DDV Mobile Maintenence

Predictive maintenance, IoT & Big Data

Kort om mig selv

Lars Dylander

CEO i 2BM A/S

Leder af innovationsselskabet Area51

Jeg har arbejdet med større ERP installationer og mobilteknologi gennem mere end 15 år – jeg elsker teknologi og området som jeg skal fortælle om i dag er absolut mig ynglings område ☺

Jeg skal prøve at gøre det inspirerende og interessant –alt hjælp, input og vidensdeling til at opnå dette er velkommen!

Sæt scenen

- De næste 45 minutter, jeg vil prøve at forklare baggrunden for den fantastiske og inspirerende forandringer, der sker rundt omkring os

- Hvorfor vi oplever et ”tiger spring” i produktiviteten på linje med den industrielle revolution

- Lad os få en dialog - kommenter og inspirere gerne mig og hinanden, som en del af præsentationen ☺

Hvorfor teknologien ændrer vores verden

- Nøglen til at forstå den forandring som teknologien giver nu, er at forstå der er flere teknologier, som modnes samtidig
- Eksempler på disse teknologiområder er f.eks.:

  - **Always on**
  - **Connectivity**
  - **Pervasive Computing**
  - **Location based**
  - **Sensoring**
  - **Big data**

→ *The Internet of things…*

- Teknologierne er hver i sær fantastiske, men når de kombineres så er det at vi skaber nye transformerende forandring, da vi så pludselig skaber helt nye løsninger og produkter

Urkraften i den teknologiske revolution

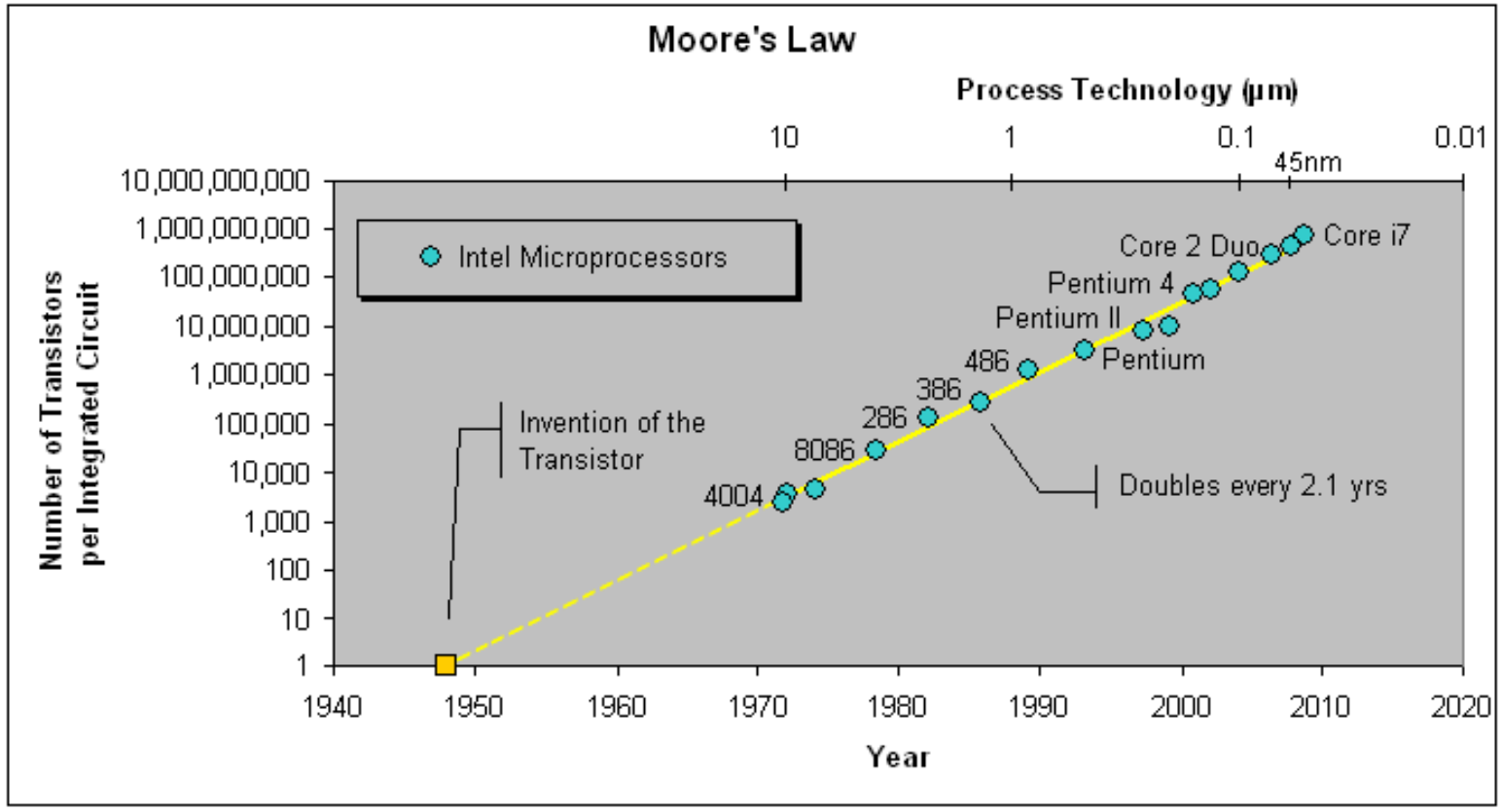
- Moores lov er en næsten uforståelig kraft

Moores lov siger:

at antallet af transistorer i et integreret kredsløb vil fordobles ca. hvert andet år.

Prøv at forestille dig, hvad denne udvikling betyder på det ekstreme CPU niveau vi har i dag…

- om to år, så er den dobbelt så kraftig ... !



Hvor er vi så på vej hen?

- En forklaring til de muligheder som skabes indenfor produktion og vedligehold…

Vi er på vej mod ”industri 4.0”

Industriens tre første store bevægelser var:

- **1.0 Mekaniseringen** i 1500-tallet, der introducerede vandmøllen og den mekaniske væv.
- **2.0 Industrialiseringen** i 18-1900-tallet, der skabte fabrikken og samlebåndet.
- **3.0 Automatiseringen** i 1980-90’erne, der bragte robotter ind på linje med arbejdere i fremstillingen.

- ***4.0 Industrial Internet of Things 2015 →***

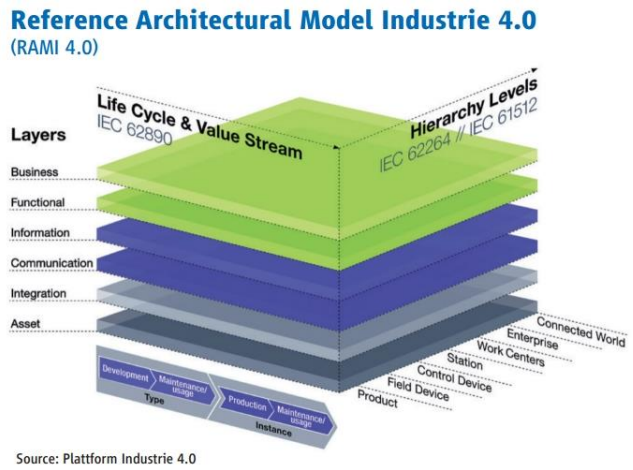
Det er integrationen mellem den digitale verden og den fysiske produktion.

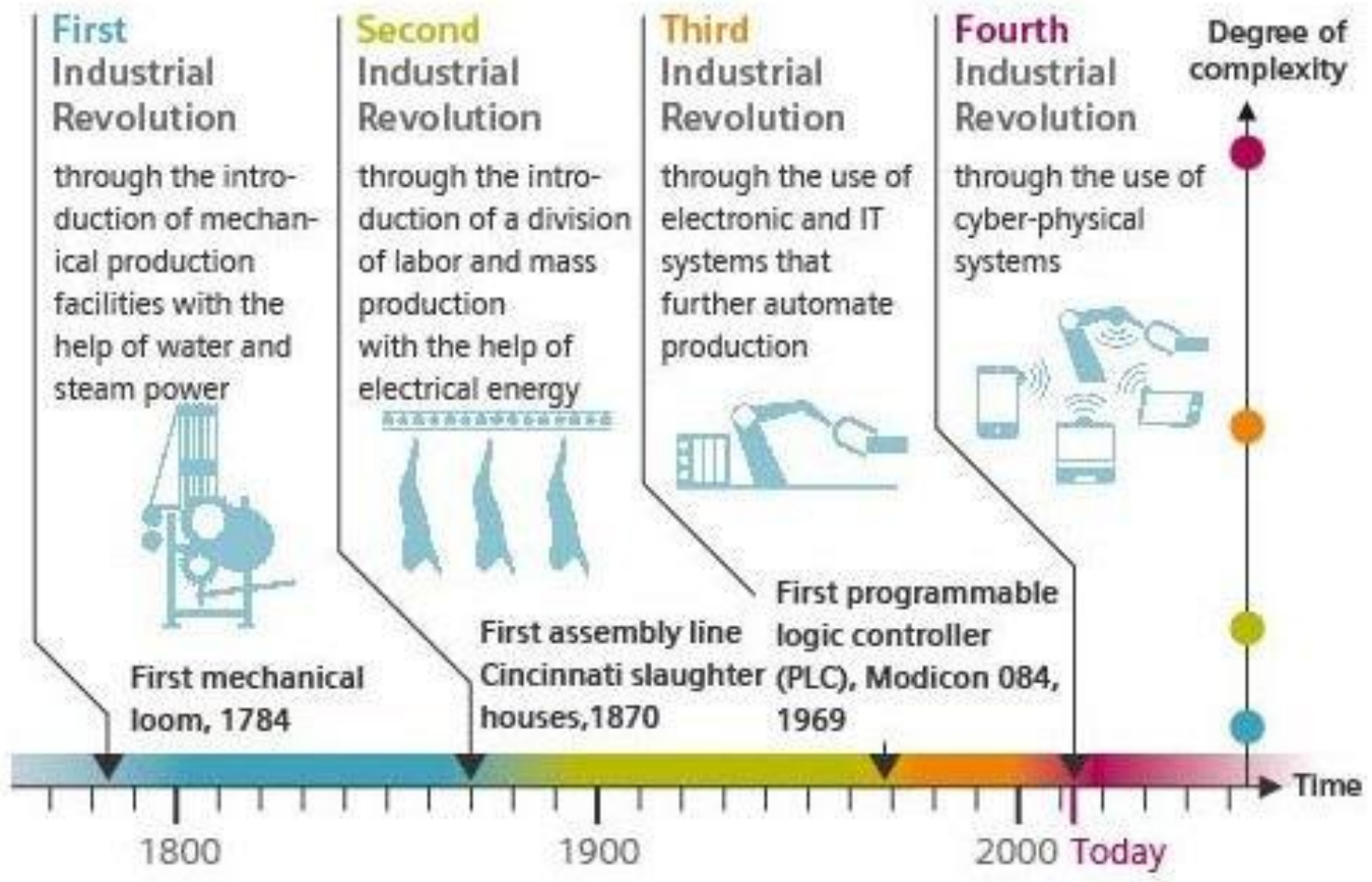
Det er ideen om, at intelligente, samtænkende produktions- og servicenetværker kan selvstyre elementer på kryds og tværs af industrielle værdikæder.

Industri 4.0

I dag handler det så bare om hvad det betyder for vedligehold ☺

Industri 4.0 betyder, at industriel styrke – konkurrenceevne – flytter sit fokus fra evnen til udelukkende at fremstille hurtigere, bedre eller billigere til evnen til at omsætte produkter og processer til digitale formler og distribuere disse formler som serviceydelser…





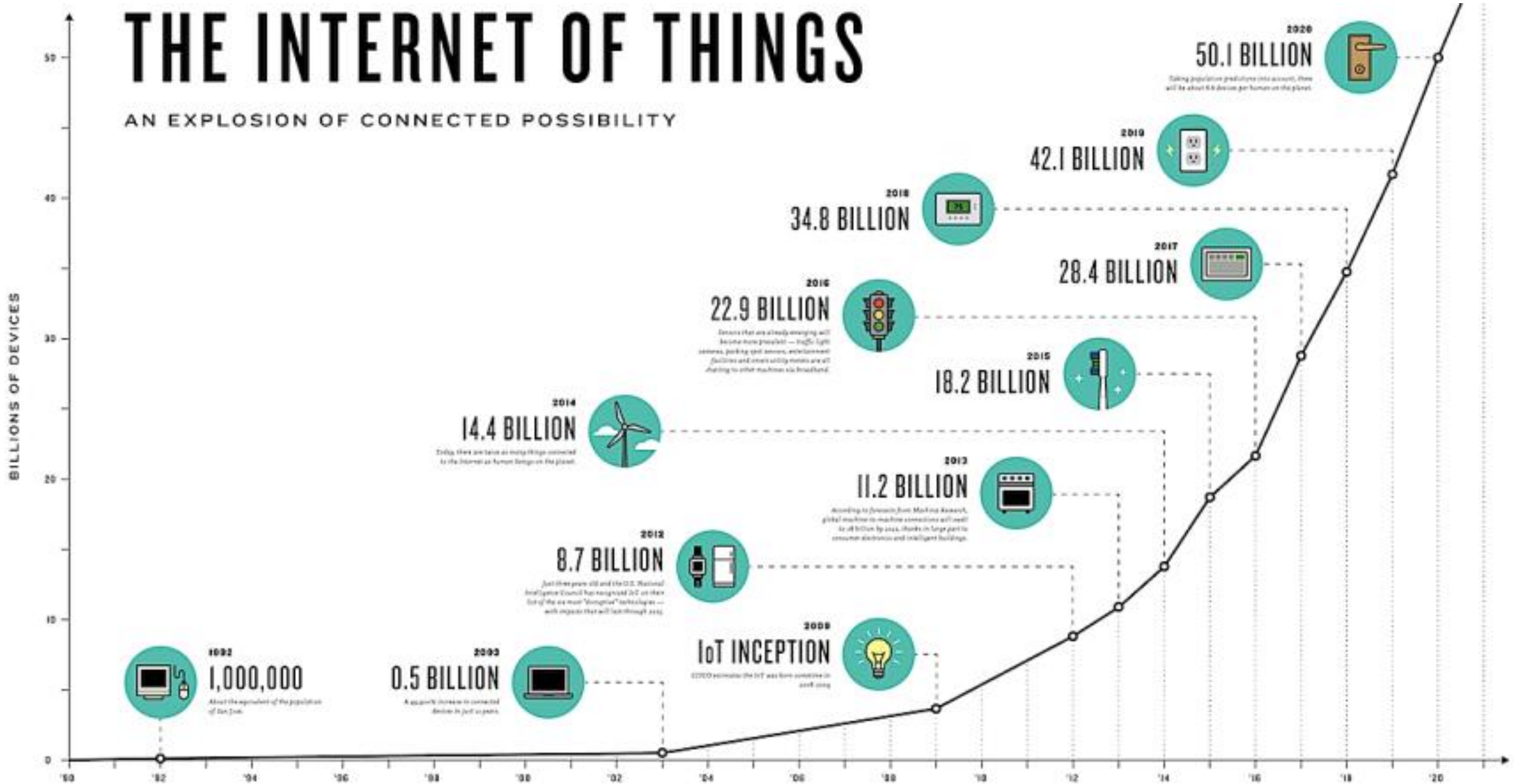
The internet of Things

- Nogle kaldet det ”internet of everything”
- Alt ting får en chip og dermed funktionalitet
- Alt bliver forbundet til internettet

- Det gælder naturligvis også maskiner, bygninger, lokaler mennesker og alt andet. Altså alle de elementer som skal vedligeholde fortæller ”hvordan de har det” og ”hvad de oplever”

THE INTERNET OF THINGS

AN EXPLOSION OF CONNECTED POSSIBILITY



BIG DATA

- Big data er resultatet af den datastrøm, som genereres fra dine mange IoT objekter.
- Som analogi til Big Data kan bruges din erfaring som menneske. Du har oplevet en lang række følelser som gør at du reagere på indikatorer forud for at noget sker.
- Big data skaber erfaringsfundamentet som gør at vi kan anvende algoritmer, finde mønstre og derved skabe forudsigeligt vedligehold.

Hvad er Machine Learning og hvordan hænger det sammen med vedligehold?

- Machine Learning / Deep Learning / Neurale Netværker – kært barn mange navne ☺
- Machine Learning er den teknologi som binder det hele sammen – det er det værktøj som gør at vi kan overskue alle vores data
- Machine Learning er den teknologi, som er hjertet i Google og FaceBook success
- Det er ved brug af Machine Learning at vi vil finde hidtil ukendte sammenhænge indenfor vedligehold.
- Det er ved brug af Machine Learning kombineret med sensor data og ”vedligeholdelses informationer” at vi skaber forudsigeligt vedligehold – men også nye og bedre designs i vores produkter…!

Machine learning workflow

Training set

Unsupervised

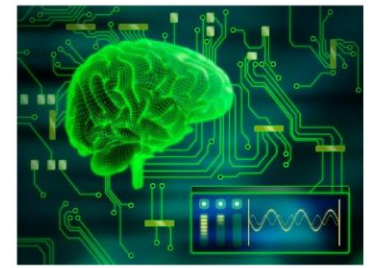
Supervised

Feature extraction

Machine learning algorithm

Grouping of objects

Predictive model



New Data

Annotated data

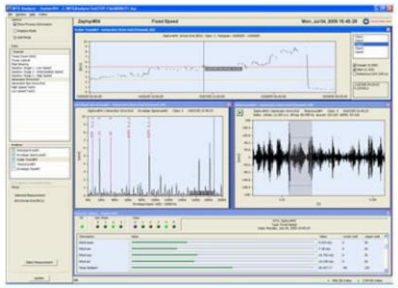
Hvad betyder det for vedligehold

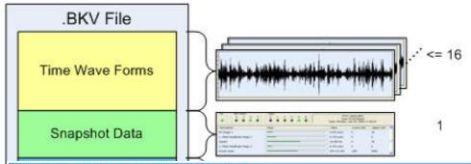
Digitalisering i vedligehold

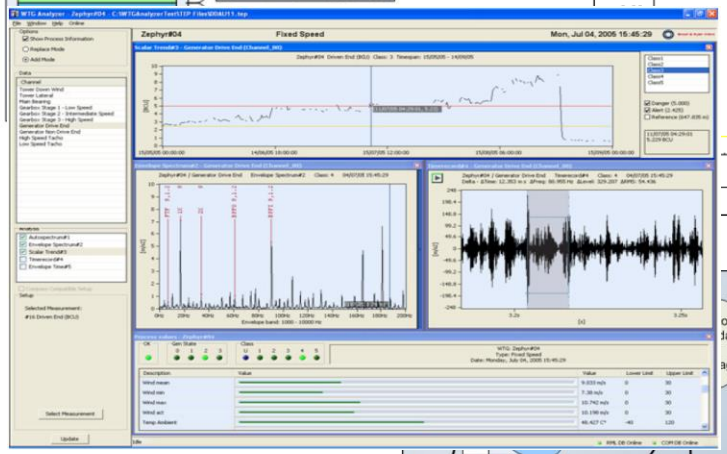
For at overgå til forudsigeligt vedligehold, skal vi have viden og erfaring som grundlag for vores algoritmer

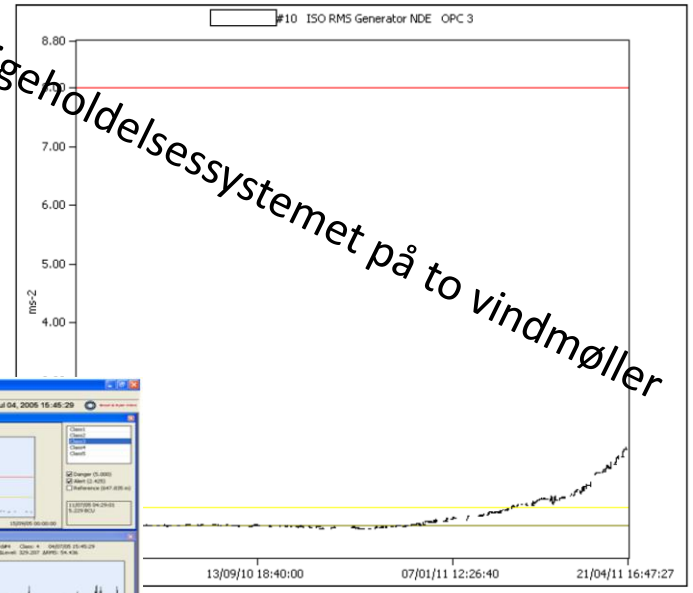
- Eksempler på sensorer
  - TEMPERATUR
  - TRYK
  - LUFTFUGTIGHED
  - GYRO
  - MAGNETISME
  - VÆSKEHØJDE
  - MATERIALEFUGTIGHED
  - UV
  - PROXIMITY (radio og kapacitiv)
  - LYS
  - LYD
  - VIBRATION

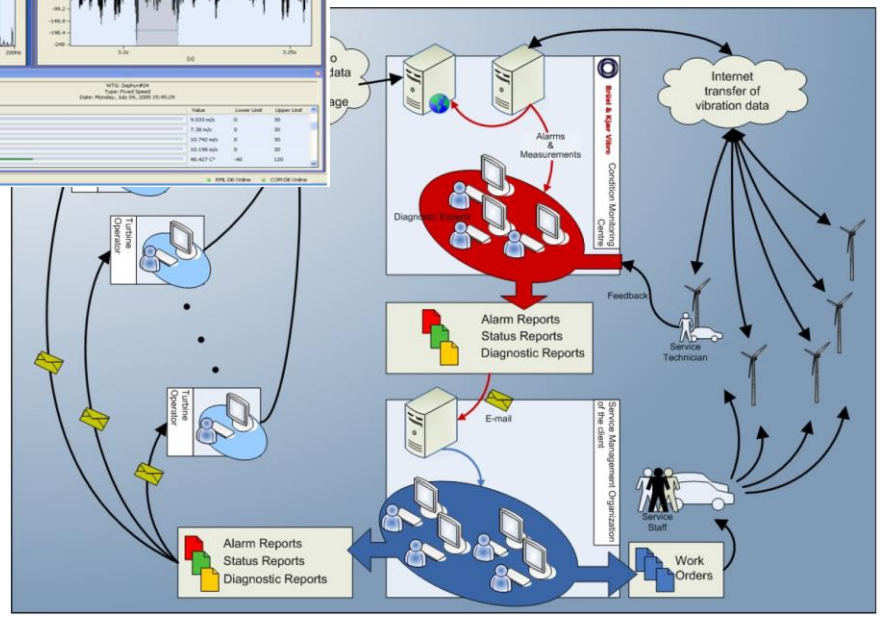
Billeder for vedligeholdelsessystemet på to vindmøller









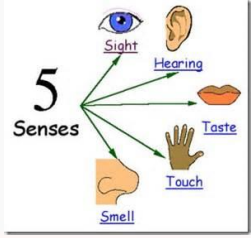


Hvorfor er det vigtigt…

- Fordi det forandre forretningsprocesserne…
- Det er naturligvis forskelligt fra industri til industri – men størstedelen af jer som er her i dag, vil fundamentalt have effektiviseret jeres vedligeholdelsesprocesser indenfor de næste 5 år ved brug af sensoring
- OG måske lige så vigtigt, så er den viden og kompetence som virksomheden fundamentet for at deltage i konkurrencen i et marked hvor ”Internet Of Things” bliver den nye norm

Predictive Maintenance
Fremtidens vedligehold

- Vi skal sikre at de equiptments som kræver vedligehold kontinuerligt melder data ind til vores videns bank.
- Forandringer i disse data strømme er indikatorer for at noget er forandret, som måske indikere et slid og/eller behov for vedligehold
- Jo mere data virksomheden har – jo ”dygtigere” bliver de algoritmer som bygges til at analysere og skabe viden fra data



Hvilke krav stiller det til forretning og IT

- Vi skal være **dygtigere til at indhente data** fra et stort antal kilder (ting) som kontinuerligt fortæller deres status
- Vi skal lære at beherske ”**signal behandling**” på samme måde som transaktionsdata er en naturlig del af virksomhedens datastrømme

- Vi skal lade os **inspirere af** de **teknologiske muligheder** i et **samspil mellem forretning og IT**, og anerkende mulighederne fremfor truslerne i den digitaliserede forretningsmodel

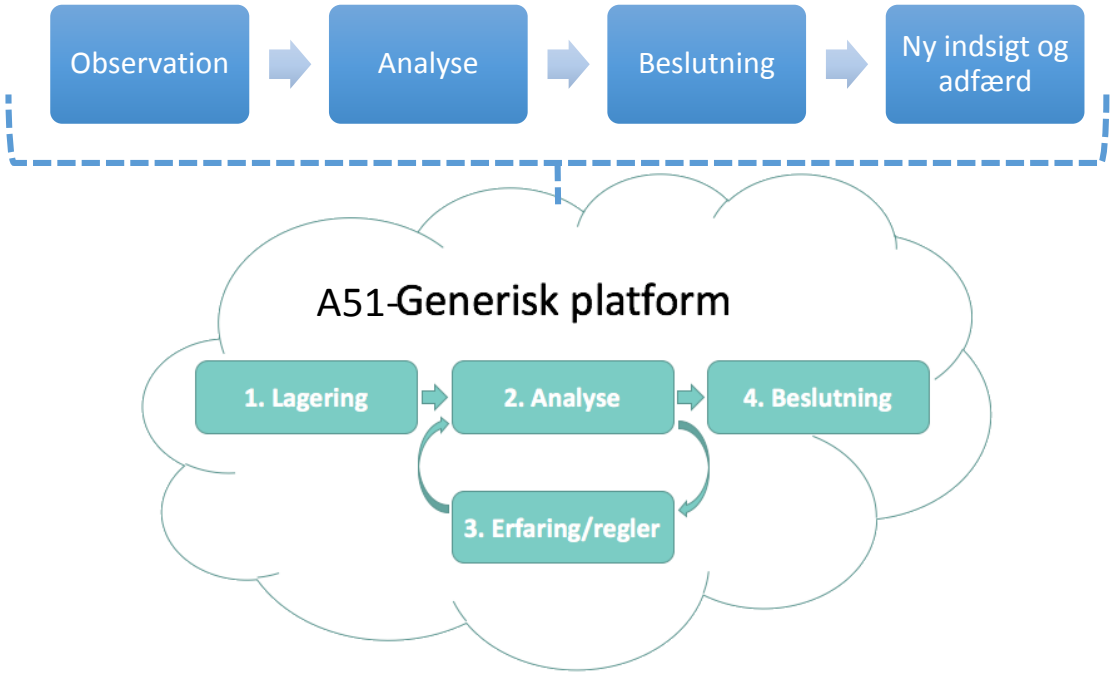
- Stort set alle **virksomheder bliver udfordret** af digitaliseringen som forandre måden hvorpå vores virksomheder fungere

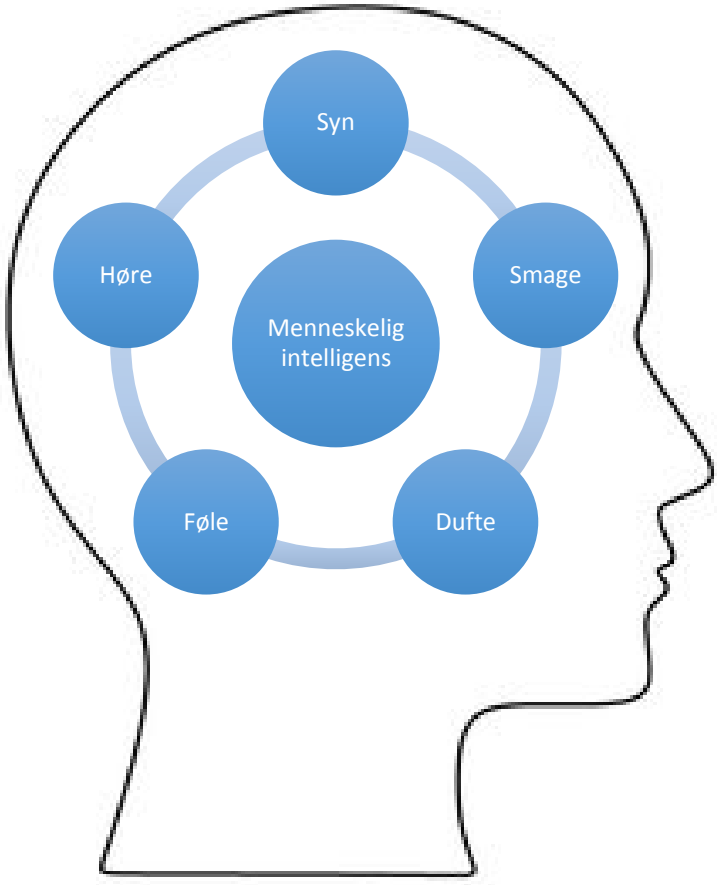
Area51 software – “Mobile Sensor Platform”

Enablement of Internet of Things

Målsætningen for vores platform

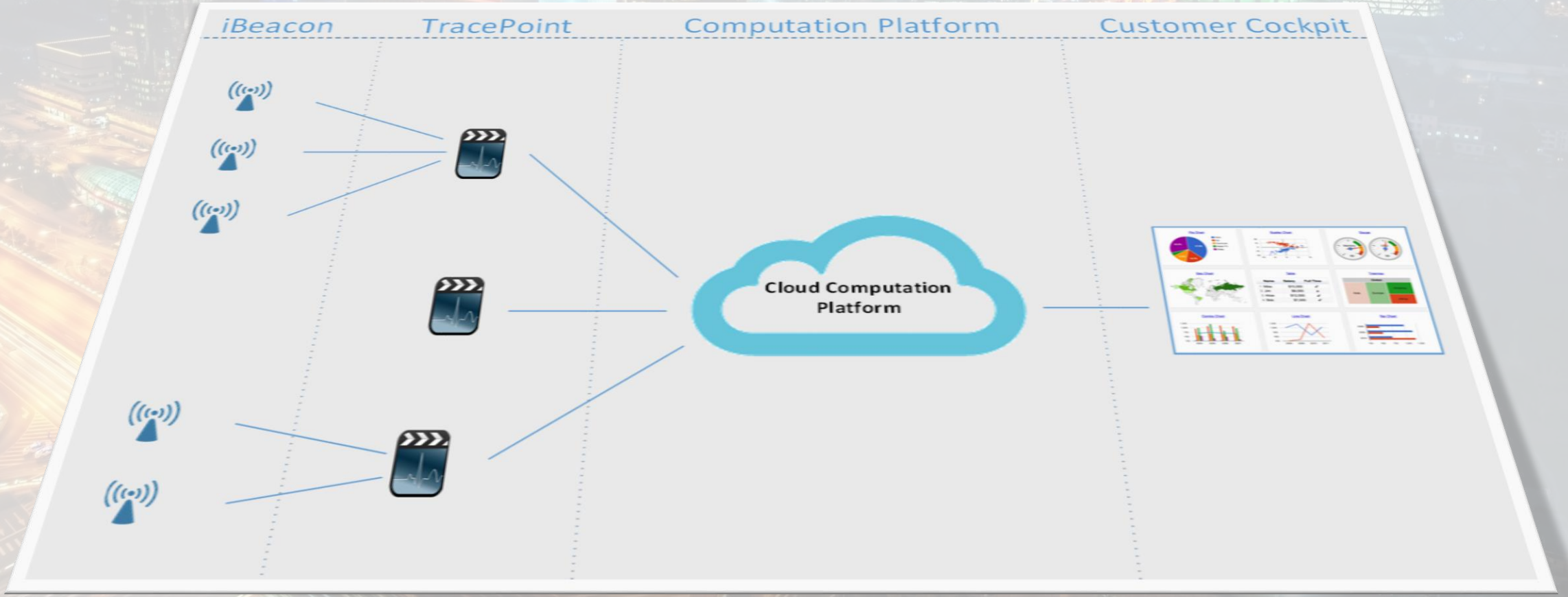
- At kunne ”fornemme” og registrere ”real tid situationer”





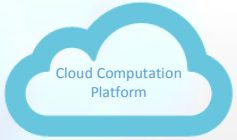
Solution overview

It’s an integrated platform consisting of 4 central components:



The Solution – “Sensor platform”

- Treatability and monitoring are key elements in the solutions.
  - **TracePoint**
    - The TracePiont device can function as an independent unit monitor and as an access point for other smaller monitor devices called beacons. The TracePoint has storage capacity and Internet access.
  - **iBeacon**
    - The iBeacons are small monitor objects (things) that communicate information to the TrackPoint. The beacons are different in size, price and functionality – but common for all is that they measure and send information to a TracePoint.
  - **C-Cloud**
    - The C-Cloud is where all information is gathered and computation is added to create information from all the collected data. Using well known computation and more sophisticated learning algorithms the C-cloud makes sense of the data, enabling rich monitoring and predictive support for more reliable forecasting
  - **Customer Cockpit**
    - In the customer cockpit you monitor and follow the data and information collected by the sensors in the solution. Reporting and analytics are accessed in the cockpit, where the raw data also is available for download.



TracePoint

- The TracePoint unit monitors the following information:
  - Location (latitude & longitude coordinates)
  - Speed
  - Altitude
  - Bearing
  - Vibrations and accelerations
  - Orientation in the 3D space
  - Magnetic field
  - Light sensitivity
  - Air pressure
  - Temperature
  - Humidity
- Furthermore, the TracePoint enables:
  - Local storage capacity
  - LAN Connectivity (Wifi and Bluetooth)
  - Mobile Connectivity (GSM)

Together this monitoring creates "**situation awareness**" and supported by computation in algorithms, a variety of information is obtained from the data.

iBeacon

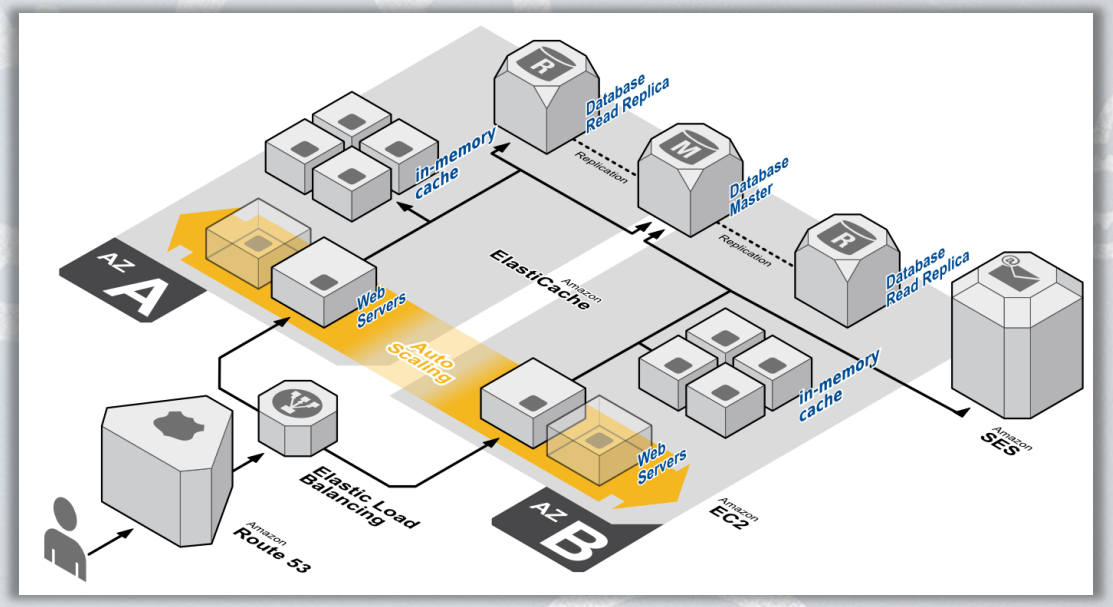
- The iBeacon unit is a small unit specialized for different kind of measurements. Basically the iBeacon consists of a small sensor unit, a low energy Bluetooth radio and a battery.

- The iBeacon transmits the following information:
  - All iBeacons:
    - Unique identification code
  - Dependent of unit:
    - Temperature
    - Humidity
    - Accelerometer
    - Light
    - Etc…

Cloud Computation Platform

- The Cloud Computation Platform (CCP) is the heart in the solution. It is here that all data is gathered and stored for further processing, creating information of the data.

- The CCP provides:
  - Web services for data capture
  - Storage capacity
  - Computer power (CPU)
  - Algorithms
  - Data security



Customer Cockpit

- The Customer Cockpit is the user interface for the solution and here all units, master data and information is accessed and maintained.
- The Customer Cockpit provides:
  - Information Cockpit
  - Algorithms and reporting
  - Predictive and alert management
  - Login and user management
  - Master data management
  - Unit management
  - Sensor data management

Industry solution – Shipping

Sensoring platform for shipping

Track, Trace and Monitoring

2BM Mobile Sensor Center

When connected:

- Login using User Account
- Check for new configuration
- Submit data to cloud

Data:

- Location data (gps)
- Speed and direction (gps)
- Directional force (accelerometer)
- Forced vibrations (gyroscope)
- State (battery, charging etc.)
- Temperature (Thermometer)
- Humidity (Humidity Sensor)
- Pressure (Barometer)
- Data recording from 2BM beacons (Bluetooth)

2BM Beacon

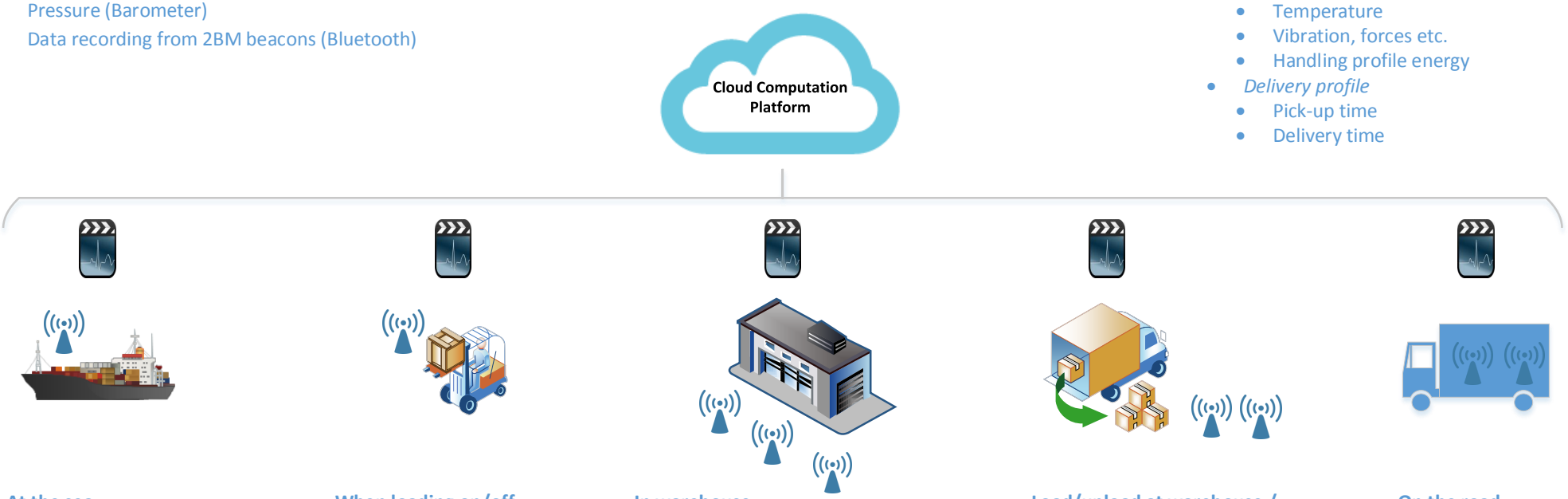
Data:

- Transmit my ID (Bluetooth)
- Transmit power (Bluetooth)
- Battery status (Bluetooth)
- Actual temperature (Bluetooth)

2BM sensor cloud

Data analytics:

- Handling and insurance documentation
- Energy Profile
- Track & Trace
- *Ship situation profile*
  - Weather profile
  - Sea & waves
  - Route, speed, Bearing etc.
  - Crew on deck
  - Safety Zones
  - Vibration, forces etc.
  - Harbor & Anchor time
- *Cargo handling profile*
  - Temperature
  - Vibration, forces etc.
  - Handling profile energy
- *Delivery profile*
  - Pick-up time
  - Delivery time



At the sea…

- Location, Speed, Bearing etc.
- Vessel energy profile
- Weather profile
- Sea profile (roll, wave etc.)
- Crew at deck

When loading on/off

- Arrivals and departures of tagged cargo

In warehouse

- Inventory location
- Inventory relocation
- Inventory environment

Load/unload at warehouse / customer

- Document delivery
- Geo-mapping to customers and warehouse

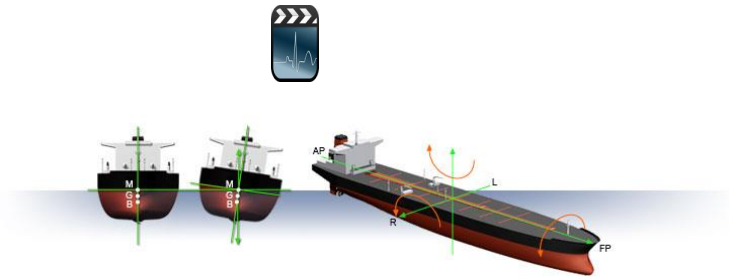
On the road…

- Handling profile
- Energy profile
- Wear and tear profile

VESSEL & CARGO

At the sea…

- Location, Speed, Bearing etc.
- Vessel energy profile
- Weather profile
- Sea profile (roll, wave etc.)
- Realtime Route info
- Crew at deck



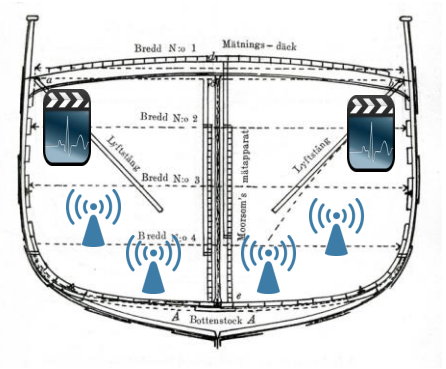
Habor information

- Harbor time
- Anchor time
- Monitor safety zones
- When “near shore” detailed route profile is loaded (broad band internet available)

Cloud Computation Platform

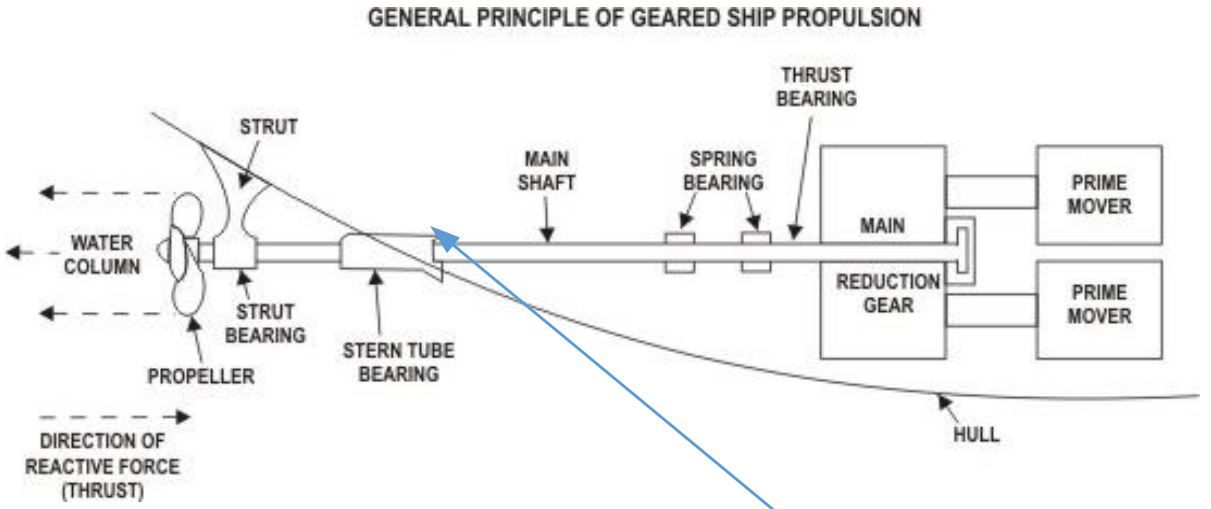
Global Control center

- Situation overview
- Route Analysis
- Energy consumption



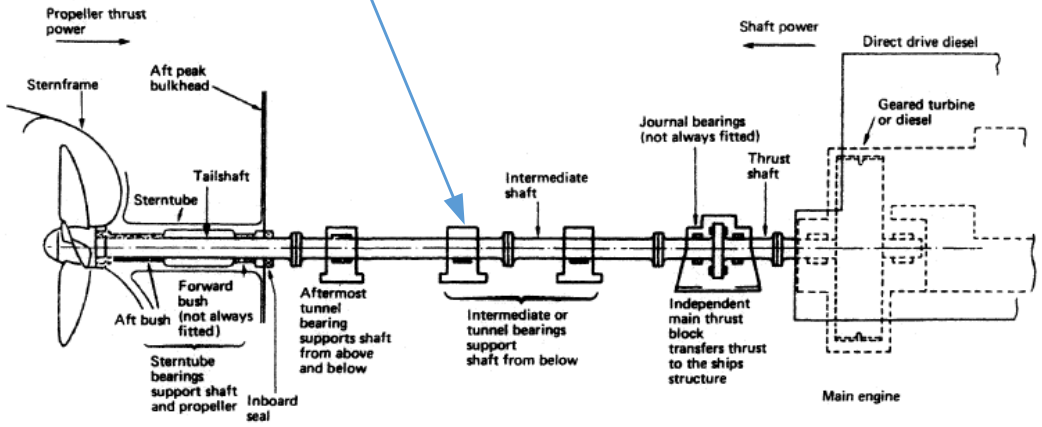
Cargo information

- Temperature
- Humidity

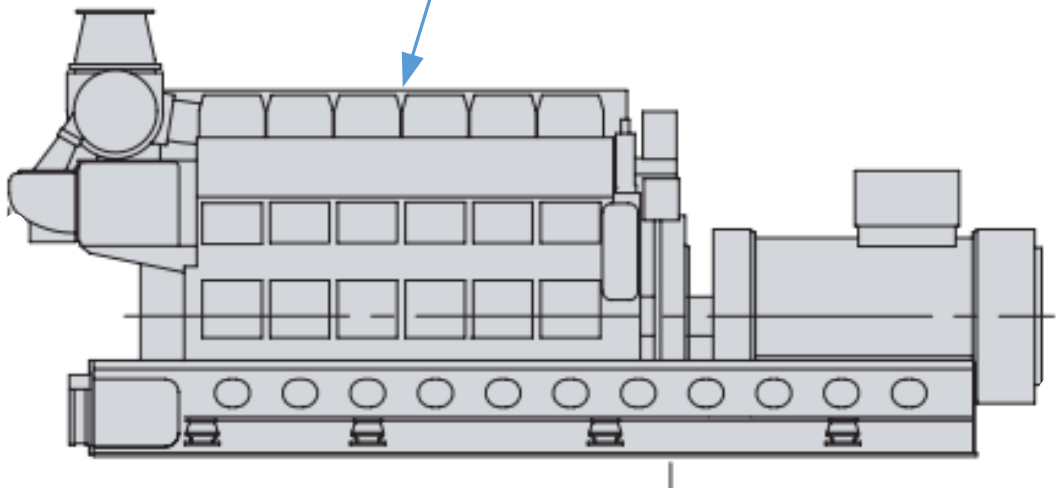


Sensor 5 (SEN_SHAFT)
The sensor must be mounted on the stern tube bearing or on one of the spring bearings.

Where will we get the most “contact” to the shaft – on the tubebearing or on the spring bearings?

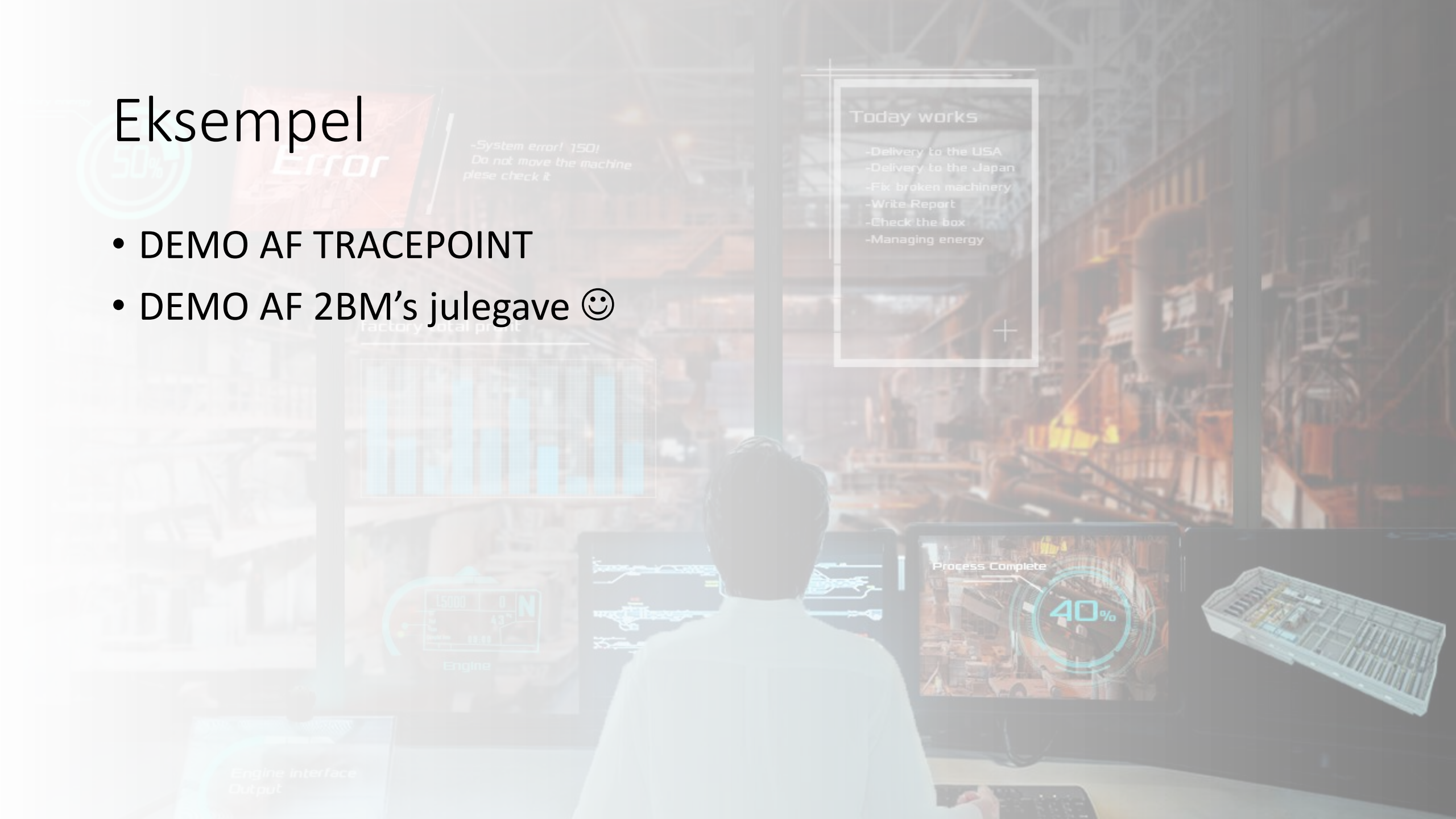


Sensor 4 (SEN_ENGINE)
The sensor is mounted as close to the middle of the propulsion engine to monitor the vibrations in the engine.



Eksempel

- DEMO AF TRACEPOINT
- DEMO AF 2BM's julegave ☺



Hvordan kommer man igang

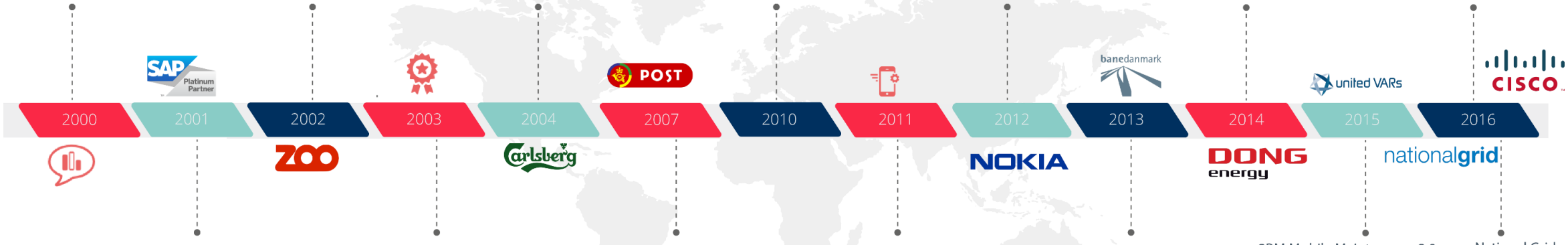
- Det er faktisk meget nemt:

- skriv en mail til: sales@2bm.com

*Som en del af arrangementet så tilbyder vi et **gratis pilotprojekt til DDV medlemmer** – inklusive udlån af 3 TracePoints og tilhørende IoT platform.*

Appendix

2BM mobile storyboard



2BMobile is founded
The name 2BM stands for "to be mobile" – making 2BM the first enterprise mobility consultancy on the Danish market

Mobile Poll Solution
2BM developed a real-time mobile poll solution enabling conference audiencea to rate opinions in real-time. The solution was launched at a conference in Copenhagen with Microsoft CEO Bill Gates and statsminister Poul Nyrup as speakers.

Mobile infocenter Zoologisk Have
In a collaboration between Zoologisk Have in Copenhagen and Sonofon, 2BM was hired to create an enhanced experience when visiting the garden. The solution included quiz, completions, interactive touch-screen and guided tours. All giving the guest an enhanced experience.

Enterprise SMS platform
More than 100 customers using the 2BM enterprise SMS platform: Carlsberg communication with their customers when the beer arrives, DLG information about meat and corn prices & Ancotrans dispatching the truck and orders.

The 10.000.000'th SMS…
Our enterprise SMS engine generates more that 10.000.000 SMS

Biometric Clock-in system
At a plant in Vietnam we implemented a biometric clock-in system ensuring the 10.000 workers were only able to clock-in themselves

Wins second place in European app contest
The first version of the 2BM Mobile Maintenance wins second place in European app contest.

2BM Mobile Warehouse
Flexible warehouse solution implemented at Danish Defence

2BM Mobile Warehouse Ver 2.0
Specialized warehouse solution for offshore demands developed and implemented at Dong Energy - enhancement of the SAP Work Order app.

Augmented IPad
Plug-in for the 2BM Mobile Maintenance 2.0, enabling augmented reality and field collaboration.

Algorithms and A.I.
Algorithms for wave detection and road quality

Mobile Payment platform
2BM developed the first mobile payment platform for TDC and Sonofon. This was the first payment platform enabling the consumer to purchase through the mobile phone. 2BM was the first integrator to interface the SMSC as payment engine.

2BM - SAP Service Partner
2BM is specialized in SAP Human Capital solutions. 2BM becomes a certificed SAP partner and VAR

Videnskabsminister recognise 2BM
SMS platform for 2 way communication - branded as e-mail2sms and sold as white label by TDC and Sonofon.

Mobile Route Planning
A solution for PostDanmark enabling the 12.000 Postbud to get the route plan and time recording on a mobile device - a Microsoft phone.

2BM Mobile Maintenance kick-off
Based on market expectations and business potential the development of a specialised SAP app supporting the Maintenance modules (PM, CS and MM) was agreed and developent started.

GPS Tracking
A solution for tracking all Banedanmark equipment and a fully automated drivers logbook for company cars. The driver "scan-in" by use of RFID chip.

2BM Mobile Maintenance
2BM Mobile Maintenance implemented at a business unit in Banedanmark

2BM Mobile Maintenance 2.0
Error corrections and extension to existing solution, adding location-based functionality, advanced camera functions and performance optimization for offline functionality. Movement of to SMP technology

United VAR's
2BM becomes the Danish office of the global organisation United VAR's and are now reprecenting global coverage and 7.500 SAP consultants.

National Grid
The international company with 24000 employees selects software from 2BM

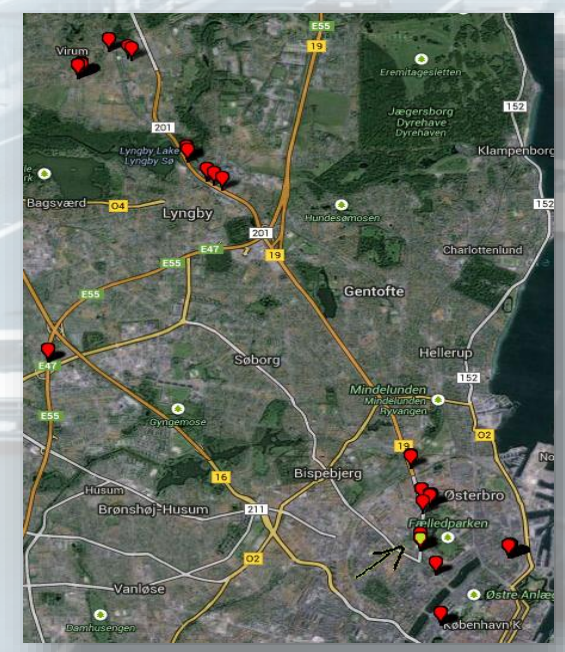
2BM Mobile Work Order 3.0
Migration to HCPms and SAPUI5 enabling cross mobile platform supporting iOS, Androyd and Windows 10

AWARDS:

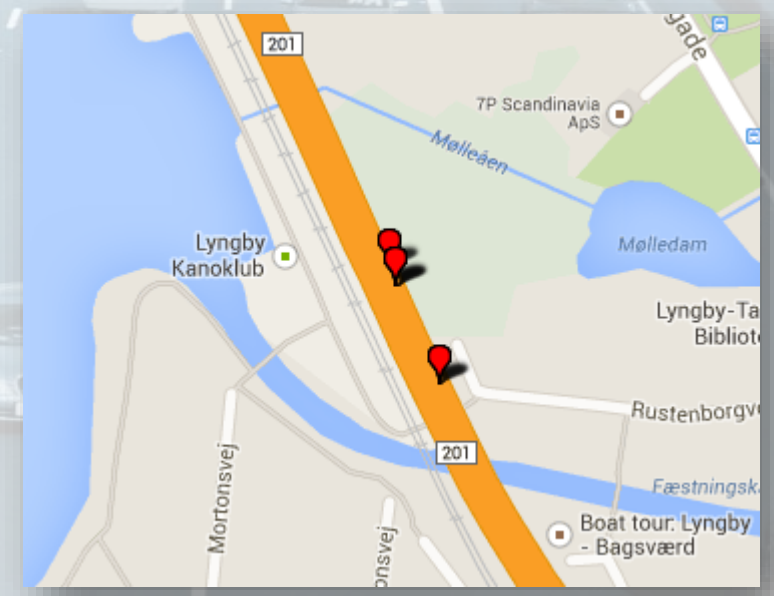
STUDY CASE

IDENTIFY POTHOLES

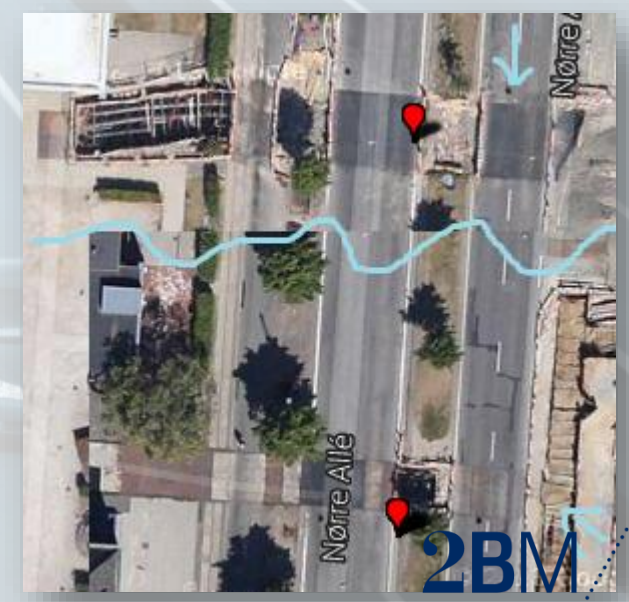
Map with potential problem areas



Bumps at Lyngbyvej driving north.

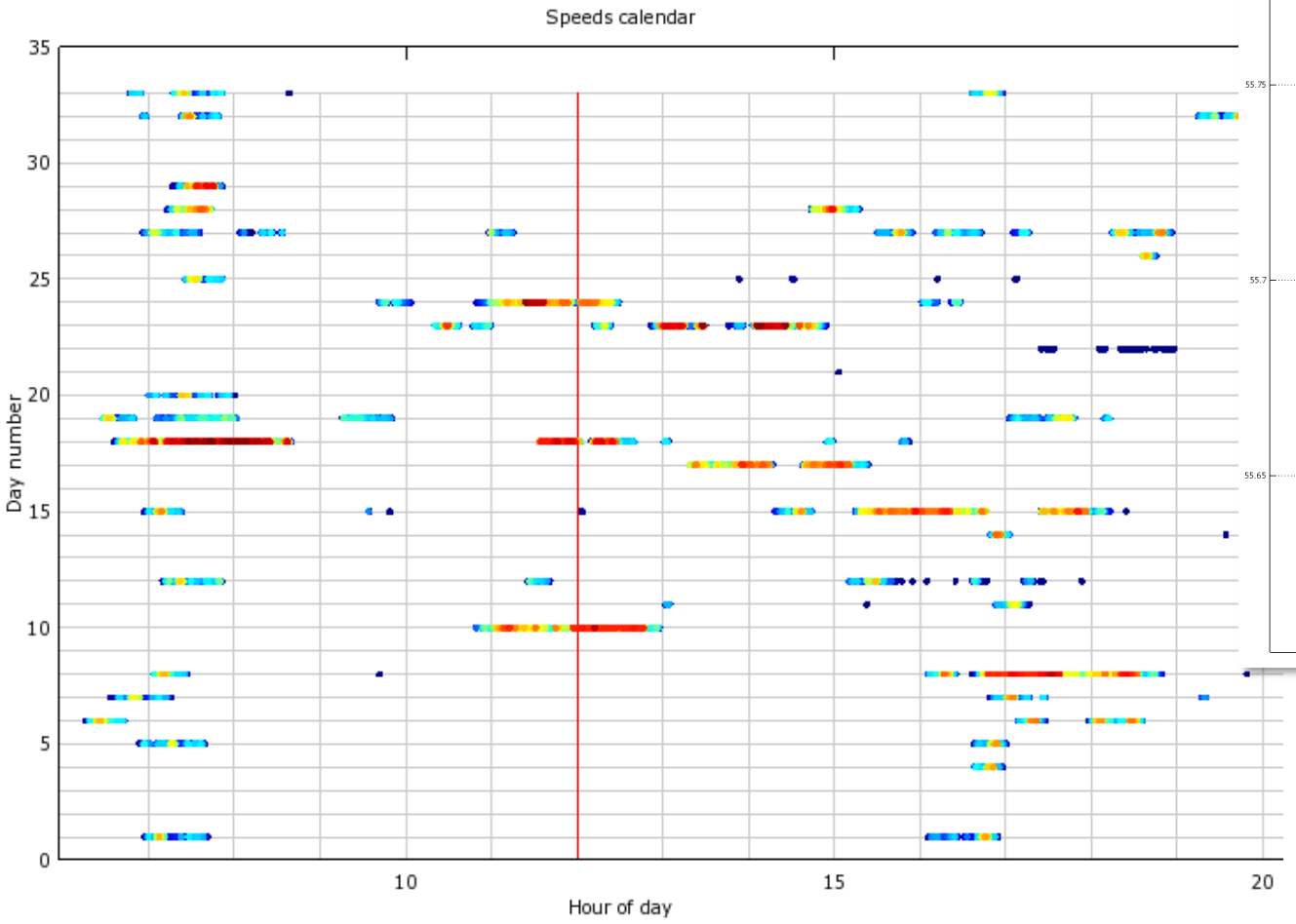


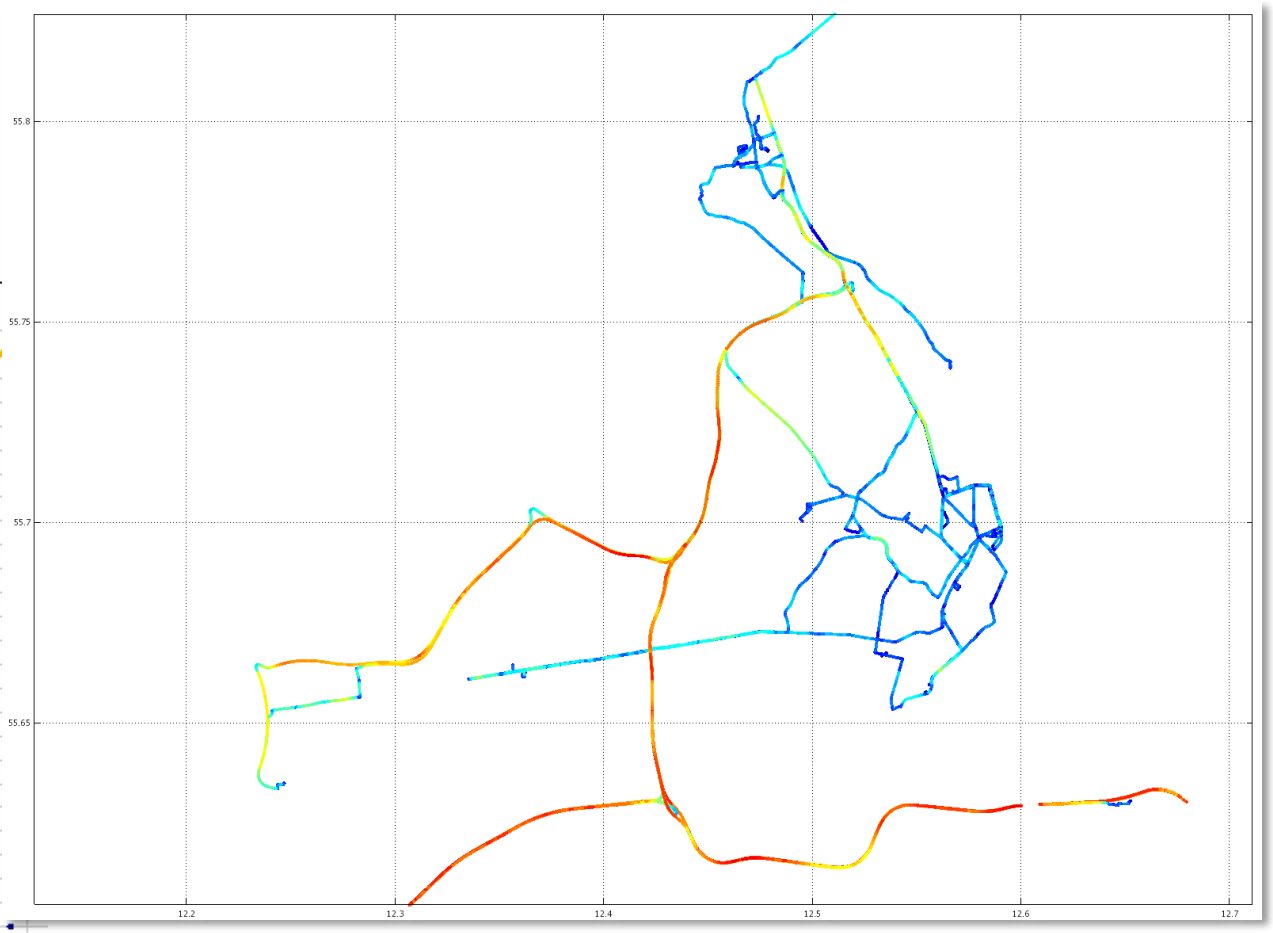
Zoom into specific area: Nørre Alle - a road work is the problem.



STUDY CASE **SPEED MAP, CALENDAR**

A speed map is like a heat map of the speeds of the car. The faster the speed, the hotter the color.





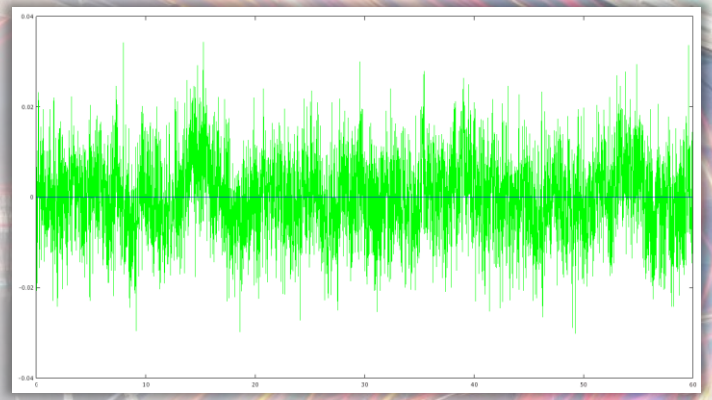
- Monitor vehicle speeds
- See traffic violations & driving patters to optimize traffic flow

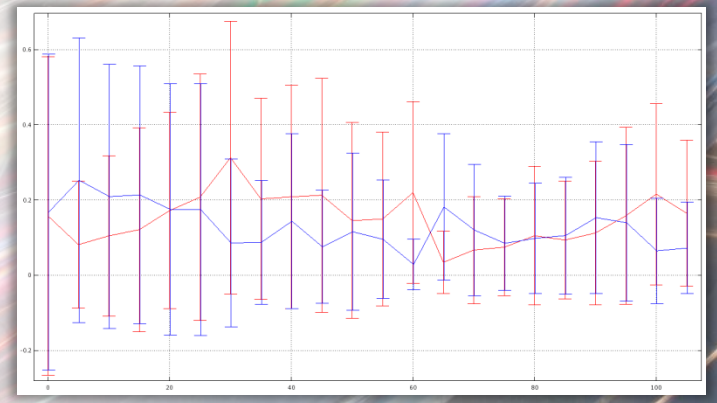
DATA ANALYSIS

- Continuous and automatic analysis is performed of new data against historical data.

- Identify peaks in the measurements which indicate attention points for treatment

- The data is analyzed by monitoring:
  - Vibrations (acceleration & sounds)
  - Rotations
  - Weather (temperature, moisture etc.)





What else can we measure?

- Proximity
- Barometer
- Temperature
- Humidity

Often the weather information is part of the situation aware solutions