VirIoT architecture

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# Cloud, Standards and IoT: a reality check

- IoT application developers must deploy: infrastructure, integration platform and the eventual application
  - **expenditure** problem
  - **interoperability** management
- Standard integrating platform manage data life-cycle
  - oneM2M, FIWARE NGSI v2, NGSI-LD
- IoT Cloud services help data processing only
  - AWS , Azure, Google
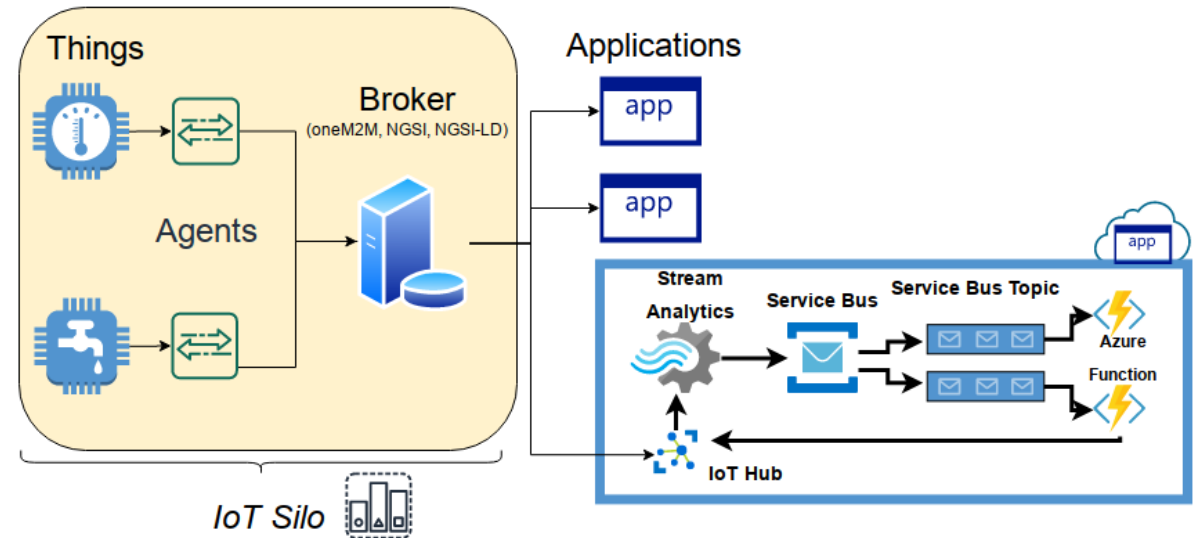
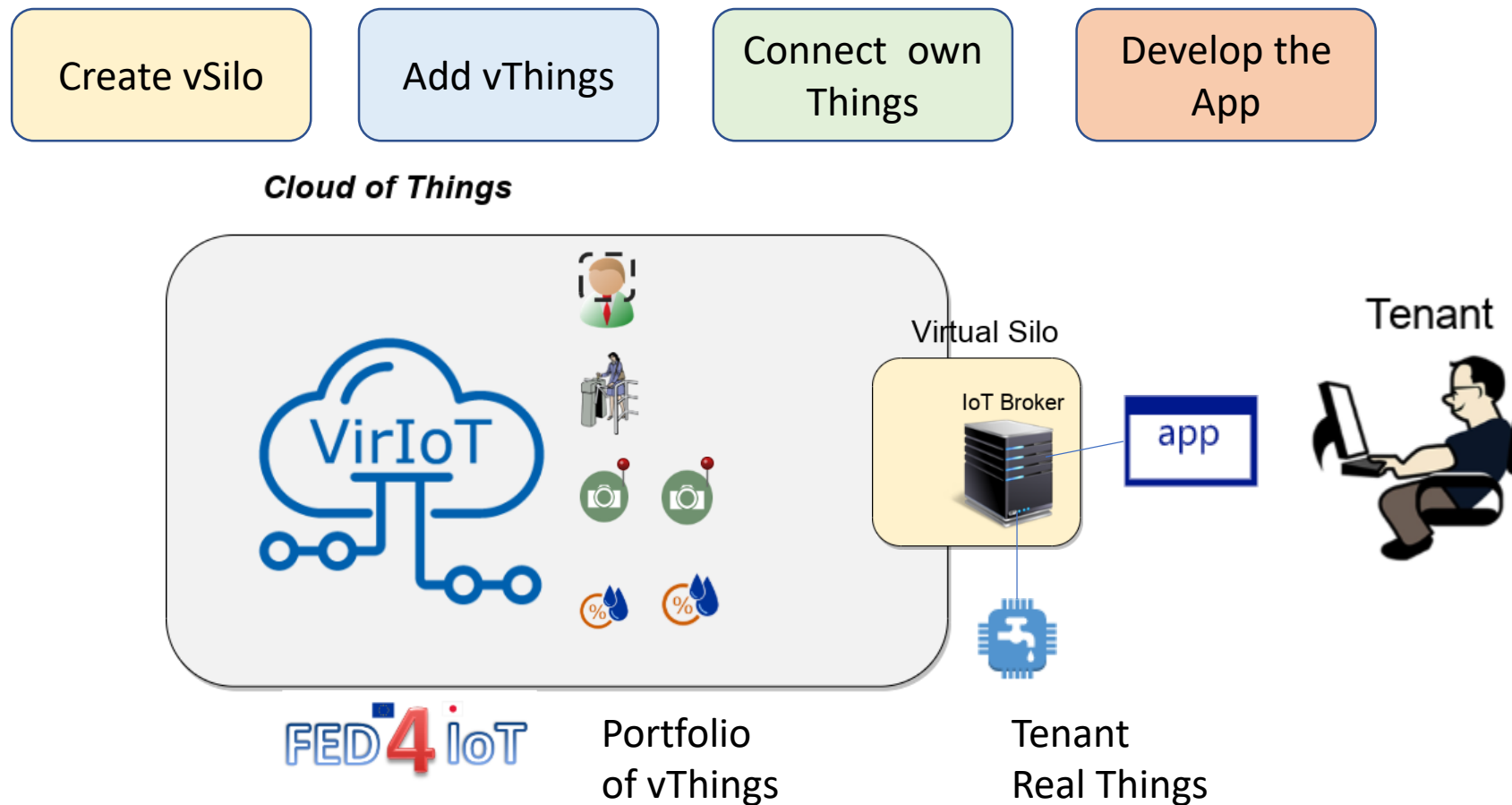# VirIoT: the Fed4IoT *Cloud of Things*

Virtualize what is still real: the IoT Silo made of things and broker

Manage data/API interoperability by allowing user to chose the preferred IoT standard
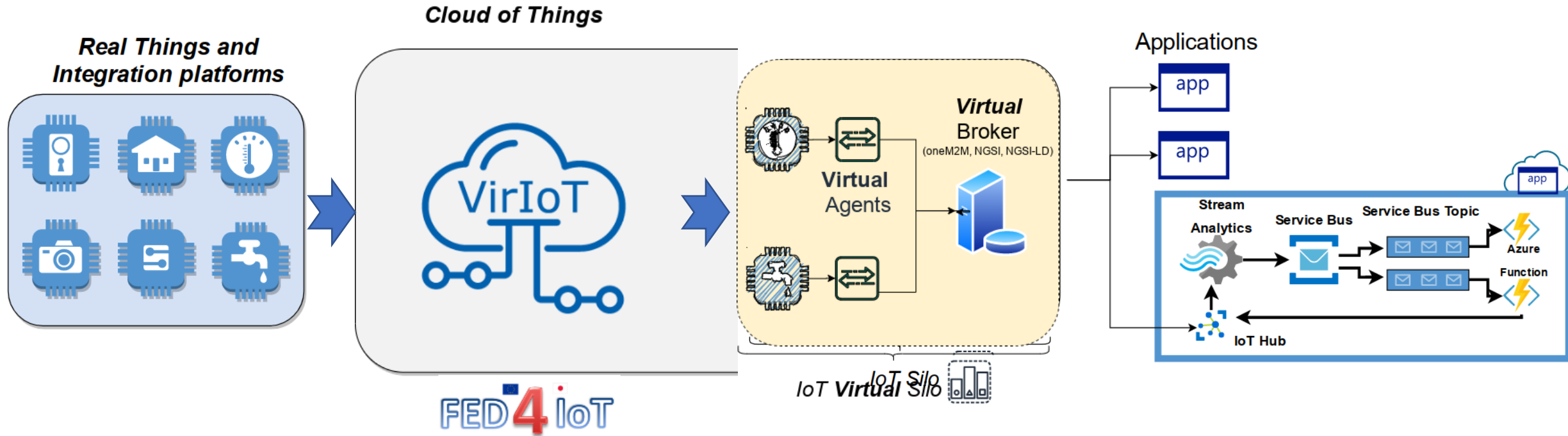
VirIoT in Action

Tenant needs to build a watering system made of own things and virtual things for rent
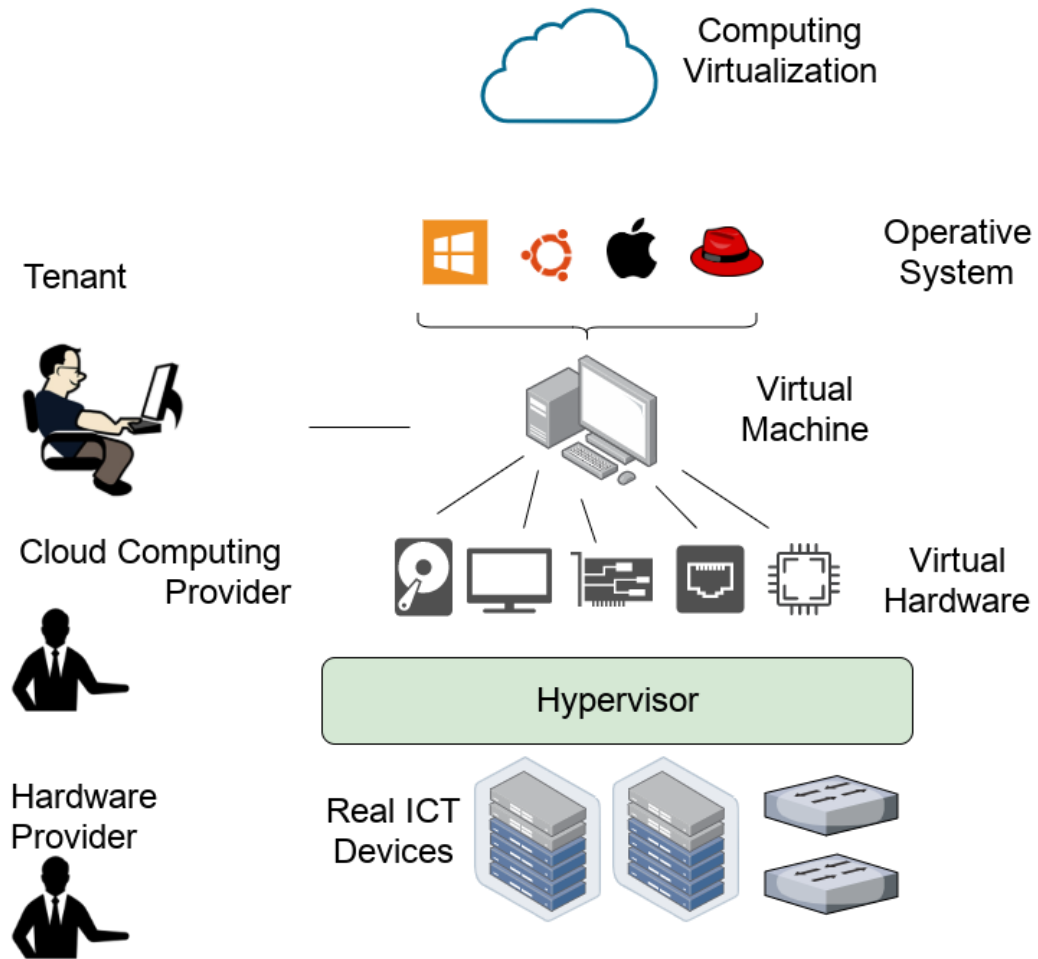
ThingVisor and Virtual Things

- VirtualThings are **emulation of real things**
  - Sharing of real things
  - Analytics
  - Physical Control
- Virtual **Sensors**
  - Virtual Face Detector
  - Virtual Person Finder
  - Hygrometer
- Virtual **Actuator**
  - Rented Drones
  - Door locks
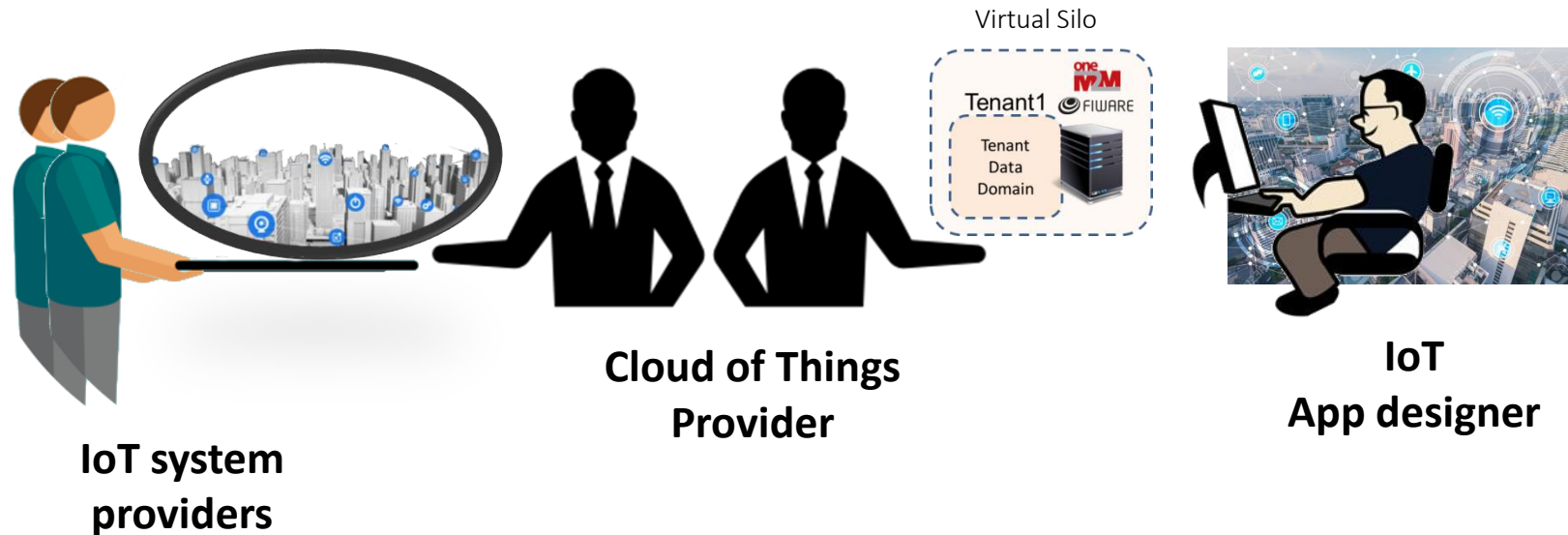- **ThingVisor**: software component performing the emulation
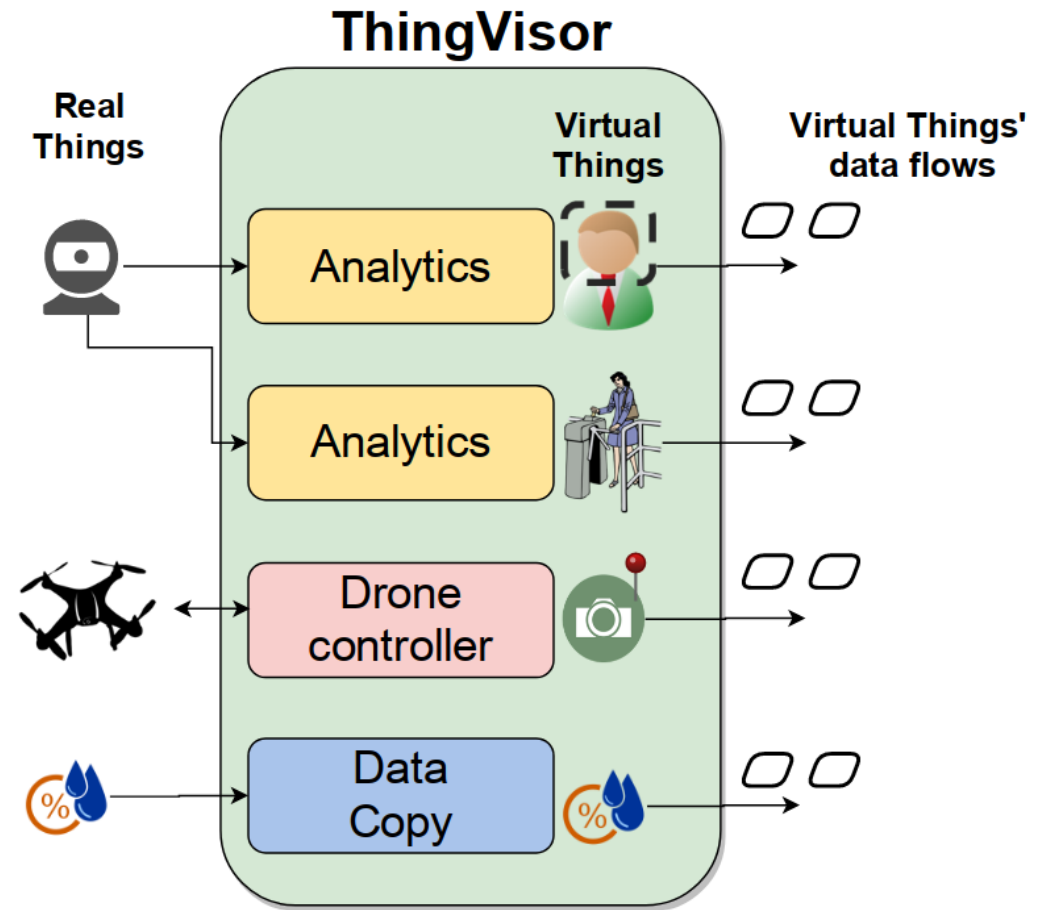
Cloud Computing vs Cloud of Things
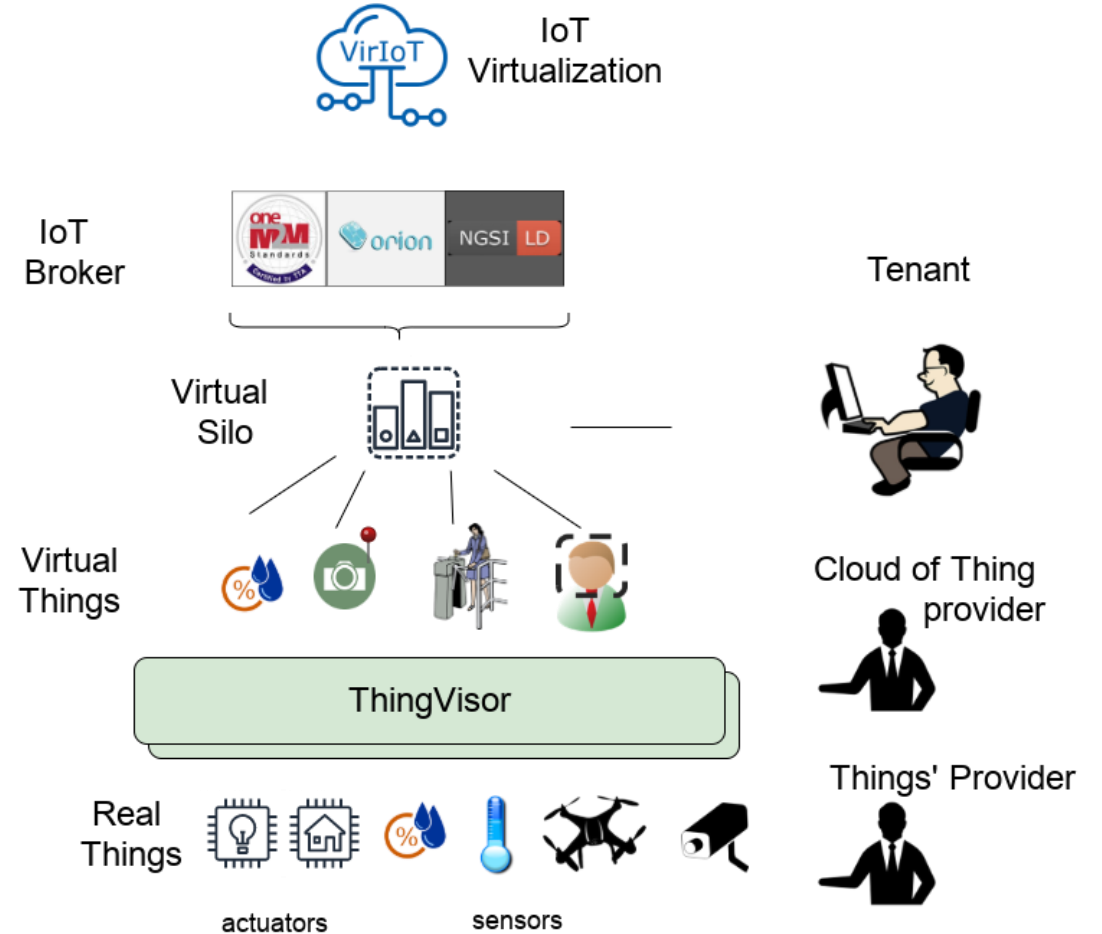
Use Cases: public services

- Decoupling of IoT infrastructure provider from application developer

IoT system providers

Cloud of Things Provider

Virtual Silo

Tenant1 FIWARE

Tenant Data Domain

IoT App designer

Use cases : private services

- IoT sandbox for application

Real Things, Integration System and APPs

New Service in Virtual Silos

Tenant1

Tenant Data Domain

Create Virtual Silo

Add Virtual Things

Receive data on broker

Production IoT system

(e.g. smart harbor)
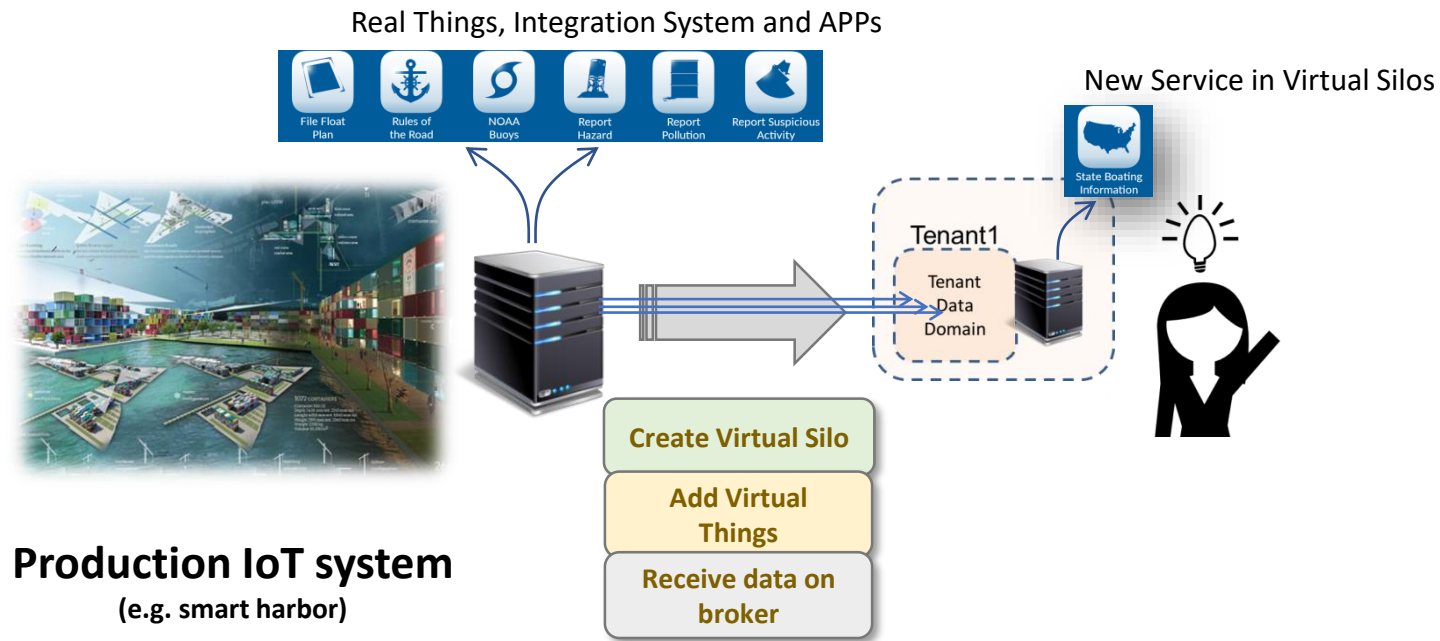
VirIoT Architecture

- Microservice
- Edge-computing
- Efficient data dissemination
- Kubernetes
- Open-source
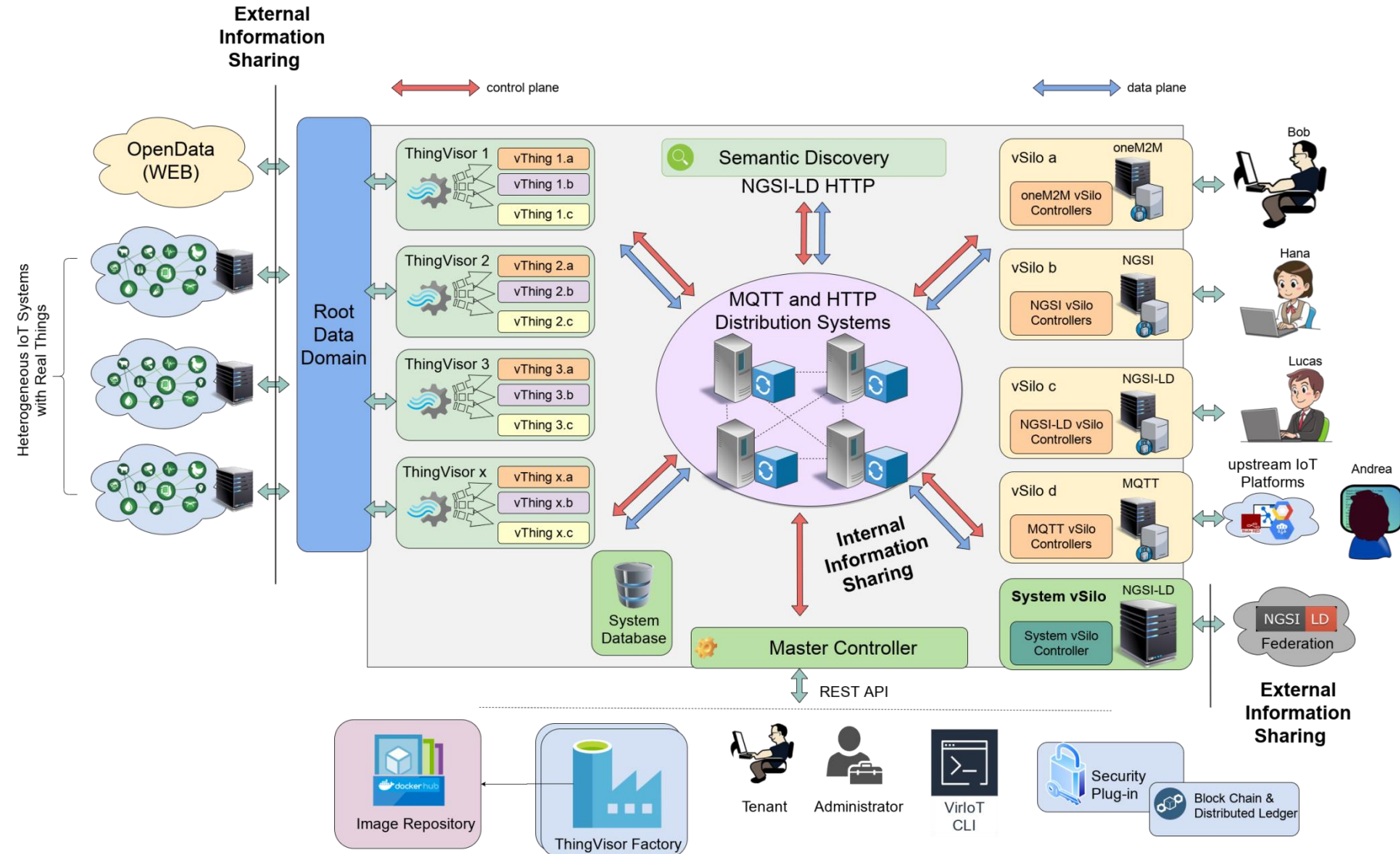
Data planes
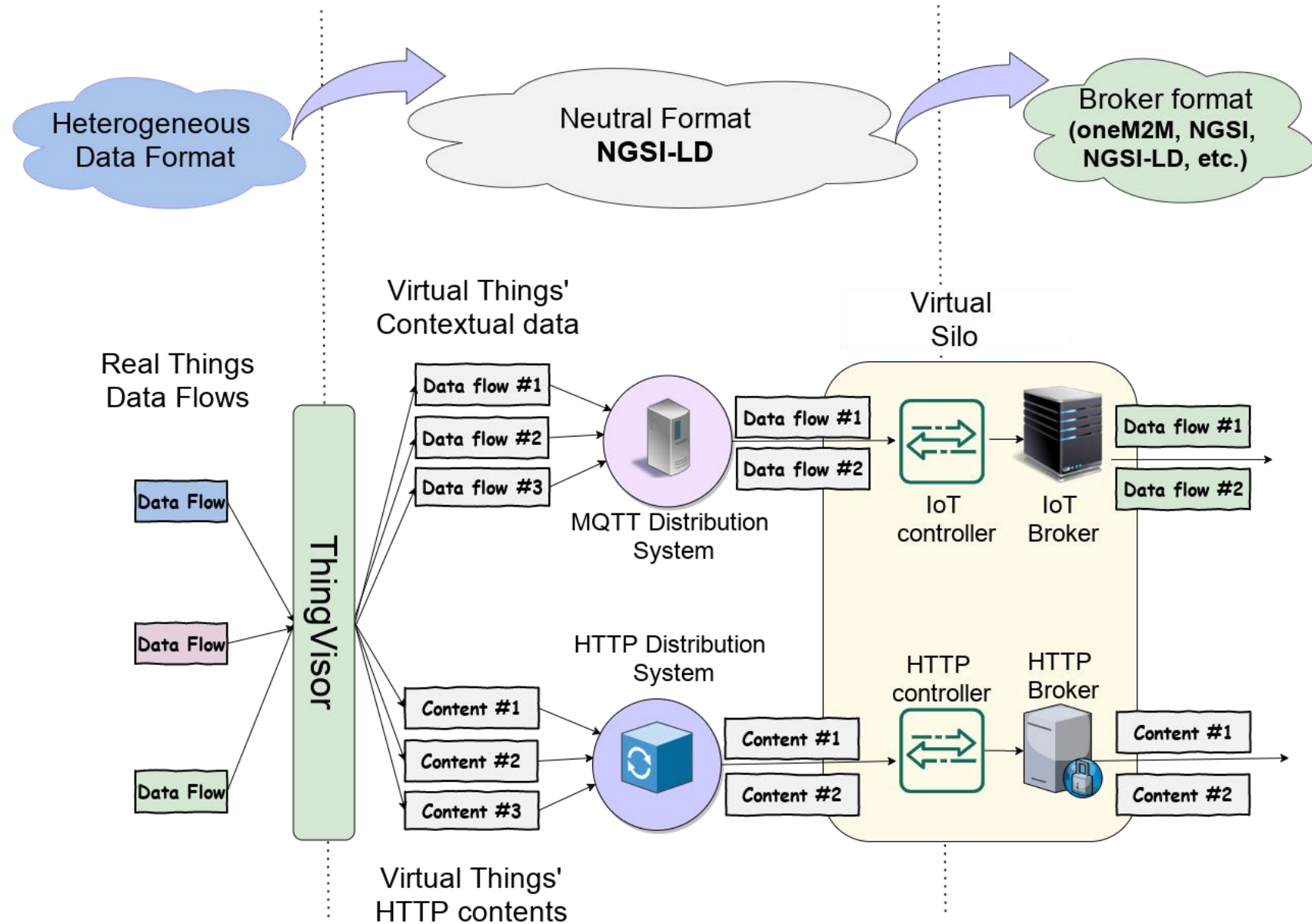
- **Contextual** data plane
  - Data topics on a MQTT service mesh made of a cluster of MQTT servers
  - **NGSI-LD** as internal *neutral* format translated by vSilo IoT Controllers
- **Content** data plane (e.g. video streaming)
 - Raw contents on HTTP service mesh made of a cluster of HTTP Proxies

Control Plane

- Control Topics on the MQTT service mesh

- Control Commands and Procedures

VirIoT control commands (JSON)

{command:[value], [arg1]:[value], [argN]:[value]}

Command	arguments:value	Senders	Receivers	Description of Actions
addVThing	vSiloID: <vSiloID> vThingID: <ThingID>	Master Controller	vSilo Controller	Add a vThing to the vSilo whose ID is vSiloID
deleteVThing	vSiloID: <vSiloID> vThingID: <ThingID>	Master Controller	vSilo Controller	Disconnect the vThing from the vSilo whose ID is vSiloID

createVThing	thingVisorID: <thingVisorID>
	vThing:{ label: <vThingLabel>
	    id: <vThingID>
	    description: <vThingDescription> }
		ThingVisor	Master Controller	Notify the creation of a new VirtualThing
				Note: <vThingID> must be equal to <thingVisorID>/<vThingLID>
				where vThingLID is a local identifier, e.g. a random number

destroyTV	thingVisorID: <thingVisorID>	Master Controller	ThingVisor	Destroy thing Visor request
destroyTVAck	thingVisorID: <thingVisorID>	ThingVisor	Master Controller	Destroy thing Visor ack
destroyVSilo	vSiloID: <vSiloID>	Master Controller	vSilo Controller	Notify the silo of an impending shutdown of the container
destroyVSiloAck	vSiloID: <vSiloID>	Vsilo Controller	Master Controller	Destroy virtual silo ack
deleteVThing	vSiloID: ALL vThingID: <ThingID>	ThingVisor	vSilo Controller	Delete from all silos the vThing whose ID is <thingVisorID>/<vThingLID>
getContextRequest	vSiloID: <vSiloID> vThingID: <ThingID>	vSilo Controller	ThingVisor	Get the current status of the virtual Thing whose id is vThingID
getContextResponse	data: [NGSI-LD Entity array] meta: { vThingID: <ThingID> }	ThingVisor	vSilo Controller	Response to getContextRequest message. The payload of the message is an array of NGSI-LD entities
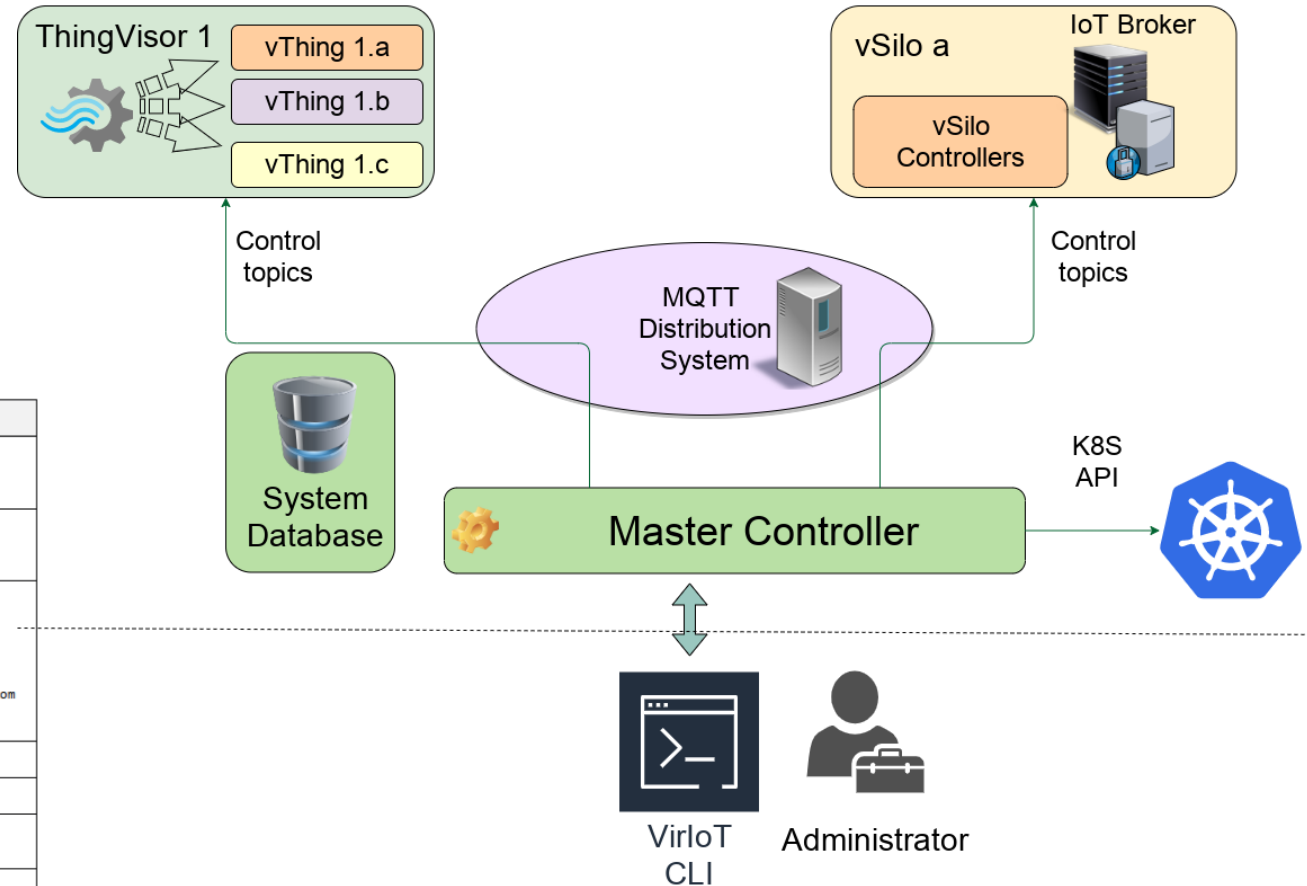
VirIoT over Kubernetes: EU-JP deployment

- Kubernetes

- VPN

- Zone labels to support edge computing

- Service topology feature to route traffic towards closest MQTT/HTTP server
  - Low latency
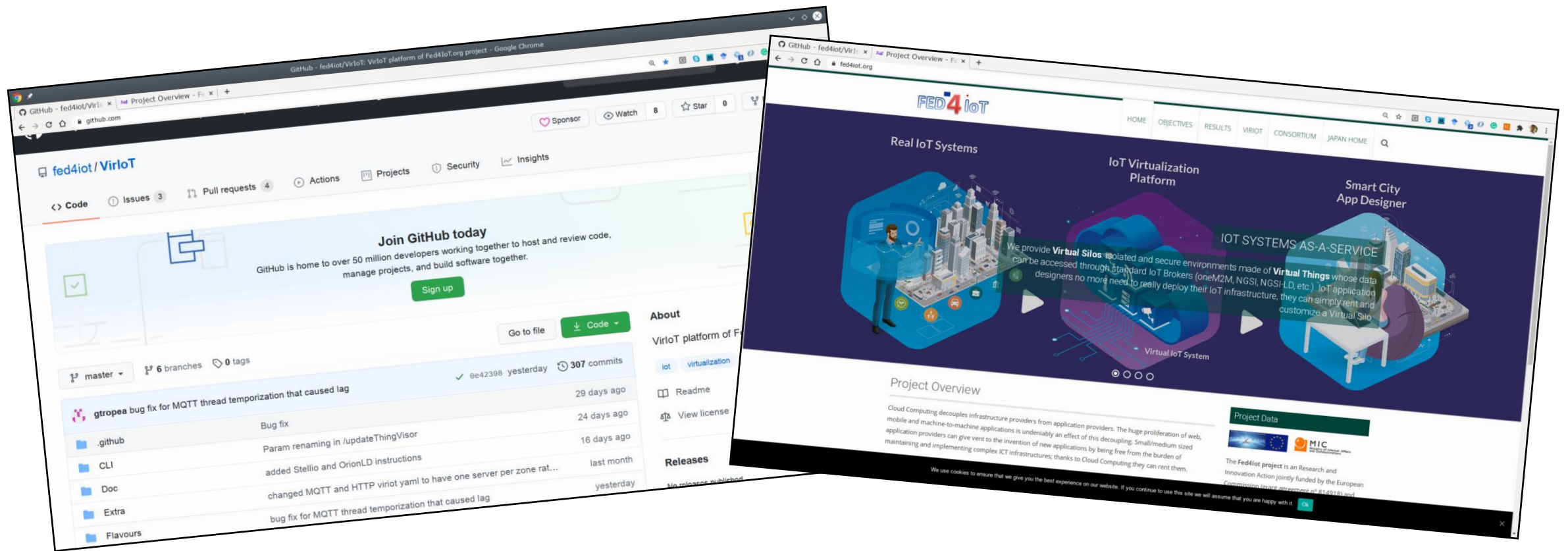 - Low bandwidth consumption
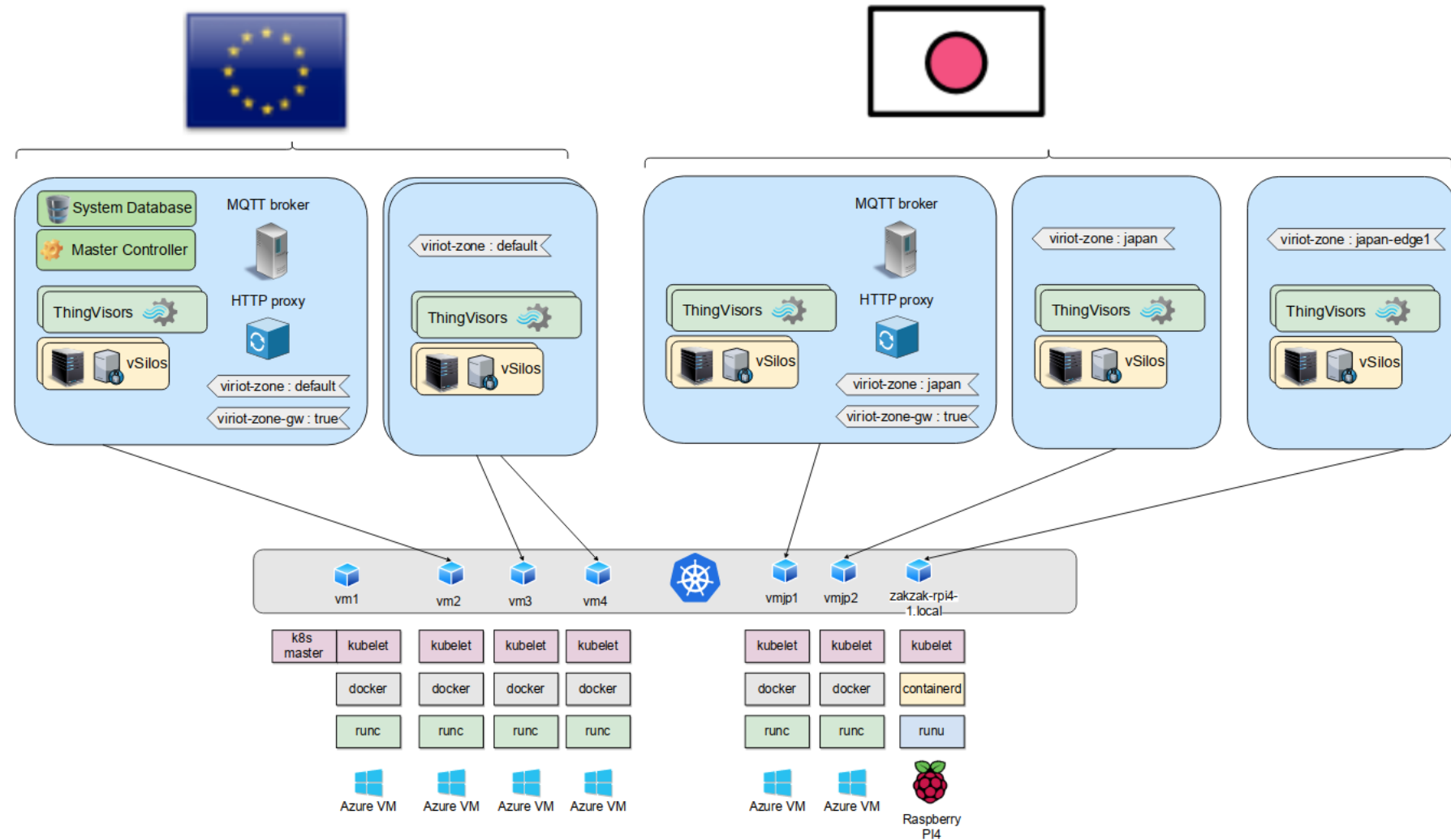
VirIoT: essential characteristics

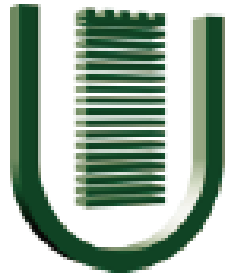*Inspired from NIST definition of cloud computing*

- **On-demand self-service**
  - a consumer can unilaterally provision IoT resources, such as Virtual Things, IoT Broker and Virtual Silos, as needed automatically without requiring human interaction with each service provider.
- **Broad IoT access**
  - IoT resources are available over the network and accessed through heterogeneous IoT standard mechanisms, such as those specified by NGSI, NGSI-LD, oneM2M, etc.
- **Broad support of IoT devices**
  - Support of heterogeneous IoT sensors and actuators producing or consuming contextual data and generic HTTP contents (images, streams, etc.)
- **Resource pooling**
  - Underlying computing and IoT resources (real things, open data, etc.) are pooled to serve multiple consumers with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

References

- Project web site : **https://fed4iot.org**

- GitHub of software : **https://github.com/fed4iot/VirIoT**

- Video of VirIoT software in Action : https://fed4iot.org/wp-content/uploads/ftp/VirIoT-in-Action.mp4

Questions ?

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