[오픈테크넷서밋 2018]

KSB 인공지능 프레임워크

2018. 9. 13

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KSB Convergence Research Department, ETRI

Agenda

I. Issus in Developing AI Services
II. Recent trend in AI Platforms
III. Strategies of KSB Framework
IV. Usecases
V. Conclusion

I. Issus in Developing AI Services

AI Opportunity and Challenges

AI Opportunity:

Opportunity to transform their business by implementing sophisticated models for recommendation engines, ads targeting, speech recognition, object recognition, bots, sentiment analysis, predictive analysis, and more.

However, practitioners face multiple challenges when implementing such applications:

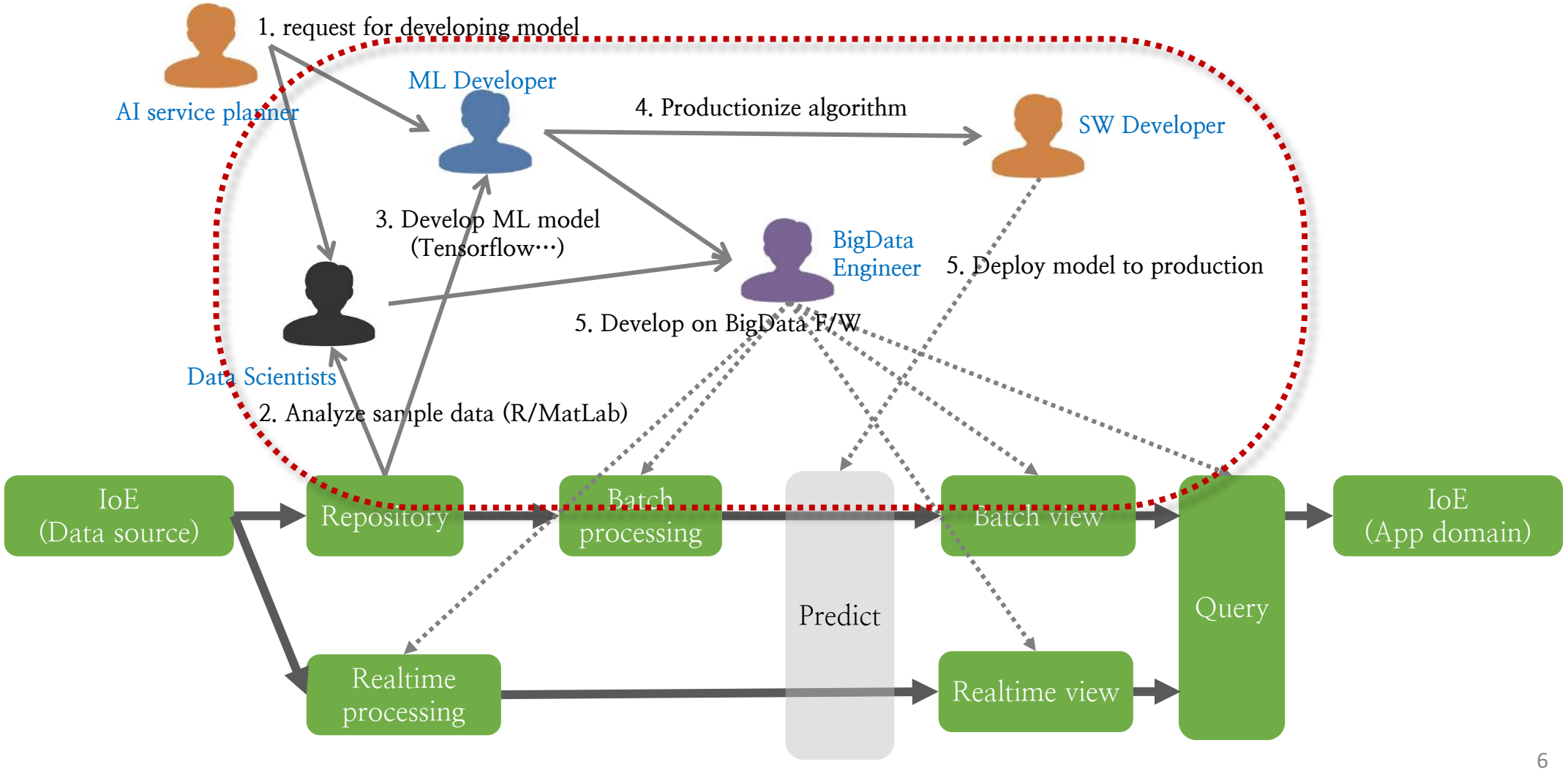
- **Environment Configuration:** Ability to setup and maintain complex environments due to the multitude of Machine Learning frameworks available.
- **Distributed Training:** Ability to train models in a distributed fashion to get results faster. This requires specialized skills and complex code to manage.
- **Compute Power:** Ability to run parallelized workloads on GPUs for maximum performances. This is essential for Deep Learning applications.

** source: https://databricks.com/blog/2018/06/05/distributed-deep-learning-made-simple.html*

Era of AI, but still there are many difficulties …

- Diverse AI frameworks
  - Diverse ML/DL libraries – Tensorflow, MXNet, PyTorch, Caffe2, Torch, theano
- Diverse form of data to the model
- Deliver data to the model on time
- Update model for understanding recent trends
- Interact from models to model for solving one problem
- Cloud dependency
- …

Journey from Data to AI Application



Machine Learning in Real World

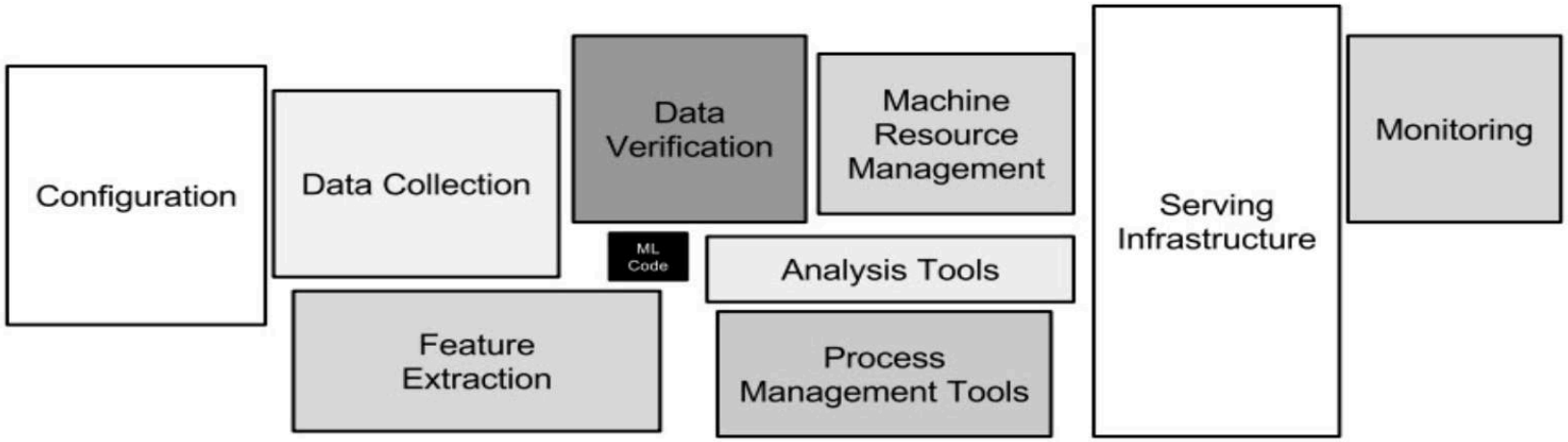
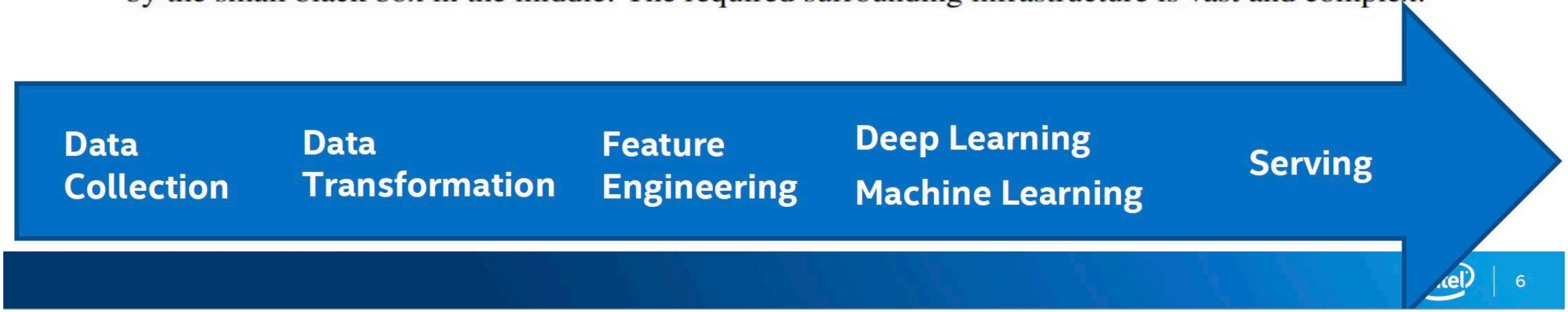


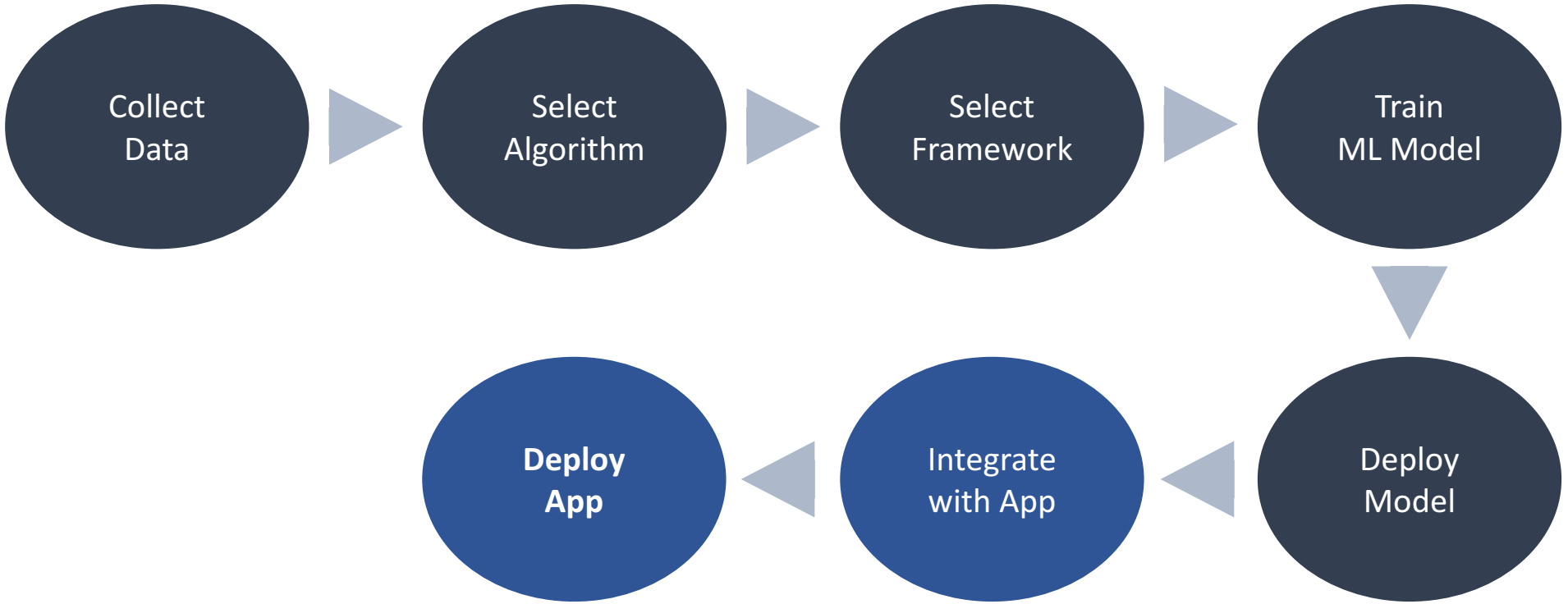
Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.



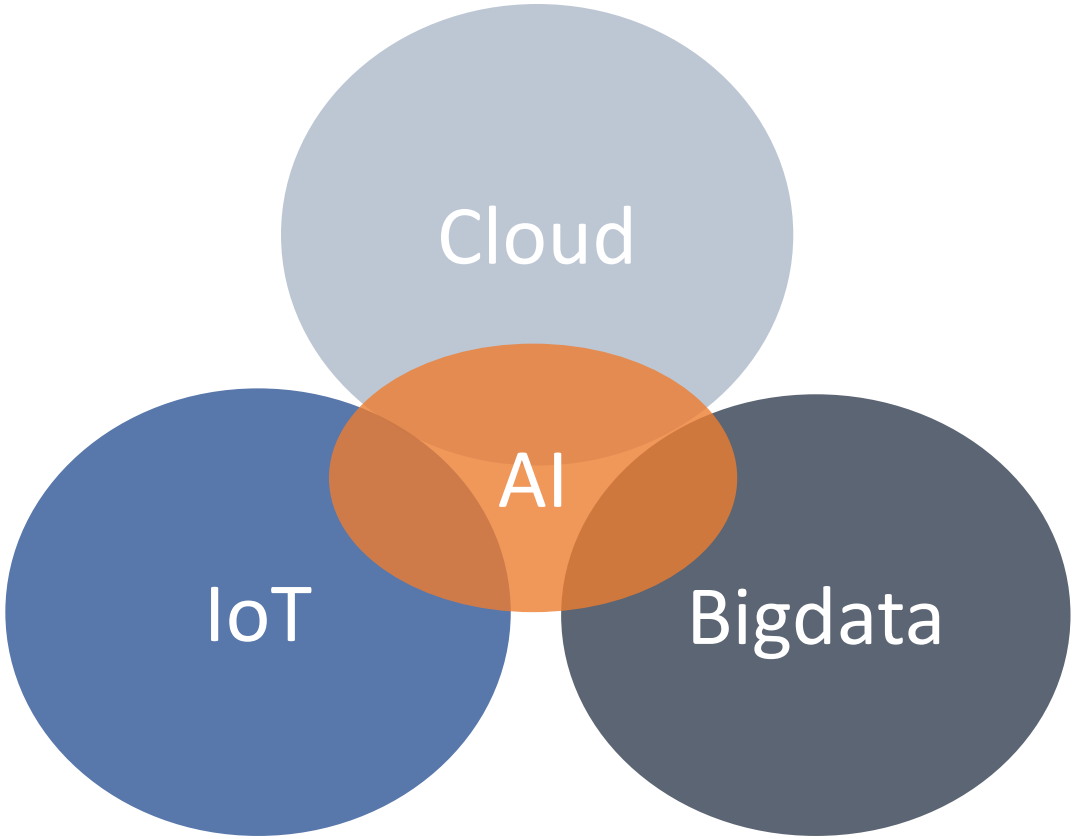
Source: Future of data analytics (Intel, Open Data Science Conference 2017)

II. Recent trend in AI Platforms

Journey from Data to AI Application

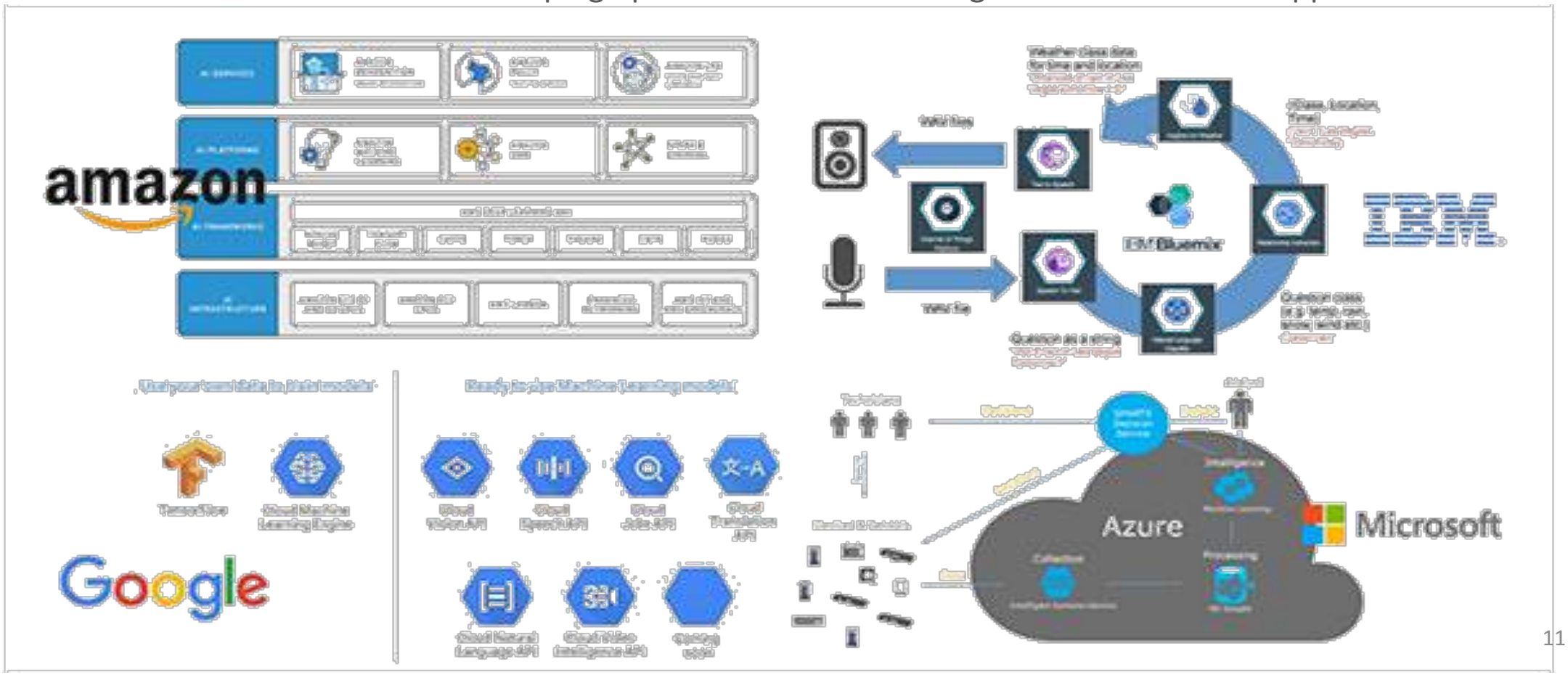


Global IT Companies

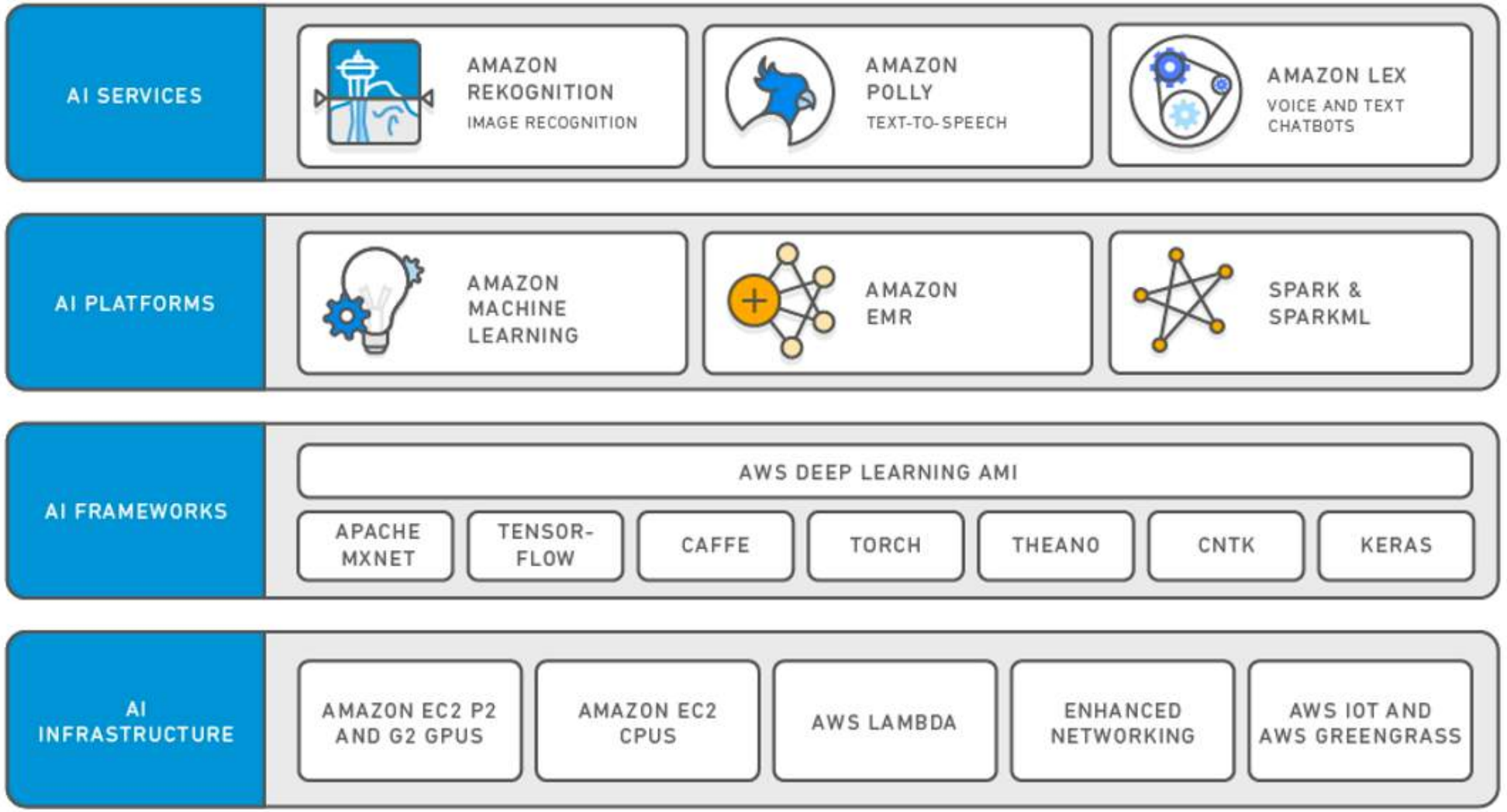


Cloud + AI

- Global IT Companies (Google, Amazon, IBM, MS)
  - Provide cloud computing-based cognitive service and ML service platform
  - Provide foundation for developing open source-based intelligent services and IoT application



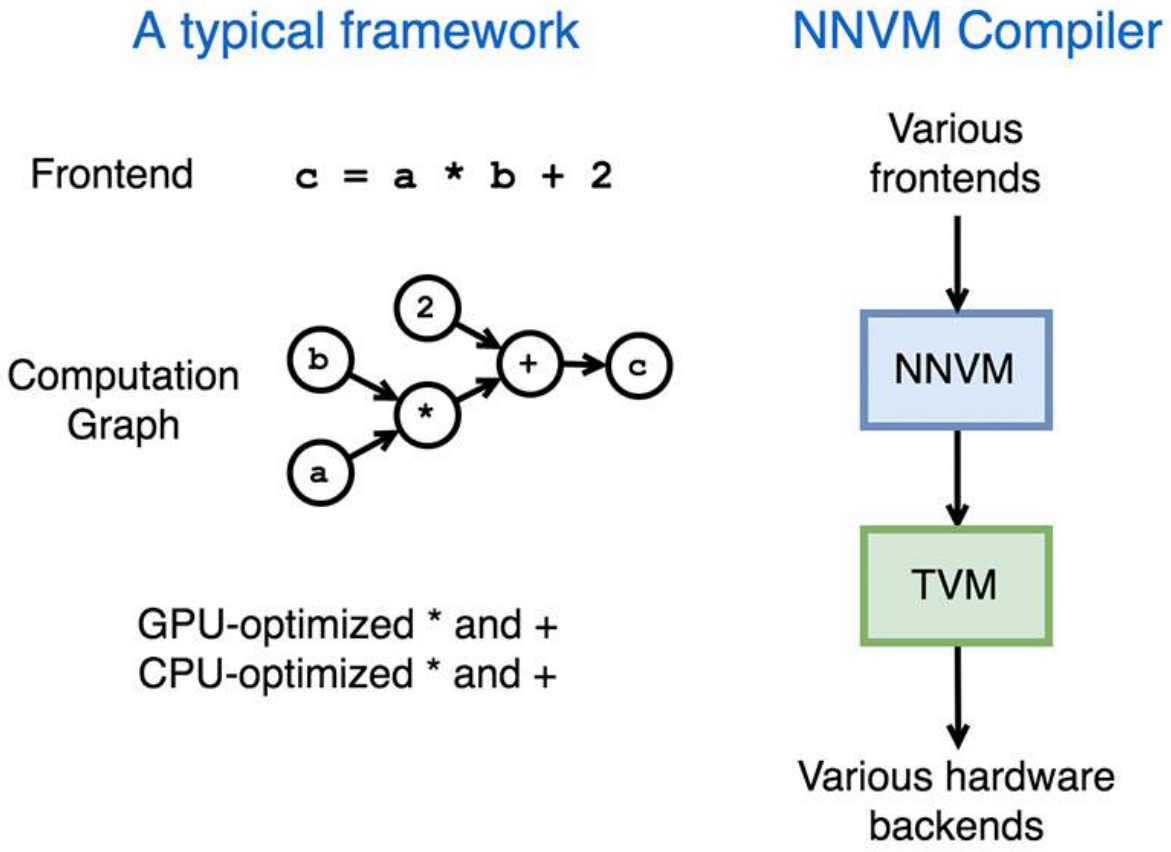
Cloud + AI: Amazon AI



Cloud + AI: Amazon AI

NNVM Compiler: Open Compiler for AI Frameworks

- Three challenges:
  - Switch from one AI framework
    - (e.g. pyTorch -> Caffe2)
  - Multiple backends to guarantee performance
  - Supporting multiple frameworks requires enormous engineering efforts

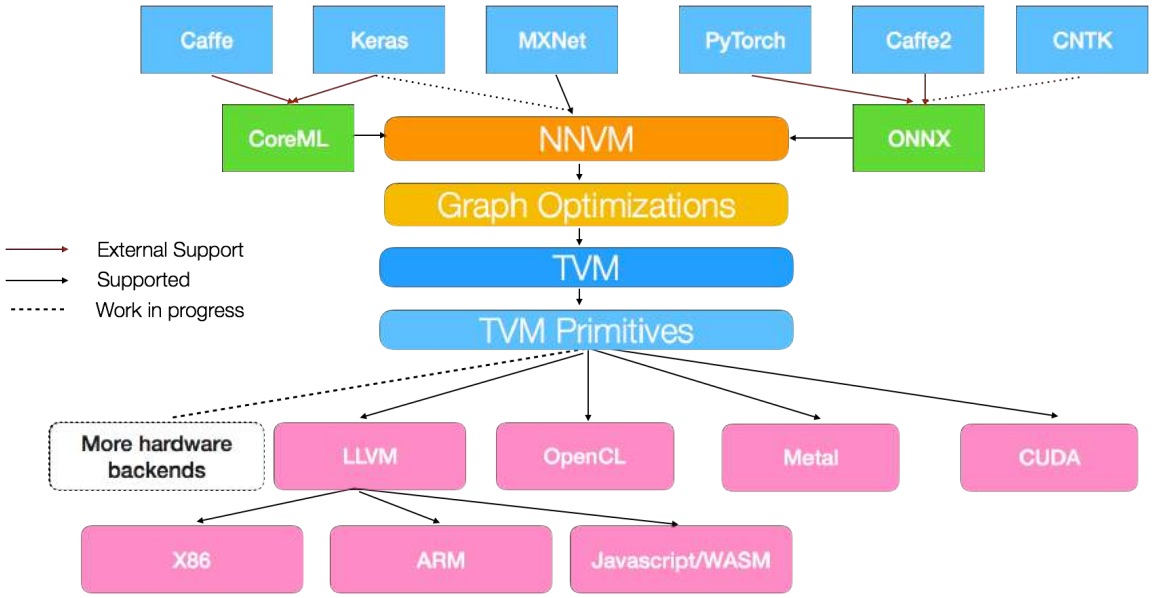


Source: https://aws.amazon.com/ko/blogs/machine-learning/introducing-nnvm-compiler-a-new-open-end-to-end-compiler-for-ai-frameworks/

Cloud + AI: Amazon AI

NNVM Compiler: Open Compiler for AI Frameworks

- an end-to-end compiler based on the TVM stack that compiles workloads directly from various deep learning frontends into optimized machine codes.



Typical Workflow of NNVM Compiler

model from framework

```
graph, params = nnvm.frontend.from_xyz(...)
```

compile

```
graph, lib, params = nnvm.compiler.build(
      graph, target="cuda", {"data", data_shape}, params=params)
```

deploy

```
module = graph_runtime.create(graph, lib, tvm.gpu(0))
module.set_input(**params)
module.run(data=data_array)
output = tvm.nd.empty(out_shape, ctx=tvm.gpu(0))
module.get_output(0, output)
```

Separation of Optimization and Deployment

** Source: NNVM Compiler: Open Compiler for AI Frameworks*

Cloud + AI: Google AI

Use your own data to train models

TensorFlow

Cloud Machine Learning Engine

Ready to use Machine Learning models

Cloud Vision API

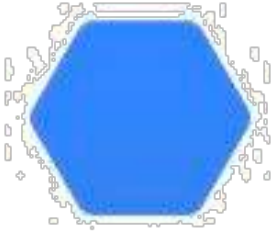
Cloud Speech API

Cloud Jobs API

Cloud Translation API

Cloud Natural Language API

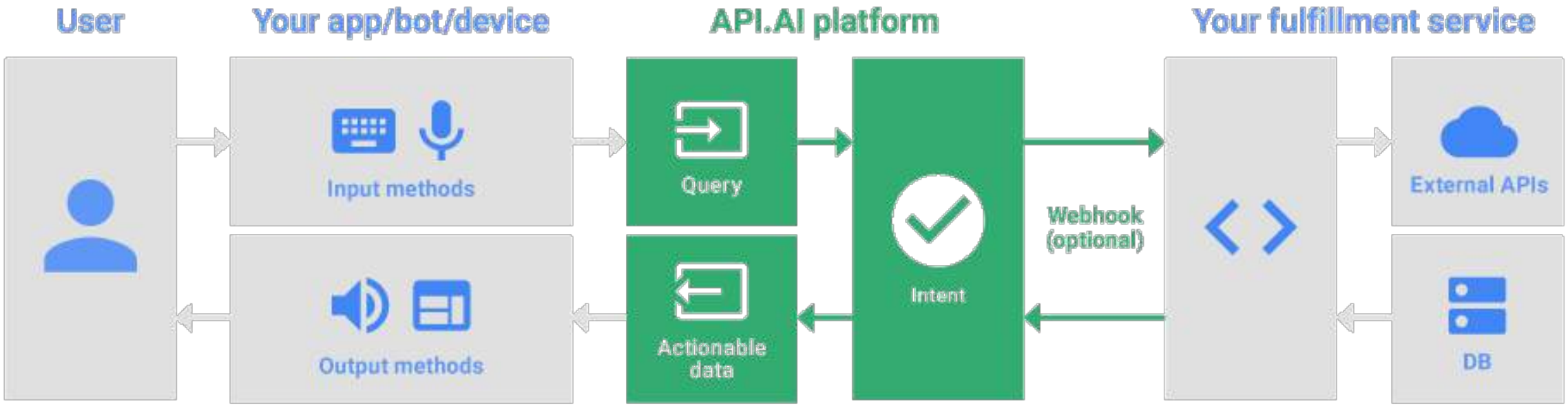
Cloud Video Intelligence API



Coming soon

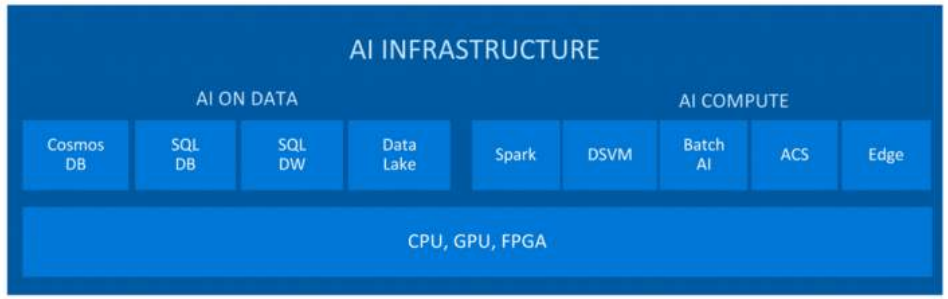
Cloud + AI: Google AI

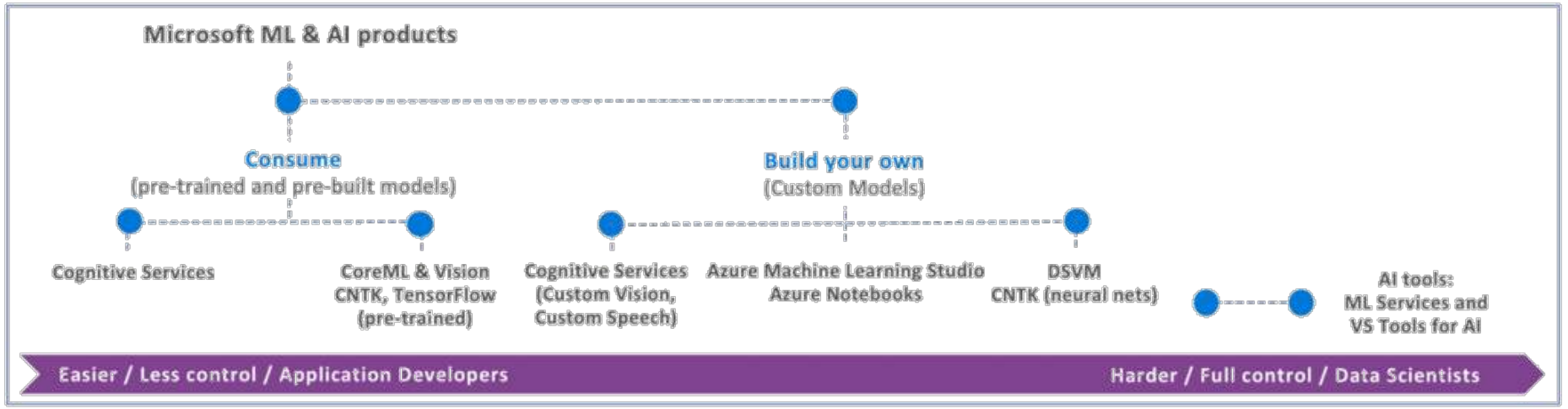
Dialogflow: Build natural and rich conversational experiences



** source: https://dialogflow.com*

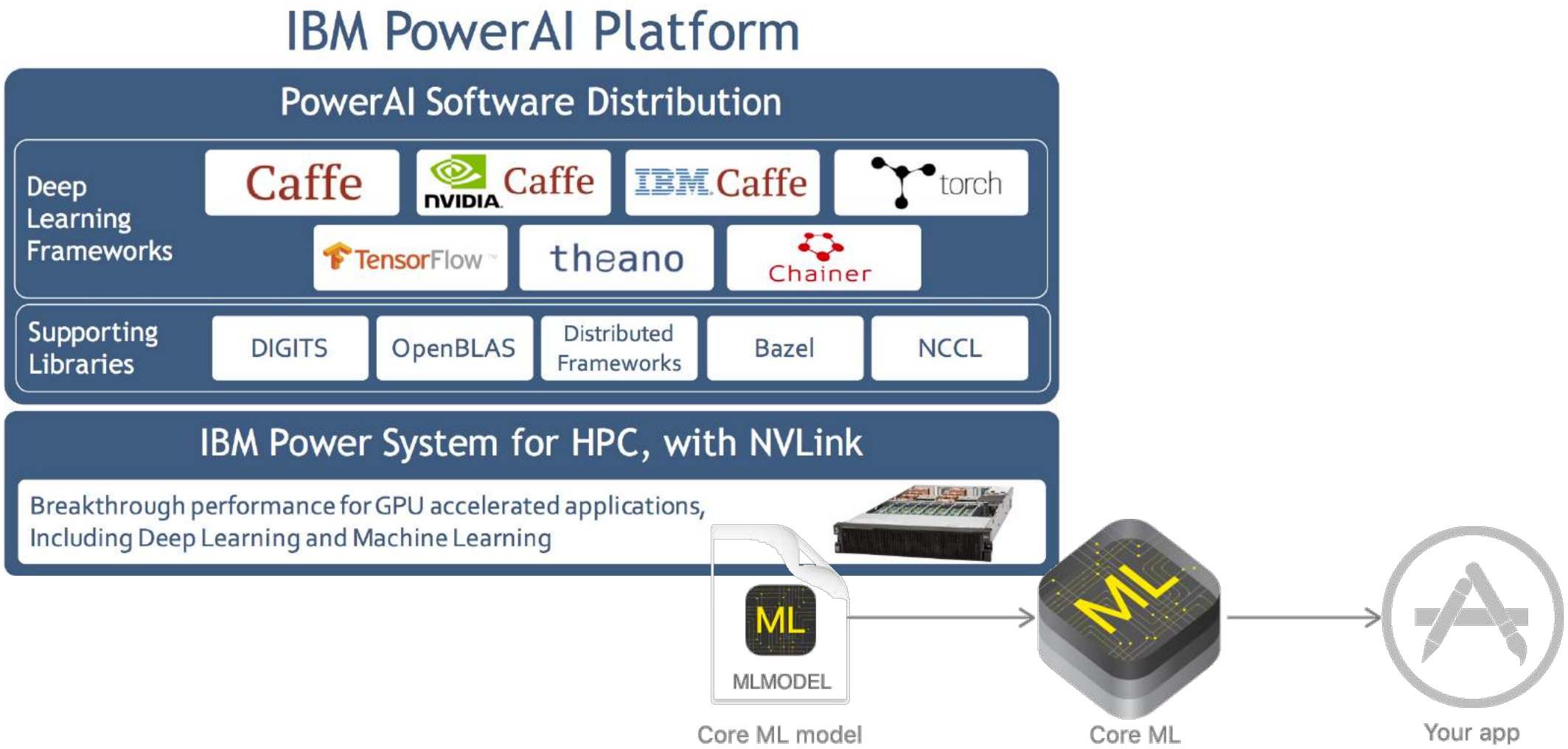
Cloud + AI: Microsoft AI





https://blogs.technet.microsoft.com

Cloud + AI: IBM AI



Build a production-ready iOS app

BigData + AI

SPARK+AI SUMMIT 2018
JUNE 4 - 6 | SAN FRANCISCO
ORGANIZED BY databricks

BigData + AI: Databricks

Open source project announcements:

- **MLflow:** MLflow (currently in alpha) is a cross-cloud open source framework designed to manage the entire machine learning lifecycle and work with any machine learning library.
- **Databricks Runtime for ML:** Based on customer demand, Databricks announced the new native and deep integration of popular ML libraries as part of the Databricks Runtime, including xgboost, scikit-learn, numpy as well as TensorFlow, Keras and Horovod. You can find more information here.
- **Analytics-ready Data with Databricks Delta:** Simplify data reliability and performance of Apache Spark™ with Databricks Delta. Ensure your data is ready for analytics. Watch the keynote by Apple and demo to learn more.
- **Unified Analytics Platform for Genomics:** Accelerate discovery with a collaborative platform for genomic data processing, tertiary analytics and AI at massive scale. Read the blog and sign-up for our private preview.

BigData + AI: Databricks

AI Opportunity vs. Challenges

AI Opportunity:

Today more than ever, data scientists and Machine Learning practitioners have the opportunity to transform their business by implementing sophisticated models for recommendation engines, ads targeting, speech recognition, object recognition, bots, sentiment analysis, predictive analysis, and more.

However, practitioners face multiple challenges when implementing such applications:

- **Environment Configuration:** Ability to setup and maintain complex environments due to the multitude of Machine Learning frameworks available.
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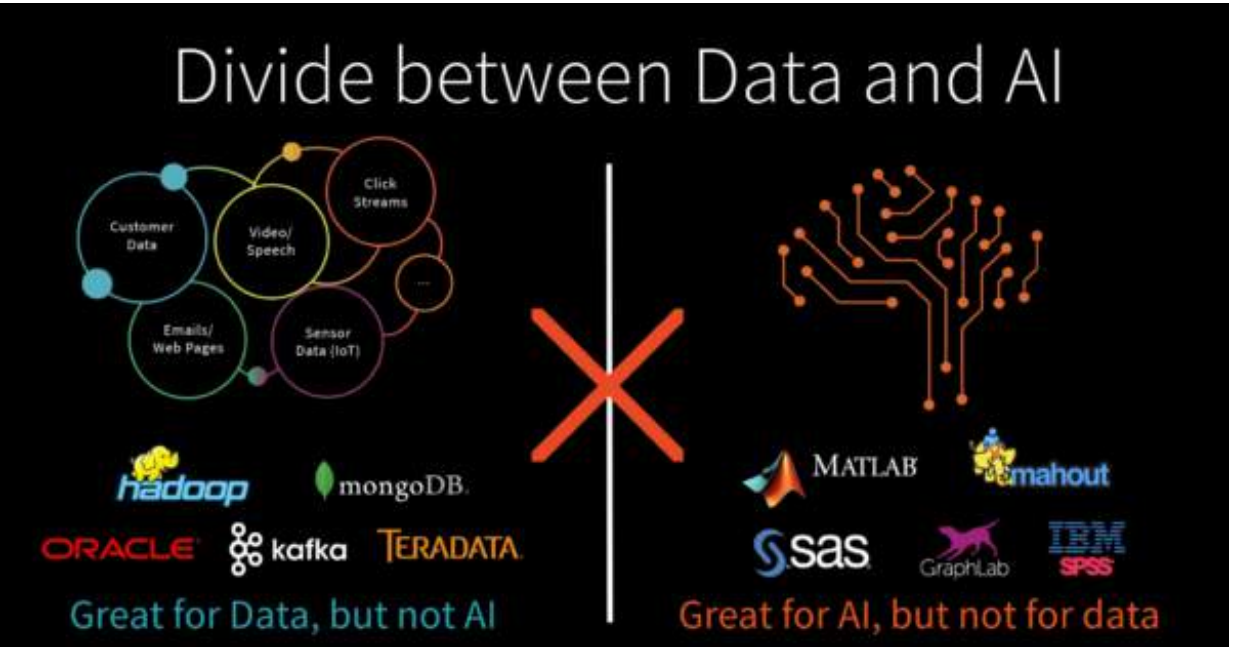
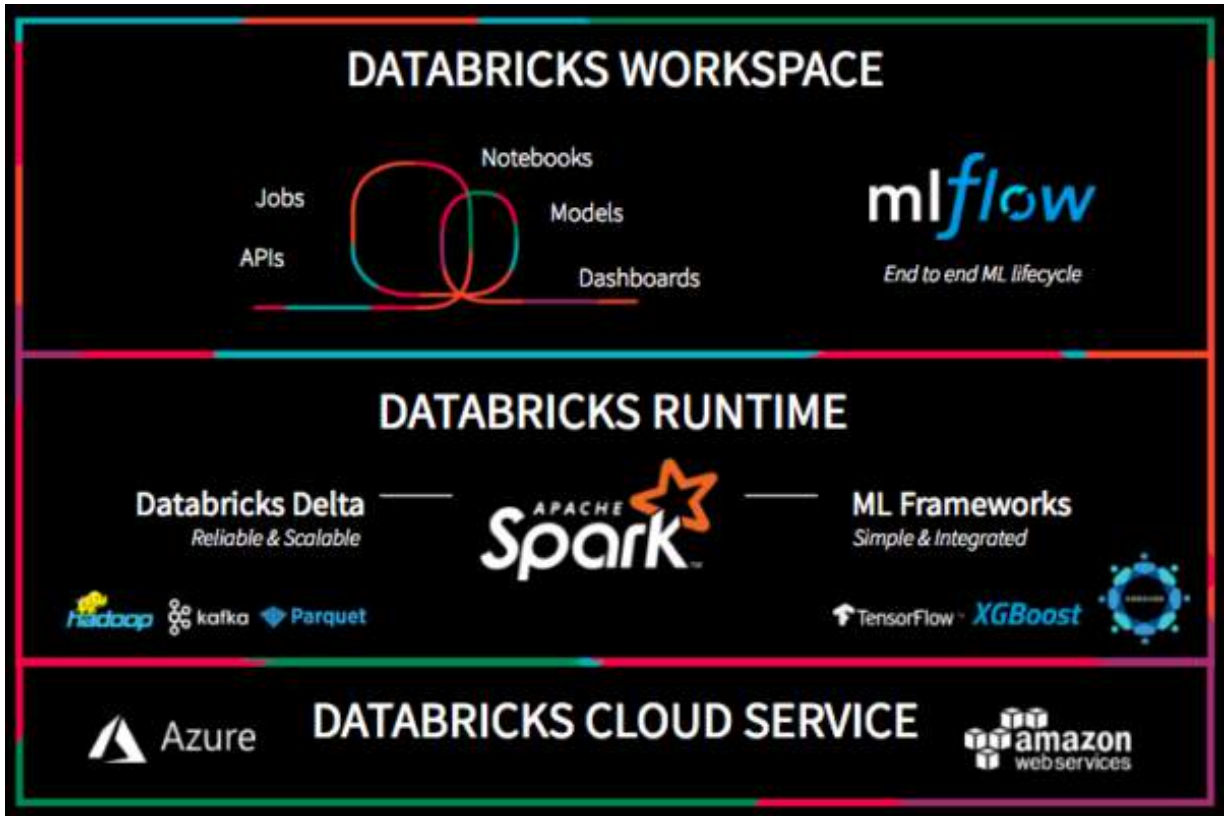
BigData + AI: Databricks
Databricks Unified Analytics Platform

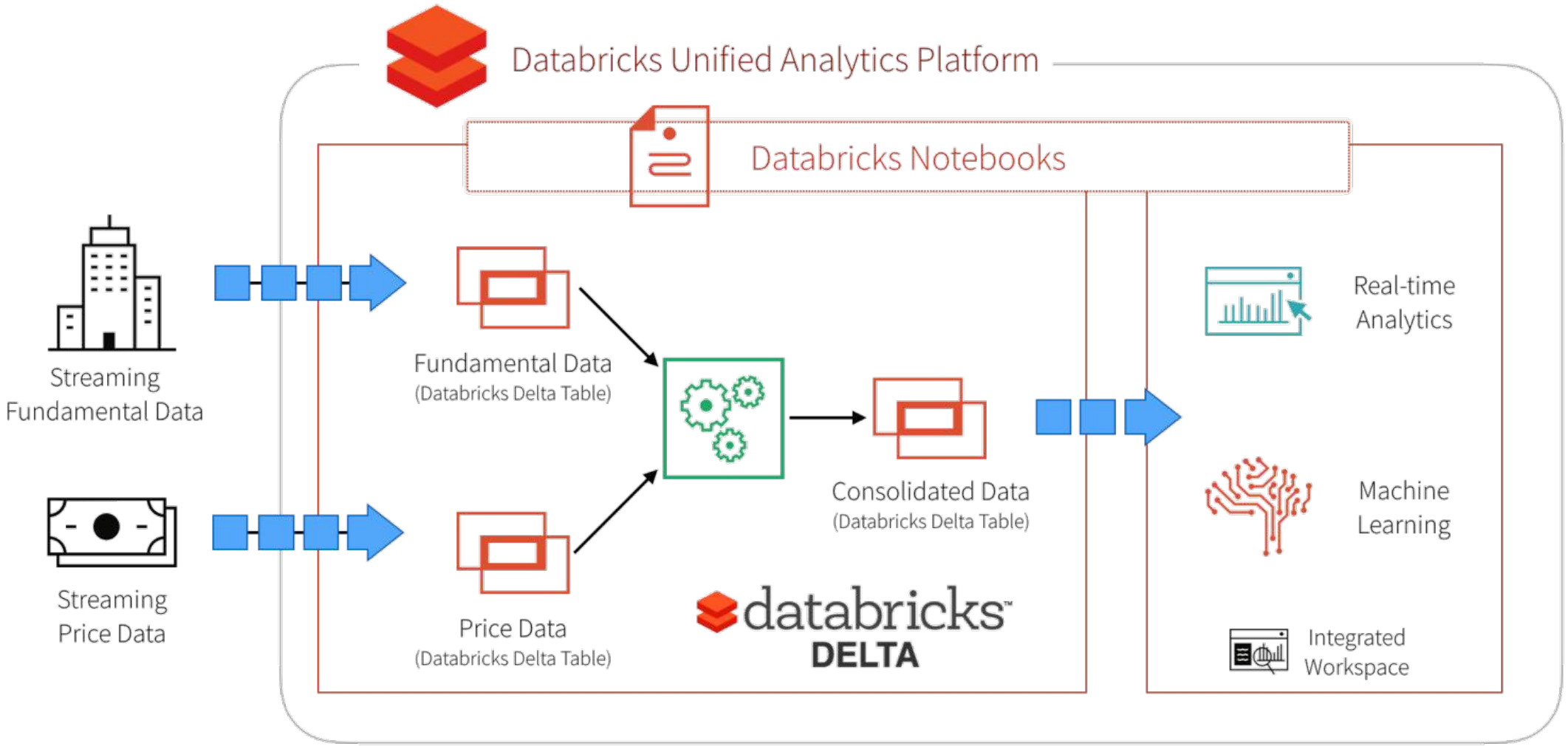




https://databricks.com/blog/2018/06/05/accelerating-innovation-with-unified-analytics.html

BigData + AI: Databricks

Databricks Unified Analytics Platform



BigData + AI: Databricks

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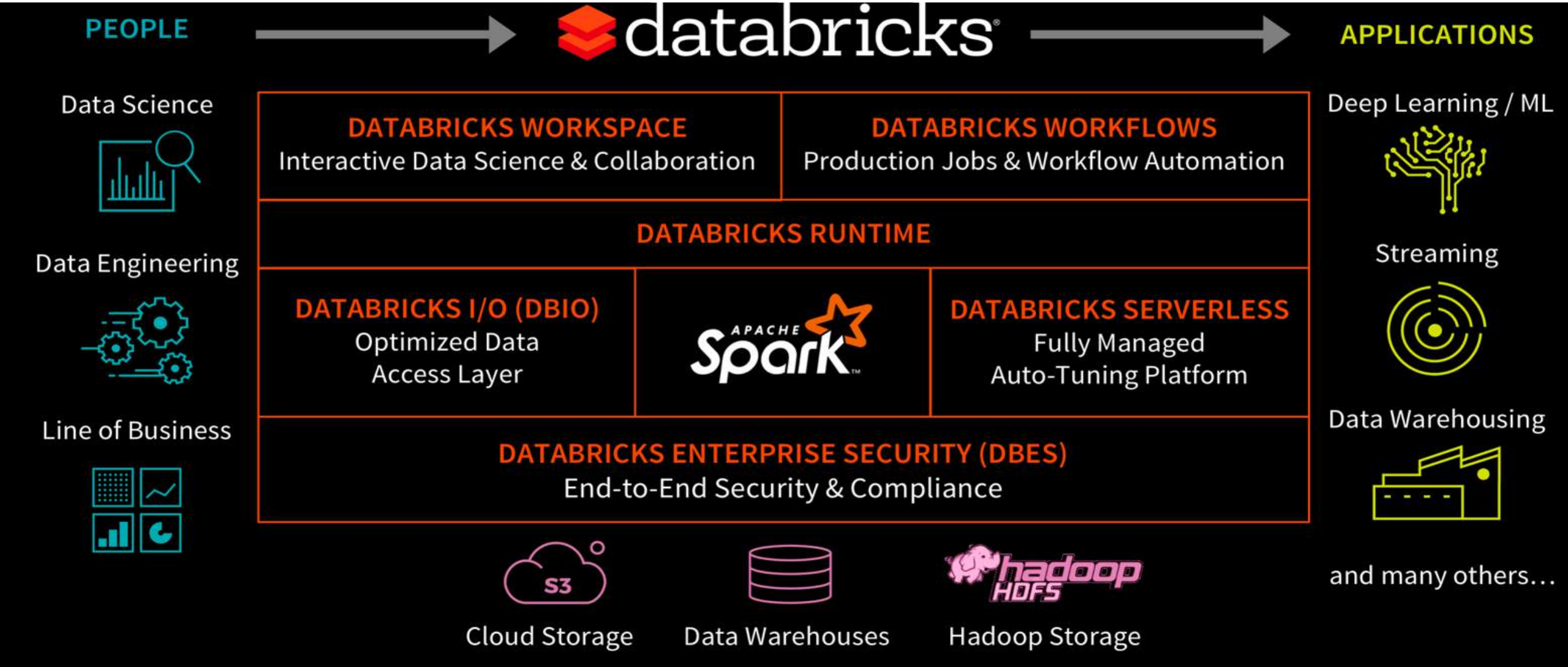
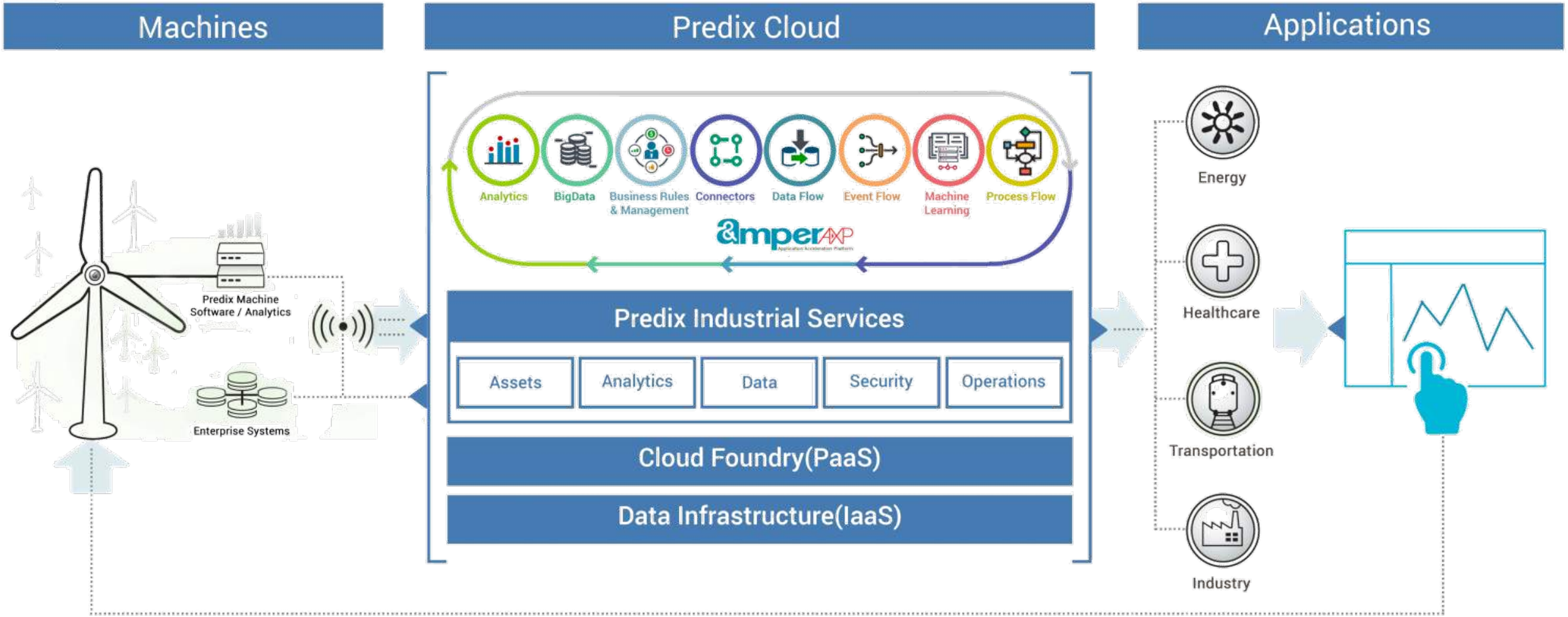


IoT + AI: GE Predix

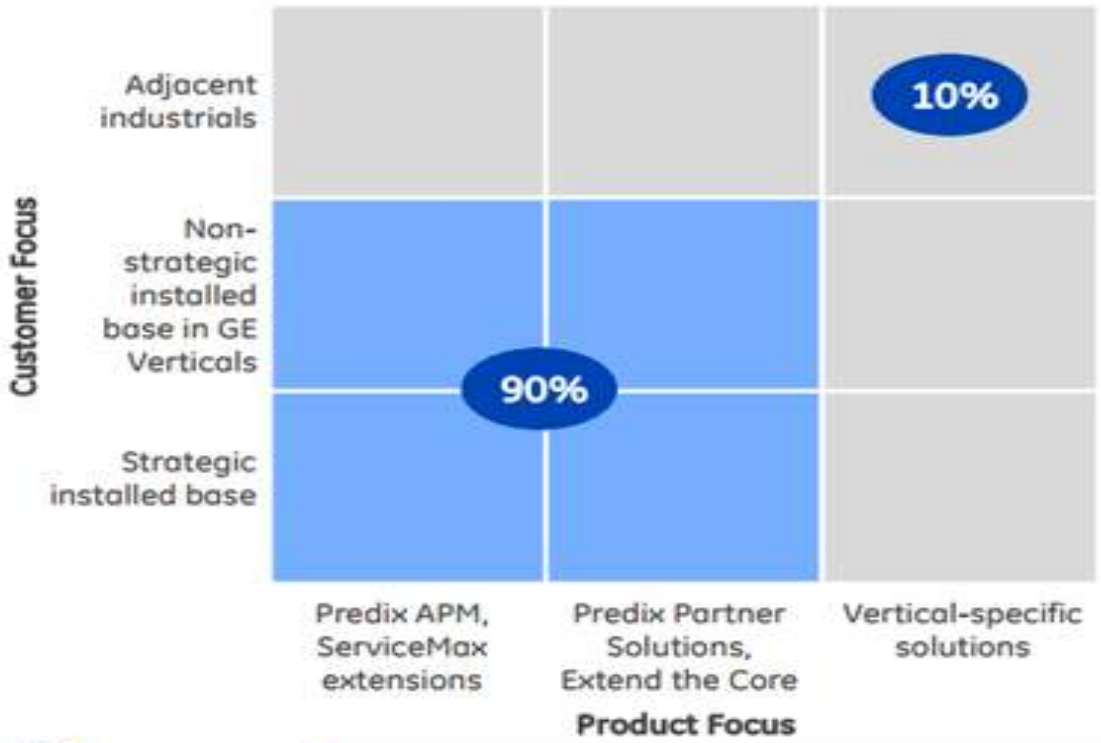


** source: http://www.amperaxp.com/ge-predix-and-amper/*

IoT + AI: GE Predix

4 Digital

Focusing on the core



Approach

1. Lead with Predix applications that drive customer outcomes: APM, OPM, and ServiceMax
2. Focus spend on Predix platform differentiation: asset model, Edge to Cloud, Digital Twin
3. Partner for technology that is not differentiated (i.e. Cloud)
4. Prioritize go to market around GE business verticals where win rate is ~2x higher

Customer examples

HUBCO
- APM used at 1.3 GW power plant
- 1% efficiency gain on mixed fleet
- ~$18MM annual customer value

VALE
- APM used to improve asset availability
- $1.4MM saved in production losses
- ~$1.3MM revenue increase

Targeting $1B+ Predix-powered revenue and $0.4B of cost out in 2018

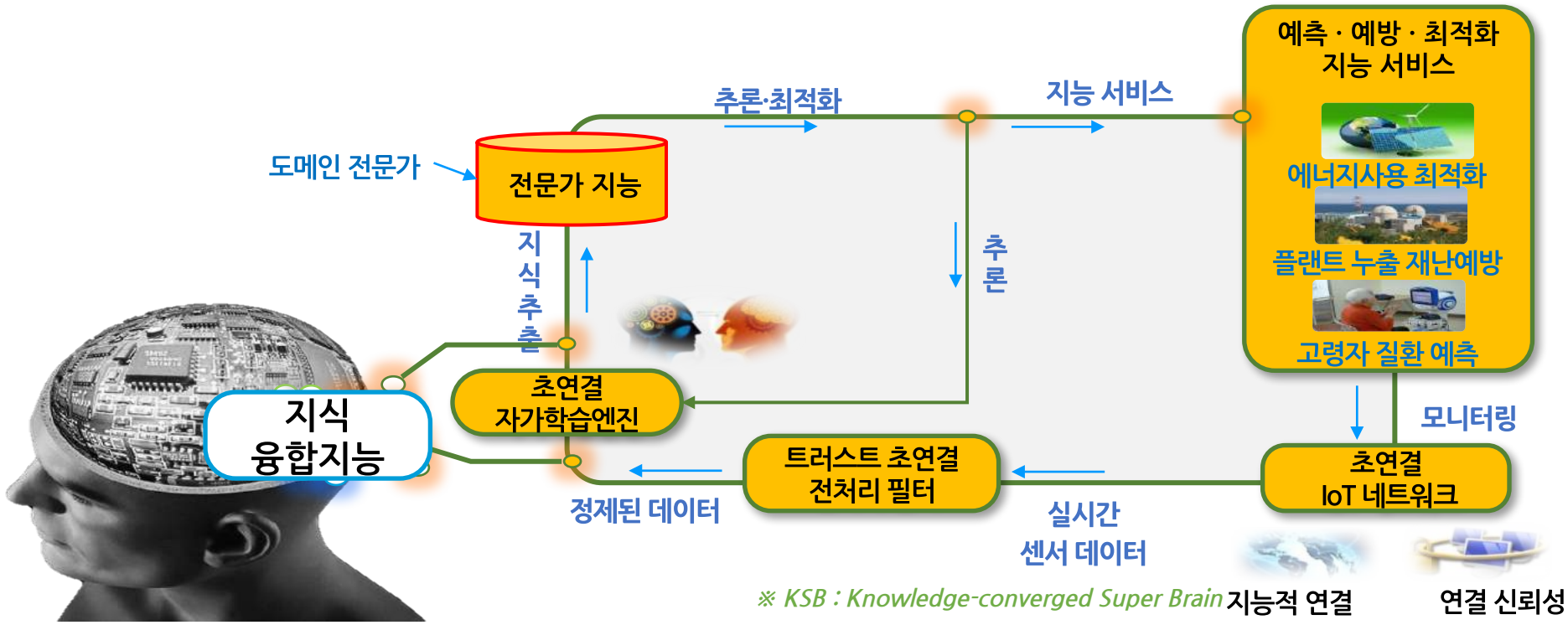
18

** source: https://www.zdnet.com/article/ge-to-hone-digital-efforts-leverage-additive-manufacturing-as-it-focuses-on-core-businesses/*

III. Strategies of KSB Framework

Knowledge-converged Super Brain

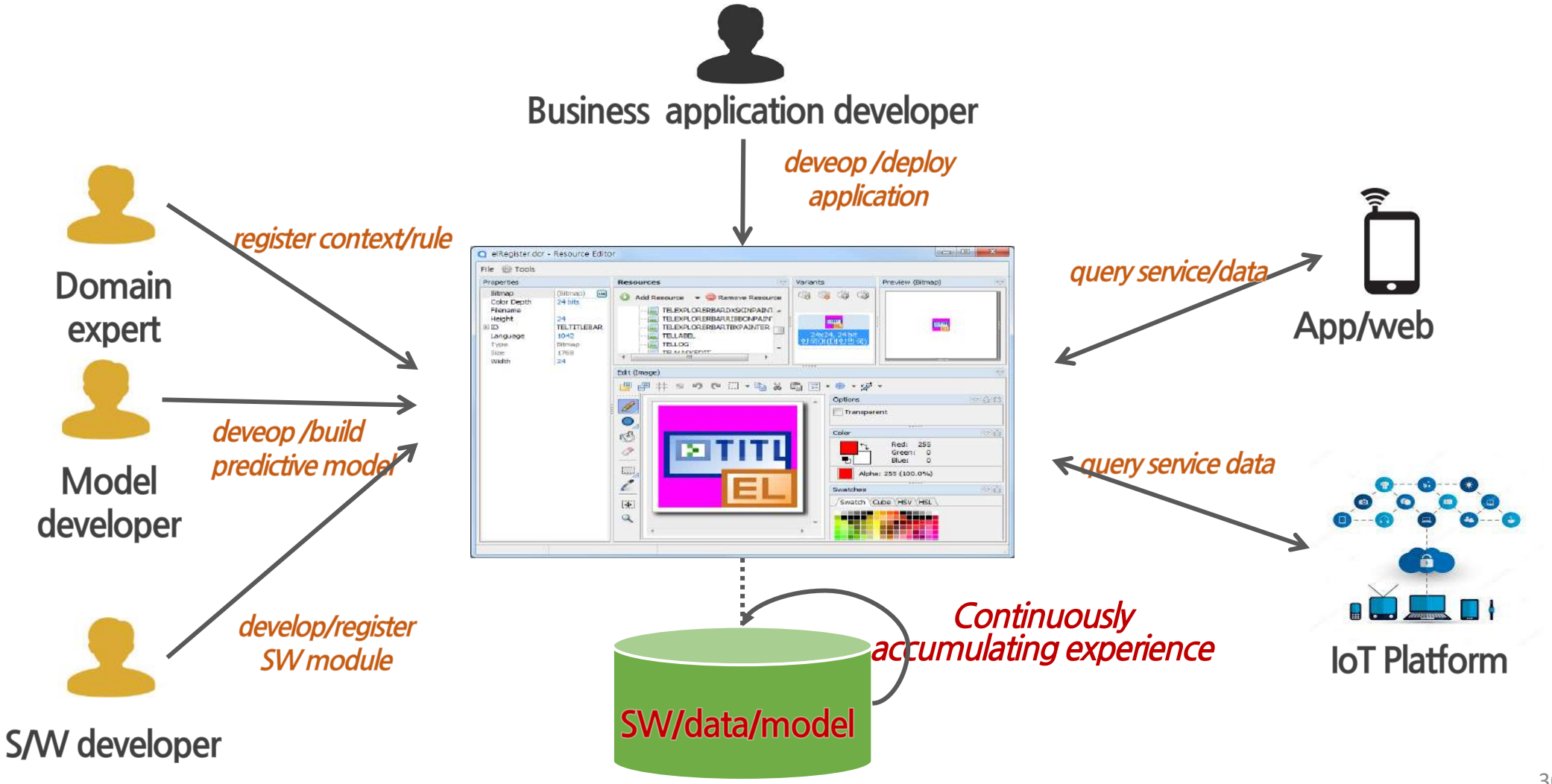
① 상태를 모니터링하여 데이터를 수집 ② 수집된 데이터를 정제 ③ 기계학습·지식추출하고
④ 도메인의 전문가지식과 융합하여 추론· 최적화함으로써 ⑤ 예측 · 예방 · 최적화 지능 서비스 제공



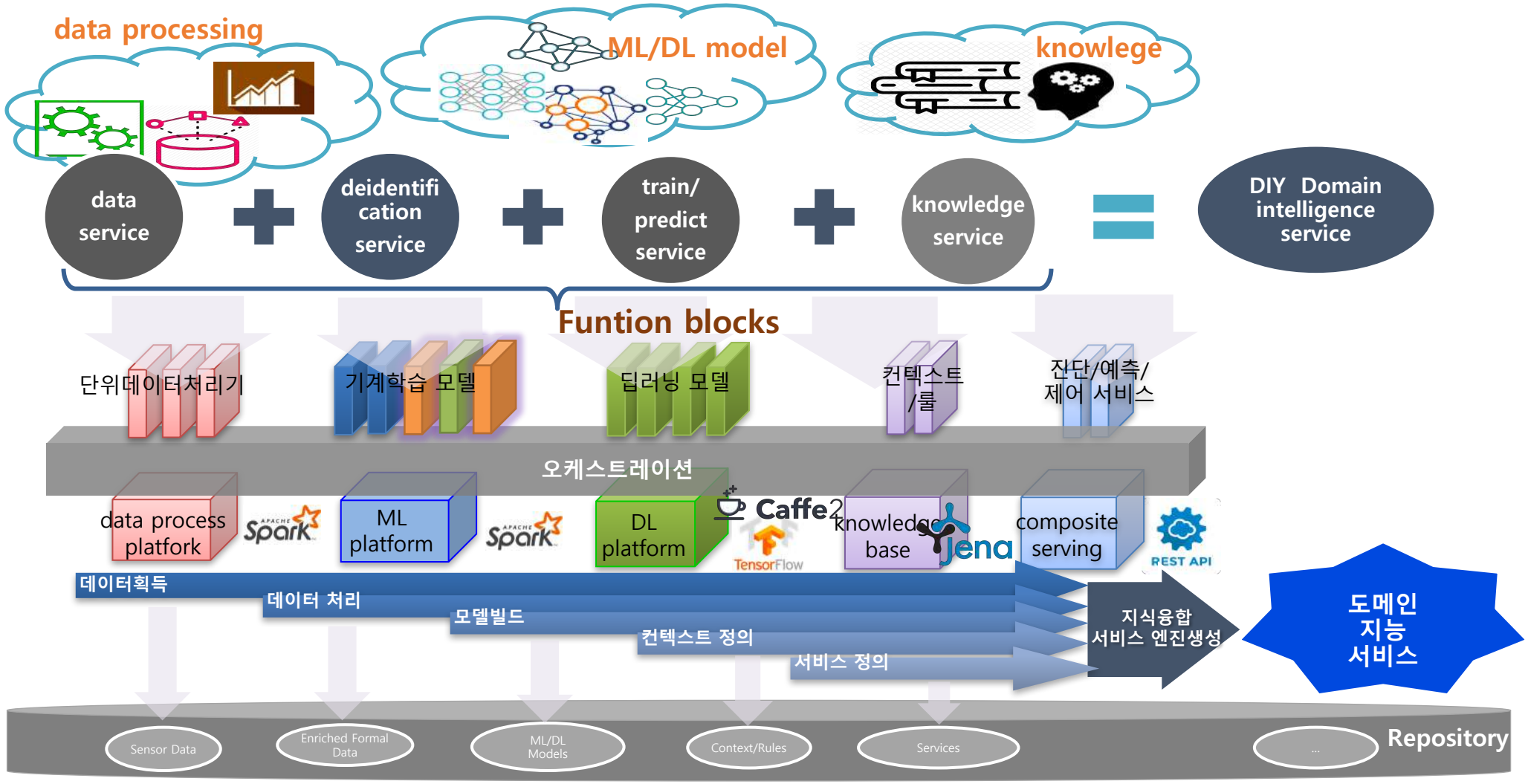
Knowledge-converged Super Brain

Enery/Plant/Health

KSB Framework Approach



KSB Framework Concept



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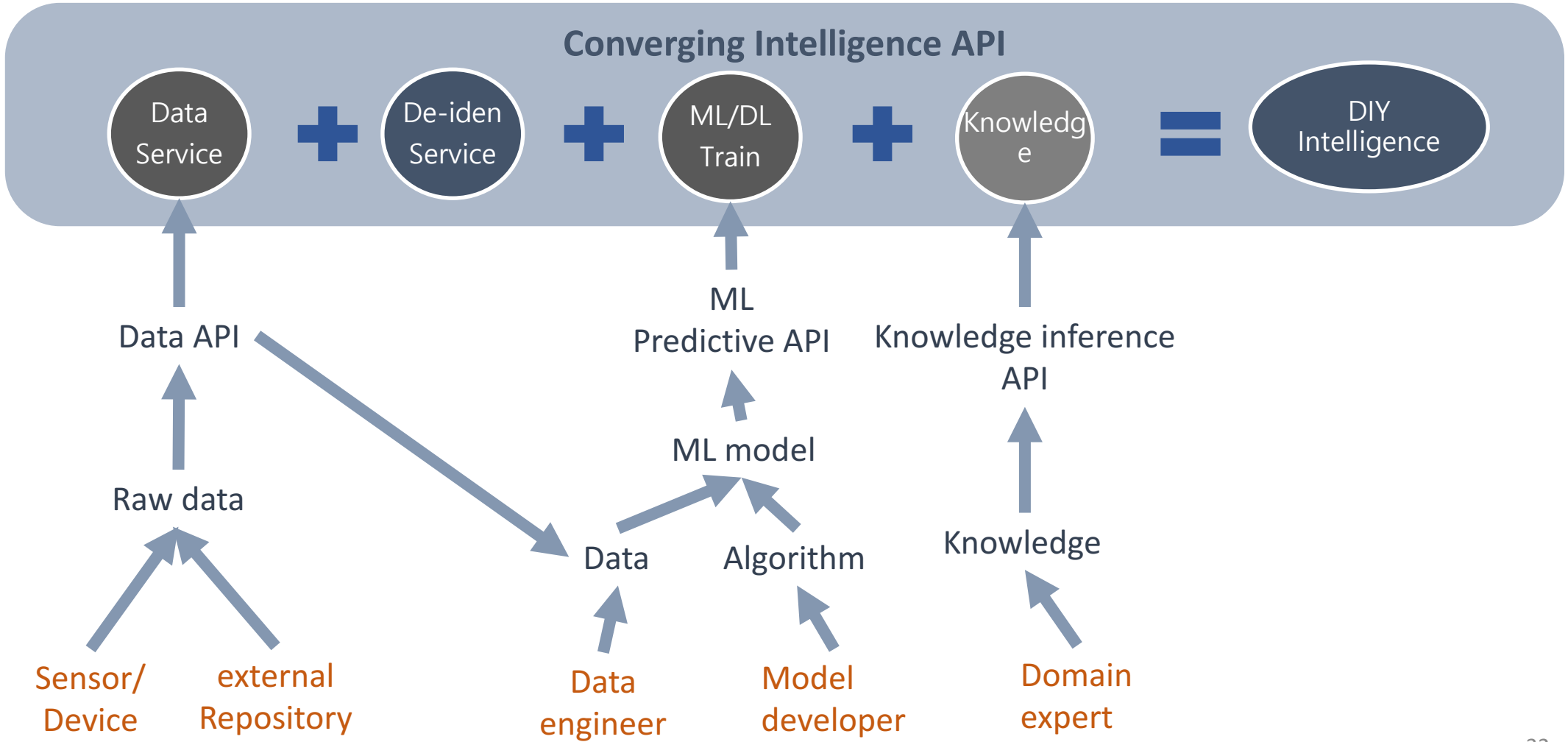
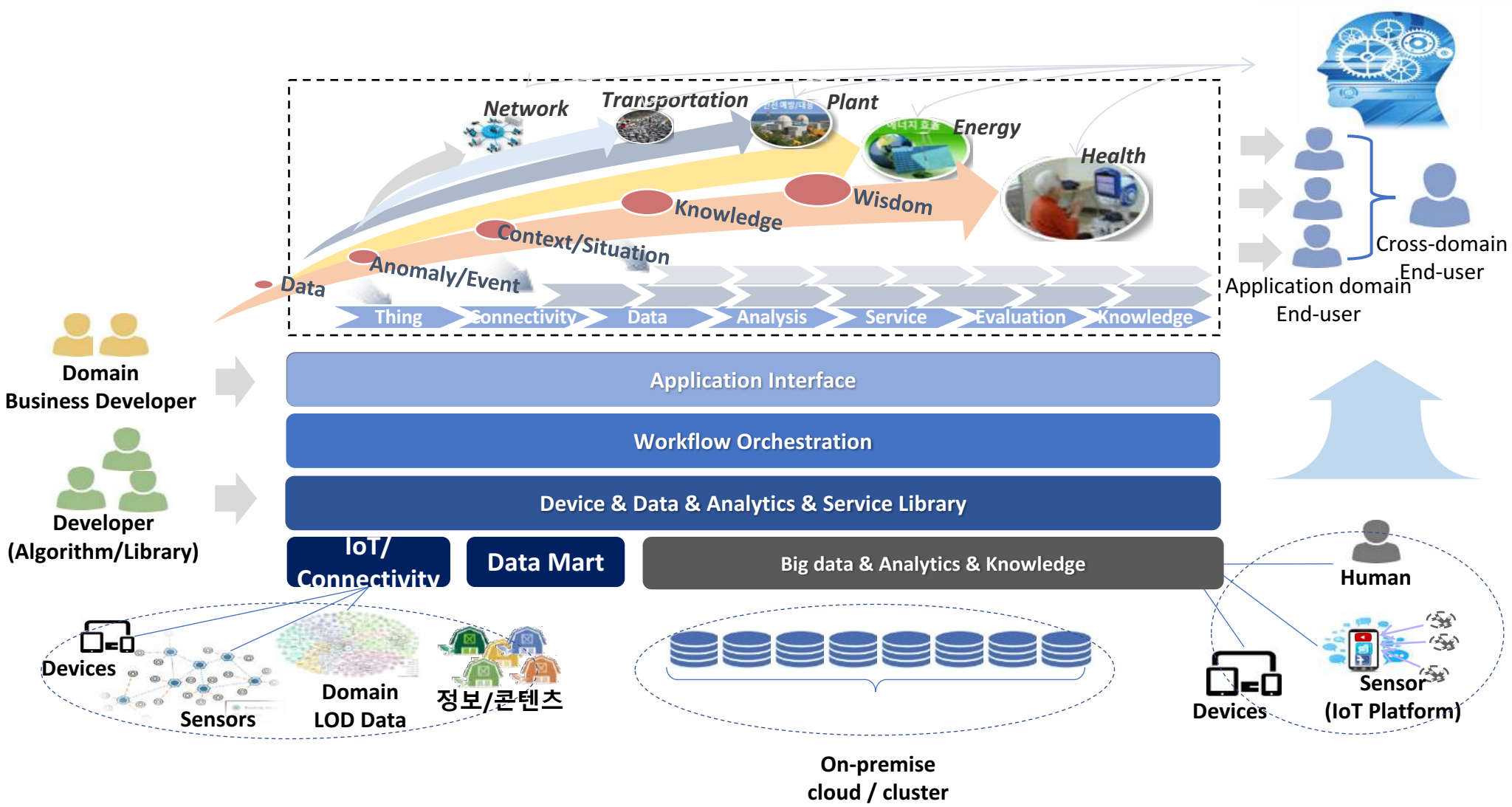


KSB Framework Overview



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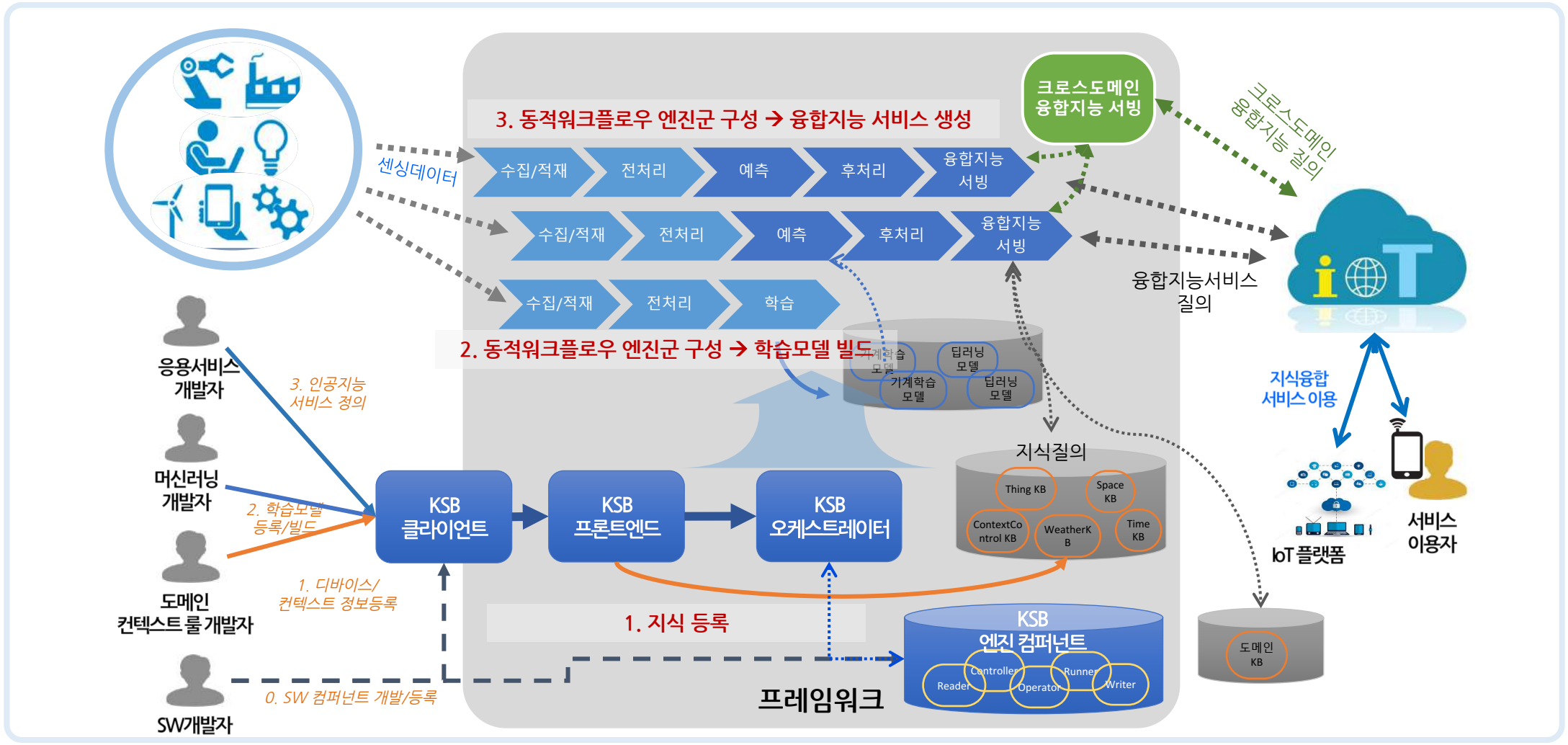
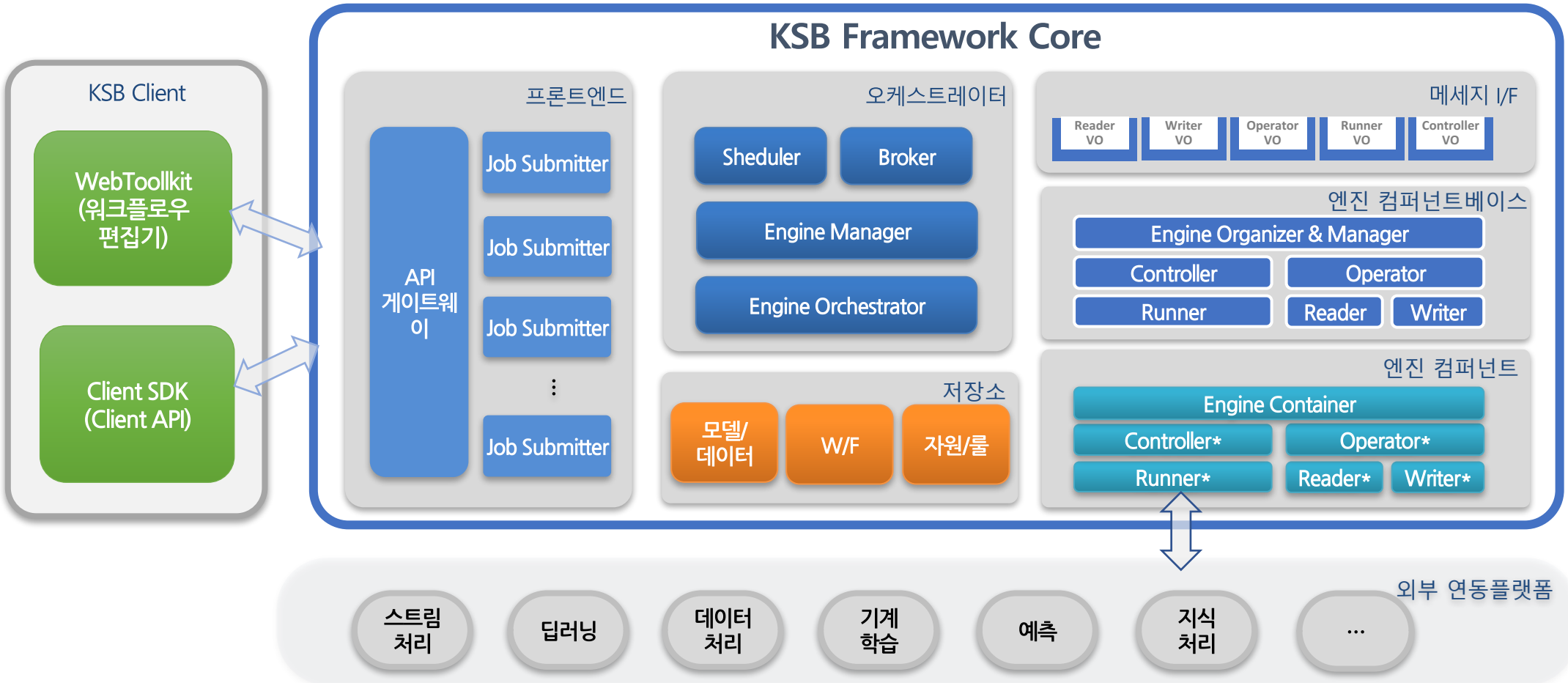


KSB Framework Architecture



KSB 인공지능 프레임워크 Core

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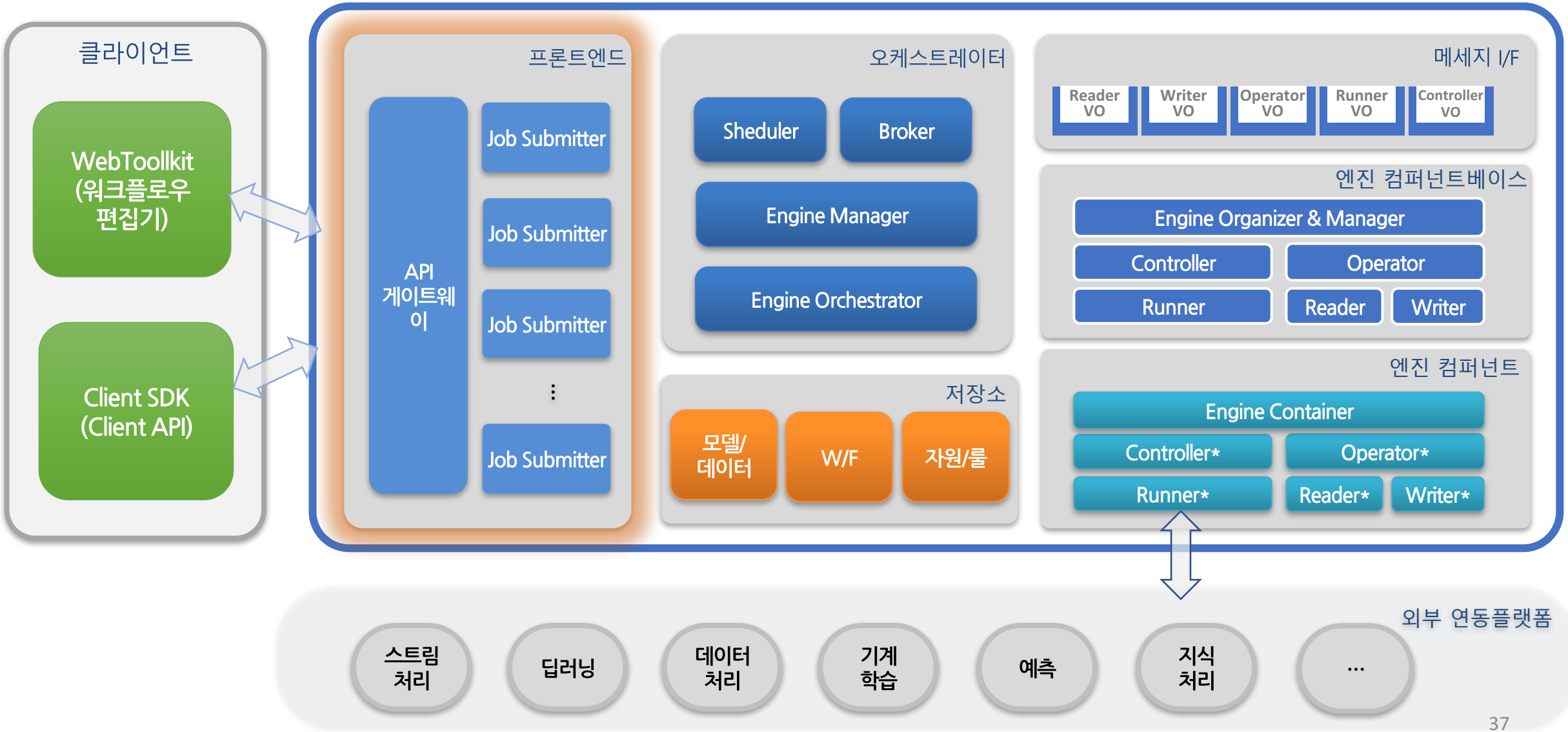

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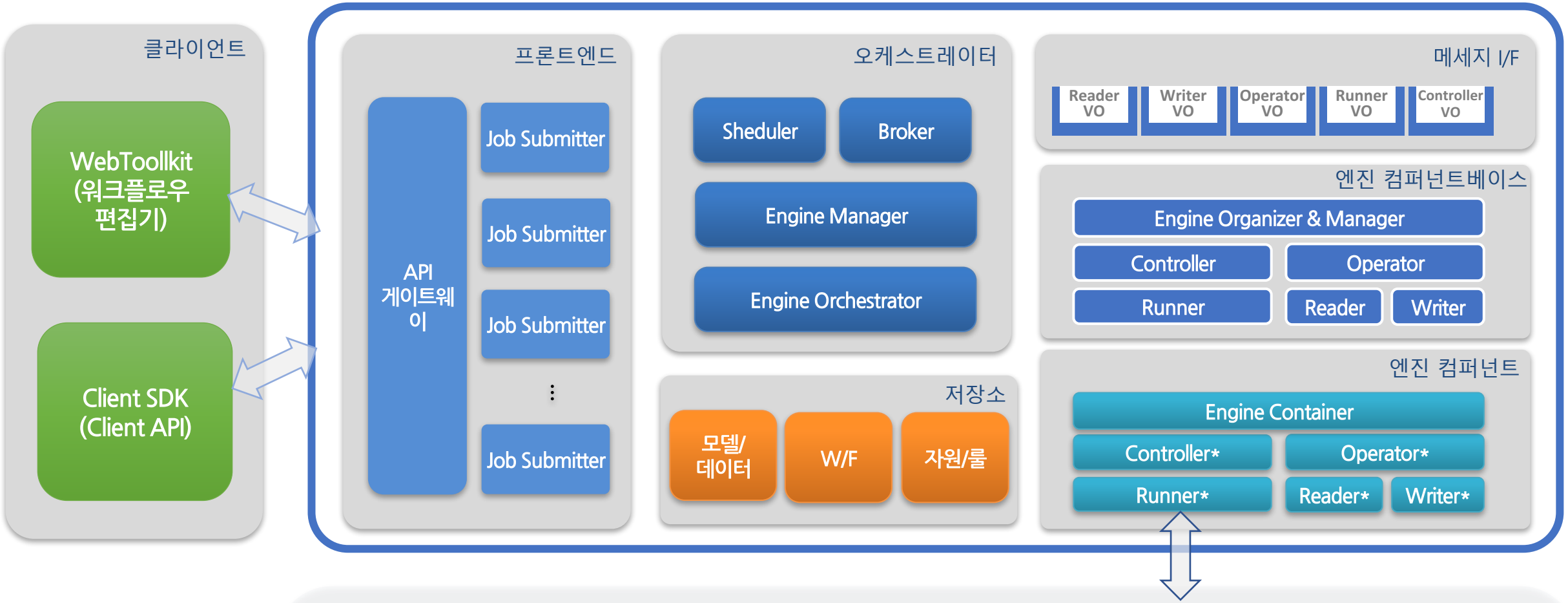

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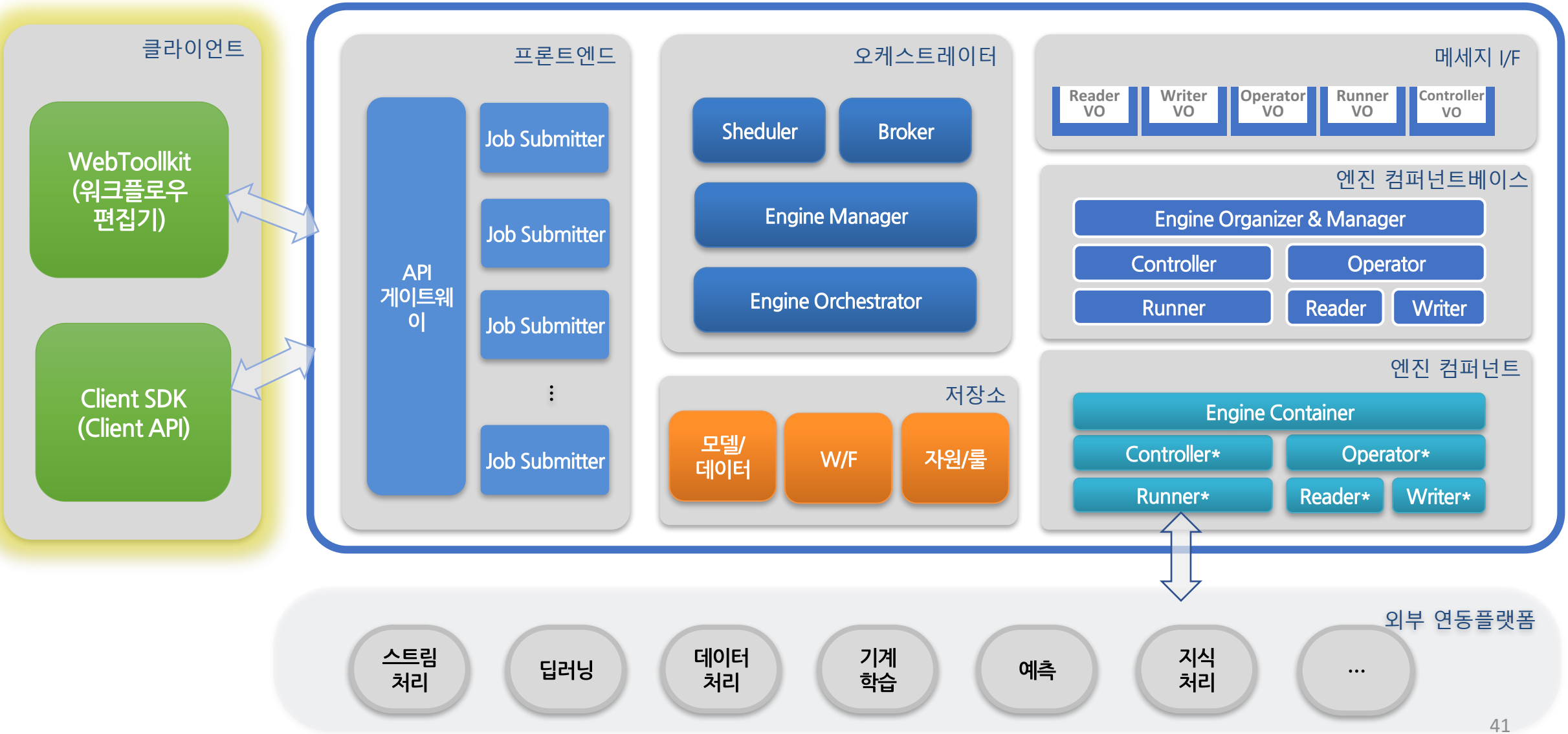

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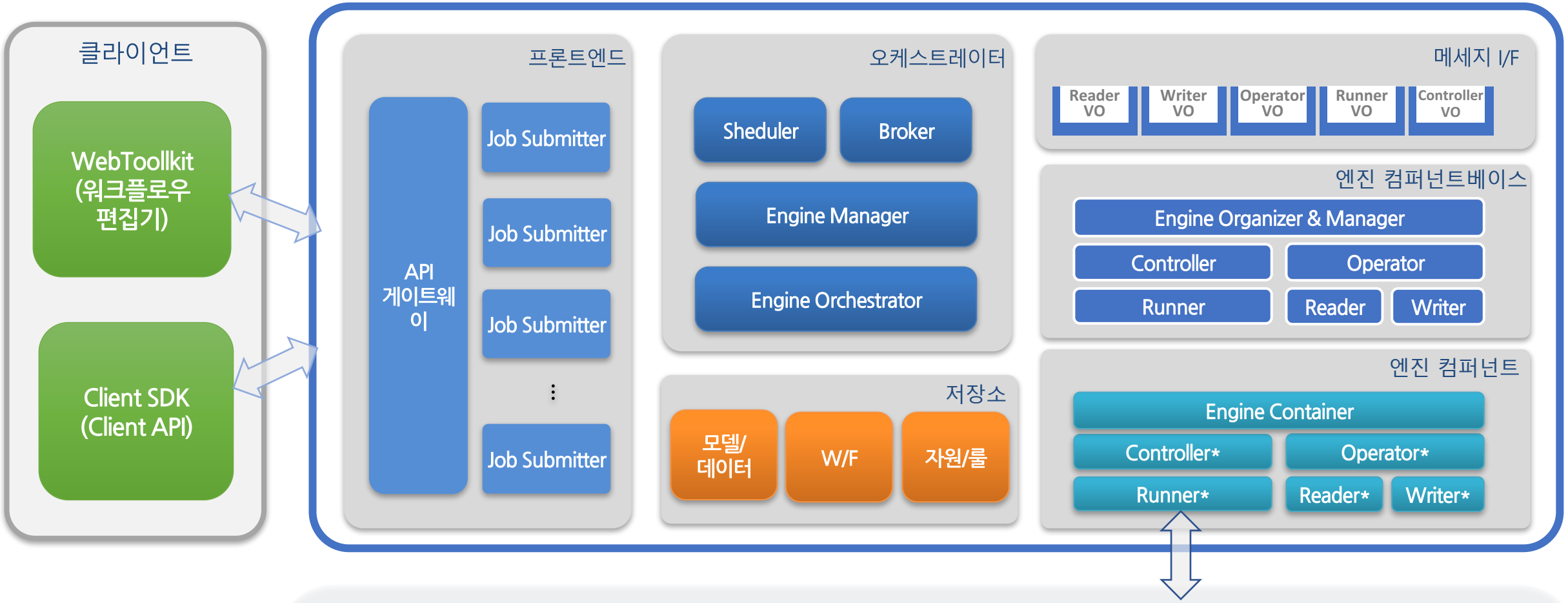
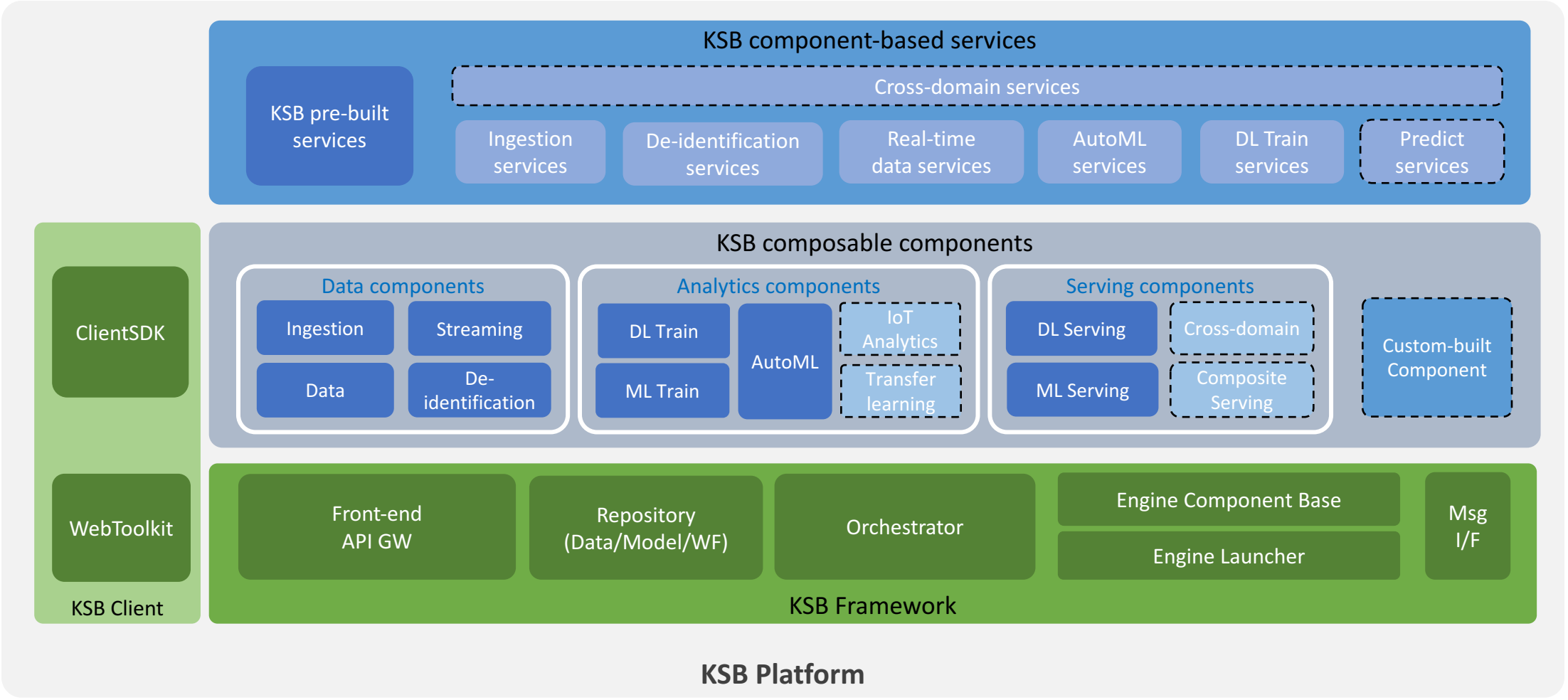
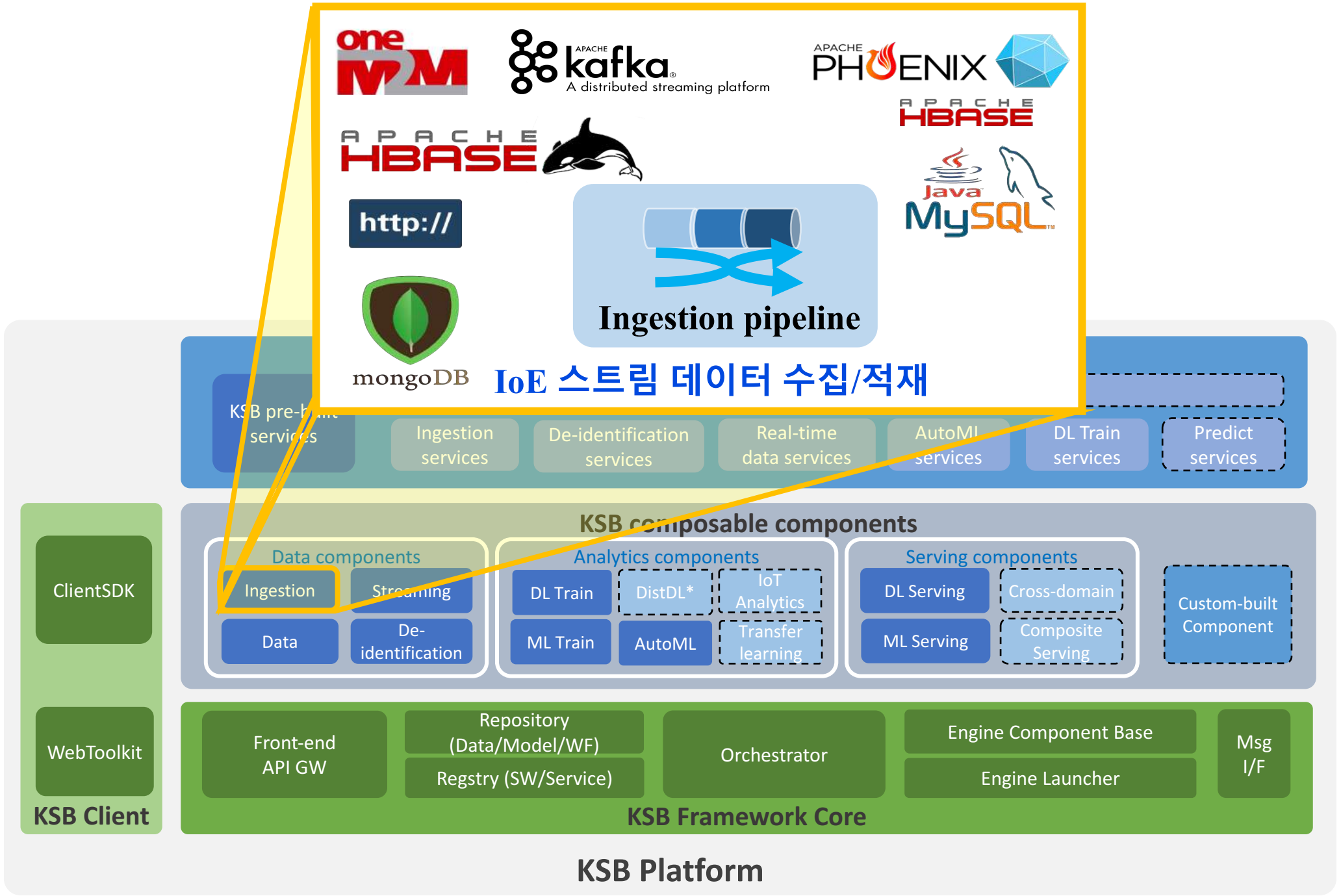


KSB Framework Stack




oneM2M
APACHE kafka
A distributed streaming platform
APACHE PHOENIX
APACHE HBASE
APACHE HBASE
http://
Java MySQL
mongoDB
Ingestion pipeline
IoE 스트림 데이터 수집/적재
KSB pre-built services
Ingestion services
De-identification services
Real-time data services
AutoML services
DL Train services
Predict services
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KSB Platform

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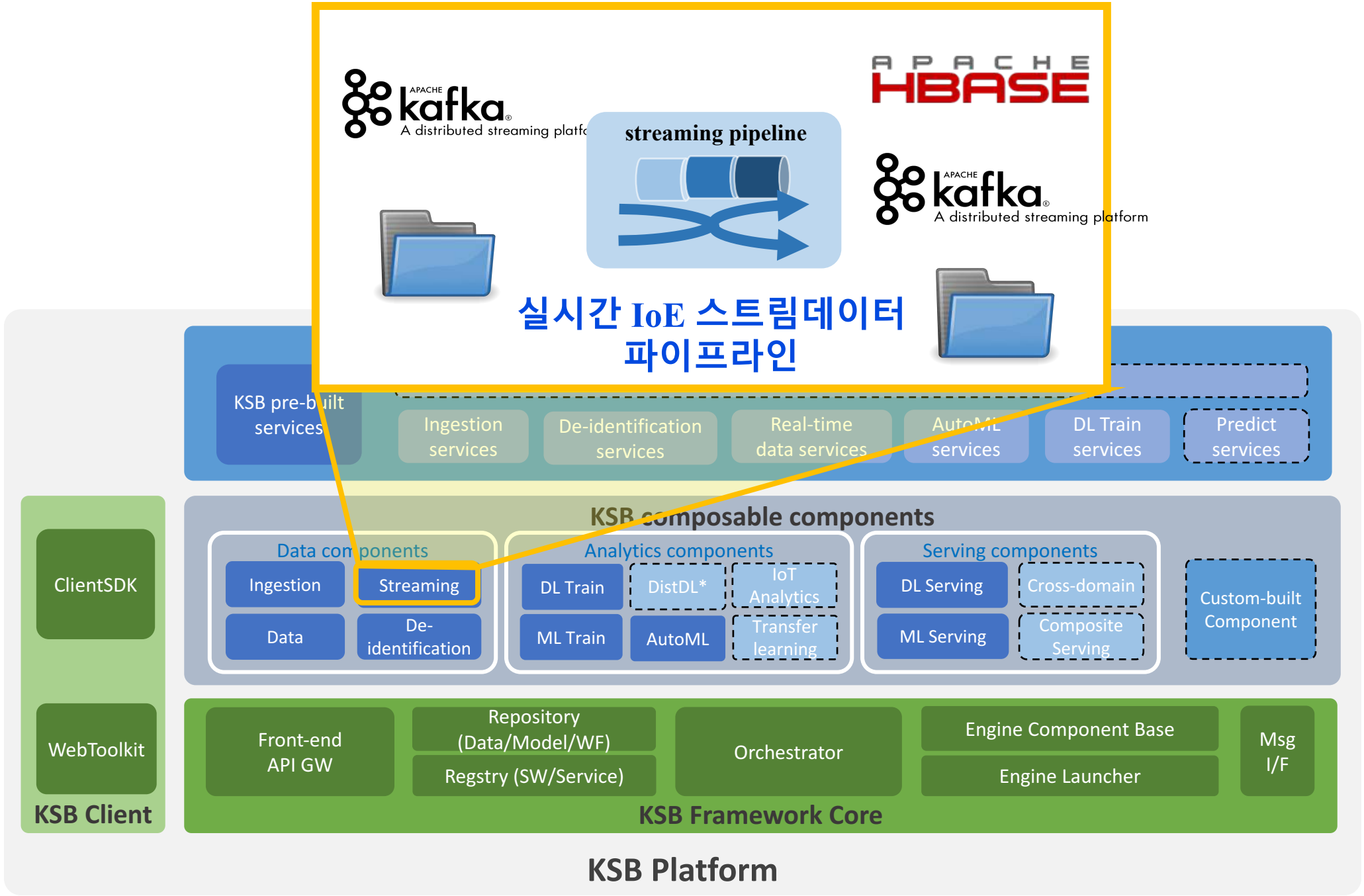
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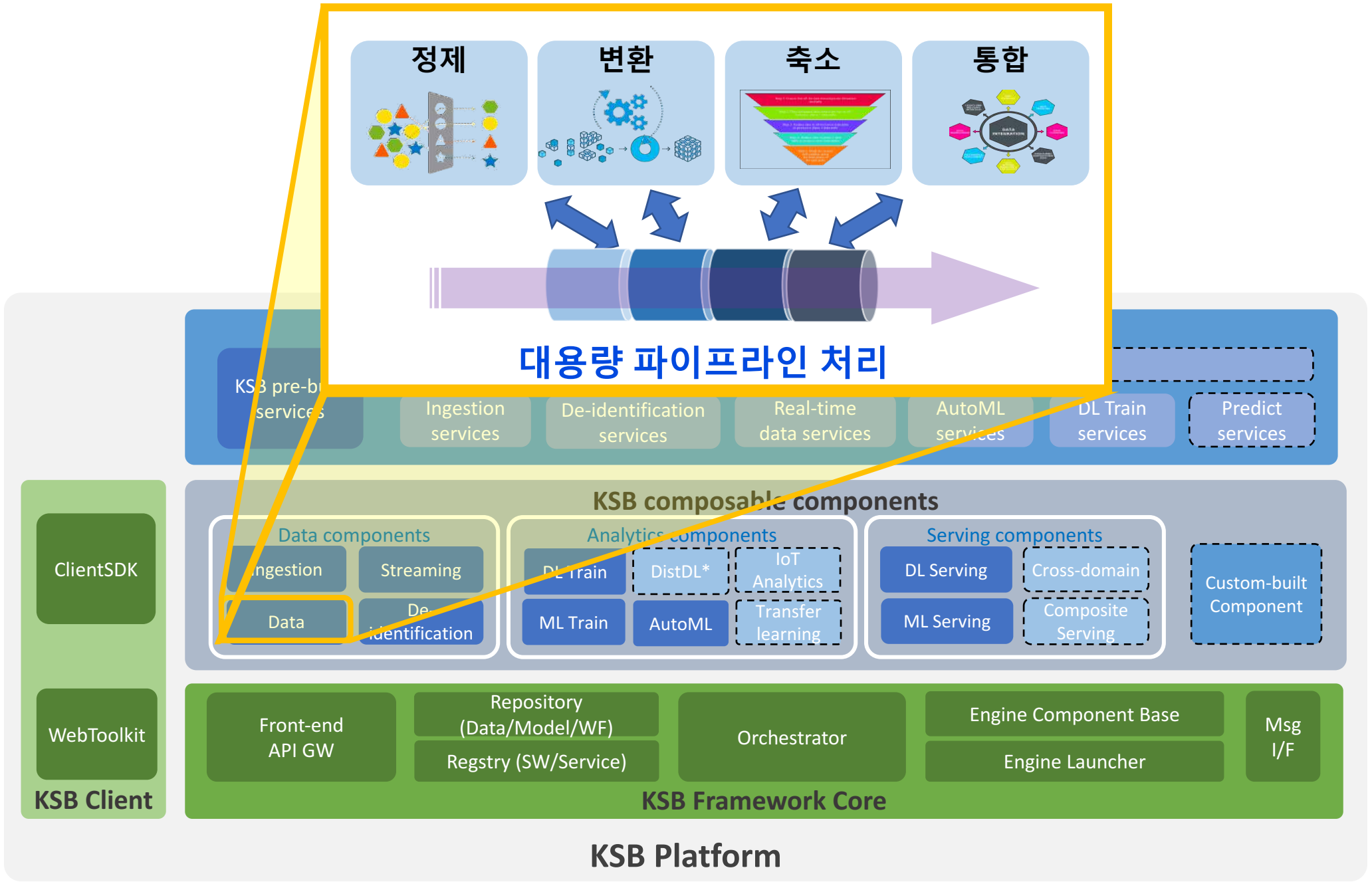
정제
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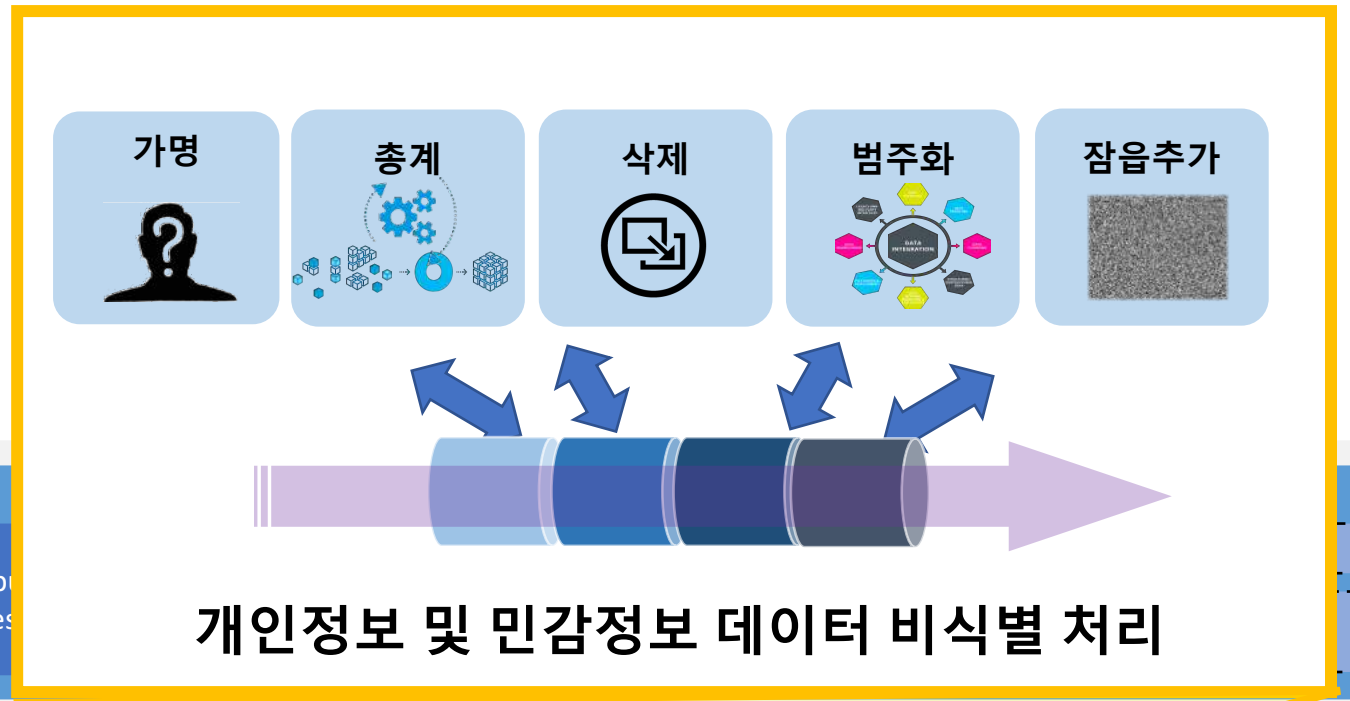

KSB pre-b
services

Predict
services

ClientSDK

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KSB Client

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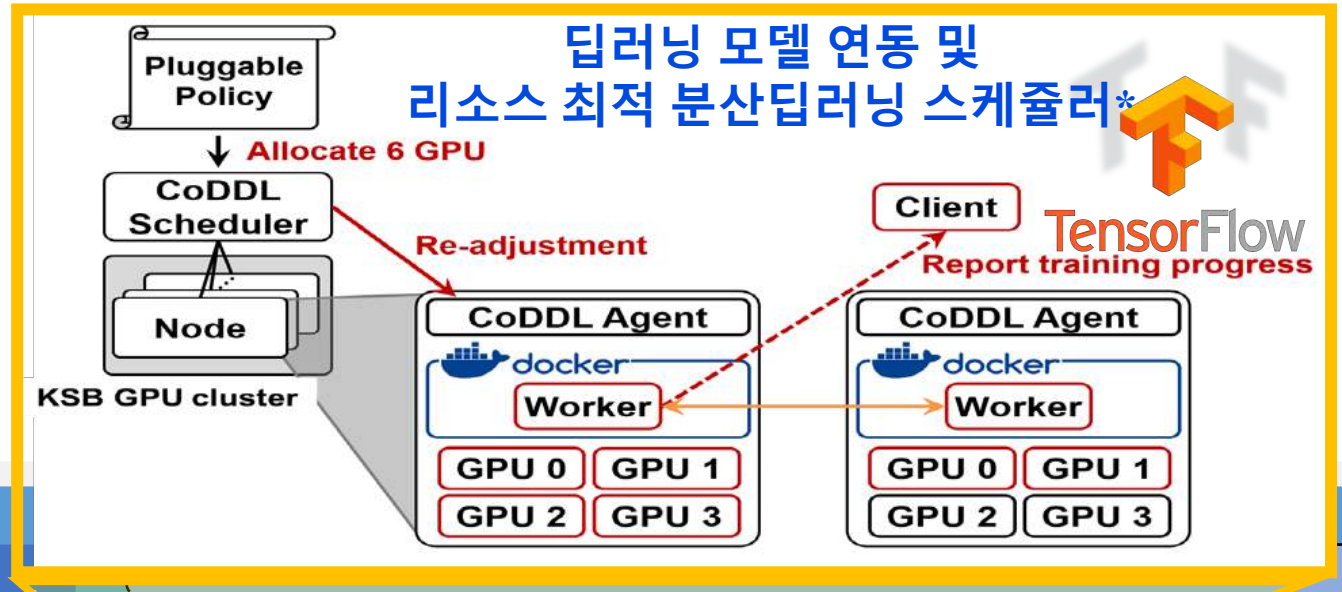
KSB Platform



KSB pre-built services

Ingestion services

De-identification services

Real-time data services

AutoML services

DL Train services

Predict services

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DistDL*

IoT Analytics

ML Train

AutoML

Transfer learning

Serving components

DL Serving

Cross-domain

ML Serving

Composite Serving

Custom-built Component

Front-end API GW

Repository (Data/Model/WF)

Regstry (SW/Service)

Orchestrator

Engine Component Base

Engine Launcher

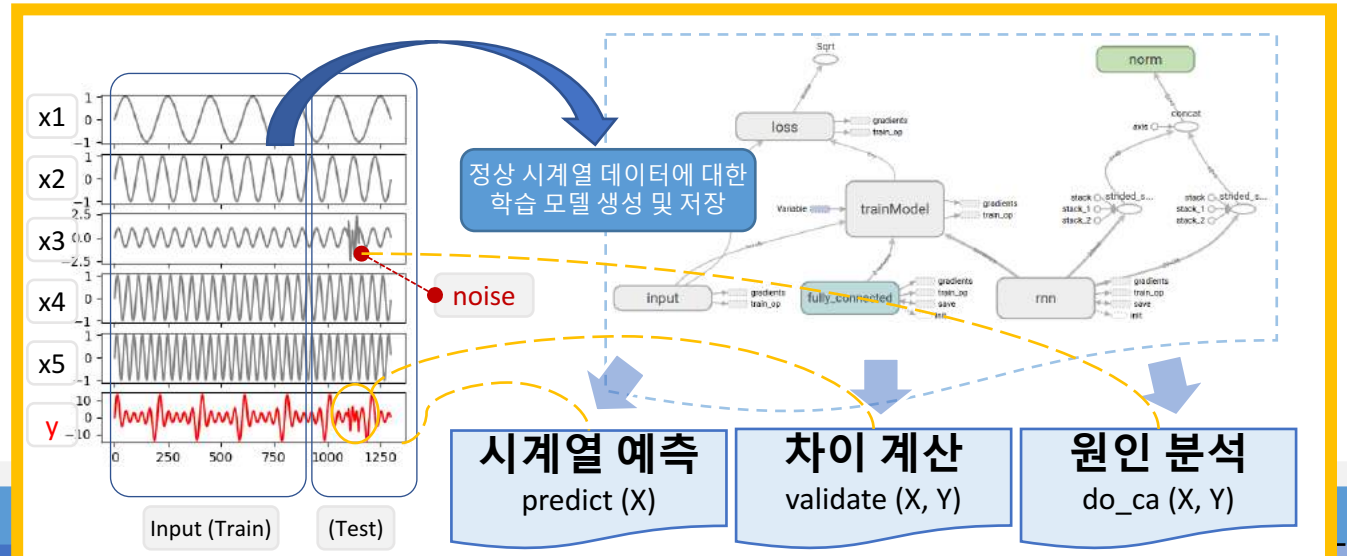
Msg I/F

KSB Framework Core

KSB Platform

ETRI

이상감지



KSB pre-built services

Ingestion services | De-identification services | Real-time data services | AutoML services | DL Train services | Predict services

ClientSDK

WebToolkit

KSB Client

KSB composable components

Data components
- Ingestion
- Streaming
- Data
- De-identification

Analytics components
- DL Train
- DistDL*
- IoT Analytics
- ML Train
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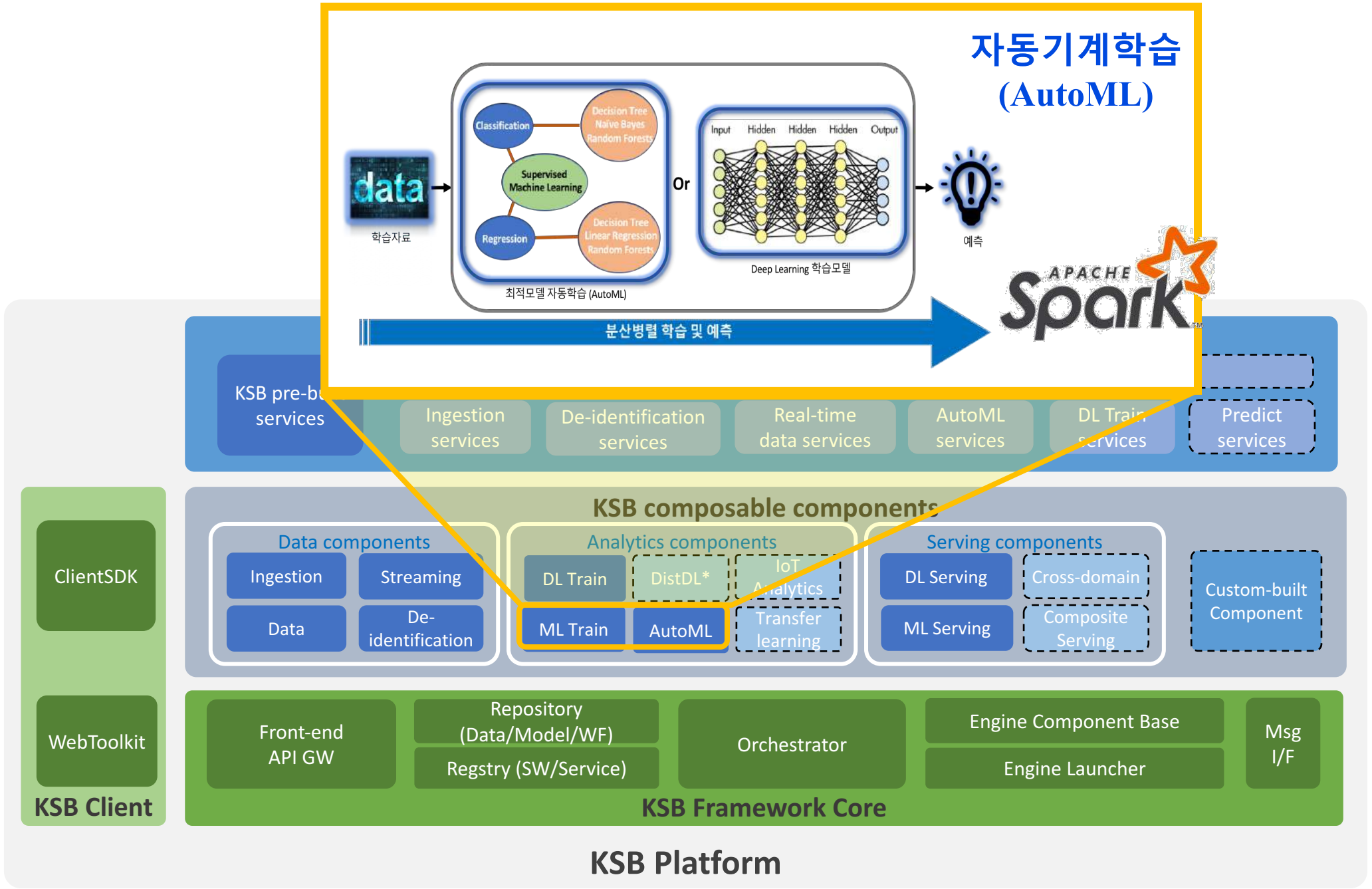
자동기계학습
(AutoML)
data
학습자료
Classification
Decision Tree
Naïve Bayes
Random Forests
Supervised
Machine Learning
Regression
Decision Tree
Linear Regression
Random Forests
최적모델 자동학습 (AutoML)
Or
Input
Hidden
Hidden
Hidden
Output
Deep Learning 학습모델
예측
분산병렬 학습 및 예측
APACHE
Spark
KSB pre-built services
Ingestion services
De-identification services
Real-time data services
AutoML services
DL Train services
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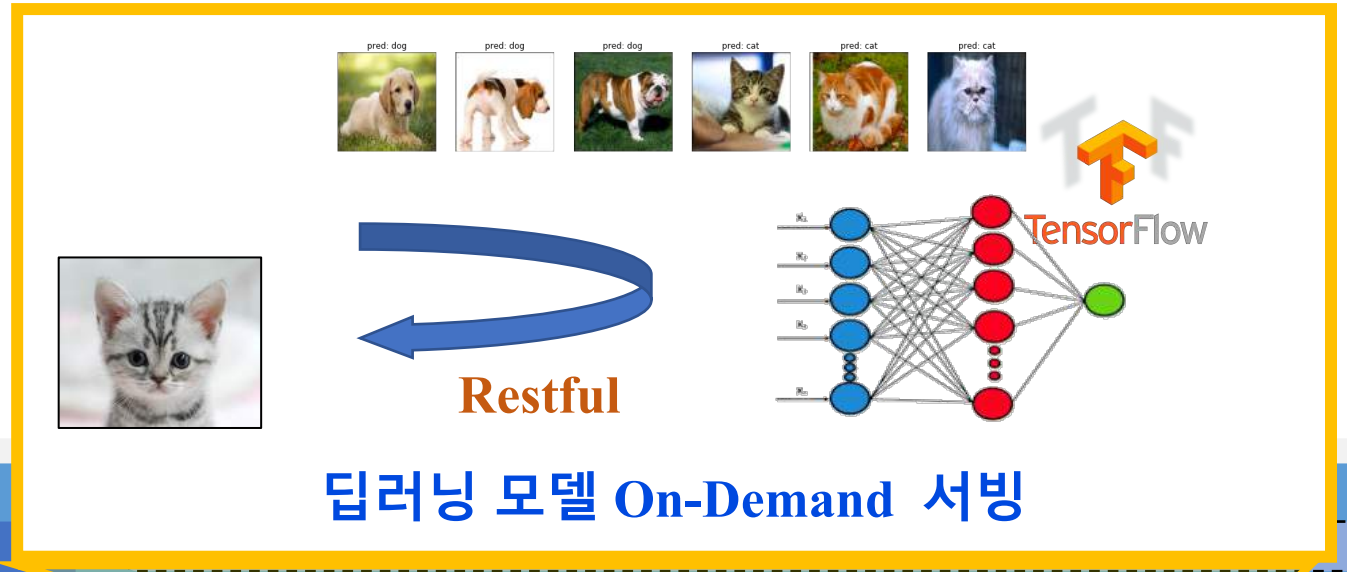

KSB pre-built services

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De-identification services

Real-time data services

AutoML services

DL Train services

Predict services

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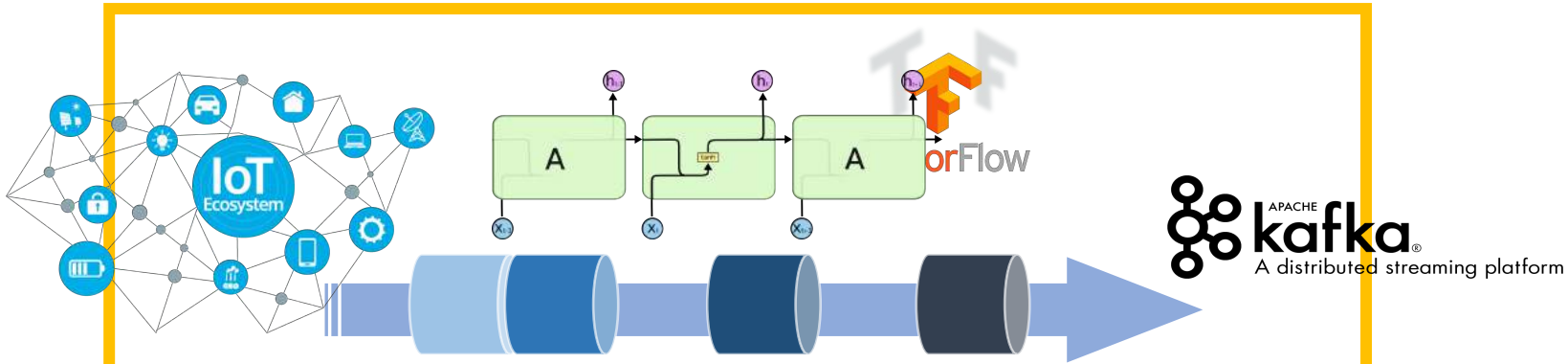

Data pipeline

딥러닝 모델 스트리밍 서빙

KSB pre-built services

Ingestion services

De-identification services

Real-time data services

AutoML services

DL Train services

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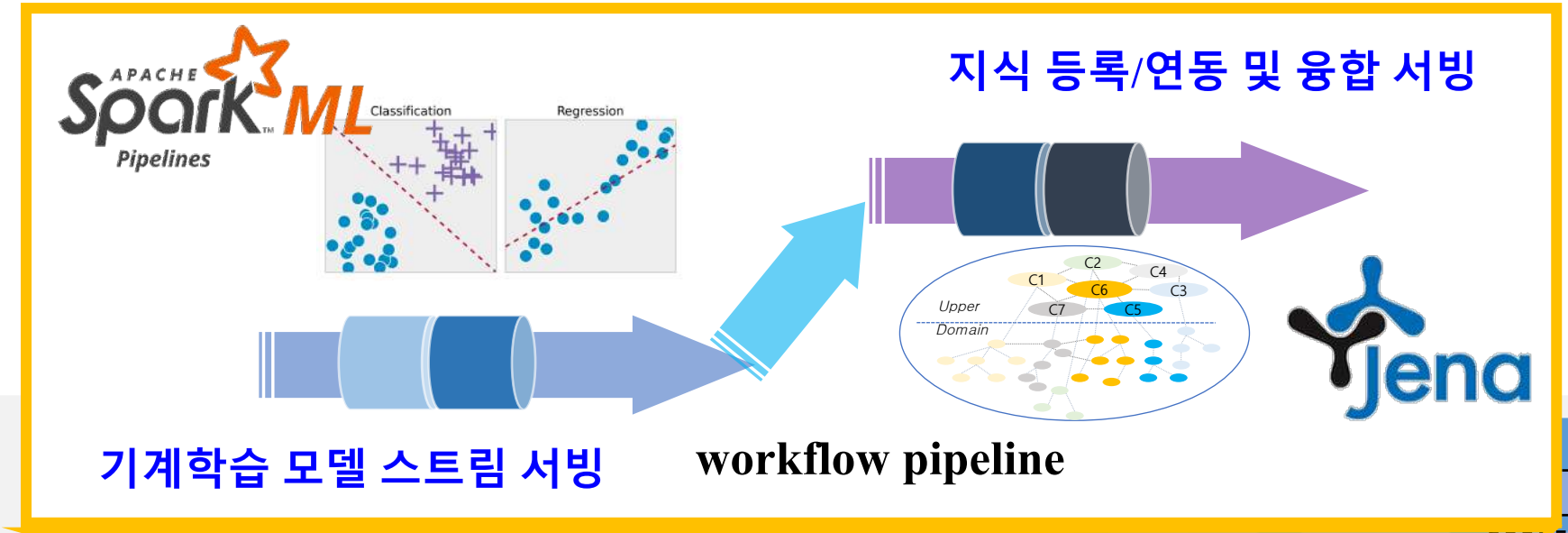

services
Ingestion services
De-identification services
Real-time data services
AutoML services
DL Train services
Predict services

ClientSDK

KSB composable components

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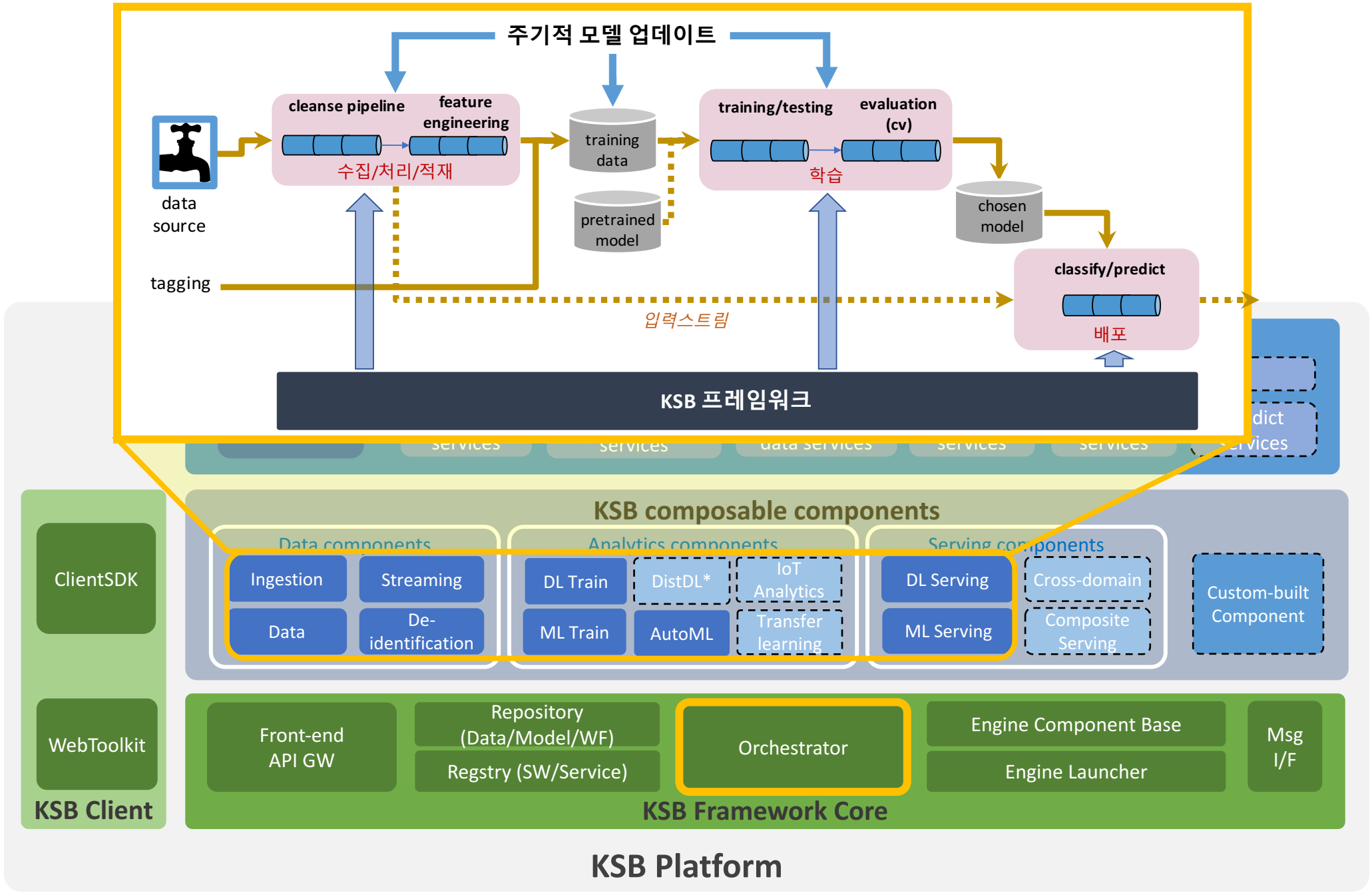
KSB Platform


주기적 모델 업데이트
cleanse pipeline
feature engineering
수집/처리/적재
training data
pretrained model
training/testing
evaluation (cv)
학습
chosen model
classify/predict
배포
data source
tagging
입력스트림
KSB 프레임워크
KSB composable components
Data components
Analytics components
Serving components
Ingestion
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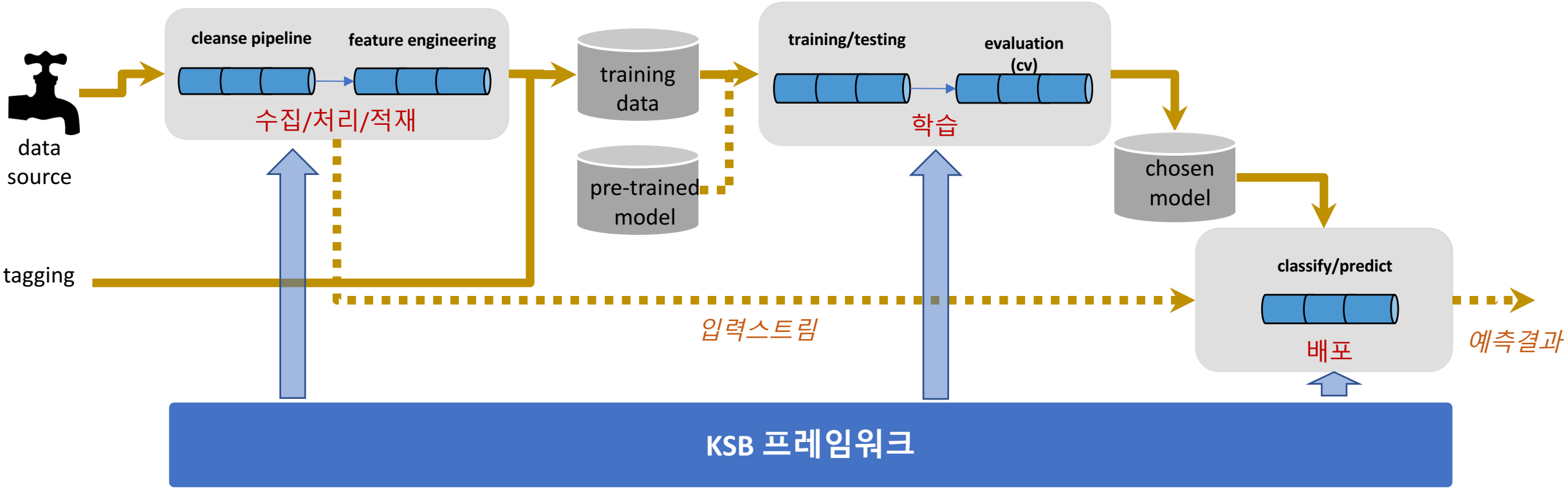
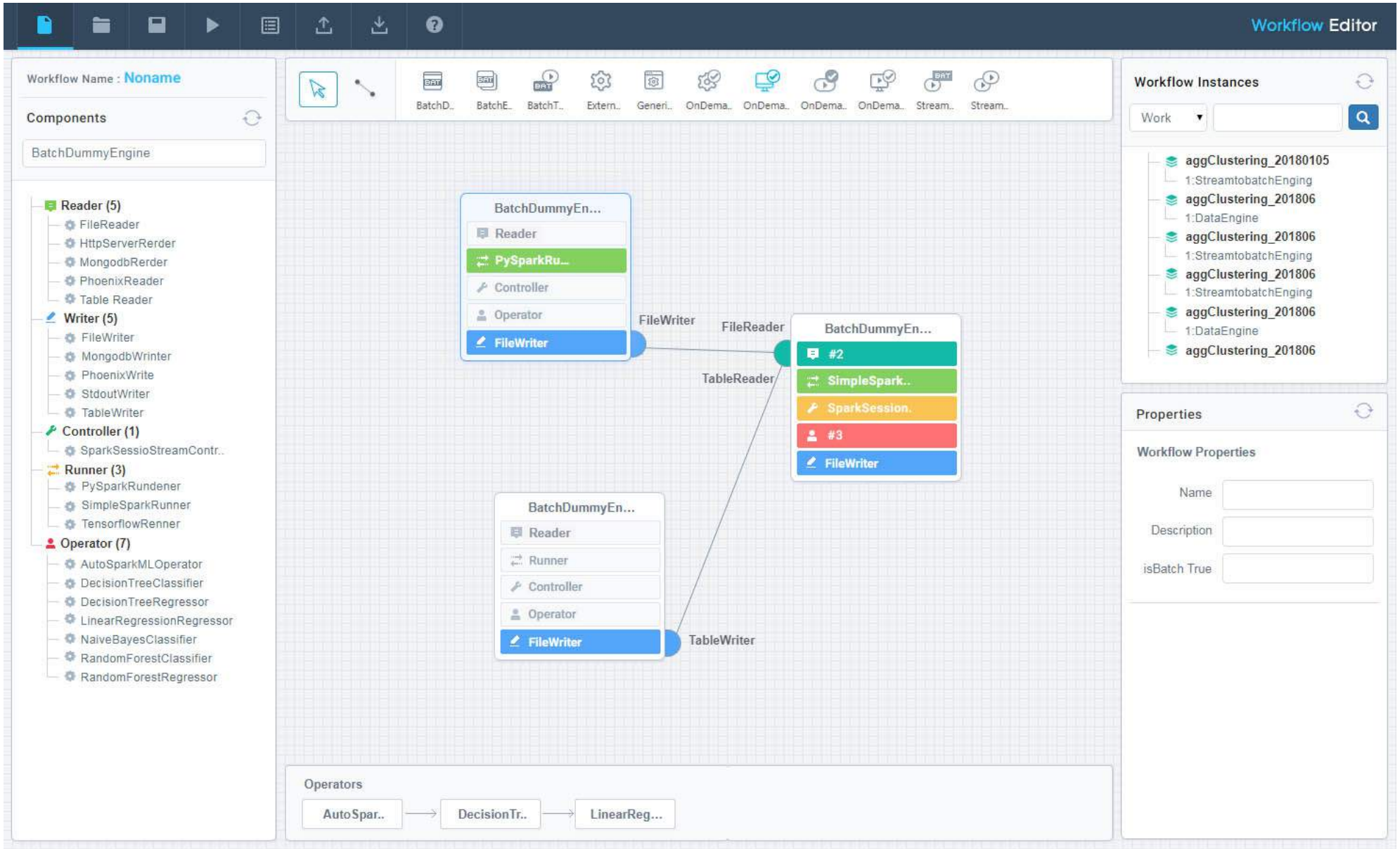
KSB Framework Key Feature

- End-to-end IoT Intelligence
  - From real-time streaming to streaming predictive serving
  - Predictive serving API to domain application serving API
- Easy of Use
  - DIY Workflow Editor
  - Develop and Deploy in One Place
- Extendibility
  - Accumulating SW component
  - Building Predictive Api using ML Model

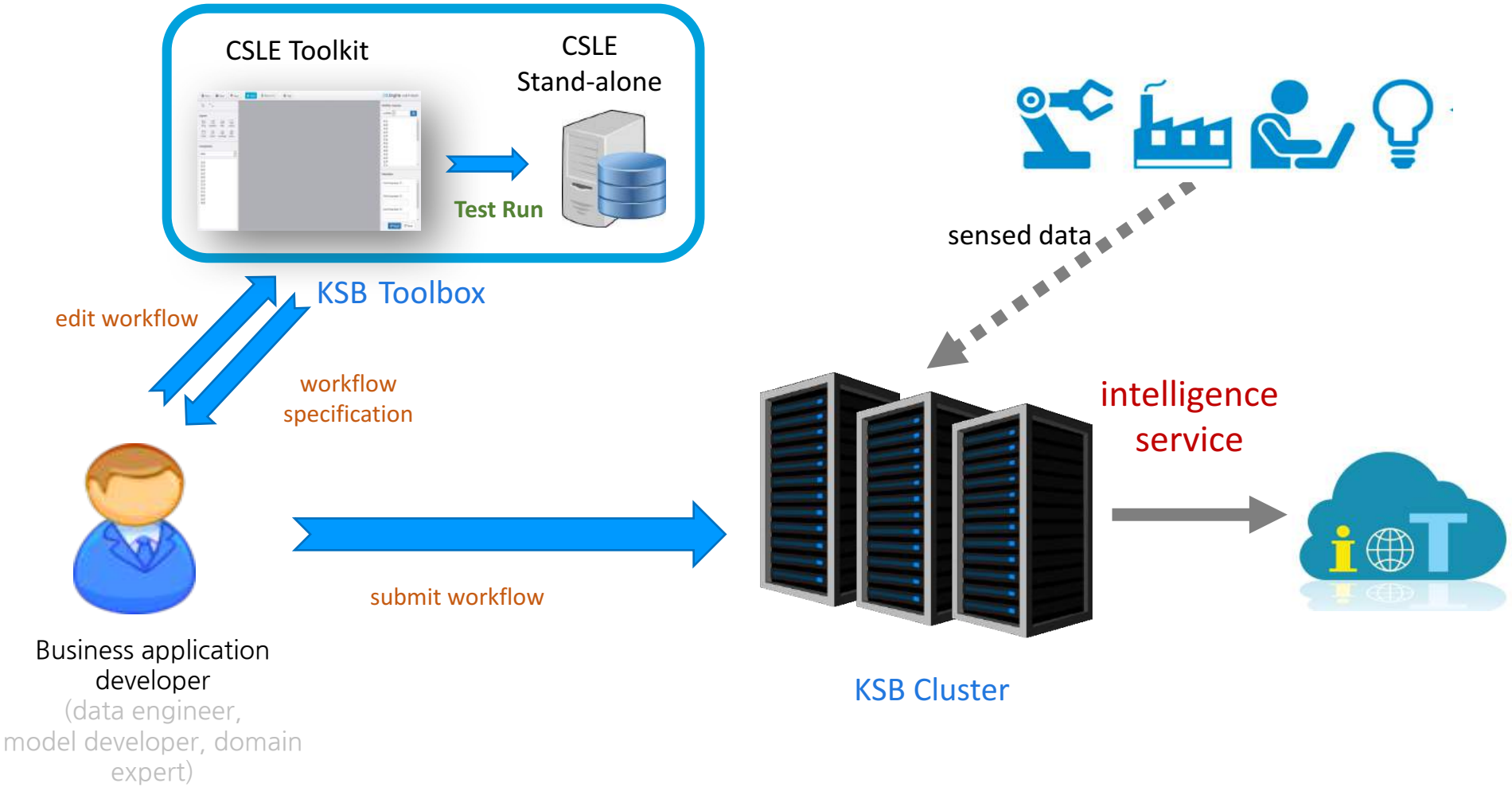
End-to-end Machine Learning Workflow



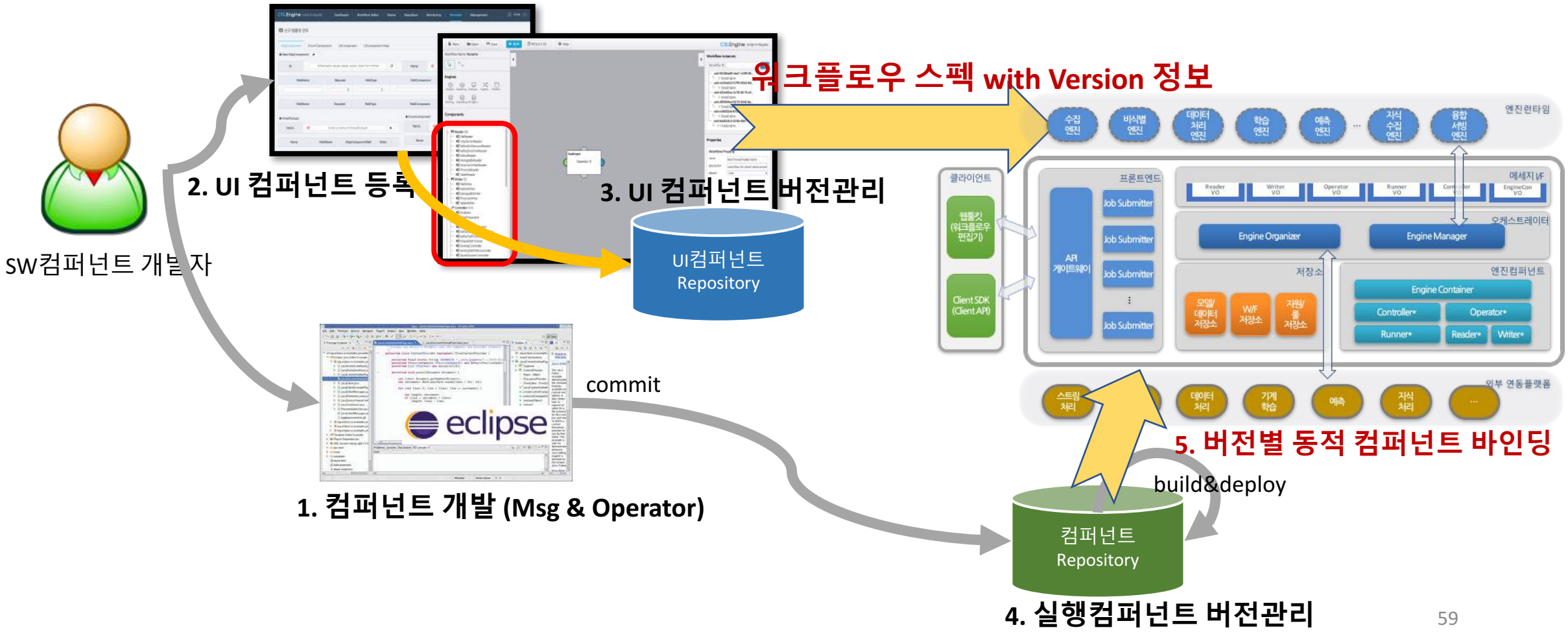
Easy of use : DIY Workflow Editor



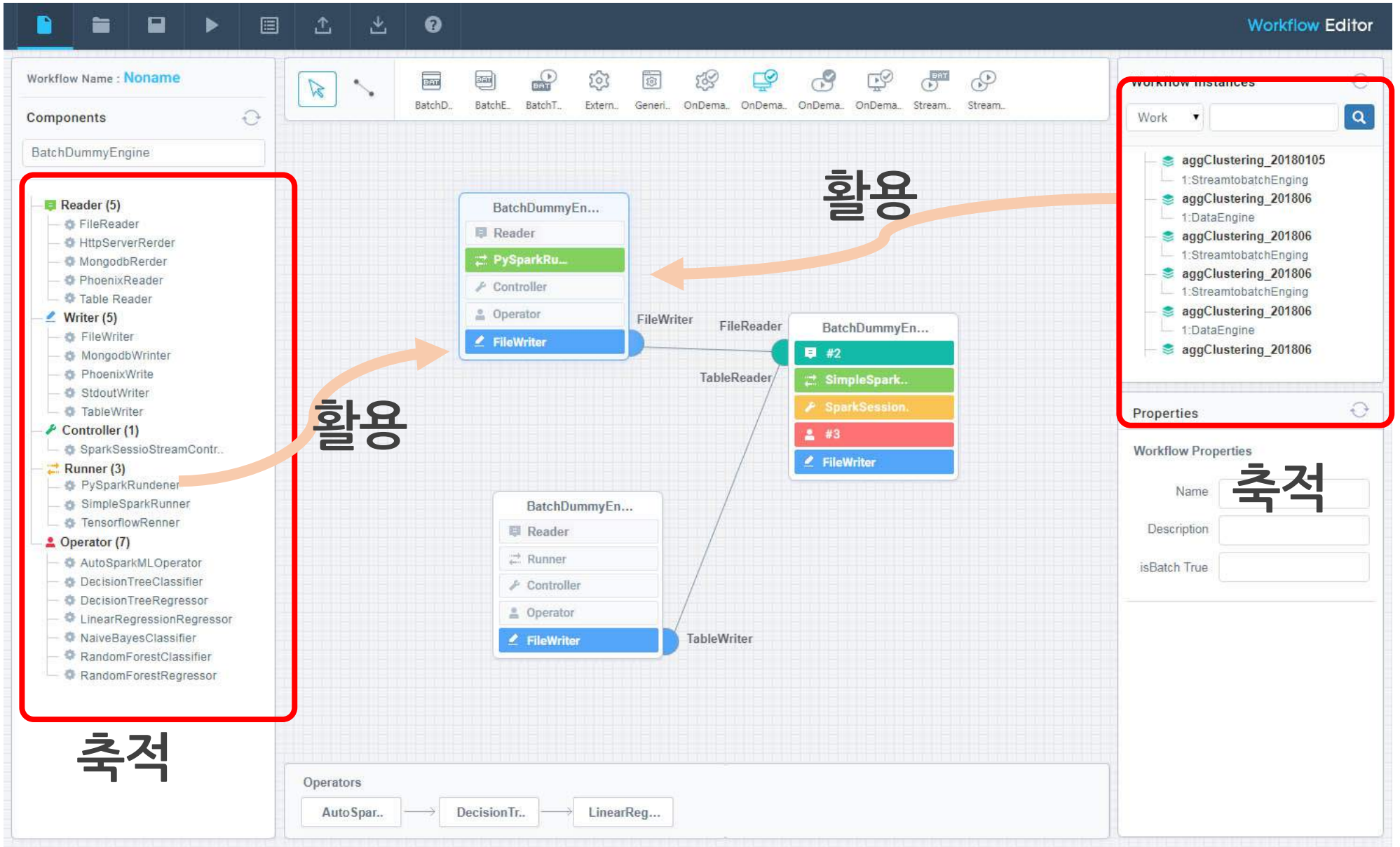
Easy of Use: Develop and Deploy in One Place



Extendibility: Accumulating SW component

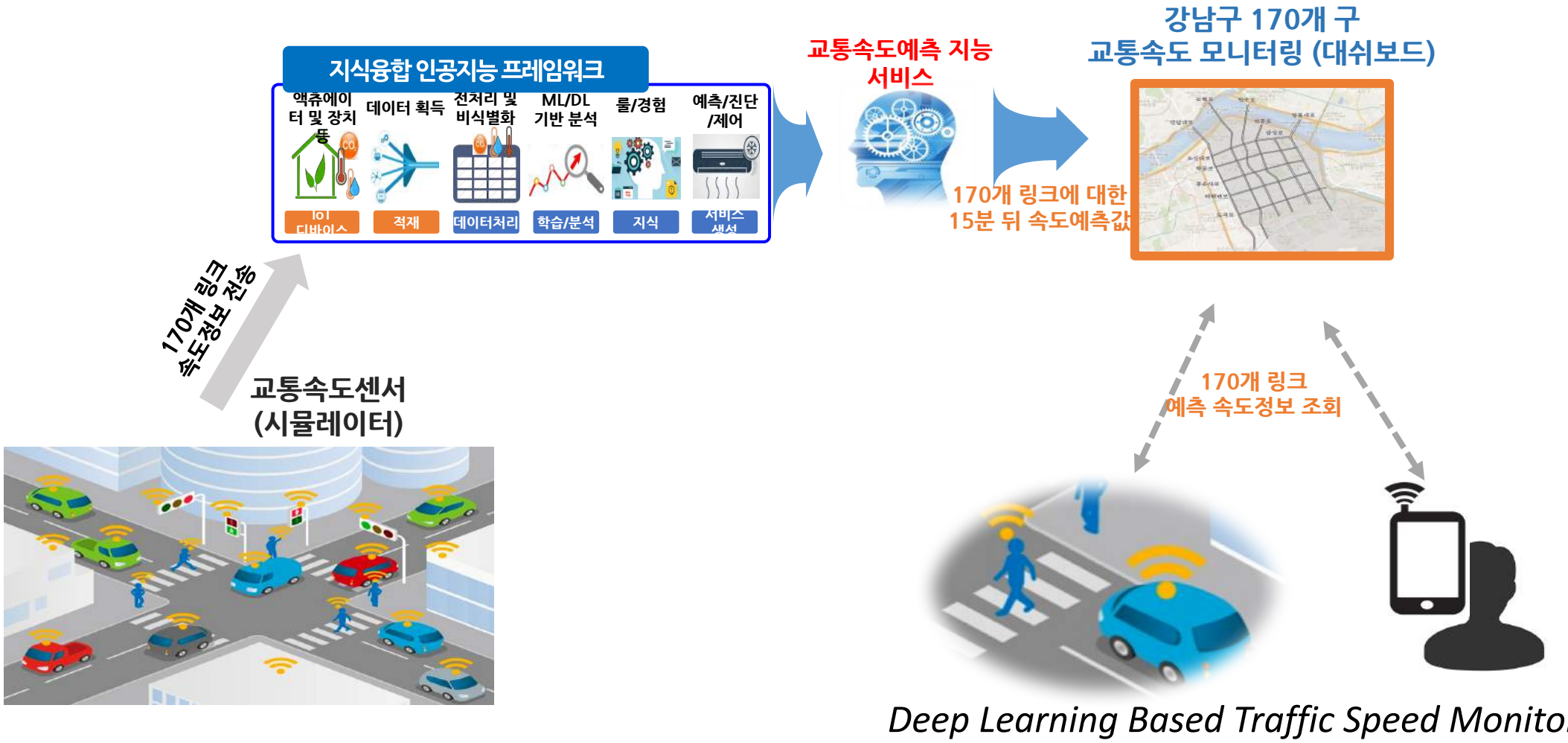


Extendibility: Accumulating SW component



IV. Usecases

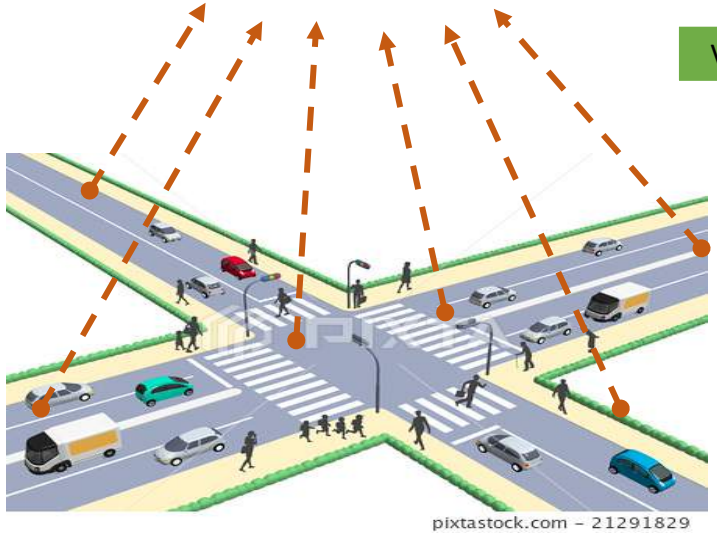
U1. Real-time streaming analytics with continuous model update



Deep Learning Based Traffic Speed Monitoring

시간	ID	속도
..	..	..
..	..	..
..	..	..

httpReader



1,440개 교통정보 수집 센서

ColumnSelectOperator

ConcatAndReshapeOperator

MinMaxScalingOperator

PivotOperator

ColumnSelectWithOperator

MissingValueImputeOperator

VectorAssembleColumnAddOpertor

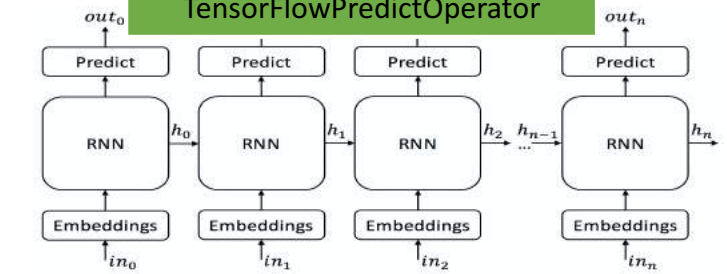
FlattenOperator

링크

24주기

1	2	3
..	..	..
..	..	..
..	..	..

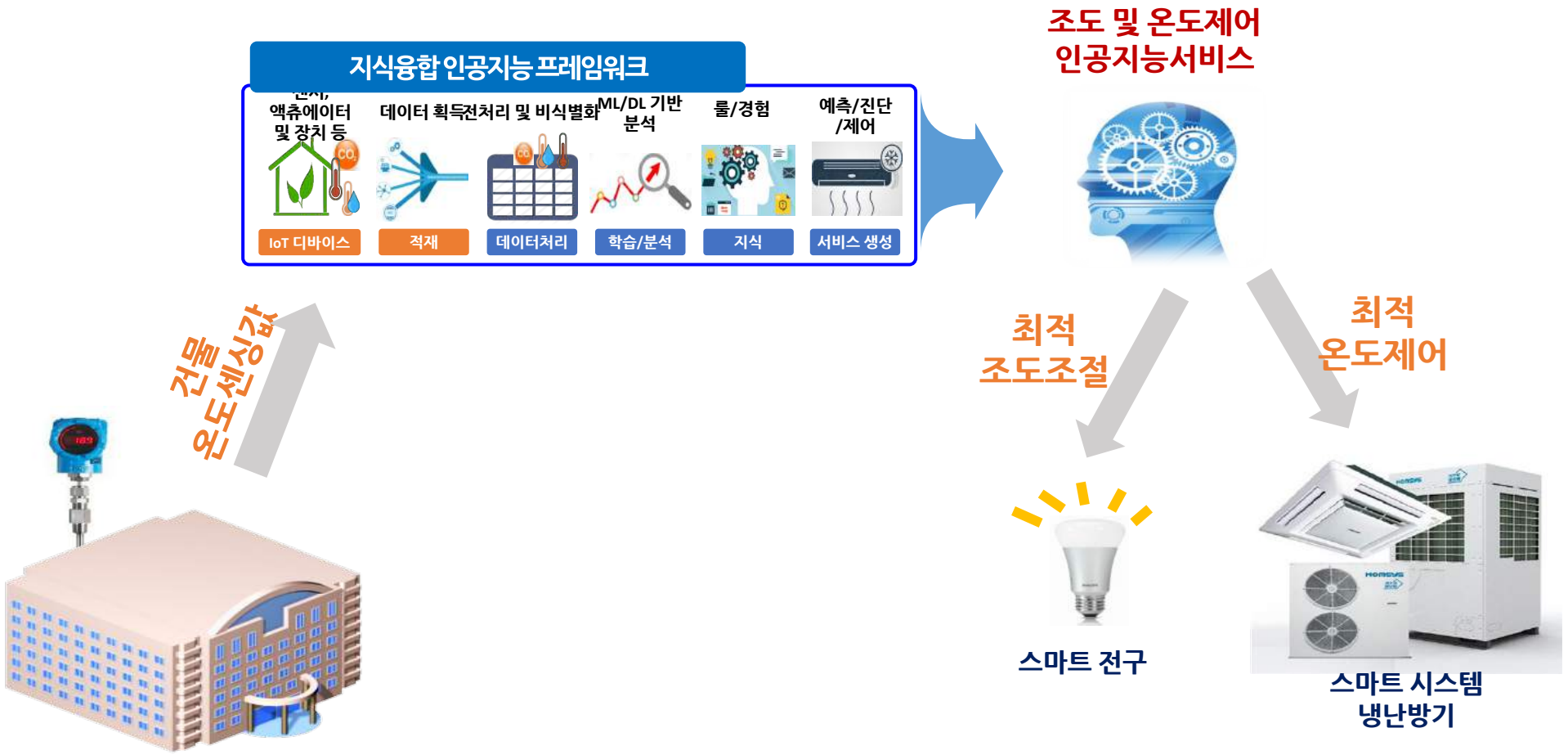
TensorFlowPredictOperator



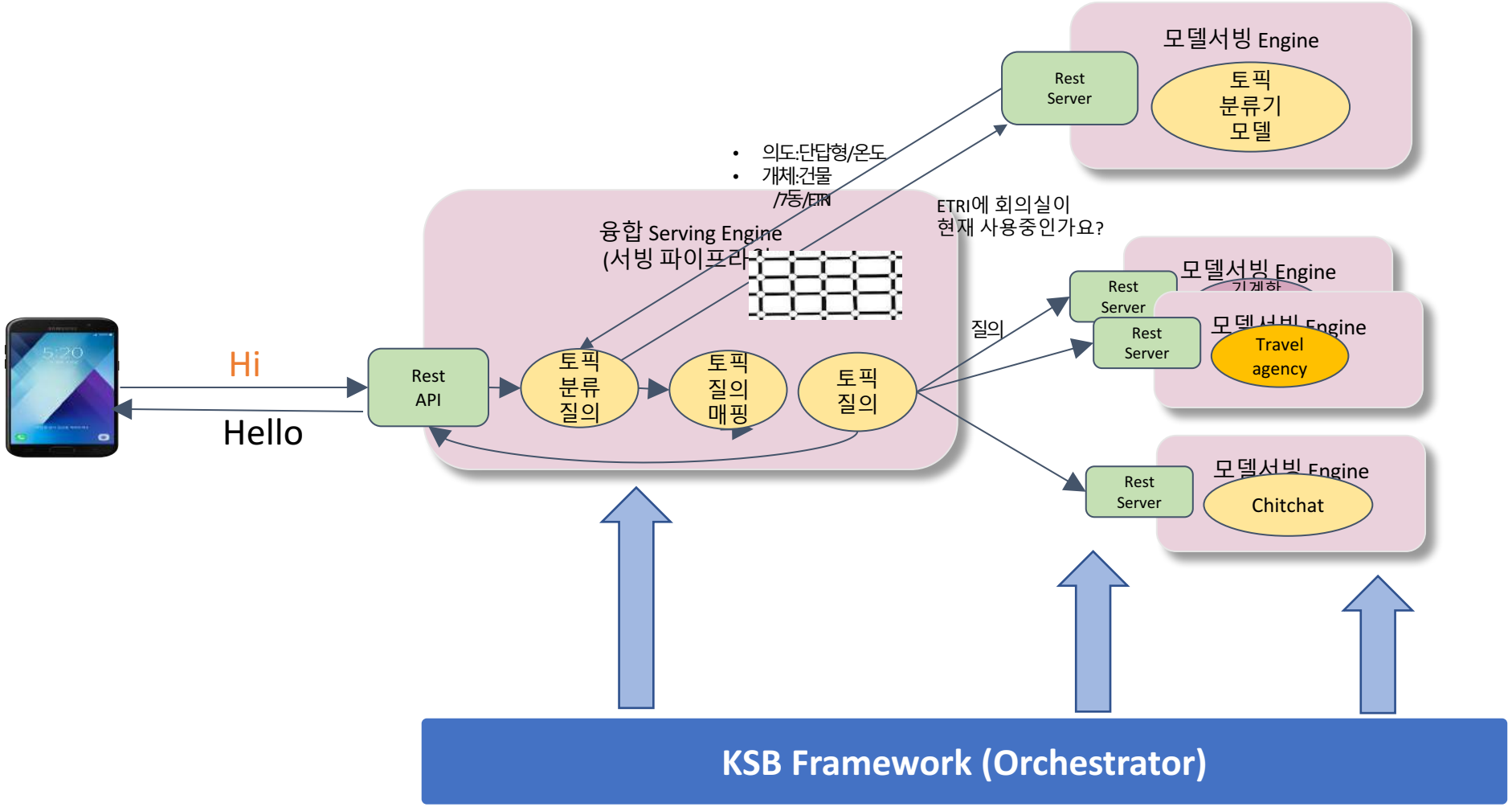
KafkaWriter

예측/ 모니터링

U2. Energy efficient building control (Prototype)

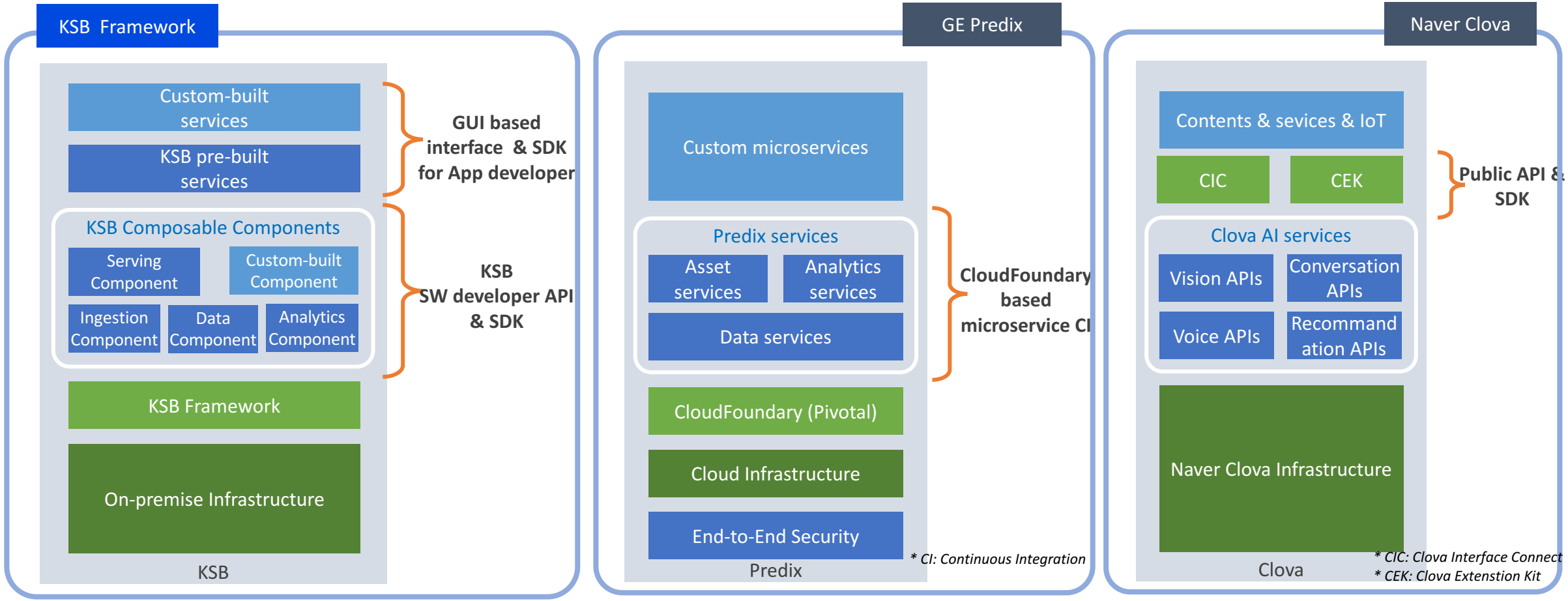


U3. Chatbot (prototype)



V. Conclusion

KSB vs. AI Platforms (Predix/Clova)



Conclusion

KSB VISION is to create Intelligence information industry ecosystem and to spread technology

공공분야 융합 선도 서비스 구축

Conclusion

기업의 경험 지속적으로 축적하고,

공유 및 협력을 위한 장과,

기술의 장벽을 넘어 끊임없이 진화할 수 있는 기반기술 제공

Thank you !