FLUKE®
Reliability

Best Practices
Webinar

IIoT and Vibration Based Condition Monitoring – A False Dawn?

Reducing Downtime – how software can help

Meet the Speaker

John Bernet, CMRP

Reliability Application Specialist at Fluke Reliability (11 years)

- Previously worked at Azima DLI for 18 years
- Served 12 years in U.S. Navy on cruiser & aircraft carrier as electrical technician
- Has 40 years of experience in preventive and predictive maintenance
- Written many technical articles for global trade publications and a 240-page vibration training program

Certified Maintenance & Reliability Professional (CMRP)

Vibration Analysis Category II certified

Ultrasound Category I certified

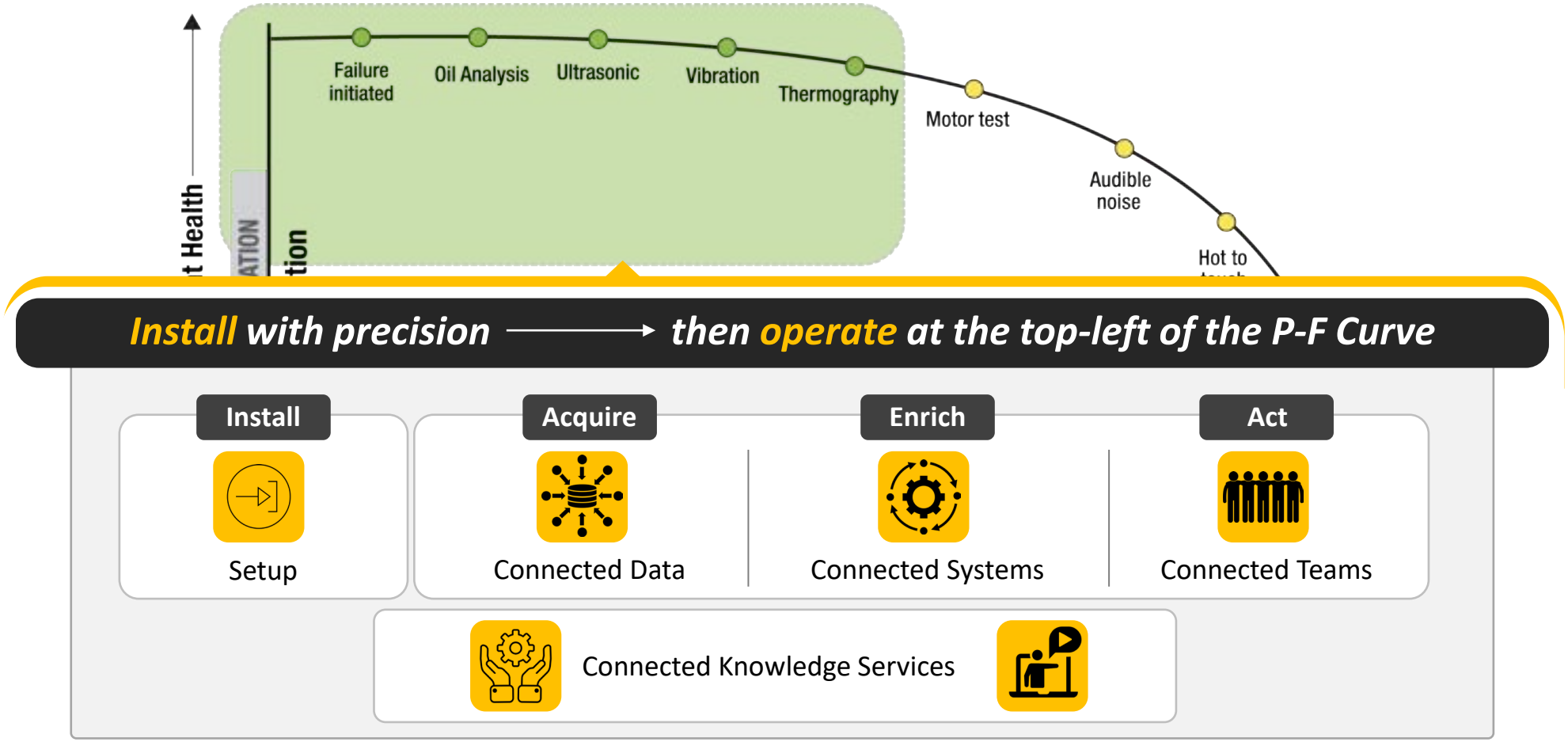
Thermal/Infrared Thermography Level I certified

Overview

- Industrial Internet of Things technologies can radically transform the way organizations approach Condition Monitoring.
- Many new entrants to the market touting their usage of low cost and low power sensing technologies.
- Machine Learning and Artificial Intelligence techniques can now provide scalable, cost-effective balance of plant condition monitoring coverage.
- We'll explore:
  - The promise of IIoT to increase asset coverage
  - Some of the challenges with developing and deploying these solutions
  - How AI/ML is enabling human on the loop, but not out of it
  - The resultant need for Reliability Engineers to work with a trusted partner who brings a balanced approach blending human expertise and IIoT technologies.

Connected Reliability

Industrial Internet of Things technologies can radically transform the way organizations approach Condition Monitoring



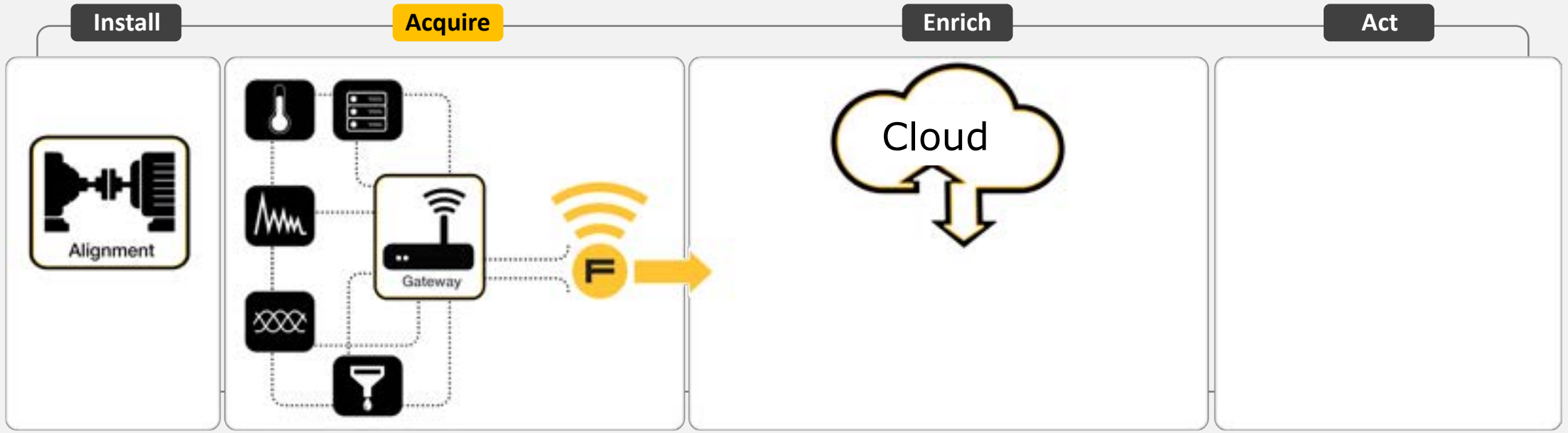
Precision alignment / balancing up front: Peak Performance from Day 1

Install | **Acquire** | **Enrich** | **Act**

Laser Shaft Alignment	Balancing	Active Situational Intelligence	Geometrical Alignment	Pulley Alignment

FLUKE Reliability

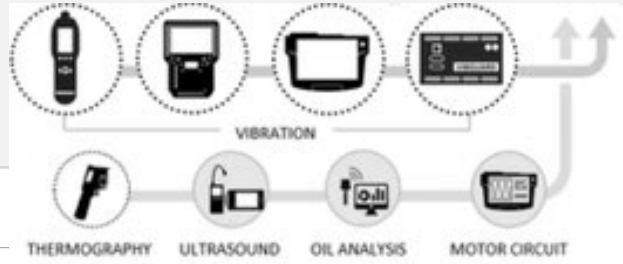
Connected Data



Handheld Tools | Wired Sensors | Wireless Sensors | Automation & Controls

CONNECT2 ASSETS

- Route- and sensor-based tools
- Simple to complex measurement
- Multiple P-F Curve modalities (vibration, ultrasound, oil analysis, etc.)



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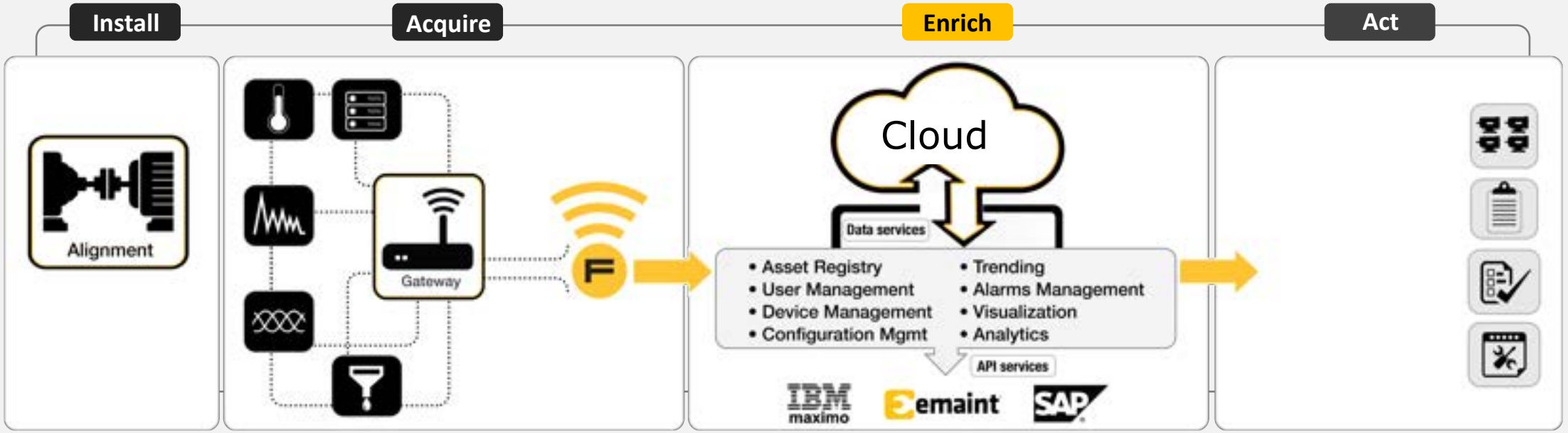
Connected Systems



Data and API services provided by the Accelix Data Platform

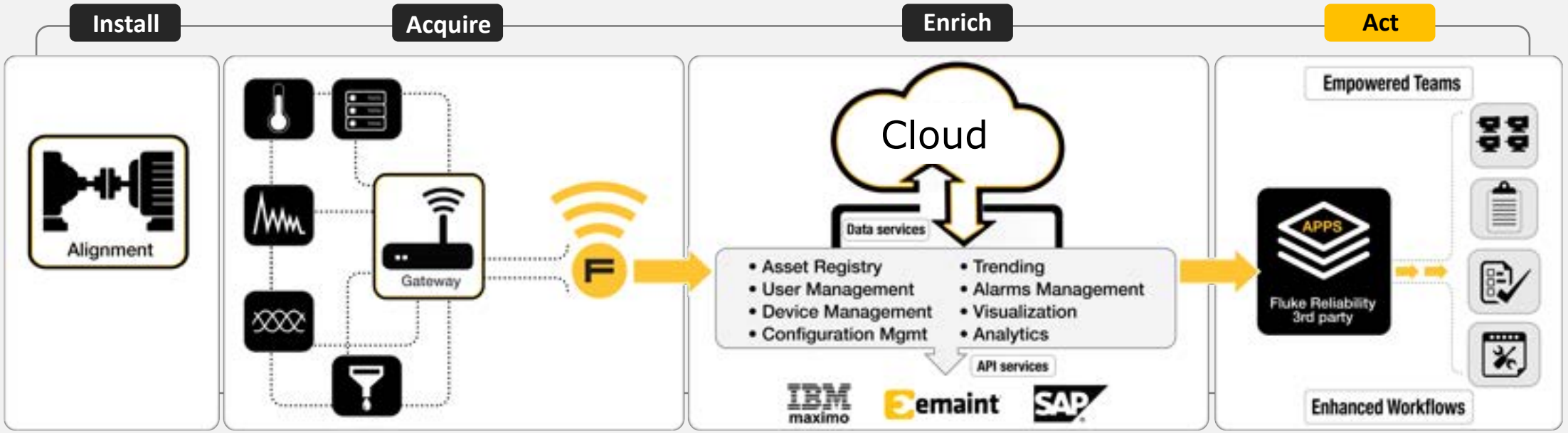
Aggregated data supports long-term trend analysis and machine learning

Enriched condition data via integration with CMMS/EAM systems

Result:

- A more complete picture of asset history and current health
- A solid basis for decision support and maintenance actions

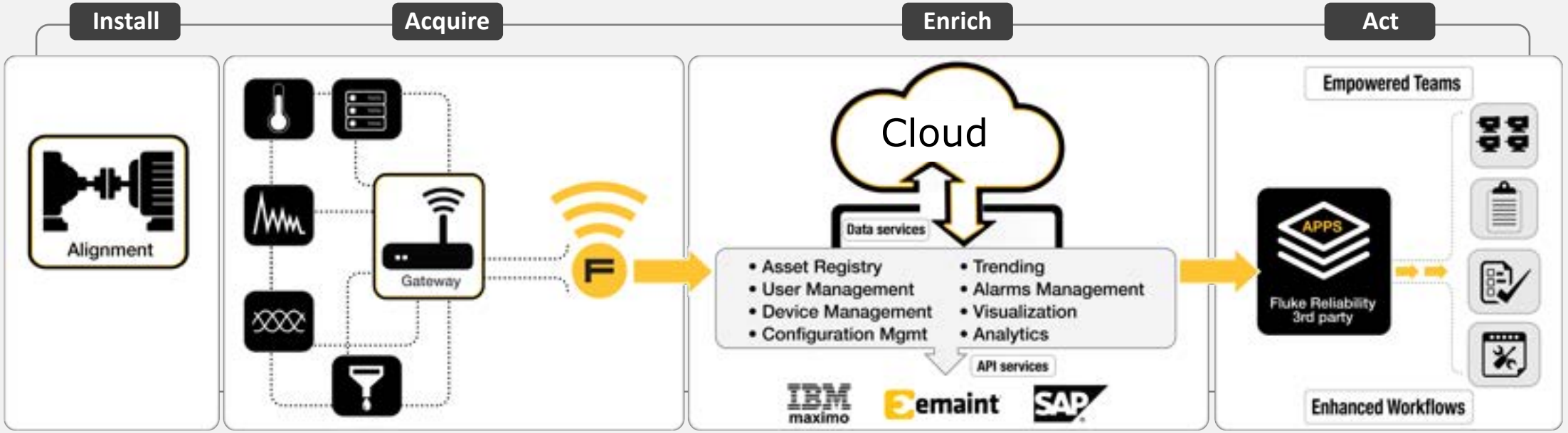
Connected Teams



FLUKE CONNECT · IBM WATSON · ALIGNMENT RELIABILITY CENTER 4.0 · emaint · SAP · infor · FLUKE MOBILE · Asset IQ · OMNITREND

Reliability-centered maintenance actions | Mobile workforce enablement | Enhanced workflows

Connected Knowledge



Connected Knowledge Services

Active Assistance

- Onsite Machinery Services
- PARALIGN
- TELEDIAGNOSIS
- Remote Condition Monitoring

On-Demand Expertise

- ISO CAT Training
- Online & In-Person Courses
- Reliability Program Consulting
- Customer Success Team

Condition Monitoring using Vibration Analysis

Pro-active Maintenance

- Most damage to rotating machinery is detectable by Condition Monitoring
- Catch issues sooner than other techniques of maintenance prevention
- Plan shutdowns only when necessary and with fewer extra spare parts

How much vibration is bad? Many customers think:

1. Just watch the trend of every unique machine and you will quickly know
2. I wish we started trending when our machines were new – get a baseline

The Bad News – both statements are false:

1. Taking vibration measurements will show the machine is dynamic like a living creature – there are many variables from background noise, adjacent machines, the structure, resonances, process, cavitation, changing load and speed, etc.
2. Just because a machine is new doesn't mean that it is good. It could already have a fault and trending a machine with a fault does not give much warning before failure.

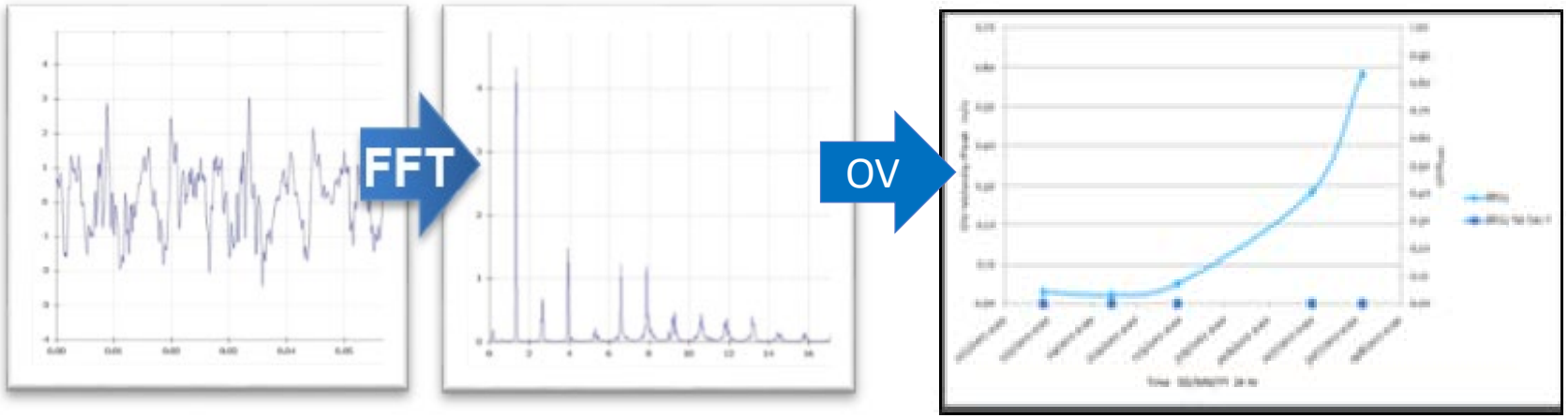
The Good News:

1. Experts have been analyzing hundreds of thousands of machines over the years, they have found that every mechanical fault has a pattern, and they have learned how to ignore the noise and other vibration that doesn't follow the algorithms.
2. Experts have developed algorithms for almost all standard machine types that allow you to have a starting point to know what is good or bad for your machine type.

There is no secret formula

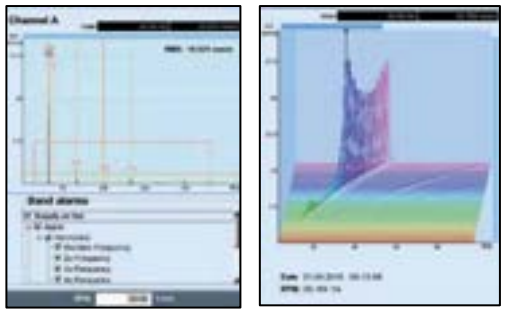
… from lessons learned we can offer best practices to guide you
… don't go it alone – partner with experts to support you

What are the 3 different types of vibration analysis?

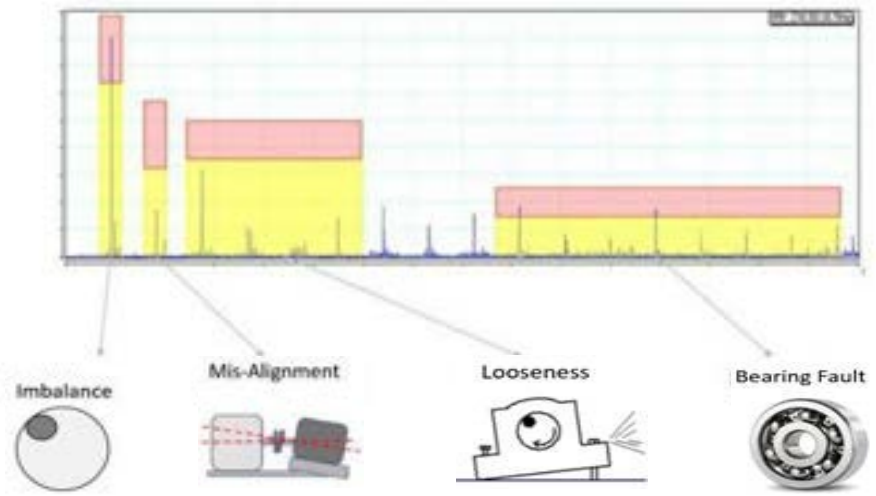


Time | Frequency | Overall Vibration

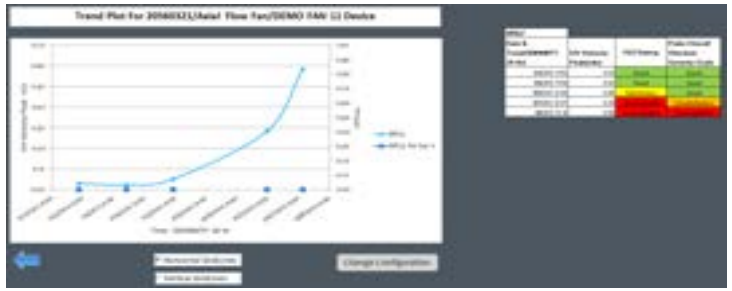
- Time waveform – raw data:
Complex - transients, noise
- Frequency spectrum – converted:
Simplified - patterns to diagnose faults
- Overall Vibration – calculated 10-1K:
One number - trend to screen health



- All information - jumbled
- Critical/complex machines
- Advanced analysis
- Experience / training
- Takes resources / hours



- 4 common faults (ignores others / noise)
- Quick answer & action recommendation
- Limited to mainstream machines



- Simple number / trend
- Good or Bad
- No answer or action

What answers are you looking for?
… from lessons learned we find most teams need quick machine condition answers to keep the plant up and running

Bridging the gap to program success

Many new entrants to the market touting their usage of low cost and low power sensing technologies, but can they overcome challenges and obstacles and bridge the gap between your goals and reliability success?

1. Low-cost sensor
Small, easy to install

CUSTOMER GOALS

- Asset Availability
- Proactive Maintenance
- Cost Savings
- Continuous Improvement
- Deliver Business Value

- Low frequency – no bearings
- Triax MEMS – screening only
- App shows trends – Good/Bad

- Further testing needed
- Data - Numbers only
- No answers - faults / actions

Lesson learned: Hardware is only part of the solution and will only get you part way to your goal of Connected Reliability.

CONNECTED RELIABILITY

- Uptime
- Cost Control
- Production excellence
- Optimal Resource Allocation
- Just-in-time Inventory
- Reporting/Documentation

Bridging the gap to program success

To overcome challenges / obstacles and bridge the gap between your goals and reliability success, 3 things are required

1. Best Solution Hardware – higher frequency

CUSTOMER GOALS

- Asset Availability
- Proactive Maintenance
- Cost Savings
- Continuous Improvement
- Deliver Business Value

- High frequency – see bearings
- Hybrid piezo / MEMS – analysis
- FFT and time waveform

- Quick review of data
- Gives answers - faults / actions

CONNECTED RELIABILITY

- Uptime
- Cost Control
- Production excellence
- Optimal Resource Allocation
- Just-in-time Inventory
- Reporting/Documentation

Bridging the gap to program success

To overcome challenges / obstacles and bridge the gap between your goals and reliability success, 3 things are required

1. Best Solution Hardware – higher frequency

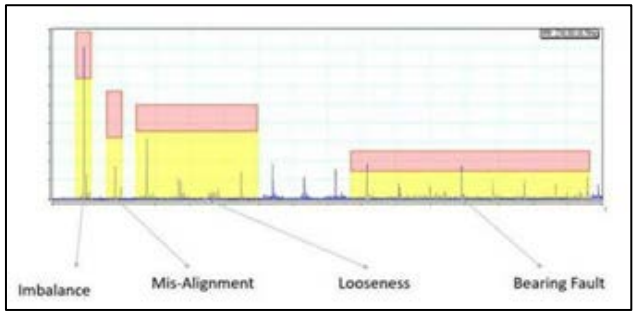
2. Common Software Portal - answers from the data

CUSTOMER GOALS

- Asset Availability
- Proactive Maintenance
- Cost Savings
- Continuous Improvement
- Deliver Business Value

Broadband alarm notifications warn when something is abnormal

Narrowband alarm notifications warn when a specific spectrum is high which allows analysis of a specific machine fault



CONNECTED RELIABILITY

- Uptime
- Cost Control
- Production excellence
- Optimal Resource Allocation
- Just-in-time Inventory
- Reporting/Documentation

Bridging the gap to program success

Wireless Vibration Sensor Solution –
High freq. sensor + Software Portal + Fluke Reliability

To overcome challenges / obstacles and bridge the gap between your goals and reliability success, 3 things are required

2. Common Software Portal -

1. Best Solution Hardware – higher frequency

2. Common Software Portal - answers from data

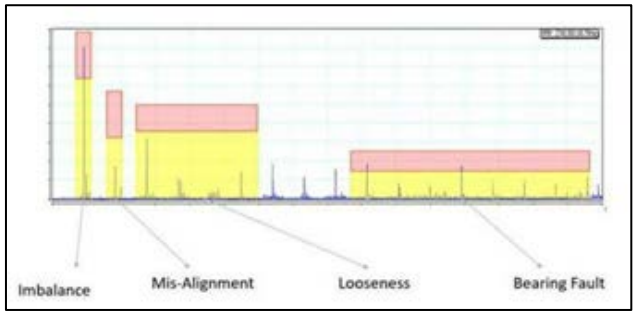
3. Support Services – help from experts

CUSTOMER GOALS

- Asset Availability
- Proactive Maintenance
- Cost Savings
- Continuous Improvement
- Deliver Business Value

Broadband alarm notifications warn when something is abnormal

Narrowband alarm notifications warn when a specific spectrum is high which allows analysis of a specific machine fault



- Assessment / Consulting
- Start-up packages
- Training – onsite/remote
- Remote Condition Monitoring
- Remote Data Analysis
- Alarm Management
- Database audits
- Analytics
- Program Audits

CONNECTED RELIABILITY

- Uptime
- Cost Control
- Production excellence
- Optimal Resource Allocation
- Just-in-time Inventory
- Reporting/Documentation

Data → Answers → Action → Savings → Success

Expert assistance to bridge the gap when needed

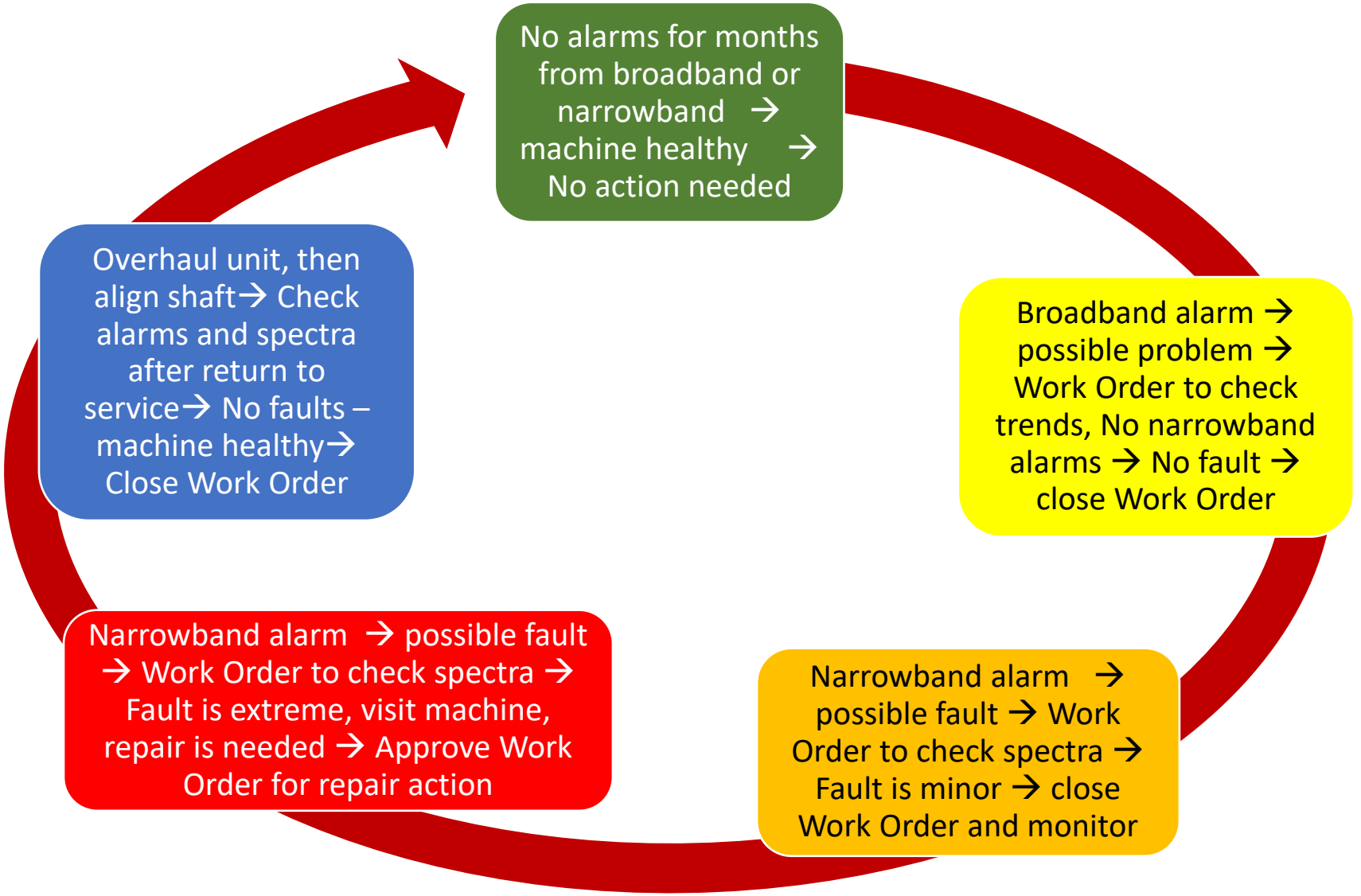
FLUKE Reliability

Increase coverage by enabling teams and easing adoption journey for expert constrained customers

Criticality	Tiers	Applications	Answers needed	Data requirements	Skills needed	Best remote	Best portable
Most Critical & Most Complex	1	Turbine Generator Paper Machines Machining Tools ❖ **Few**	4 common faults + component faults + resonances + structural	Lots of high-resolution data - vibration, process, real-time, etc.	Machine experts, vibration experts (Weeks of training)		
Very Critical & a little complex	2	Mixers Shredders Extruders Mills/Crushers ❖ **Dozens**	4 common faults + component faults	Short bursts of high-res vibration	Technicians with remote services (16-24 hr. training)		
Mainstream – still critical	3	Standard motors Standard pumps Standard fans Standard blowers Standard compressors Single shaft machines ❖ **Hundreds**					
Non-vital	4	Non-vital motors, pumps, fans, compressors, blowers, single shaft machines ❖ **Thousands**	4 common faults (ignore others)	Short bursts of high-res vibration	Technicians with AI/ML/ Remote (8 hr. training)		
Expendable	5	Small, low speed motors Rollers for conveyors ❖ **Thousands**					

Now we can add Machine Learning and Artificial Intelligence techniques to provide scalable, cost-effective balance of plant condition monitoring coverage

Connected Reliability transforms asset life cycle



The use of **Industrial Internet of Things technologies** has the potential **to radically transform the way organizations approach Condition Monitoring**.

We are Fluke Reliability

Need for **Reliability Engineers to work with a trusted partner** who brings a **balanced approach blending human expertise and IIoT technologies**.

- ✓ **Successful start-up**
- ✓ **Successful implementation**
- ✓ **Successful sustainment**

Our Purpose: Help guide the customer past the obstacles on their reliability journey from Point A to Point B

Summary: Bridging the gap to program success

Lesson learned: Hardware is only part of the solution and will only get you part way to your goal of Connected Reliability.

For a complete solution and bridge the gap between your goals and reliability success, 3 things are required

1. Best Solution Hardware

2. Common Software Portal

3. Support Services

CUSTOMER GOALS

- Asset Availability
- Proactive Maintenance
- Cost Savings
- Continuous Improvement
- Deliver Business Value

Cloud - Common Portal

CMMS

Automated Diagnosis

Advanced Analysis

Common Portal

Alignment Center

- Assessment / Consulting
- Start-up packages
- Training – onsite/remote
- Remote Condition Monitoring
- Remote Data Analysis
- Alarm Management
- Database audits
- Analytics
- Program Audits

CONNECTED RELIABILITY

- Uptime
- Cost Control
- Production excellence
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Thank you