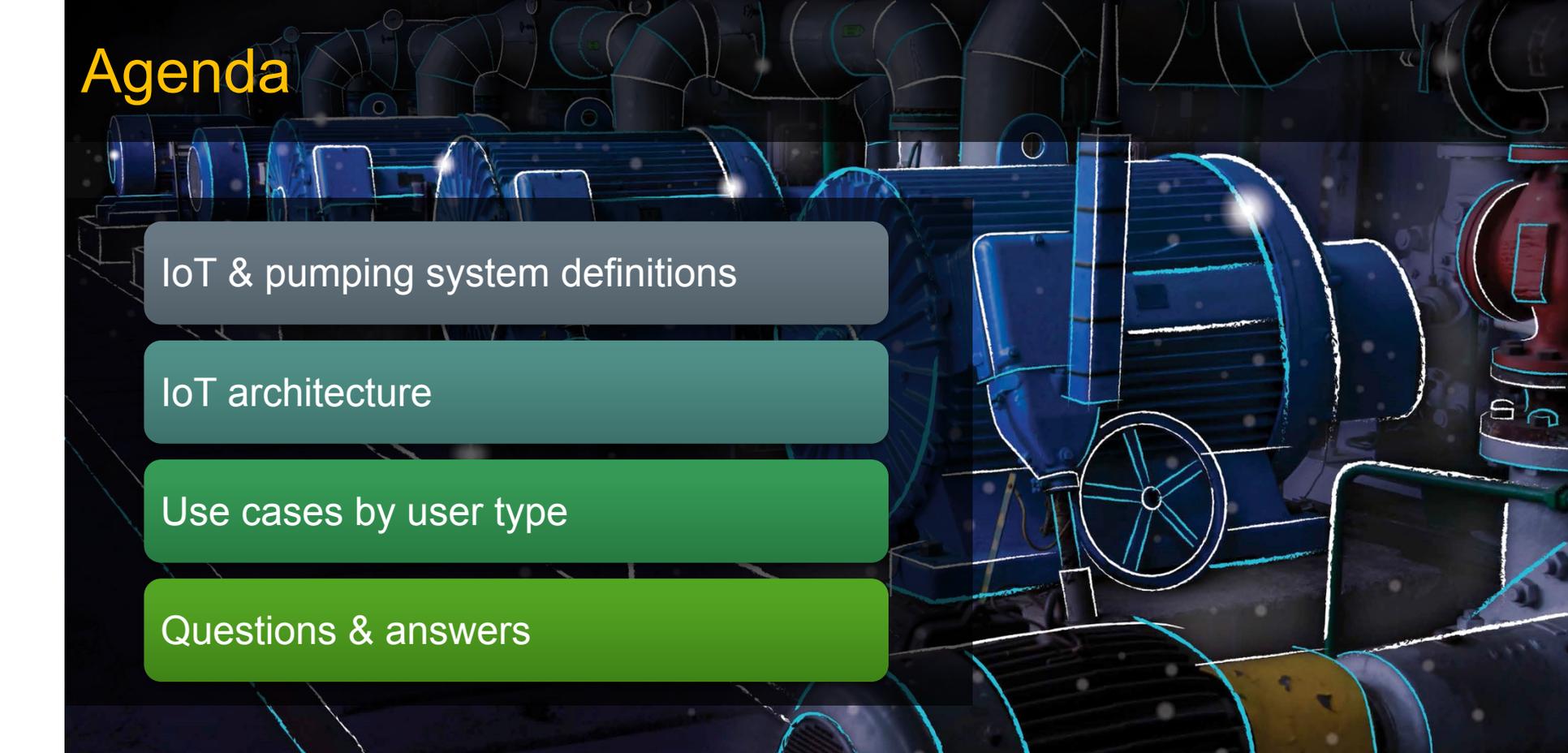
Presented by: Jake Wysocki & Nicole George

# Housekeeping



- Today's webinar is being recorded and will be available next week at [pumpsandsystems.com/webinars](https://pumpsandsystems.com/webinars).
- The presentation will last about 45 minutes, and there will be a short question and answer session at the end.
- Enter your questions in the chat feature at the lower left side of your screen.

# Agenda



IoT & pumping system definitions

IoT architecture

Use cases by user type

Questions & answers

# Poll question

- What type of organization do you represent?
  - Manufacturer
  - Consulting engineer
  - Distributor
  - Contractor
  - Systems integrator
  - Service provider
  - End user
  - Other

# Definitions of IoT pumping systems

# Definitions

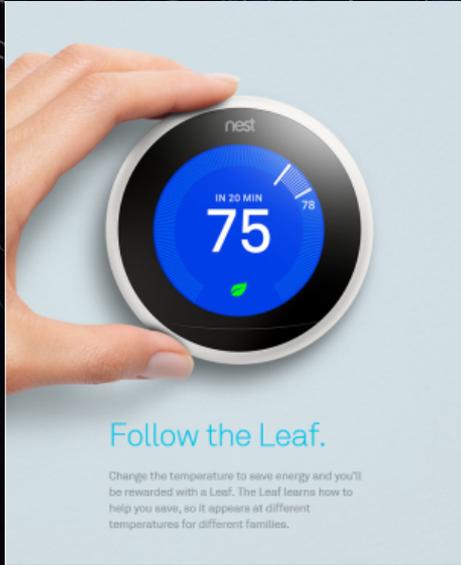
## Internet of Things (IoT)

- Network-connected devices that can produce, analyze and exchange data

## Pumping system

- Pump, motor, starter and controls

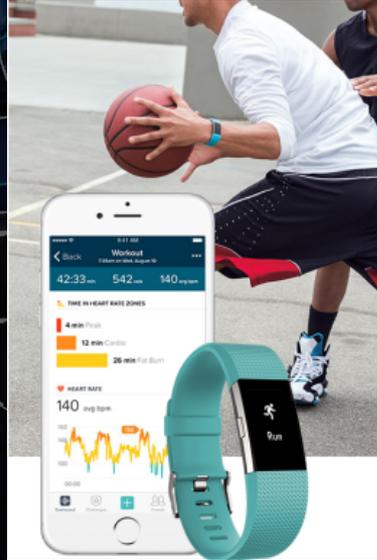
# Consumer examples



A hand is shown adjusting a Nest smart thermostat. The thermostat's circular display shows a temperature of 75 degrees Fahrenheit, with a green leaf icon indicating energy-saving mode. The text "IN 20 MIN" is visible above the temperature.

**Follow the Leaf.**

Change the temperature to save energy and you'll be rewarded with a Leaf. The Leaf learns how to help you save, so it appears at different temperatures for different families.



A composite image featuring a person playing basketball in the background. In the foreground, there is a smartphone displaying a fitness app interface with various metrics and a teal Fitbit smartwatch.

The smartphone screen shows:

- Time in Heart Rate Zones: 4 min Peak, 12 min Cardio, 26 min Fat Burn
- Heart Rate: 140 bpm



The Amazon Echo smart speaker is shown in a minimalist setting. The word "echo" is written in blue above the device, and the "amazon" logo is at the bottom of the speaker's fabric mesh.

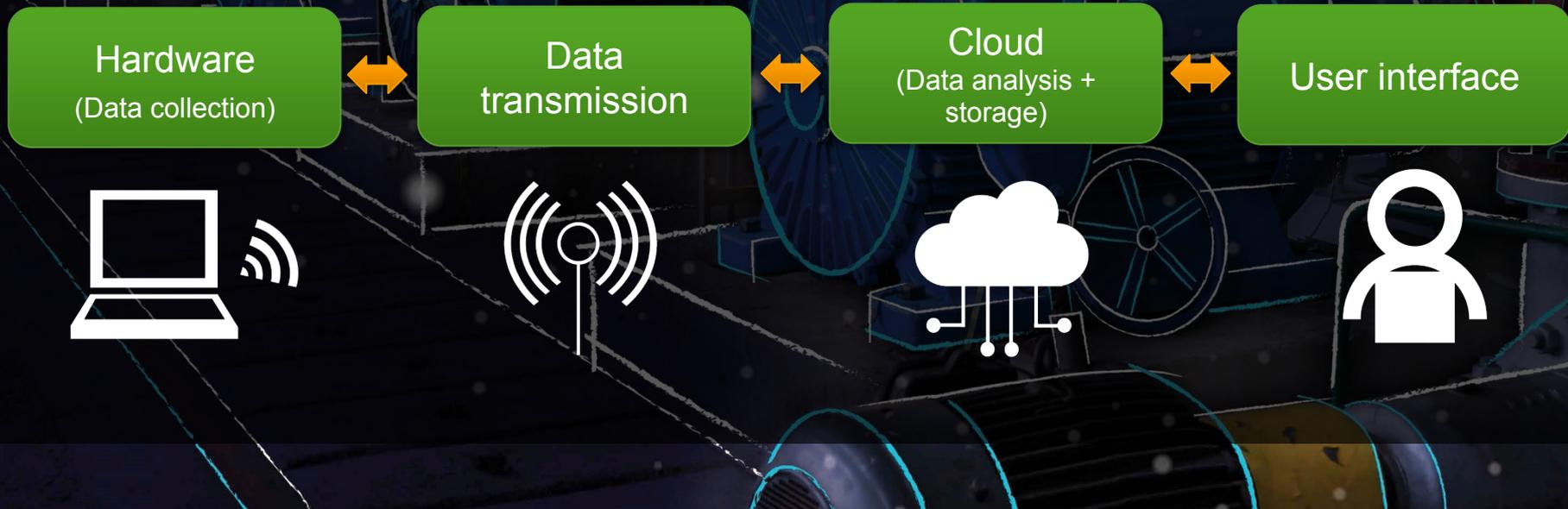
Below the speaker, a row of partner service logos is displayed: music, P, Spotify, SiriusXM, news, WeMo, dish, and UBER.

## Poll question

- According to a Gartner study, how many connected devices will be installed in 2020?
  - 3 billion
  - 12 billion
  - 26 billion
  - 54 billion

# IoT architecture

# IoT architecture



# Hardware

Data collection



**Consumer**

**Industrial**

# Data transmission



# Cloud

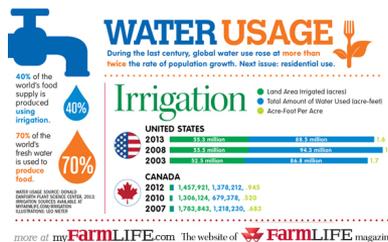
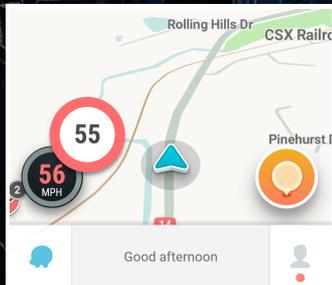
Data analysis + storage



"Now" Analytics

"Past" Analytics

"Future" Analytics



# User interface

A screenshot of a web application interface. It features a green header with a 'T' logo, a 'LOGIN' section with fields for Username and Password, and a 'My equipment' section containing a table of equipment details and a calendar view.

MODEL	UNIT PRICE	STOCK		
Model X 100 (2Y with battery)	595.00	✓		
Model X 150 (2Y with battery)	595.00	✓		
Range	Acceleration	Temp	Tap Level	Water Level
270 m/s	4.2 m/s/s (0.01 g)	400 m/s	150 cm	225 l/s (hot and red)
90 kWh upgrade with 5%				417 l/s
Model X 100 (2Y with battery)	595.00	✗		
Model X 150 (2Y with battery)	595.00	✗		
Model X 100 (2Y with battery)	595.00	✗		
Model X 150 (2Y with battery)	595.00	✓		



# Poll question

- How would you describe your organization's engagement with IoT?
  - Our pumping systems are IoT enabled
  - We see the value of IoT but haven't installed devices onto our system yet
  - We need to learn more about IoT
  - We don't clearly see the value or business justification of IoT

# Use cases by user type

# Equipment manufacturers

Value



Remote troubleshooting & diagnosis



Data analytics & product development



Enable downstream value chain

# Equipment manufacturers Architecture

## Traditional systems

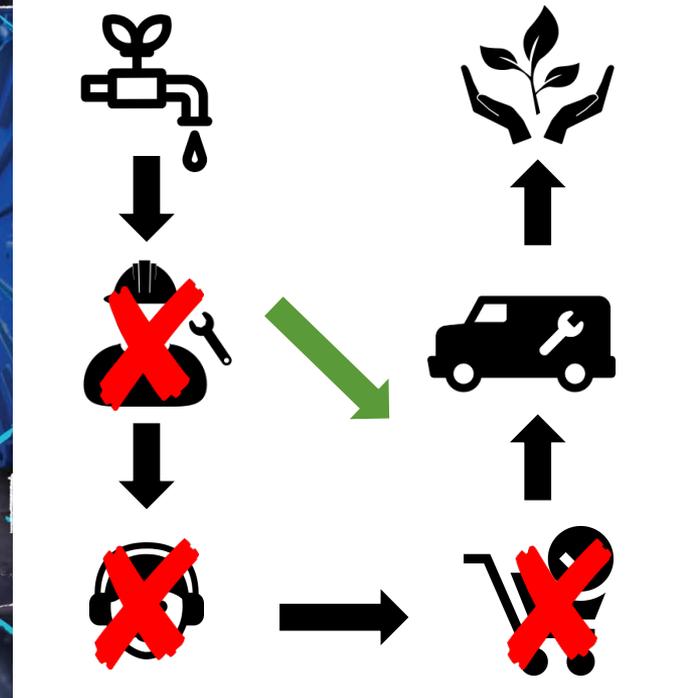
- Irrigation pump
- Operator discovers failure
- Calls OEM for troubleshooting support
- Orders parts
- Drives back to pump for installation
- Operator installs parts

3 days, 8 labor hours

## Connected systems

- Irrigation pump
- Data analytics predict potential failure
- System alerts OEM as part of premium technical support
- OEM proactively advises preventative maintenance and sends replacement parts
- Operator receives parts and installs

0 days, 1 labor hour



# Equipment distributors

Value



Replacement parts



Predictive

Get the  
right parts  
at the right  
time

# Equipment distributors

## Architecture

### Traditional systems

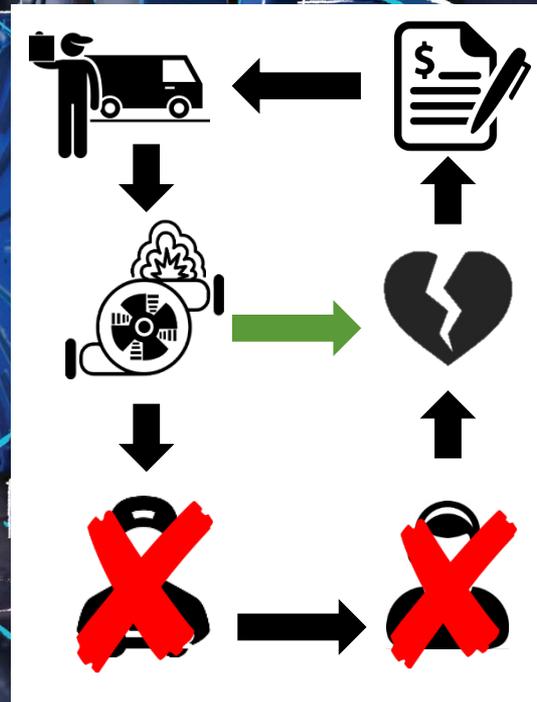
- Distributor sells VFD pump system
- System begins to run poorly
- Operator discovers failure
- Calls OEM for troubleshooting support
- Services finds broken seal
- Sends PO to distributor
- Distributor orders replacement parts

2 days, 6 labor hours

### Connected systems

- Distributor sells connected VFD pump system
- VFD auto detects decline in system performance
- VFD predicts seal failure based on data analytics
- Error note is sent to user
- PO is sent to distributor automatically

0 days, 0 labor hours

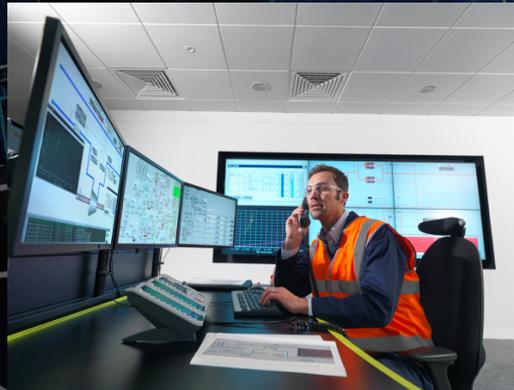


# Service providers

Value



Remote monitoring



Predictive diagnostics



Solve problem in one trip

# Service providers

## Architecture

### Traditional system

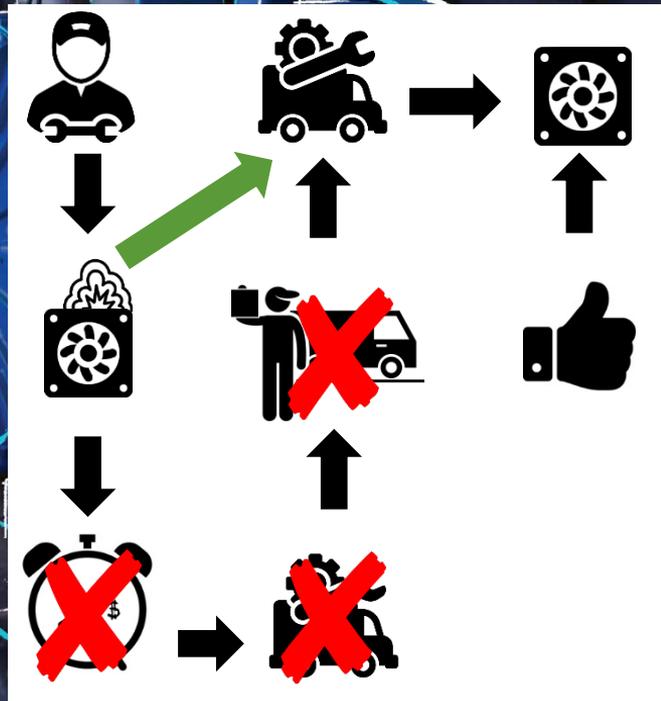
- SP performs startup and commissioning on system
- Cooling fan nearing end of life begins to cause system to slowly deteriorate
- System fails causing unscheduled downtime
- User calls SP to get them on site
- SP travels to site to find a failed cooling fan after hours of troubleshooting
- Drives to distributor to pick up replacement part
- Drives back to user to install part and get user running again

1 day, 12 labor hours

### Connected system

- SP performs startup and commissioning on system
- Cooling fan nearing end of life begins to cause system to slowly deteriorate
- Connected VFD sends alert to SP notifying them of system performance
- SP remotely monitors system to determine severity
- System automatically orders replacement part
- SP gets planned downtime schedule from user
- SP installs replacement cooling fan on one visit and without unplanned downtime

1 days, 2 labor hours



# System integrators

Value



Startup & commissioning



Troubleshooting

Labor  
savings

# System integrators

## Architecture

### Traditional system

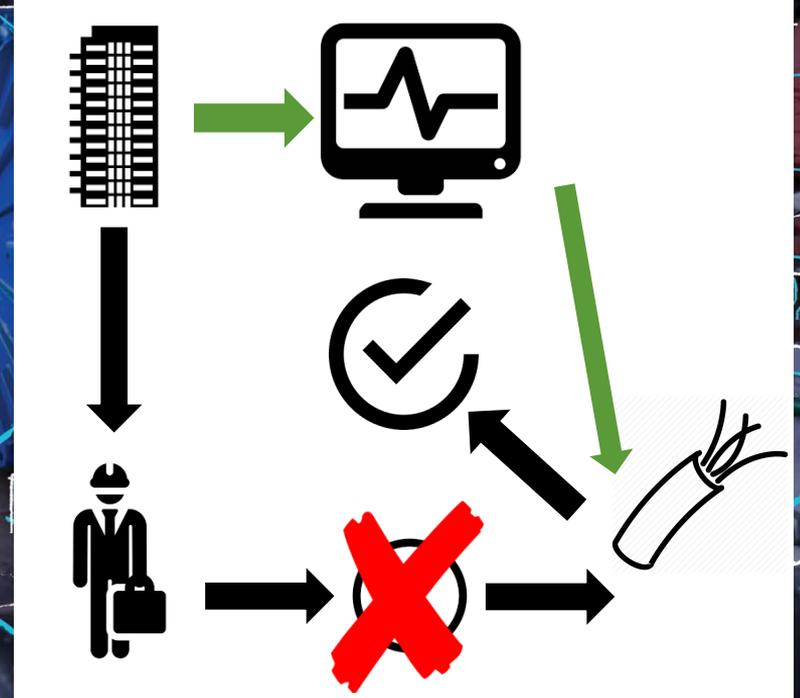
- New booster pump system arrives at commercial high-rise building
- Field engineer arrives for startup & commissioning
- System checks fail and field engineer pulls up VFD, pump, motor and sensor manuals to troubleshoot
- Field engineer finds loose wire and restarts system checks

1 day, 8 labor hours

### Connected system

- New booster pump system arrives at commercial high-rise building
- Field engineer arrives for startup & commissioning
- Connected HMI performs system check when powered on
- Connected HMI detects loose connection between pressure gage and VFD
- Field engineer corrects wiring and completes startup

0 days, 1 labor hour



# End users

Value



Predictive diagnostics (downtime)



System optimization (efficiency)

Reduce  
total cost  
of  
ownership

# End users

## Architecture

### Traditional system

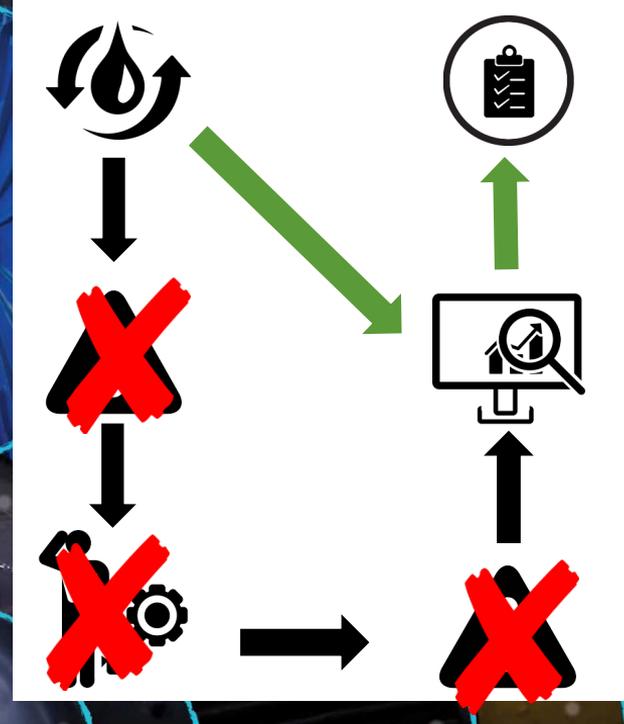
- Water treatment facility has 10 VFDs installed on critical pumps
- 3 VFDs continue to display faults
- Electricians work to troubleshoot and find root cause through trial and error
- Faults cleared and reset but VFDs continue to fault

10+ days, 40+ labor hours

### Connected system

- Water treatment facility has 10 VFDs installed on critical pumps
- Connected VFDs with health & wellness algorithms send data to server for analytics
- Data analytics identify cavitation as potential failure mode
- System alerts electrician with recommended preventative maintenance

0 days, 1 labor hour



# Poll question

- Where do you see the most value for IoT in pumping?
  - Collecting performance data for analytics
  - Alarming and notifications of system status
  - Predictive diagnostics and failure prevention
  - Startup and commissioning
  - Remote troubleshooting
  - Artificial intelligence and machine learning

# The Eaton solution

# Eaton solutions

## PowerXL™ VFD family

- Active Energy Control™
- Single-phase applications
- Multi-pump control
- Flying start
- Built-in communications
- Dual PID control
- Expandable I/O



## Advancing your pumping system

The PowerXL™ drives family is engineered to provide a complete solution for your demanding pumping applications. The PowerXL DE1, DC1, DA1 and DG1 provide the reliable performance you need while also generating the energy savings you want. With advanced yet easy-to-use features, precise system control and dedicated product support, the PowerXL drives are designed to optimize your pumping systems.

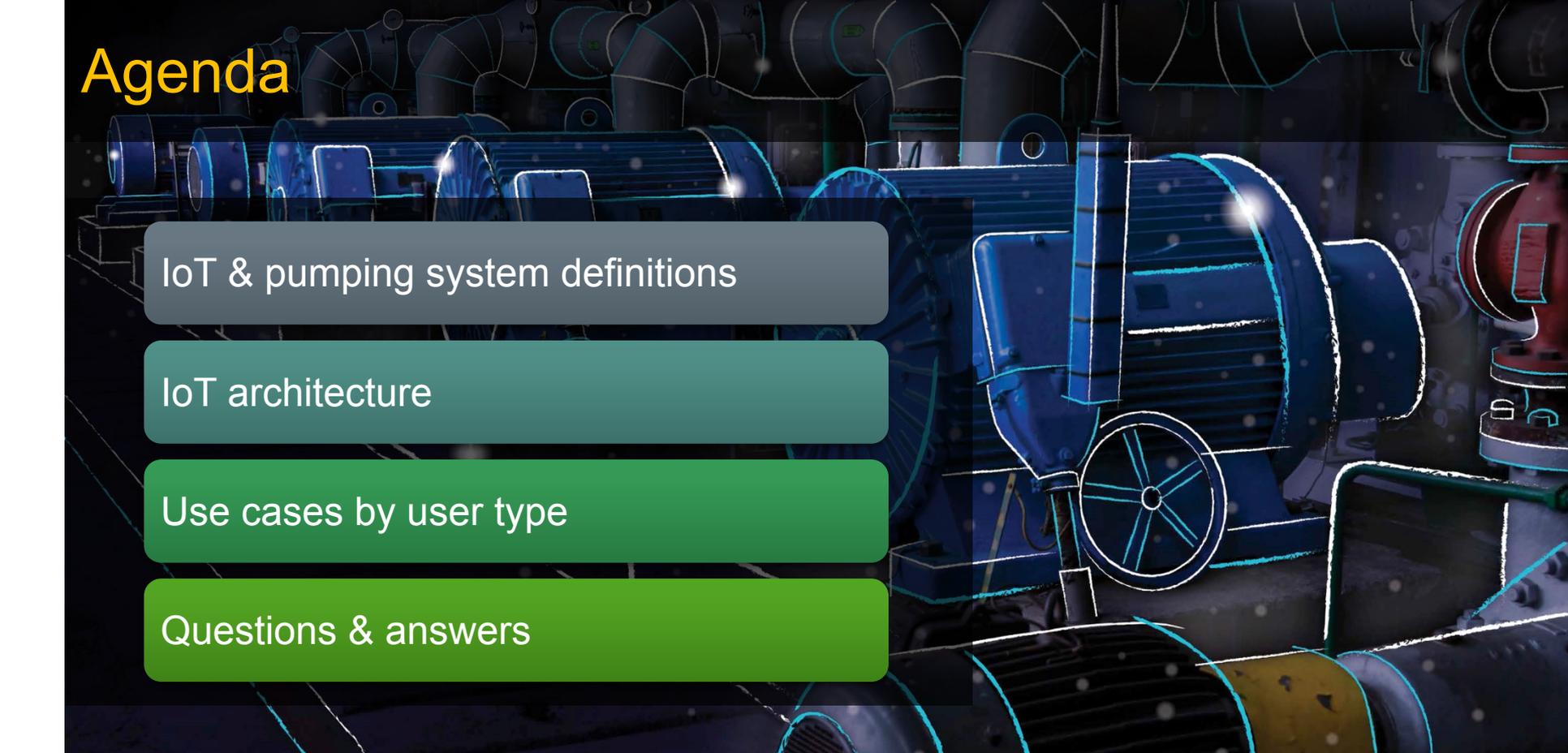
# Eaton solutions

## CPX9000 Clean Power VFD

- 40 to 800 hp @ 480 V, 50 / 60 Hz
- 18-pulse low harmonics VFD
- 0.1 to 400 Hz frequency range
- Smallest footprint in the industry
- Guarantees IEEE® 519 compliance < 5%THD
- Customizable power and control options



# Agenda



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**EATON**

*Powering Business Worldwide*