Welcome!

The program will begin soon.

You will not hear audio until we begin.

A Pragmatic Approach to Interoperability

Son Pham

Hari Koduru

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Webinars

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Outline

- What is interoperability?
- History / industry collaboration
- Case history
- Challenges / Path Forward
- Questions and Answers

Interoperability in Action

World monetary system

Language translation

International power adapter

EXCHANGE

Spare parts

OMG Standards Development Organization

CORBA

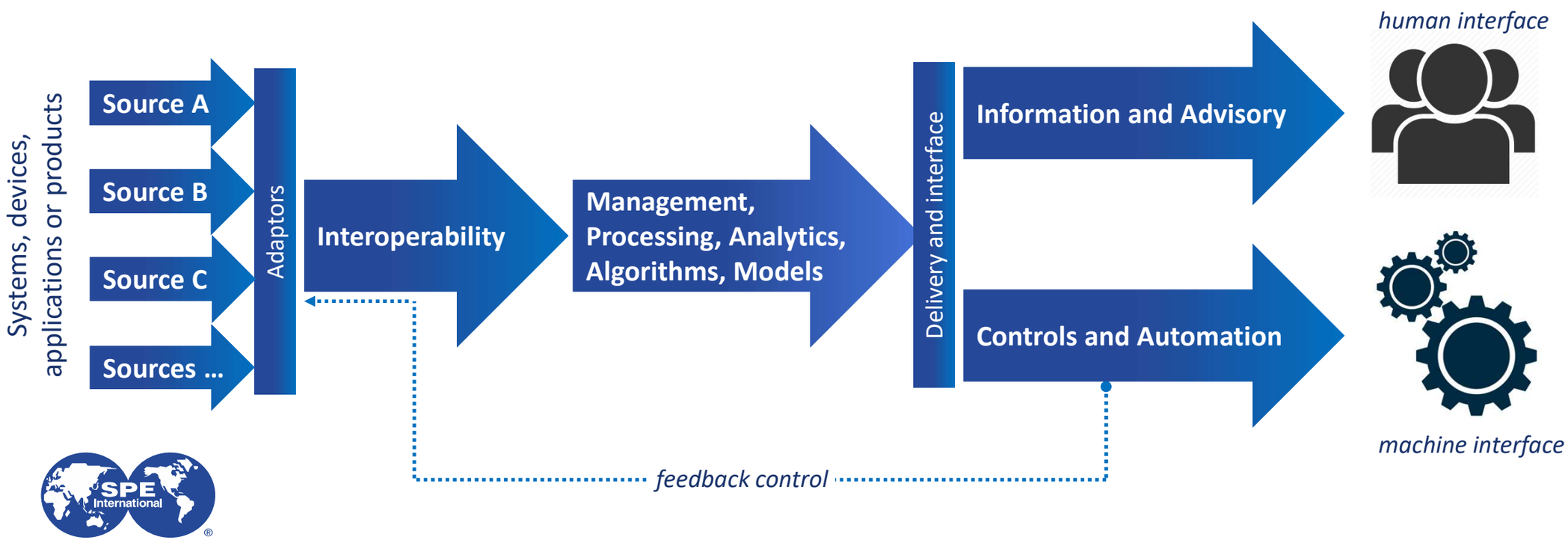
Common Object Request Broker Architecture

Discoverable services

XML

Interoperability

Interoperability is the ability of different **systems, devices, applications or products to connect and communicate** in a coordinated way, without effort from the end user. Functions of interoperable components include ***data access, data transmission and cross-organizational collaboration regardless of its developer or origin***. Similar to compatibility, interoperability helps organizations achieve higher efficiency and a more holistic view of information.



Key Considerations

- Quality interoperability layer reduces friction during exchange
- Allows *original content manufacturer* to innovate unfettered by exchange constraints
- Lack of interoperability creates islands and silos
- Interoperability is NEGOTIATION (handshake)
- Almost always intermediated by a third-party
    - Anti-patterns
        - Confirm to universal data model
        - Speak one dialect of one language, universally
        - Everyone use OPC or C#
- Not a luxury, a necessity

Challenges

Unification of disparate systems:

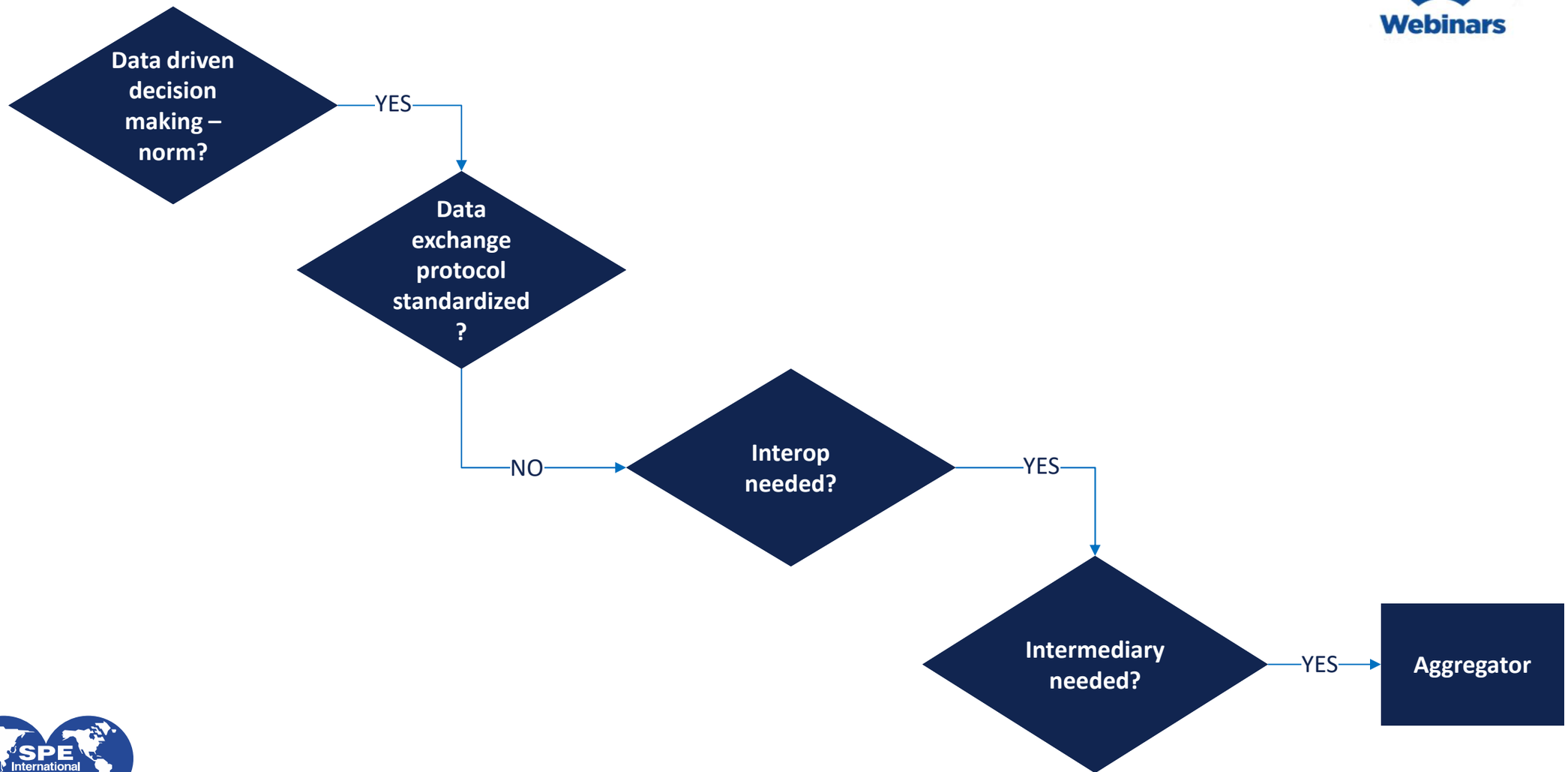
- Challenges
  - Access to necessary systems
  - Access to data (data ownership)
  - Capabilities/limitations of data sources
  - Commercial agreements
  - Legalities and liabilities
  - Vendor lock-in

Vertical integrations (one stop shop):

- Rig and rig systems
  - Rig Operating System (OS)
  - Top Drive
  - Draw Works
  - Mud Pumps
  - Generators
  - Automatic slips
  - Automatic Catwalk
  - Iron Roughnecks
- Third party systems
  - Cementing
  - Fracturing
  - Electronic Drilling Recorder (EDR)
  - MPD
  - …

Data interoperability and integration is key to analytics, controls, and automation

Why Interoperability for Oil and Gas



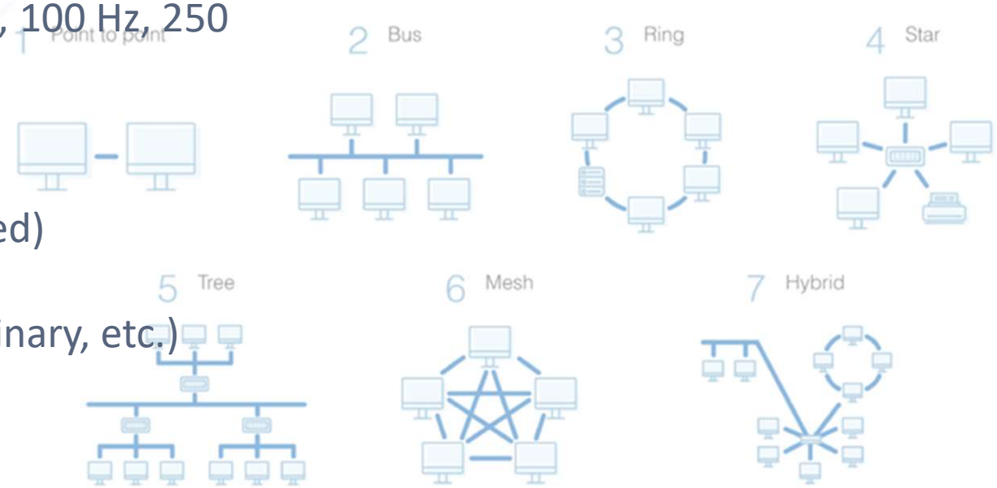
Solution - Key Components

- **Hardware**
  - Edge aggregator
  - Compute and storage
  - Installation Considerations
    - Wireless
    - Rig Move
- **Software**
  - Flexible Data Aggregator
    - Time Stamp
    - Mnemonics translation
    - Units of Measure translation
    - Regularization – ingest/egress moderation
    - Data Adaptors
    - Bi-Directional Communication
  - Streams computing

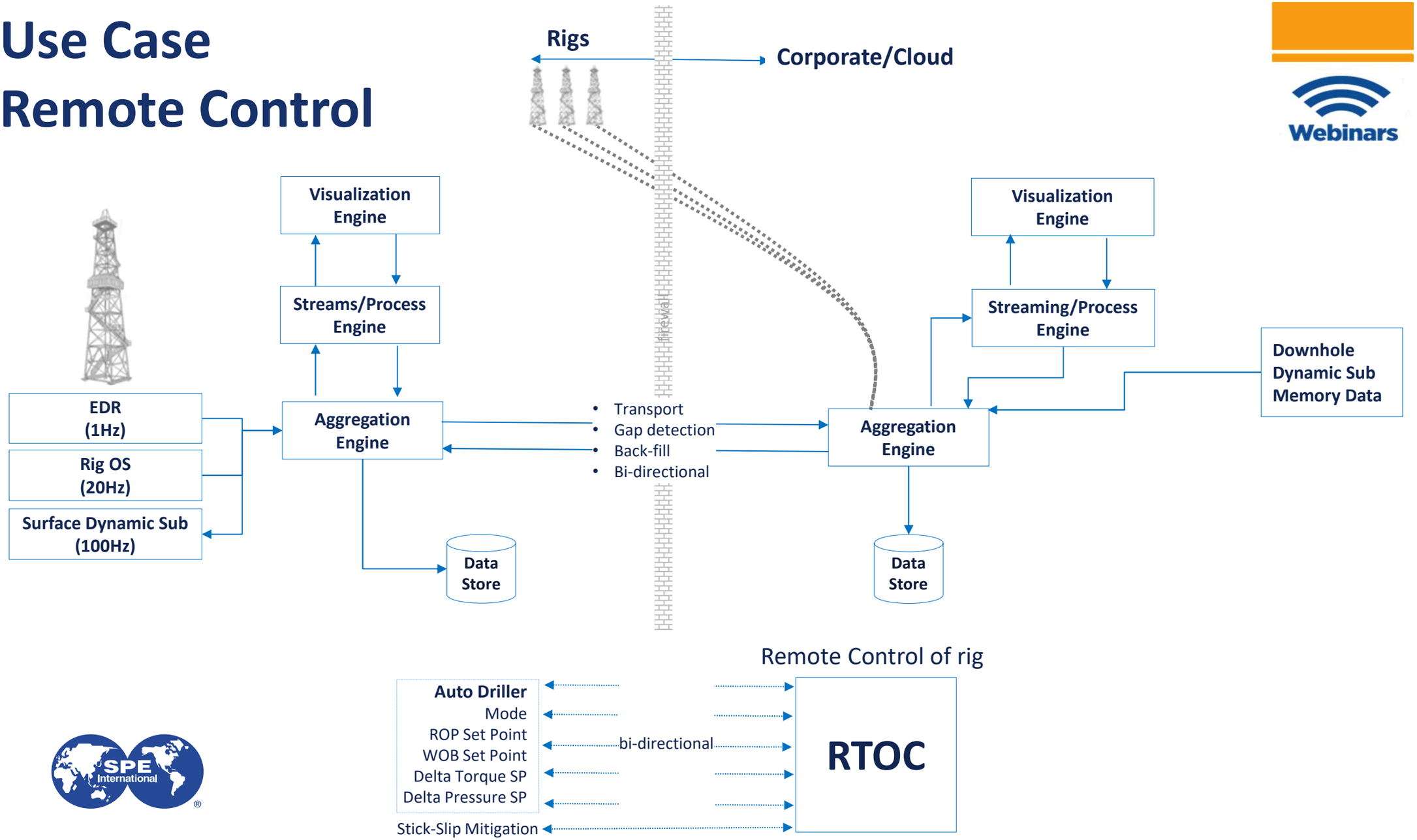
- **Data**
  - Streaming quality check
  - Collect from as many sources as possible
  - Highest quality and least expensive to collect data at the source
  - Avoid merging data after operation

Aggregation Engine - Characteristics

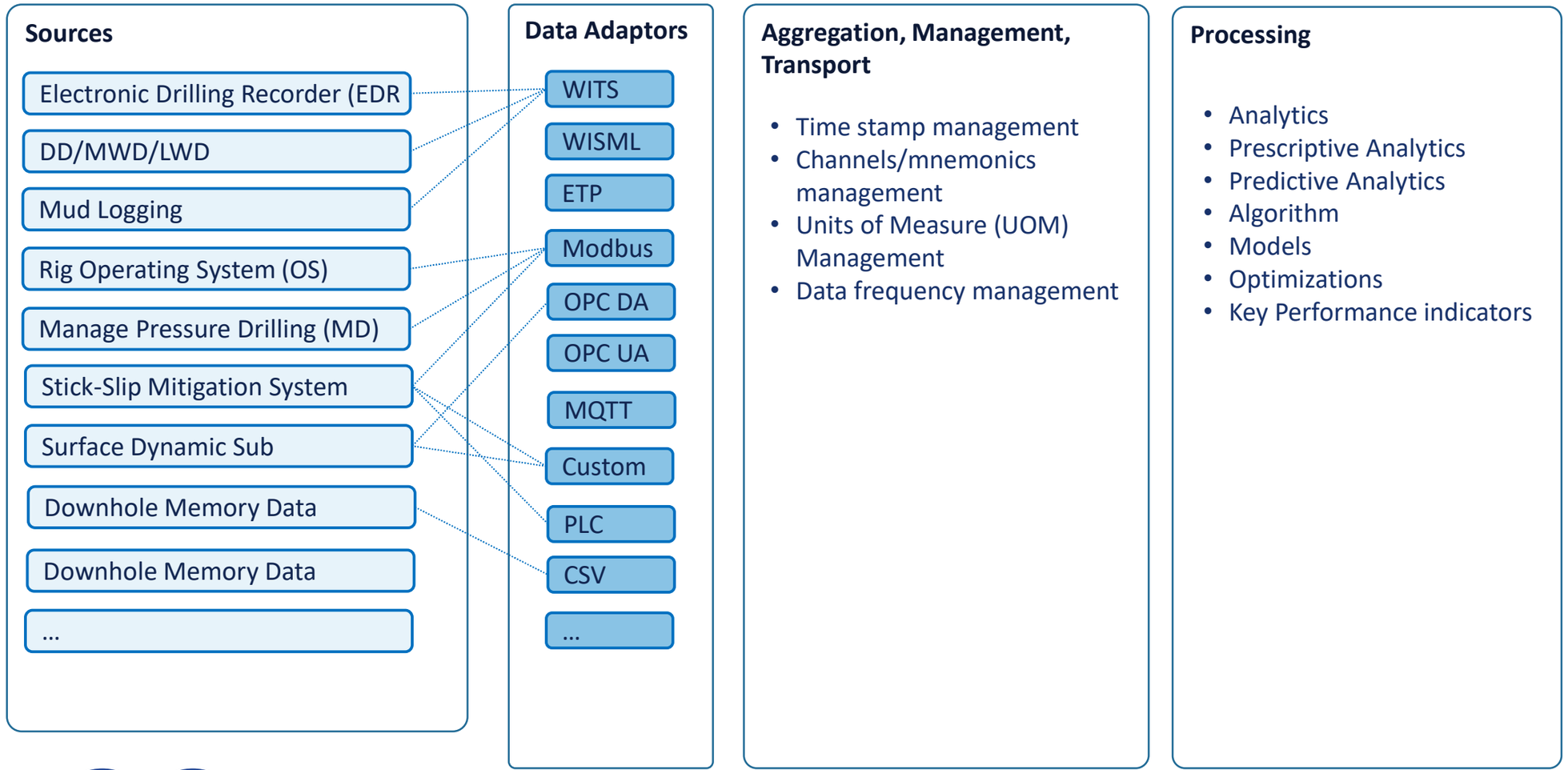
- Handle multiple data transmission protocols (WITS, WITSML, OPC UA/DA, ETP, Ethernet-IP, Modbus, Profibus, etc.)
- Handle multiple data transmission speeds (0.2 Hz, 1 Hz, 20 Hz, 100 Hz, 250 Hz, 1000 Hz, 1.2 kHz, etc.)
- Handle multiple data units of measurement (Imperial, SI, mixed)
- Handle multiple data formats (XML, JSON, CSV, TSV, custom binary, etc.)
- Handle multiple network topologies
- Handle multiple consumer/producer types (RESTful, Websockets, gRPC, etc.)



Use Case
Remote Control



Data Unification inside the Aggregator



Aggregation – Beyond Collecting Data

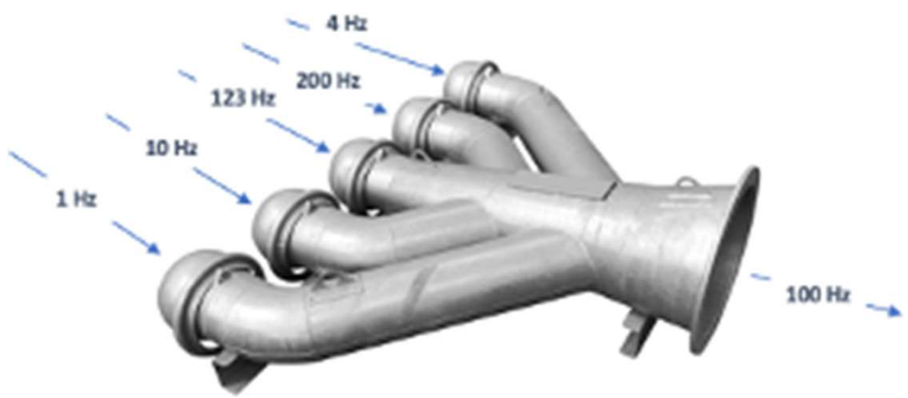
- Throttling
- Real-time mathematical aggregation (smoothing, averaging, decimation, etc.)
- Simple and complex compression
- Computed channels

Streaming and Complex Event Processing capability

$$MSE = WOB \cdot \left(\frac{1}{A_b} + \frac{13.33 \cdot \mu_b \cdot RPM}{D_b \cdot ROP} \right)$$

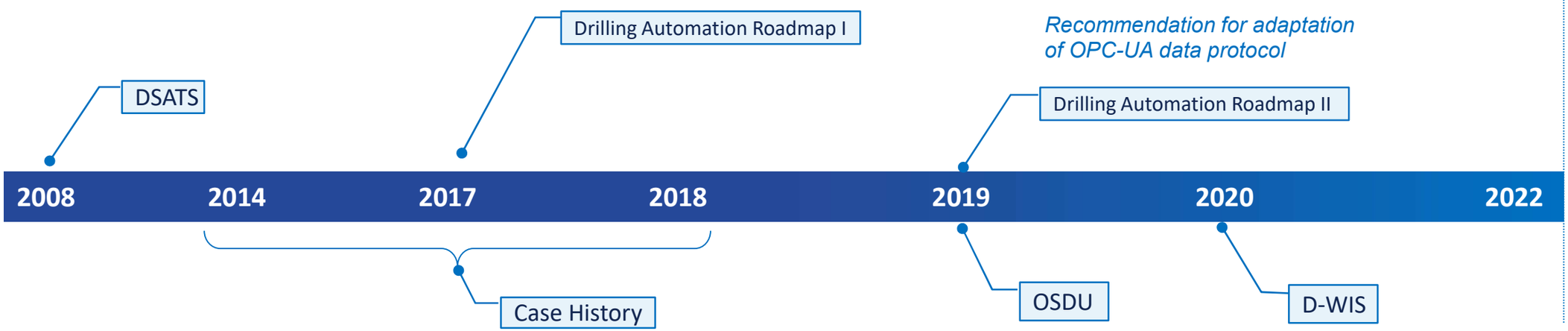
$$\mu_b = 36 \frac{T}{D_b \cdot WOB}$$

- Regularization – great to have



Industry Collaboration

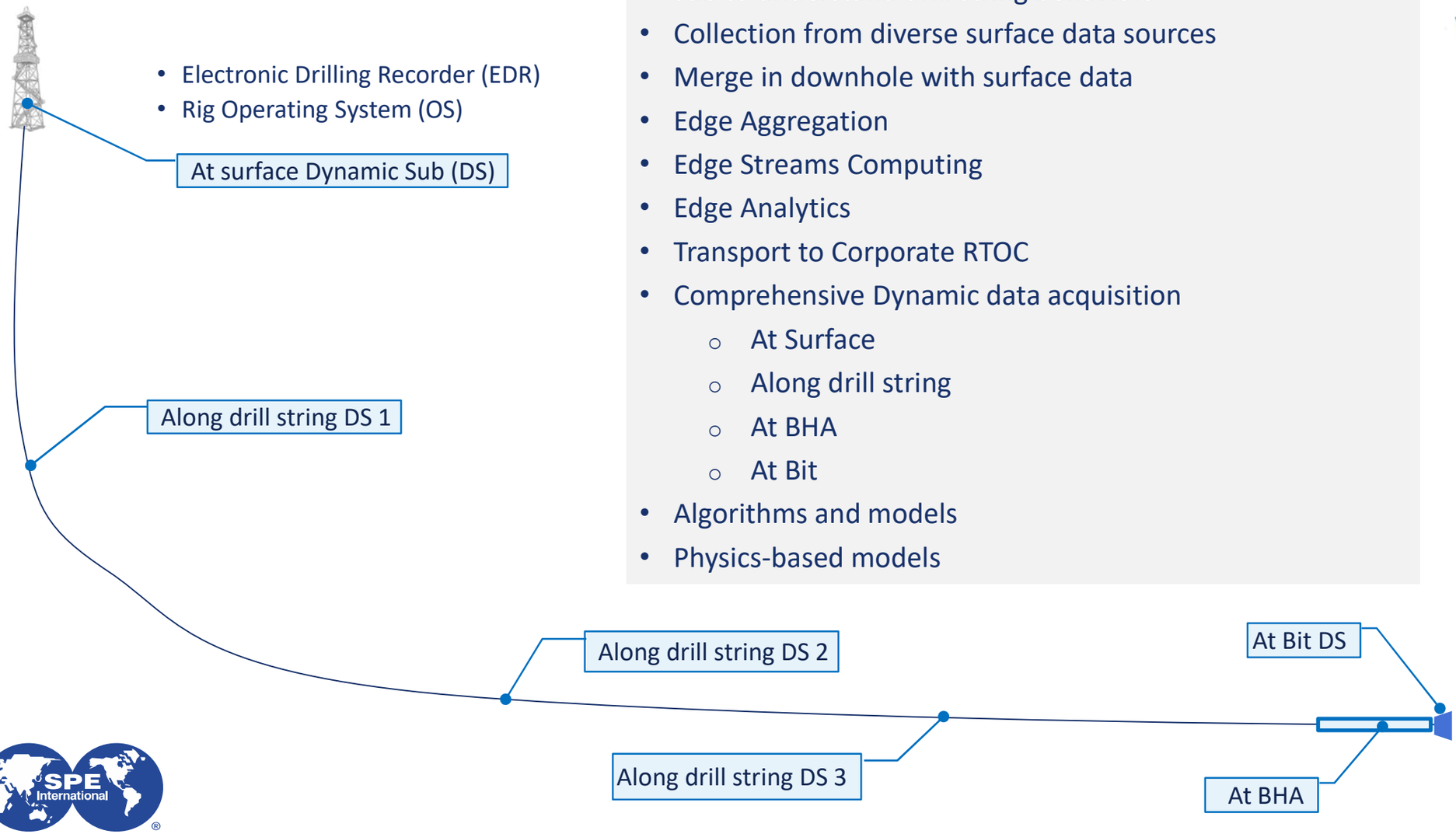
- SPE DSATS – Drilling Systems Automation Technical Section (*connect.spe.org/dsats*)
- Drilling Systems Automation Roadmap (dsaroadmap.org) – IADC DEC
- DSABOK - Drilling Systems Automation Body of Knowledge (*dsabok.org*)
- D-WIS – Drilling-Wells Inoperability Standards (*d-wis.org*)
- OSDU – Open Subsurface Data Universe (*osduforum.org*) – Energistics
- IADC ART – Advanced Rig Technology (*drillingcontractor.org/departments/rig*)



Our purpose is to accelerate the development and implementation of systems automation in the well drilling industry by supporting initiatives that communicate the technology, recommend best practices, standardize nomenclature and help define the value of drilling systems automation. Appropriate initiatives include workshops, forums, lectures, and technical and white papers. **DSATS** actively encourages the participation of automation experts from outside the drilling industry as well as those from within.

2014-2018 Case History

- Deployment of bit, BHA, along string, and surface dynamic sub to understand drill string behaviors
- Collection from diverse surface data sources
- Merge in downhole with surface data
- Edge Aggregation
- Edge Streams Computing
- Edge Analytics
- Transport to Corporate RTOC
- Comprehensive Dynamic data acquisition
  - At Surface
  - Along drill string
  - At BHA
  - At Bit
- Algorithms and models
- Physics-based models



Interoperability: Embrace it or fail!

Thank you

Questions