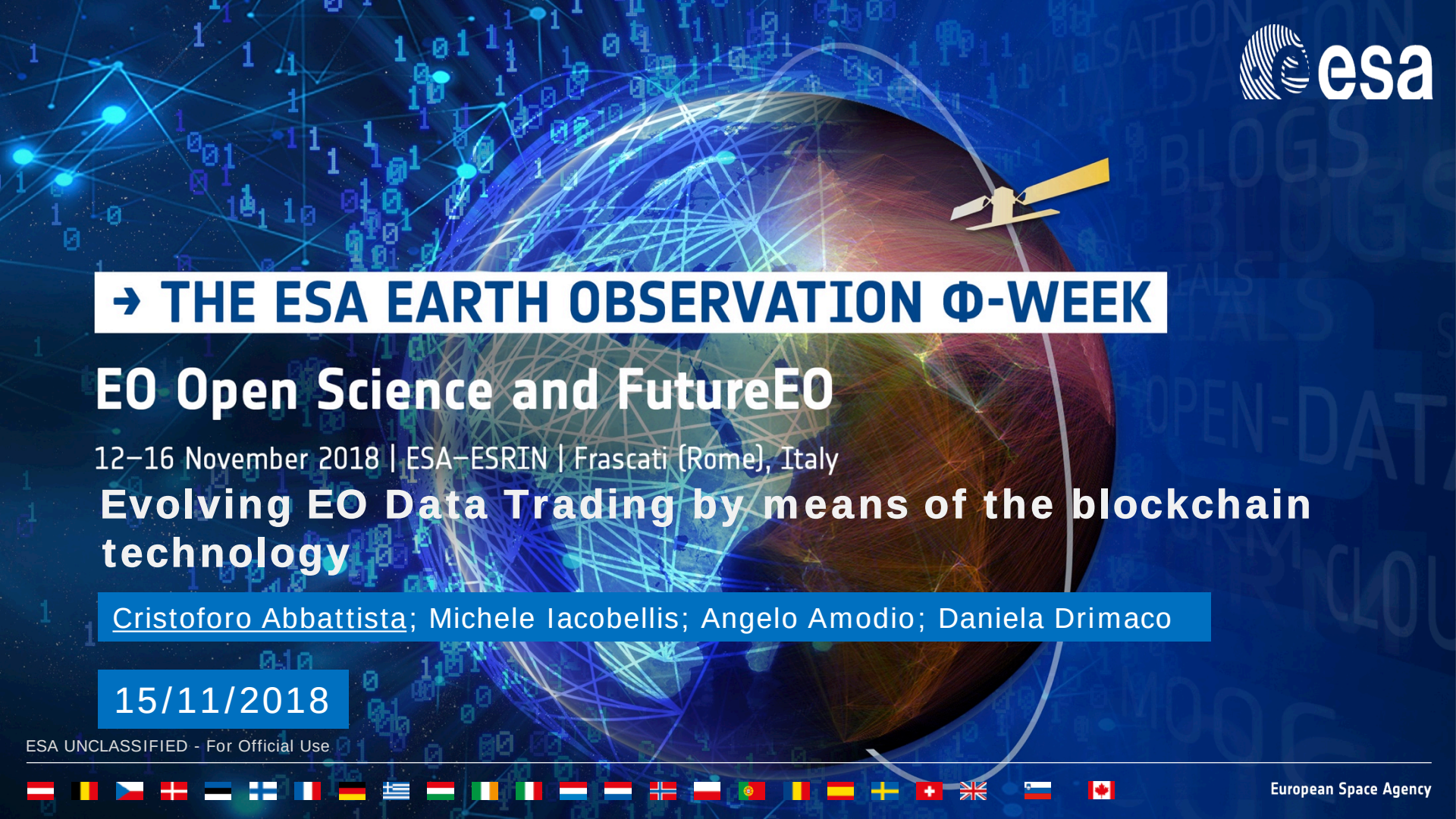

→ THE ESA EARTH OBSERVATION Φ-WEEK

EO Open Science and FutureEO

12–16 November 2018 | ESA–ESRIN | Frascati (Rome), Italy

Evolving EO Data Trading by means of the blockchain technology

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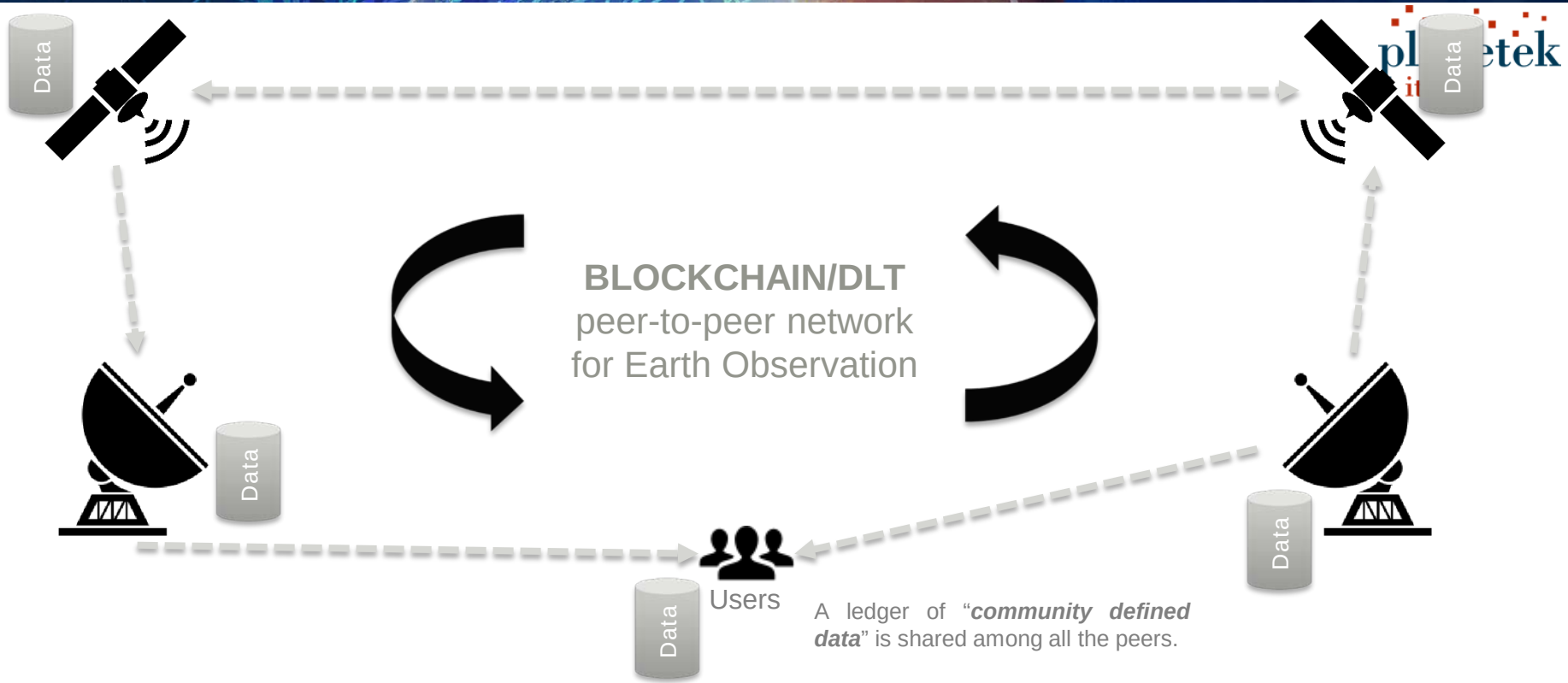
15/11/2018

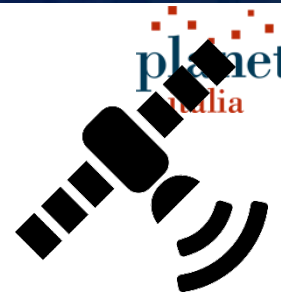
INTRODUCTION



A ledger of "***community defined data***" is shared among all the peers.

WHY ? The Space Agents

- Space/ground devices (agents) shall have an unequivocal identity in the modern cyber magma.
- Space/ground devices (agents) shall exchange data in a cryptographically secure way.
- Space/ground devices (agents) and people shall contribute to a shared knowledge whose coherency and accuracy shall be certified in robust, peer reviewed ways.



- **DLT** technologies (public key cryptography, peer-to-peer networks, distributed consensus) seems the ideal solution.

WHY ?

- Many efforts are spent in algorithm design and testing.
- The EDGE now offers interesting computational power.
- Results and VAPs contain the Value, undoubtedly.
- But "***reproducible results***" have more Value.
- This is enforced today by the fact that "***data is now a commodity***".

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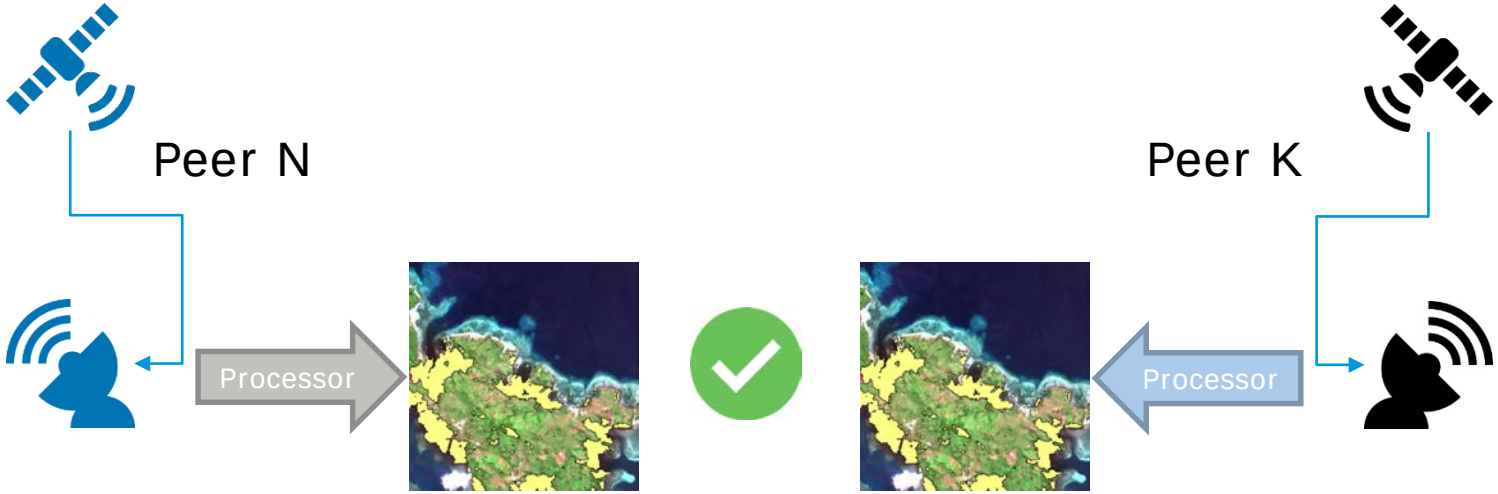


WHY ?

Benefit examples:

- VAPs providers could be certain that their products in the network have a *certified source and identity*.
- VAPs providers could be sure that their products are *delivered to certified well defined target consumers*.
- Any company involved in EO value chain is eligible to enter the network and *become target user of certified products*.
- The EO value chain is *cryptographically traceable* against damage, theft and forgery.

WHAT DO WE GAIN ?

A **DLT** network allows us to:

Focus on the User *by focusing on the quality of the data*, given the collaborative way of updating the distributed ledger.

WHAT DO WE GAIN ?

This is a step towards:

PEER EO, a *peer to peer based Earth Observation* platform for a paradigm that involves traditional cloud and distributed edge cloud computing.

TECHNOLOGY OVERVIEW

BLOCKCHAIN/DLT is a combination of:

- Peer to Peer Networking,
- Public-Key Cryptography,
- Distributed Consensus (*fault tolerance*),
- Deterministic execution of code (*smart contracts*),
- Business logic based on value exchange,
- Reputation management.

CTEO - BLOCKCHAIN FOR EO

Planetek is involved in an ESA project.

The project aims at delivering an initial software development kit (SDK) for enabling present and future systems to run over existing blockchain/dlt technologies, expanded with our customized software layers tailored for typical EO data.

Project duration: 12 (twelve) months.

General design of algorithms and techniques (details 1/3):

- Design a mechanism for signing and uniquely identifying smart contracts based on their input requirements and output products.
- Design an execution environment suitable for running EO smart contracts with specific constraints (execution time, disk usage, network usage, etc.).

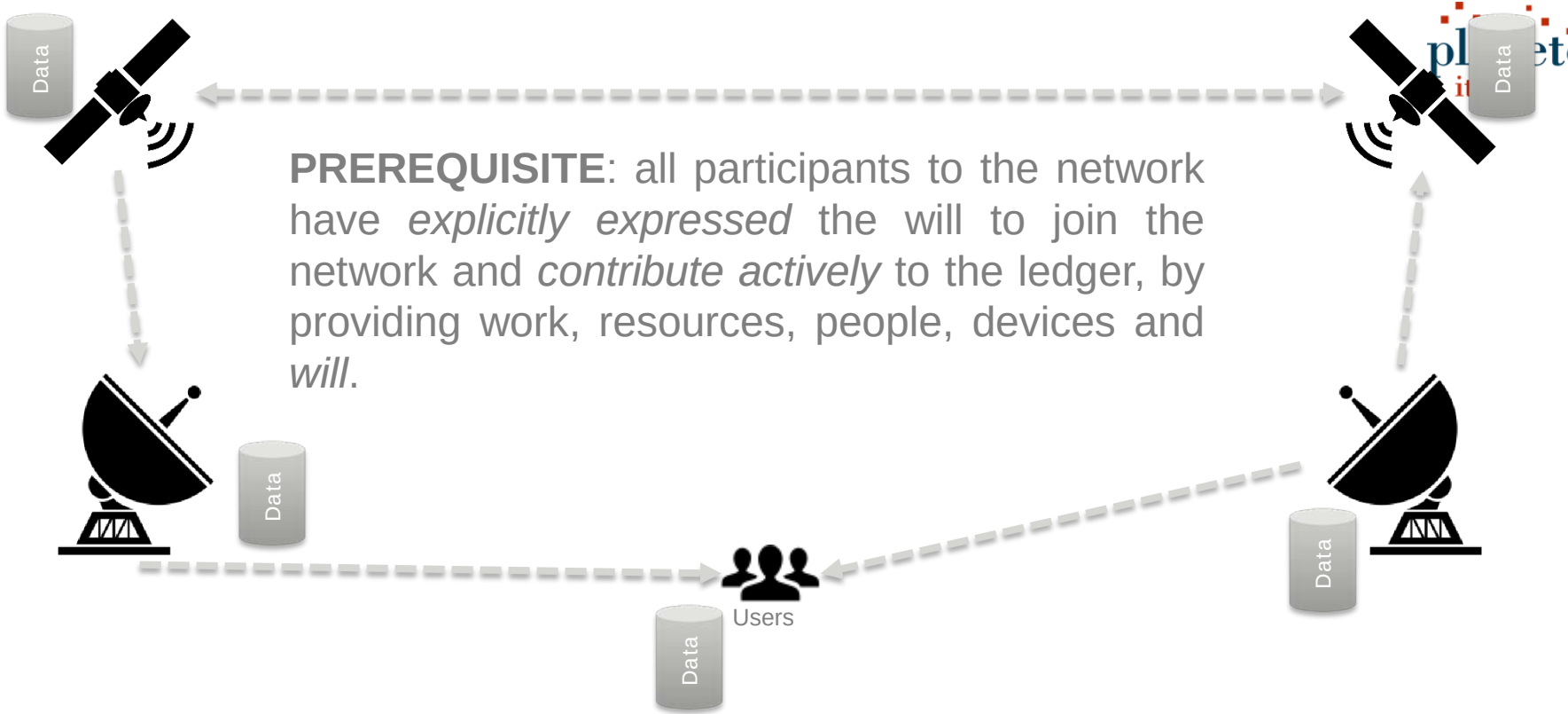
General design of algorithms and techniques (details 2/3):

- Design a dedicated custom crypto-currency rewarding mechanism for stimulating peer participation to the network.
- Determine a set of suitable “proof of *” algorithms to use when dealing with consensus mechanism.

General design of algorithms and techniques (details 3/3):

- Determine classification criteria of source and destination endpoints for creating unique representations of BC concepts (signatures, transactions, identities).
- Design a mechanism for dividing, encrypting and distributing large datasets (typical EO imagery) to a group of peers in the network.
- Design a mechanism for unsupervised and/or user-guided selection of area of interests on the datasets, to use for distribution.

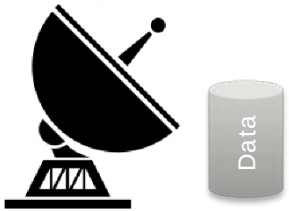
Space/Ground Network



PREREQUISITE: all participants to the network have *explicitly expressed* the will to join the network and *contribute actively* to the ledger, by providing work, resources, people, devices and *will*.

Space/Ground Network

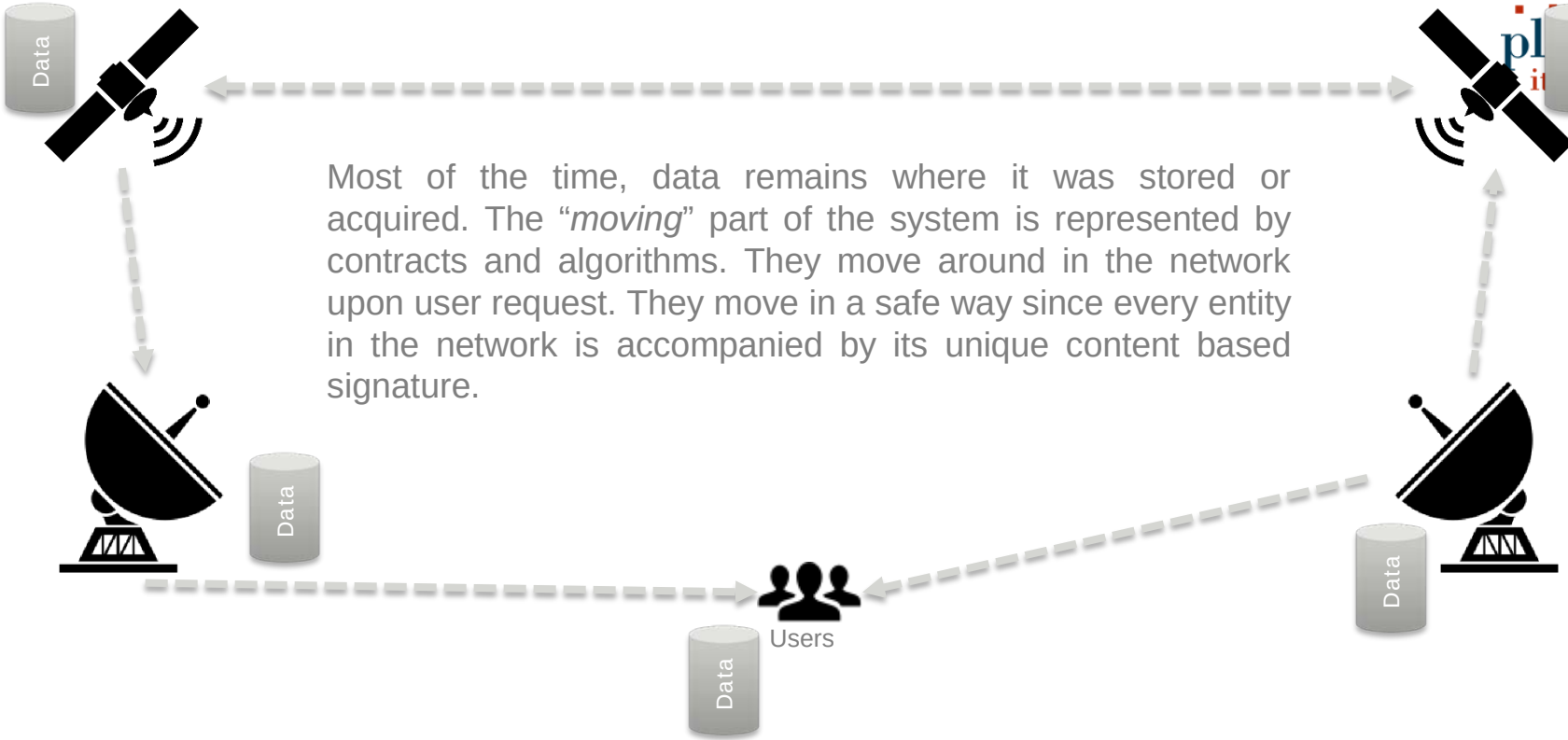
Peers exchange information (VAPs) emerging from the application of smart contracts (algorithms) to data. This is accompanied by an exchange of value (for example a crypto currency or some rating mechanics) to feed the execution of algorithms.



All peers share the ledger so that information is updated through transactions and consensus management. Data is partitioned to meet device storage requirements.

Users

Space/Ground Network



Most of the time, data remains where it was stored or acquired. The "*moving*" part of the system is represented by contracts and algorithms. They move around in the network upon user request. They move in a safe way since every entity in the network is accompanied by its unique content based signature.

Achievements

This approach will foster:

- Resiliency (thanks to signatures, encryption, fault tolerance),
- Decentralization (thanks to peer to peer networking),
- Distribution (thanks to peer to peer networking),
- Efficiency (no unexpected or undesired intermediaries),

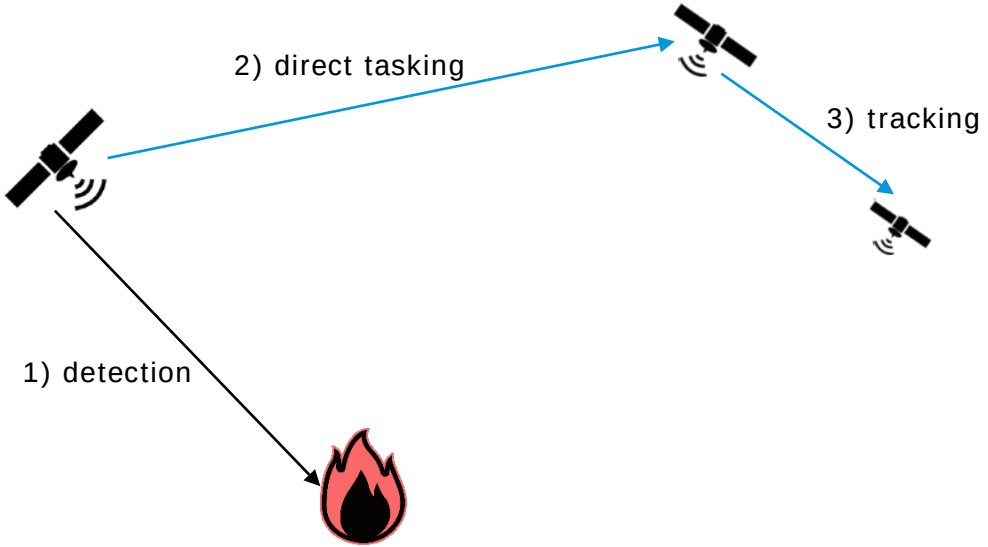
Achievements

This approach will foster:

- Effectiveness (deterministic code execution [smart contracts]),
- Robustness (thanks to signatures, encryption, fault tolerance),
- Immutability (distributed ledger),
- Transparency (distributed ledger),
- Trust (reputation).

Scenarios

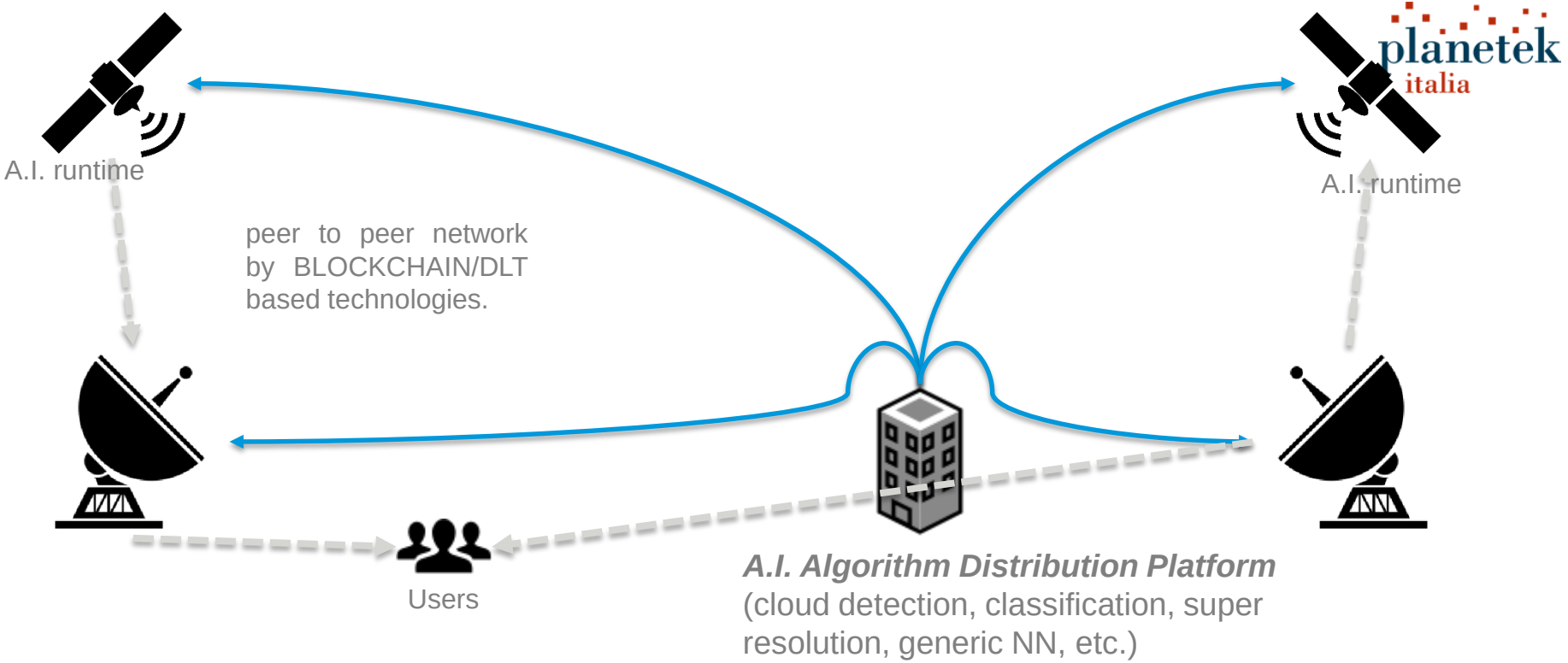
- ***Autonomous*** spacecrafts and satellites may host configurable A.I. algorithms, which could be activated ***on demand***.
- A.I. algorithms ***operation and deployment*** could be inserted into a rewarding mechanism such as a rating system and/or crypto-currency.
- A.I. algorithm providers could ***distribute*** algorithms to selected devices on request.



Scenarios

- Autonomous vehicles (**RPAS**) may host configurable A.I. algorithms, which could be activated on demand.
- Monitoring stations with ***advanced analytics*** inside.
- ***A.I.*** farms (DIAS+) with dedicated processing hardware for continuous data stream processing and analysis.
- ***A.I.*** in ***5G*** networks for advanced traffic routing, prioritization, packet inspection and quality checks.

Scenarios


A.I. runtime
peer to peer network by BLOCKCHAIN/DLT based technologies.
A.I. runtime
Users
A.I. Algorithm Distribution Platform
(cloud detection, classification, super resolution, generic NN, etc.)

Thank you for your attention

For further information

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