predict
...that a system will fail
...with a measure of certainty
...and the type of repair needed

optimise
...the engineer to be tasked
...the priority
...the parts required

intelligent
...the online manual
...that learns and improves the human/machine interaction
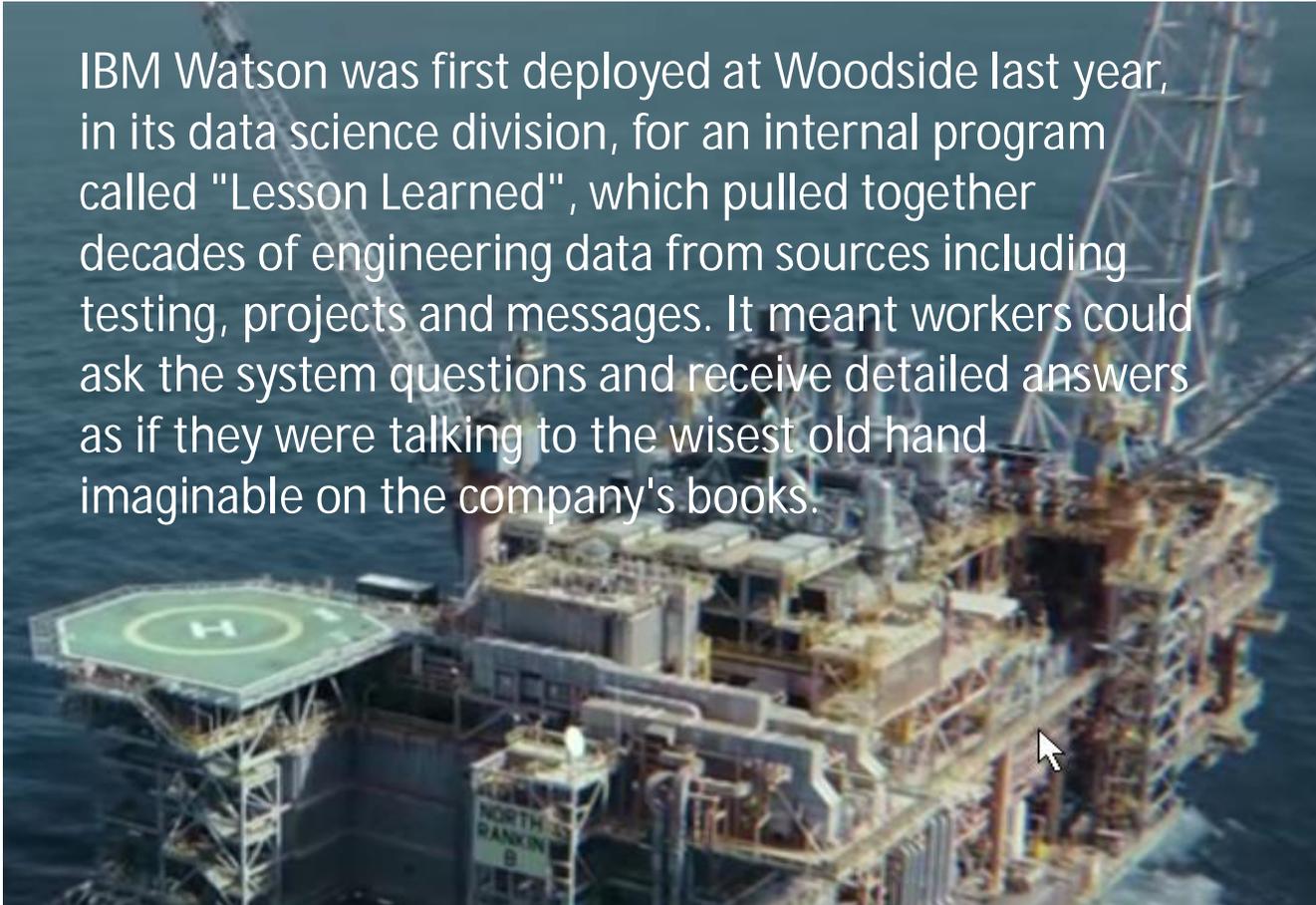
IBM

CASE STUDY

Woodside Petroleum has expanded its use of IBM's Watson cognitive computing as it seeks to drive more value out of its systems

IBM Watson was first deployed at Woodside last year, in its data science division, for an internal program called "Lesson Learned", which pulled together decades of engineering data from sources including testing, projects and messages. It meant workers could ask the system questions and receive detailed answers as if they were talking to the wisest old hand imaginable on the company's books.

"It has actually surpassed our expectations ... we ended up with nearly 400 people taking time out of their day, such as engineers, to train Watson and it has been able to return answers to some very difficult questions," Mr Gregory said.

"We had pessimist engineers saying it would never be able to answer some kinds of really technical questions and then bang, Watson answered it first off."

The use of Watson is now being pushed beyond the sharing of "lessons learned", to be used in other areas of the business, including human resources, legal and exploration.

https://www.jeopardy.com/be-a-contestant/practice-tests

https://www.youtube.com/watch?v=9joEsWiYFEI

This is probably where you are going to encounter artificial intelligence and self driving vehicles yourself any day now....This is on the streets already around Europe

0:08 / 3:48

Cognitive Mobility: Olli the self-driving vehicle and Watson the cognitive system

Watson Intelligent Manual

Available as an IOS APP, for example here using the Volvo XC90 manual as its data source
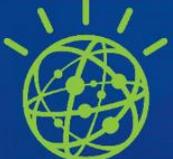

Settings   Vehicle

HOW CAN I HELP?

Searching with: Volvo 2016 XC90

Type or dictate a question, just as you would if you were asking a friend or colleague
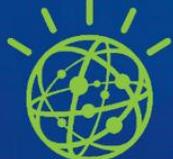
Ask Question

ottolly   Powered by IBM Watson™

Settings   Vehicle

HOW CAN I HELP?

Searching with: Volvo 2016 XC90

How do you open the trunk with your foot

Ask Question

Done

Done

Back

Q:How do you open the trunk with your foot

Power tailgate operation

All of the new XC90s are equipped standard with a power operated tailgate. As you reach your Volvo with the remote key with you, your car prepares itself to be unlocked. You can operate the tailgate by a few different methods:

- Press the button located on the dashboard. You can press this button to both open the tailgate and then again to close the tailgate when you are finished.
- Use the remote key: Press and hold the tailgate button on the remote key to open the tailgate and press and hold the same button to close the tailgate when you are finished.
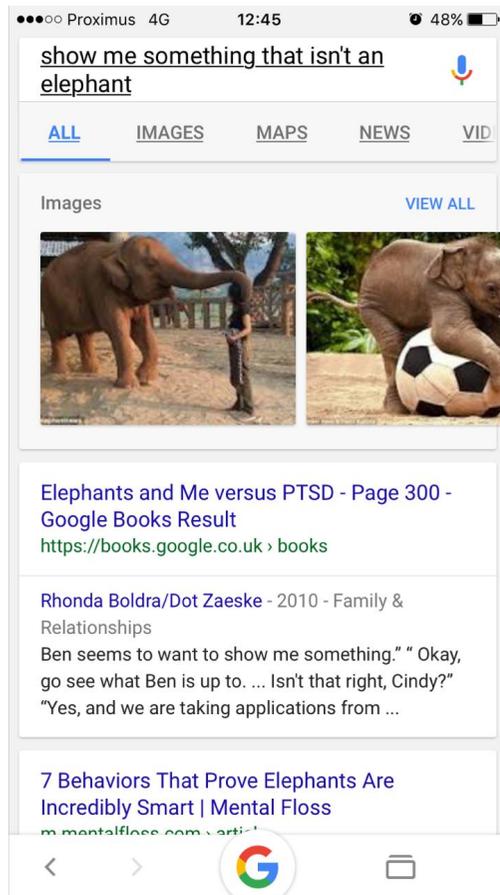- Use the hands-free foot movement: The sensor is located left of center beneath

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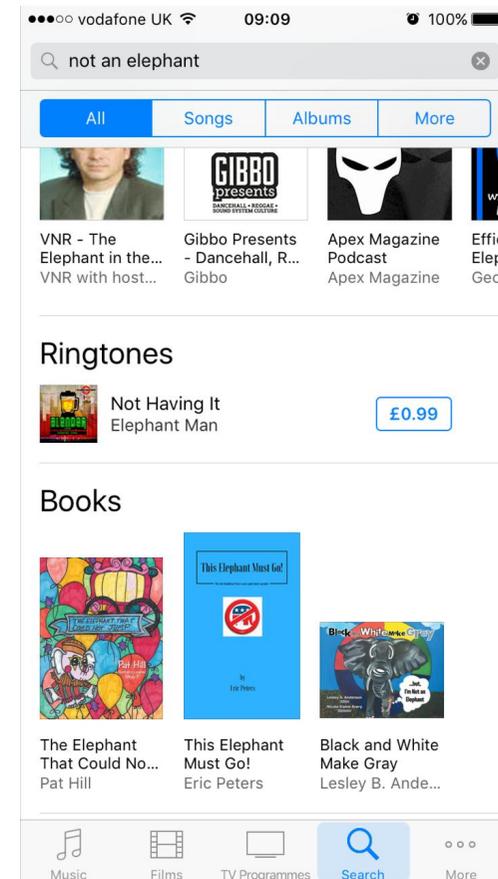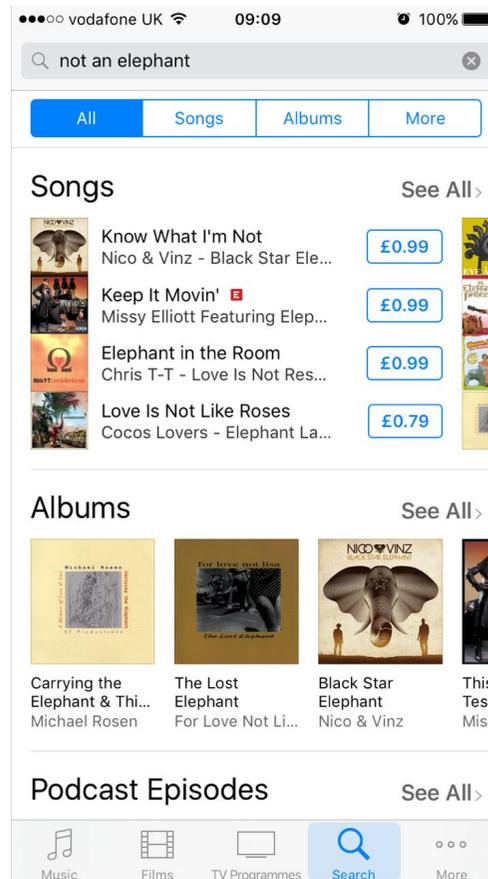Done

Kick motion for foot operated tailgate se...

What happens if you ask other apps to "show me something that is not an elephant"

Google says....

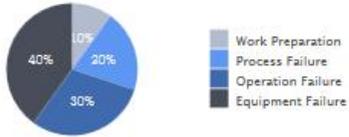Siris' response was this comprehensive range of elephant products
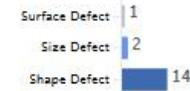
Operation Shutdown Time

40%
20%
30%
10%

- Work Preparation
- Process Failure
- Operation Failure
- Equipment Failure

Overall Equipment Health Score

85%

LOW   HIGH

Production Output with Target(Day)

365/800(EA)

Product Defect Count(Day)

Surface Defect | 1
Size Defect | 2
Shape Defect | 14

Equipment Anomaly Count(Month)

987

40   28

Reheating   Roughing   Finishing   C

Reheating	13	27
	RF1	RF2
Roughing	13	15
	RM1	RM2
Finishing		927
	FM1	
		15
	FM2	
		5
	FM3	
		29
	FM4	
		11
	FM5	
Coiling	18	11
	DC1	DC2

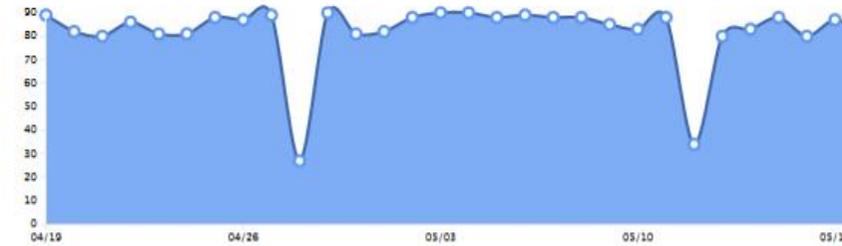| Equipment Profile	Overall Health Score Today	Failure Probability %	Anomaly Count After previous maintenance	Work Order Overdue Current	Failure Count Past 1 year
FM1 FinishingMill1 Mill Stand Yoido	68	68	927	7	3

Healthy Score Trend
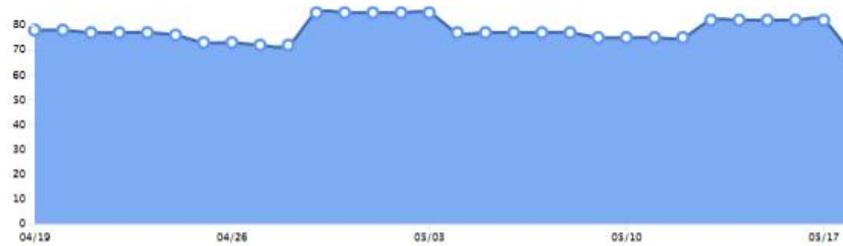
Equipment Availablity Trend

Measurement Profile

Measurement Type	Min	Max	Average	Last Value
Current on the load	456.80	476.90	466.85	468.05
Current on the no load	44.30	45.60	44.95	45.20
Cylinder position difference	8.10	9.20	8.65	8.90
Roll Force difference between WS and DS	131.40	146.00	138.70	139.90
Roll Speed Variance on the no load	761.70	839.90	800.80	802.00

Event Log

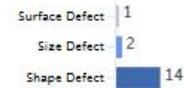| Time	Event Type	Comment
17:08:48	ALARM	F1 Cylinder Position difference
17:08:40	ALARM	F1 Motor Stator Temperature difference
17:08:31	ALARM	F1 Cylinder Position difference
17:07:48	ALARM	F1 Main Drive Speed diff(control~actual)
17:05:36	ALARM	F1 Motor Stator Temperature difference

Operation Shutdown Time
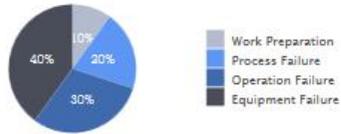
- Work Preparation
- Process Failure
- Operation Failure
- Equipment Failure

40% / 20% / 30% / 10%

Overall Equipment Health Score

85%

LOW   HIGH

Production Output with Target(Day)

365/800(EA)

Product Defect Count(Day)

- Surface Defect | 1
- Size Defect | 2
- Shape Defect | 14

Equipment Anomaly Count(Month)

987

| Reheating | Roughing | Finishing | Coiling |
| 40 | 28 | 987 | 29 |

Equipment Failure Probability

Equipment Name	Failure Probability
FM1	85.00
FM4	55.00
DC1	47.00
FM3	42.00
FM5	41.00
FM2	40.00
DC2	40.00
RF2	35.00
RM1	30.00
RF1	27.00
RM2	24.00

Equipment Failure Model

Model ID	Model Name	Failure Probability	Change	Execution Date
FM1-01	Rotating Failure	85.00	13%	2015-05-17
FM1-02	Motor Failure	60.00	7%	2015-05-17

Input Variables (Key Predictors)

No	Variable Name	Predictor Importance	Last Value
1	Motor Temperautre	0.53	65
2	Drive Speed Control Difference	0.24	200
3	Motor Vibration Speed	0.17	75
4	Crack Check	0.04	2
5	Load Accumulation	0.02	51604

Failure Probability Trend

FM1-01
FM1-02

Fri 17 Apr 19 Tue 21 Thu 23 Sat 25 Mon 27 Wed 29 May May 03 Tue 05 Thu 07 Sat 09 Mon 11 Wed 13 Fri 15 May 17
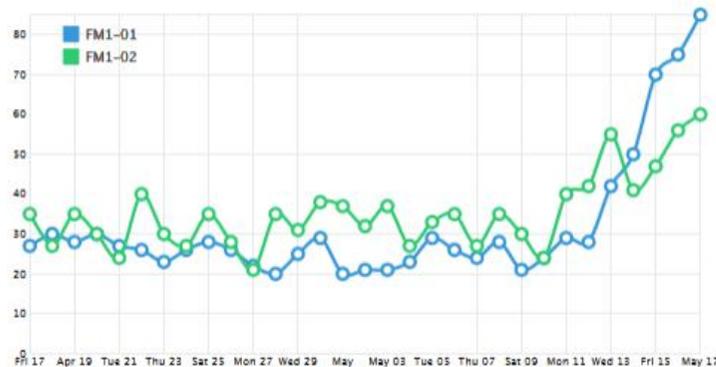
Failure Prediction Model
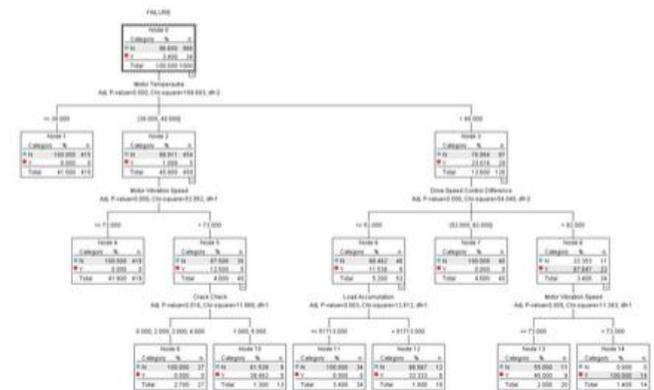
Introducing IBM QEWS = Quality Early warning System algorithms

https://www-07.ibm.com/sg/manufacturing/pdf/manufacturing/QEWS-services-Sept.pdf

QEWS Chart (same x-axis as SPC)

- QEWS alerts when the cumulative evidence line crosses above a horizontal threshold line (in black)

SPC Chart (same x-axis as QEWS)

- SPC indicates around the mean (solid red line) for much of this reporting period

- SPC alerts when the evidence line crosses the upper control limit, shown on this graph on the far right

Earlier Detection

- QEWS alerts 8 weeks before SPC

www.BLUEMIX.net IBM Cloud application development system
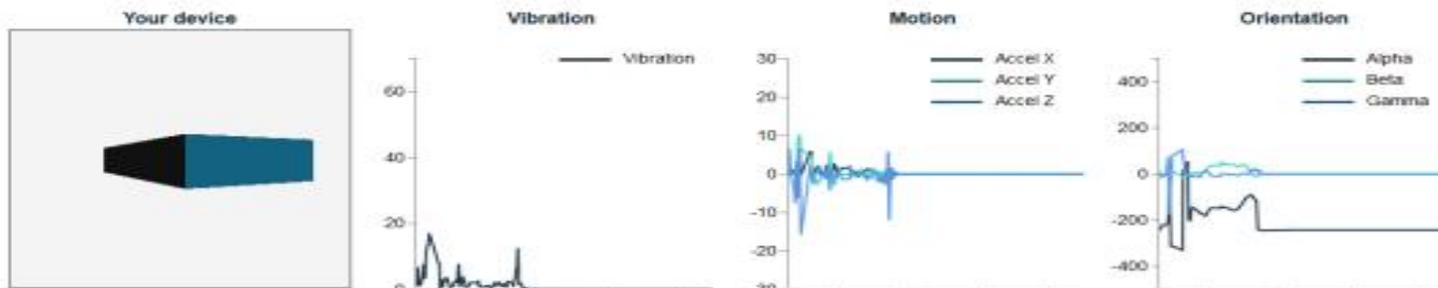
Watson Factory Health

Body & Weld Machine Health

Welcome!

Primary Plant Feed

Predicted Time to Failure: **48.88** Hours
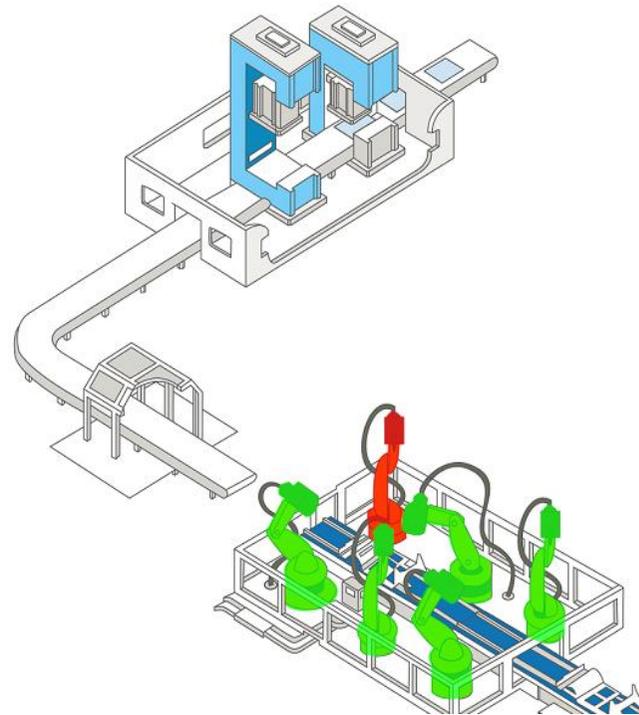
Probability of Failure: **72.30%**
Dec 30, 2015

Predicted Time to Recover: **2.94** Hours

Predicted Fault: **Servo 1 Fault**

Watson Equipment Advisor as the engineer's AI guide

WORK ORDER 952332533

Best Solution

37,0XX.xx Errors - PEST Faults

- 68 min
- 81% success

Parts

200469880 Ink Loader Assembly and Door

Tools

[Troubleshoot]

[✓ Complete]

Repair Passages

37,0XX.xx Errors - PEST Faults

AC power supplied by power sources such as uninterruptible power supplies (UPSs) or DC-to-AC inverter systems may not supply correct voltage to properly power up the printer. Likewise, other devices sharing the same AC circuit can cause AC voltage sags that cause the printer to fail its AC heater PEST tests (Print Engine Self Test). The printer may produce any of the following disconnected heater errors: ▪ Printhead jet-stack 37,002.47 or 37,003.48 Troubleshooting Procedure for Drum Maintenance...

View Passage

13,0XX.xx Errors - Thermal Faults

13,000.48: Thermal fault. 13,003.42: 13,007.46: 13,008.47: The Drum heater is too hot. 13,010.49: The Drum heater took too long to reach its setpoint. Troubleshooting Procedures for Error Code 13,000 (Printhead) Step Questions and Actions Yes No 1 Ensure ground integrity for the printer. Did this correct the problem? Complete. Go to Step 2. 2 Reset NVRAM and retest. Did this correct the problem? Complete. Go to Step 3. 3 Check and reseat all data cables to the Printhead. Did this correct the...

View Passage

Watson Field Advisor is deployed to assist field technicians diagnose faults, identify the fix required along with the time it should take, the parts and tools required and the likelihood that this recommendation will result in success.

As it gets used, the knowledge base grows so the certainty level will increase.

The context for the vehicle industry is proven in a second-line technical helpdesk environment where 80% of the faults are recognised by IBM's analytics of the unstructured database of previous experience immediately, giving the engineer a way to accelerate complex fault rectification.

The Ind 4.0 worker is connected too
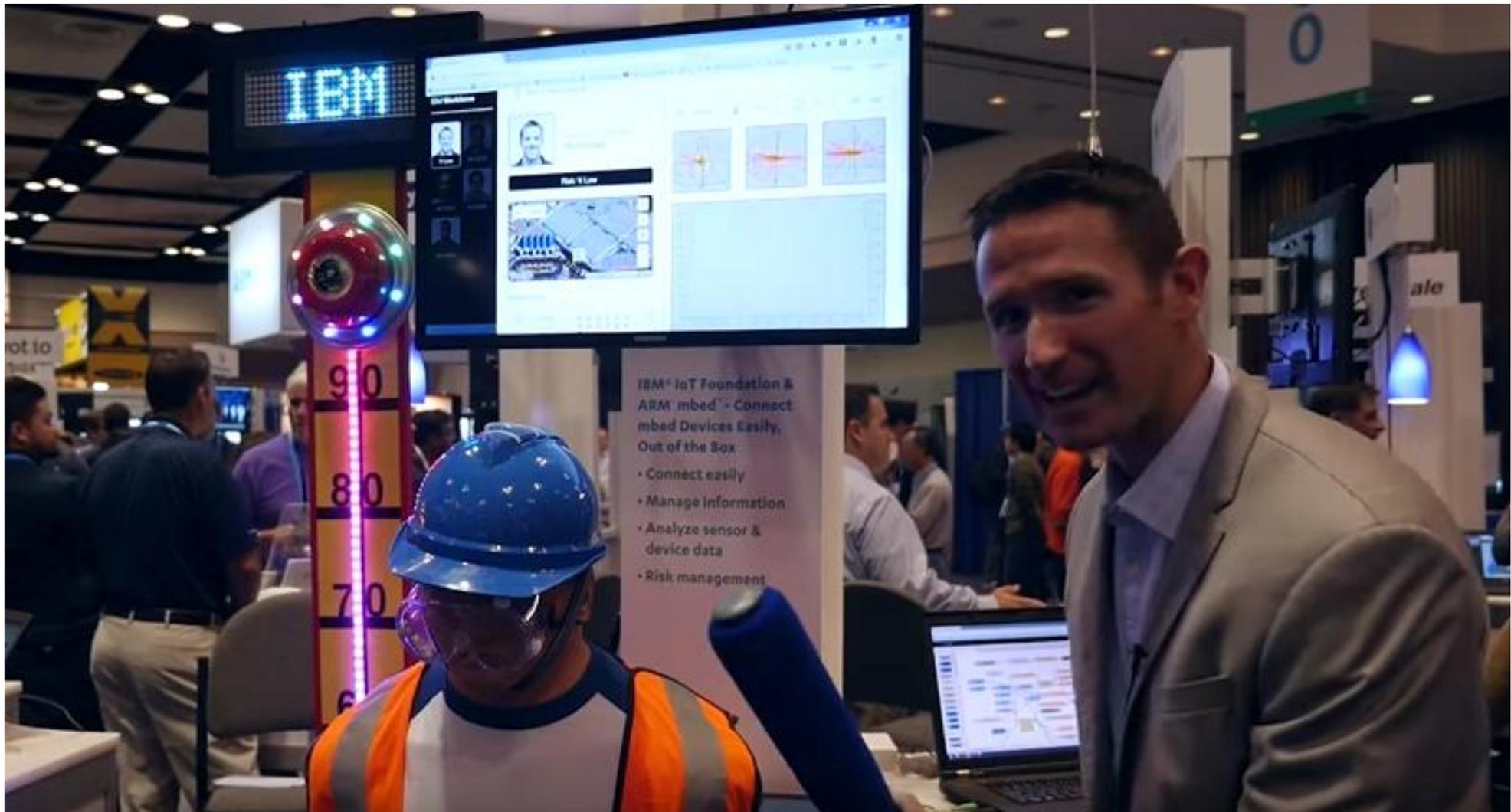
Thank you

Toby Woolfe

Industrial and Automotive Cognitive Solutions

toby.woolfe@uk.ibm.com +44 7795 328 742