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DL AS A SERVICE: UNA PROSPETTIVA PER IL WEB OF THINGS

4th DLT Working Group Meeting
Firenze, 7-8 Novembre 2022

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IoT Definition

- ▣ term “**Internet of Things**” [Kevin Ashton 1999]
 - ▣ RFID + Internet in supply chain
 - ▣ “*The Internet of Things has the potential to **change** the world, just as the **Internet** did. Maybe even **more**.*”
- ▣ Historical perspective:
 1. *things on the Internet*
 2. *intranets of things*
 3. *global internetworking among things*
- ▣ “*IoT is the **network of things**, with device **identification**, embedded **intelligence**, and sensing and acting capabilities, connecting people and things **over the Internet**.*” [...]

IoT General Use Case

- ▣ Sensing/Actuating-as-a-Service (**SAaaS**)
 - ▣ virtualize physical hardware of various sensors and actuators
 - ▣ creating IoT cloud/fog/edge infrastructure
 - ▣ to serve *multiple* sensing/actuating applications *concurrently*
- ▣ SDN+NFV can bring IoT to maturity
 - ▣ full-customization
 - ▣ network programmability

IoT Abstract Resources

- ▣ categorized into *three domains*:
 - ▣ **compute** and **storage** domain
 - computing hardware
 - ▣ **hypervisor** domain
 - both virtual computing and virtualization layer
 - ▣ **infrastructure network** domain
 - virtual networks as well as network hardware

DLaaS Motivation

- ▣ DLT:
 - ▣ decentralized (distributed) *sensed* data management
 - ▣ trusted immutable samples
 - ▣ spread across a P2P network
- ▣ Ambient Intelligence
 - ▣ AI \Leftrightarrow IA
- ▣ IoE
 - ▣ *Speed* layer
 - ▣ event based (space+time)
 - ▣ Batch layer (*human-in-the-loop*)

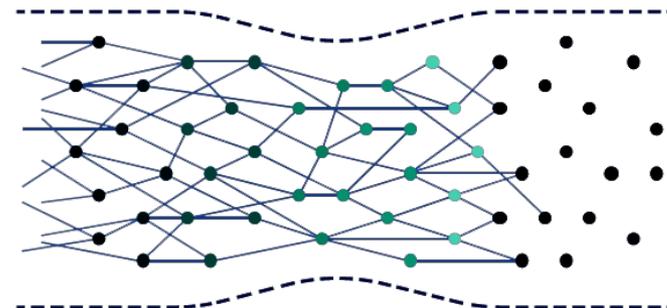
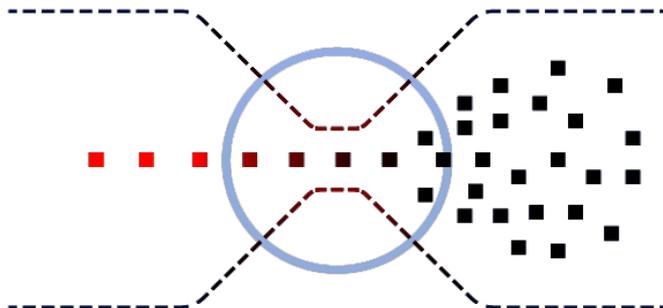
IOTA: a DL for IoT



- ▣ IOTA: an open source DLT specifically conceived for IoT domains [IOTA Foundation, 2016]
 - ▣ IOTA 1.0 (*Original*)
 - ▣ IOTA 1.5 (*Chrysalis*)
 - ▣ IOTA 2.0 (*Coordicide*)
- ▣ Lifecycle:
 - ▣ *Whitepaper*: development guidelines
 - ▣ Design: research and software specifications on *Devnet*
 - ▣ Release: protocol and complete development on *Mainnet*

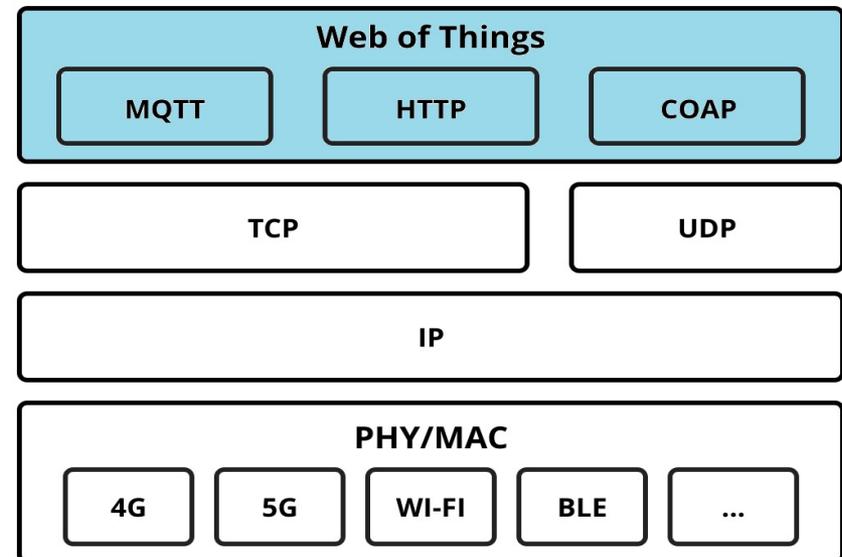
Blockchain vs IOTA

Blockchain	IOTA
Chain of transactions	Tangle of microtransactions
point-to-point connection	point-to-multipoint connection
limited scalability (mining)	"un"limited scalability
<i>always</i> secure and decentralized	secure and decentralized <i>above</i> a critical mass



Web of Things

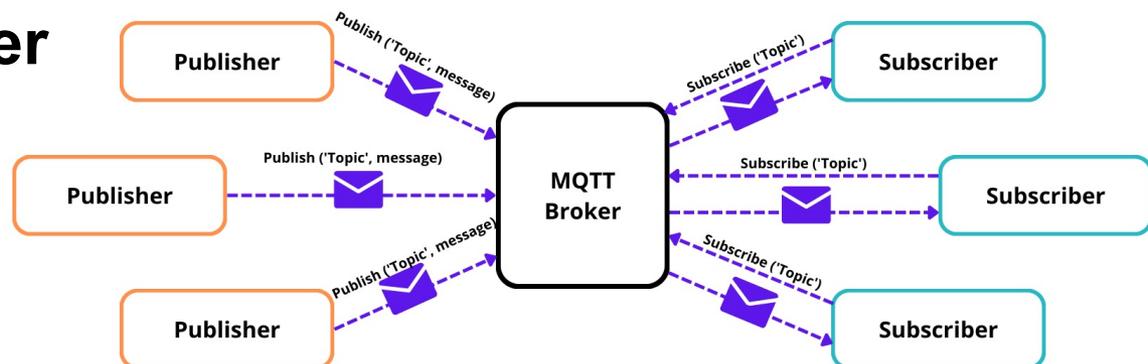
- ▣ a plethora of *closed vertical* applications
- ▣ REST paradigm could provide
 - ▣ interoperability
 - ▣ long-term evolution
 - ▣ robustness



Web of Things



- ▣ **Message Queue Telemetry Transport** [OASIS, 1999]
- ▣ lightweight and reliable L5 protocol
 - ▣ based on **pub/sub** (*topic*) messaging
 - ▣ **Publisher**
 - ▣ **Subscriber**
 - ▣ **Broker**



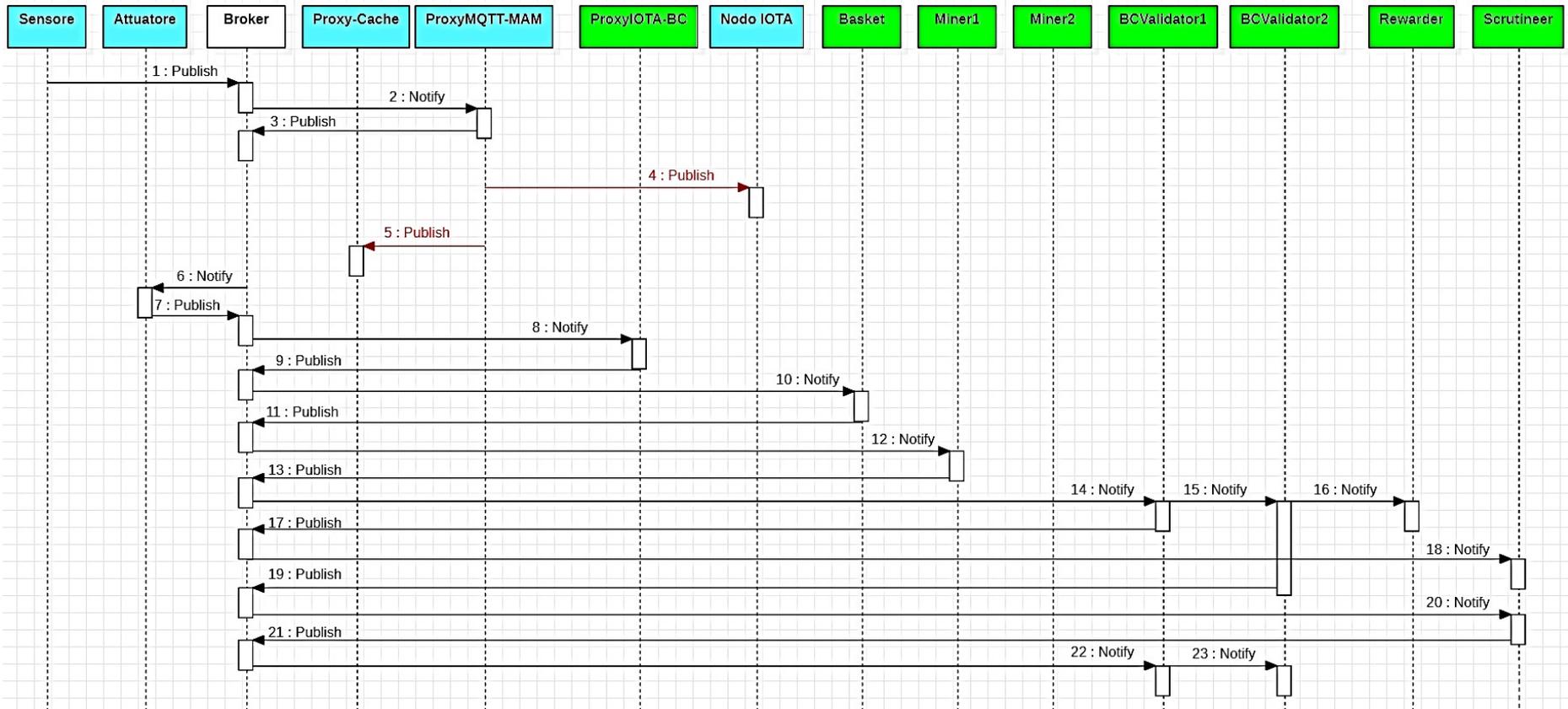


Proposed approach

- ▣ Integrated communications architecture *design*
 - ▣ Messages
 - **publish**(string *TopicURI*, int *QoS*)
 - **subscribe**(string *TopicURI*, int *QoS*=NULL)
 - **unsubscribe**(string *TopicURI*)
 - **notify**(time-t *timeNotify*, string *TopicURI*)
 - ▣ Actors
 - Sensor / Actuator
 - Broker / Proxy-Cache
 - ProxyMQTT-MAM / ProxyIOTA-BC / IOTA Node
 - Miner / Basket / BCValidator / Scrutineer / Rewarder

Proposed approach

▣ Communications protocol (**IOTA** + **Blockchain**)



Proposed approach

- ▣ Pros
 - ▣ interoperability (Lambda model)
 - ▣ scalability
 - ▣ portability
 - ▣ modularity
 - ▣ mobility support
- ▣ Cons
 - ▣ Broker constraints
 - IPv6 public address
 - availability
 - storage and security (DoS)

Acknowledgment

- **FABuLOuS - Florence Area Blockchain Laboratory Observatory Studies**
 - Bando “*Ricercatori a Firenze*”, Fondazione Cassa di Risparmio di Firenze (2021)
 - **DiMal**: Dipartimento di Matematica e Informatica “Ulisse Dini”
 - **DiSEI**: Dipartimento di Scienze per l'Economia e l'Impresa
 - **DInfo**: Dipartimento di Ingegneria dell'Informazione
 - *Dott. Giorgio Gandini*



THANK



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