Edge (Fog) Computing

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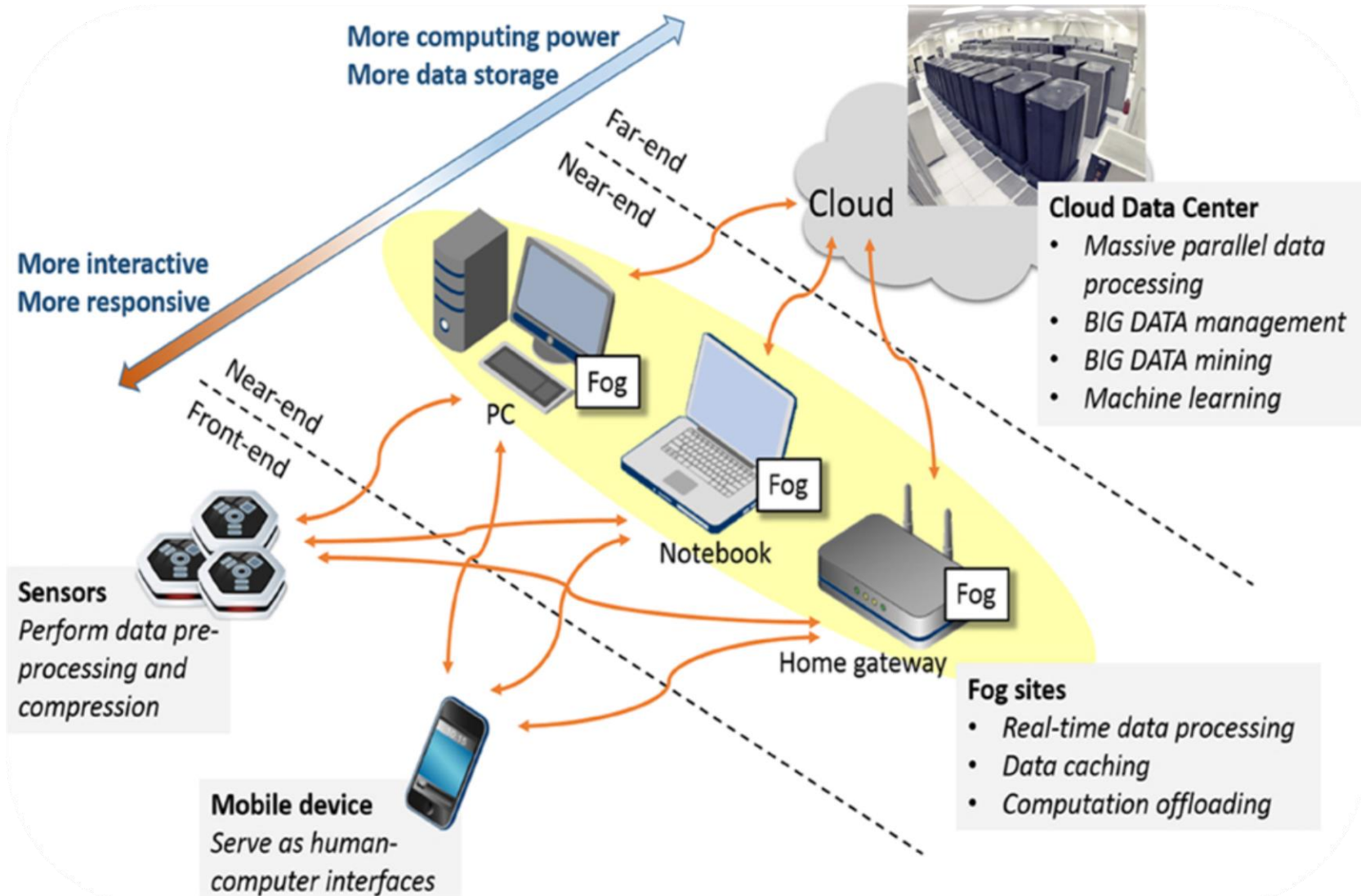
Agenda

- Introduction
- Cloud vs. Edge
- Applications of Edge
- Conclusion
- References

Introduction

What is Edge Computing?

- Edge computing = Fog computing
- Action takes place at the edge of the network
- The term "Fog Computing" was introduced by the Cisco Systems
- Devices communicate peer-to-peer
- Design still in progressing stage

Introduction

More computing power
More data storage

More interactive
More responsive

Far-end

Near-end

Cloud

Cloud Data Center
- *Massive parallel data processing*
- *BIG DATA management*
- *BIG DATA mining*
- *Machine learning*

Near-end

Front-end

Fog

PC

Fog

Notebook

Fog

Home gateway

Sensors
Perform data pre-processing and compression

Mobile device
Serve as human-computer interfaces

Fog sites
- *Real-time data processing*
- *Data caching*
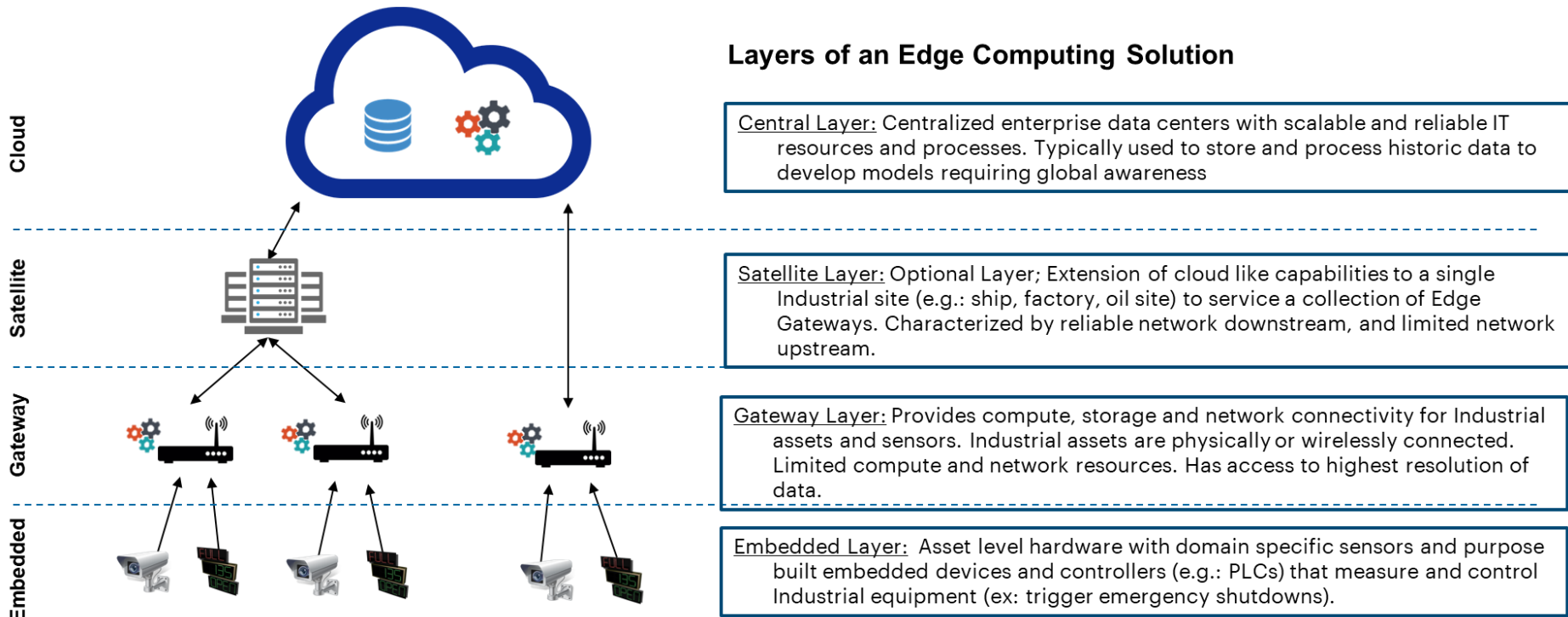- *Computation offloading*

4

Introduction

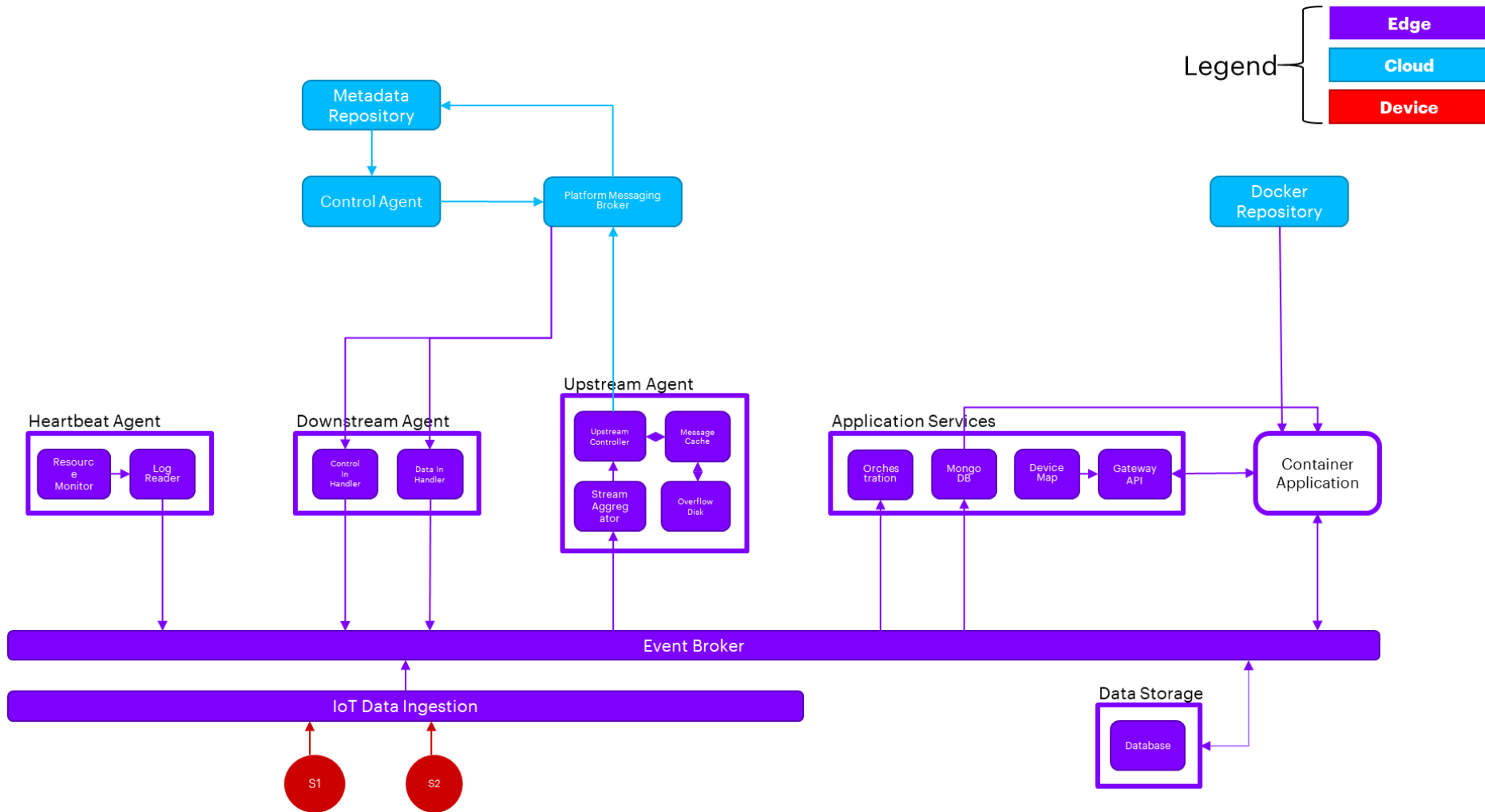What is the need for Edge computing ?

- Edge computing was developed to address applications and services that do not fit the paradigm of the cloud
- Edge Computing keeps data right where the Internet of Things needs it
- Existing data protection mechanisms in Cloud Computing are insufficient

Edge Computing

Edge computing extends control to the source of internet of things

Layers of an Edge Computing Solution

Underline Cloud, Satellite, Gateway, Embedded labels on the left side.

<u>Central Layer:</u> Centralized enterprise data centers with scalable and reliable IT resources and processes. Typically used to store and process historic data to develop models requiring global awareness

<u>Satellite Layer:</u> Optional Layer; Extension of cloud like capabilities to a single Industrial site (e.g.: ship, factory, oil site) to service a collection of Edge Gateways. Characterized by reliable network downstream, and limited network upstream.

<u>Gateway Layer:</u> Provides compute, storage and network connectivity for Industrial assets and sensors. Industrial assets are physically or wirelessly connected. Limited compute and network resources. Has access to highest resolution of data.

<u>Embedded Layer:</u> Asset level hardware with domain specific sensors and purpose built embedded devices and controllers (e.g.: PLCs) that measure and control Industrial equipment (ex: trigger emergency shutdowns).

The Edge "Stack": Example Information flow

Legend
- Edge
- Cloud
- Device

Metadata Repository

Control Agent

Platform Messaging Broker

Docker Repository

Upstream Agent
- Upstream Controller
- Message Cache
- Stream Aggregator
- Overflow Disk

Heartbeat Agent
- Resource Monitor
- Log Reader

Downstream Agent
- Control In Handler
- Data In Handler

Application Services
- Orchestration
- Mongo DB
- Device Map
- Gateway API

Container Application

Event Broker

IoT Data Ingestion

Data Storage
- Database

S1

S2

7

Cloud vs. Edge

Characteristics of Edge compared to cloud

- Edge location, location awareness, and low latency
- Geographical distribution
- Real time interactions
- Support for mobility
- Heterogeneity and Interoperability

Cloud vs. Edge

Edge – Solution to Cloud's Limitations

- Reduction in data movement across the network resulting in reduced congestion.

- Elimination of bottlenecks resulting from centralized computing systems.

- Improved security of encrypted data as it stays closer to the end user.

Applications of Edge

- Edge drivers

- Tech giants Cisco and IBM are the driving forces behind Edge computing, and link their concept to the emerging Internet of Things (IoT).

- According to CISCO, the important areas where Edge would play a vital   role are the following :
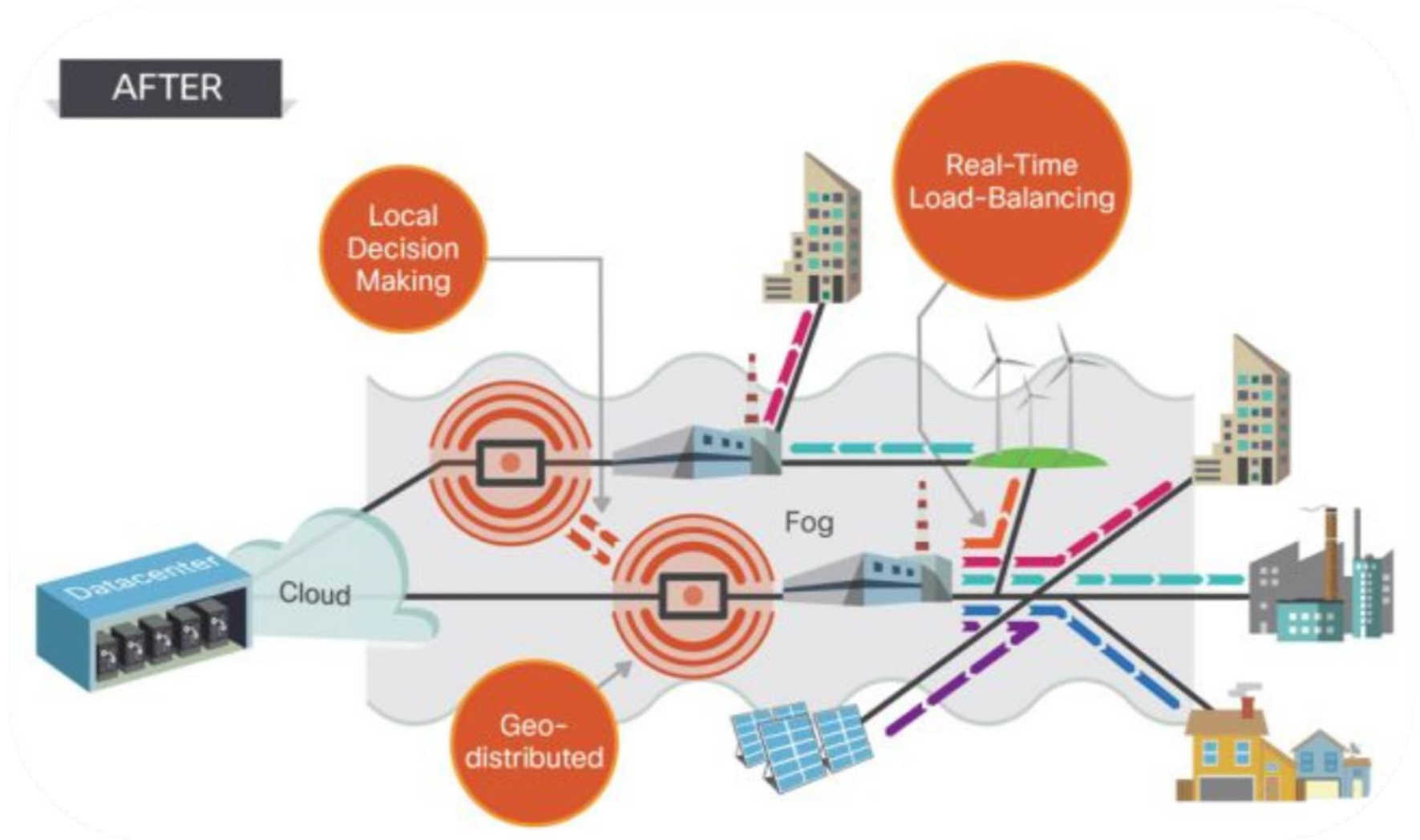
Applications of Edge
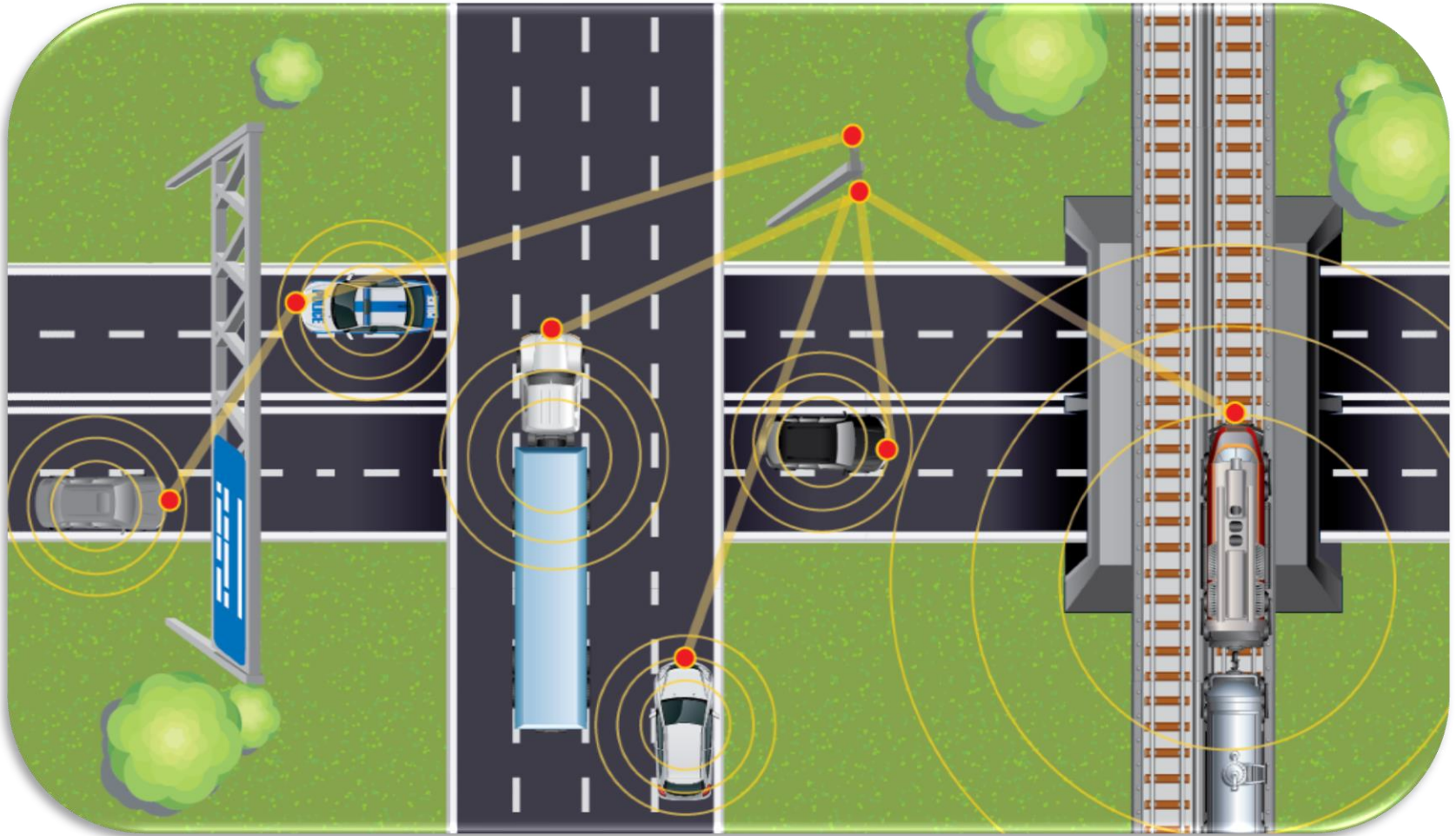
Connected Vehicles Communicating With Each Other

Applications of Edge
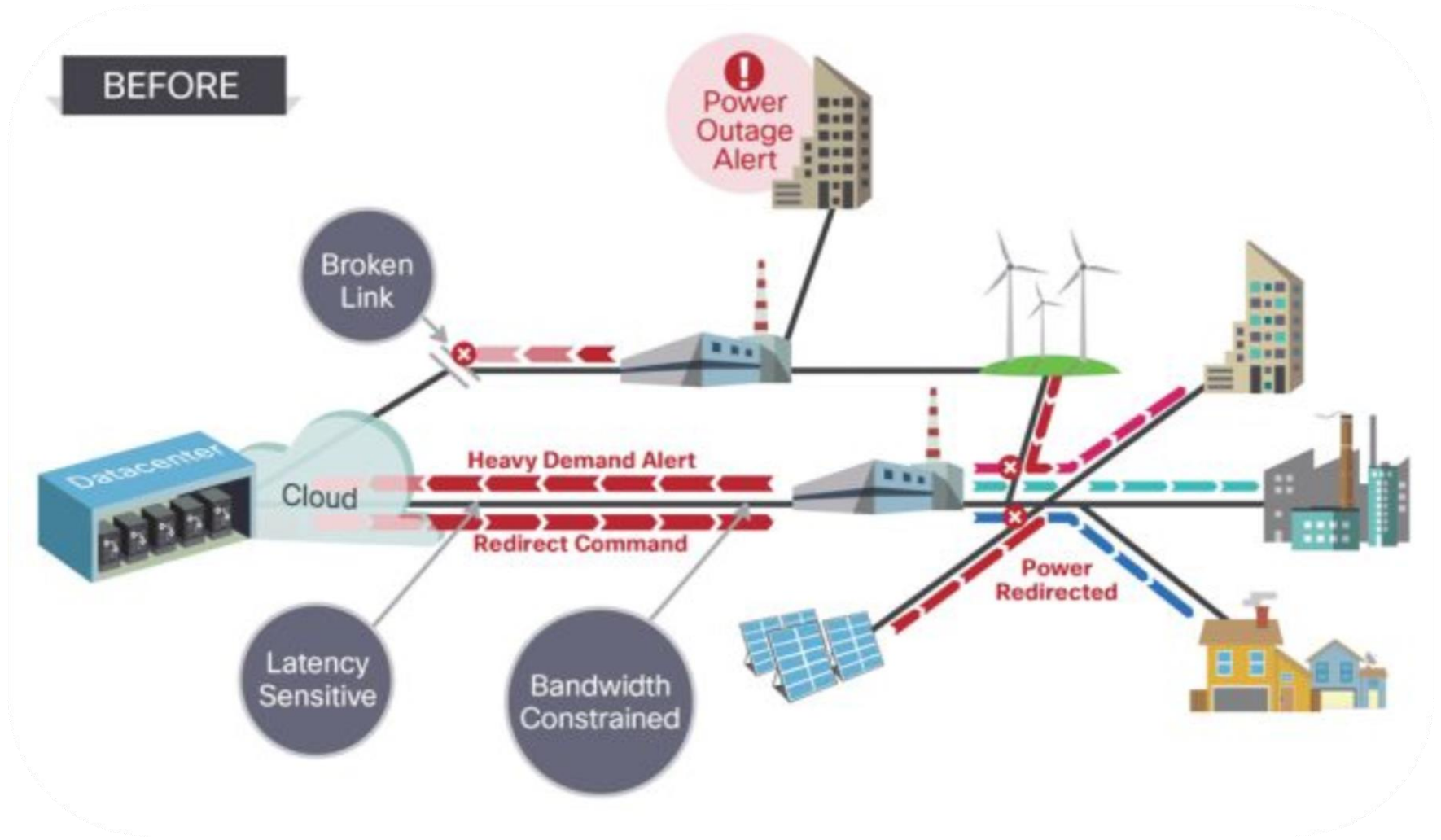
Smart grid cloud architecture before the advent of Edge technology

Applications of Edge

Smart grid cloud architecture before the advent of Edge technology

Applications of Edge

Decentralized smart building control

Applications of Edge

Smart City

Summary

- Edge computing has the ability to handle the data tsunami created by Internet of Things.

- The characteristics of fog computing like mobility, proximity to end-users, low latency, location awareness, heterogeneity and due to its real-time applications fog computing platform is considered as the appropriate platform for Internet of Things improving the overall user experience