2020 IT 21
Global Conference
Digital New Deal
Technology Essentials
디지털 뉴딜 기술 핵심

Session 6-5

클라우드 기반 머신러닝 서비스 (Machine learning as a Service) 표준 기술

신성필 연구원 (ETRI)

[요약문]

서비스형 기계학습(Machine Learning as a Service, MLaaS)은 클라우드 컴퓨팅 서비스로 클라우드 환경에서 기계학습 프레임워크를 제공하는 서비스이다. 대표적으로 AWS의 Sagemaker, GCP의 AI Platform(구 ML engine), MS Azure의 ML studio가 있다.
기계학습의 개발 과정은 일반적으로 '학습 데이터의 수집 및 전처리', '기계학습 모델 학습', '학습된 모델 배포' 과정을 거치게 되는데, 특히 기계학습에 필요한 많은 양의 데이터 처리와 기계학습 모델 학습 과정에 한시적으로 많은 양의 컴퓨팅 파워가 필요한 특징이 있다. 클라우드 환경의 MLaaS는 탄력적 컴퓨팅 파워를 제공함으로써 기계학습 개발자, 혹은 사업자에게 저비용의 개발환경을 제공할 수 있는 장점이 있다.
ITU-T Y.3531(Cloud computing- Functional requirements for machine learning as a service)은 MLaaS를 위한 국제표준으로 클라우드 환경에서 기계학습 서비스의 개념 및 기능 요구사항을 제공하는 표준이다. 특히, 기계학습 서비스, 프레임워크, 생태계, 시스템 구조의 정의를 제공하고, 클라우드 컴퓨팅 환경에서 기계학습 프레임워크가 동작하는 상세 유즈케이스와 함께 MLaaS의 필요한 상세 기능 요구사항을 제공한다.

[발표자 약력]

2013년 고려대학교 컴퓨터·통신공학 학사
2013년 고려대학교 뇌인지과학 학사
2015년 고려대학교 컴퓨터·전파통신공학 공학석사
2015년~ ETRI 연구원
관심분야 : 머신러닝, 인공지능, 클라우드 컴퓨팅, 뇌기계 인터페이스, 통신 신호처리

AI
클라우드 기반 머신러닝
서비스 표준 기술
한국전자통신연구원 표준연구본부
지능정보표준연구실
신성필
ETRI

Speaker Introduction

아바타 (2009)

https://www.youtube.com/watch?v=jXpjRwPQC5Q

https://www.youtube.com/watch?v=8nud2RrJTfA&t=6s

학습과 기억(2011)

Speaker Introduction

[2017-2020] : [SG13] : [Q17/13]

[Declared patent(s)] - [Associated work]

Work item: Y.3531 (ex Y.MLaaS-reqts)
Status: Consented on 2020-07-31
Approval process: AAP
Type of work item: Supplement
Version: New
Provisional name: Y.MLaaS-reqts
Equivalent number: -
Timing: 2020-Q4 (Medium priority)
Liaison: ITU-T SG16, SG17, SG20, JTC 1 SC 42, ETSI, IEEE
Supersedes: Cloud computing - Functional requirements for machine learning as a service
Summary: This Recommendation provides cloud computing requirements for machine learning as a service (MLaaS), which addresses requirements from use cases. Machine learning as a service is a cloud service category in which the capability provided to the cloud service customer is the provision and use of machine learning framework. Machine learning framework is a set of functionalities for provisioning machine learning data as well as training, deploying, and managing machine learning model. On the perspective of cloud computing service provisioning, this Recommendation provides the functional requirements for MLaaS to identify functionalities such as machine learning data pre-processing, machine learning model training, machine learning model testing, and etc. Also, this Recommendation aligned with the cloud computing reference architecture of [ITU-T Y.3502].
Comment: -
Base text(s): [TD 297-PLEN]
Contact(s): Sungjin Shin, Editor
Xiaohui He, Editor
ITU-T A.5 reference(s): -
[Submit new A.5 reference]
See guidelines for creating & submitting ITU-T A.5 justifications
First registration in the WP: 2019-07-03 13:08:04
Last update: 2020-08-05 18:40:01

클라우드 머신러닝 표준
ITU-T Y.3531(ex. Y.MLaaS-reqts)

[2017-2020] : [SG13] : [Q17/13]

[Declared patent(s)] - [Associated work]

Work item: Y.RaaS-reqts
Status: Under study
Approval process: AAP
Type of work item: Recommendation
Version: New
Provisional name: Y.RaaS-reqts
Equivalent number: -
Timing: 2023-Q2 (Medium priority)
Liaison: JTC 1/SC 42, ISO/TC 299, IEEE
Supersedes: Cloud Computing - Functional requirements for Robotics as a Service
Summary: This Recommendation provides the overview and functional requirements for robotics as a service (RaaS) in the cloud environment. This Recommendation addresses the following subjects: - Concept and overview of robotics service; - System context of robotics as a service; - Functional requirements for robotics as a service; - Use cases of robotics as a service.
Comment: -
Base text(s): [TD 612-WP2]
Contact(s): Sungjin Shin, Editor
Lanze Wu, Editor
ITU-T A.5 reference(s): -
[Submit new A.5 reference]
See guidelines for creating & submitting ITU-T A.5 justifications
First registration in the WP: 2020-08-05 20:33:33
Last update: 2020-08-05 20:36:58

클라우드 로보틱스 표준
ITU-T Y.RaaS-reqts

ITU-T

- ITU-T는 국제 표준화 기구인 ITU(International Telecommunication Union)에서 전기통신표준화부문(Telecommunication Standardization Sector)을 담당하는 기구
- 4년 주기로 유지되는 Study Period에서 구체적인 표준 영역을 구분함.
- 2017 ~2020의 Study Period에서는 총 11개의 SG을 운영하였으며, 현재 총회에서 Next Period를 위한 그룹 구조를 논의 중.

ITU-T Study Groups (Study Period 2017-2020)

YOU ARE HERE HOME > ITU-T > STUDY GROUPS > STUDY PERIOD 2017-2020

Standardization work is carried out by the technical Study Groups (SGs) in which representatives of the ITU-T membership develop Recommendations (standards) for the various fields of international telecommunications.

SG2 - Operational aspects
- SG2 at a Glance

SG3 - Economic and policy issues
- SG3 at a Glance

SG5 - Environment and circular economy
- SG5 at a Glance

SG9 - Broadband cable and TV
- SG9 at a Glance

SG11 - Protocols and test specifications
- SG11 at a Glance

SG12 - Performance, QoS and QoE
- SG12 at a Glance

SG13 - Future networks (& cloud)
- SG13 at a Glance

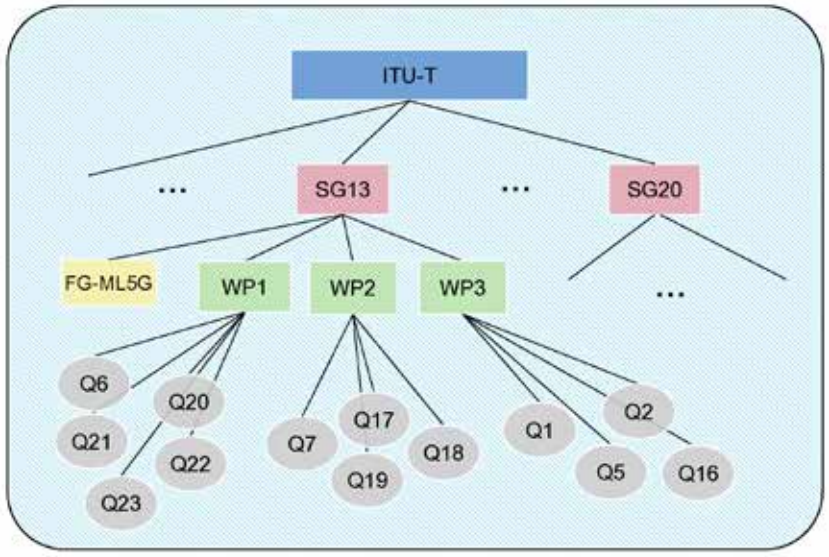
SG15 - Transport, access and home
- SG15 at a Glance

SG16 - Multimedia
- SG16 at a Glance

SG17 - Security
- SG17 at a Glance

SG20 - IoT, smart cities & communities
- SG20 at a Glance

ITU-T 그룹 구조



ITU-T의 표준 개발 그룹 구조 (SG13 중심)

- ITU-T 산하의 SG은 그룹별로 다양한 분야 및 산업영역의 국제표준을 개발 중
  * ex) SG13(Future network, Cloud computing), SG16(Multimedia), SG20(IoT, smart cities)
- SG 내부에는 세부 기술 항목을 담당하는 WP와 Q를 운영하여 회의를 진행.
- FG(Focus Group)은 산업/사회적인 영향력을 고려, 표준 필요성이 시급한 분야에 한해 단기적으로 운영
- ITU-T SG13 WP2는 클라우드 컴퓨팅을 표준을 담당하며, JTC 1와 교류하며 Y.3500, Y.3501, Y.3502 등의 표준을 개발.

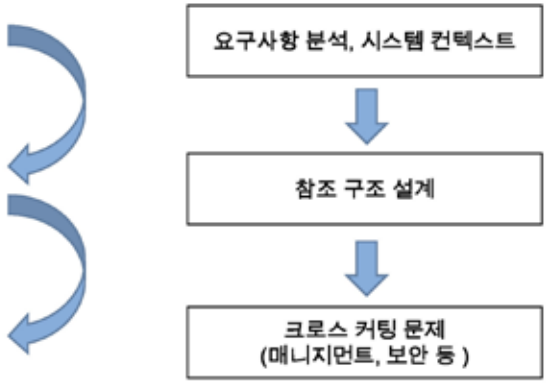
ITU-T SG13 WP2 (Cloud computing & Big data)

WP2 **Cloud Computing & Big Data**

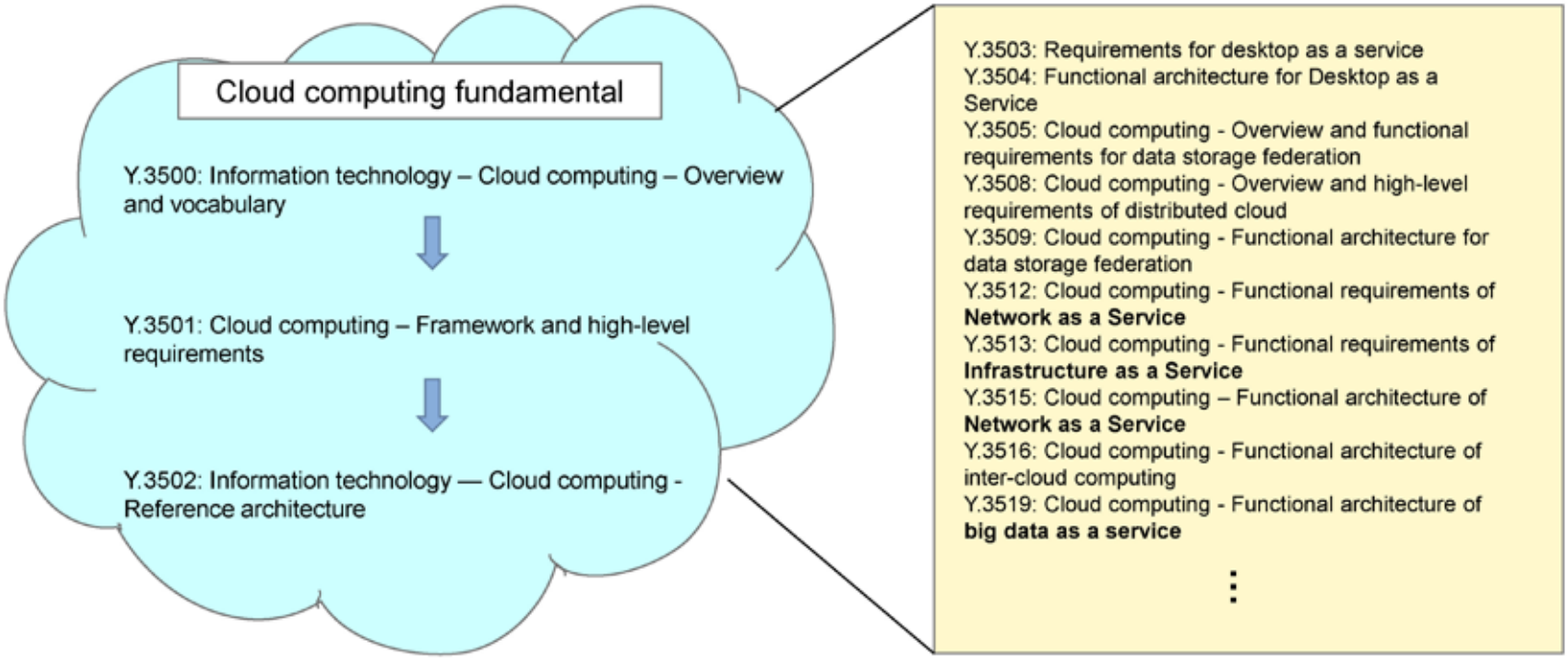
Q17 **Requirements, ecosystem, and general capabilities for cloud computing and big data**

Q18 **Functional architecture for cloud computing and big data**

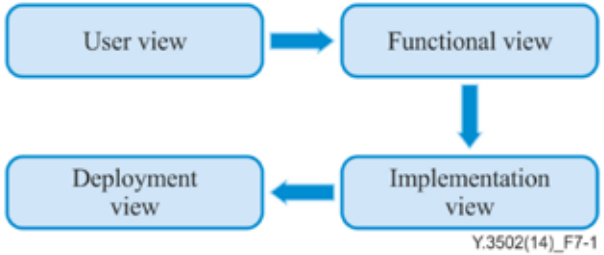
Q19 **End-to-end cloud computing management, cloud security and big data governance**



ITU-T Y.35xx series



Fundamental Concepts for ITU-T Y.35xx series



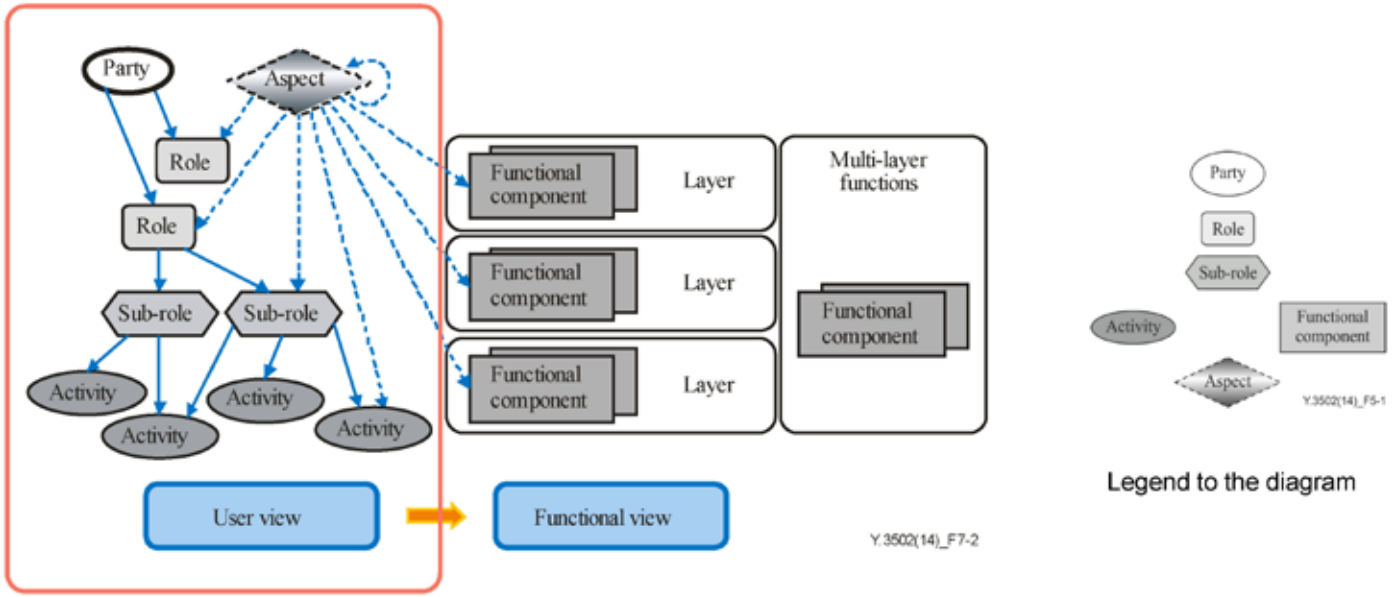
Y.3502(14)_F7-1

<Transformations between architectural views>

CCRA view	Description of the CCRA view	Scope
User view	The system context, the parties, the roles, the sub-roles and the cloud computing activities	Within scope
Functional view	The functions necessary for the support of cloud computing activities	Within scope
Implementation view	The functions necessary for the implementation of a cloud service within service parts and/or infrastructure parts	Out of scope
Deployment view	How the functions of a cloud service are technically implemented within already existing infrastructure elements or within new elements to be introduced in this infrastructure	Out of scope
NOTE – While details of the user view and functional view are addressed within this Recommendation | International Standard, the implementation and deployment views are related to technology and vendor-specific cloud computing implementations and actual deployments, and are therefore out of the scope of this Recommendation | International Standard.		

<Cloud computing reference architecture views in Y.3502>

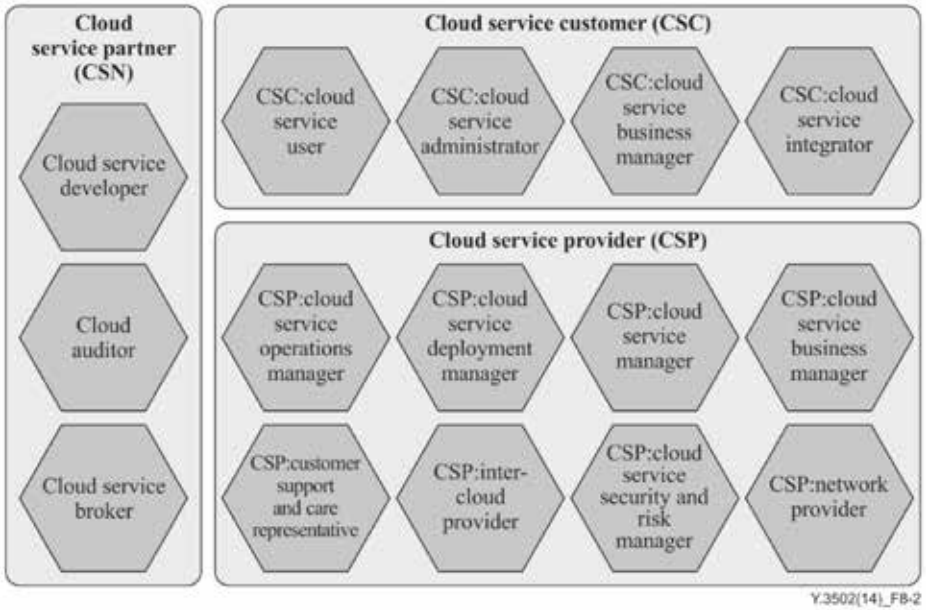
Fundamental Concepts for ITU-T Y.35xx series



<Transition from user view to functional view>

[Reference] ITU-T Y.3502 Information technology – Cloud computing – Reference architecture, 2014.08.

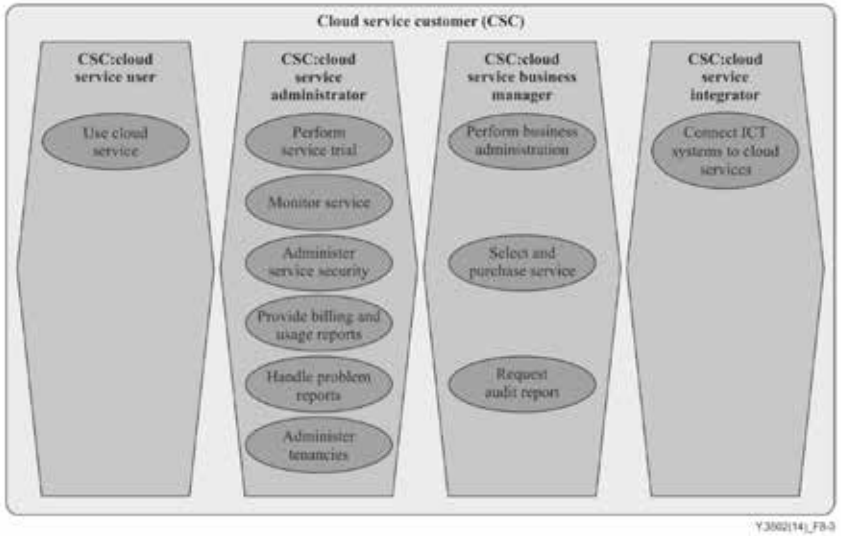
Fundamental Concepts for ITU-T Y.35xx series



<Cloud computing roles and sub-roles>

Legend to the diagram

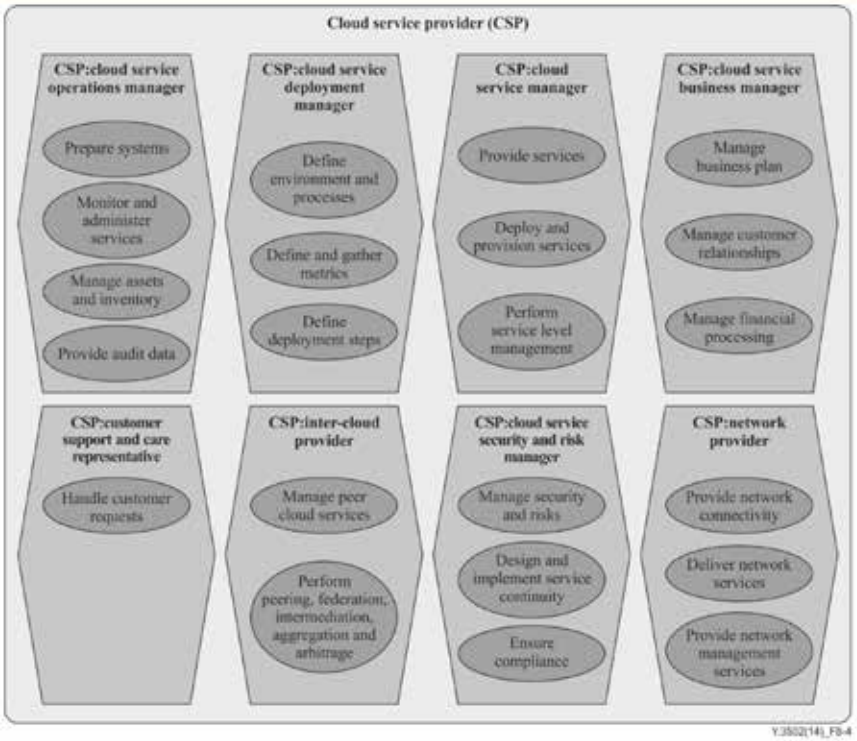
Fundamental Concepts for ITU-T Y.35xx series



Legend to the diagram

<Cloud computing activities relating to cloud service customer sub-roles>

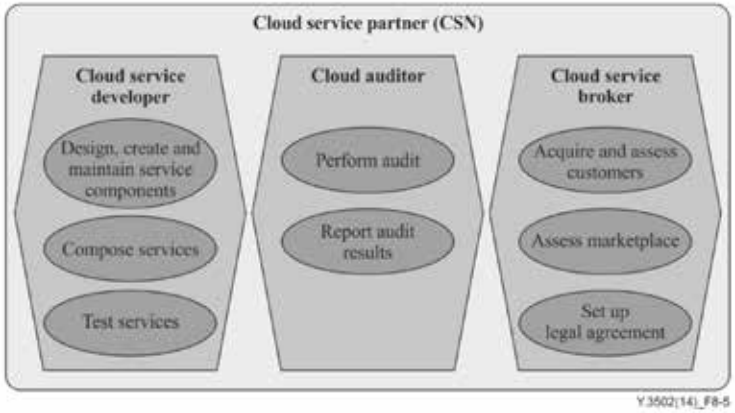
Fundamental Concepts for ITU-T Y.35xx series



<cloud computing activities relating to cloud service provider sub-roles>

Legend to the diagram

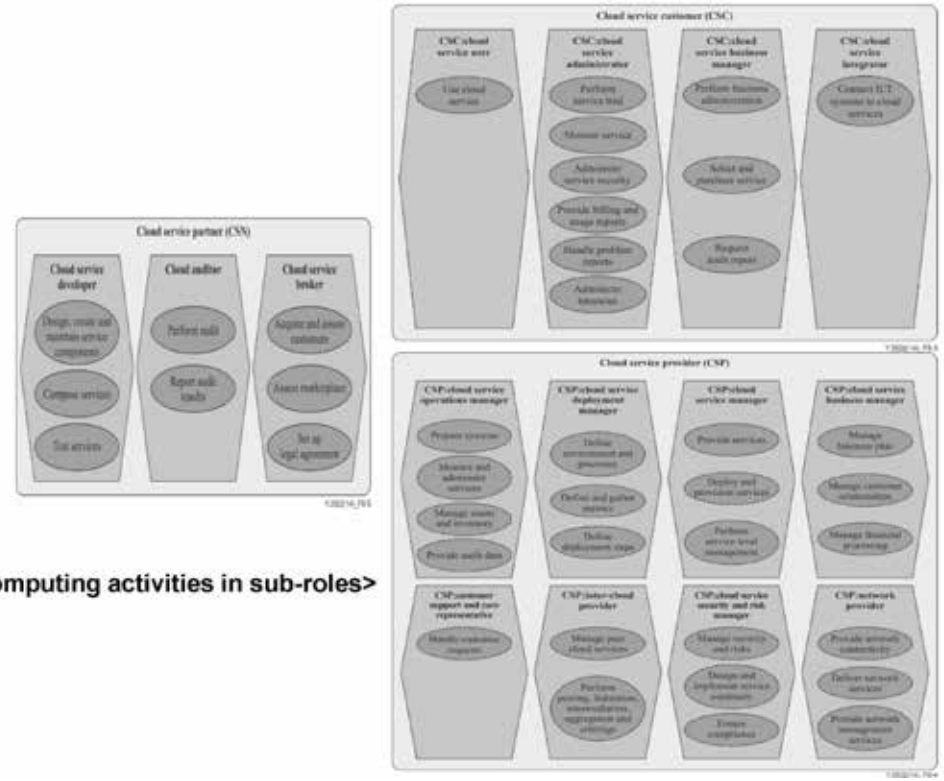
Fundamental Concepts for ITU-T Y.35xx series



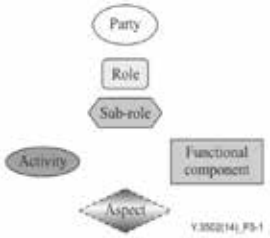
Legend to the diagram

<Cloud computing activities relating to cloud service partner sub-roles>

Fundamental Concepts for ITU-T Y.35xx series

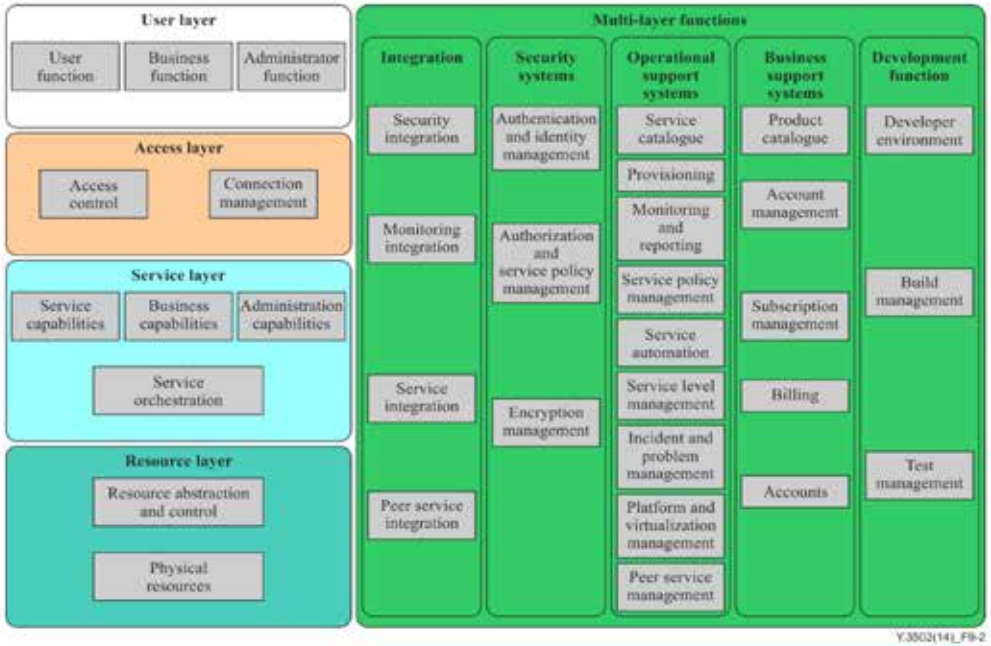


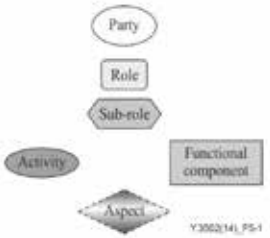
<Overall of cloud computing activities in sub-roles>



Legend to the diagram

Fundamental Concepts for ITU-T Y.35xx series





Legend to the diagram

<Functional components of the cloud computing reference architecture (CCRA)>

ITU-T Y.3531 : Standardization for MLaaS

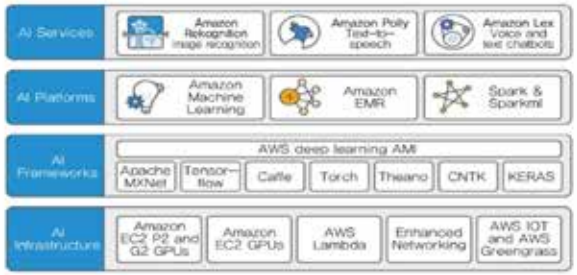
Machine Learning as a Service (MLaaS): A cloud service category in which the capabilities provided to the cloud service customer is the provision and use of machine learning framework

***Infrastructure as a service (IaaS):** Cloud service category in which the cloud capabilities type provided to the cloud service customer is an infrastructure capabilities type.

***Platform as a service (PaaS):** Cloud service category in which the cloud capabilities type provided to the cloud service customer is a platform capabilities type.

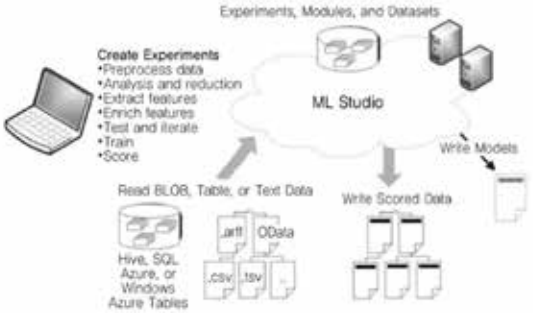
***Network as a service (NaaS):** Cloud service category in which the capability provided to the cloud service customer is transport connectivity and related network capabilities.

Global services of MLaaS in the field

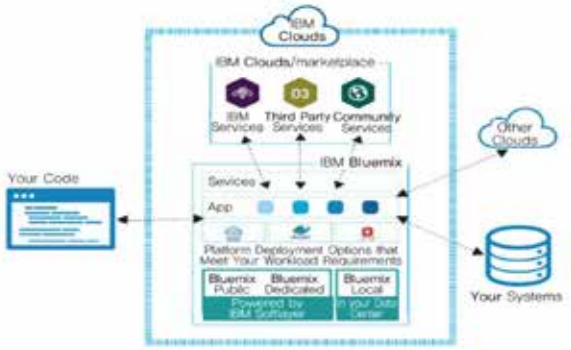


AWS AI & ML services

Google Cloud Platform

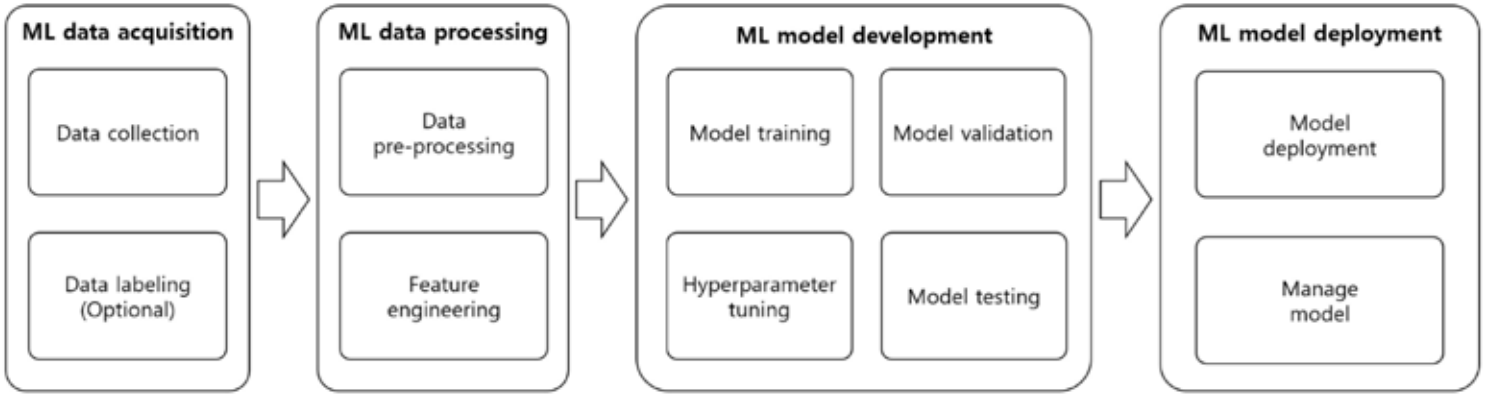


MS Azure ML studio



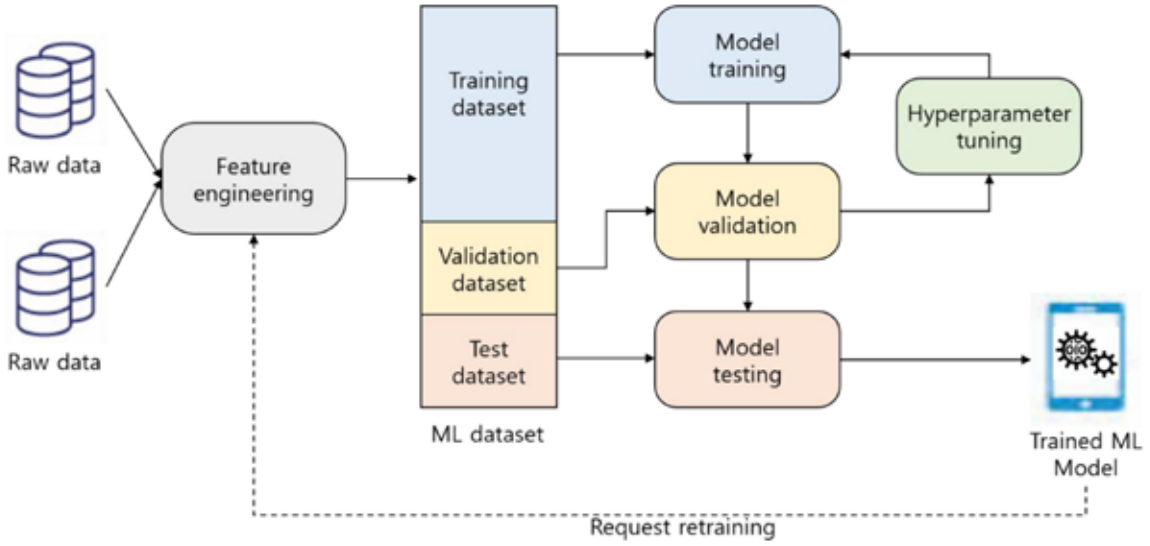
IBM Bluemix

Generic Process of ML



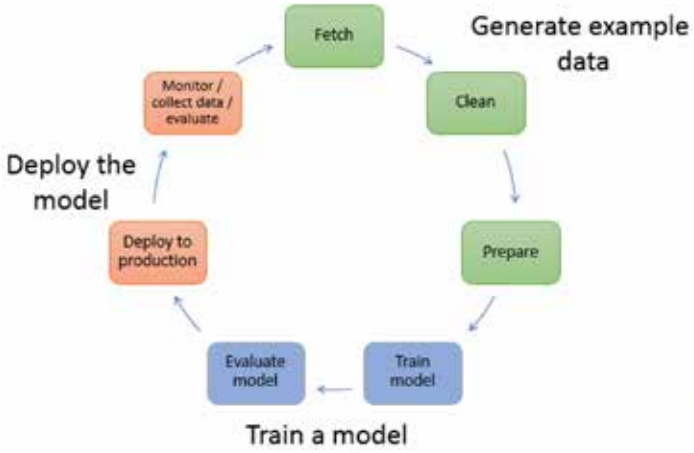
[Reference] ITU-T Y.3531 Cloud computing - Functional requirements for machine learning as a service, 2020.07.

Implementations of Generic Process of ML



[Reference] ITU-T Y.3531 Cloud computing - Functional requirements for machine learning as a service, 2020.07.

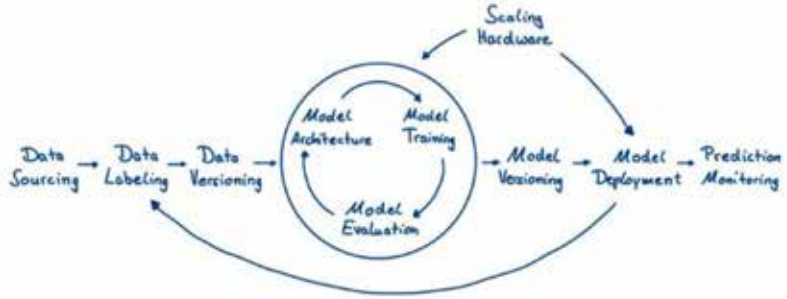
ML Process in the Real Service



<AWS ML process>

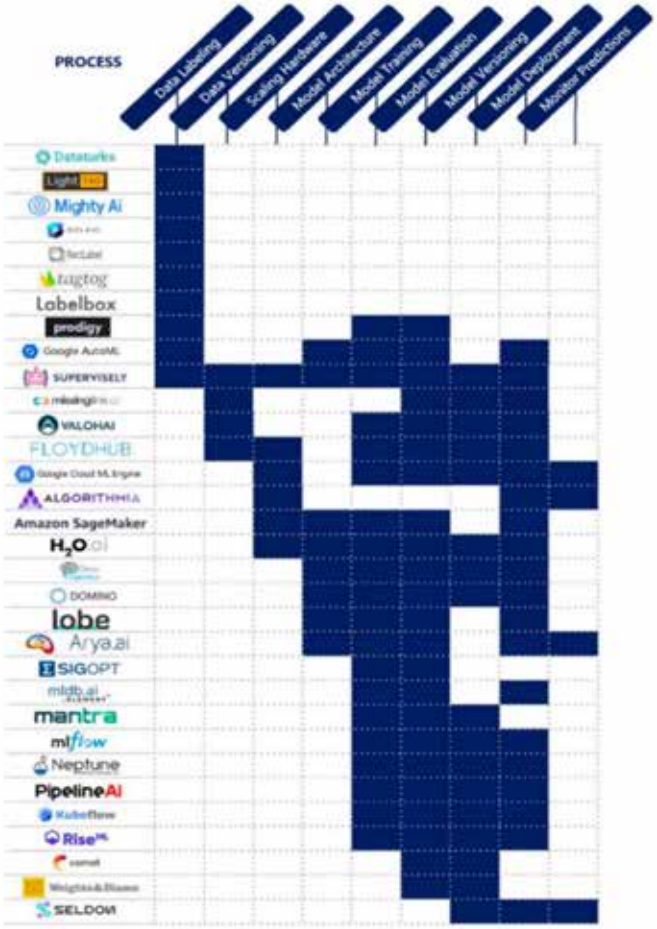
<Google Cloud Platform ML process>

Companies in Real Field

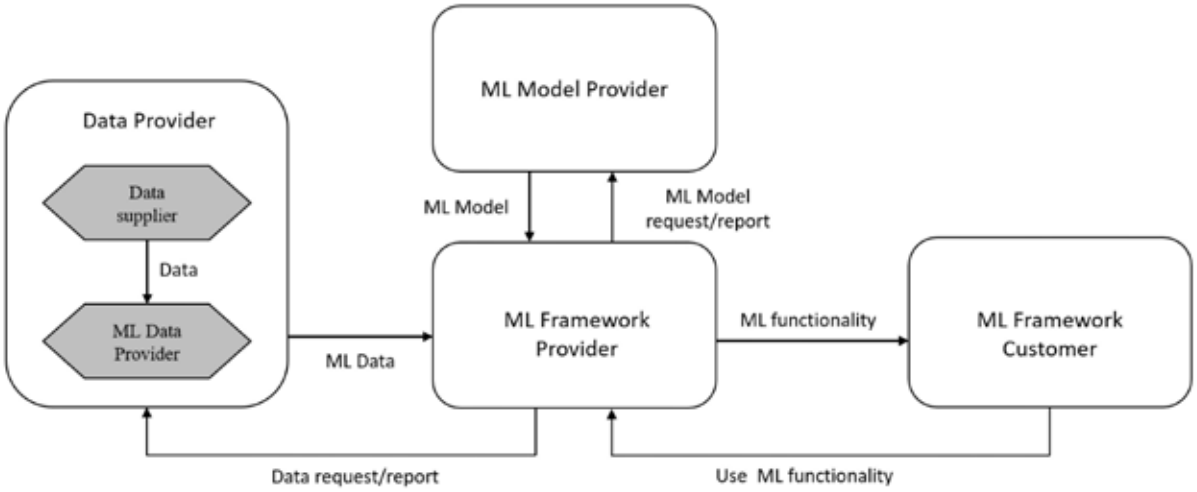


<An example of ML life cycles>

[Reference] The Deep Learning Toolset - An Overview, Medium,
URL: https://medium.com/luminovo/the-deep-learning-toolset-an-overview-b71755016c08

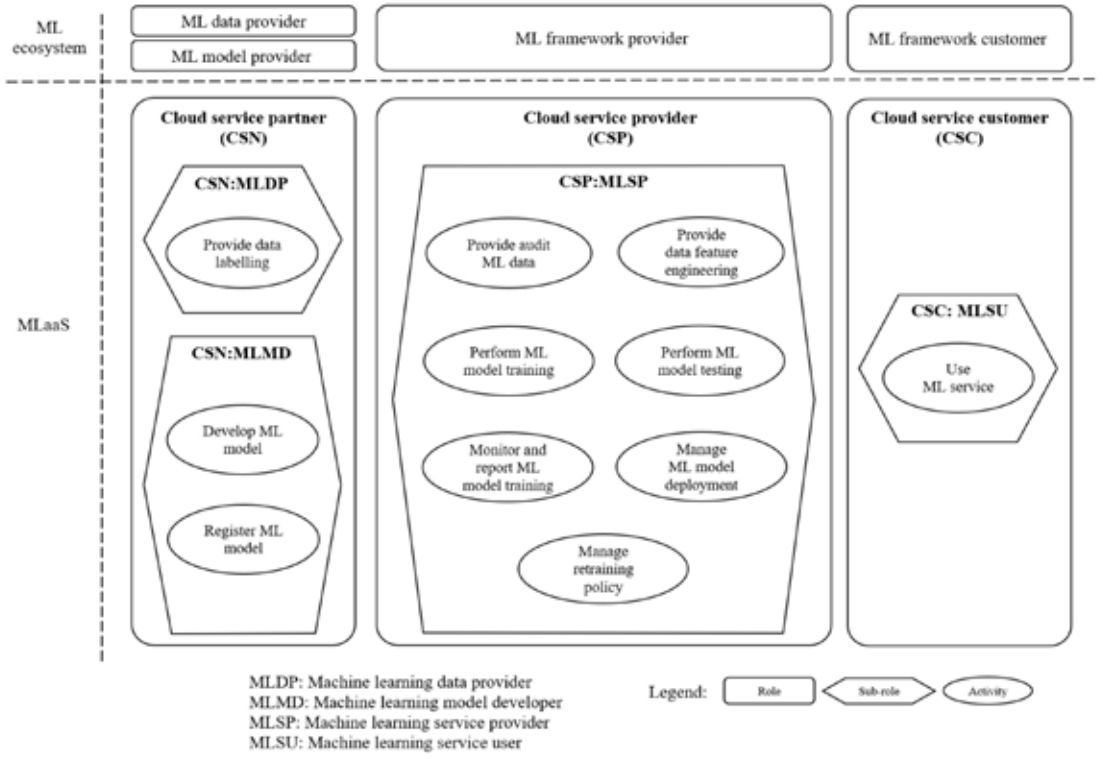


Ecosystem for ML

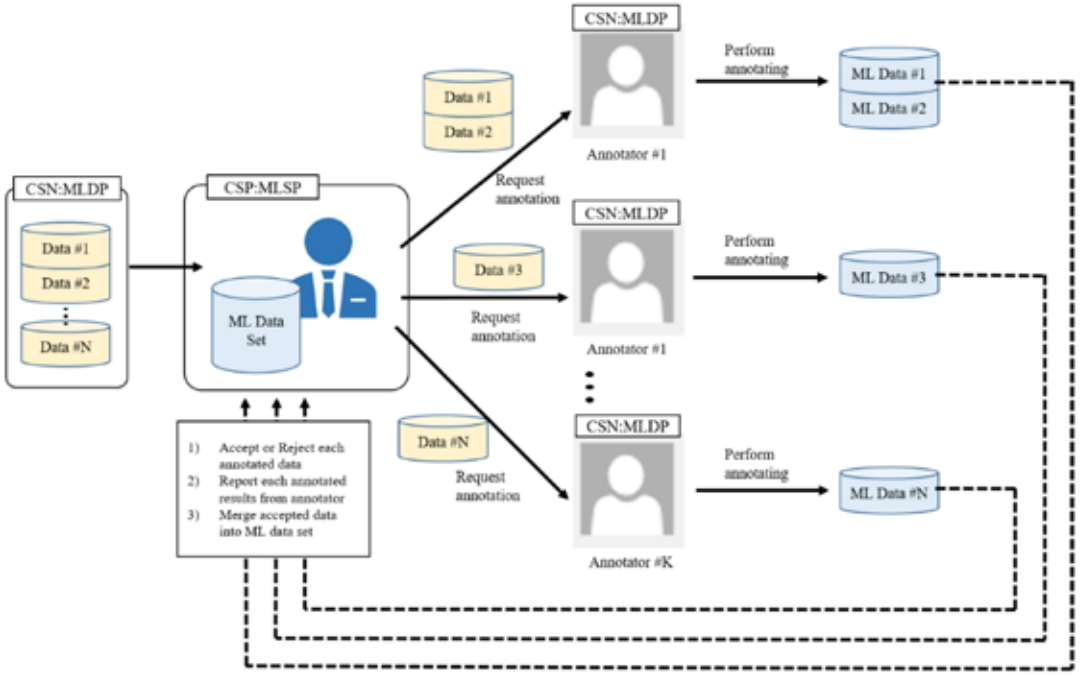


[Reference] ITU-T Y.3531 Cloud computing - Functional requirements for machine learning as a service, 2020.07.

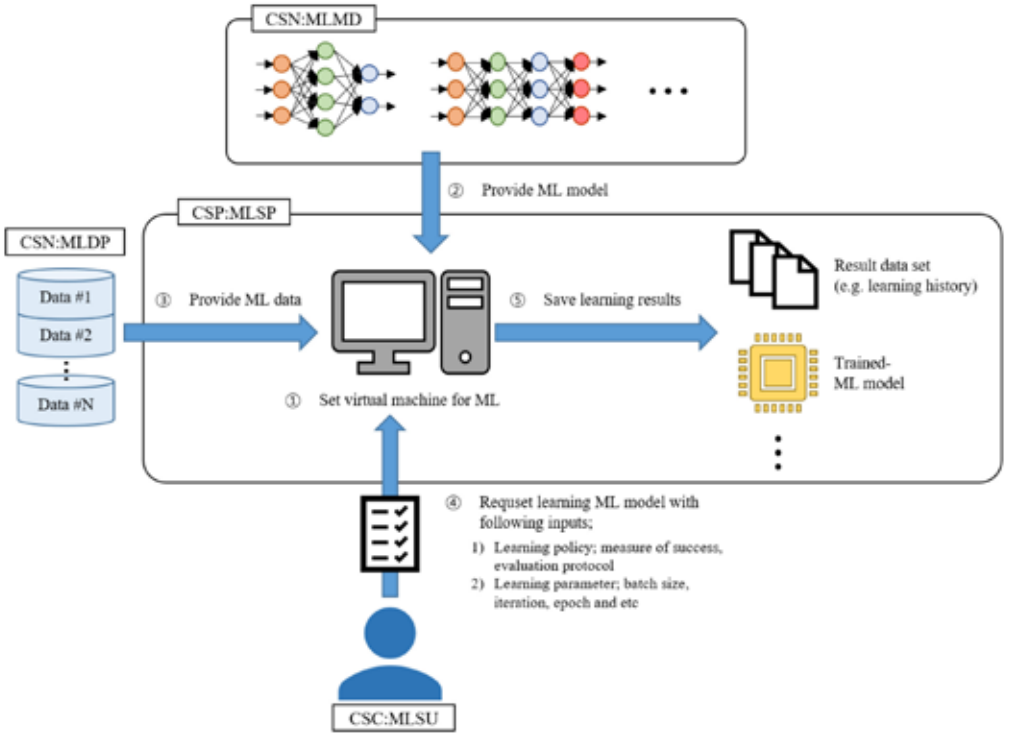
MLaaS System Context (cloud computing aspect)



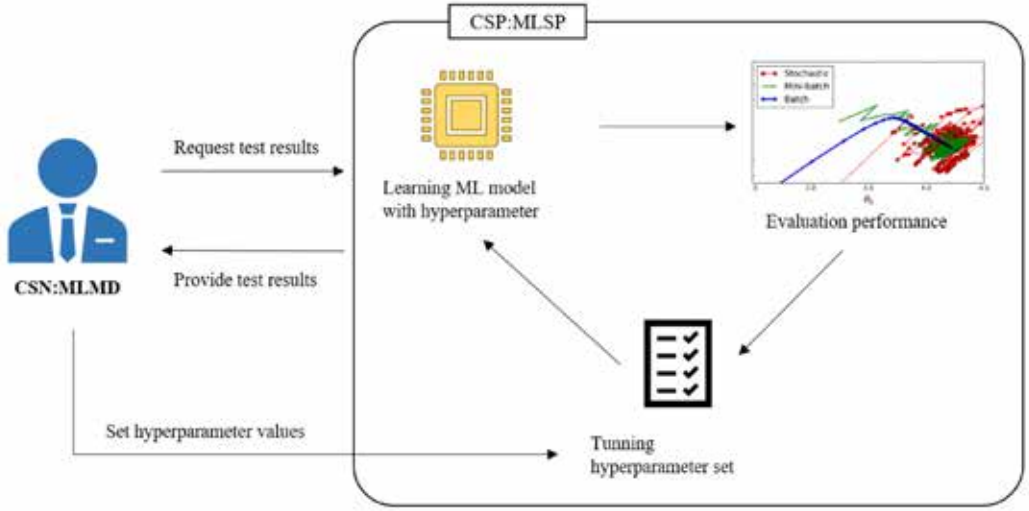
ML Data Annotation/Labelling Management



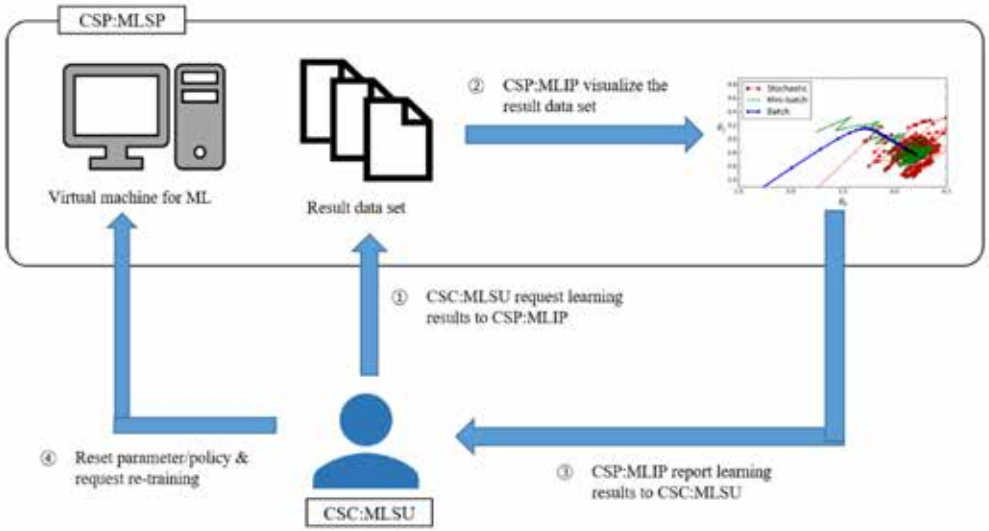
Model Training with User Configuration



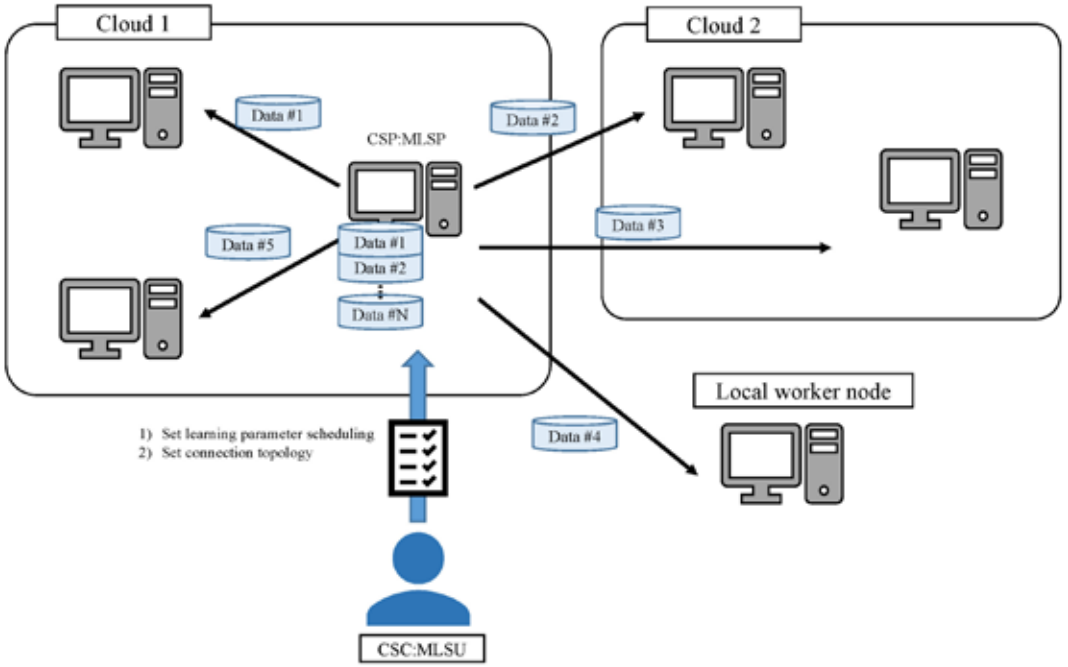
Model Testing and Optimizing the Hyperparameter



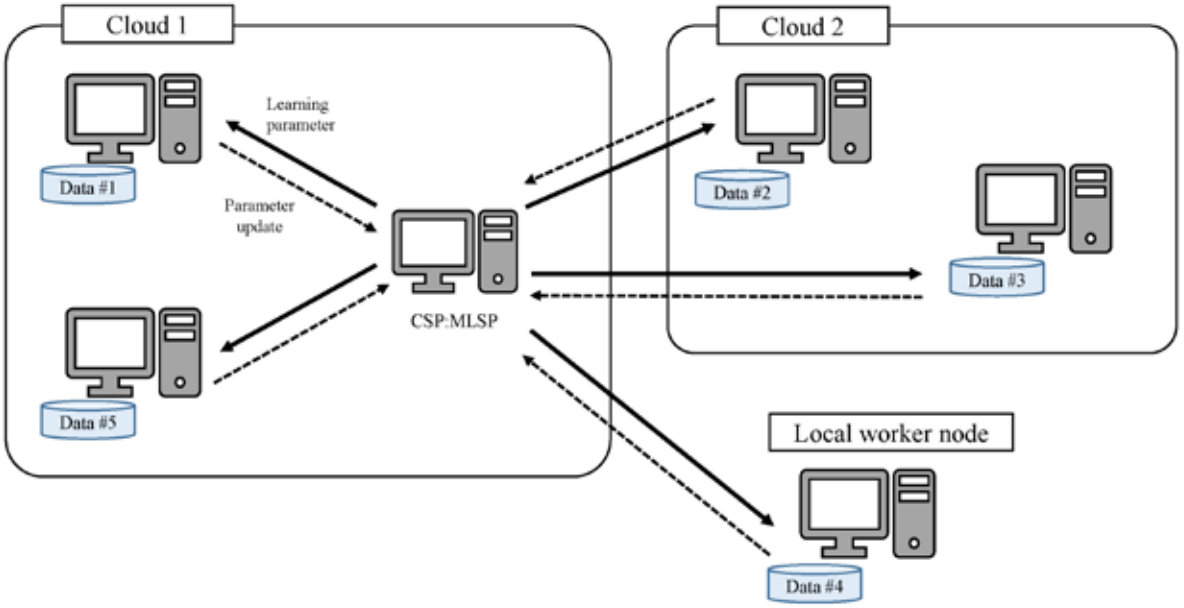
Reporting Learning Result and Re-training



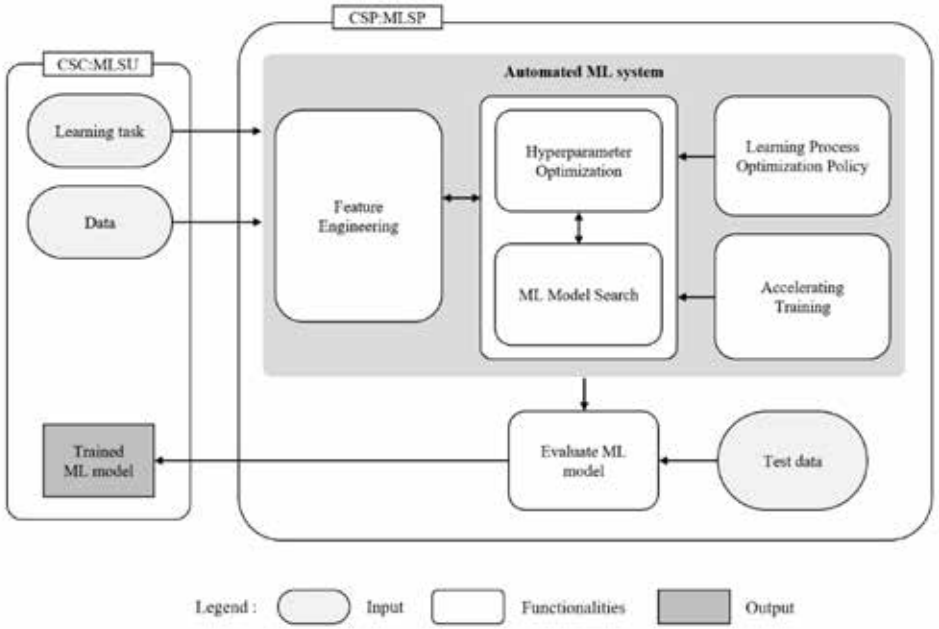
Distributed Training with Multiple Worker Nodes



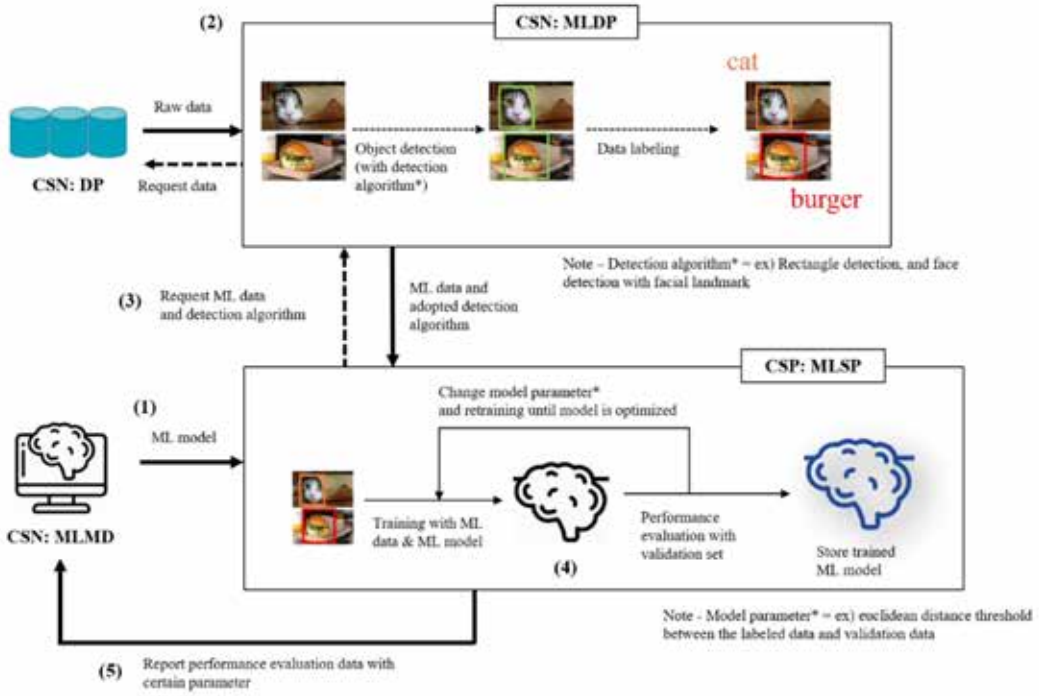
Distributed Training with Multiple Worker Nodes (2)



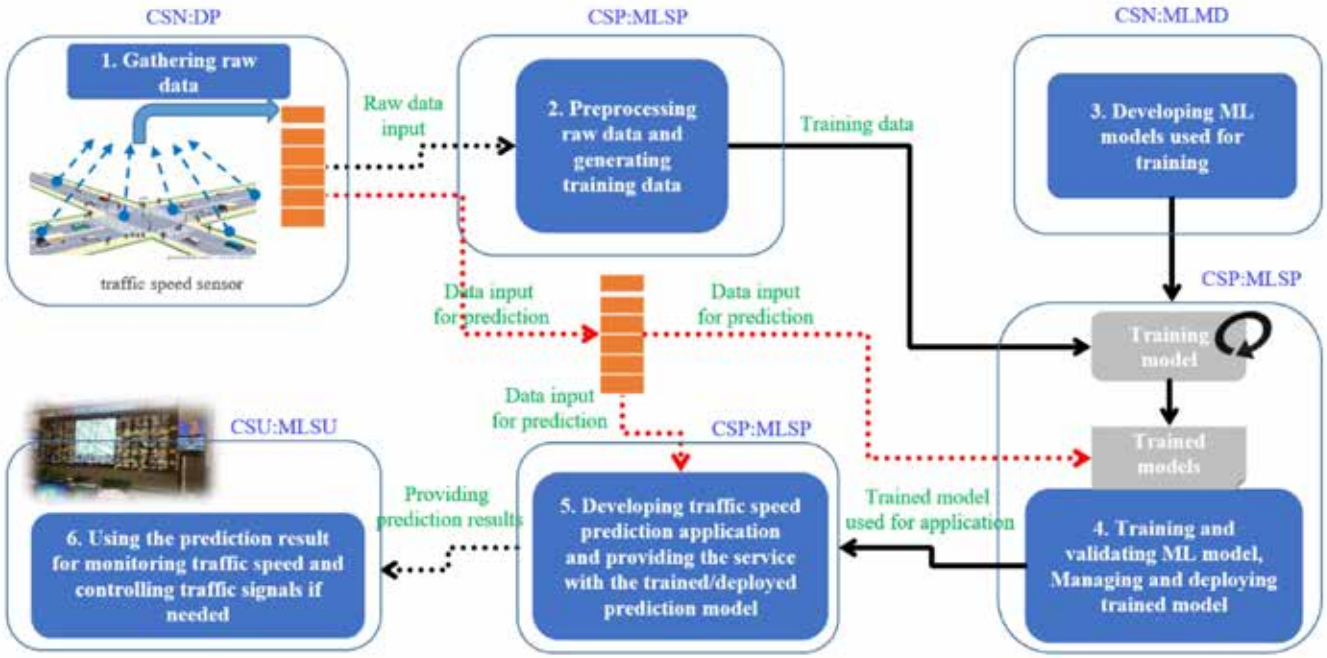
Auto ML in Cloud Computing



Example of ML (Objective Recognition)



Example of ML (Traffic monitoring)



Thank You