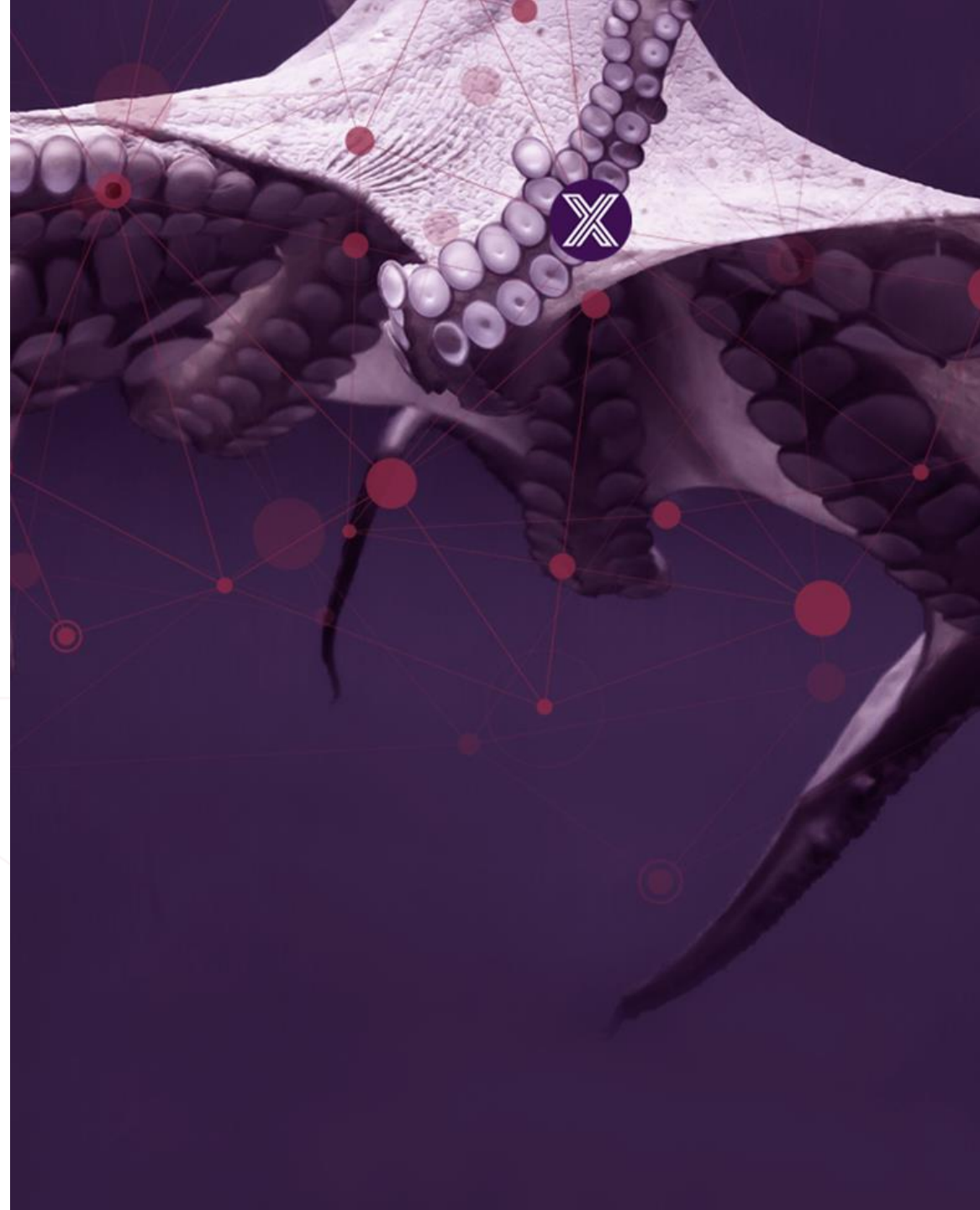


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Oil & Gas Business Cases

Alberto Dellabianca - October 2017



Agenda

- Business Context
- Use Cases & Requirements
- Edge Vision
- Proposal for Next Steps

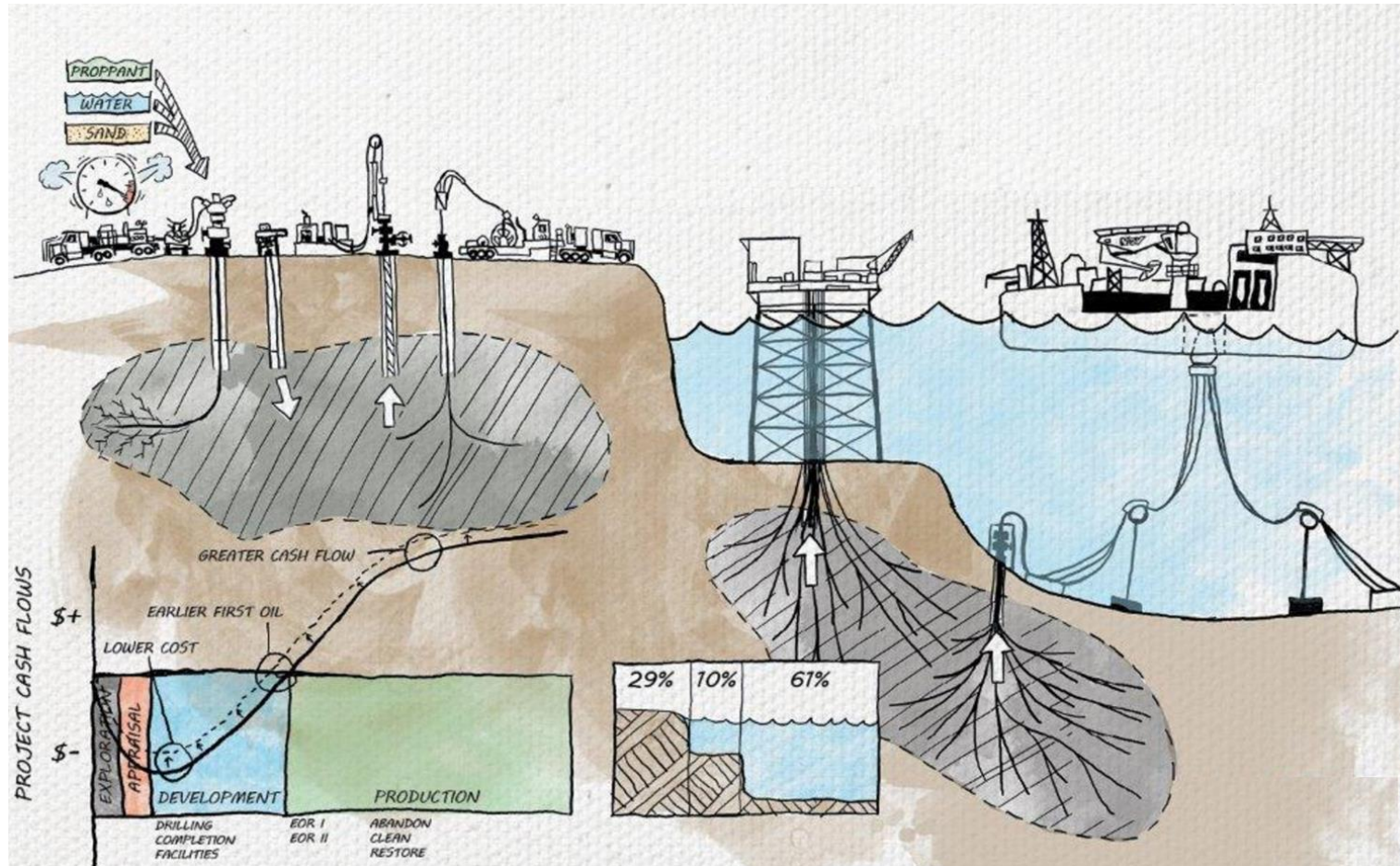




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Business Context

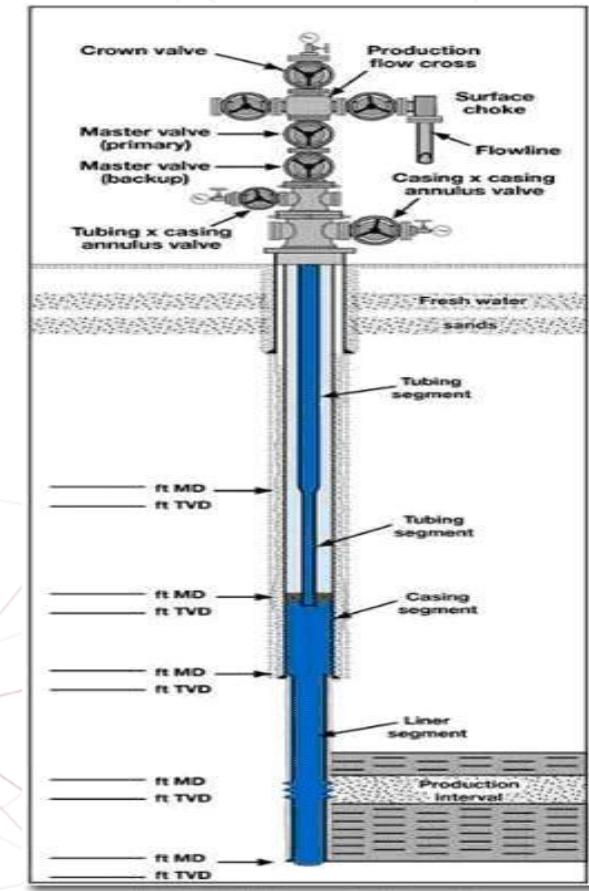
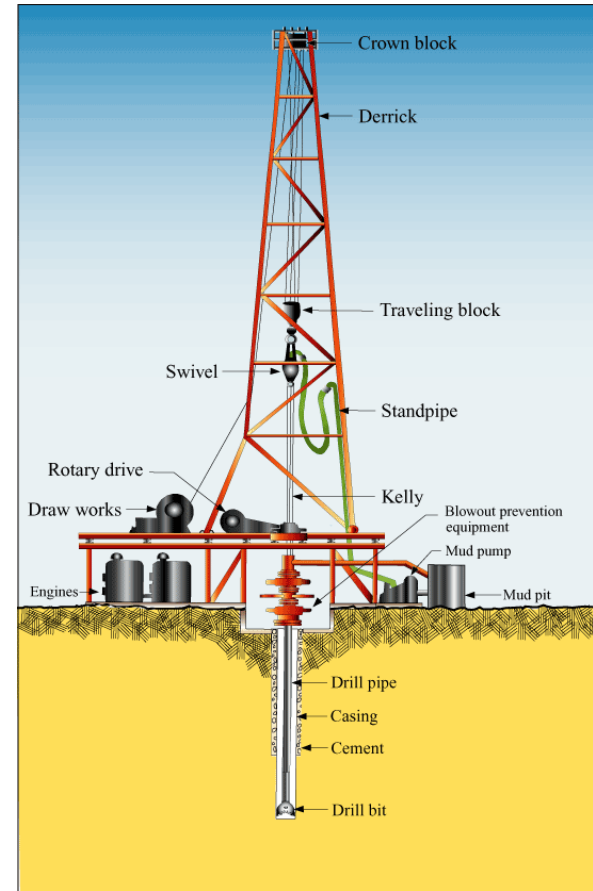
Upstream Process



- Projects with long lifespan (20-30 yrs)
- Automation and sensors in all phases from drilling to production
- Traditional control systems and related architecture are dominant
- IIOT adoption is slower compared to other industries

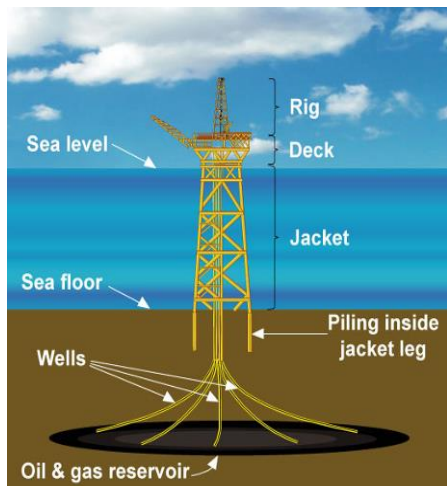
Onshore Drilling

- Rig moving from one well pad to the other by road
- 1-2 months of activity for a single well
- Sensors, control systems and automation in place
- On-site optimization services as well as remote monitoring

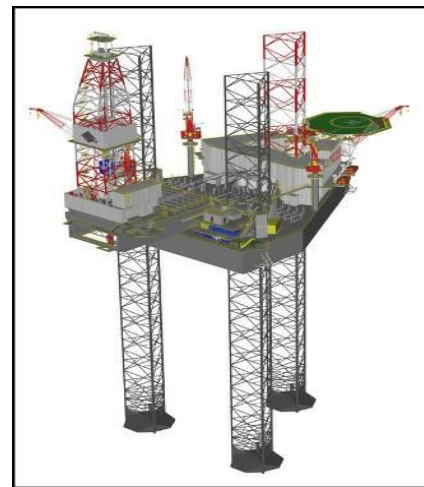


Offshore Drilling

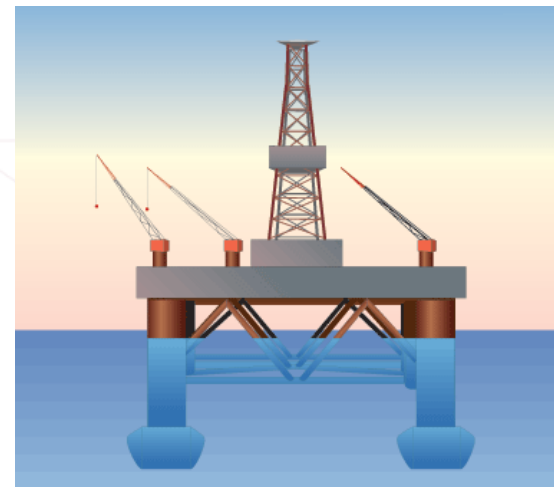
- 2-3 months of activity for a single well
- Advanced Sensors, control systems and automation with extensive safety features
- Different type of rigs based on water depth and other conditions



Fixed Rig



Jack-up



Semisub



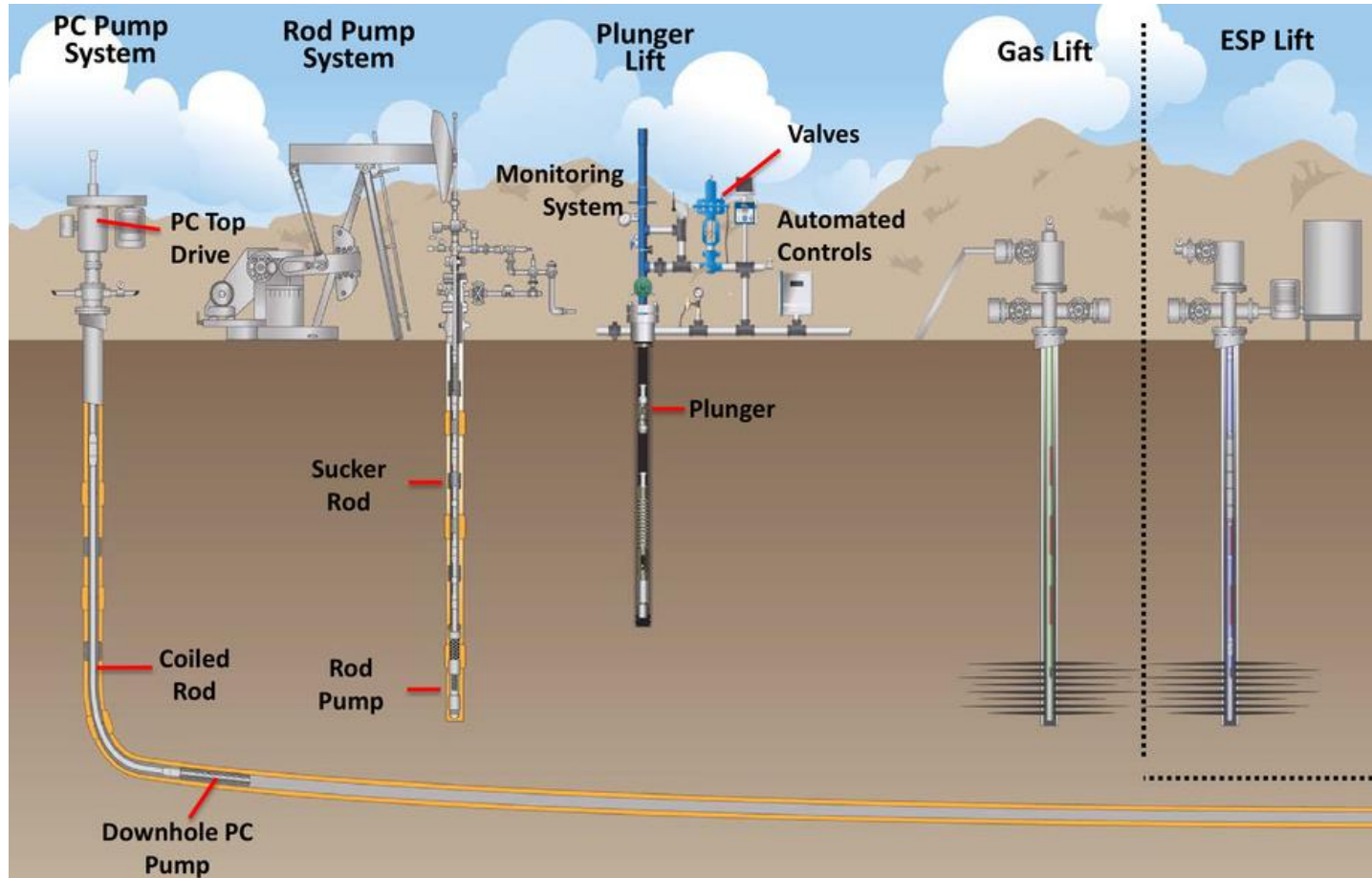
Drilling Ship

Well Intervention & Stimulation

- Quick interventions (1-3 weeks per well)
- Each mobile unit with its own control system
- Frac Spreads for pressure pumping
- Coiled Tubing services
- Wireline services

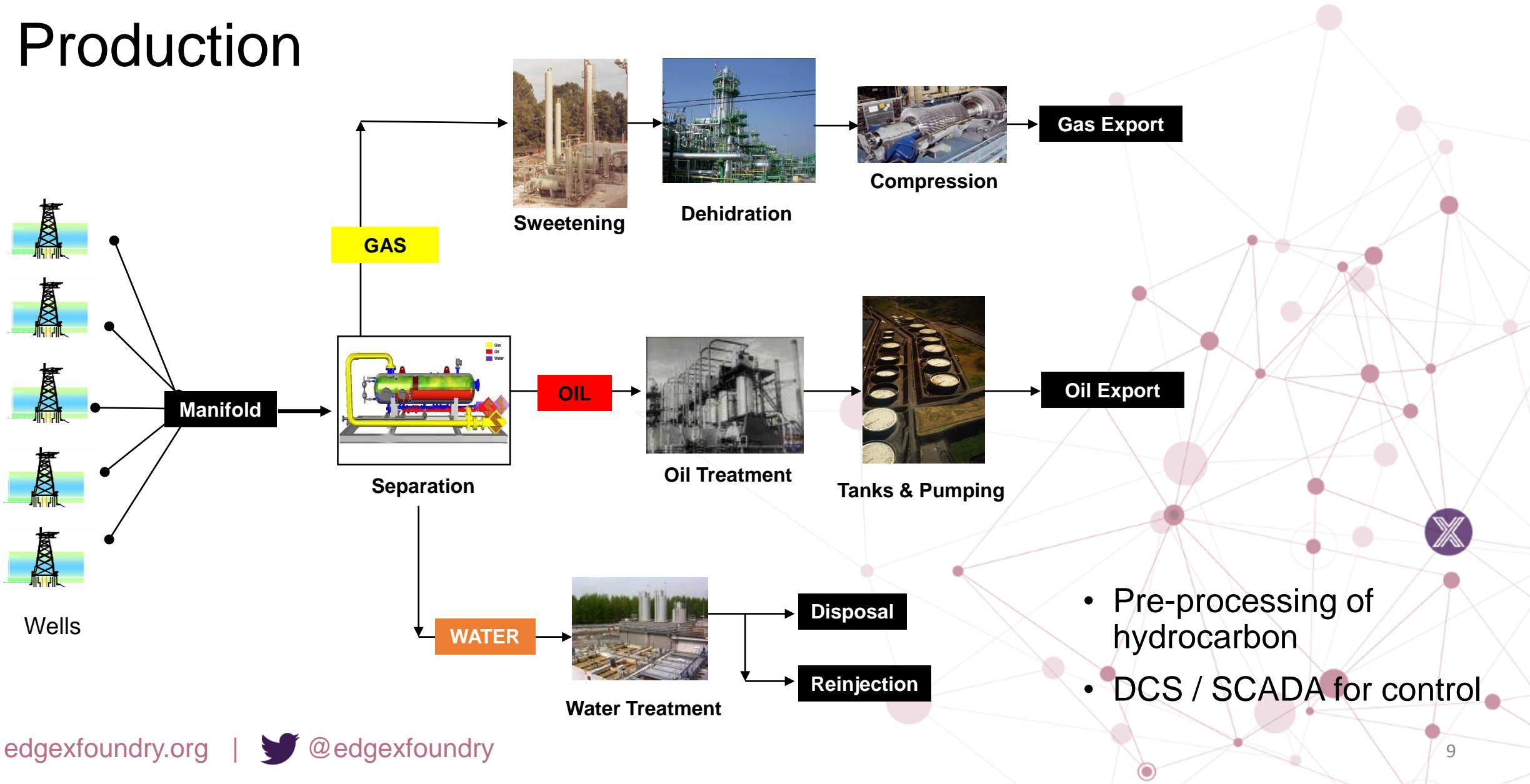


Artificial Lift



- System to help the well produce liquids
- Can stay onsite for the duration of the well (10-20 years)
- Surface and subsurface permanent components
- Local PLC in surface cabin

Production



Points of attention

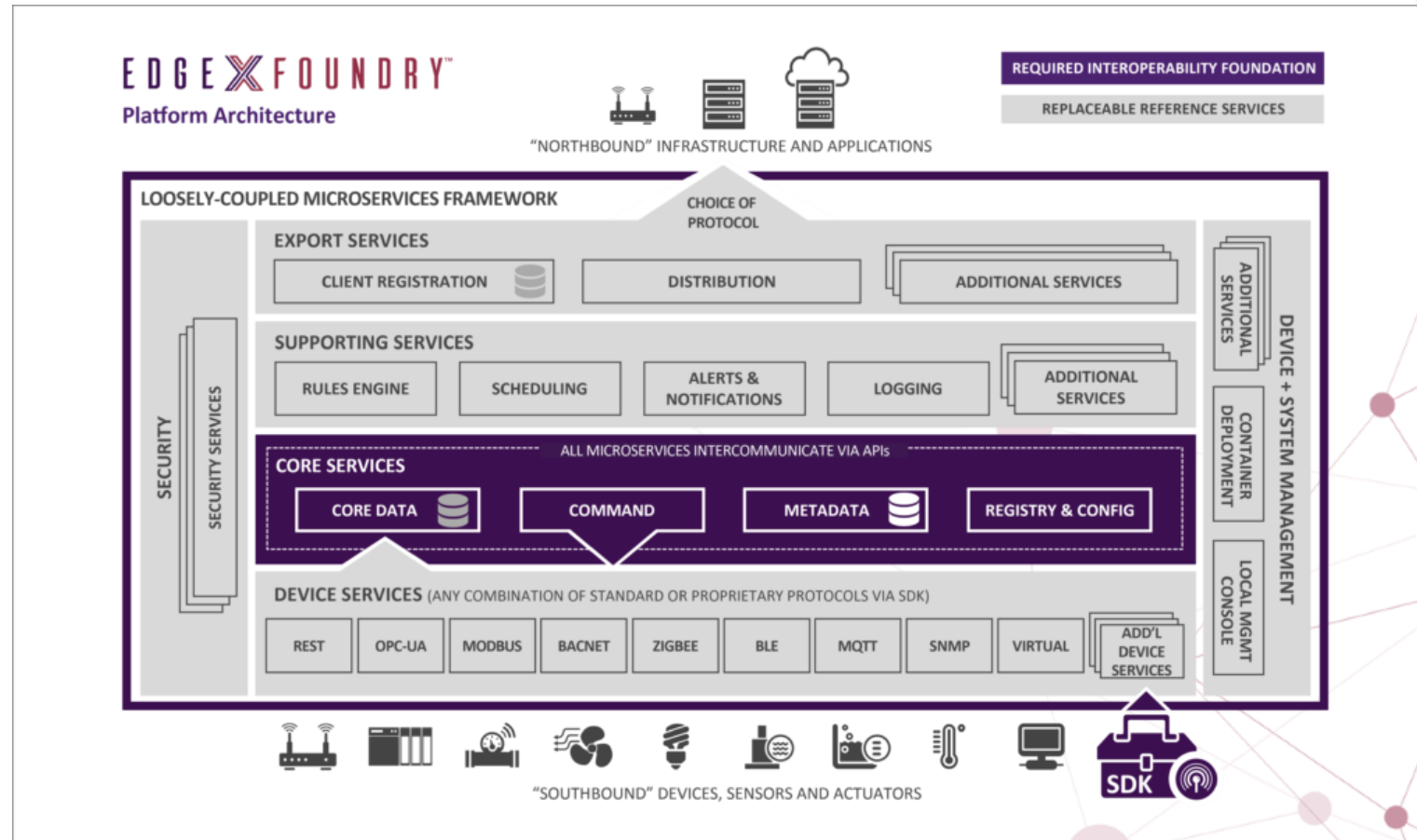
- Fields are in remote areas, the software stack tends to become antiquate, difficult to upgrade and secure → **remote manageability**
- Challenging interoperability in the field between entities (Operators, Service Providers, Contractors) → **standardization**
- Business model not cost effective, redundant/overlapping Hardware and Software → **microservices with plug-n-play architecture**



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Use Cases & Requirements

Current EdgeX – very flexible architecture



Areas of attention

Legacy Systems
High Frequency

Scalability

Analytics

Low Latency

Poor Connectivity

Cyber Security


Local Sharing

Visualization


Reliability

Remote Management


Scalability




Standalone Equipment
10-1000 channels




Onshore Facility
3000-30000 channels




Onshore Rig
1000-5000 channels




Well Intervention Unit
50-300 channels




Well
200-1000 channels



Offshore Facility
5000-50000 channels



Offshore Rig
10000-60000 channels



Frac Spread
5000-10000 channels

Cybersecurity

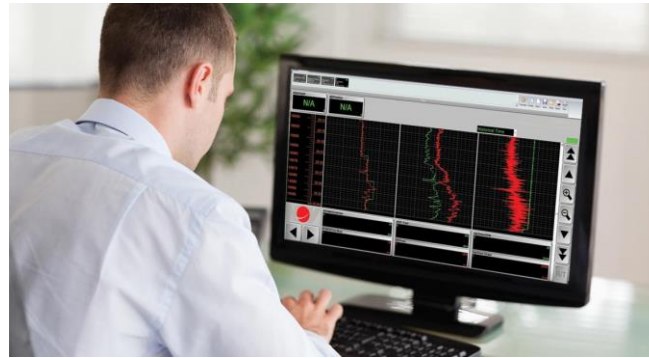
- Oil & Gas not the most loved industry on our planet. [Hacktivists targeted it publicly](#)
- Nearly 70% of Oil & Gas companies were attacked in 2016
- Some of the risks faced in the case of a successful attack:
 - Plant shutdown
 - Equipment damage
 - Oil spills resulting in environmental damage
 - Safety measures violation resulting in injuries and death
- Geopolitics in the picture
- Without strong security foundations, EdgeX cannot even be considered

Poor Connectivity

- Operating in remote zones with bandwidth constraints
- Satellite (very expensive) is the only option available in many cases
- Bandwidth assigned is often times low (e.g. 16kbps in North America to stream 1000 channels to the cloud)
- Local queuing mechanism to sync data as soon as the connection comes back after an interruption
- Possibility to backfill data in reverse order (most updated first)



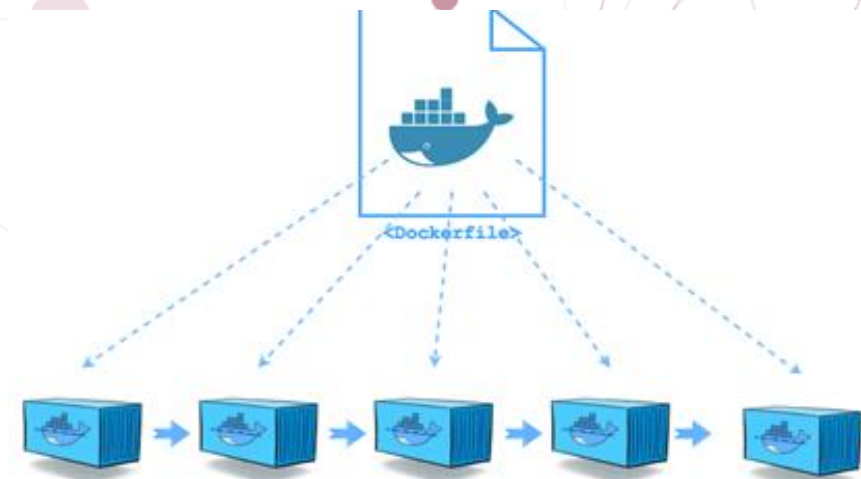
Low Latency



- Many cases require a quick response from remote monitoring centers
- Latency < 3 sec is needed end-to-end (from data acquisition @edge to visualization on remote web portal). This means EdgeX latency from South to North shall be less than 500ms
- Direct streaming to the cloud bypassing Core Data?

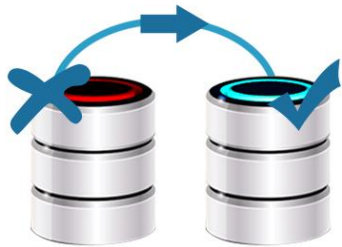
Remote management

- Limited digital skills onsite
- Push remote updates on the configuration (update Core Metadata)
- Push updated docker containers for binary upgrades on one of the microservices
- Central web portal for all admin & remote management activities
- Kubernetes?



Reliability

- Downtimes may have big safety and economic consequences
- High Availability architecture (East-West connections) with 2 nodes in failover
- Scheduled (e.g. every night) backup of all Core-Metadata config to the cloud to enable an easy swap of hardware in case of replacement with a new provisioned EdgeX



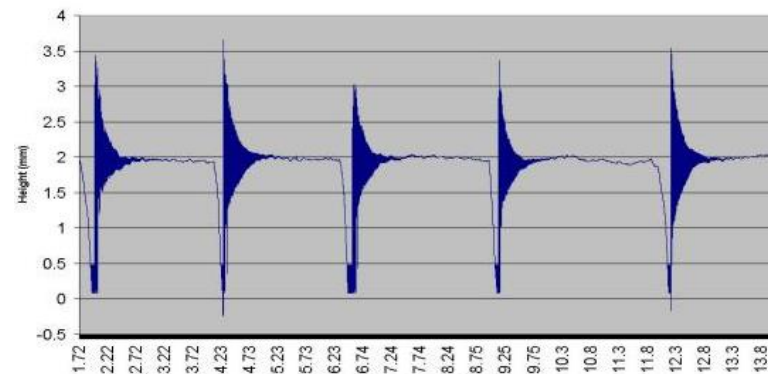
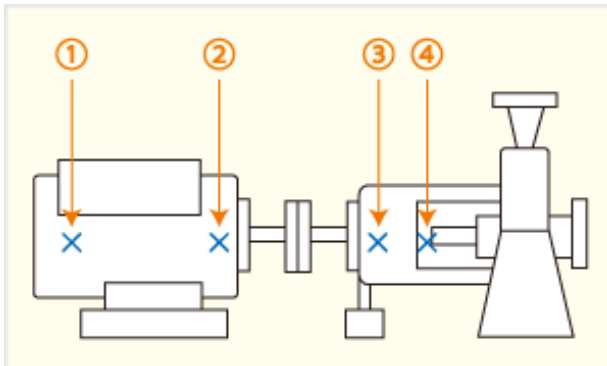
Local Sharing

- Local OPC UA server exposing Core Data and Core Metadata
- This is necessary to share information to non-edgeX devices
- Interoperability between different entities



High-Frequency

- Vibration Sensors with data at 10khz
- High speed protocols such as DDS are used. EdgeX Device Service for Open DDS?
- Why not using a Time Series Database as Influxdb within Core Data? That would provide native time-series functions used for local apps and analytics (Influxdb is written in Go, runs well in docker, supports batch writes and has a REST API to interact with)

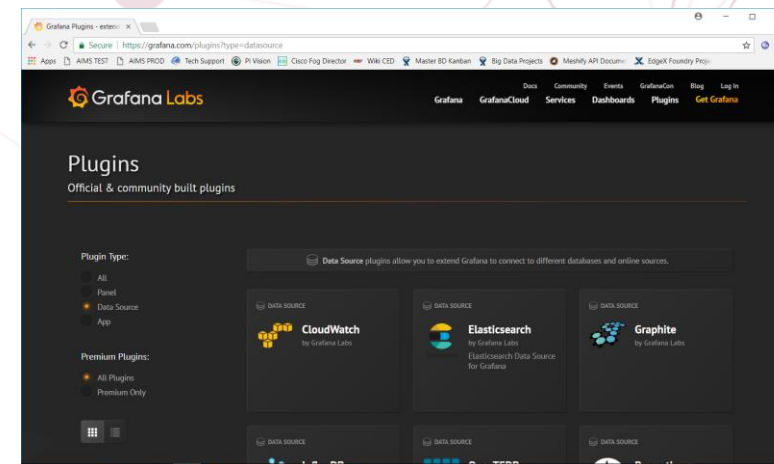
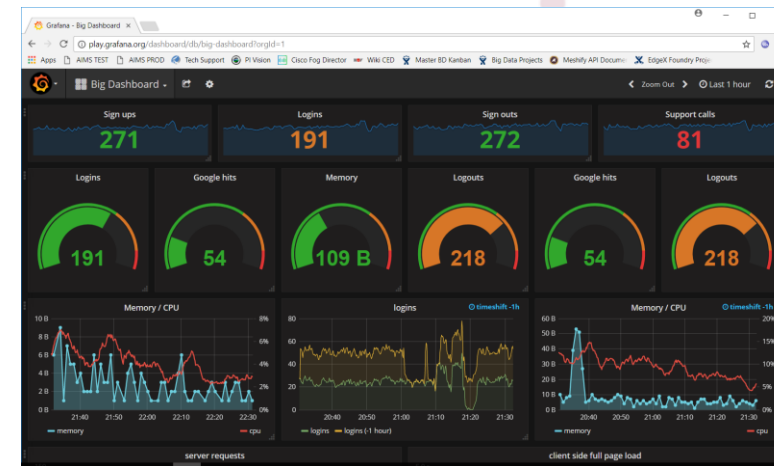


Analytics

- An offshore rig generates between 1TB and 2TB data per day
- It's impossible to send all data to the cloud → edge analytics
- R and Scikit learn Python engines may be too heavy to run on an edge device
- Possibility to save the model as PMML (Predictive Model Markup Language) which is a de facto standard
- Have a microservice to run a lightweight (Go? C/C++?) machine learning engine accepting the PMML model as config input as well as the reference to core data inputs to feed the model

Visualization

- Local visualization solution is required
- Grafana is a perfect match (open source, built in Go, runs on docker, web- based, light footprint, very fast, lots of features, extensible with plugins)
- Would need a Grafana “Datasource plugin”
- Where to save config data?



Legacy Systems

- OPC DA is a first class citizen now and for years to come
- Running OPC DA on Linux is challenging... New device service using OpenOPC which leverages on pyro?
- Modbus Serial still present in many cases





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Edge Vision

Ideas for mid-long term

Asset Template

App Store

East/West
Interop.

Industrial
Sharing

AI Agents

Asset Template

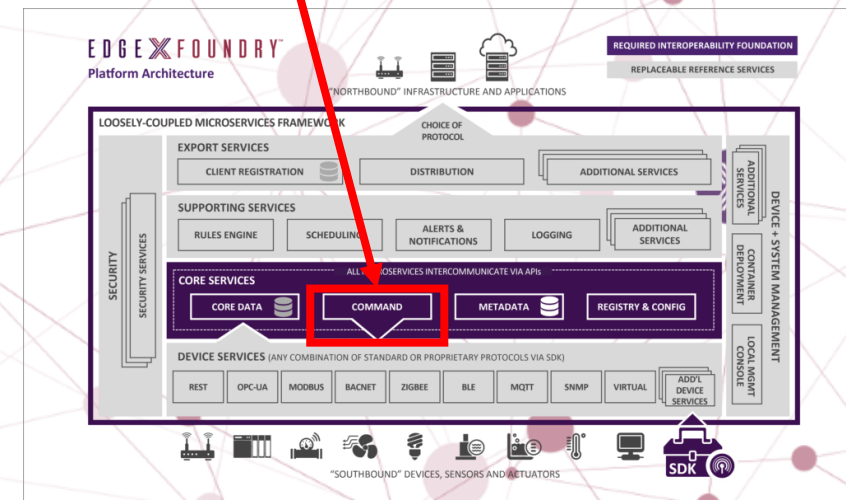
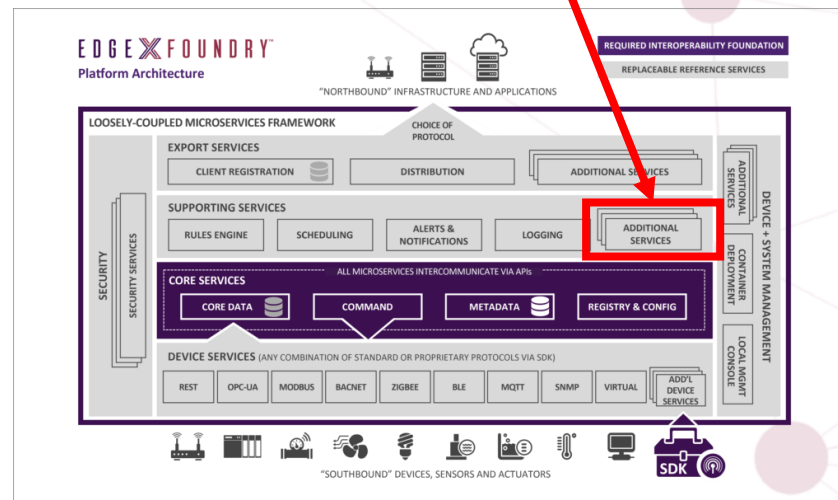
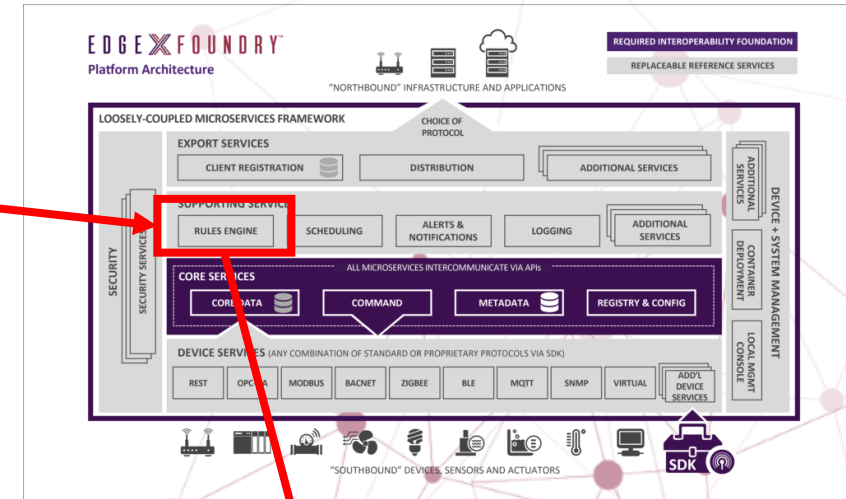
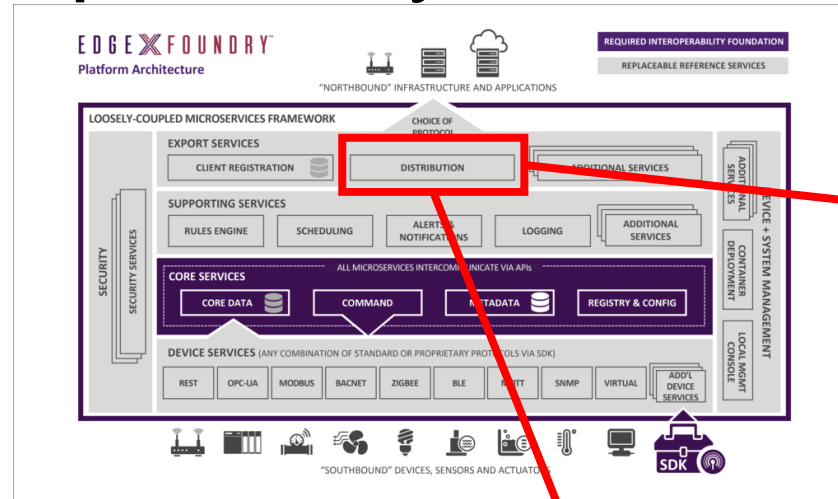
- Goal: declare a specific instance of EdgeX to be an instance of a specific asset template (e.g. Pump model A1287B) and be able to push the relevant set of microservices and configuration
- The EdgeX asset template defines:
 - Which microservices are needed
 - Default configuration for microservices
- The central EdgeX Console should have a catalog of templates and be able to create instances based on this template
- Be able to upgrade or push the same changes to all EdgeX devices sharing the same asset template

App Store

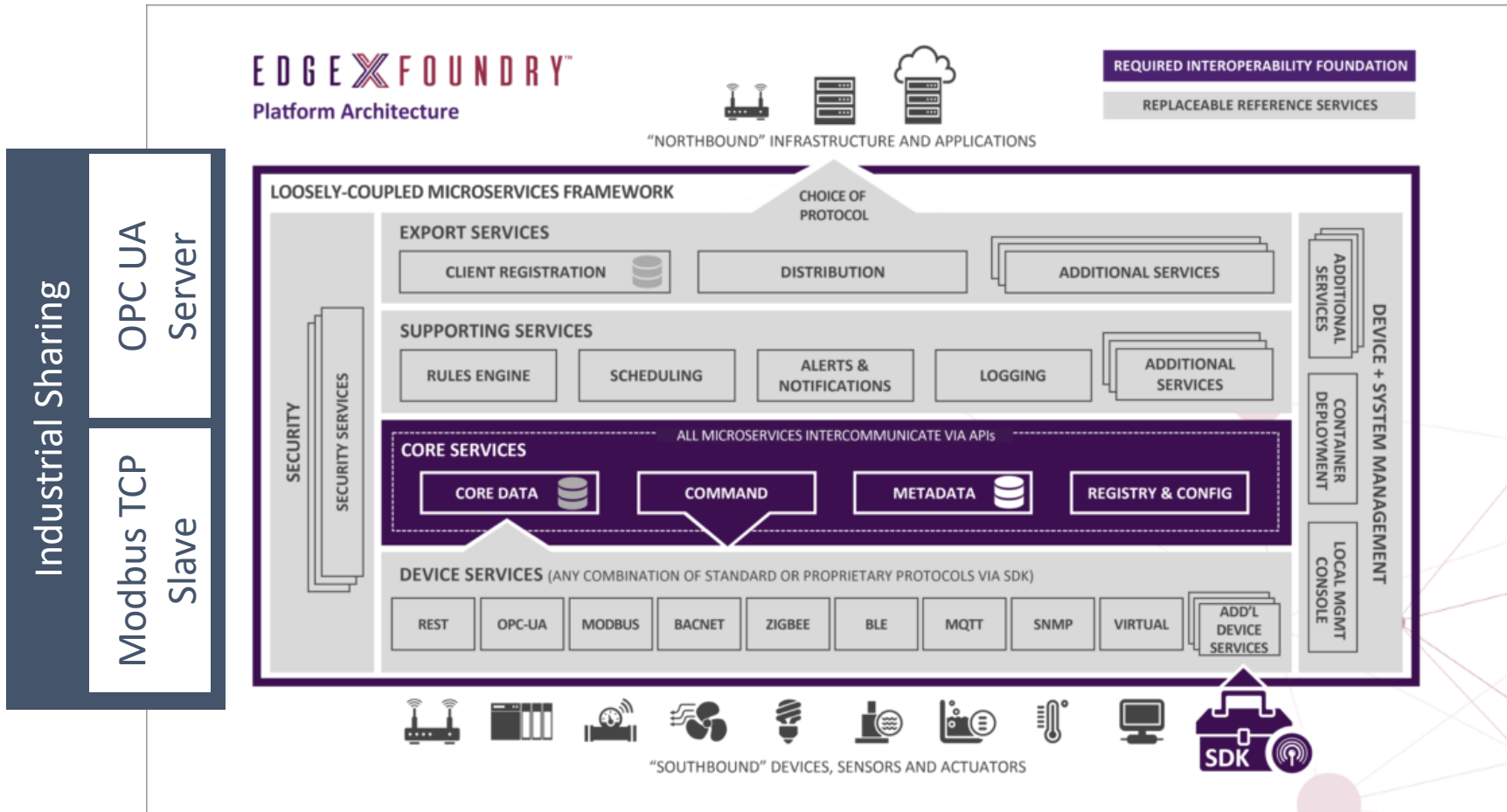
- EdgeX to become for Edge devices the same as “Android” for smartphones
- Commercial apps built by service providers and available on app store hosted by the project (an app could be the artificial intelligence model to optimize the asset)
- Business model which stimulates commercial players to contribute to the ecosystem (similar to GE Predix)

East/West Interoperability

- Microservices able to invoke other microservices running on a different EdgeX instance
- Shall this be done through a broker?
- This could be useful for different service providers interacting in the field on behalf of the operator



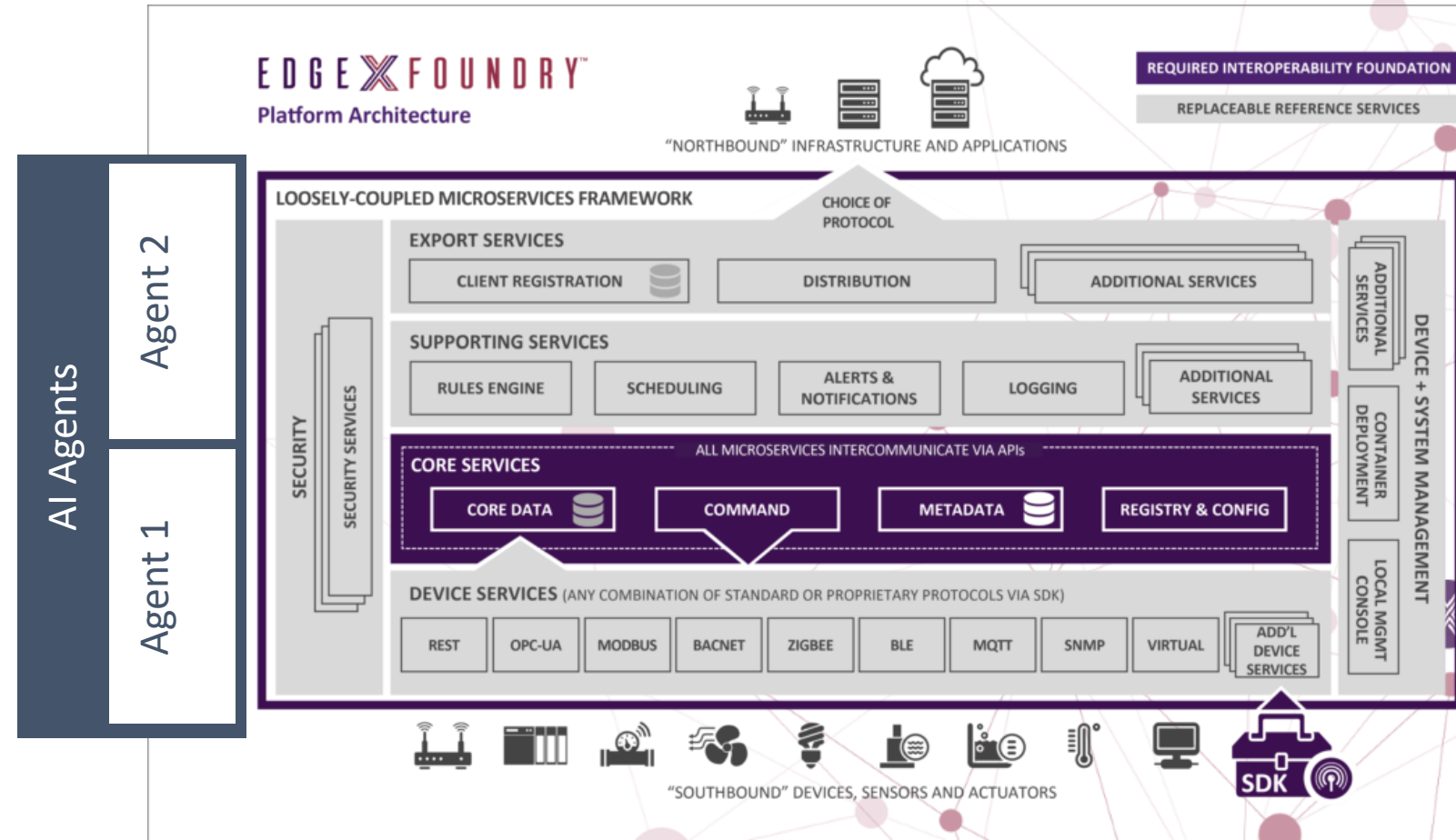
Industrial Sharing with non-EdgeX devices



- OPC UA Server and Modbus TCP Slave to expose data to other non-EdgeX devices

AI Agents

- This would be the ultimate step to achieve full data-driven automated optimization
- AI Agents on different EdgeX devices talking to each others and negotiating the best course of action based on the overall process





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Proposed Next Steps

Proposed Next Steps (1/2)

- Creation of Vertical WG for Oil&Gas (Which name? “Digital Oilfield” or simply “Oil&Gas”?)
- Active contribution to requirements & use cases, EdgeX wiki, zoom meetings, F2F workshops...
- Tests & Validation on real Oil&Gas equipment
- Influence on the Oil & Gas community (partner meetings, LinkedIn groups...)
- Evangelizing in SPE (Society of Petroleum Engineers)
- Evangelizing in Oil & Gas Conferences

Proposed Next Steps (2/2)

- Watch out for EdgeX release 20th October
- It would be useful to have a VM (OVA) with a Ubuntu 16 core and EdgeX microservices for testing / demo purposes on a Windows 10 laptop



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Thank you!