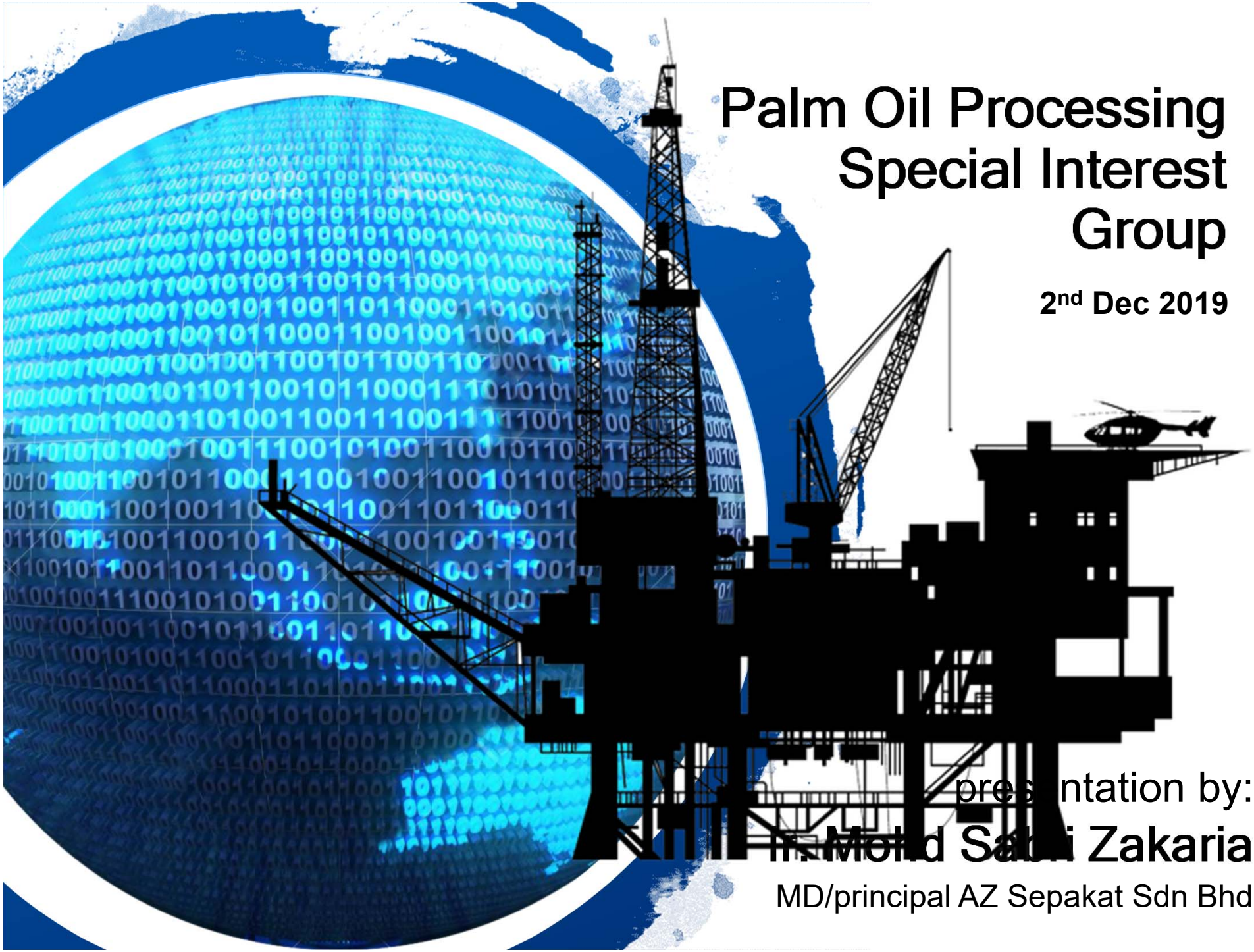


# Palm Oil Processing Special Interest Group

**2nd Dec 2019**

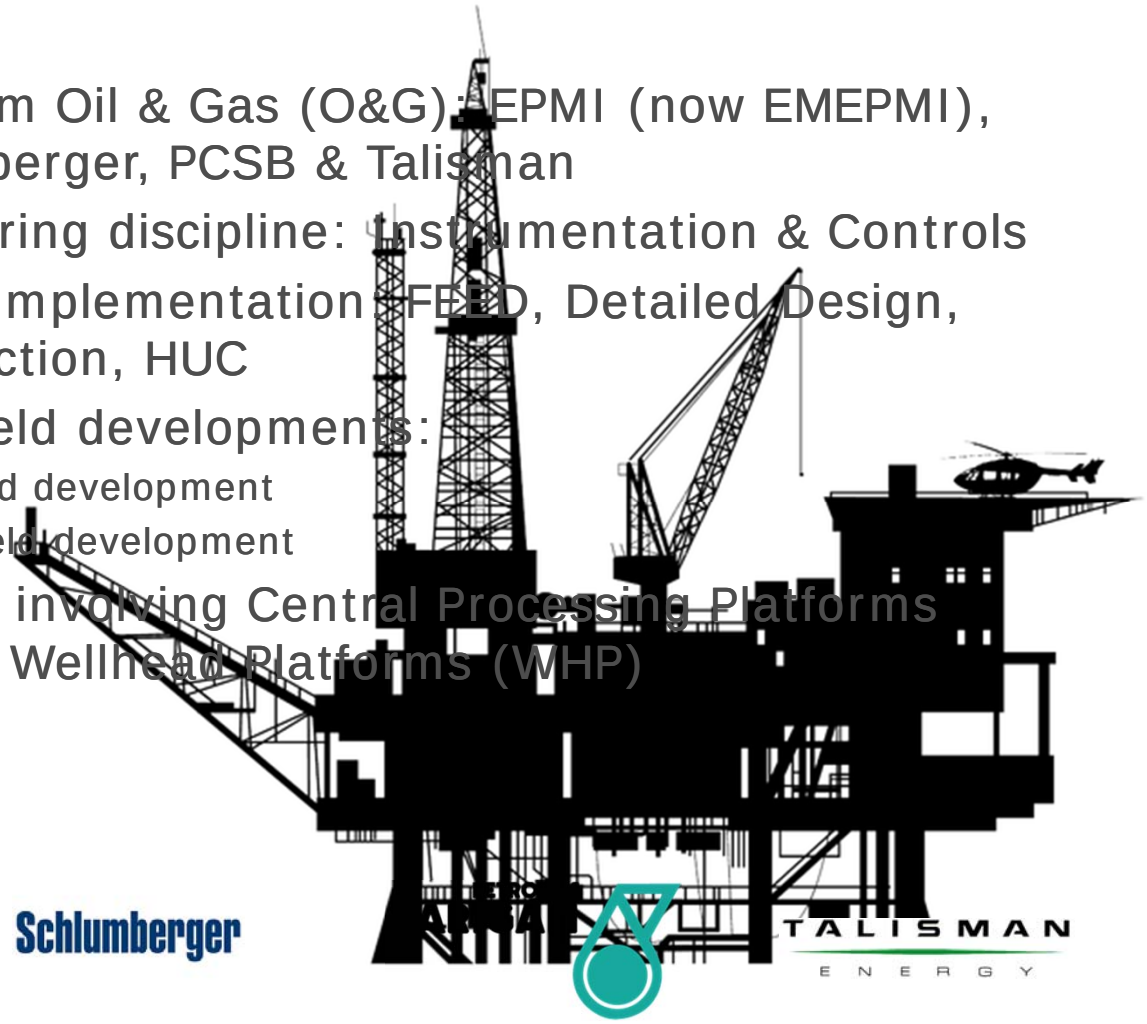
presentation by:

**Ir. Mohd Sabri Zakaria**

MD/principal AZ Sepakat Sdn Bhd

# My Background

a) Upstream Oil & Gas (O&G): EPMI (now EMEPMI), Schlumberger, PCSB & Talisman
b) Engineering discipline: Instrumentation & Controls
c) Project implementation: FEED, Detailed Design, Construction, HUC
d) Major field developments:
   - Oil field development
   - Gas field development
e) Projects involving Central Processing Platforms (CPP) & Wellhead Platforms (WHP)




Esso

Schlumberger

# My Journey in O&G Industry

Been through 4 O&G recessions

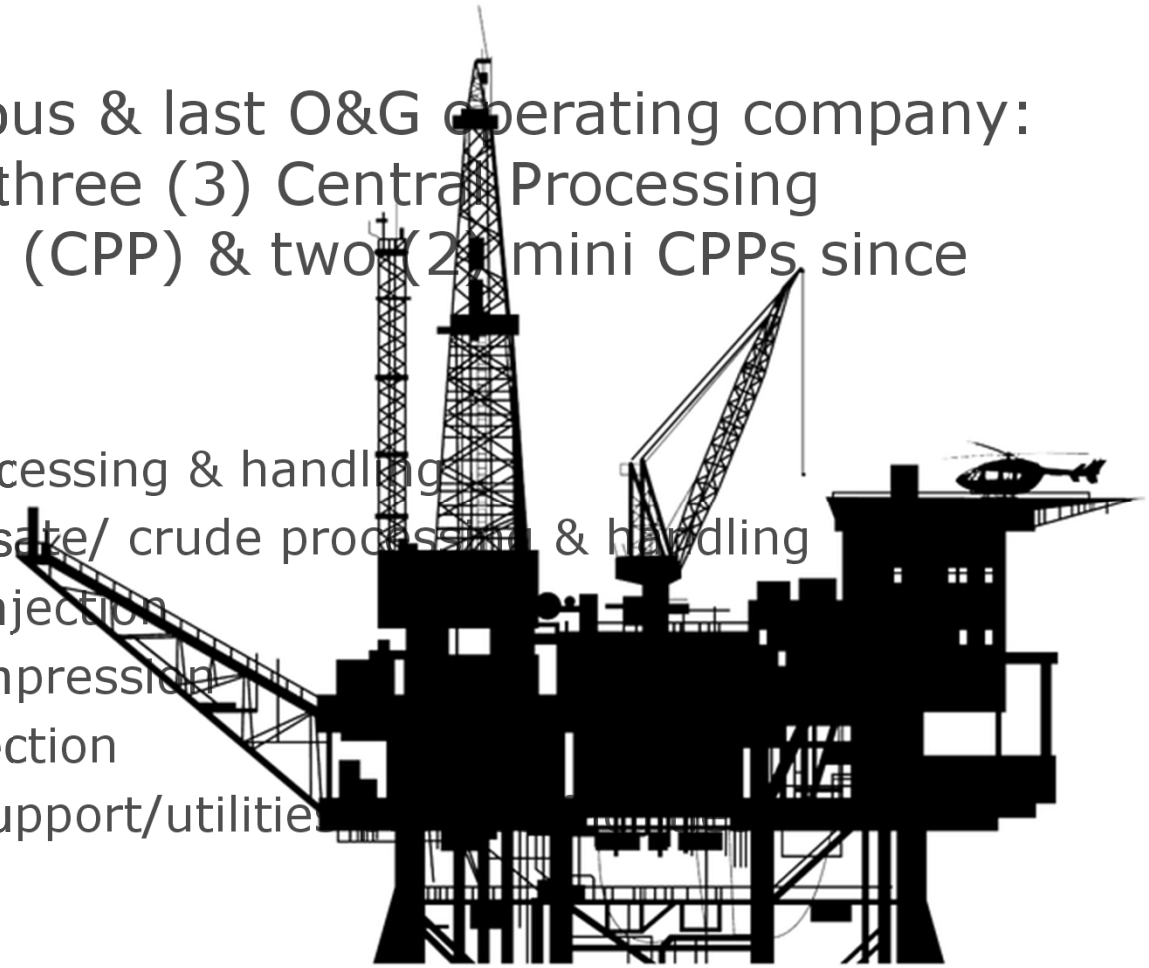
a) Recession cycles
   i. 1988s
   ii. 1998s
   iii. 2005s
   iv. 2015s



# quest to improve operational efficiencies & WHY

- My previous & last O&G operating company: installed three (3) Central Processing Platforms (CPP) & two (2) mini CPPs since 2002

  Each CPP:
  - Gas processing & handling
  - Condensate/ crude processing & handling
  - Water injection
  - Gas compression
  - Gas injection
  - Other support/utilities



# quest to improve operational efficiencies & WHY

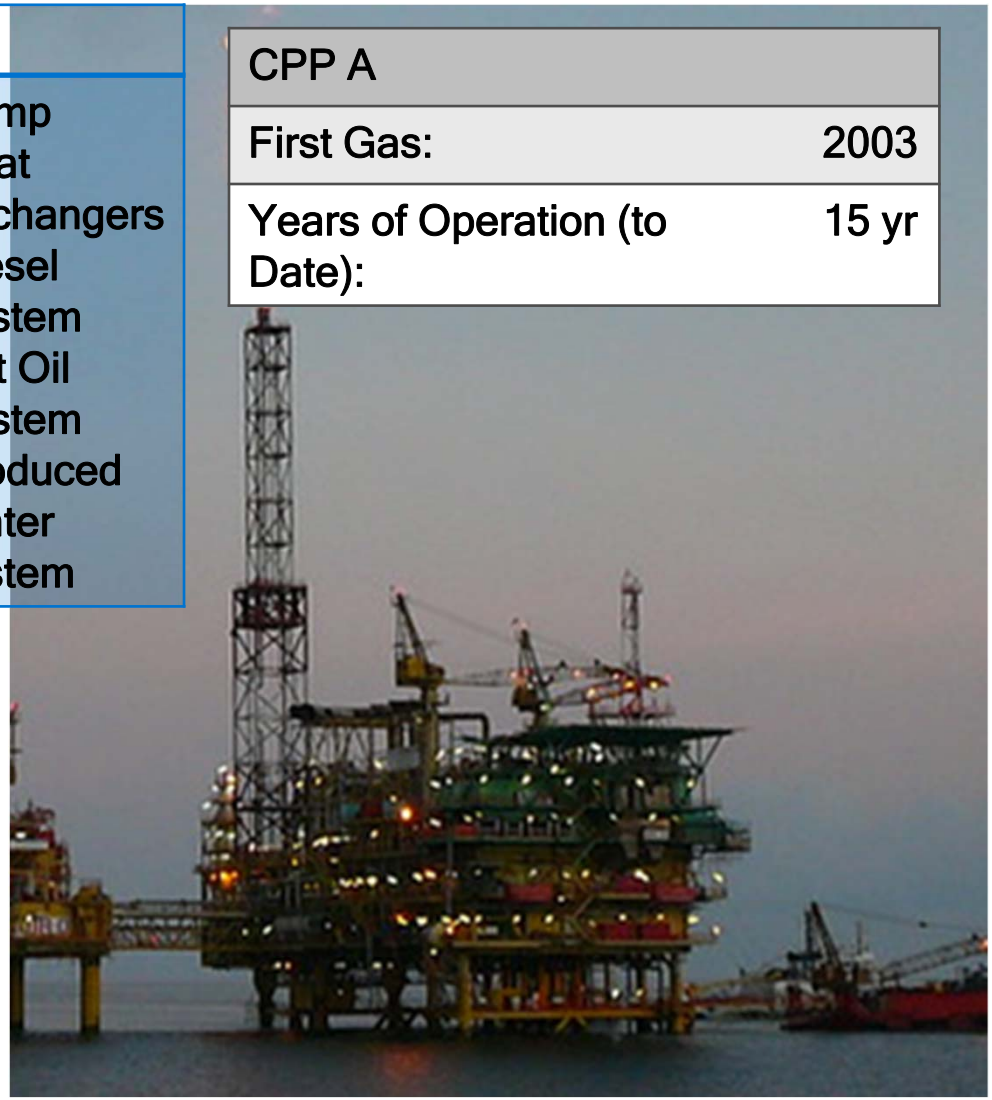
3 CPPs & 2 mini CPPs **(aging)**:

| No. | Asset | First Gas/Oil | Year of Operations (to date) |
|---|---|---|---|
| 1. | CPP A | 2003 | ≈ 15 yrs |
| 2. | CPP B | 2006 | ≈ 12 yrs |
| 3. | CPP C | 2010 | ≈ 9 yrs |
| 4. | Mini CPP (A) | 2005 | ≈ 13 yrs |
| 5. | Mini CPP (B) | 2006 | ≈ 12 yrs |

# quest to improve operational efficiencies & WHY

| Major Equipment | Others |
|---|---|
| 1. Flash Gas Compressor<br>2. Booster Compressor<br>3. Separator<br>4. Fuel Gas Package | 1. Pump<br>2. Heat Exchangers<br>3. Diesel System<br>4. Hot Oil System<br>5. Produced Water system |

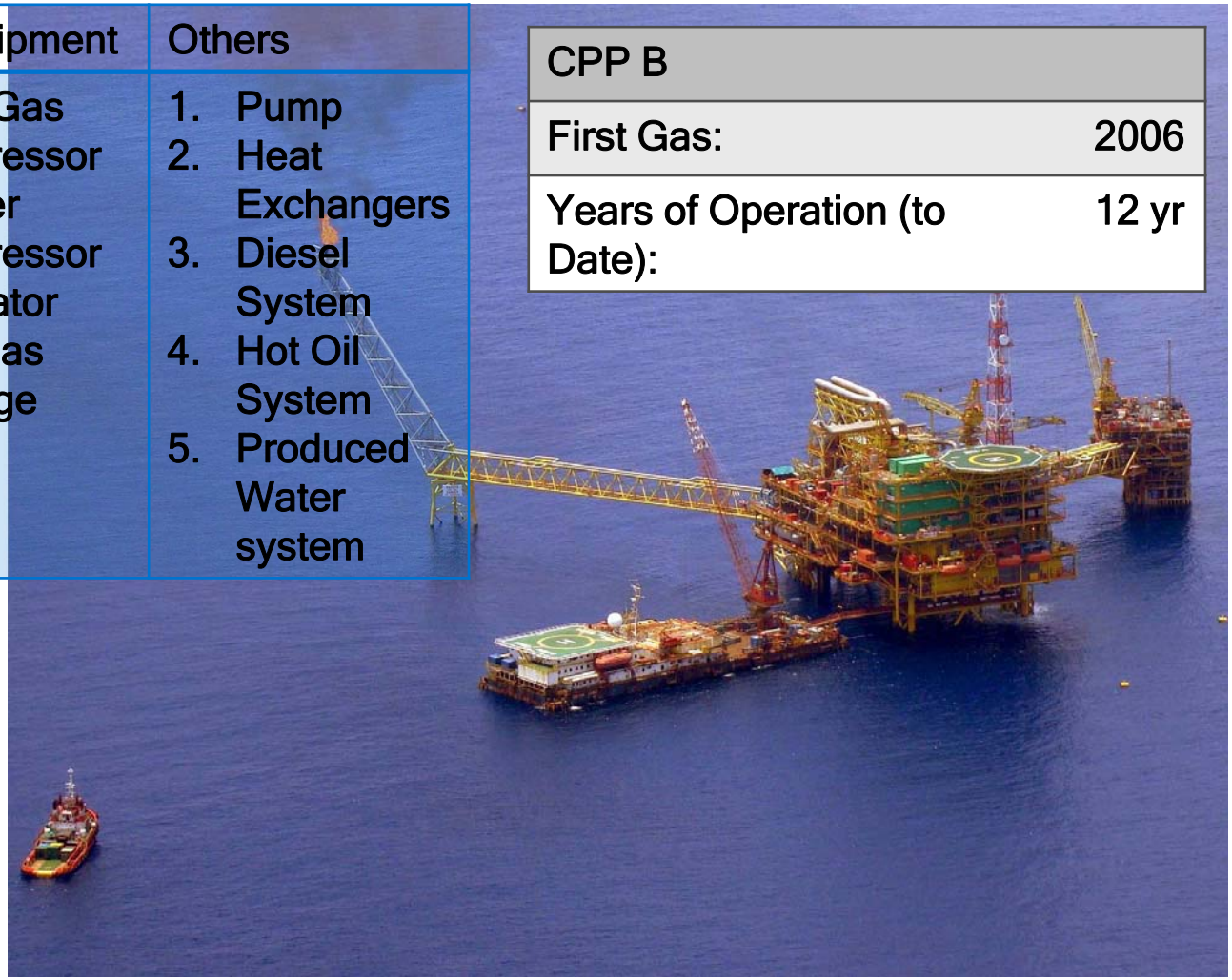
| CPP A | |
|---|---|
| First Gas: | 2003 |
| Years of Operation (to Date): | 15 yr |



# quest to improve operational efficiencies & WHY

| Major Equipment | Others |
|---|---|
| 1. Flash Gas Compressor<br>2. Booster Compressor<br>3. Separator<br>4. Fuel Gas Package | 1. Pump<br>2. Heat Exchangers<br>3. Diesel System<br>4. Hot Oil System<br>5. Produced Water system |

| CPP B | |
|---|---|
| First Gas: | 2006 |
| Years of Operation (to Date): | 12 yr |



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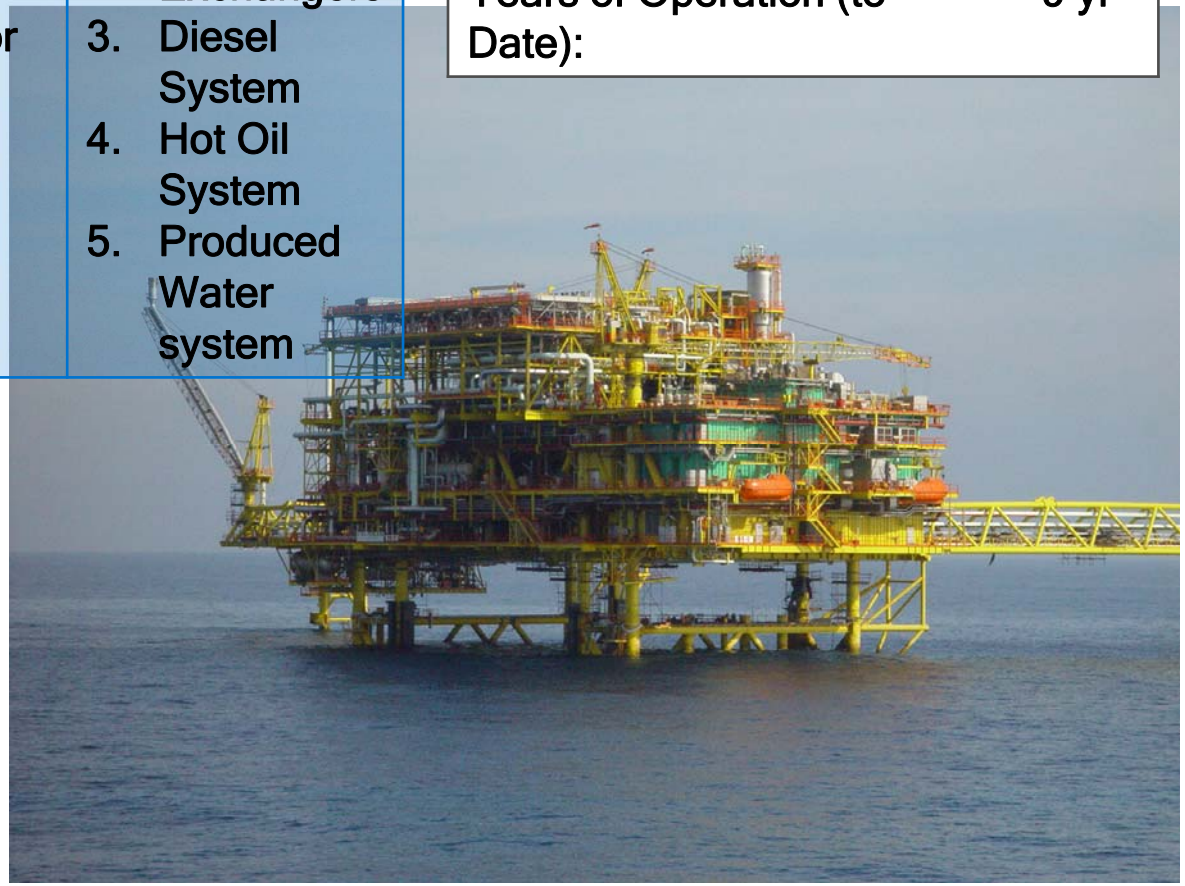
# quest to improve operational efficiencies & WHY

| Major Equipment | Others |
|---|---|
| 1. Flash Gas Compressor<br>2. Booster Compressor<br>3. Separator<br>4. Fuel Gas Package | 1. Pump<br>2. Heat Exchangers<br>3. Diesel System<br>4. Hot Oil System<br>5. Produced Water system |

| CPP C | |
|---|---|
| First Gas: | 2010 |
| Years of Operation (to Date): | 9 yr |



# quest to improve operational efficiencies & WHY

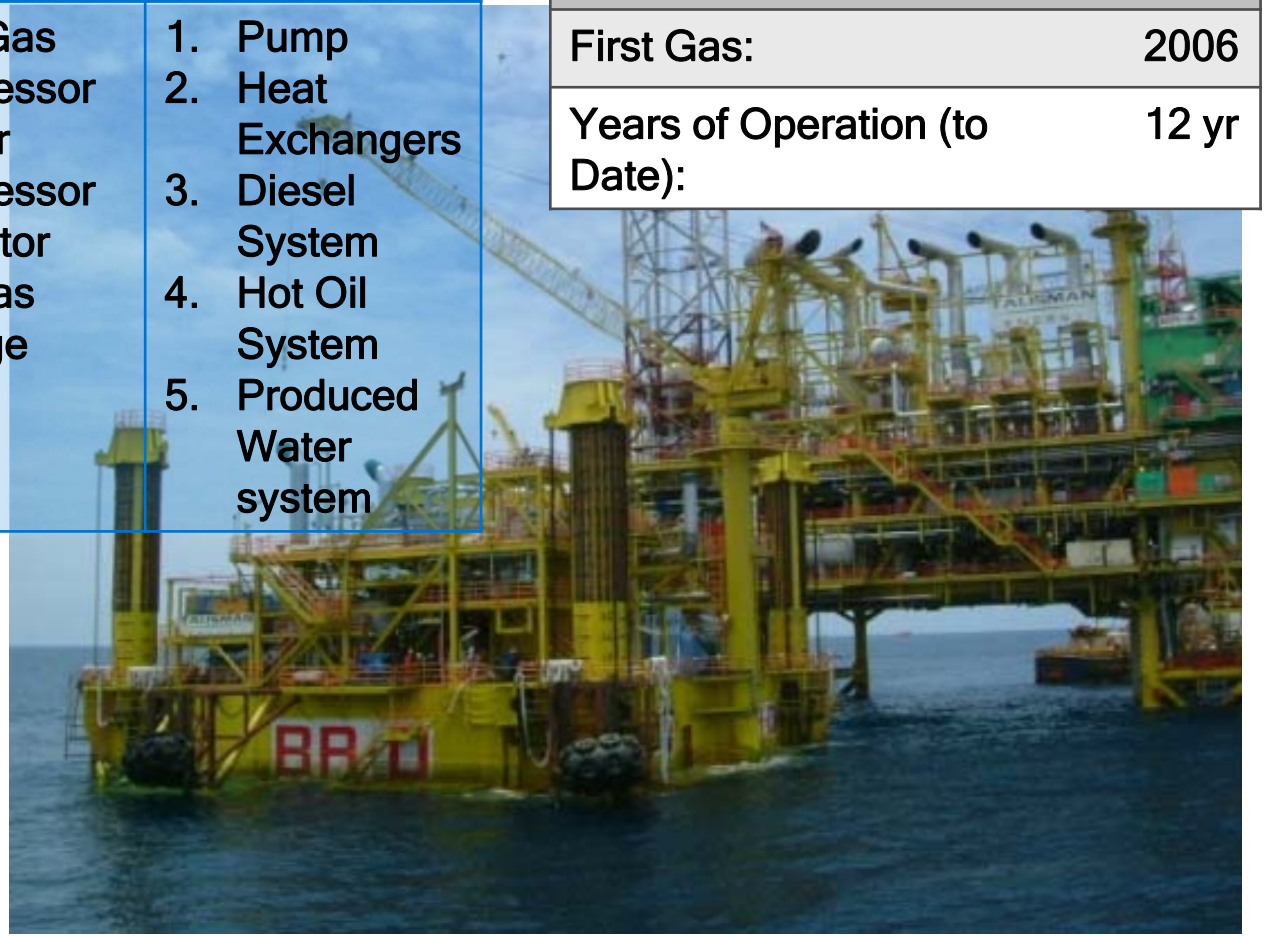
| Major Equipment | Others |
|---|---|
| 1. Flash Gas Compressor<br>2. Booster Compressor<br>3. Separator<br>4. Fuel Gas Package | 1. Pump<br>2. Heat Exchangers<br>3. Diesel System<br>4. Hot Oil System<br>5. Produced Water system |

| Mini CPP (A) | |
|---|---|
| First Gas: | 2005 |
| Years of Operation (to Date): | 13 yr |

# quest to improve operational efficiencies & WHY

| Major Equipment | Others |
|---|---|
| 1. Flash Gas Compressor<br>2. Booster Compressor<br>3. Separator<br>4. Fuel Gas Package | 1. Pump<br>2. Heat Exchangers<br>3. Diesel System<br>4. Hot Oil System<br>5. Produced Water system |

| Mini CPP (B) | |
|---|---|
| First Gas: | 2006 |
| Years of Operation (to Date): | 12 yr |



# quest to improve operational efficiencies & WHY


**Early 2002-2010**

- Oil Price = USD 60 – USD 100 per barrel
- Operation & Maintenance (5-10 personnel attended FAT/Gas Compressor String Test)

**Past 2010**

- Oil Price = USD 40 – USD 60 per barrel
- Operation & Maintenance (1-3 personnel FAT)

**operate & maintain assets with same/older no. of equipment ???**

# quest to improve operational efficiencies & WHY

## In essence:

1. high no. of static & rotating equipment, process facilities
2. of various make & model
3. requiring different frequency of maintenance & service
4. requiring different ways of operating
5. complex operating conditions – for best/optimal results

## To improve

1. safety
2. availability
3. profitability


# quest to improve operational efficiencies & WHY

## Data Analytics

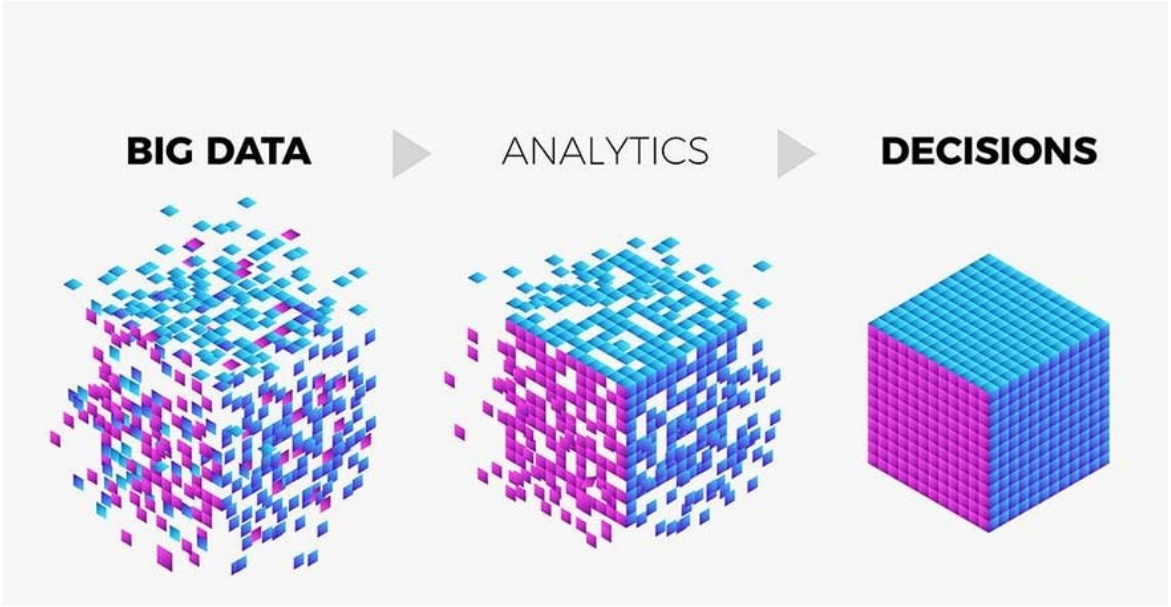
### maybe the answer


# What is Data Analytics??

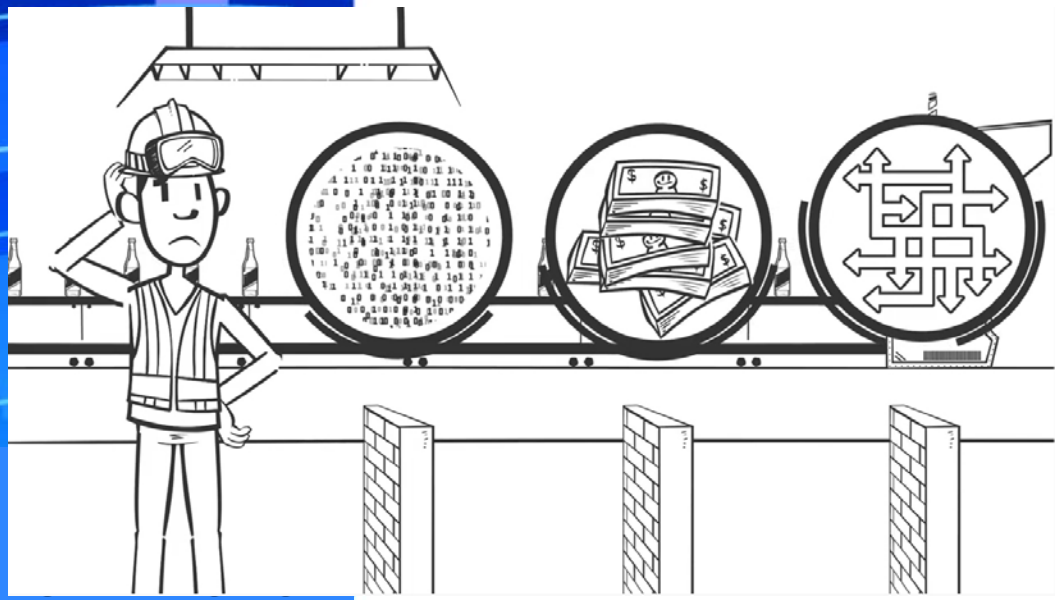
a) techniques to analyze data
   => enhance productivity & business gain

b) data is extracted from various sources
   => cleansed
   => categorized
   to analyse different behavioral patterns.

c) promote best decisions



# Challenge of Data Analytics??



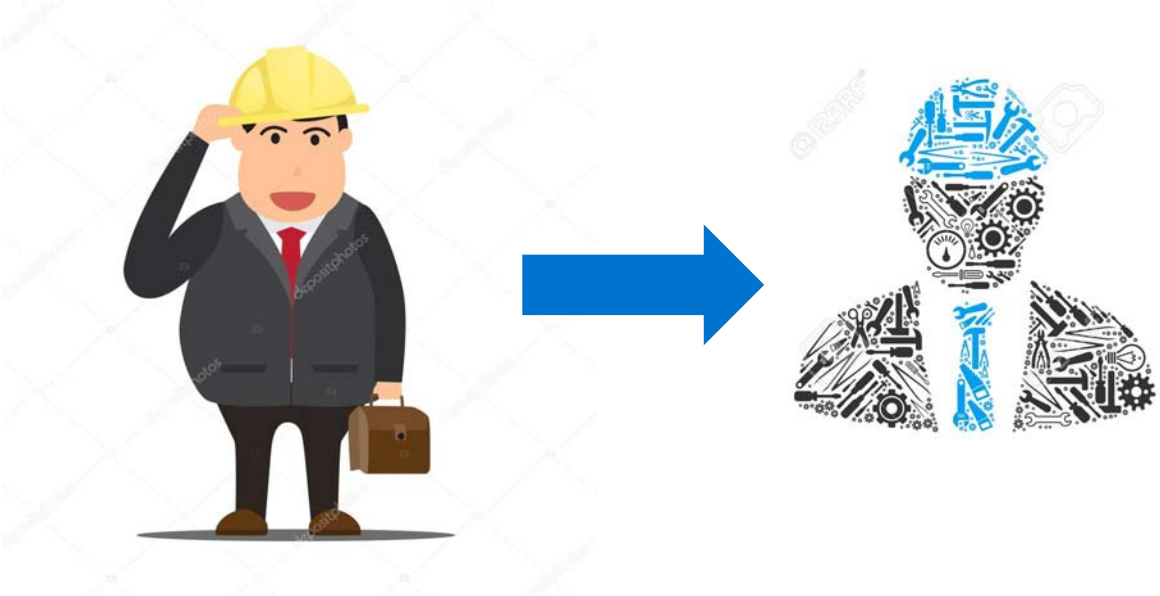
1. Data not available
2. Too much data
3. Expensive software
4. Complicated tools


# Data analytics – my perspective

a) Comprehensive? Single? Ultimate? solution/ complete tool to perform predictive analytics such as predictive maintenance, end of life prediction

b) Analytics results can be produced by a single click

c) Performed perfectly regardless of data quality




# Data Engineer's perspective

a) Data analytics is very dependent on data, thus the word ***"data*** analytics"

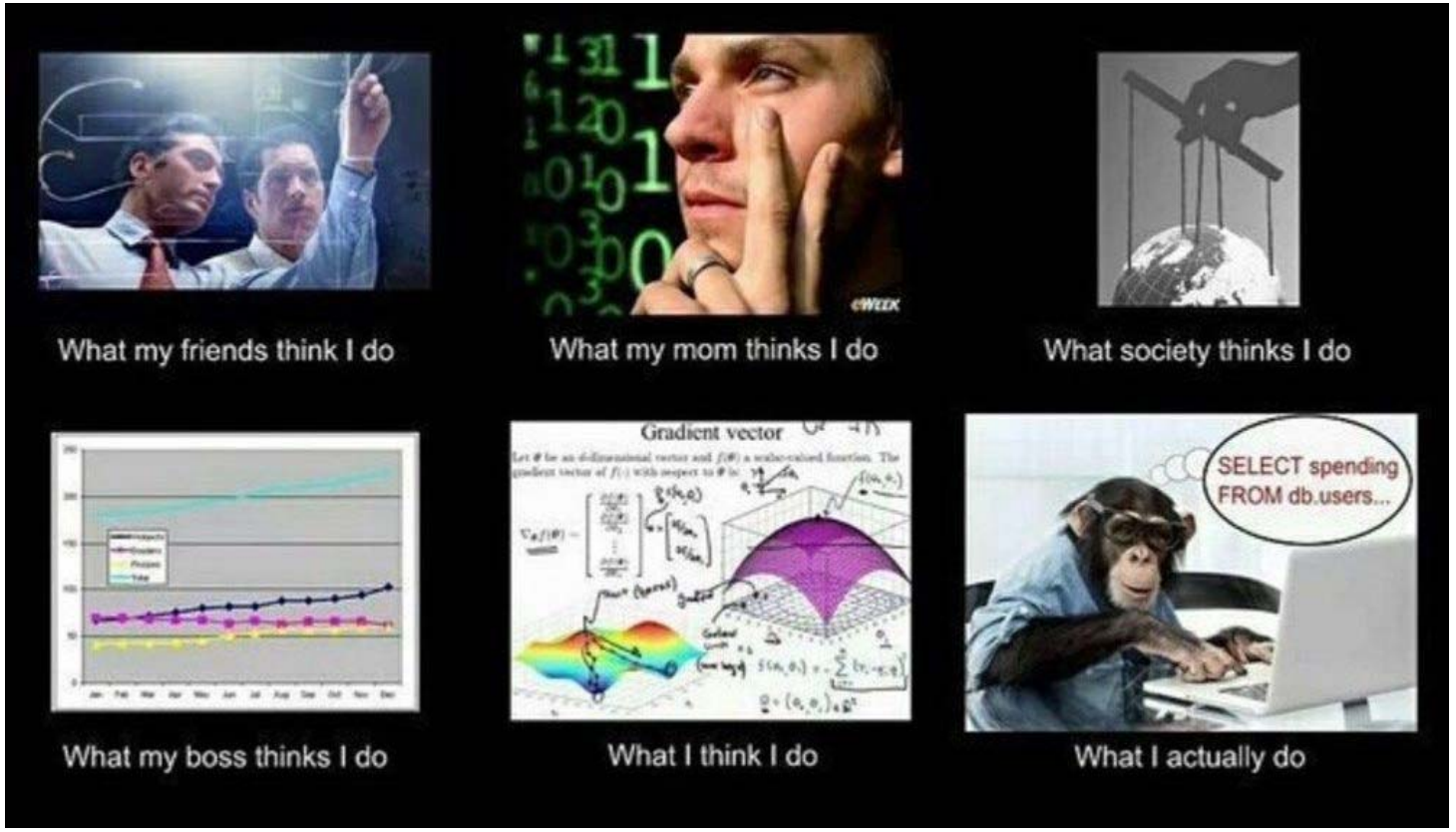
b) Dependent on data means:
   i. availability of data
   ii. completeness
   iii. data quality (accuracy, clean , units)
   iv. resolution ( current & history)

c) Knowledge of subject matter

d) or access to SME (subject matter expert)

e) Availability of asset database

# Data Analytics Engineer




# How data engineer create value from data analytics

a) bringing engineer closer to analytics, solve more day to day questions independently & enhance their effectiveness.
b) Thus, self service analytics platform tailored to user need is required.
c) Self service analytics tools designed with end users in mind. No or minimal model selection, training & validation required; instead user can directly query information from historian and get one click results.
d) resulted in heightened efficiency & greater comfort with use of analytics information


# Data Analytics – Data Engineer's perspective

## 5 WAYS WE CAN BENEFIT FROM A DATA DRIVE APPROACH


**REDUCE REWORK, WASTER AND PROJECT DELIVERY TIME**


**INFORMATION AT YOUR FINGERTIPS**

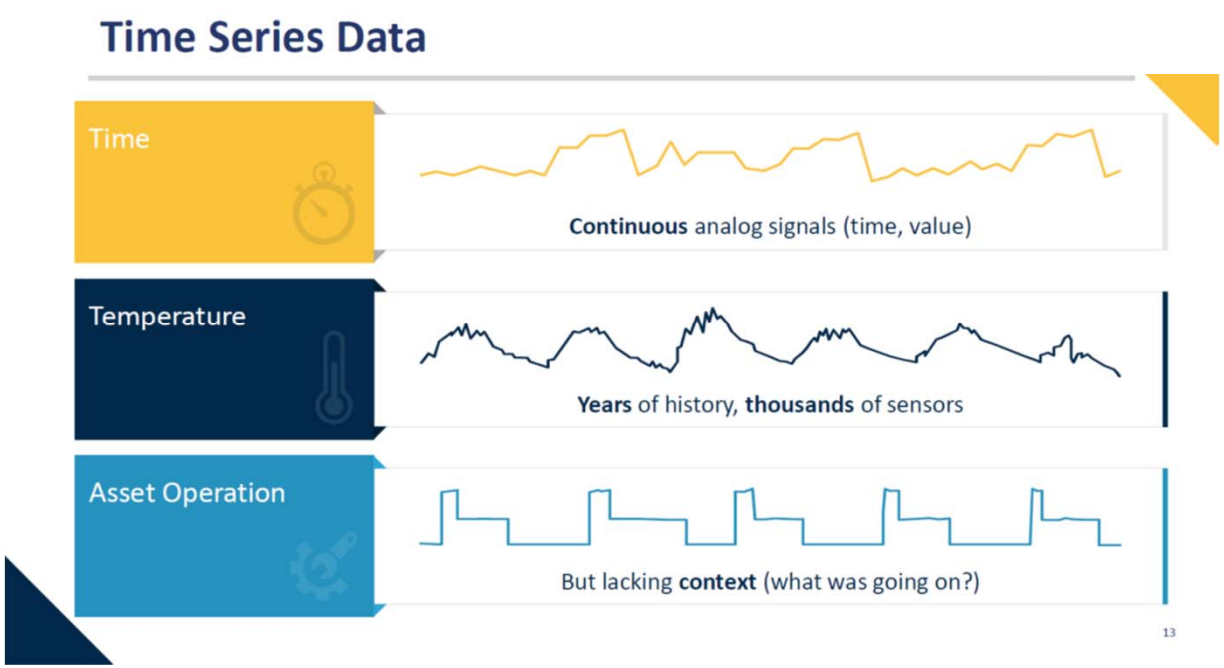

**VISUALISATION**


**MITIGATE RISK**


**COMPETITIVE ADVANTAGE**

# Perquisites to Data Analytics

## Time Series Data




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1/1/2019 0:00 | 1/1/2019 1:00 | 849.8688 | 529.9109 | 6.651748 | 11.65743 | 27.51498 | 31.06987 |
| 1/1/2019 1:00 | | | | | | | |
| 1/1/2019 2:00 | | | | | | | |
| 1/1/2019 3:00 | | | | | | | |
| 1/1/2019 4:00 | | | | | | | |
| 1/1/2019 5:00 | | | | | | | |
| 1/1/2019 6:00 | | | | | | | |
| 1/1/2019 7:00 | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1/11/2019 2:00 | 1/11/2019 3:00 | 1074.285 | 502.6122 | 7.160812 | 12.62966 | 29.32204 | 32.25526 |
| 1/11/2019 3:00 | 1/11/2019 4:00 | 1072.731 | 502.5291 | 7.161402 | 12.48437 | 29.11635 | 31.97373 |
| 1/11/2019 4:00 | 1/11/2019 5:00 | 1071.635 | 502.4149 | 7.160522 | 12.41189 | 28.97736 | 31.79846 |
| 1/11/2019 5:00 | 1/11/2019 6:00 | 1071.308 | 502.4154 | 7.160931 | 12.36427 | 28.77315 | 31.57306 |
| 1/11/2019 6:00 | 1/11/2019 7:00 | 1070.289 | 502.6366 | 7.160042 | 12.3249 | 28.62798 | 31.41039 |
| 1/11/2019 7:00 | 1/11/ | | | | | | |
| 1/11/2019 8:00 | 1/11/ | | | | | | |
| 1/11/2019 9:00 | 1/11/2 | | | | | | |
| 1/11/2019 10:00 | 1/11/2 | | | | | | |
| 1/11/2019 11:00 | 1/11/2 | | | | | | |
| 1/11/2019 12:00 | 1/11/2 | | | | | | |
| 1/11/2019 13:00 | 1/11/2 | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1/25/2019 8:00 | 1/25/2019 9:00 | 868.5031 | 529.9624 | 6.605516 | 13.22638 | 27.86518 | 32.4768 |
| 1/25/2019 9:00 | 1/25/2019 10:00 | 870.1057 | 530.0441 | 6.679761 | 12.96007 | 27.76647 | 32.11369 |
| 1/25/2019 10:00 | 1/25/2019 11:00 | 870.7246 | 529.9893 | 6.663726 | 13.28217 | 28.51653 | 33.103 |
| 1/25/2019 11:00 | 1/25/2019 12:00 | 872.2882 | 529.9793 | 6.663282 | 13.01801 | 28.86101 | 33.26113 |
| 1/25/2019 12:00 | 1/25/2019 13:00 | 872.5259 | 530.0188 | 6.670335 | 13.00801 | 29.09877 | 33.48568 |
| 1/25/2019 13:00 | 1/25/2019 14:00 | 873.6854 | 529.9541 | 6.667962 | 13.04238 | 28.93086 | 33.33787 |
| 1/25/2019 14:00 | 1/25/2019 15:00 | 874.3417 | 530.0206 | 6.678445 | 12.88735 | 28.98743 | 33.27339 |
| 1/25/2019 15:00 | 1/25/2019 16:00 | 874.9345 | 529.9518 | 6.692591 | 13.13061 | 29.72077 | 34.17144 |
| 1/25/2019 16:00 | 1/25/2019 17:00 | 875.6676 | 530.0193 | 6.68286 | 13.29694 | 29.69683 | 34.26428 |
| 1/25/2019 17:00 | 1/25/2019 18:00 | 875.6441 | 529.8377 | 6.60328 | 12.71736 | 29.7318 | 33.97303 |
| 1/25/2019 18:00 | 1/25/2019 19:00 | 881.1873 | 521.7464 | 6.761164 | 11.45157 | 28.52892 | 31.68897 |


# Perquisites to Data Analytics

- comprehensive set of data (e.g heat exchanger)
  - Time Series Data Required
    1. Hot Liquid Flow Data
    2. Cold Liquid Flow Data
    3. Hot Liquid Inlet T Data
    4. Hot Liquid Outlet T Data
    5. Cold Liquid Inlet T Data
    6. Cold Liquid Outlet T Data

**Constants Needed**

**Constants Needed**

$$C_{p,hot} = 0.6\,\frac{BTU}{lb * F} \qquad C_{p,cold} = 0.45\,\frac{BTU}{lb * F} \qquad F = 100\,\frac{BTU}{h * F * ft^2}$$

**Equations Needed**

$$Q_{hot} = \dot{m}_{hot} C_{p,hot} * |T_{in,hot} - T_{out,hot}| \qquad U = \frac{Q_{avg}}{A\Delta T_{lm}} = \frac{Q_{hot} + Q_{cold}}{2A\Delta T_{lm}}$$

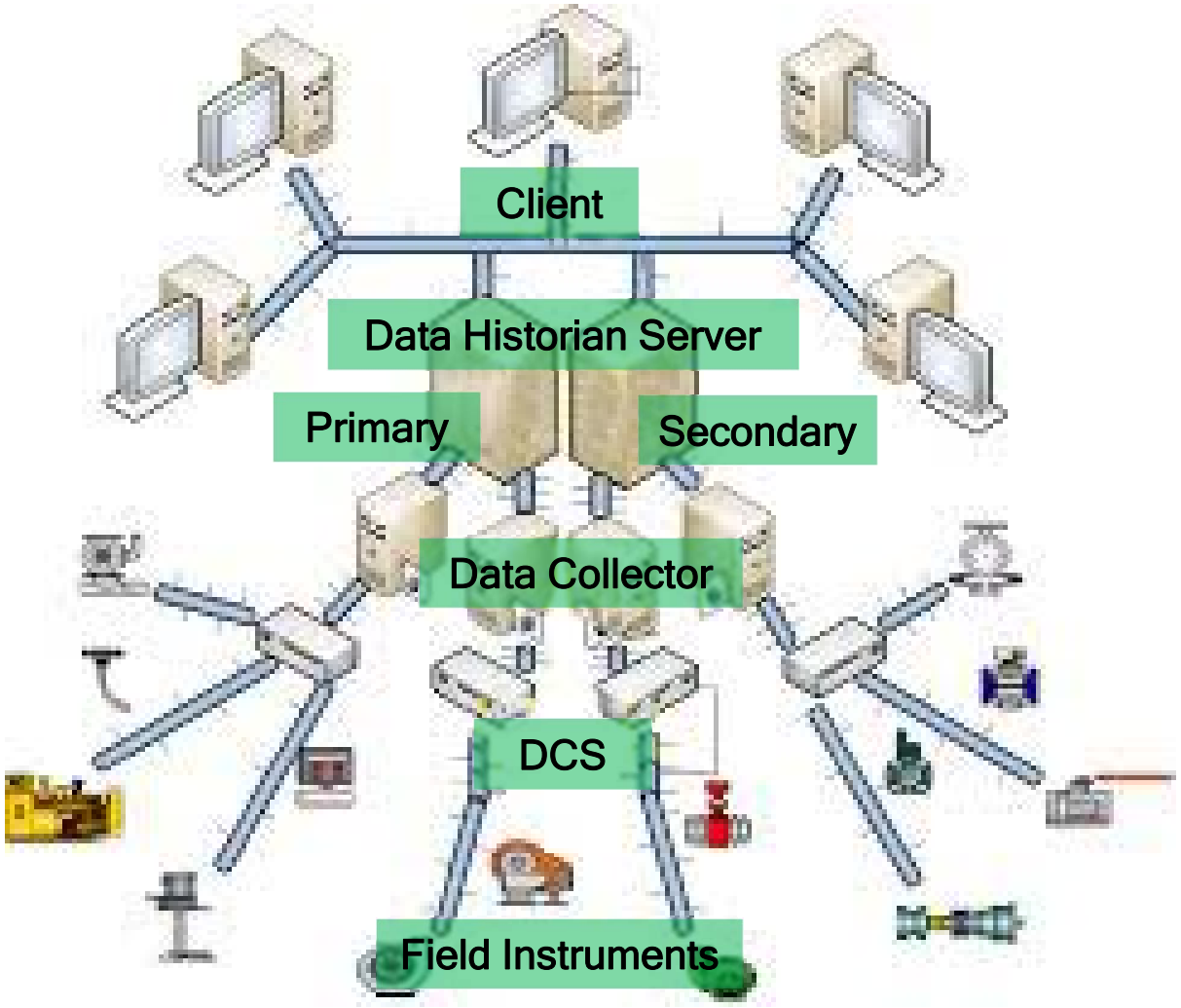
$$\Delta T_{LM} = \frac{(T_{hot,in} - T_{cold,out}) - (T_{hot,out} - T_{cold,in})}{ln(\frac{T_{hot,in} - T_{cold,out}}{T_{hot,out} - T_{cold,in}})}$$

# Functions of a Data Historian

Data Historian

- collection
- storage
- visualisation/ basic analytics

# Collection & Storage

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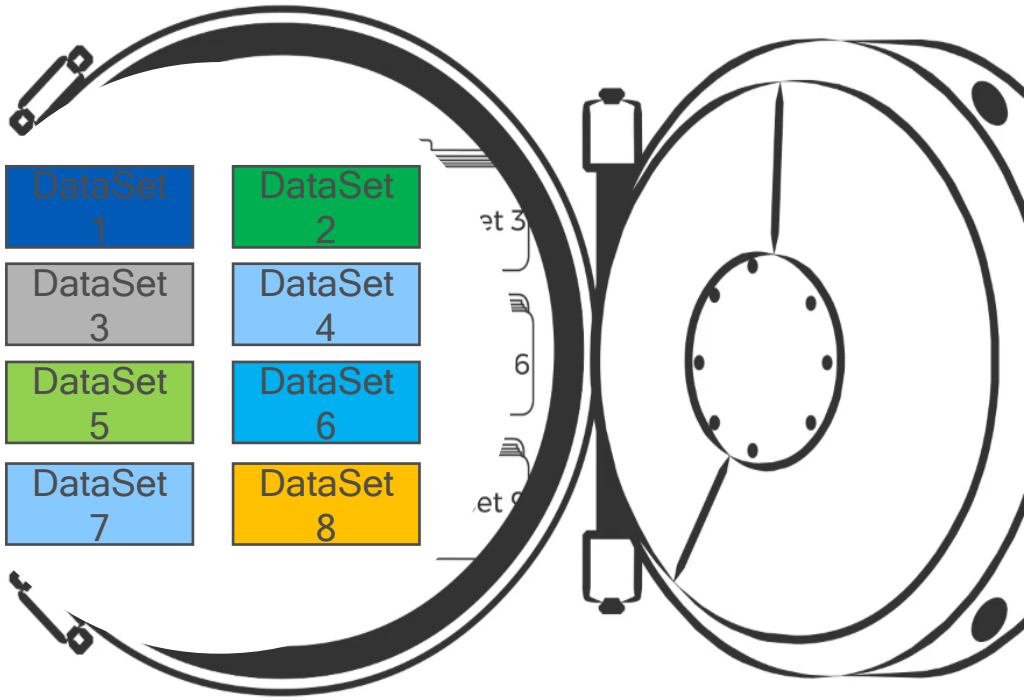
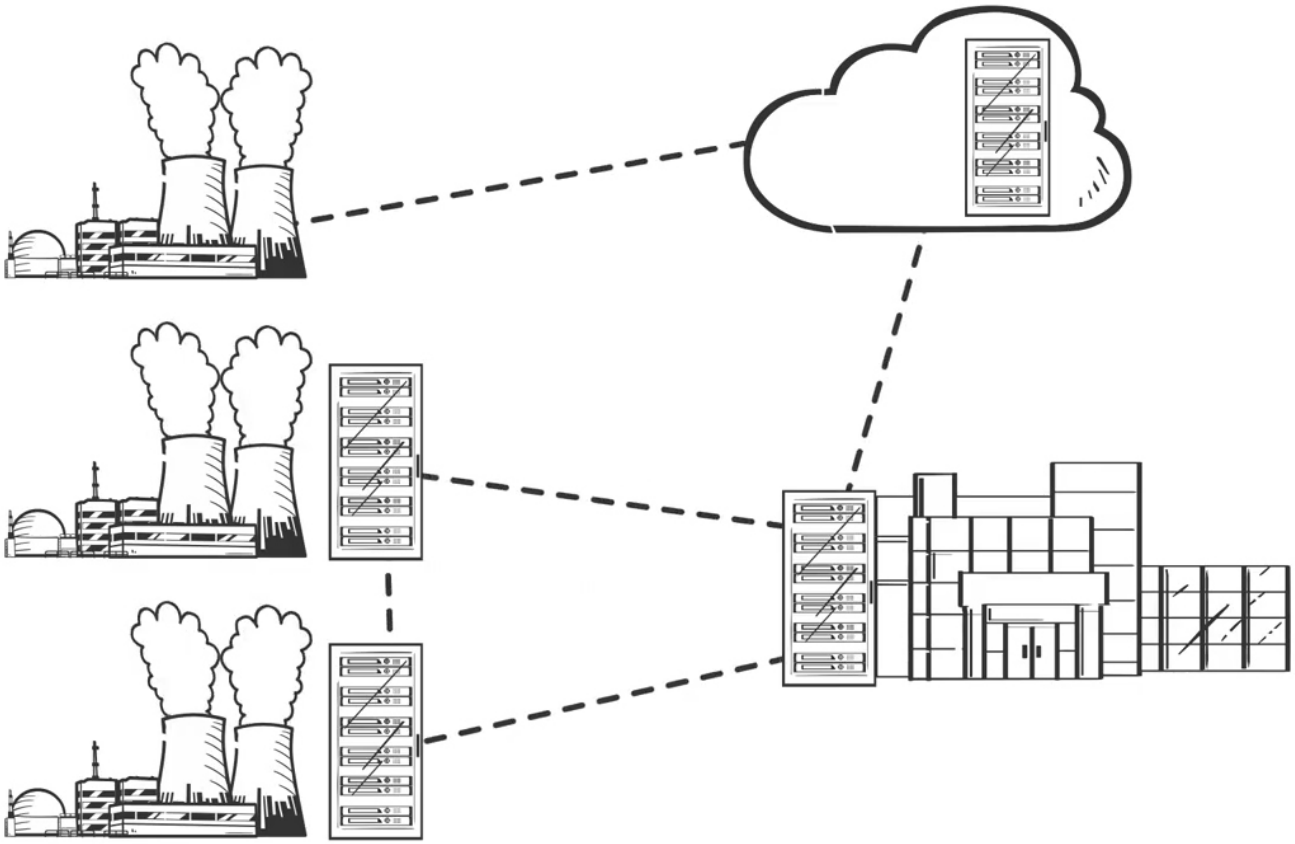
# Storage




When **HISTORIAN** saves data, it organise it into **DATA SETS**

# Data Historian



- **HISTORIAN** can be installed onsite
- hosted in the cloud
- multiple **HISTORIANs** can share data between them or mirror their data to a corporate server


# My Journey in Data analytics


# Why SEEQ

- advanced data analytics tool: created by engineers for engineers
- creating ‘value’ from massive data
- ‘easy’ data handling
- data alignment
- knowledge capture
- visualisation capabilities

courtesy of SEEQ


# Why SEEQ

a) Analytics tool: created by engineers for engineers
   i. solve problems quickly
   ii. advanced Calculation Engine
b) Creating information from massive data
c) Data handling
   i. advanced coding not required
   ii. easy to use ‘user interface’
   iii. data cleansing
   iv. pattern Searching
   v. analysing multiple data simultaneously
d) Data alignment
   i. connect to many data sources
   ii. match time stamps
e) Knowledge capture
   i. publish reports
   ii. share & collaborate Easily
   iii. auto-Updating Figures
f) Visualisation
   i. easy, flexible trends & graphs
   ii. view metric across assets

courtesy of SEEQ


# What we plan to achieve

- Customer A:
  - historical time series data for equipment type A process description, prelim analytics using SEEQ, identified anomalies, capsules of anomalies, why it happened & what can be done
- Customer B:
  - deploy proof of concept on mechanical equipment
  - target: to deploy SEEQ tool, store handle data handling and management.
  - to demonstrate benefit of data analytics in monitoring and diagnostic of equipment
- Customer C:
  - implement, employ data analytics to:
    - i) improve production,
    - ii) improve/ optimise/ monetise offloading/ sales crude.

courtesy of SEEQ


# In Future

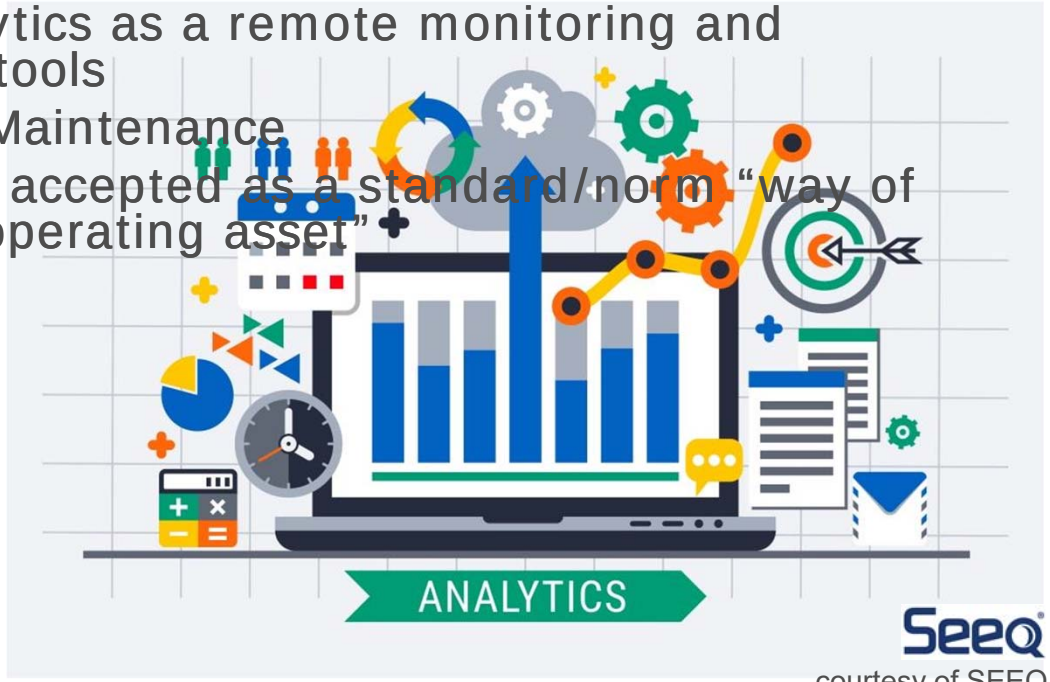
- Data Collection
  i. Data collection is a standard practice
  ii. Collect relevant data
  iii. Create value from data

- Remote monitoring for equipment and diagnostics of most equipment; should not limit to major OEM equipment such as compressors


courtesy of SEEQ


# In Future

i. Full deployment of advanced data analytics for O&G customer to optimize their operation and maintenance costs, therefore improving their safety, profitability
   a. Improve and optimize production
   b. Minimise/ eliminate UPD (unplanned production deferment)
   c. Improved operation and maintenance activities
   d. Using analytics as a remote monitoring and diagnostic tools
   e. Predictive Maintenance
ii. Data Analytics accepted as a standard/norm "way of life"/" way of operating asset"




courtesy of SEEQ


# THANK YOU

## for your attention


courtesy of SEEQ