proasense
The Proactive Sensing Enterprise

Make proactive enterprise real

The ProaSense approach

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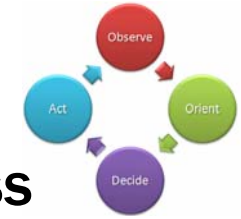
Introduction

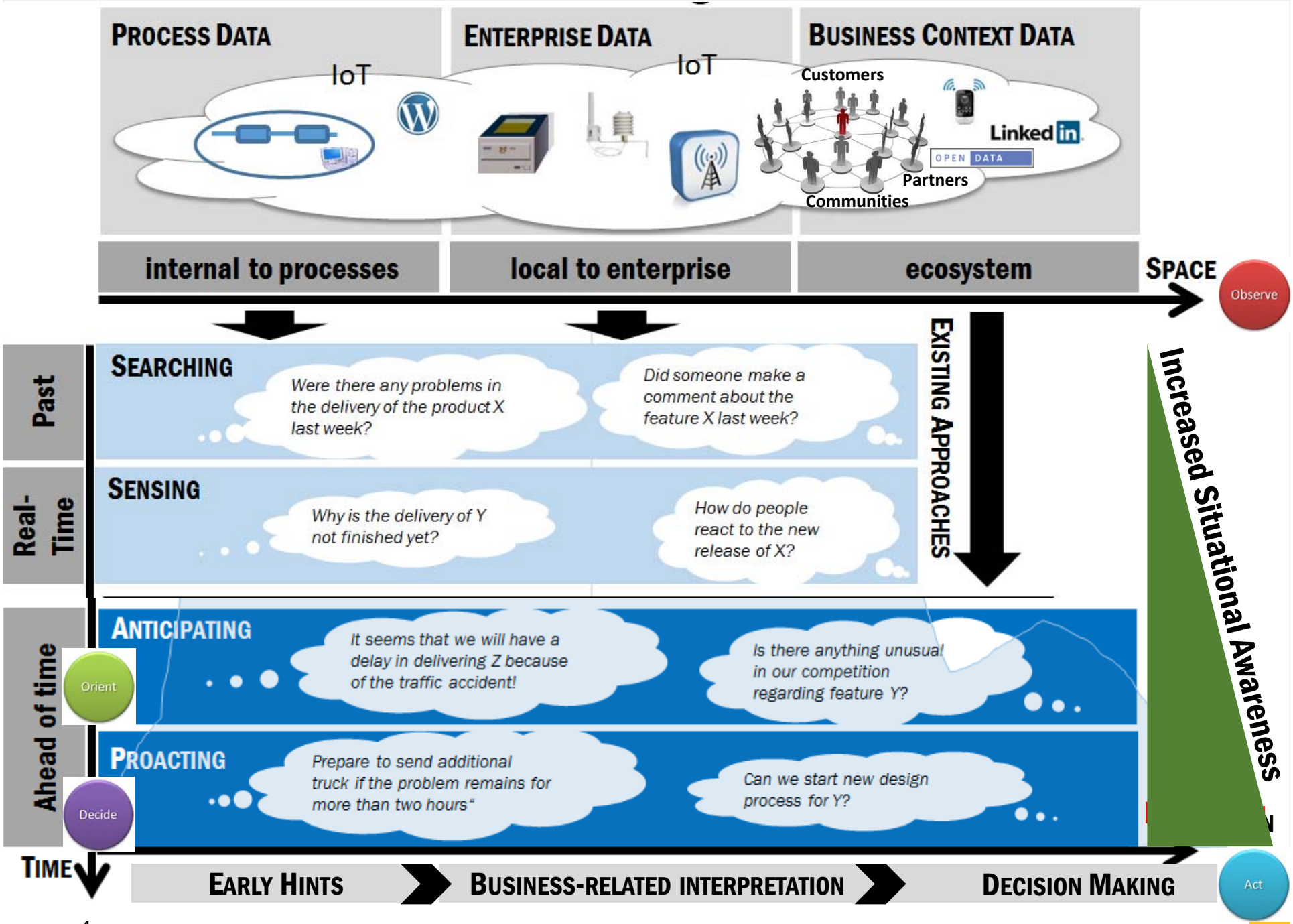
- Proactive enterprise
  - From the idea to realization
  - From realization to exploitation
  - From exploitation to revenue
- Me
  - From technical coordinator to exploitation management

ProaSense vision

- Support a transition from Sensing enterprises into **Proactive** sensing enterprises
  - to go from **reactive** to **proactive computing** in order to prevent problems or capitalize on opportunities before they even occur



- To be achieved through the adoption of the **Observe-Orient-Decide-Act (OODA)** loop of situational awareness and development of corresponding technologies:
  - a **scalable, distributed architecture** for the management and processing of IoT big-data that will enable
  - continuous monitoring, detection of the need for **service adaptation** and **propose corresponding changes** in a (semi-) automatic way


PROCESS DATA
ENTERPRISE DATA
BUSINESS CONTEXT DATA
IoT
IoT
Customers
Linked in
OPEN DATA
Partners
Communities
internal to processes
local to enterprise
ecosystem
SPACE
Observe
Past
Real-Time
Ahead of time
SEARCHING
Were there any problems in the delivery of the product X last week?
Did someone make a comment about the feature X last week?
SENSING
Why is the delivery of Y not finished yet?
How do people react to the new release of X?
EXISTING APPROACHES
Increased Situational Awareness
ANTICIPATING
It seems that we will have a delay in delivering Z because of the traffic accident!
Is there anything unusual in our competition regarding feature Y?
Orient
PROACTING
Prepare to send additional truck if the problem remains for more than two hours"
Can we start new design process for Y?
Decide
TIME
EARLY HINTS
BUSINESS-RELATED INTERPRETATION
DECISION MAKING
Act

Scenario

- The ProaSense prototype has been examined and validated in **two real use cases** (MHWirth and Hella), each of them addressing a different application domain and different challenges of the project's objectives
- Practical application of proactive **condition-based maintenance** (CBM) in the oil and gas industry
  - The strategy so far has mainly been to perform planned maintenance according to equipment manuals, mainly calendar based
  - In this respect, the ProaSense project represents a good opportunity for change

Challenges for a traditional approach

condition-based maintenance (CBM)

- **Huge amount of parameters:**
  - 4000 variables (16 selected)
  - **OBSERVE**
- **Need for correlating parameters**
  - **ORIENT**
- **Defining proactive actions**
  - **DECIDE**
- **Adapt/learn**
  - **ACT**

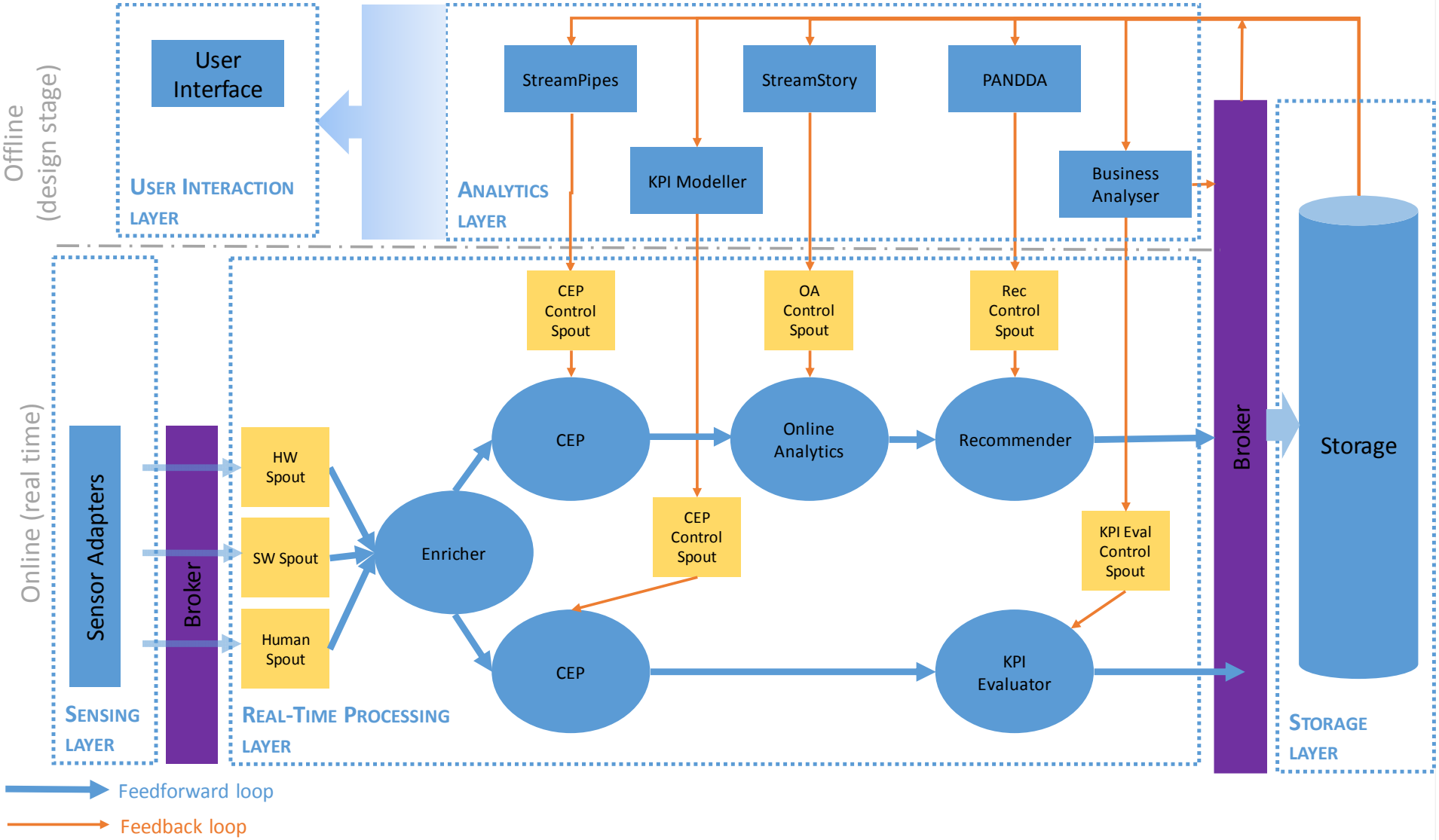
Scenario – observe phase

- CBM employs various monitoring means to detect failure in some critical drilling equipment, e.g. the rotation speed of the drilling machine's main shaft in RPM
  - The entire data set available is more than **4000 variables** related to this equipment or the surrounding environment
    - monitoring engine temperature indicators, monitoring electric indicators (measuring change in the engine's electric properties) and performing oil analysis
  - **16 variables** are selected (focus on thermal indicators)
    - All variables are sampled at 20 millisecond time resolution
    - 41 MB per day per variable

Scenario – orient phase

- **Several parameters** should be **correlated**:
  - oil temperature and RPM events characterized by an abnormal oil temperature rise (e.g. 10% above normal) measured over 30% of the drilling period when drilling RPM exceeds a threshold …
  - in order to **anticipate future states of the system** and **predict the time** when a gearbox breakdown will occur along with its probability distribution function
- This requires both **offline** and **online learning**

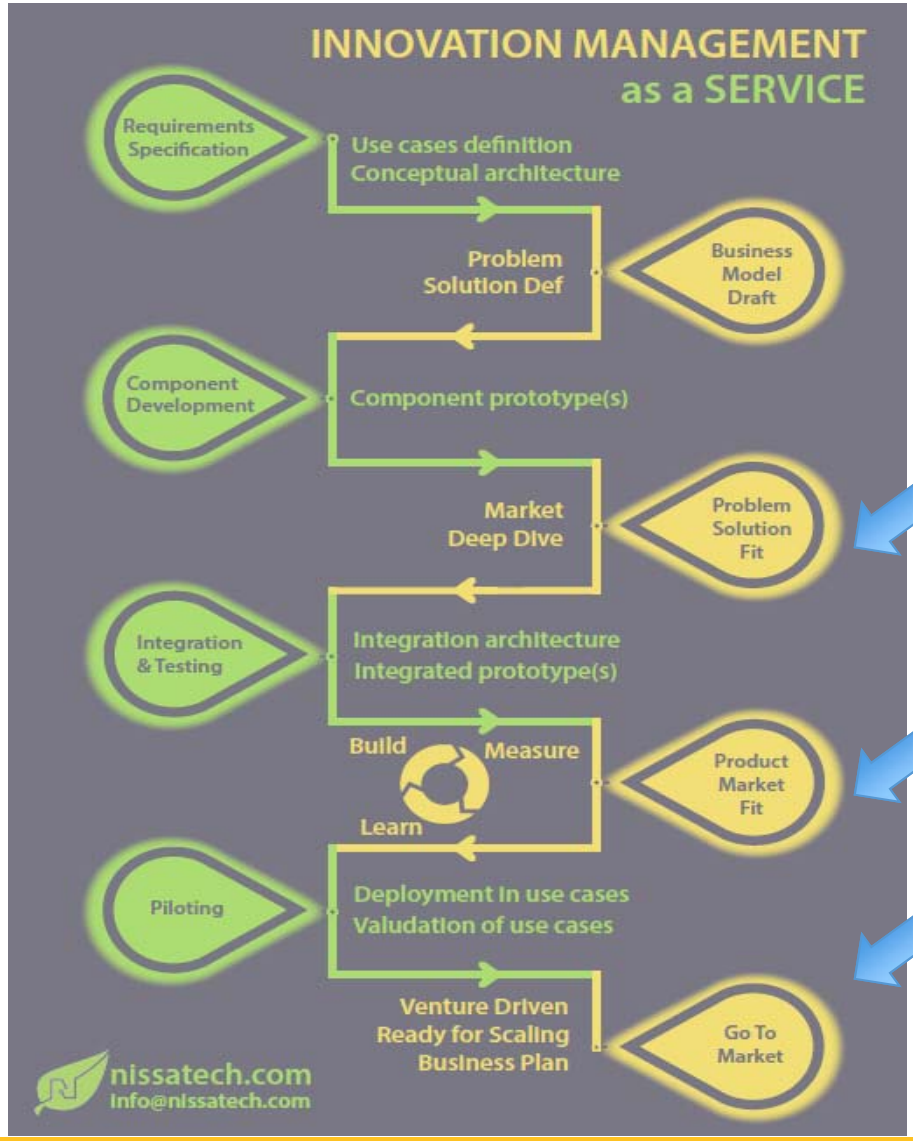
Implemented architecture



Exploitation - challenges

- Complexity of the system
  - Difficult to understand what the system is about
- Stability/reliability/performances
  - Difficult to install, adapt, maintain
- Use case validation (measurable KPIs)
  - Difficult to find measurable indicators for the success

Exploitation: common pitfalls in projects



A SOLUTION IS DEFINED
BUT THE INITIAL PROBLEM
IS NOT WELL ADDRESSED

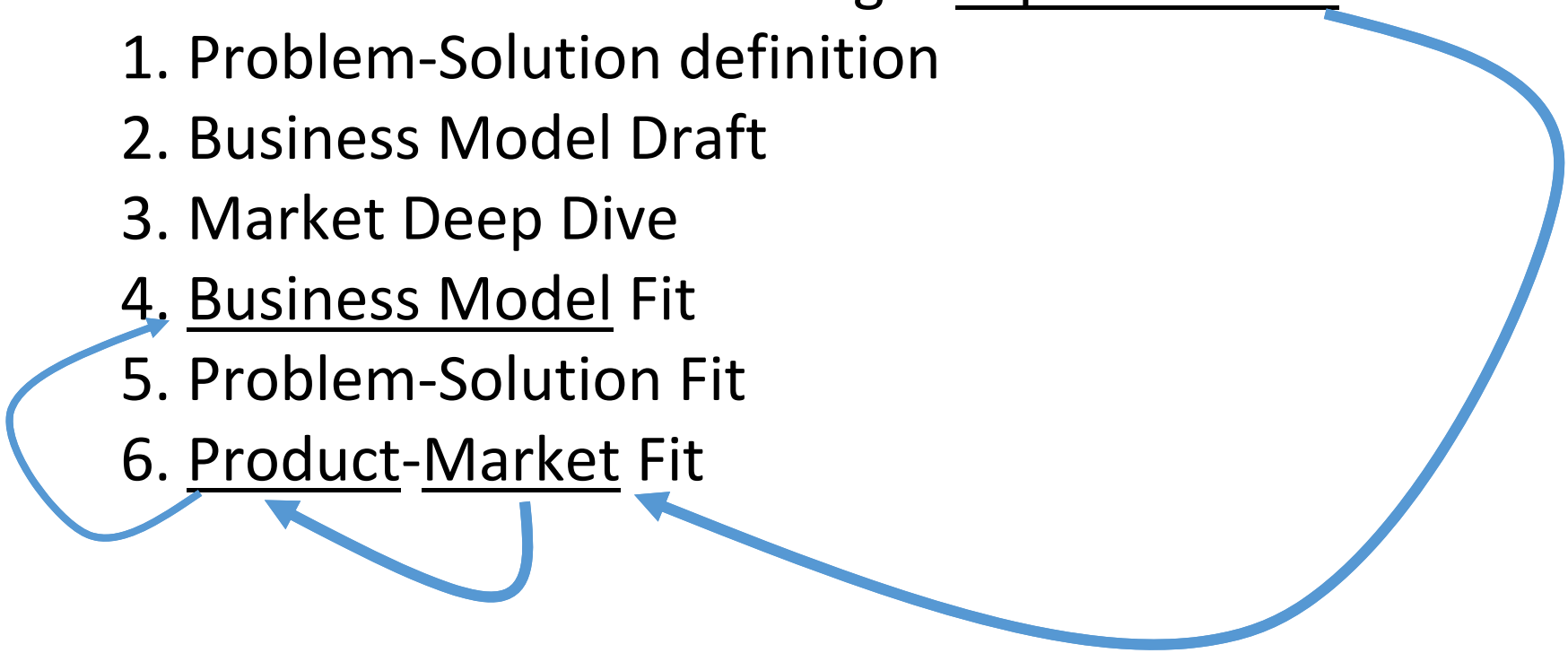
A PRODUCT IS DEVELOPED
BUT IT IS NOT PROPERLY TESTED
FOR COMMERCIAL EXPLOITATION

A PRODUCT IS DEVELOPED
BUT THE MARKET IS MISSING

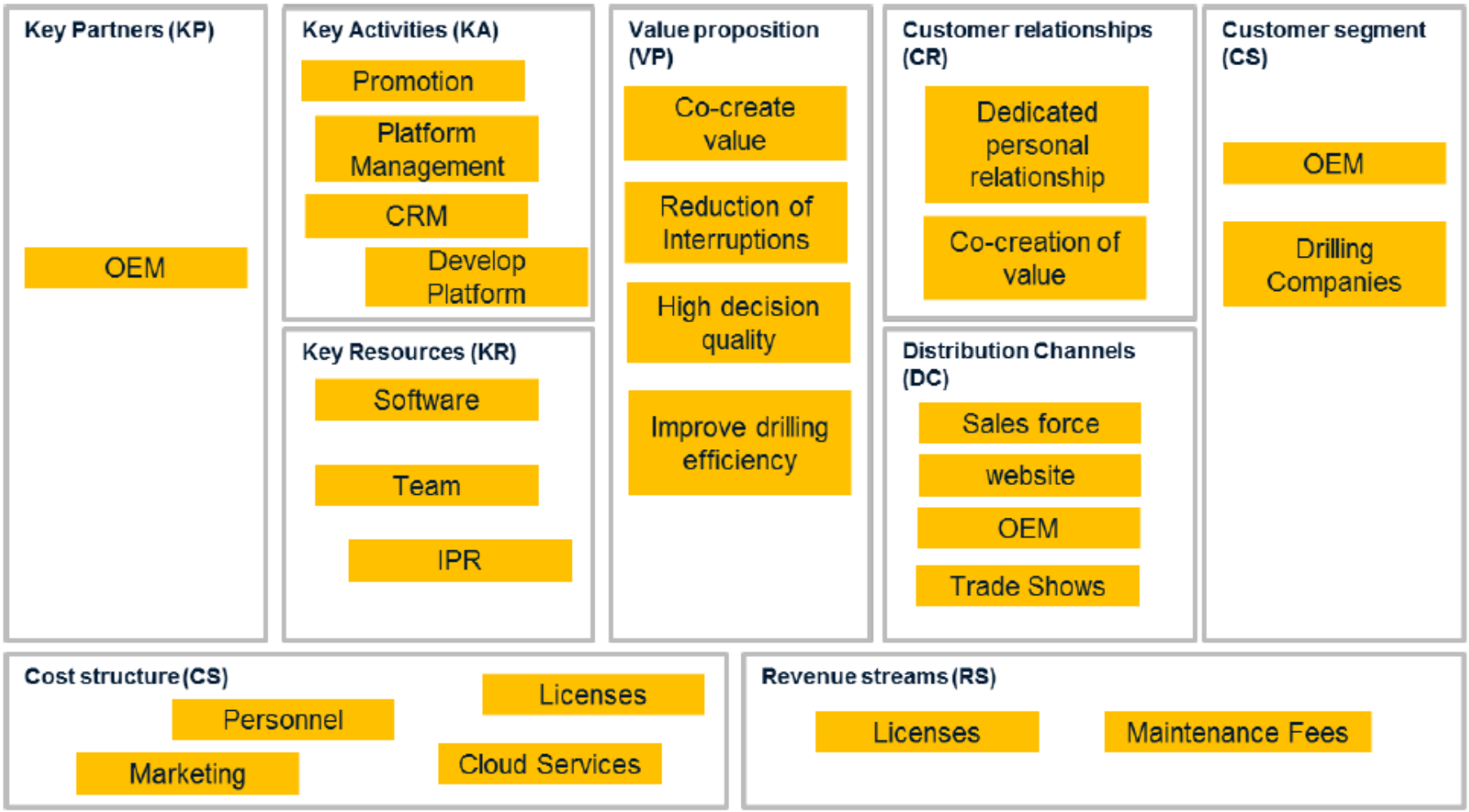
Exploitation process

Set of activities in order to get exploit results:

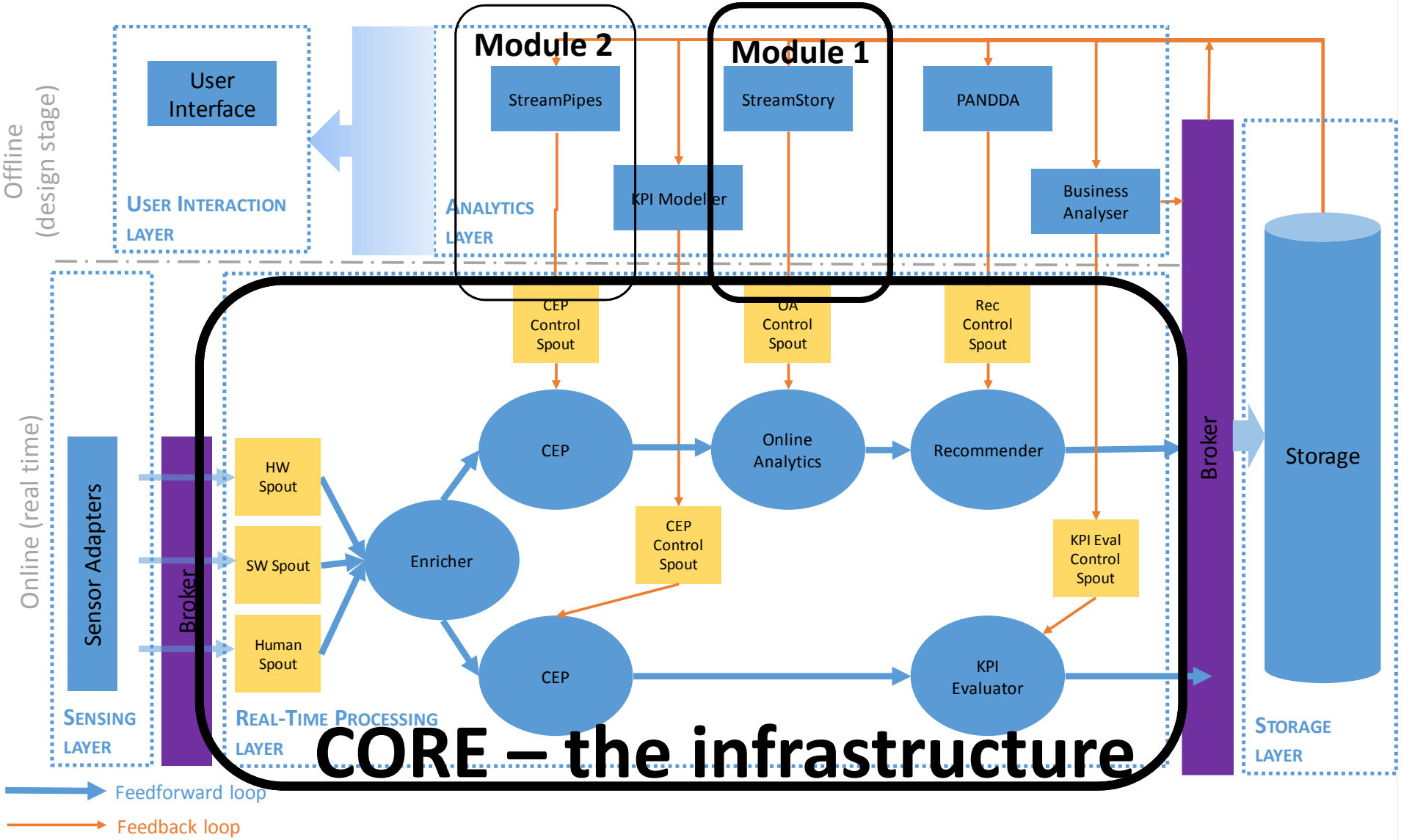
1. Problem-Solution definition
2. Business Model Draft
3. Market Deep Dive
4. Business Model Fit
5. Problem-Solution Fit
6. Product-Market Fit



Exploitation process: Business Model Draft



Exploitation architecture



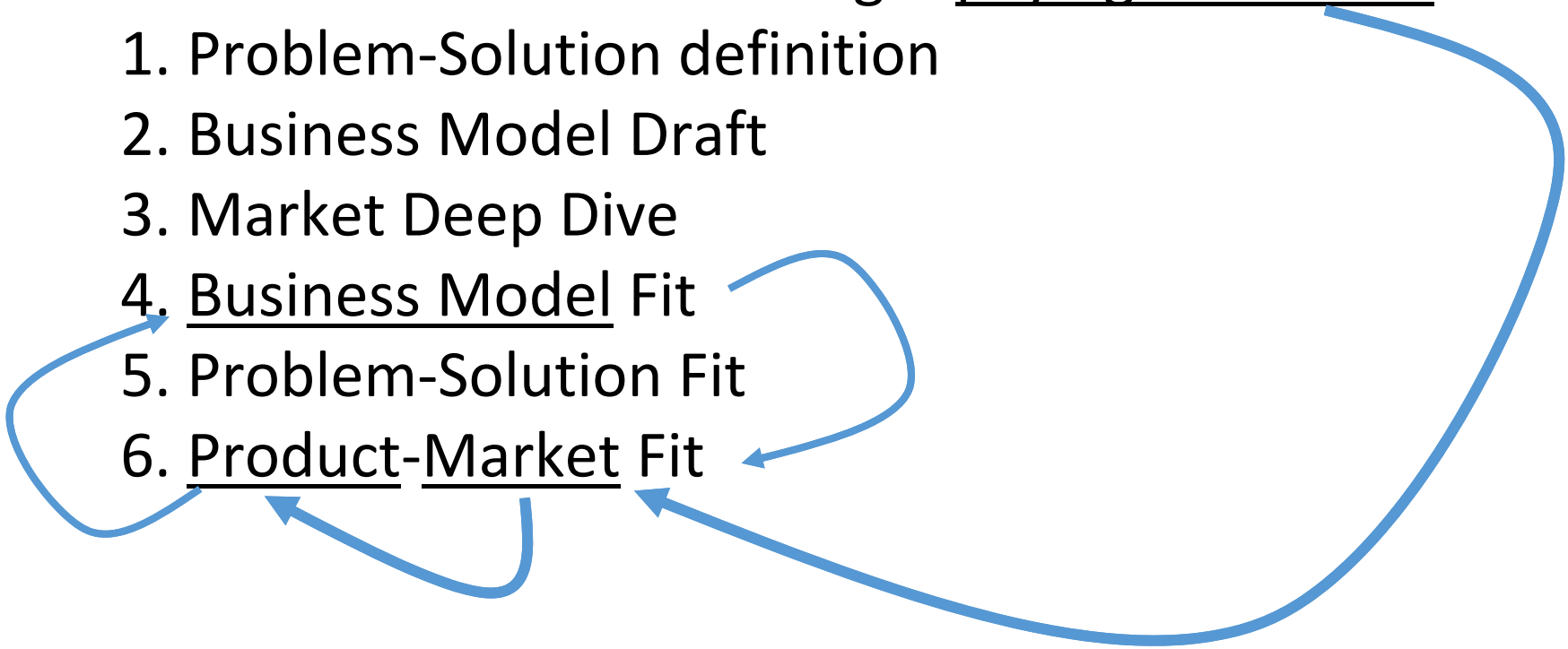
How to apply it in an industry?

- Starting with the small pilot project as PoC (proof of the concept)
  1. Selected process data is shared for test (smaller amount)
     - A rigorous Data privacy and security approach is already in place
       - Data can be anonymized, if required
  2. Testing is performed in our infrastructure
  3. The results are shared with the process owners
     (CO-CREATION)
  4. Discussion about the validity of the approach
  5. Next steps defined
- Time frame for this phase (PoC): 2-3 months

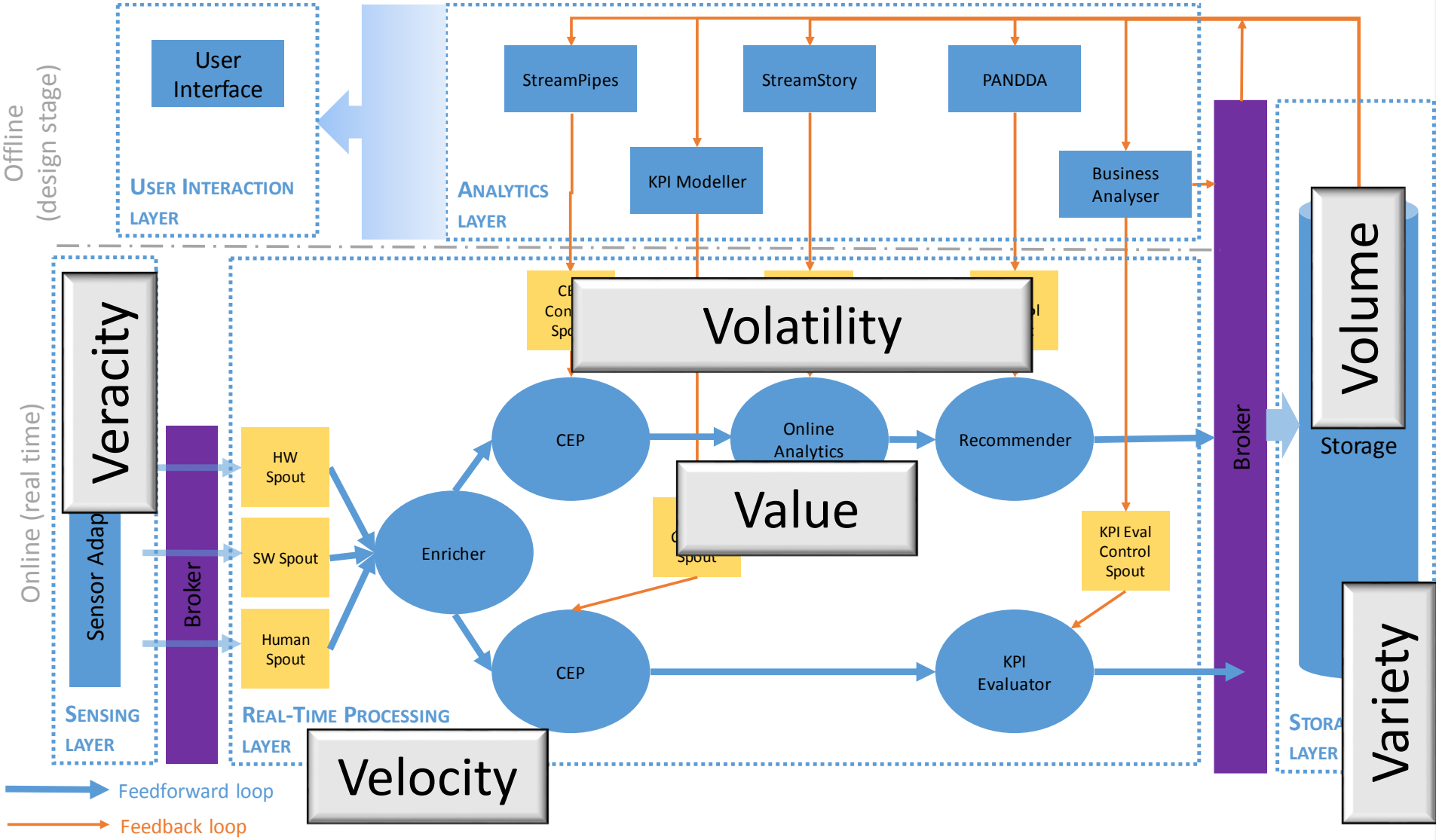
Exploitation process++

Set of activities in order to get paying customers:

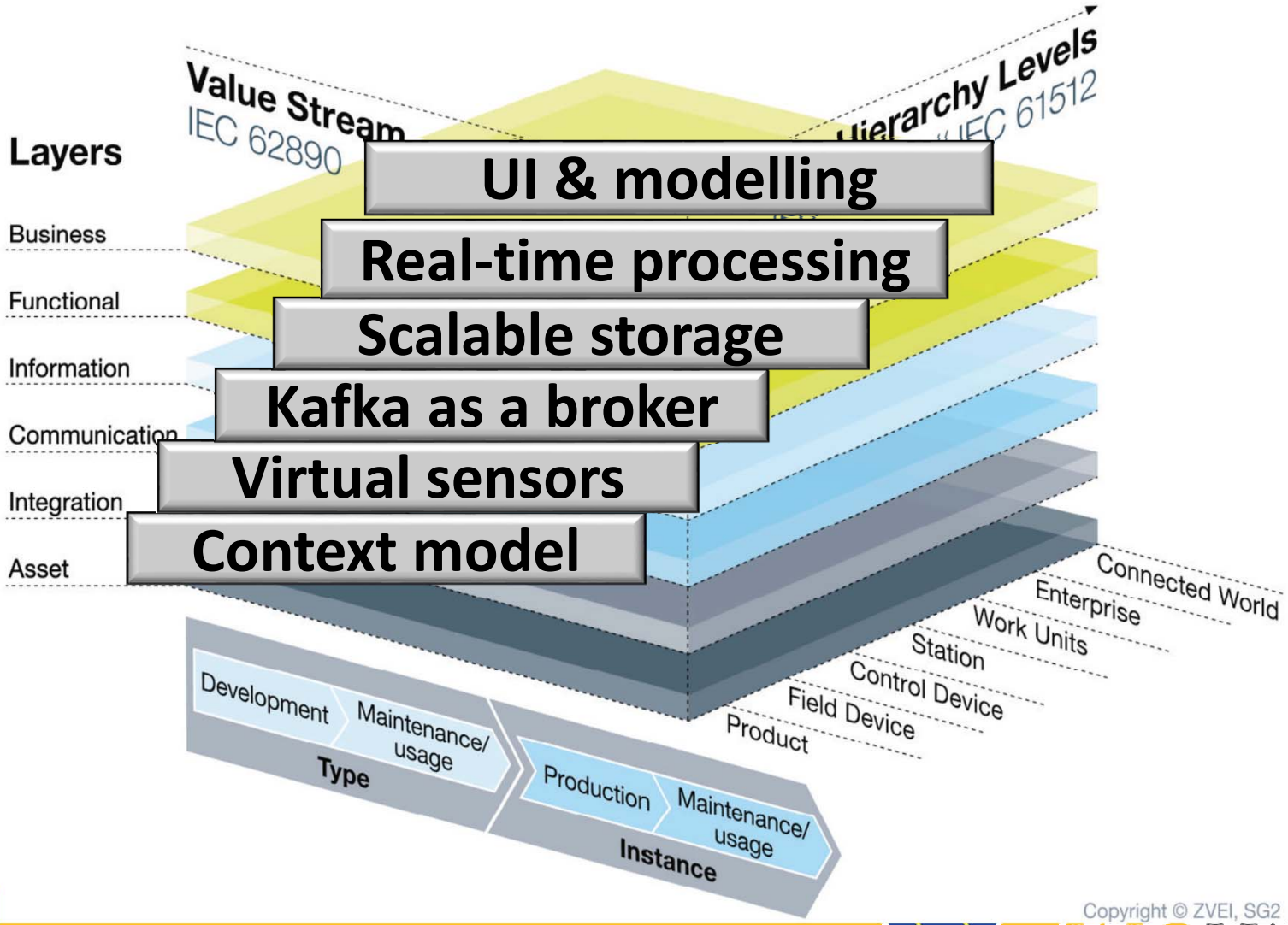
1. Problem-Solution definition
2. Business Model Draft
3. Market Deep Dive
4. Business Model Fit
5. Problem-Solution Fit
6. Product-Market Fit



EXPAND: ProaSense & Big Data



STANDARDIZE: ProaSense and RAMI (Reference Architecture Model for Industry 4.0)



Conclusion

- Different approach
- Promissing
- To be continued

Thank you for your attention!

QUESTIONS?

Scenario – decide phase

- Based on the predicted probability distribution for the occurrence of a future gearbox breakdown, the **proactive recommendations of actions** can be provided
- Recommendations along with **the recommended activation time** should
  - mitigate (i.e. reduce the probability of occurrence) or
  - completely eliminate the future gearbox breakdown
- Examples:
  - to take the equipment down for full maintenance - an action that completely eliminates the predicted gearbox breakdown
  - increase lubrication of metal parts
  - shift drilling to lower pressure mode
- The suggestion of one of these actions may consider the **company's business context**
  - location of drilling equipment
  - availability of resources
  - next planned maintenance

Scenario – act phase

- After realizing the recommended action, the responsible actor should **provide feedback** on its success, enabling **ProaSense to learn and adapt**
- The **business improvement analyzer** allows users to correlate progress of key performance indicators and recommendations made
  - How downtime of a specific gearbox and the drilling rate have evolved and how many recommendations were made during a specific period of time?
- This analysis will support users in understanding if recommendations are contributing to having an indicator **meet its target value or not**
  - In case of divergence between an indicator and target value, a deeper action may be required, such as the replacement of a piece of equipment