

Intelligent Management for Edge-computing

(Network AI Project for NMRG)

Minsuk Kim (ETRI)

Background – Cloud computing

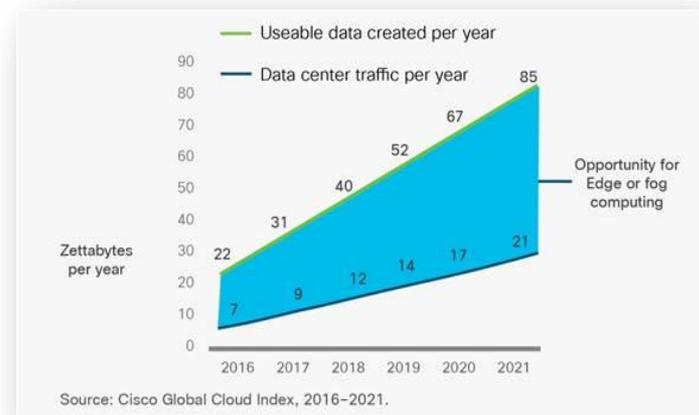
◆ Emerging paradigm

- Cloud computing has changed the way of using the computing infrastructure
 - the resources are provided to the consumer and released by the consumer on the basis of **their demands from the shared pool of resources**
 - This on-demand resource provisioning proves **very economical** to the consumer as they are supposed to pay only for the resources they have used and this feature allows the service provider to re-allocate the released resources
- Features like scalability, elasticity, less entry cost, easy to access and subscription and pay per use etc.
- Compel the businesses and end users to migrate themselves from the traditional platform to the cloud based platform.

Background – Challengeable statement

◆ Zettabytes Era

- Cisco GCI estimates that **nearly 850 ZB** will be generated by all people, machines, and things by 2021
 - Much of this ephemeral data is not useful to save,
 - but approximately 10 percent is useful
- Useful data also **exceeds data center traffic** (21 ZB per year)
- **Edge or fog computing might help bridge this gap**



Background – Limitation of CoT

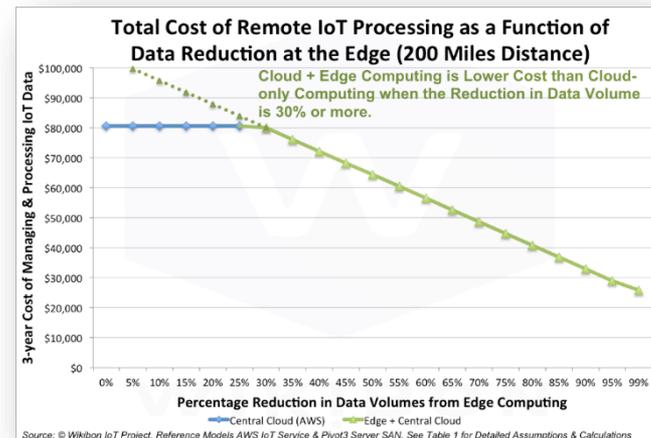
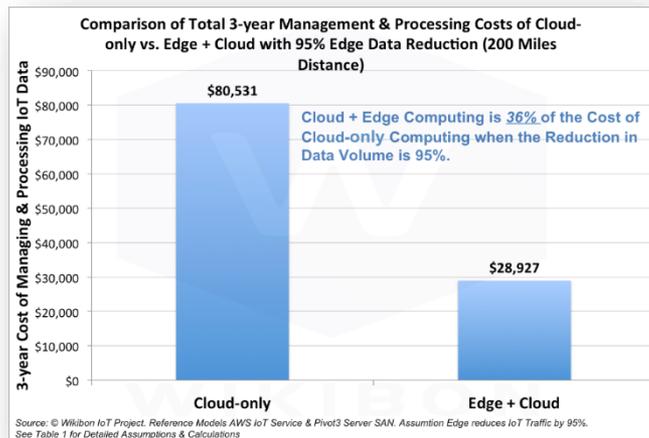
◆ Limitations of IoT-Cloud model

- Explosive growth to various operation technologies (OT)
- Smart decisions at devices
- Need to time-critical application
- Poor of Internet connectivity to Cloud
- Data privacy, security and legal implications

Background - Edge and Cloud computing

◆ IoT management architecture

- Changes Cloud-only to combining edge and cloud architecture



Background – Intelligent Edge

◆ Summary of MWC 2019

- Gartner survey

- 59% of organizations believe 5G's ability to support high densities of IoT sensors will be the top use for the next-generation mobile networking technology.
- Prepare for a 5G IoT explosion

- Intelligent Edge

- “Computing is no longer confined to a device or even a single datacentre,”
- “Instead, it's ubiquitous fabric, it's distributed from the cloud to the edge, closer to where data is generated”
- “an open-source reference it hopes will encourage growth of an ecosystem to create and deploy new edge applications and services”

What is Intelligent Edge Computing ?

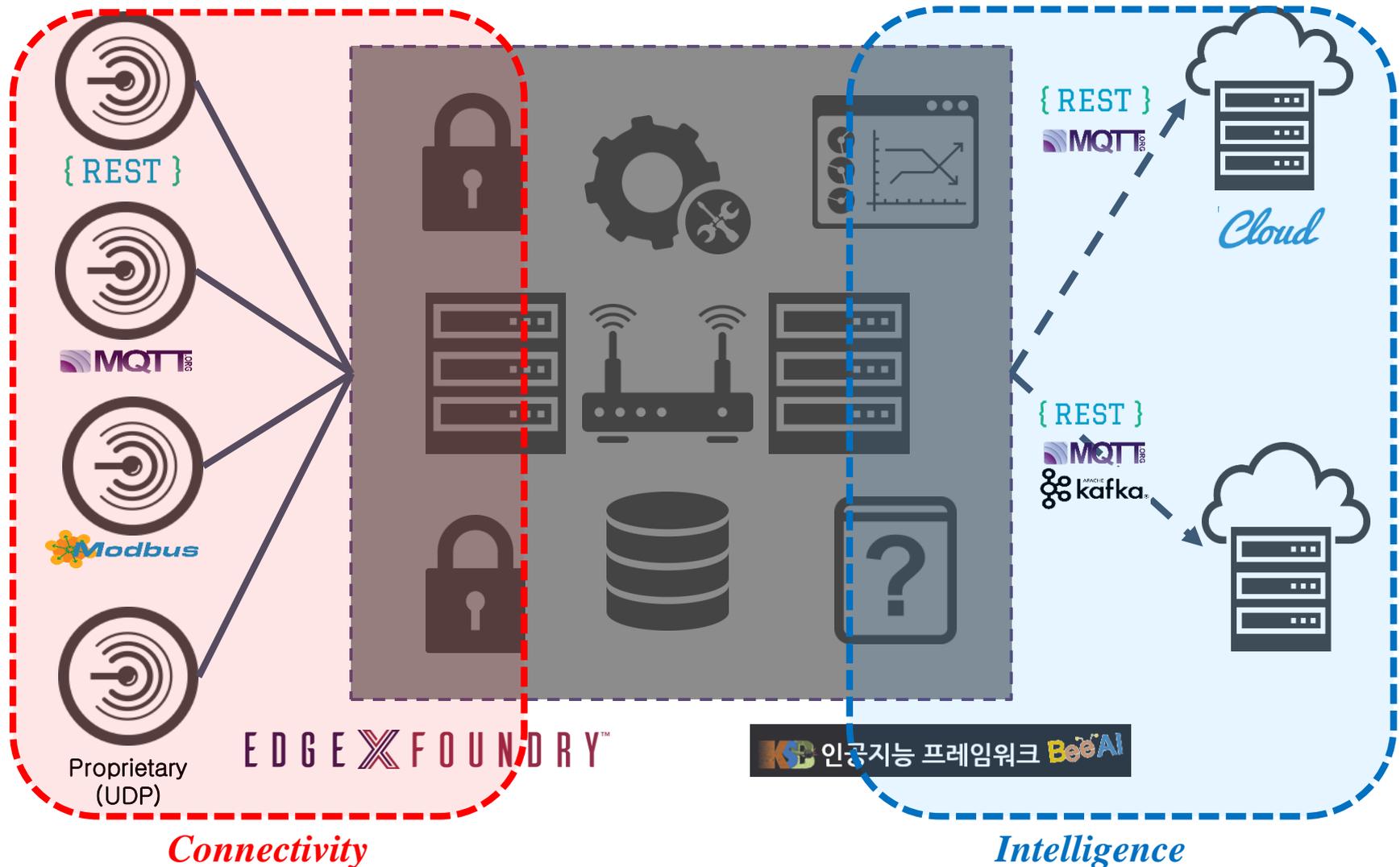
◆ AI in Edge computing

- When Edge computing is extended to the cloud
 - it can be managed and consumed as if it were local infrastructure.
 - security and privacy challenges may arise.

◆ “Intelligent Edge”

- Edge computing will **not replace** the power of the cloud.
- **Collaboration** with Cloud computing
 - reduce cloud payloads drastically when used in collaboration with ML.
- Transform the AI’s operation model
 - perform routine and time-critical **decisions at the edge**
 - only refer to the cloud where more intensive computation and historical analysis is needed.

Intelligent Management for Edge Computing (by ETRI)



Intelligent Edge Computing for Connectivity

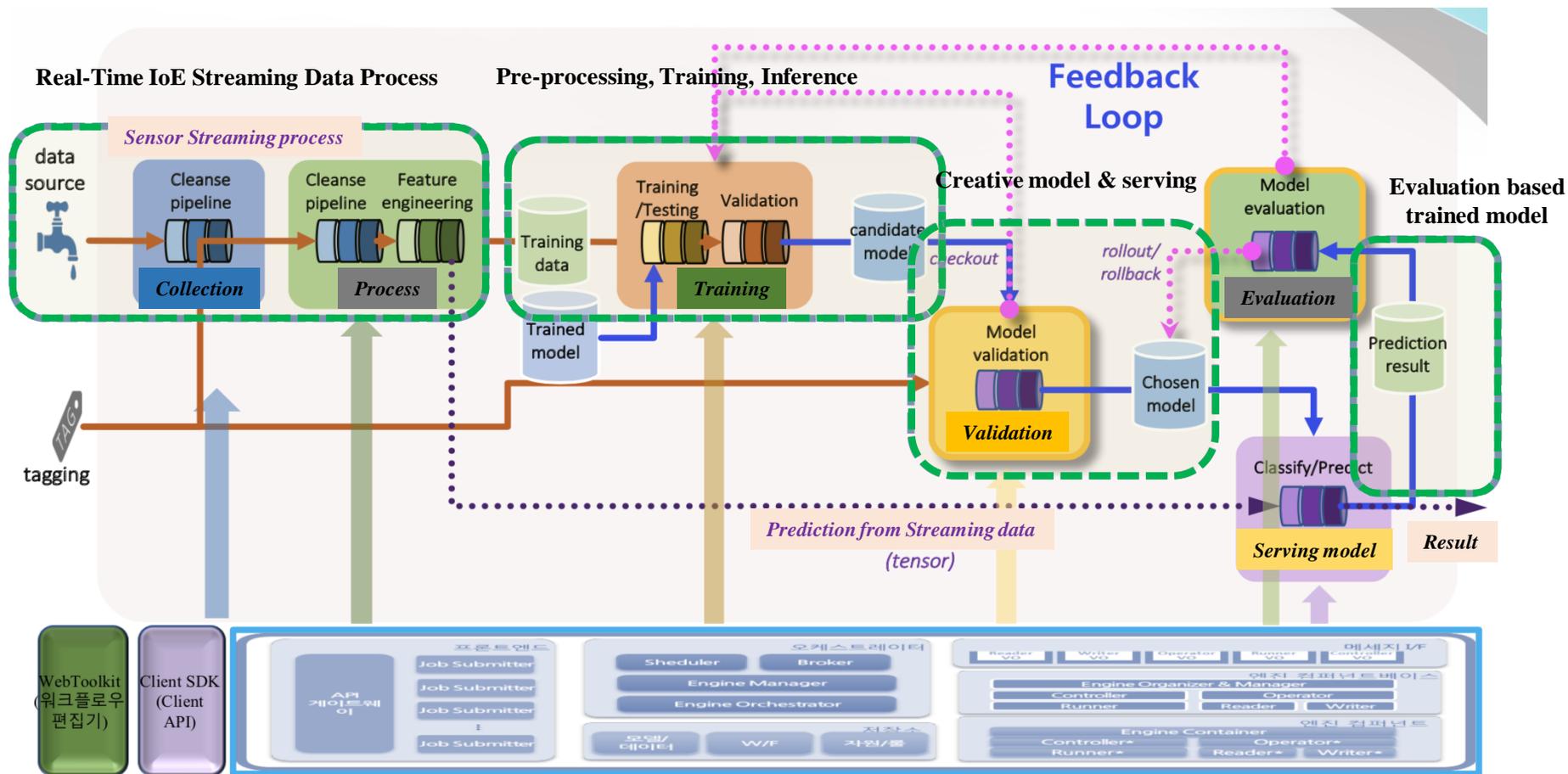
◆ EdgeX Foundry [1]

- EdgeX Foundry is a vendor-neutral, open source, loosely-coupled micro-services framework
- With a focus on the IoT Edge
 - EdgeX simplifies the process to design, develop and deploy solutions across industrial, enterprise, and consumer applications.



[1] <https://edgexfoundry.org>

Intelligent Edge Computing for Intelligence

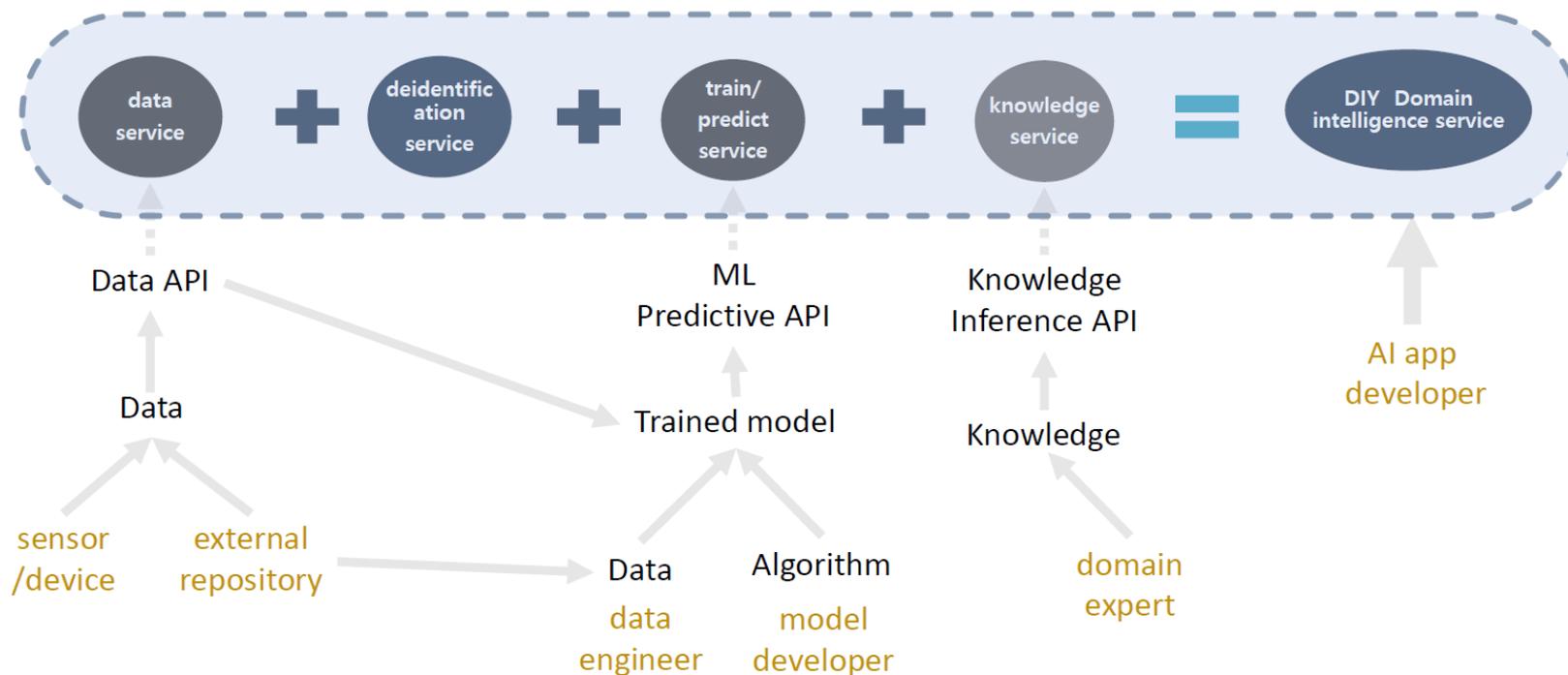


BeeAI Framework overview

Intelligent Edge Computing for Intelligence

◆ KSB Industrial AI Service Infra Framework

- For application developer, ML developer, S/W developer, etc.
- Knowledge accumulation



Intelligent Edge Computing for Intelligence (BeeAI Web-toolkit)

Workflow Editor | version: component: 1.0, ksb: 0.9

Workflow Name: **TrafficStreamingP...**

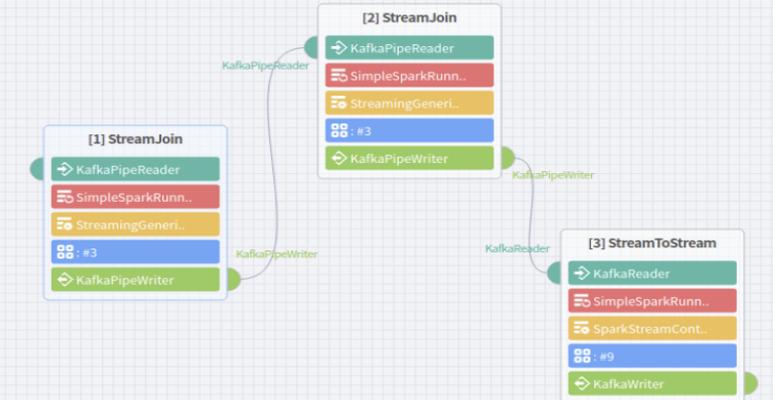
Components::StreamJoin

- Reader (2)
 - FilePipeReader
 - KafkaPipeReader
- Writer (5)
 - ConsolePipeWriter
 - FilePipeWriter
 - HBasePipeWriter
 - KafkaPipeWriter
 - MemoryPipeWriter
- Controller (4)
 - SparkSessionOrStreamController
 - SparkStreamController
 - StreamingGenericController
 - WindowedSparkSessionOrStream...
- Runner (1)
 - SimpleSparkRunner
- Operator (8)
 - FilterOperator
 - GroupByOperator
 - RenameColumnsPipeOperator
 - SelectColumnsPipeOperator
 - SparkMLPredictPipeOperator

Workflow instances

Workflow |

- 1: StreamtobatchEngine
- TrafficPreprocessing (1.0)**
 - 1: StreamtobatchEngine
- TrafficPreprocessing (1.0)**
 - 1: StreamtobatchEngine
- TrafficStreamServing (1.0)**
 - 1: StreamtostreamEngine
- TrafficTraining (1.0)**
 - 1: BatchEngine



```

    graph LR
      subgraph S1 [1] StreamJoin
        R1[KafkaPipeReader]
        W1[KafkaPipeWriter]
      end
      subgraph S2 [2] StreamJoin
        R2[KafkaPipeReader]
        W2[KafkaPipeWriter]
      end
      subgraph S3 [3] StreamToStream
        R3[KafkaReader]
        W3[KafkaWriter]
      end
      R1 -- KafkaPipeReader --> R2
      W2 -- KafkaPipeWriter --> R3
      W3 -- KafkaReader --> W1
  
```

Properties

StreamJoin

ID:

PREVID:

NICKNAME:

RUNTYPE:

Controller: X

Runner: X

Reader

- ^ v X

Writer

- ^ v v X

Operator

- ^ v v v X
- ^ v v v X
- ^ v v v X

[1] StreamJoin

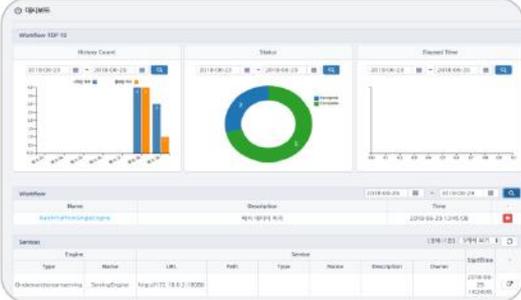


```

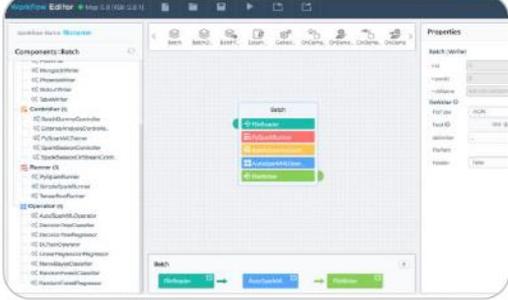
    graph LR
      R[KafkaPipeR..] --> G[GroupByOpe..]
      G --> S[SelectColu..]
      S --> W[KafkaPipeW..]
      R --> R2[RenameColu..]
      R2 --> W
  
```

Intelligent Edge Computing for Intelligence (BeeAI Web-toolkit)

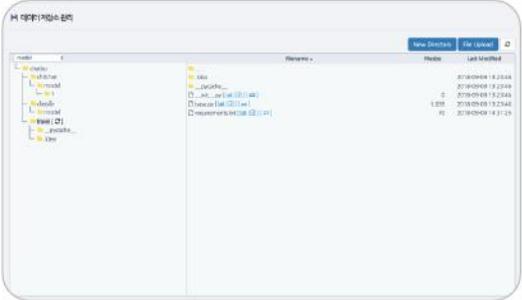
KSB WebToolkit | Dashboard | Workflow Editor | Repository | Monitoring | Component | Management | 이연희



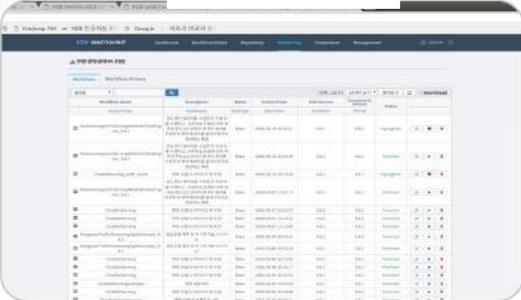
Dashboard



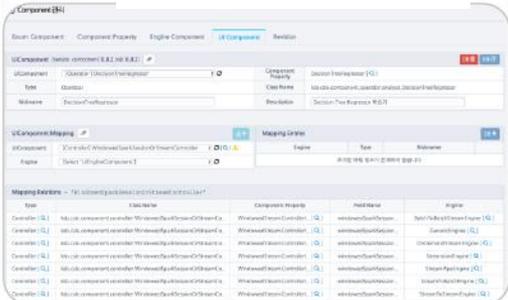
Work-Flow Editor



Repository



Monitoring



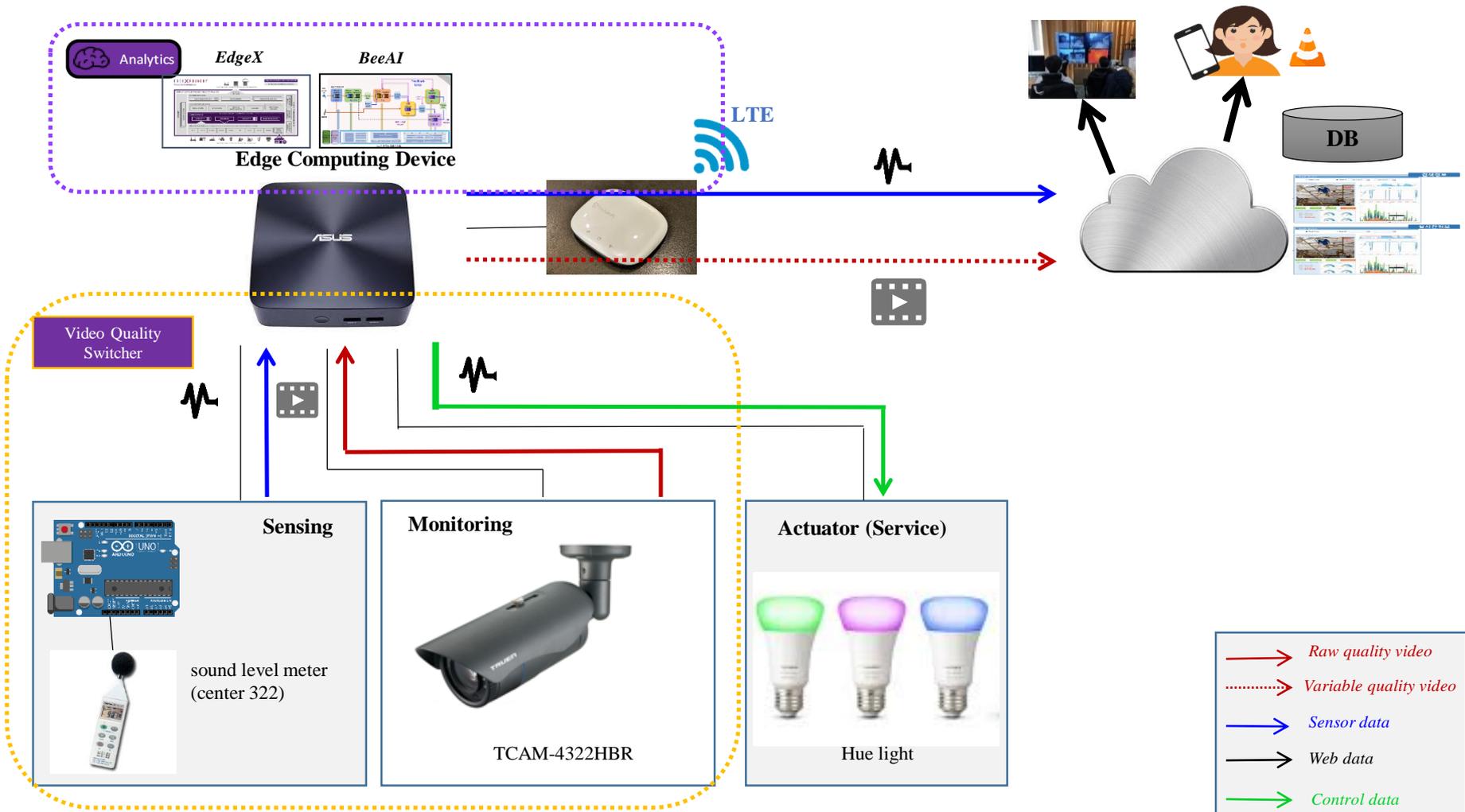
Component



Management

Intelligent Edge Computing for Intelligence

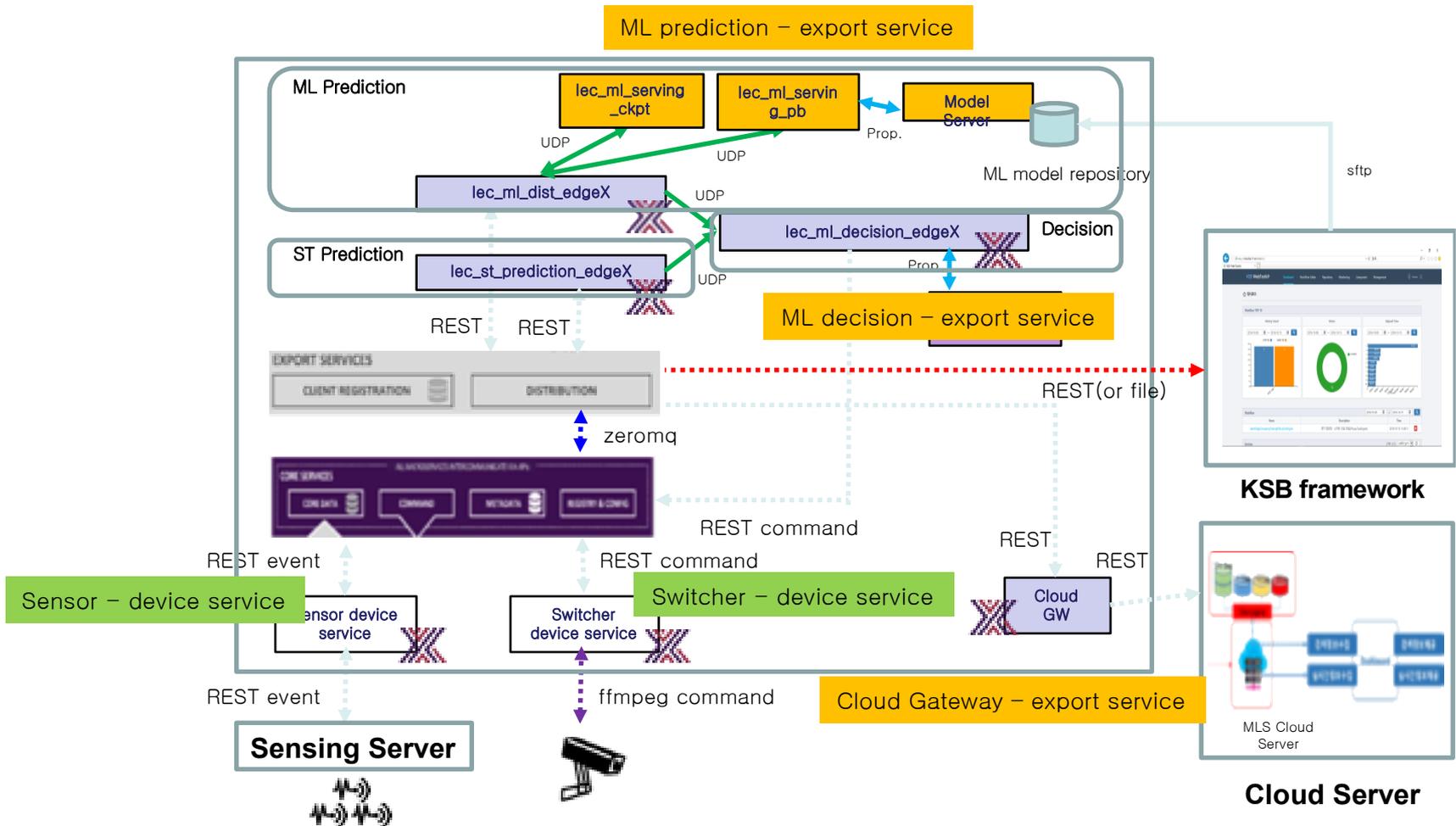
(Use-case for Smart Factory)



Intelligent Edge Computing for Intelligence

(Overview of Data Pipeline in use-case)

ML prediction – export service



Thank you

Minsuk Kim

Intelligent IoE Network Research Section
Electronics and Telecommunications Research Institute (ETRI)
E-mail: mskim16@etri.re.kr