Blueprint proposal : Smart data transaction for CPS

Attribute	Description
Type	New
Industry sector	CPS, IoT
Business driver	Cyber physical systems which combine sensor network with computing to monitor and control the physical environment become popular. The bandwidth of the sensor network depends on use cases. Large amounts of data from large amounts of sensor nodes will pressure the NW bandwidth between edge and clouds. Therefore, we need to have a means to optimize each NW bandwidth according to use cases. This blueprint propose a solution for NW bandwidth optimization.
Business use case	Smart city, agriculture, interactive live sports
Business Cost -Initial build cost target Objective	Depends on use cases. E.g. Monitoring sewerage water level Gateway:$3000 Sensor node:$2500 Water level sensor:$1500
Business Cost -Target Operational Objective	Depends on use cases. ・Power consumption and management for sensor node and gateway ・Cloud etc…
Security need	The sensor node and gateway will be used outdoors in untrusted environment and it handles potentially privacy-sensitive data such as live video. Therefore, the device needs to support trusted boot, trusted key storage, and encrypted communication.
Regulations	Depends on use cases. E.g. Monitoring sewerage water level There are several environmental design guidelines.(IPx7, etc..)
Other restrictions	Depending on use cases, there can be other requirements.
Additional details	NA

Motivation

› The bandwidth of the sensor network depends on use cases.

› Big data from many sensor nodes will pressure the NW bandwidth between edge and clouds.

Need to have a means to optimize each NW bandwidth according to use cases.

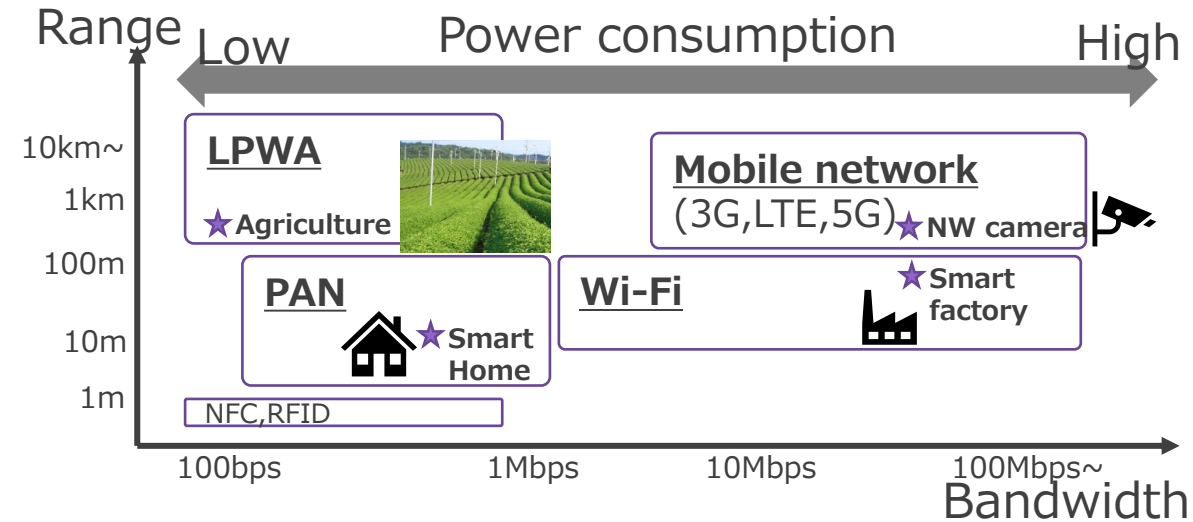This blueprint propose a solution for NW bandwidth optimization.

Range · Low · Power consumption · High

10km~ · LPWA · Mobile network (3G,LTE,5G)
1km · ★Agriculture · ★NW camera
100m · PAN · Wi-Fi · ★Smart factory
10m · ★Smart Home
1m · NFC,RFID

100bps · 1Mbps · 10Mbps · 100Mbps~ · Bandwidth

Figure1:Sensor network bandwidth and range

Cloud

Pressure on NW bandwidth
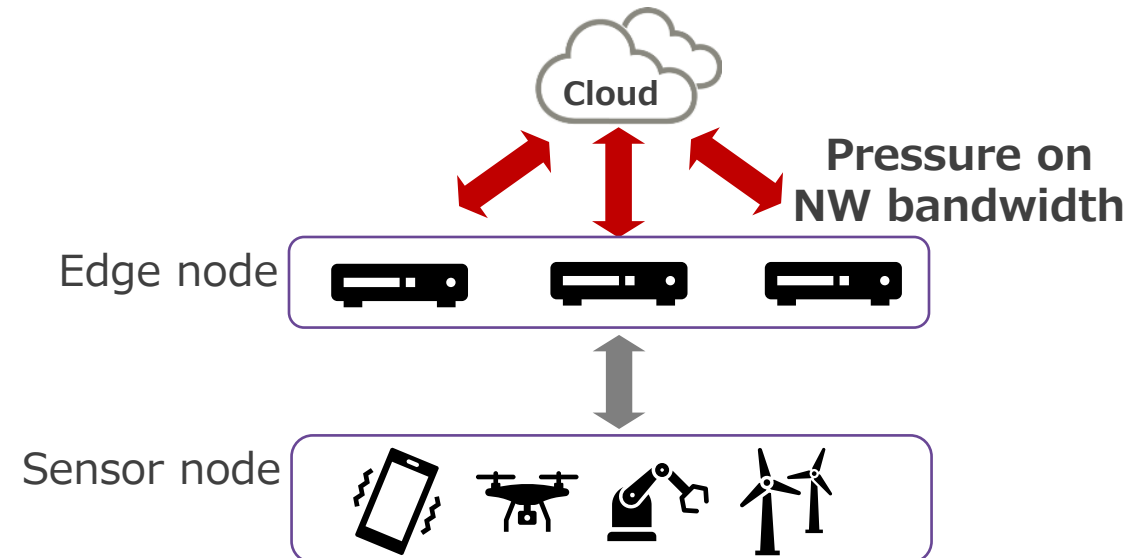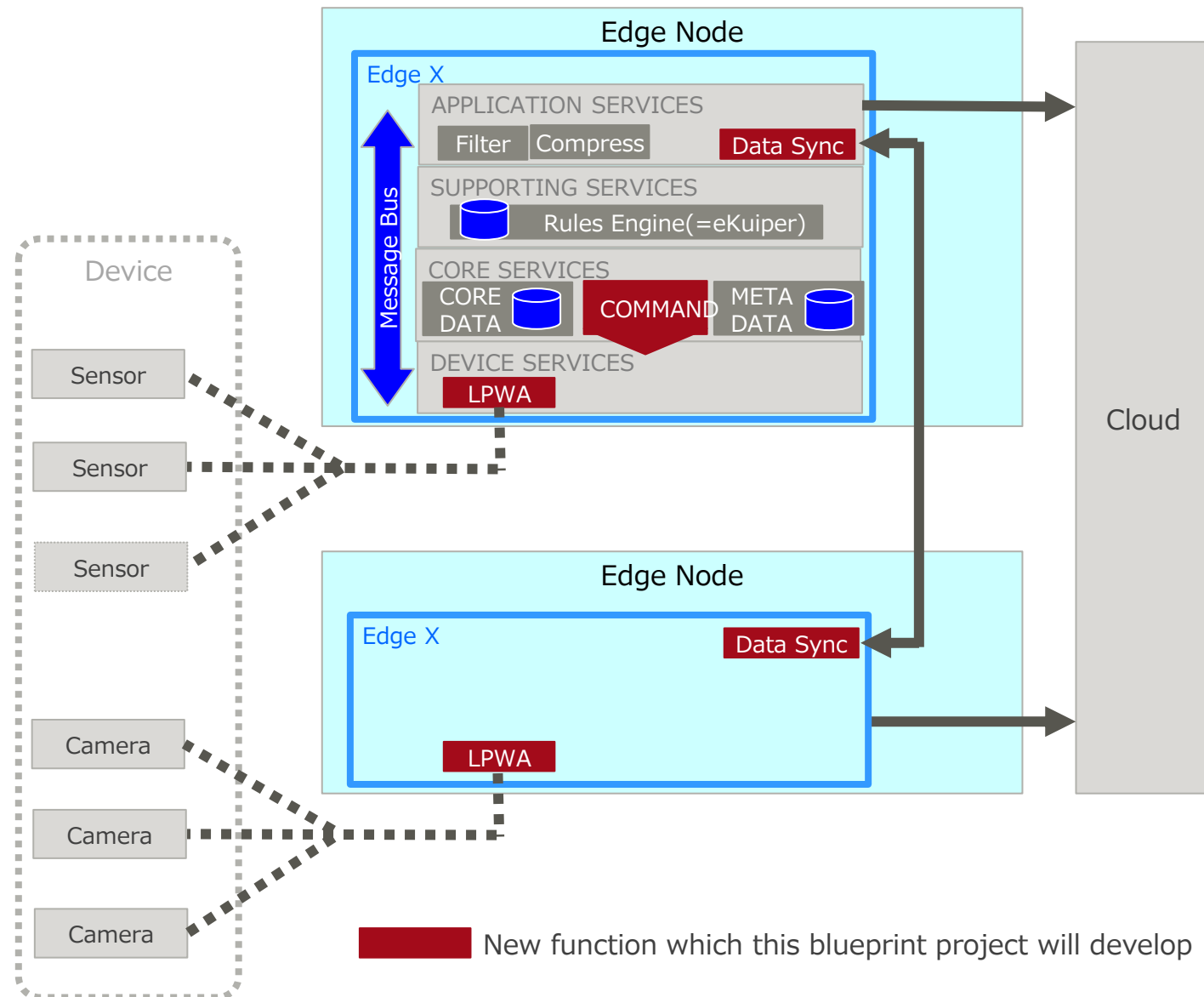
Edge node

Sensor node

Figure2:Pressure on network bandwidth

Architecture Overview

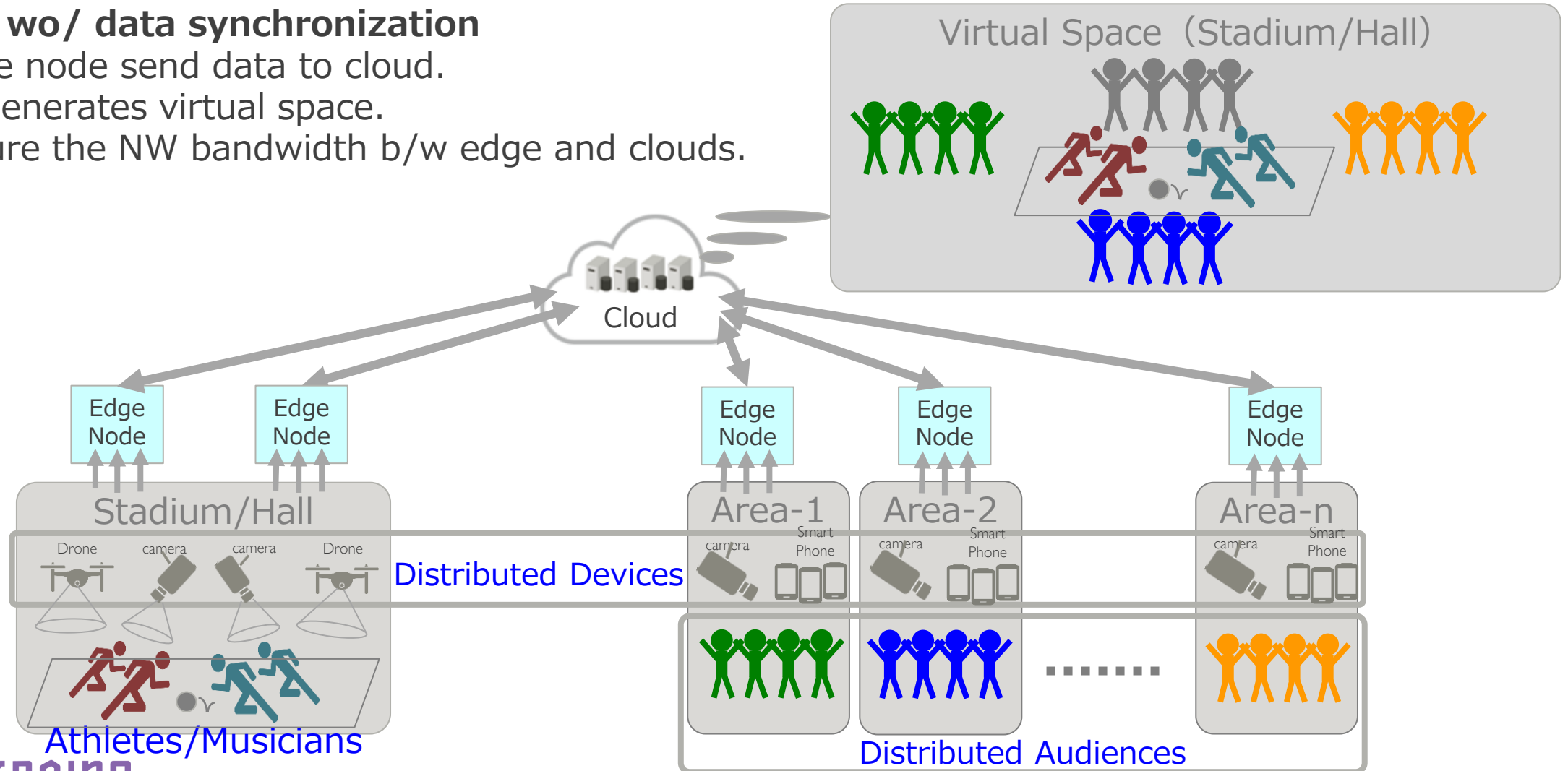Solution for NW bandwidth optimization

- **Data synchronization**
  Share process data b/w edge node
  →Can reduce
    - ・NW bandwidth b/w edge and cloud
    - ・Processing latency

- **Increase types of Sensor NW supported by akraino** (E.g. LoRa)
  →Can meet various demands about sensor NW bandwidth, distance and power consumption which comes from various use cases.

Use case: Interactive live sports/music

Before: wo/ data synchronization
·All edge node send data to cloud.
 Cloud generates virtual space.
→Pressure the NW bandwidth b/w edge and clouds.

Virtual Space （Stadium/Hall）

Cloud

Edge Node   Edge Node   Edge Node   Edge Node   Edge Node

Stadium/Hall

Drone   camera   camera   Drone

Distributed Devices

Area-1   Area-2   Area-n

camera   Smart Phone   camera   Smart Phone   camera   Smart Phone

Athletes/Musicians

·······

Distributed Audiences

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Use case: Interactive live sports/music

After: w/ data synchronization

・Synchronize data b/w edge node of neighbors.
・Some edge node generates part of virtual space, and send generated virtual space to cloud.
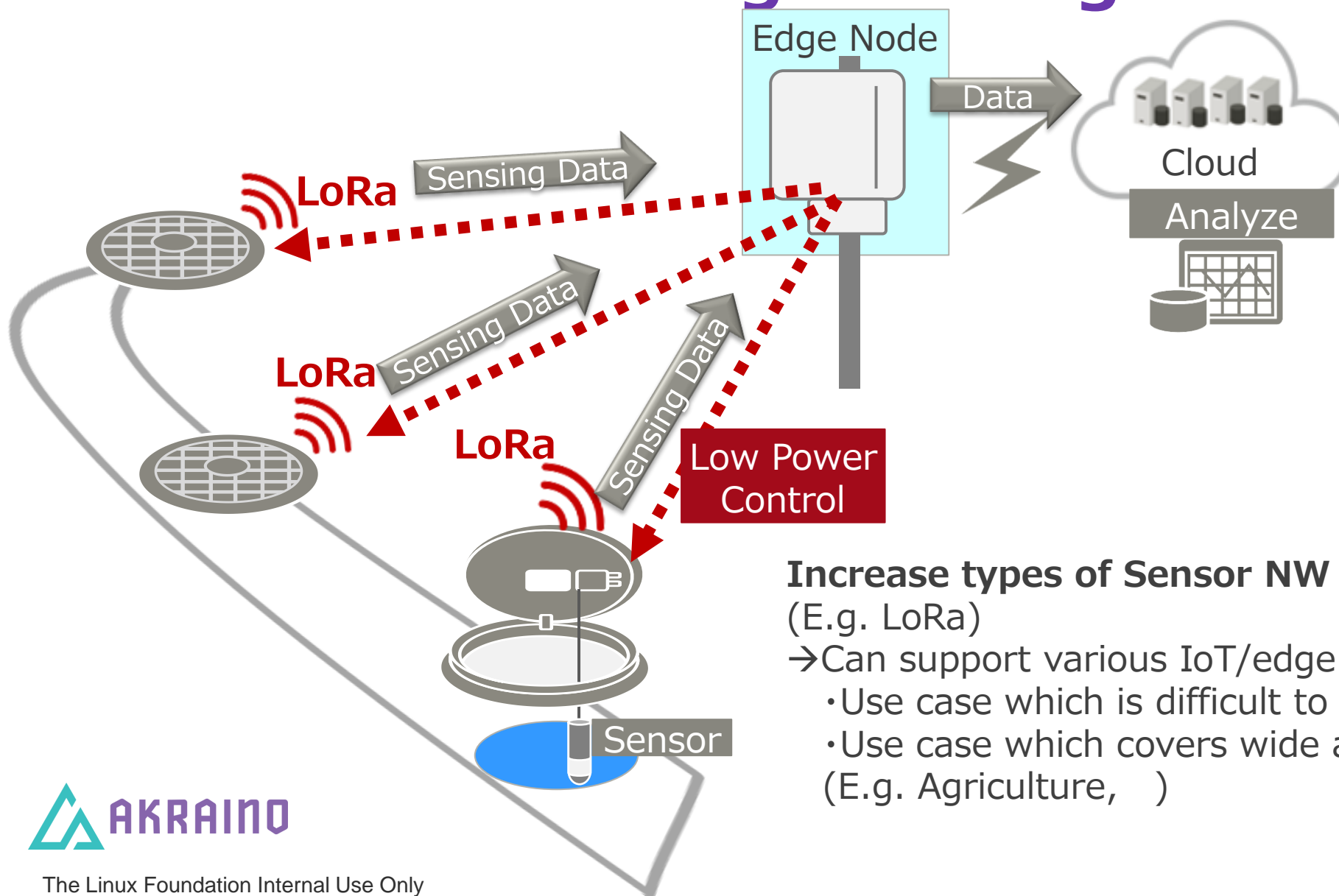・Cloud generated whole virtual space.
→Can reduce NW bandwidth b/w edge and clouds.

Virtual Space（Stadium/Hall）

Cloud

Virtual Space

Virtual Space

Virtual Space

Edge Node — Data Sync — Edge Node

Edge Node — Data Sync — Edge Node

Data Sync — Edge Node

Stadium/Hall

Drone   camera   camera   Drone

Distributed Devices

Area-1
camera   Smart Phone

Area-2
camera   Smart Phone

Area-n
camera   Smart Phone

Athletes/Musicians

Distributed Audiences
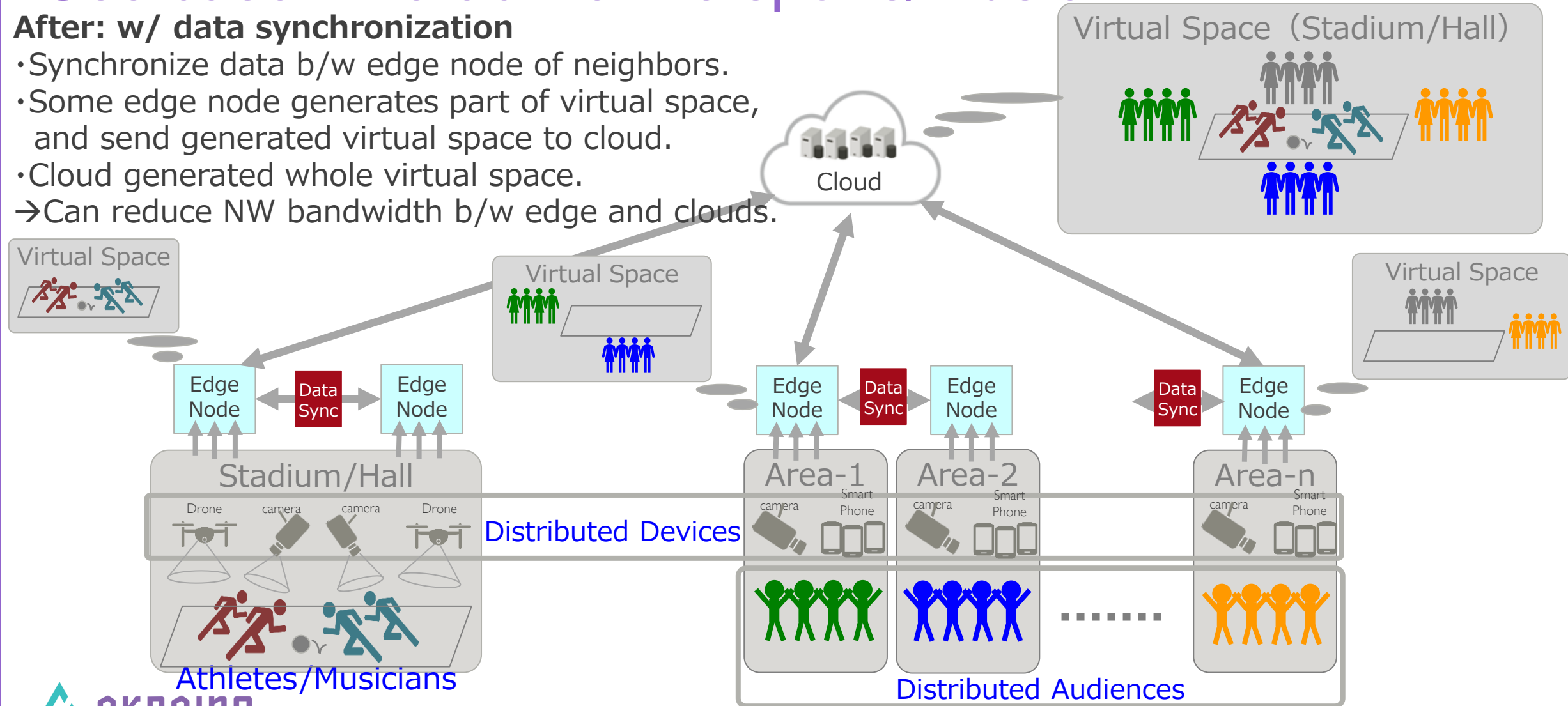
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Use case: **Monitoring sewerage water level**

Edge Node

Data

Cloud

Analyze

LoRa Sensing Data

LoRa Sensing Data

LoRa Sensing Data

Low Power Control

Sensor

Increase types of Sensor NW supported by akraino
(E.g. LoRa)
→Can support various IoT/edge use case
　・Use case which is difficult to supply power to sensor
　・Use case which covers wide area
(E.g. Agriculture,　)

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Appendix:Assessment Criteria

Criteria	
Each initial blueprint is encouraged to take on at least two committers from different companies	Could Intel join to this blueprint? Because we would like to add new function to edgeXfoundry.
Complete all templates outlined in these documents	Detailed in this slides.
A lab with the exact configuration required by the blueprint to connect with Akraino CI and demonstrate CD. Users should demonstrate either an existing lab or the funding and commitment to build the needed configuration.	We will test in Fujitsu lab.
Blueprint is aligned with the Akraino Edge Stack Charter	Yes.
Blueprint code that will be developed and used with Akraino repository should use only open-source software components either from upstream or Akraino projects.	All code will be open source.
For new blueprints submission, the submitter should review existing blueprints and ensure it is not a duplicate blueprint and explain how the submission differs. The functional fit of an existing blueprint for a use case does not prevent an additional blueprint being submitted.	Reviewed. Not a duplicate blueprint.

Criteria	
Name of the project is appropriate(no trademark issues etc.); Proposed repository name is all lower-case without any special characters.	Smart data transaction for CPS
Project contact name, company, and email are defined and documents	Haruhisa Fukano:Fujitsu fukano.haruhisa@fujitsu.com
Description of the project goal and its purpose are defined.	Implement LPWA and data synchronization between edge node for bandwidth optimization and low power consumption.
Scope and project plan are well defined.	Targeted for Release6.
Resource committed and available	Yes. 7 engineers.
Contributors identified	Fujitsu
Initial list of committers identified (elected/proposed by initial contributors)	Fujitsu
Meets Akraino TSC policies	Yes.
Proposal has been socialized with potentially interested or affected projects and/or parties	A part of blueprint has already been implemented in market.
Cross Project Dependencies.	EdgeXFoundry

Thanks

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