STEAMLANE

Future trends in predictive maintenance and the role of AI

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Steamlane-tiimi

Steamlane Oy on vuonna 2015 perustettu tamperelainen data-analytiikan ja tekoälyn asiantuntijayritys.
Kaikki kolme perustajajäsentä toimivat yrityksen avainrooleissa yli 20 vuoden kokemuksella teknologia- ja IT-aloilta.
Tällä hetkellä tiimimme koko on kuusi henkeä, jota tarvittaessa laajennamme projekteissa kumppaniverkostomme avulla.

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2 ohjelmistokehittäjää
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Tekoälyratkaisujen ja sovellusten toteuttaminen Microsoft Azure pilvialustalla

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Predictive maintenance

Legacy

Two + One forces of discontinuity

Essential role of machine learning

Predictive maintenance is a hot topic, but it is not actually anything new

Source: flickr/Wisconsin Department of Natural Resources

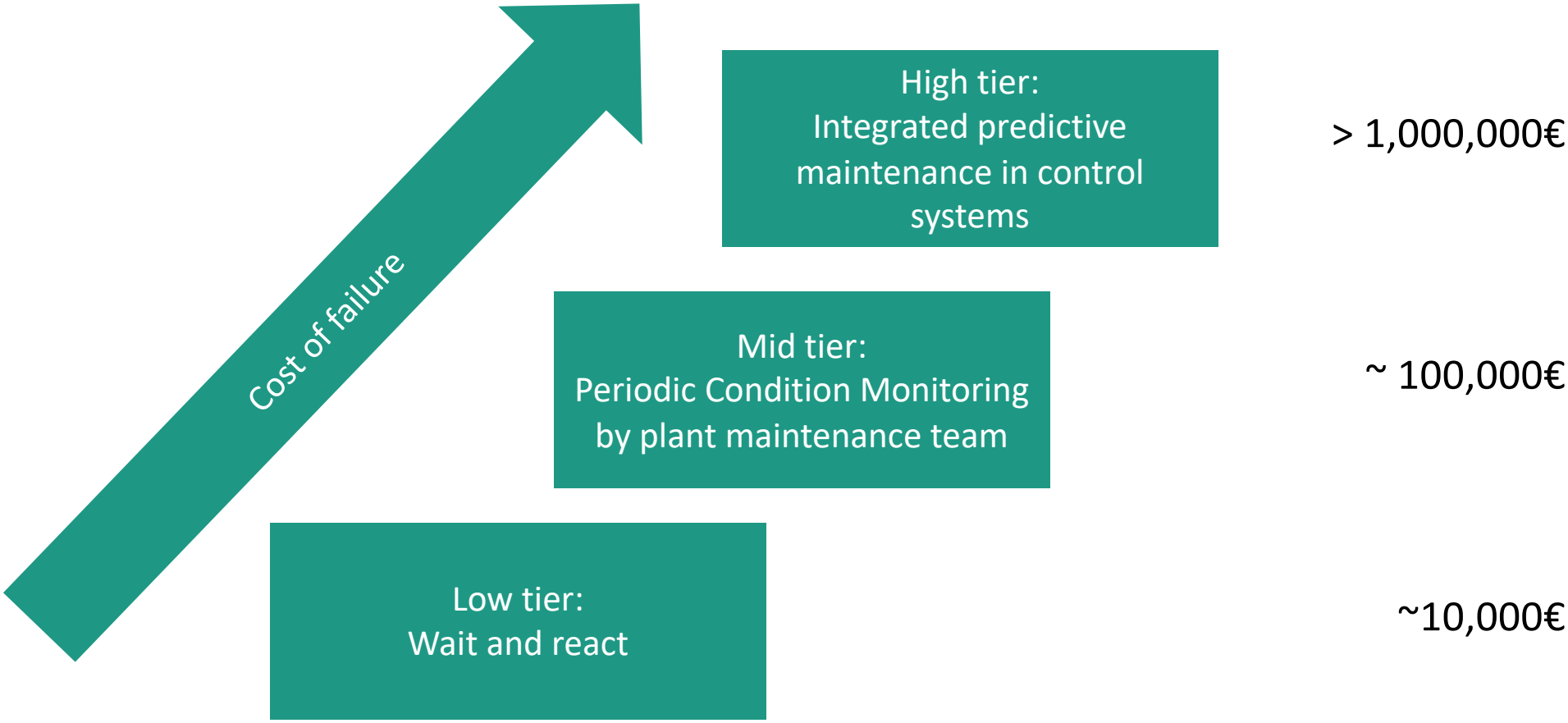
- Predictive maintenance has been done in heavy industry for years
- In applications where the cost of failure is very high
  - Paper making machines
  - Nuclear power plants
  - Offshore oil drilling

Characteristics of legacy predictive maintenance

- A feature of a plant control system
- Proprietary hardware and interfaces
- Commercial off-the-self innovations can not be integrated
- High talented experts needed in operations
- High initial investments and operations costs

Source: https://www.pexels.com/ - "Gray Control Panel Room Empty"

Current solutions of predictive maintenance are too expensive for mid and low tier applications



Two trends which will drastically lower the cost of predictive maintenance

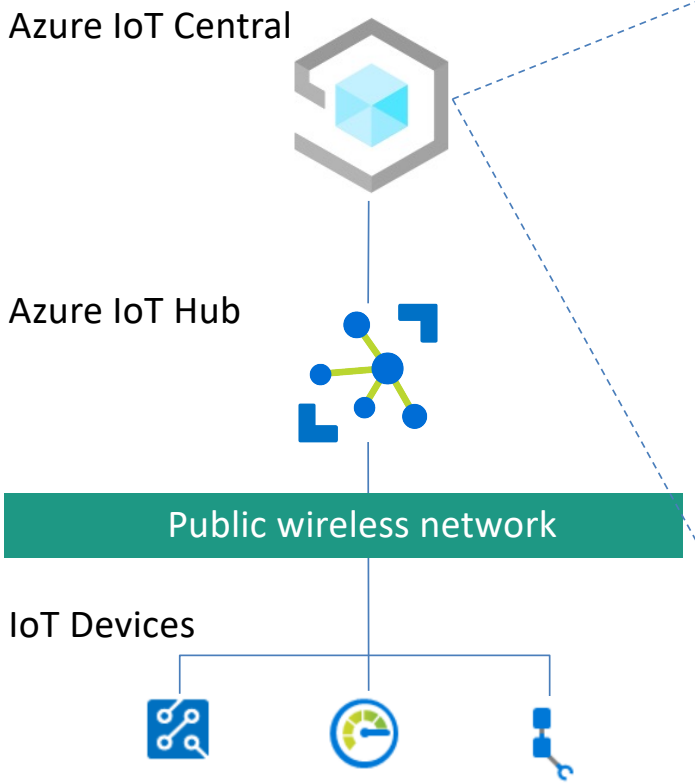
Cloud computing

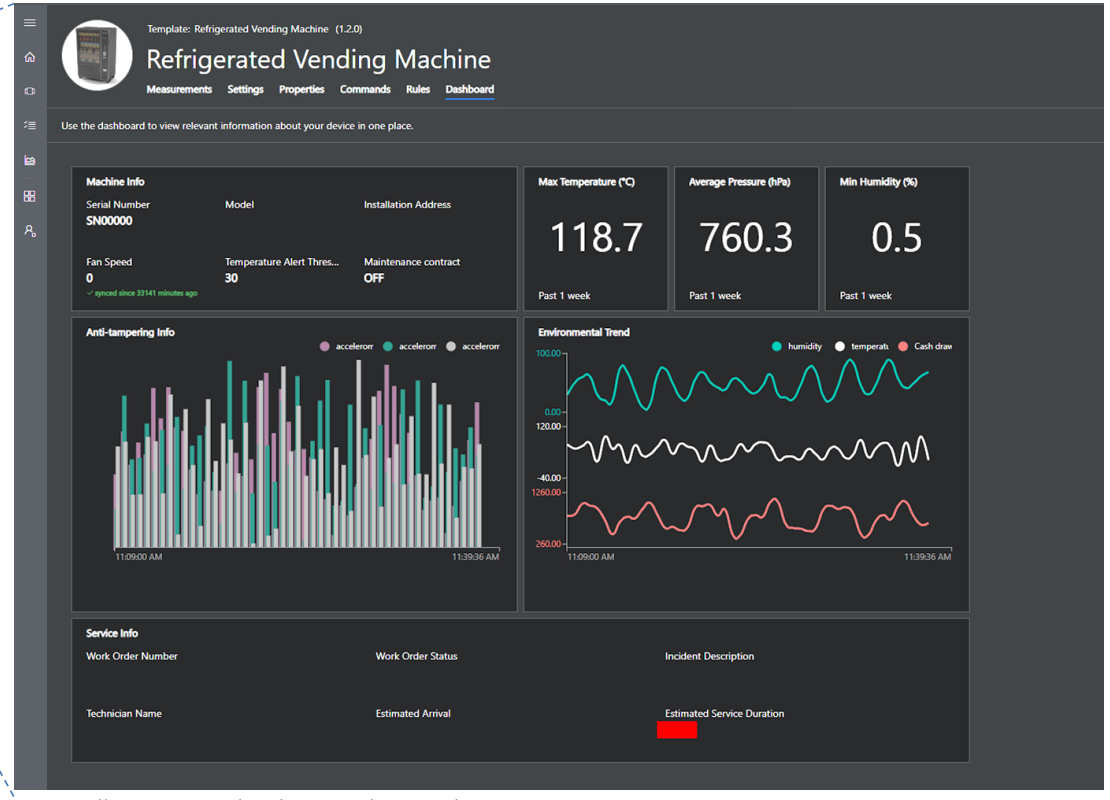
- From fixed to variable cost
- Highly scalable computing, but still pay only on usage

IoT

- Cost benefit of commercial-off-the-self hardware and software
- The cost of dedicated bus vs public wireless network

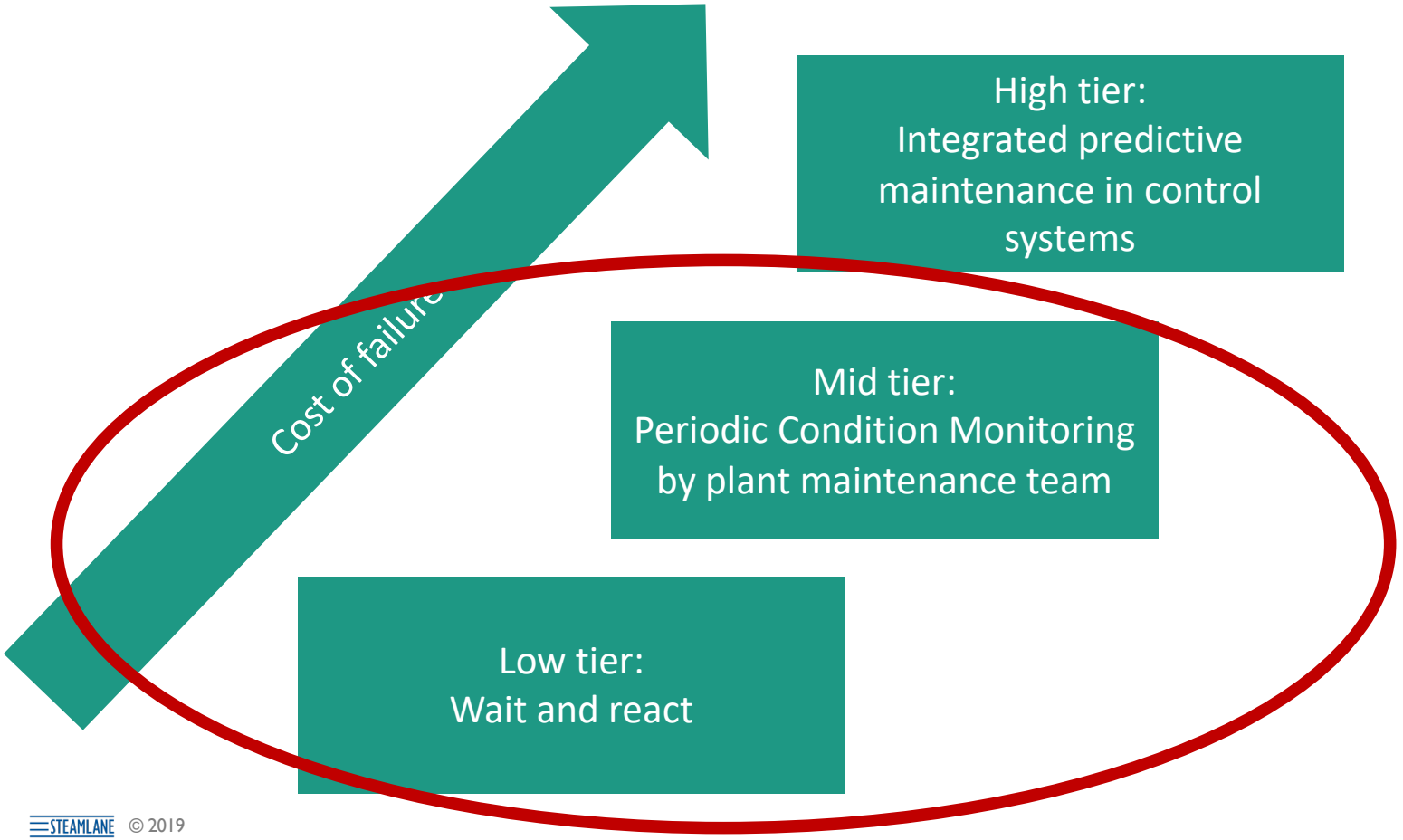
Cloud example: Azure IoT Central





Source: https://docs.microsoft.com/en-us/dynamics365/field-service/cfs-iot-central-alerts

Cloud and IoT revolution in predictive maintenance of low and mid tiers



But cost issue is still lurking behind the corner . . .

Cloud computing and IoT dramatically lowers the cost of real time monitoring

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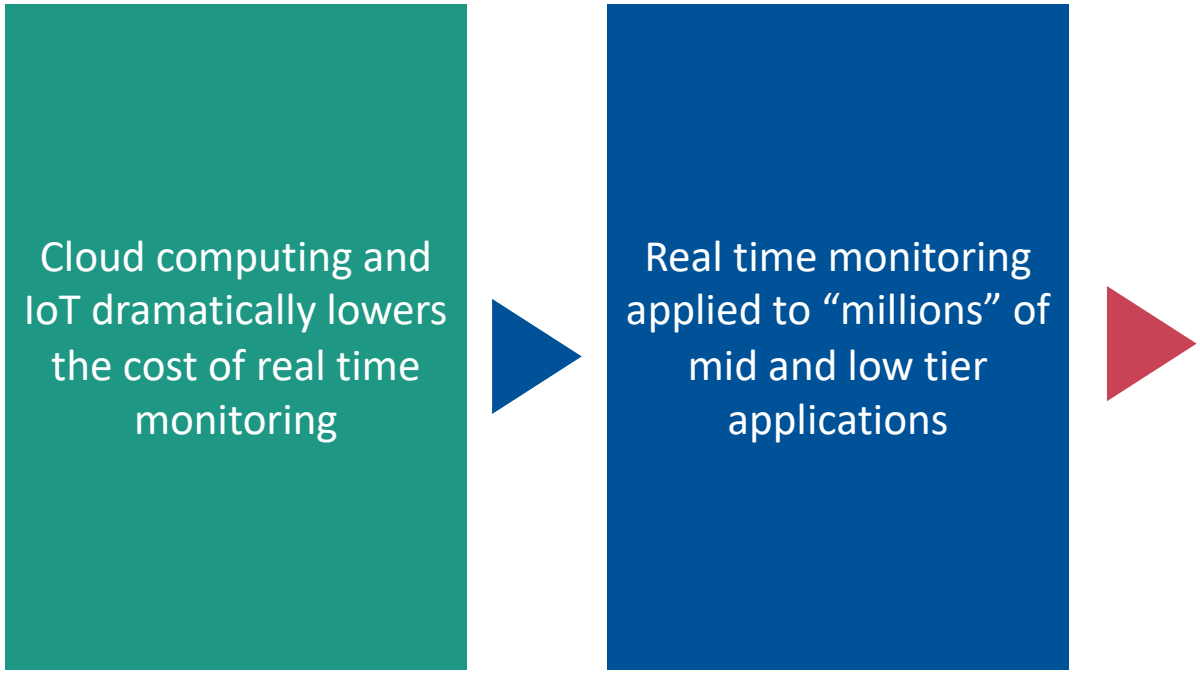

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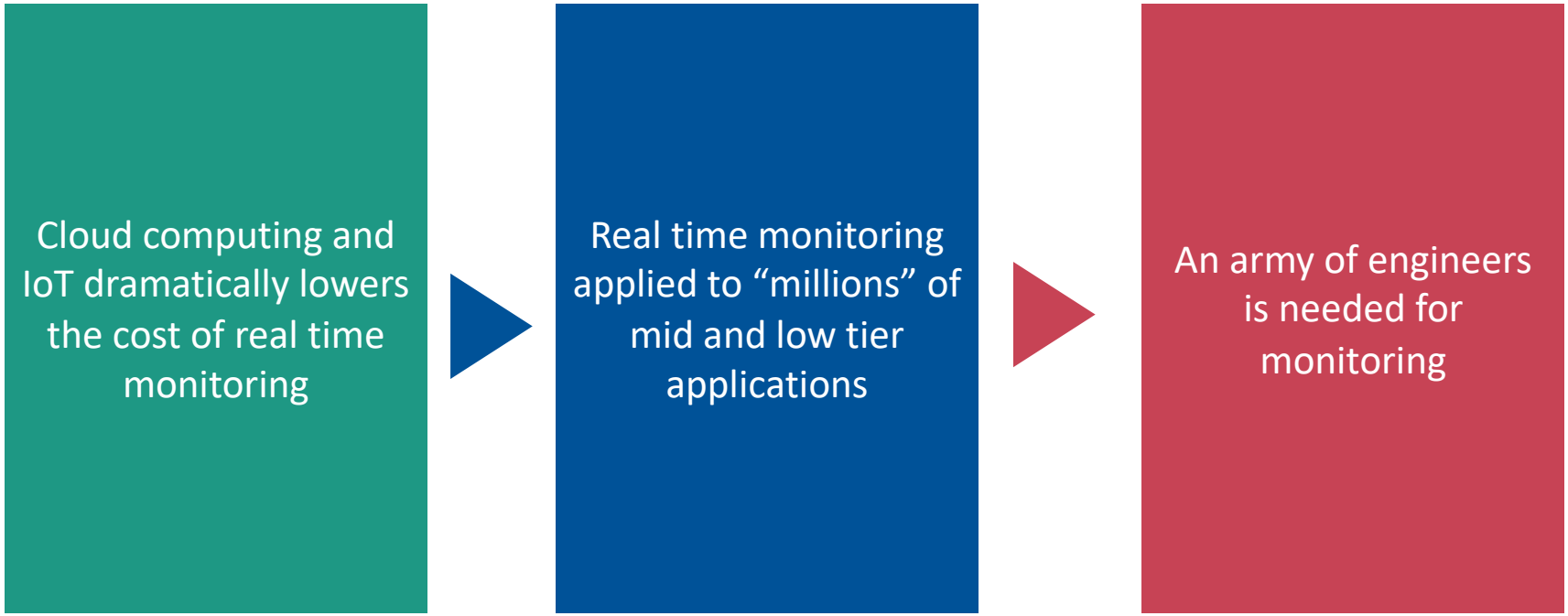
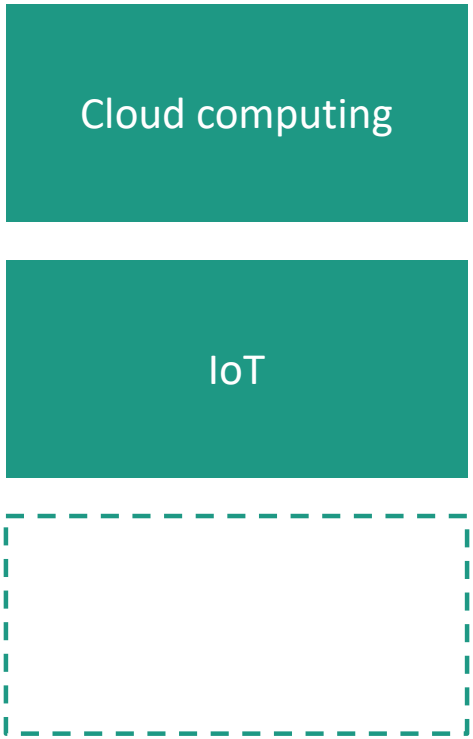


The third enabler is needed



- From fixed to variable cost
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- Cost benefit of commercial-off-the-self hardware and software
- The cost of dedicated buss vs public wireless networking

Machine learning enables monitoring in massive scale

Cloud computing

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IoT

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Machine learning

- Enables low cost monitoring in massive scale

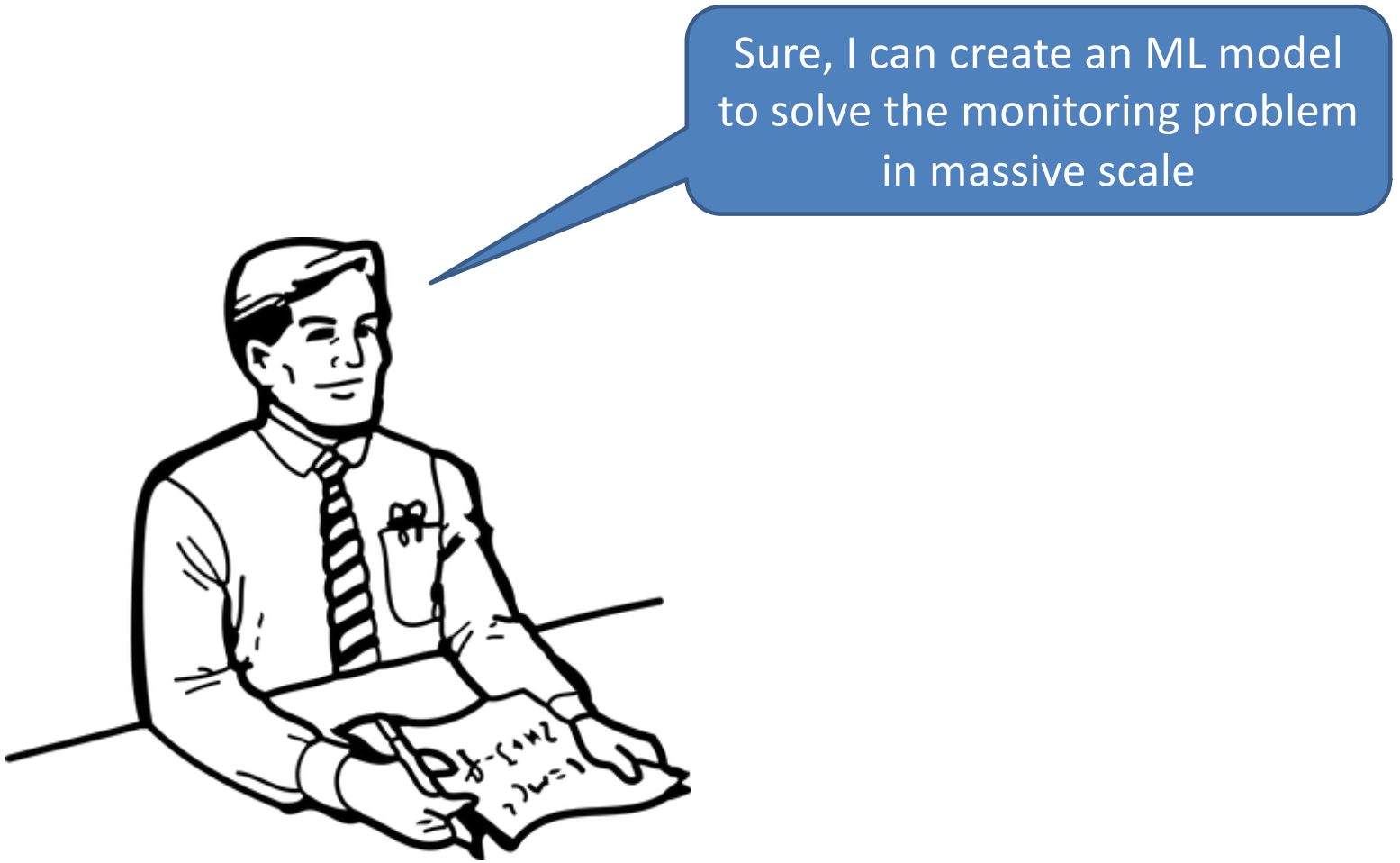
We will see transform from reactive maintenance to predictive maintenance in massive scale

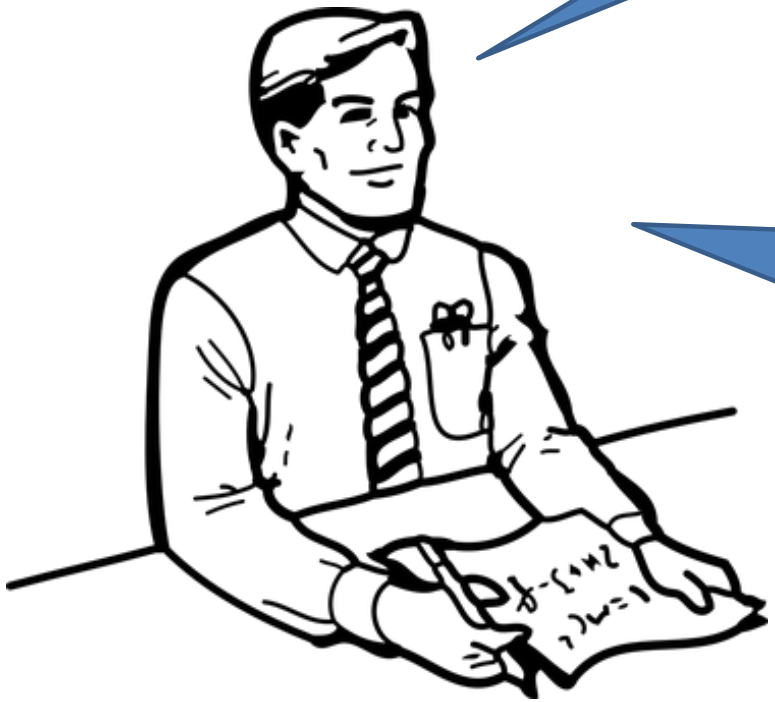
High tier

- No dramatic discontinuity
- Evolution toward smarter systems

Mid and low tier

- Major business discontinuity
- **Periodic condition monitoring** and "**Wait and react**" replaced by Cloud-IoT-ML solutions in millions of applications

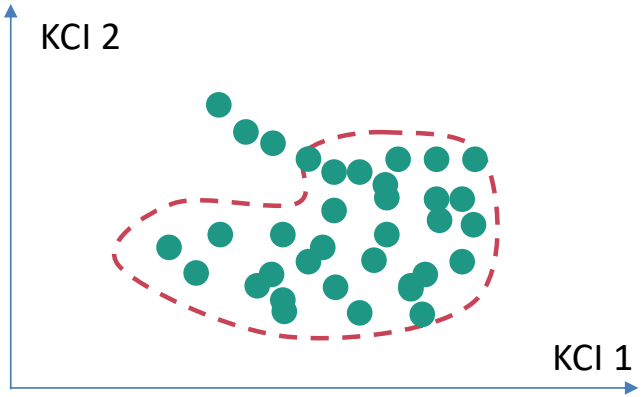


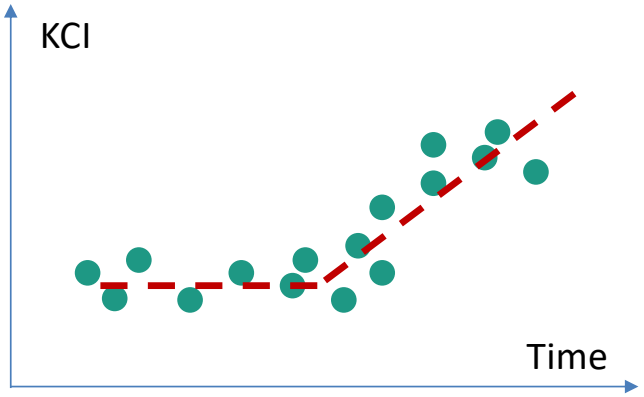


Sure, I can create an ML model to solve the monitoring problem in massive scale

Just give me historical data on normally operating and soon-to-be-failing devices

Recipe for ML based predictive maintenance in massive scale





- Use expert knowledge to define a set of Key-Condition-Indicators (KCI)
- For example A1/A2 from Power Spectral Density
- (often) automatic detection of **rotating speed** by Machine Learning
- (often) automatic detection of sensor **installation angle** by Machine Learning
- **Anomaly detection** to monitor if the combined KCIs stay within range
- **Trend monitoring** to detect if there is a long term KCI trend

Key takeaways

- Cloud, IoT and ML combined will lower the cost of predictive maintenance by several orders of magnitude
- This will be a discontinuity in mid and low tier applications; not so much in high tier applications
- Supervised learning can not be applied as there is no labelled training data available in low and mid tier applications; use anomaly & trend detection
- Machine learning is needed not only in monitoring but also in supporting applications e.g. rotating speed and angle detection to enable massive scale

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Thank you
We are ready to help you

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