통신 인프라를 위한 AI

(for SMB)

2020. 12.

안 종 석

james@jslab.kr

JS Lab

목차

1. Market
2. 인프라
3. 오픈소스 프로젝트
4. 퍼블릭 클라우드
5. Use case

james@jslab.kr

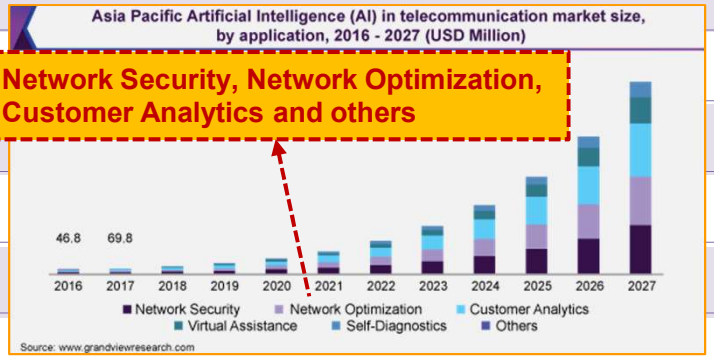
1. **Market**
2. 인프라
3. 오픈소스 프로젝트
4. 퍼블릭 클라우드
5. Use case

james@jslab.kr

1. Market

❖ Artificial Intelligence In Telecommunication Market (예)

Report Attribute	Details
Market size value (2020)	• USD 962.2 million
Revenue forecast (2027)	• USD 9,350.3 million
Growth Rate	• CAGR of 38.4% from 2020 to 2027
Base year for estimation	• 2019
Historical data	• 2016 - 2018
Forecast period	• 2020 - 2027
Quantitative units	• Revenue in USD million and CAGR from 2020 to 2027
Segments covered	• Application, region
Regional scope	• North America; Europe; Asia Pacific; South America; MEA
Country scope	• U.S.; Canada; Mexico; Germany; U.K.; France; China; Japan; India; Brazil
Key companies	• IBM Corporation; Microsoft; Intel Corporation; Google; AT&T Intellectual Property; Cisco Systems; Nuance Communications, Inc.; Evolv Technology Solutions, Inc.; H2O.ai; Infosys Limited; Salesforce.com, Inc.; and NVIDIA Corporation



james@jslab.kr

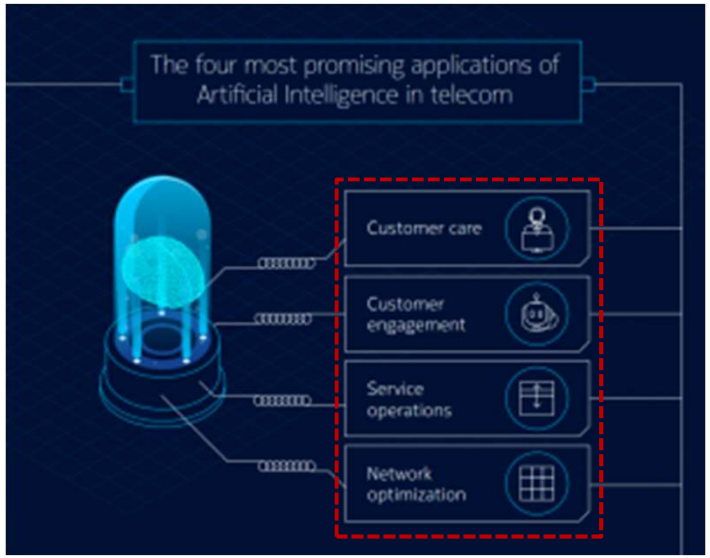
https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-telecommunication-market

1. Market

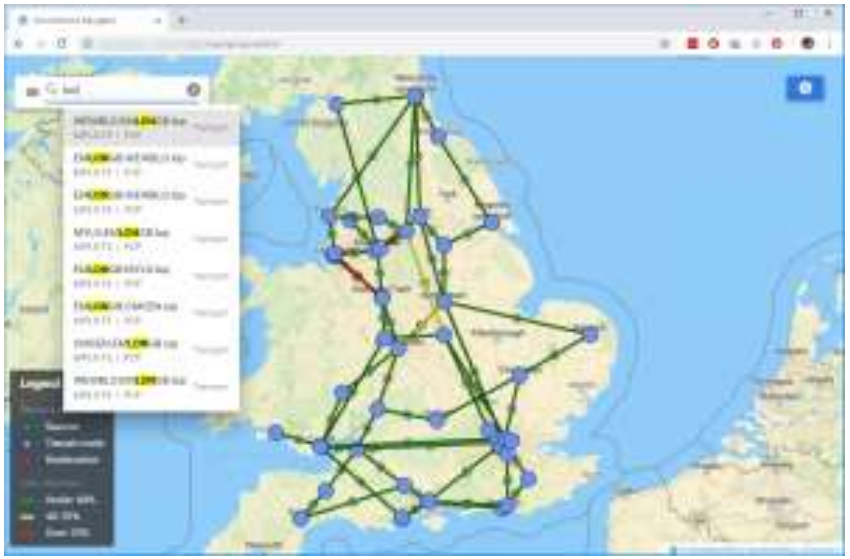
❖ **IDC indicates that 63.5% of operators are investing in AI systems to improve their infrastructure. Some popular AI use cases in telecom include**

- **ZeroStack's ZBrain Cloud Management**
- **Aria Networks, an AI-based network**
- **Sedona Systems' NetFusion**
- **Nokia launched its own machine learning-based AVA platform**

ZeroStack's ZBrain Cloud Management



Aria Networks, an AI-based network

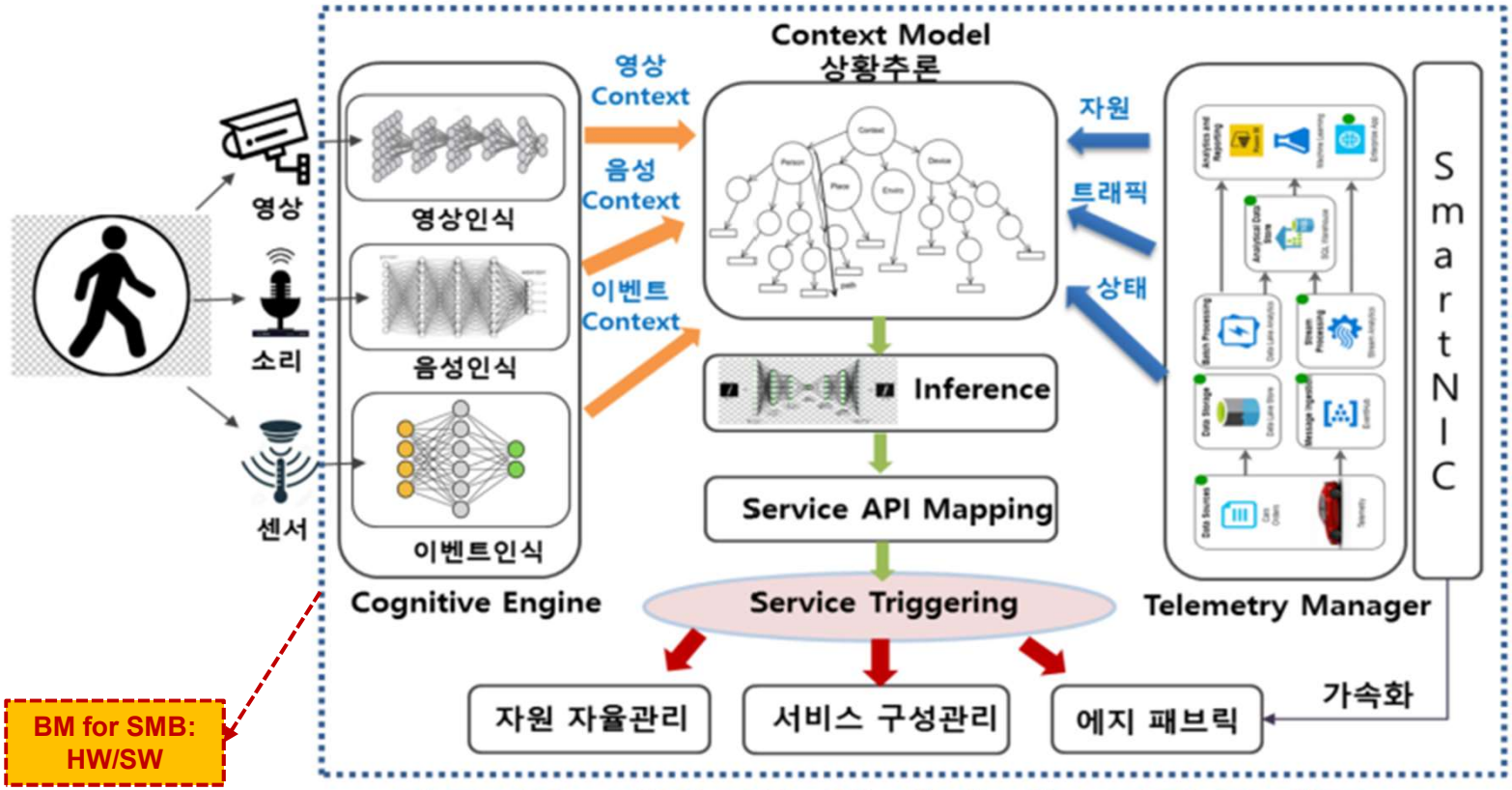


https://techsee.me/blog/artificial-intelligence-in-telecommunications-industry/

james@jslab.kr

1. Market

❖ ETRI의 인공지능 기반 지능형 에지 네트워킹 플랫폼

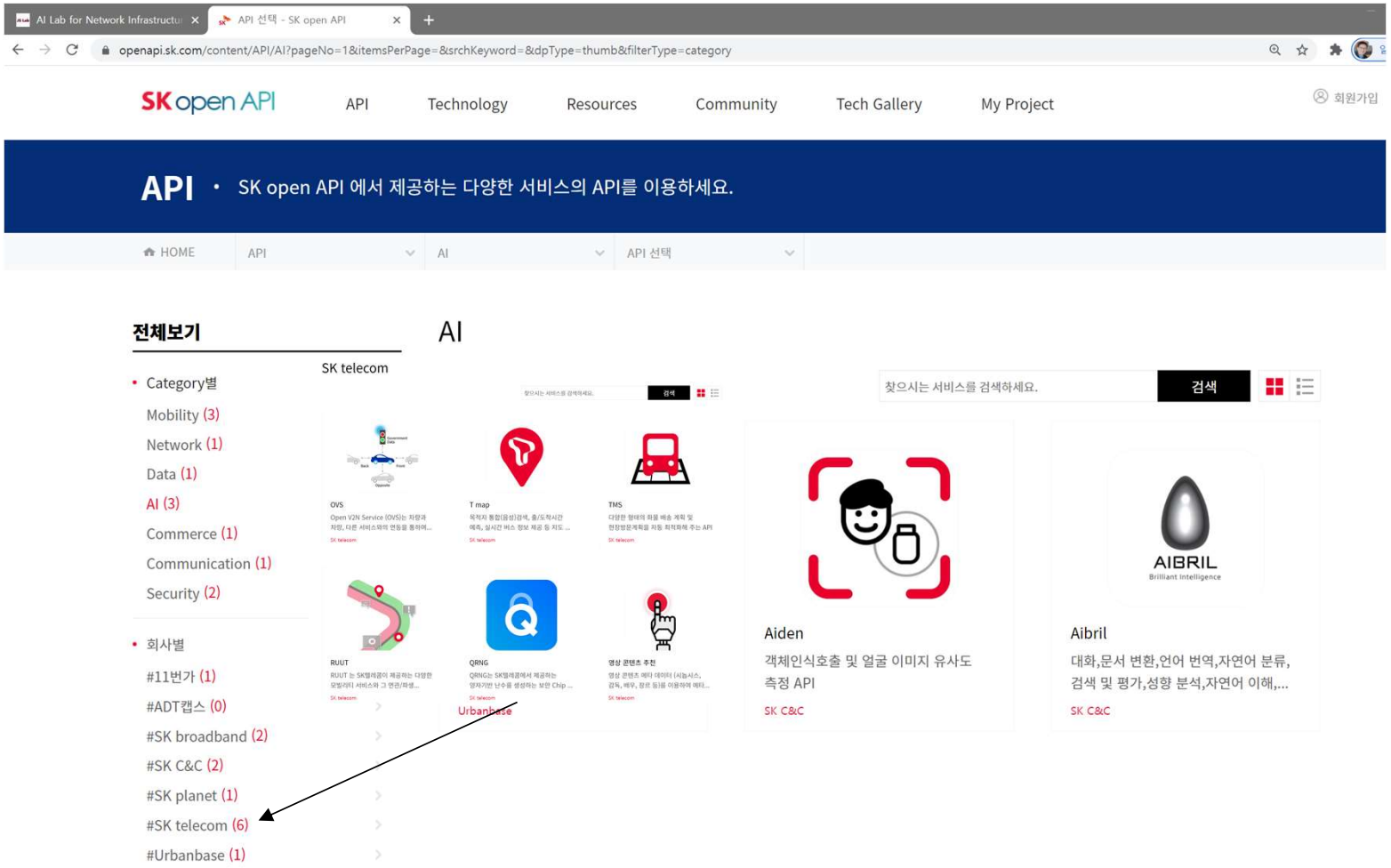


인공지능 기반 지능형 에지 네트워킹 플랫폼
(iENP: intelligence-based Edge Networking Platform)

james@jslab.kr

1. Market

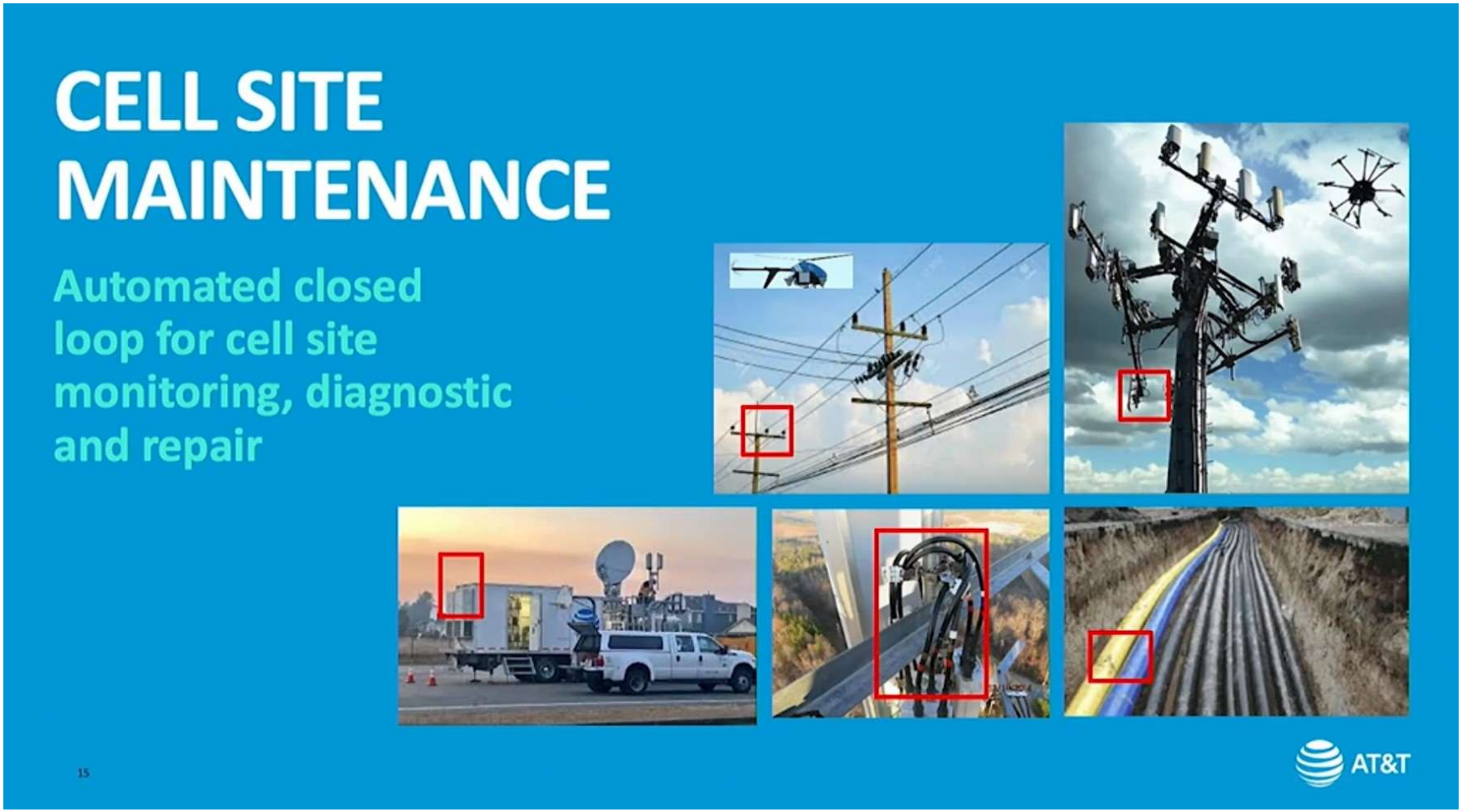
❖ 통신사: SK open API 서비스



james@jslab.kr

1. Market

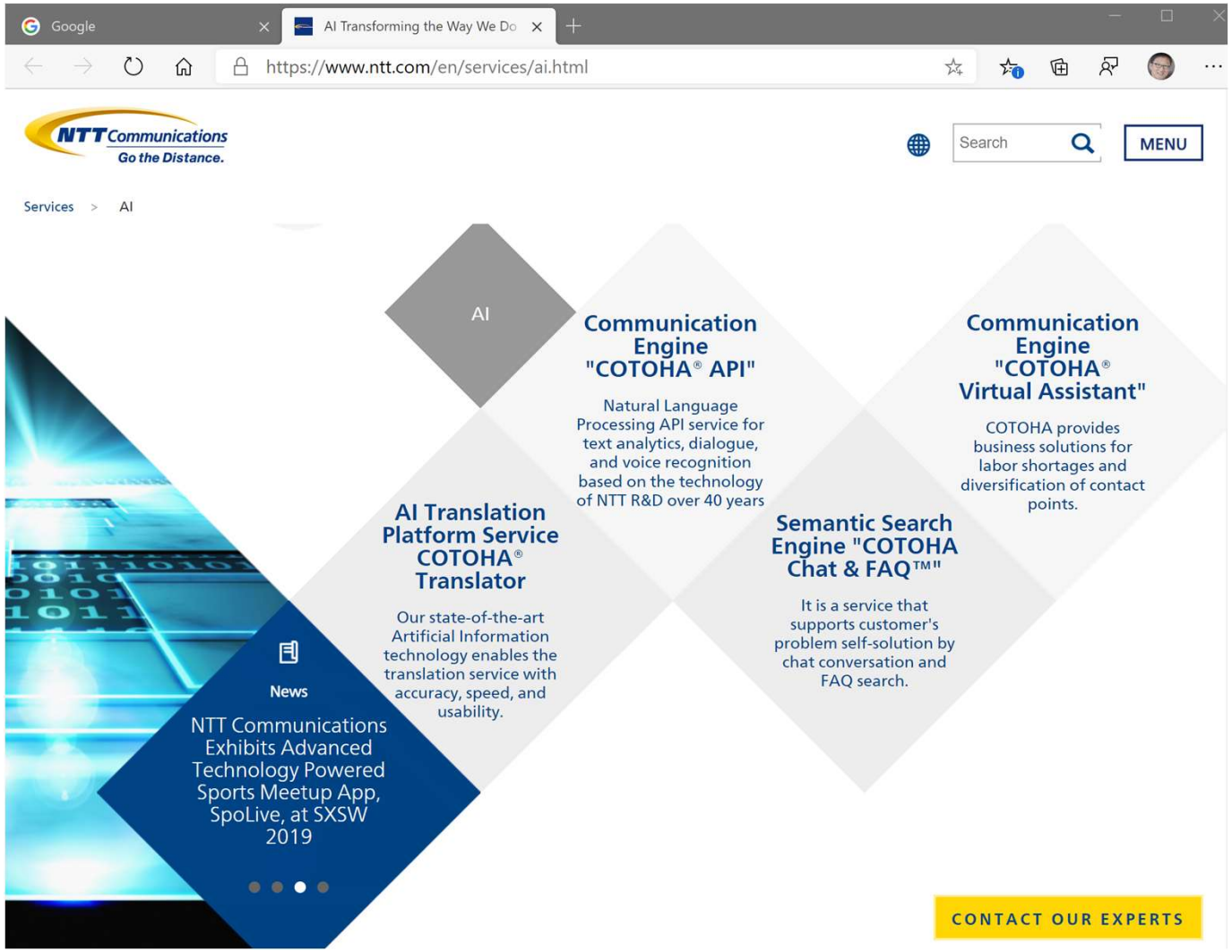
❖ 무선 시설 관리



james@jslab.kr

1. Market

❖ 통신사: NTT Docomo의 Edge AI Platform 서비스



https://www.ntt.com/en/services/ai.html

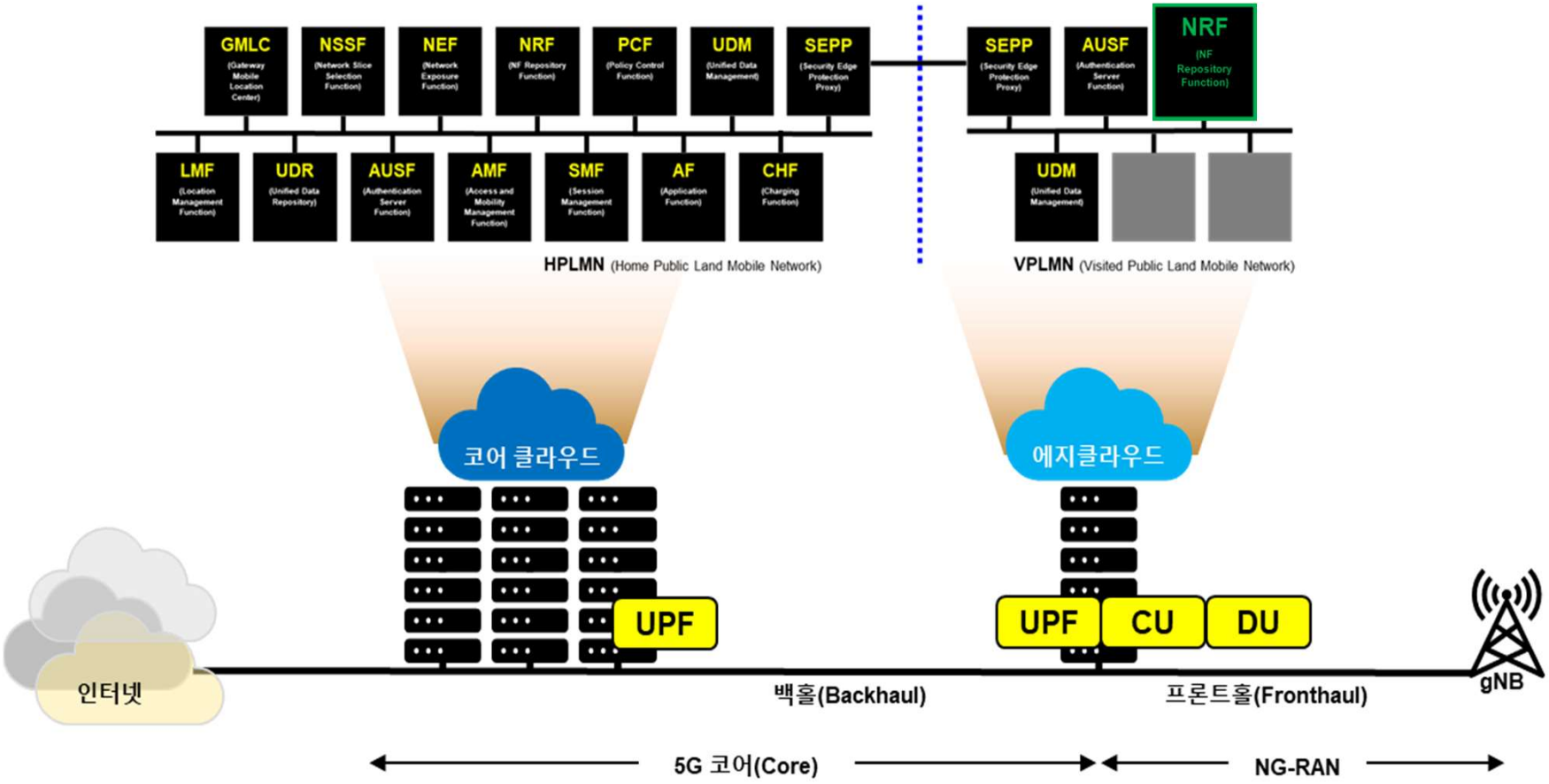
james@jslab.kr

1. Market
2. 인프라
3. 오픈소스 프로젝트
4. 퍼블릭 클라우드
5. Use case

james@jslab.kr

2. 인프라

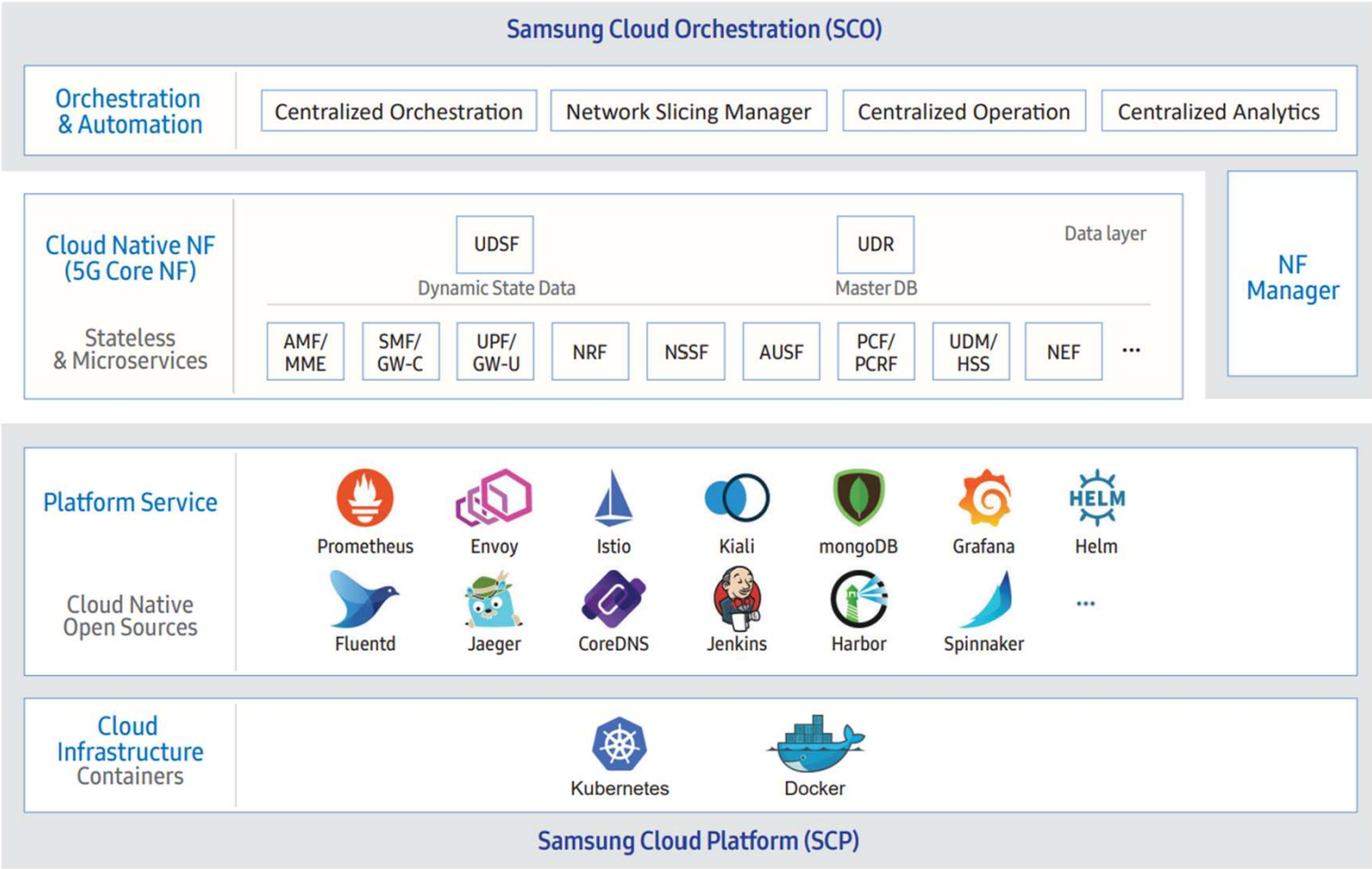
- ❖ NRF for NF service access
- ❖ Cloud Native Framework



james@jslab.kr

2. 인프라

❖ Cloud Native 5G Core



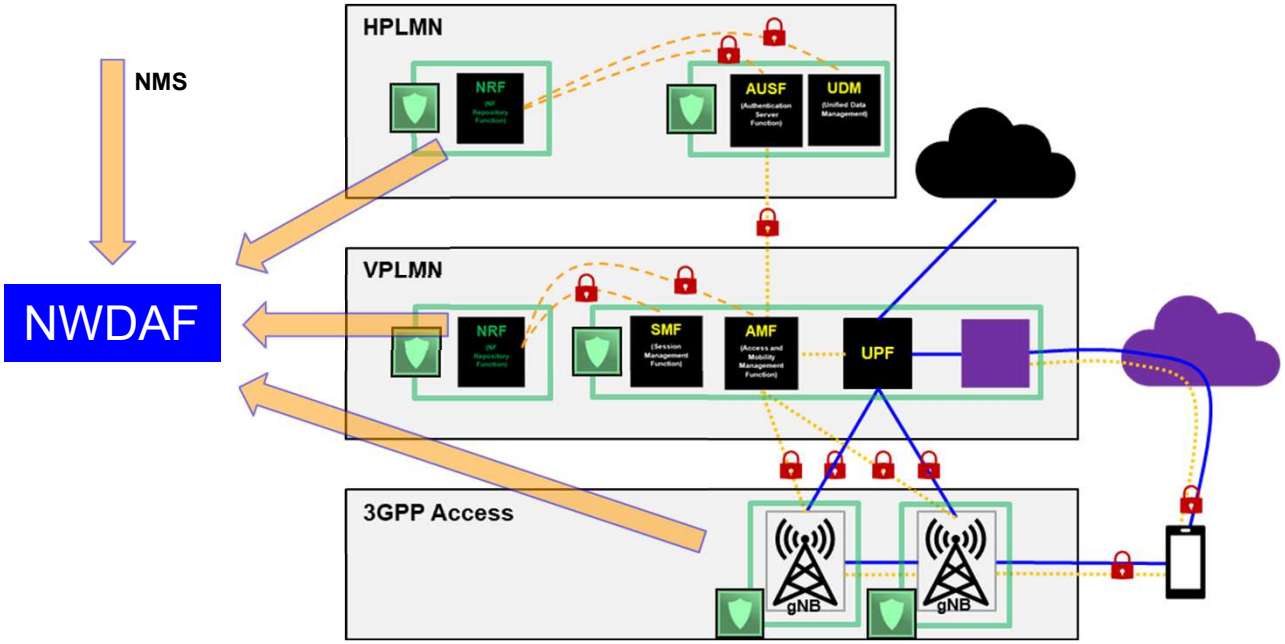
Samsung 5G Core's Cloud Native Enabled Architecture

james@jslab.kr

2. 인프라

❖ **NRF의 Management Architecture**

- 인증 (Authentication framework), 가입자 프라이버시 (Subscriber privacy)
- SBA(Service based architecture) 와 보안 연결
- User Plane의 통합 보안 고려
- NWDAF: Network Data Analytics Function

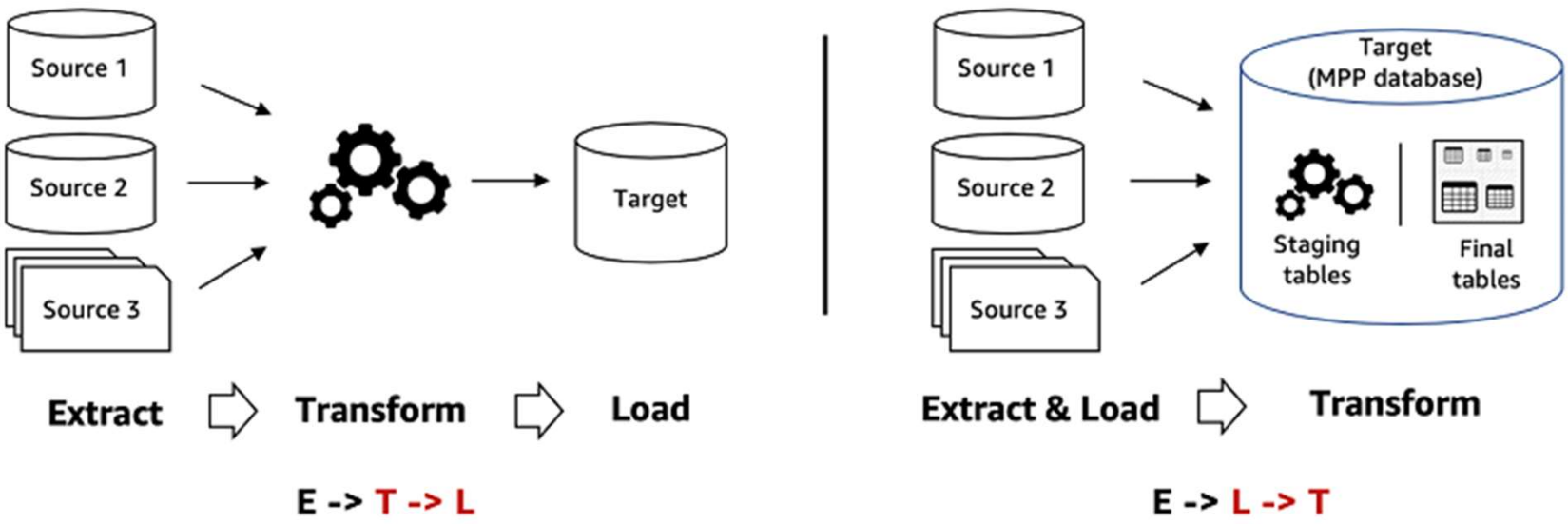


james@jslab.kr

2. 인프라

❖ From ETL to ELT

- Extraction
- Transformation (Data Cleaning)
- Loading and Refreshing



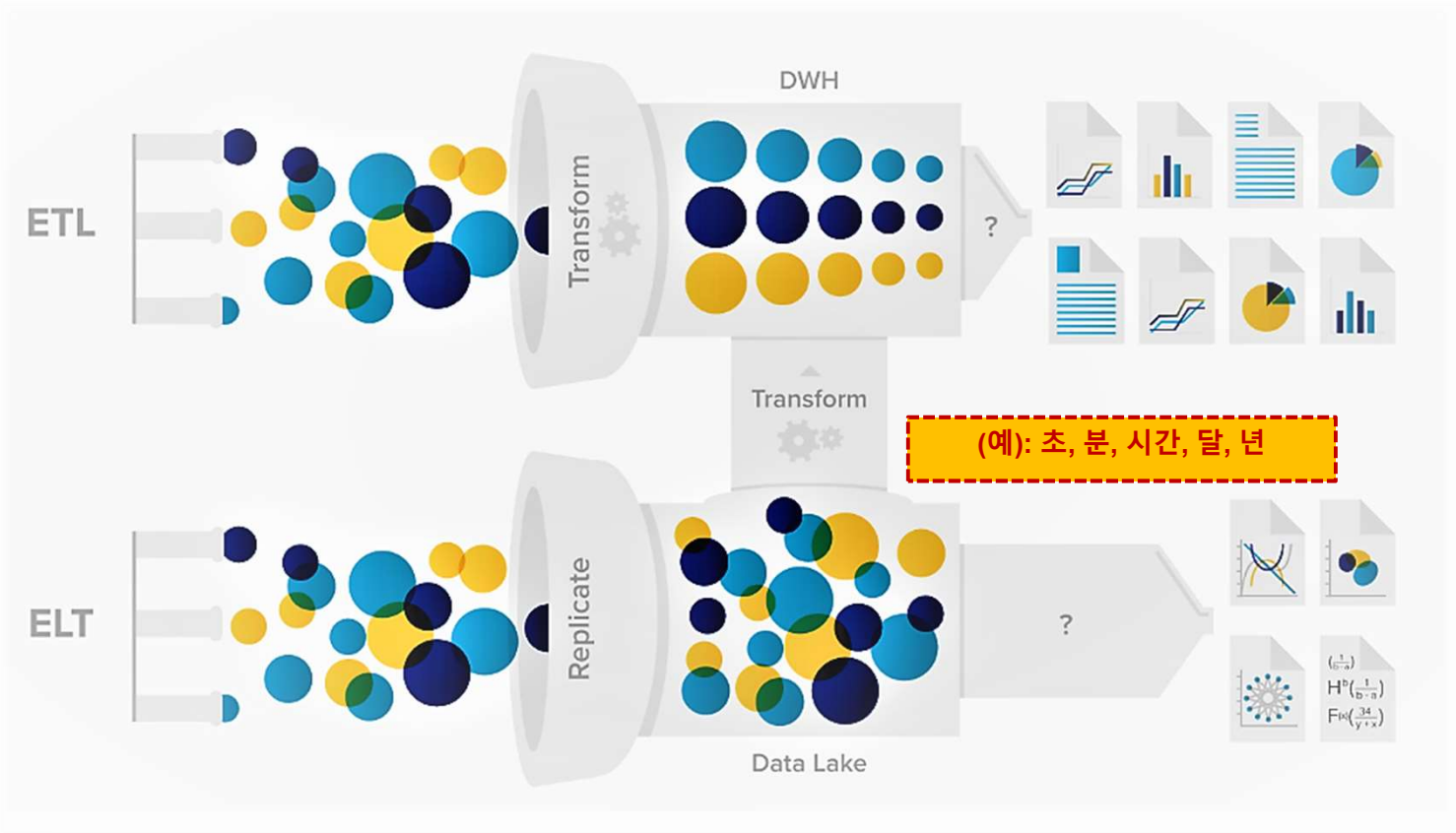
https://aws.amazon.com/blogs/big-data/etl-and-elt-design-patterns-for-lake-house-architecture-using-amazon-redshift-part-1/

james@jslab.kr

2. 인프라

❖ Data Lake vs. Data Warehouse

- **Extraction**
- **Transformation (Data Cleaning)**
- **Loading and Refreshing**



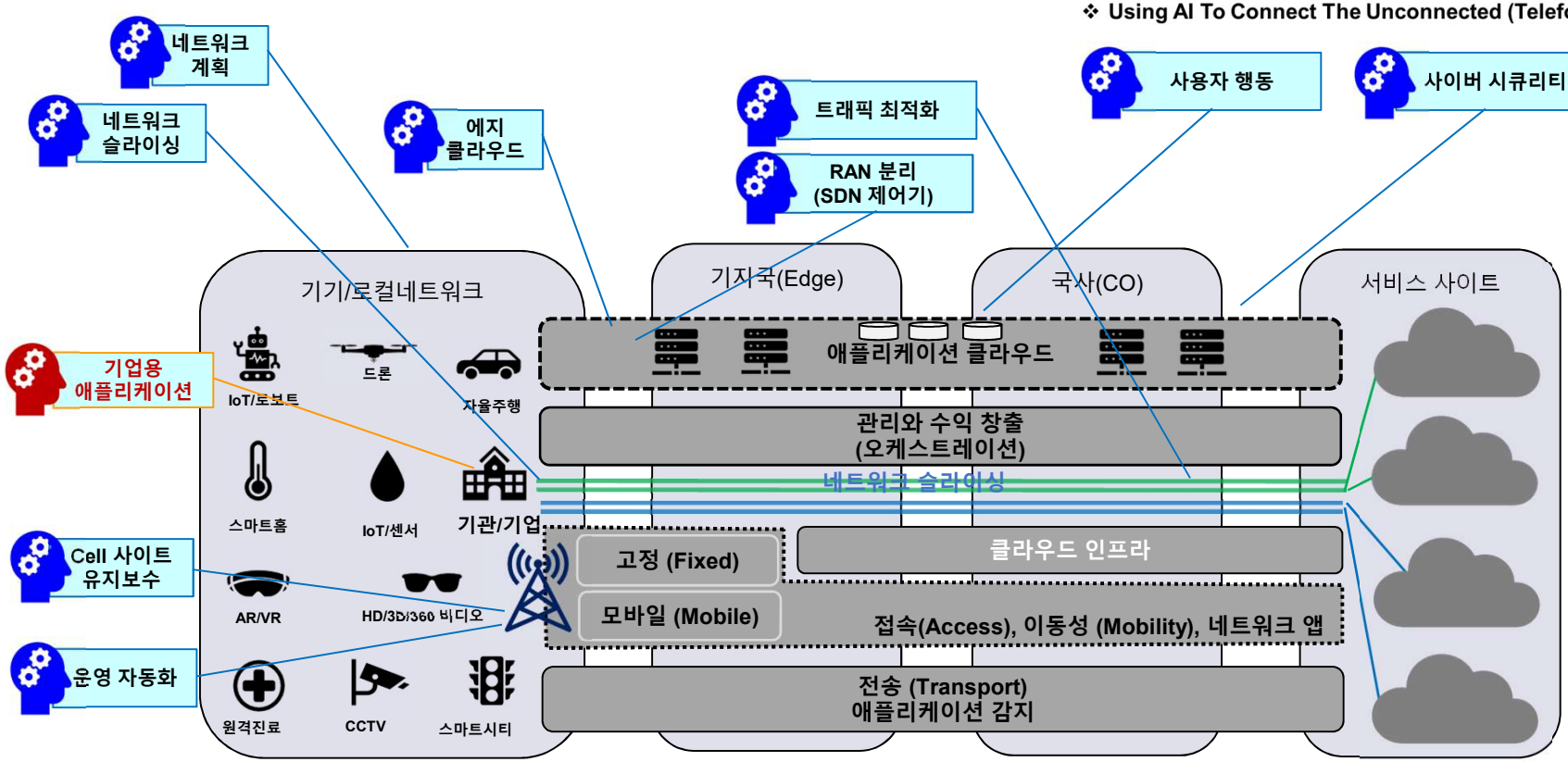
https://big2smart.com/data-lake-vs-data-warehouse-whats-the-difference-and-which-is-the-best-data-architecture/

james@jslab.kr

2. 인프라

- ❖ 복잡한 연관 관계 학습
- ❖ 전체/선택적 제어
- ❖ 사전 예방적 자동 모드 운영
- ❖ 새로운 비용 구조와 매출 기회

- ❖ AI.Ops네트워크 어슈런스 구현
- ❖ CNF 네트워크 어슈런스 구현 (Globe)
- ❖ AI.Ops 기반 장애 예측 관리 (통신사 다수)
- ❖ ML 기반 지원 스마트 시티 IoT 플랫폼(VzW)
- ❖ Telco 데이터레이크 (통신사 다수)
- ❖ 고객 경험 관리를 위한 데이터 저장 (레퍼런스 아키텍쳐)
- ❖ 고객관리를 위한 SageMaker 활용(T-Mobile)
- ❖ 사기 감지(VF), 가입자 이탈 예측 (Telenor)
- ❖ Using ML To Assess Service Quality (Verizon)
- ❖ Using AI To Connect The Unconnected (Telefonica)



james@jslab.kr

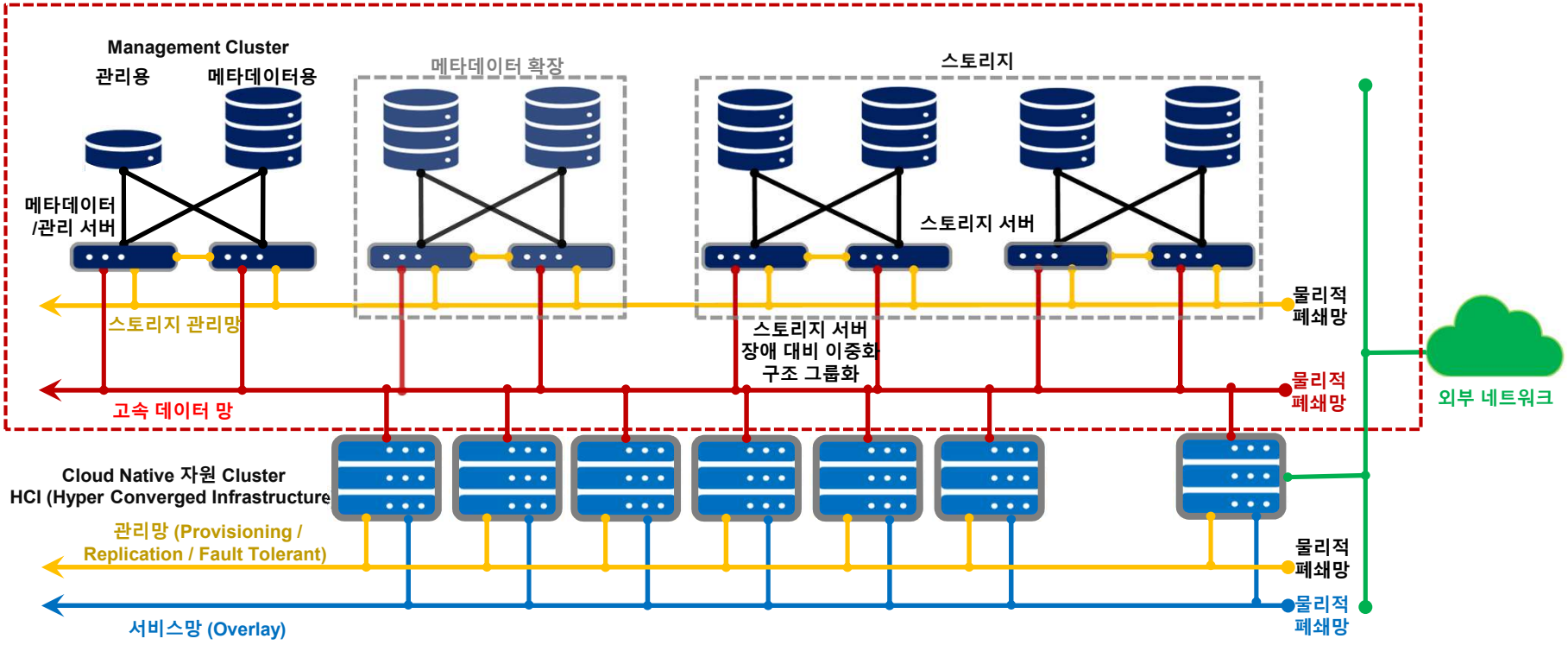
1. Market
2. 인프라
3. **오픈소스 프로젝트**
4. 퍼블릭 클라우드
5. Use case

james@jslab.kr

3. 오픈소스 프로젝트

❖ Lustre Storage for AI

- 병목 구간없이 저장 용량 확장 가능
- Data Lake 구축 기반 구성
- https://www.lustre.org/

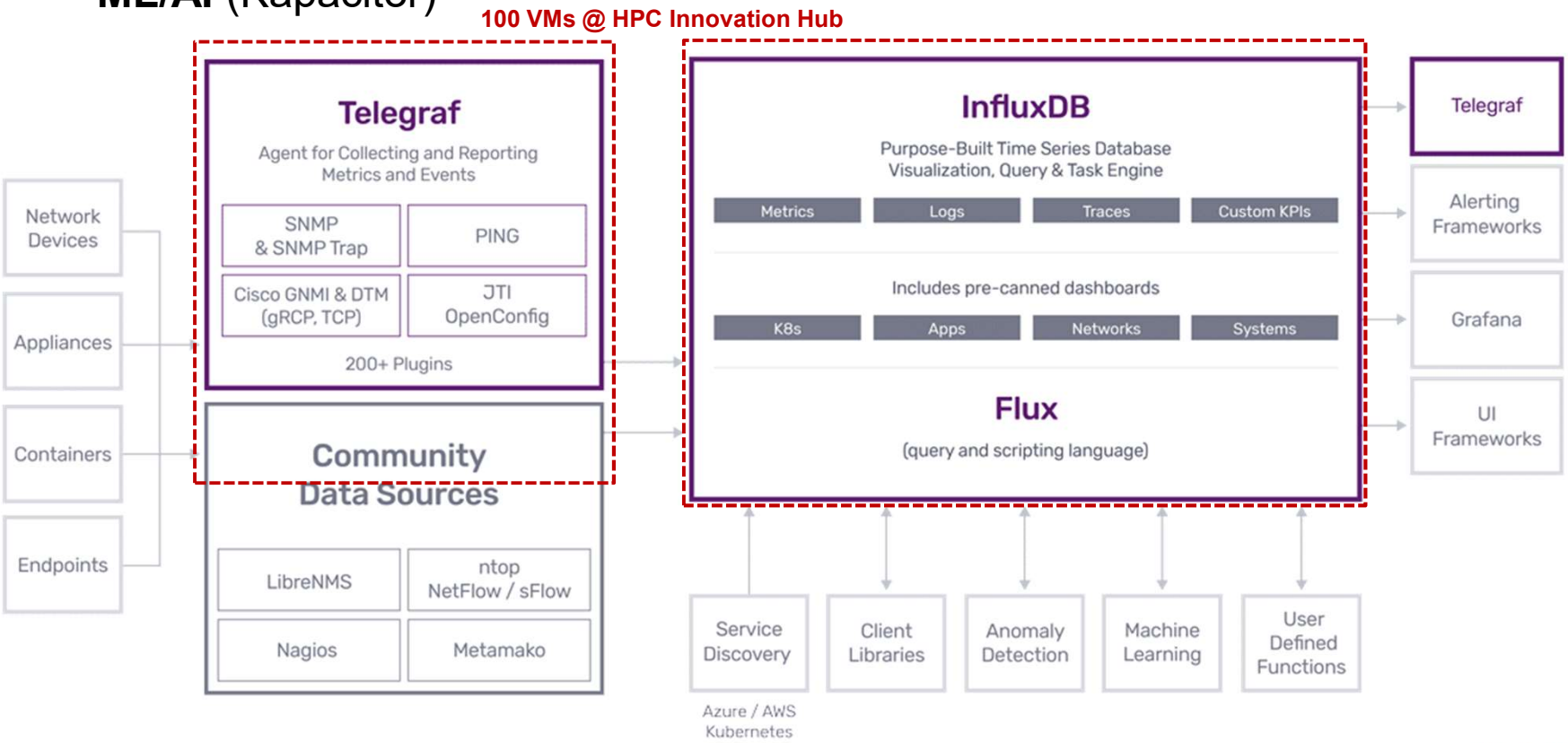


james@jslab.kr

3. 오픈소스 프로젝트

❖ Software Stack for Network Management and AI

- **Agent** (Telegraf)
- **DB** (InfluxDB)
- **UI** (Chronograf or Grafana or Dev.)
- **ML/AI** (Kapacitor)



https://www.influxdata.com/solutions/network-monitoring/

james@jslab.kr

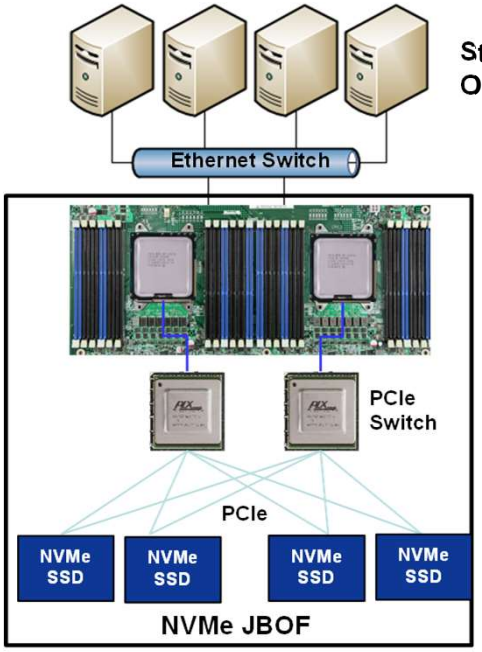
3. 오픈소스 프로젝트

❖ NVMe-oF SSD based EBOF

- **NVMe-oF (NVMe over Fabrics)**
- **EBOF (Ethernet Bunch of Flash)**

JBOF (just a bunch of flash)

Conventional NVMe JBOF

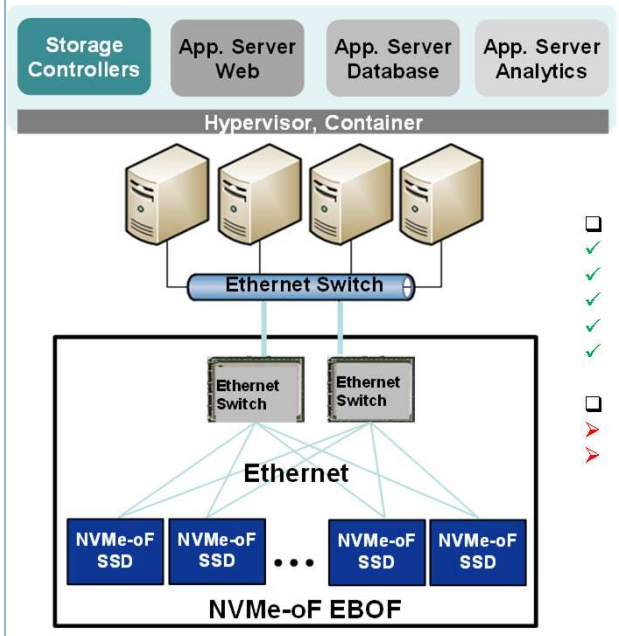


❑ **Pros**
- ✓ Enables disaggregation of NVMe SSDs
- ✓ Management & Storage Services
- ✓ Utilizing existing storage & server architectures

❑ **Cons**
- ➢ Non-scalable Storage Controller - PCIe single root constraint
- ➢ Bandwidth Limitation
  - CPU, PCIe, Networking Constraints
- ➢ Power and Thermals

EBOF (Ethernet Bunch of Flash)

NVMe-oF EBOF



❑ **Pros**
- ✓ High Bandwidth
- ✓ Scaled Linearly (Ethernet)
- ✓ Sharable via NVMe-oF
- ✓ Less power
- ✓ Lower latency

❑ **Cons**
- ➢ New platform architecture
- ➢ Management of Storage Services & Network Devices

james@jslab.kr

3. 오픈소스 프로젝트

❖ 리눅스 재단 (Linux Foundation)

❖ 통신사와 통신관련 제조사들은 다양한 오픈소스 프로젝트에서 활동

- LF AI Foundation (인공지능)
- LF Edge Foundation (에지)
- LF Networking Fund (오픈소스 네트워킹)
- Hyperledger (블록체인)

LF AI

LF EDGE

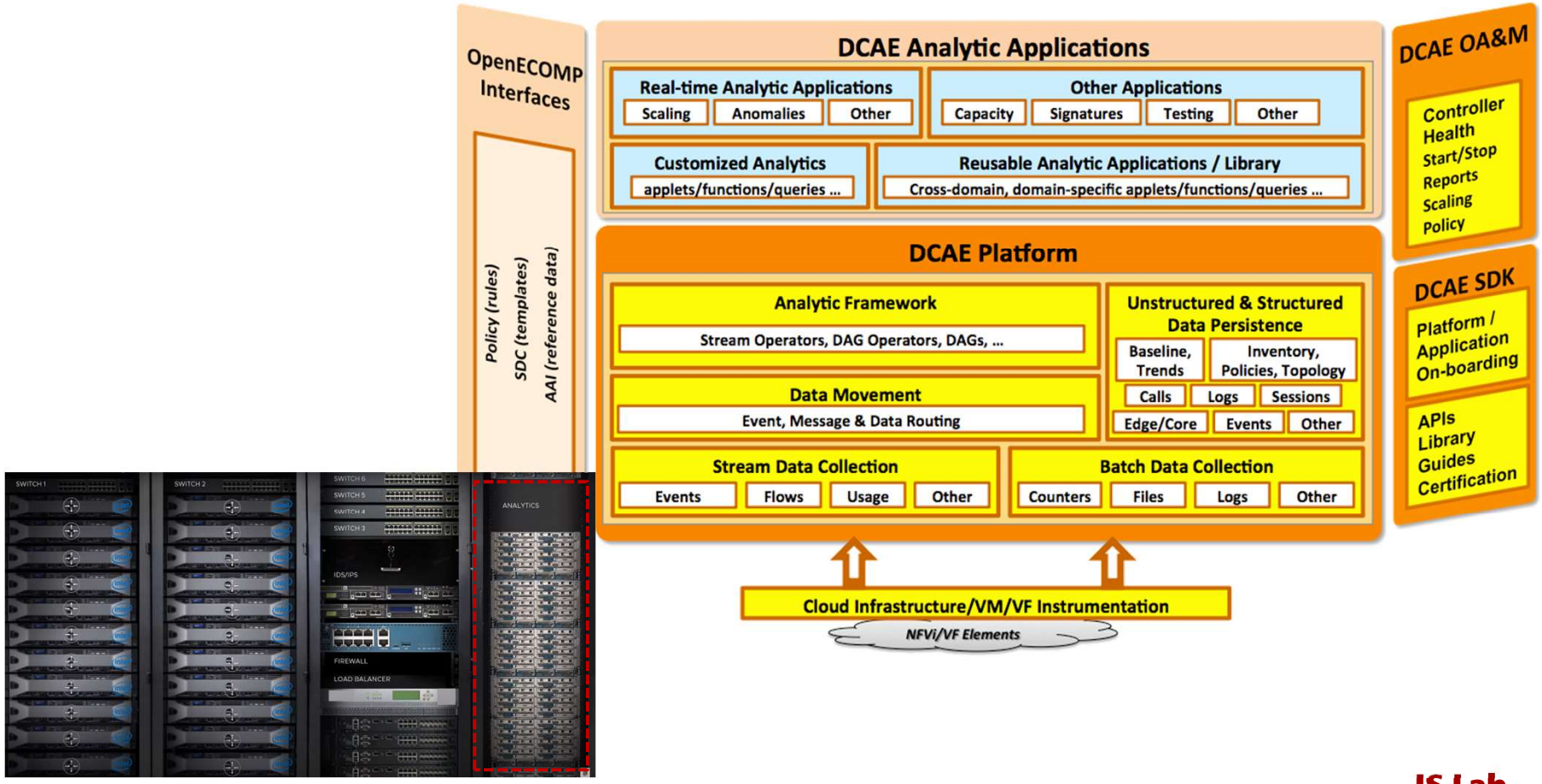
LF NETWORKING

HYPERLEDGER
BLOCKCHAIN TECHNOLOGIES FOR BUSINESS

james@jslab.kr

3. 오픈소스 프로젝트

- ONAP(Open Network Automation Platform)
- DCAE(Data Collection Analytics and Events Project)

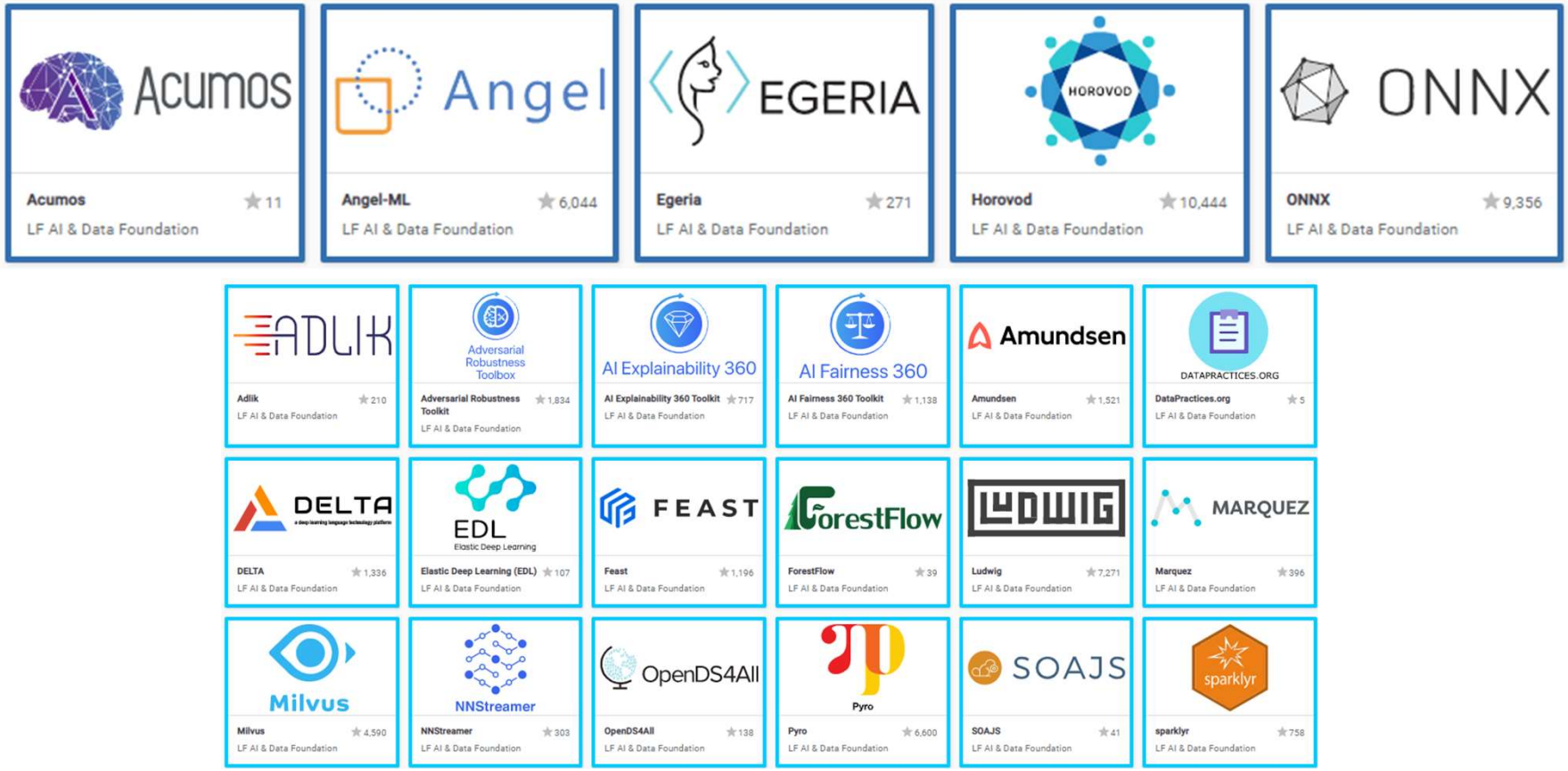


james@jslab.kr

3. 오픈소스 프로젝트

❖ **LF AI Foundation (인공지능)**

- 실시간 데이터 처리
- 분산 환경



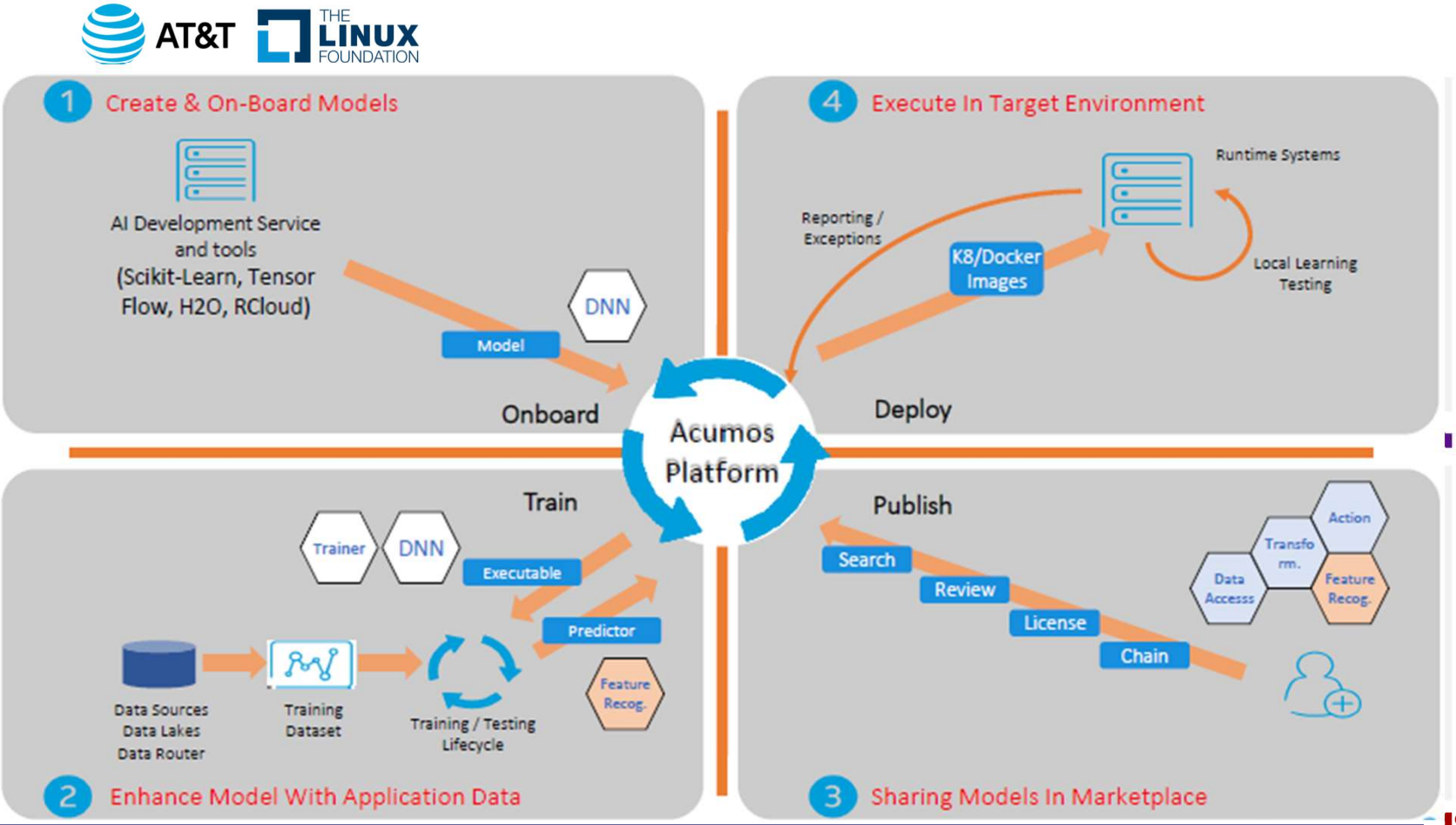
출처: https://landscape.lfai.foundation/

james@jslab.kr

3. 오픈소스 프로젝트

❖ **ACUMOS**

- **An Open Source AI Machine Learning Platform**
- **By AT&T and The Linux Foundation**

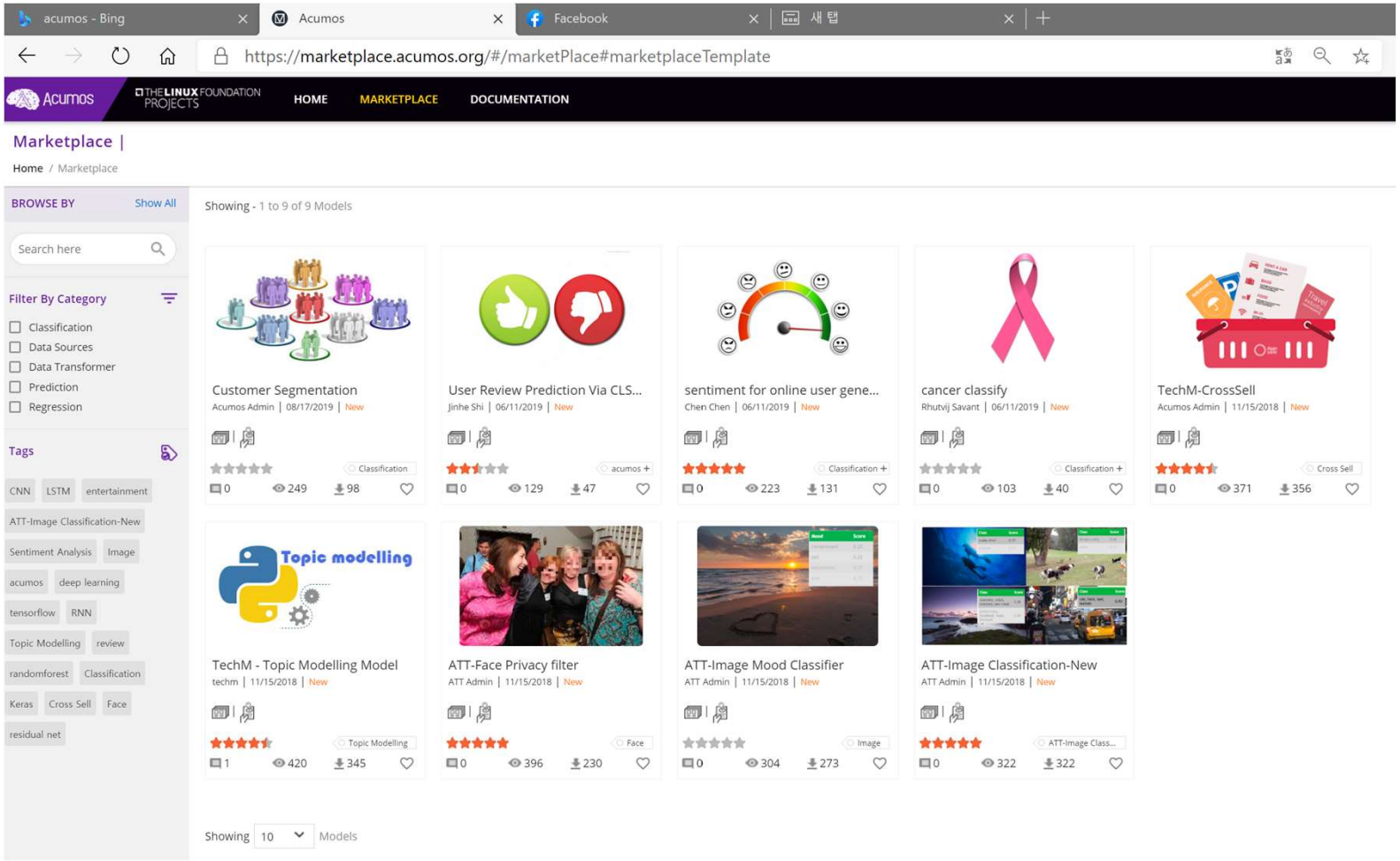


출처: https://www.acumos.org/wp-content/uploads/sites/61/2018/03/acumos_open_source_ai_platform_032518.pdf

james@jslab.kr

3. 오픈소스 프로젝트

❖ ACUMOS Marketplace

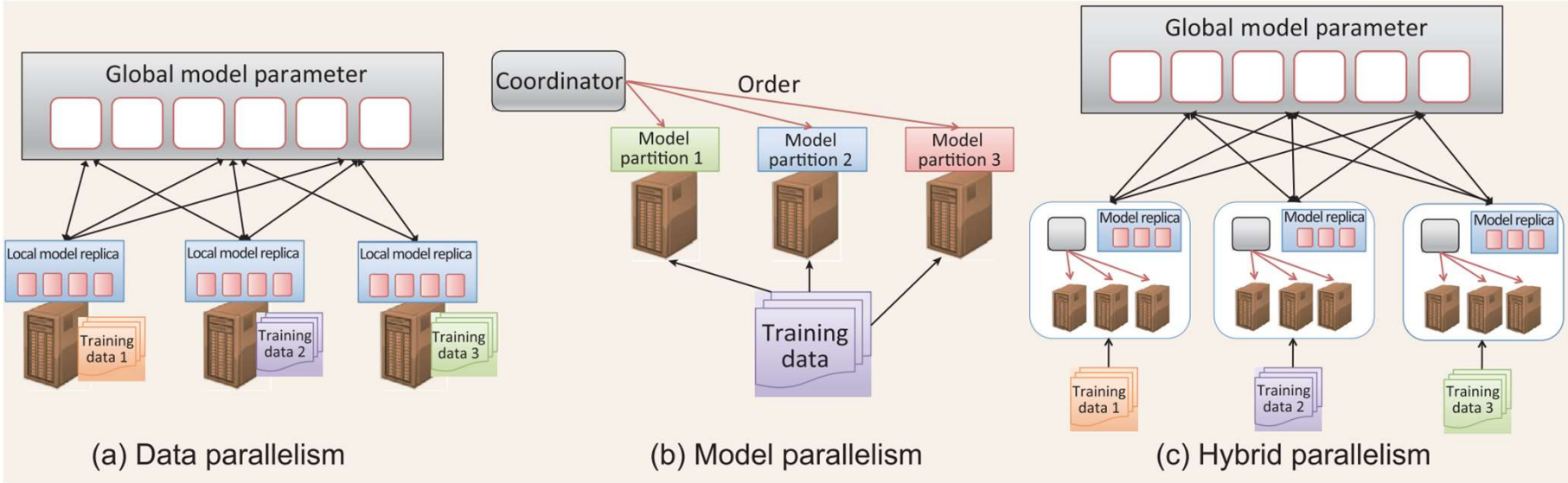


james@jslab.kr

3. 오픈소스 프로젝트

❖ **Angel: distributed ML**

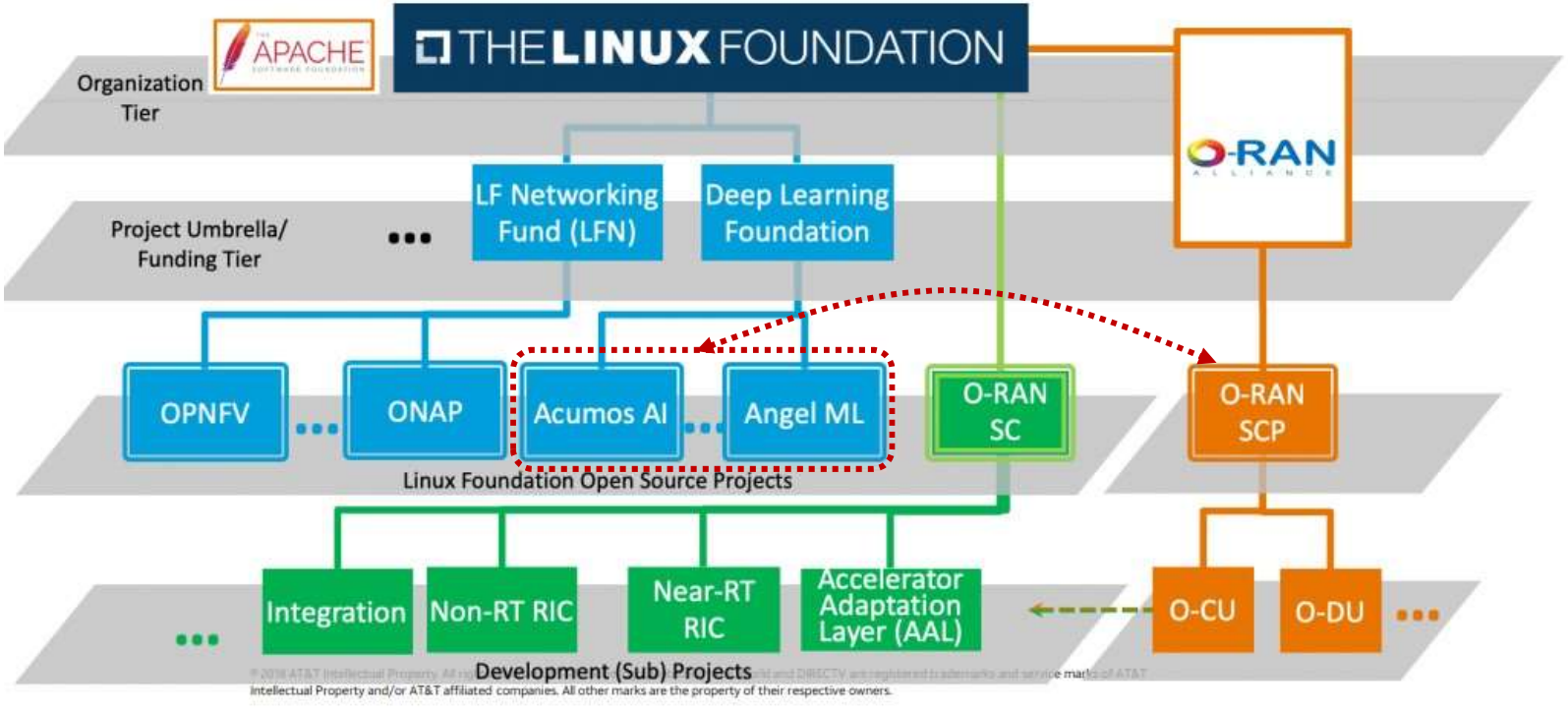
- **Data parallelism**
- **Model parallelism**
- **Hybrid parallelism**



james@jslab.kr

3. 오픈소스 프로젝트

❖ **Acumos and Angel @ RAN**



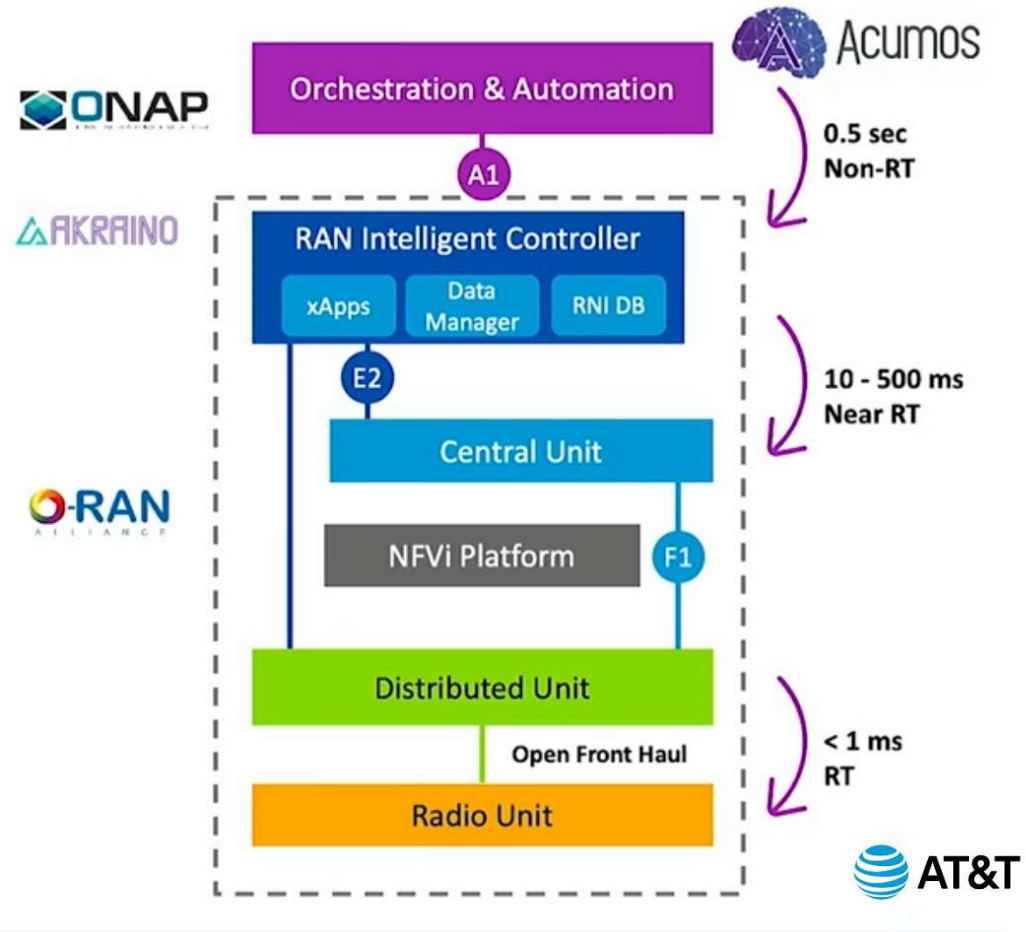
AT&T

james@jslab.kr

3. 오픈소스 프로젝트

❖ **Disaggregate RAN**

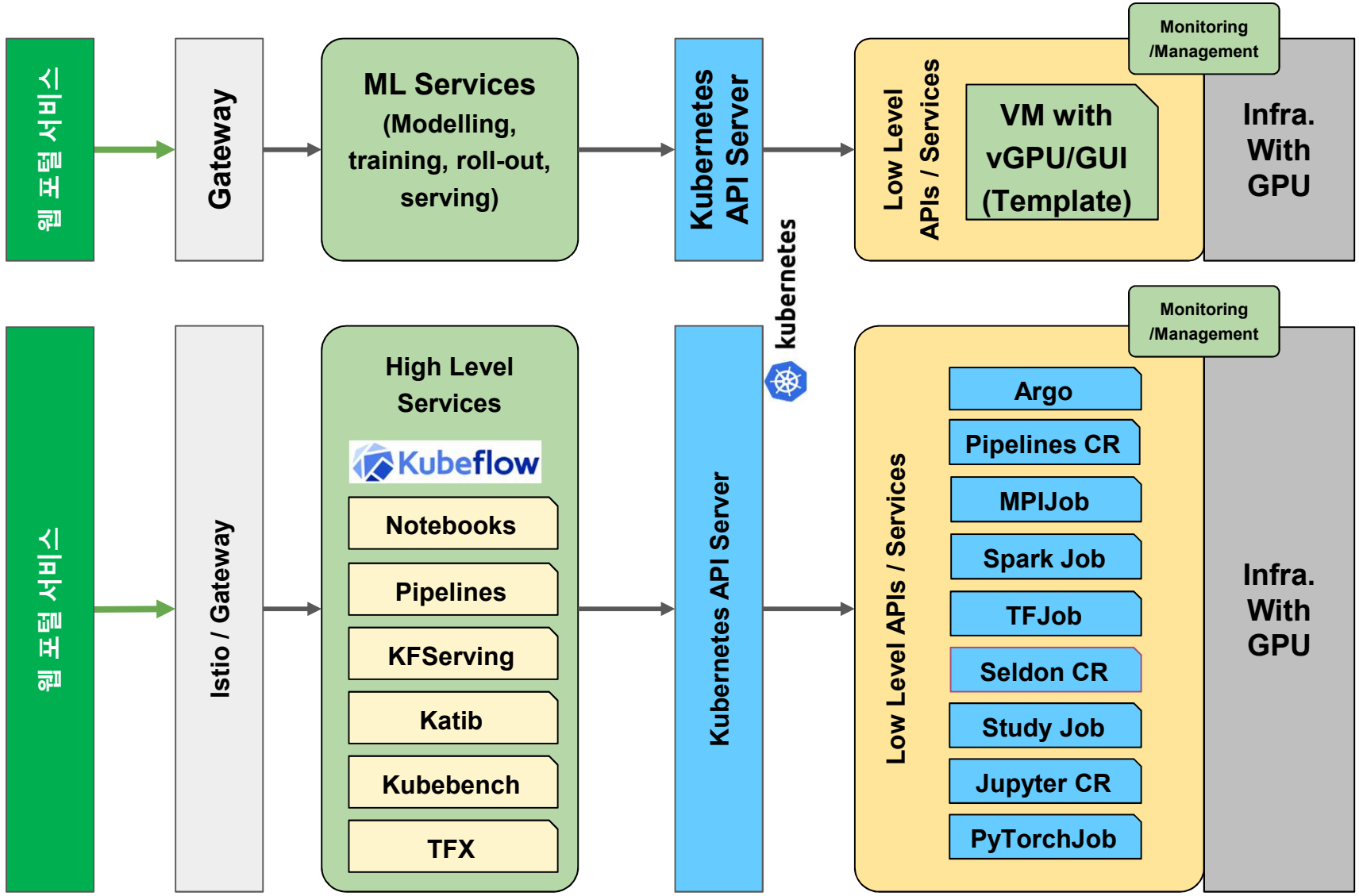
- **Ex.) 무선 접속 장비 DDoS 공격 탐지 후 즉시 차단**



LF AI 졸업 프로젝트

james@jslab.kr

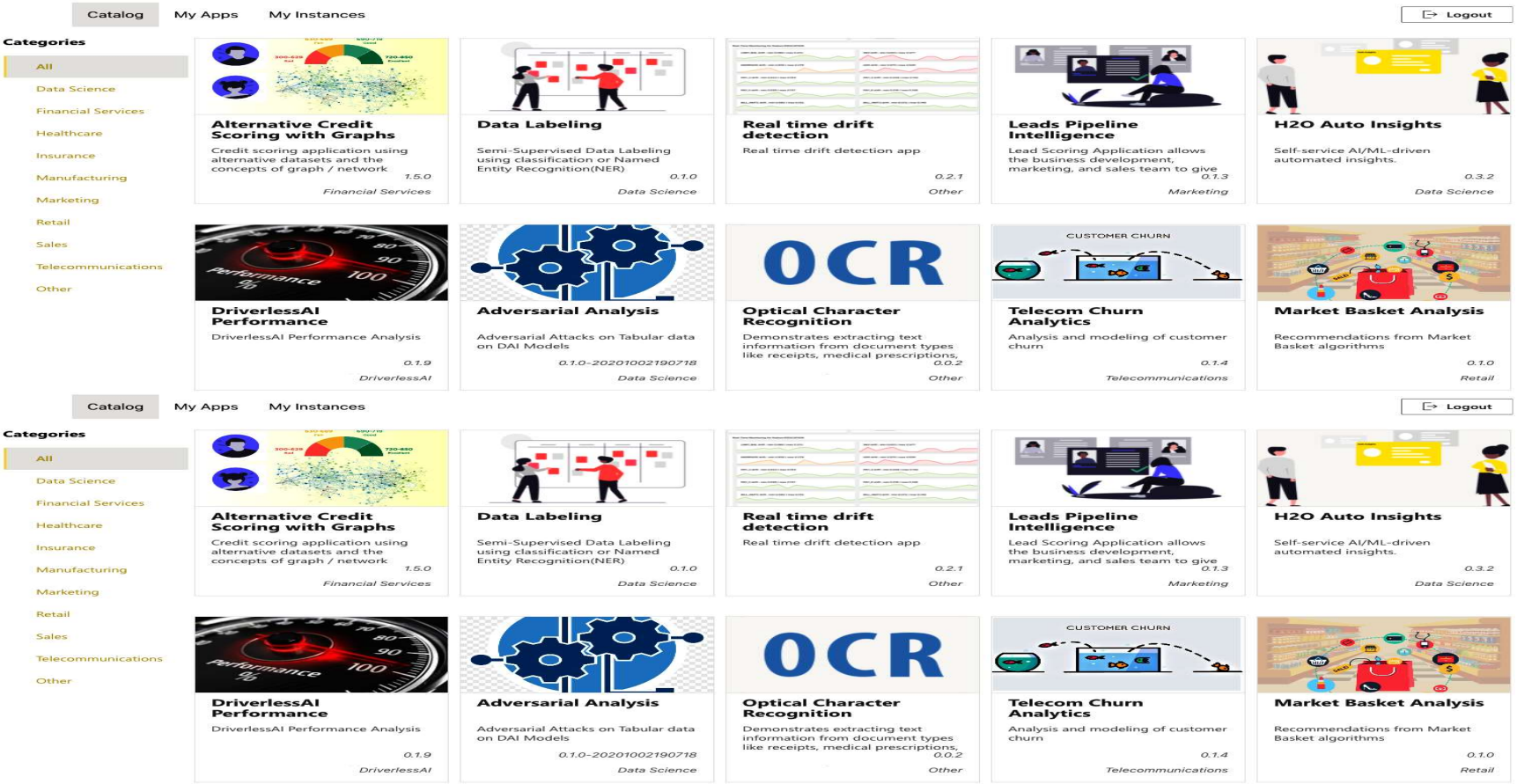
3. 오픈소스 프로젝트



james@jslab.kr

3. 오픈소스 프로젝트

❖ H2O



james@jslab.kr

1. Market
2. 인프라
3. 오픈소스 프로젝트
4. **퍼블릭 클라우드**
5. Use case

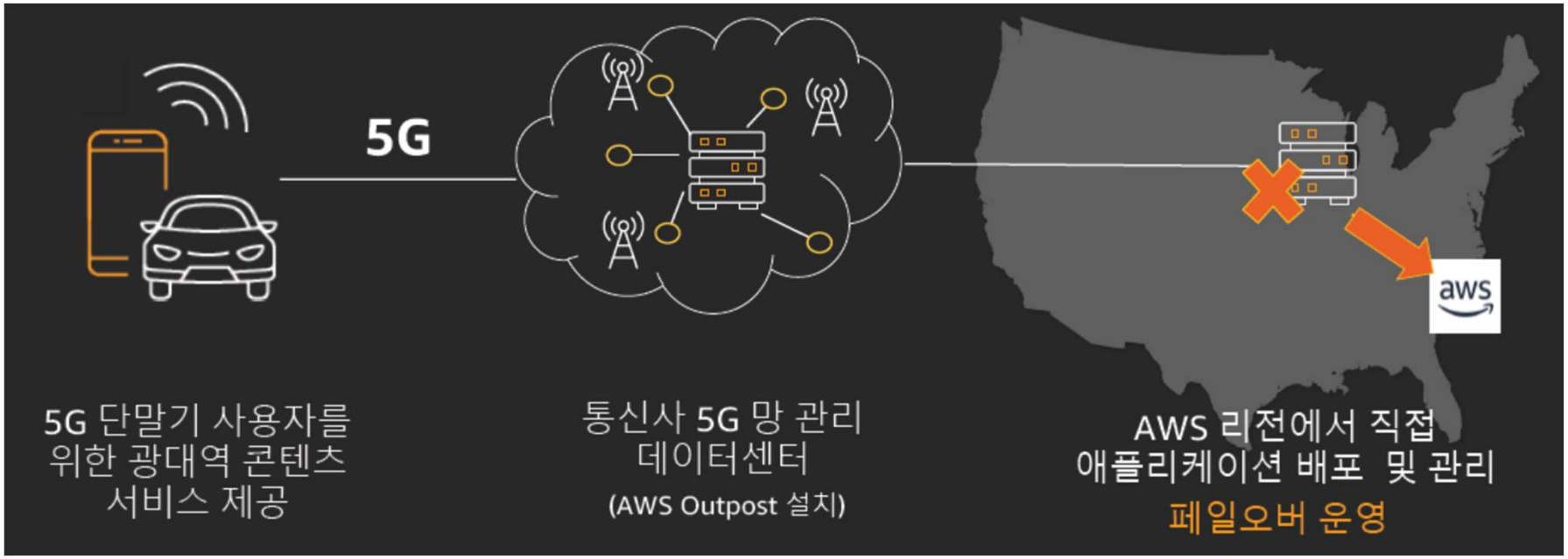
james@jslab.kr

4. 퍼블릭 클라우드

❖ Amazon AWS Outpost Wavelength

- 5G 네트워크 에지에서 AWS 커퓨팅 및 스토리지를 사용하여, 5G 기반 모바일 기기 및 사용자에게 초저지연 서비스를 제공하는 애플리케이션 제공 가능
- AWS 리전과 통신사 5G 망을 직접연결
- 로컬 컴퓨팅, 스토리지, 데이터베이스 및 기타 서비스제공
- 5G 기반 새로운 모바일 앱 제공

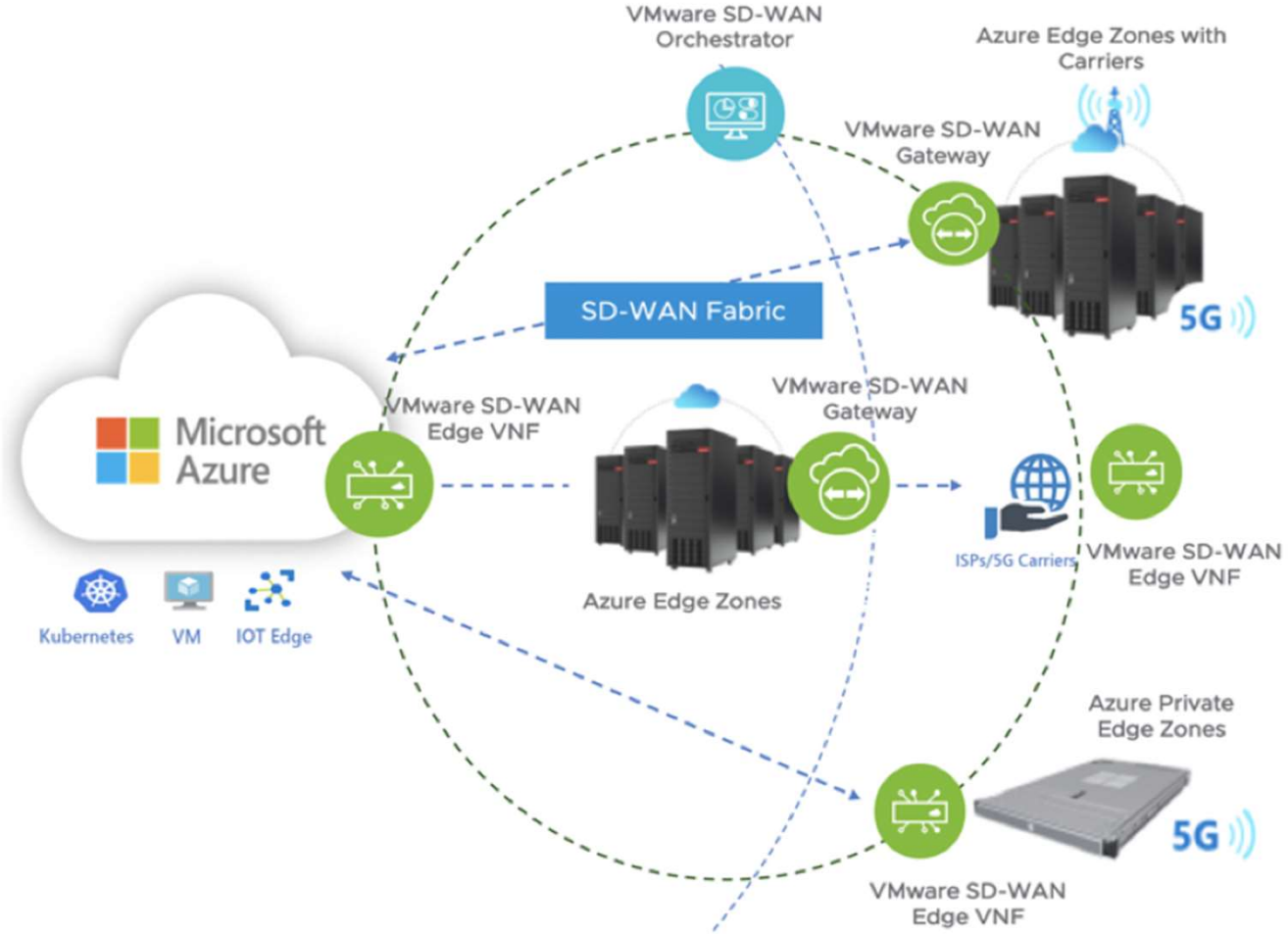
출처: AWS re:Invent 2019



james@jslab.kr

4. 퍼블릭 클라우드

❖ **Microsoft Azure Edge Zones: 5G 통신사와 연결하여 기업에 설치하는 사설망 구성**



출처: https://blogs.vmware.com/velocloud/2020/03/31/vmware-to-deliver-networking-solutions-with-azure-edge-zones/

james@jslab.kr

4. 퍼블릭 클라우드

❖ Comparison shopping of vision API providers

Comparison shopping of vision API providers (as of Aug. 2019)

	Algorithmia	Amazon Rekognition	Clarifai	Microsoft Cognitive Services	Google Cloud Vision	IBM Watson Visual Recognition
Image classification	✓	✓	✓	✓	✓	✓
Image detection	✓	✓		✓	✓	
OCR	✓	✓		✓	✓	
Face recognition	✓	✓		✓		
Emotion	✓		✓	✓	✓	
Logo recognition			✓	✓	✓	
Landmark recognition			✓	✓	✓	✓
Celebrity	✓	✓	✓	✓	✓	✓
Multilingual tagging			✓			
Image description				✓		
Handwriting				✓	✓	
Thumbnail generation	✓			✓	✓	
Content moderation	✓	✓	✓	✓	✓	
Custom classification training			✓	✓	✓	✓
Custom detector training				✓	✓	
Mobile custom models			✓	✓	✓	
Free tier	5,000 requests per month	5,000 requests per month	5,000 requests per month	5,000 requests per month	1,000 requests per month	7,500

O'REILLY

james@jslab.kr

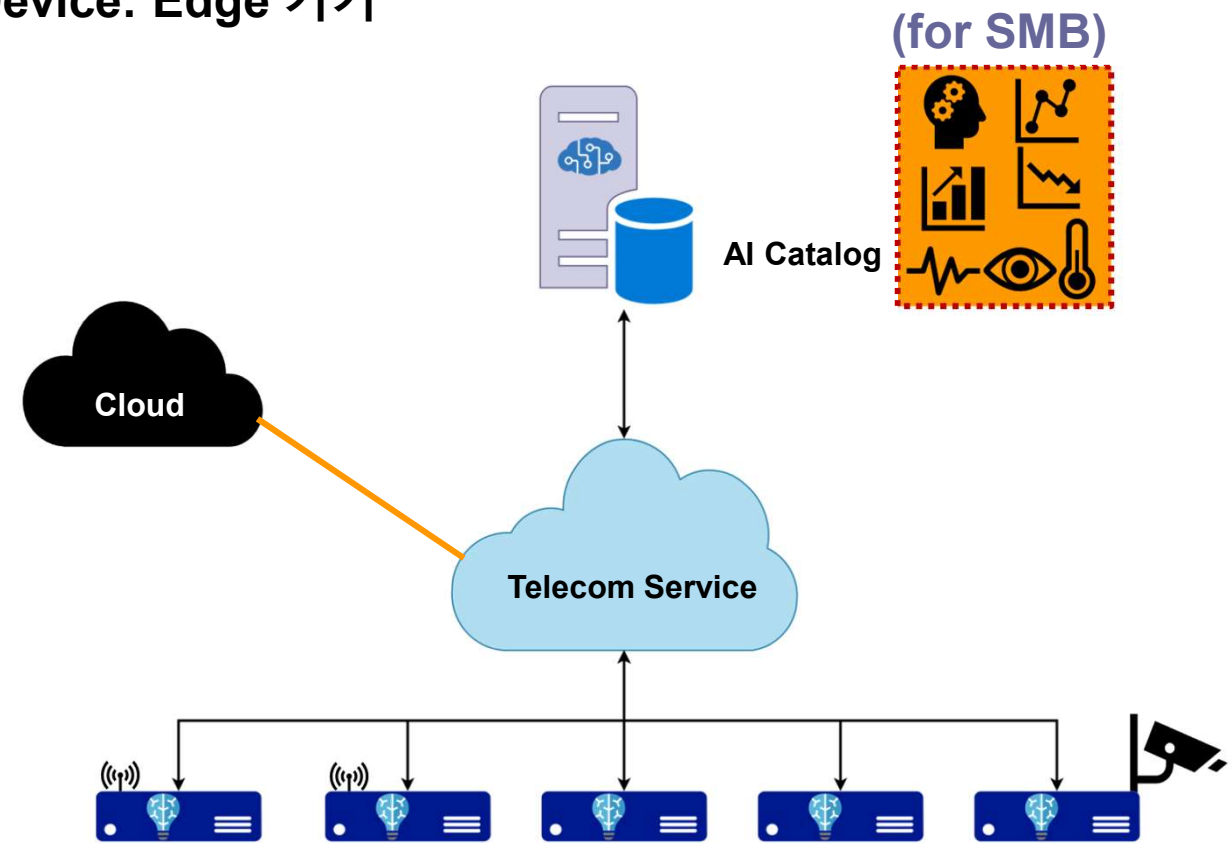
1. Market
2. 인프라
3. 오픈소스 프로젝트
4. 퍼블릭 클라우드
5. **Use case**

james@jslab.kr

5. Use Case

❖ **AI Service Platform 구성(예)**

- **AI Platform: 모델링 학습과 카탈로그 저장**
- **AI Catalog: AI 서비스 저장**
- **AI Device: Edge 기기**

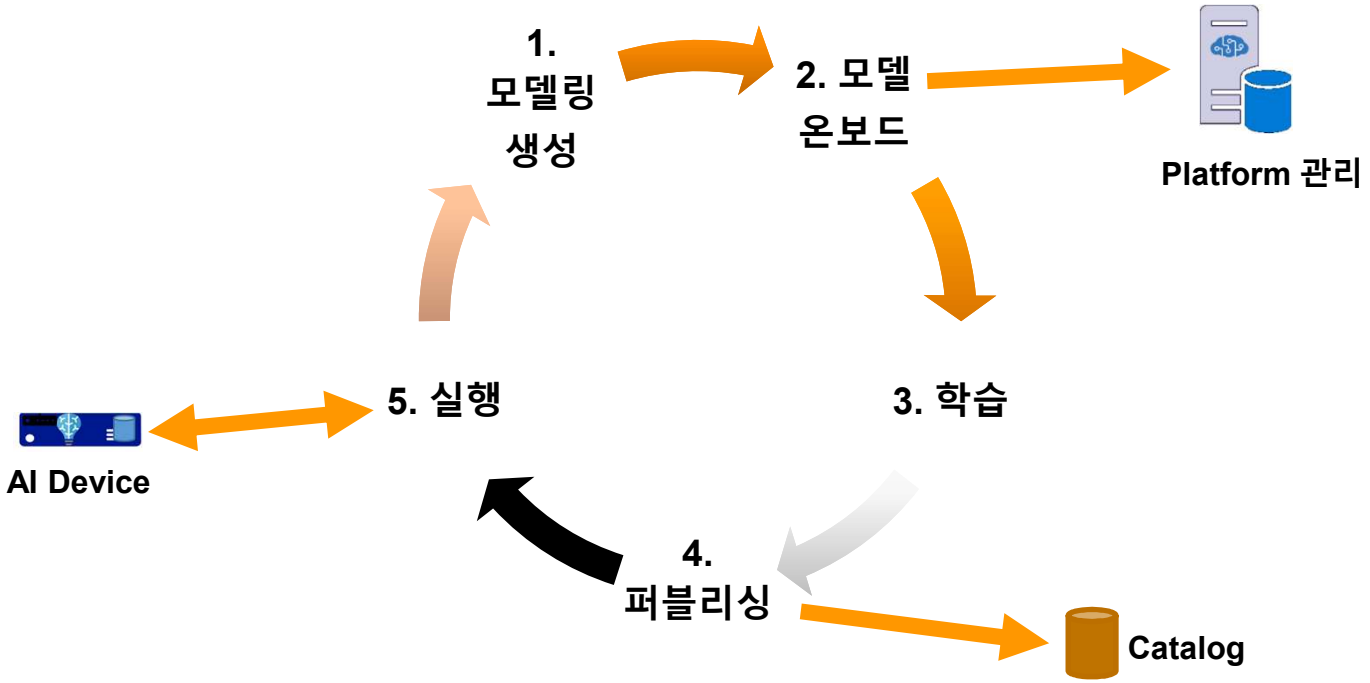


james@jslab.kr

5. Use Case

❖ 통신을 위한 AI Platform의 서비스 Architecture(예)

- 서비스 모델링 생성
- 모델링 온보드
- 학습
- 퍼블리싱
- 실행(기기 실행/재학습)



james@jslab.kr

감사합니다

james@jslab.kr