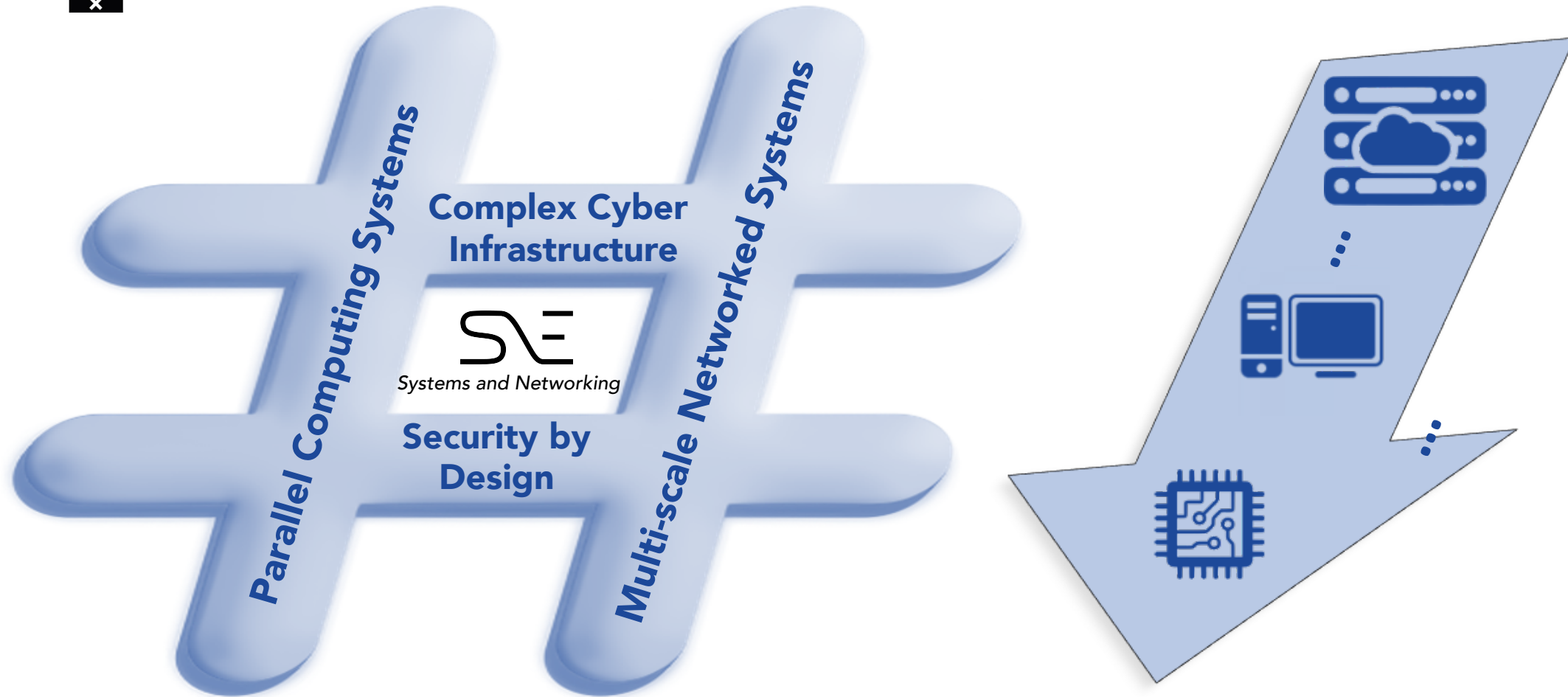# Trusted data sharing and the responsible Internet

Paola Grosso
on behalf of the whole UvA team

Multiscale Networked Systems research group
University of Amsterdam

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Multiscale Networked Systems

Parallel Computing Systems

Complex Cyber Infrastructure

Systems and Networking

Security by Design

Multi-scale Networked Systems

- We conduct research on leading-edge computer systems of all scales, ranging from global-scale systems and networks to embedded and on-chip devices
- Our particular interest is on the extra-functional properties of these systems, such as performance, programmability, productivity, security, trust, sustainability and, last but not least, the societal impact of emerging systems-related technologies
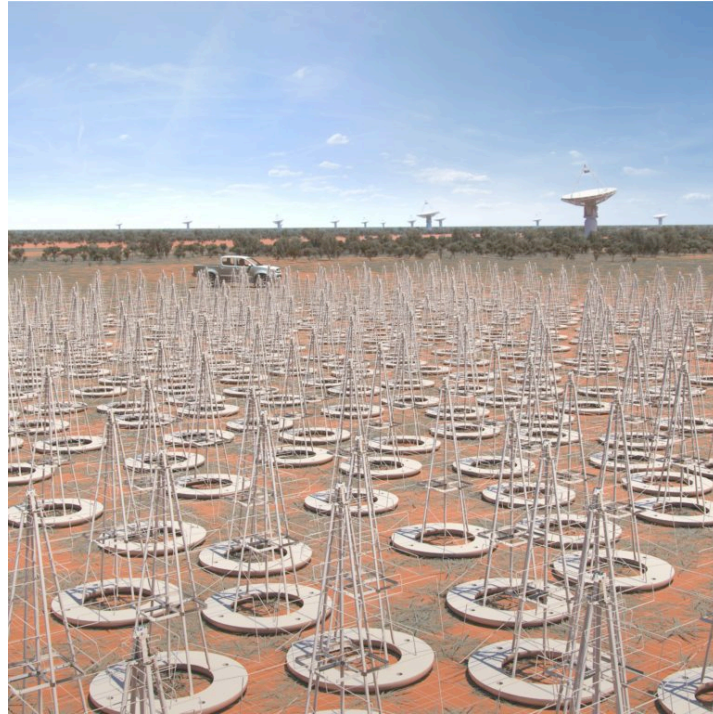
Multiscale Networked Systems

Scientific challenges:

1. Put the user at the center. Letting the user decide what happens with his/her data.

Q: Who is the user?

2. Research methods to exchange data between parties that work together for a common goal but otherwise compete.

Q: How to keep control on data, algorithms so that it is only used for the agreed purposes?

Research data

Photo source: CERN

High energy physics (LHC)

Photo source: SKA organisation

Radio astronomy (SKA)

Scientific data is shared by many users to be integrated/reused.
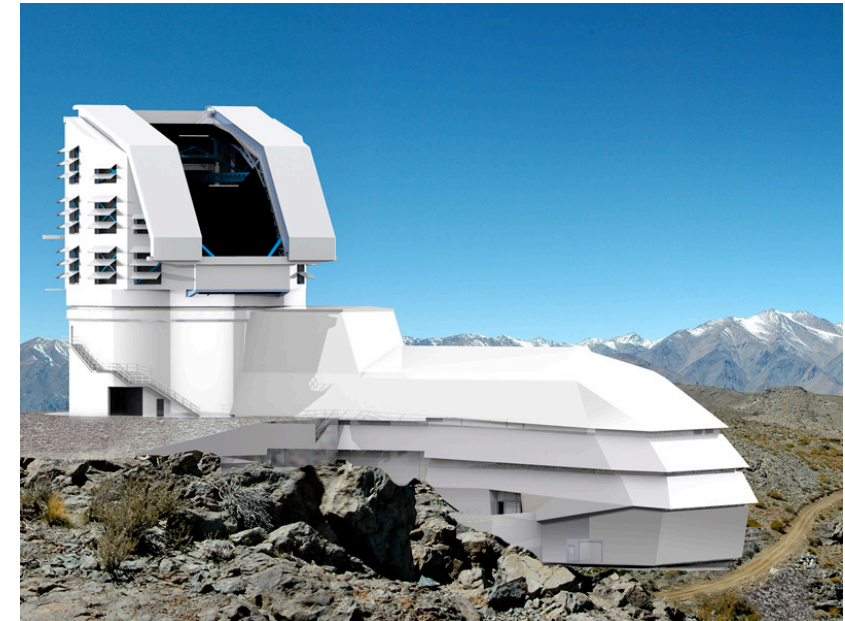
Photo source: LSST/NSF/AURA
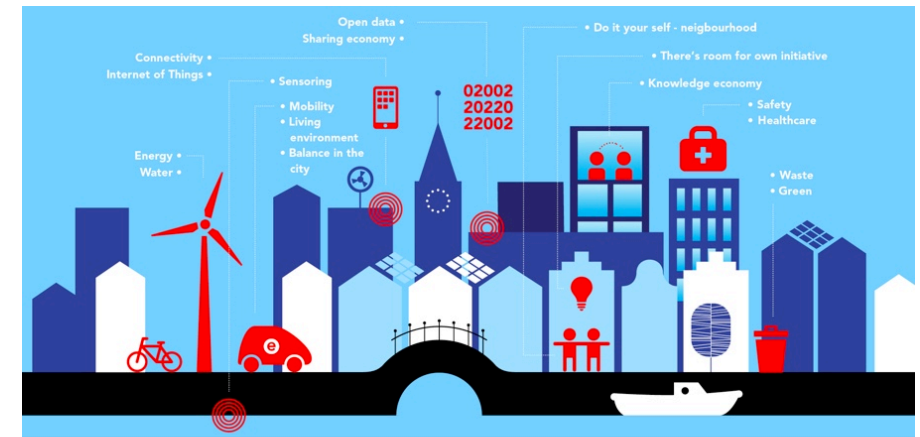
Radio astronomy (LSST)

Data about people

Logistics business integration by trustworthy data sharing

Photo source: DL4LD project

Logistics (DL4LD)

Photo source: Genetic Literacy Project
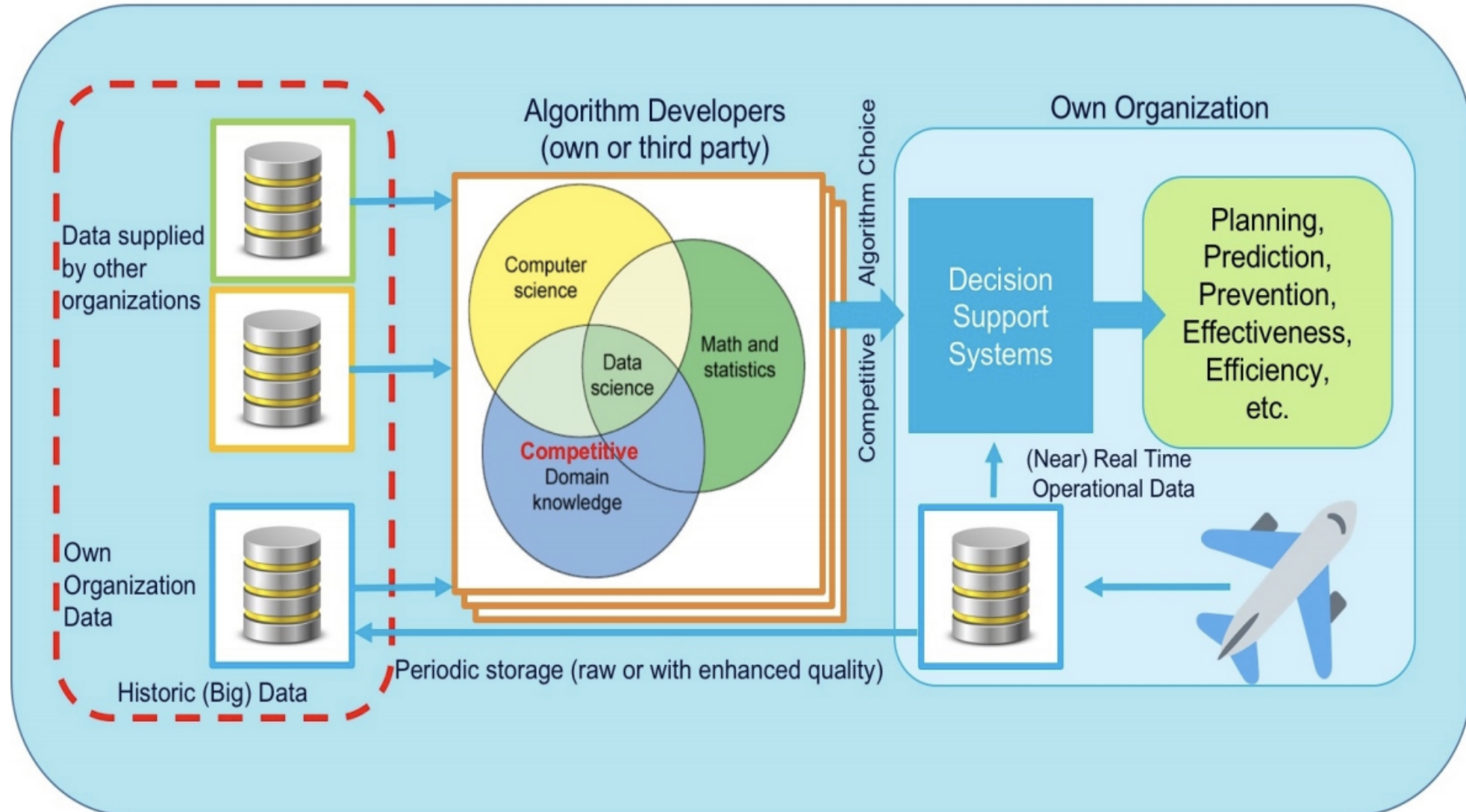
Personalized medicine (EPI)

Personal data is shared by many parties.

Smart cities (AMDeX)

Photo source: AMS Economic Board

A triad: data, algorithms and resources

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Multiscale Networked Systems

AAA   Discovery   Metadata   Auditing

services

Domain A

ML training

services

Domain C

ML training

services
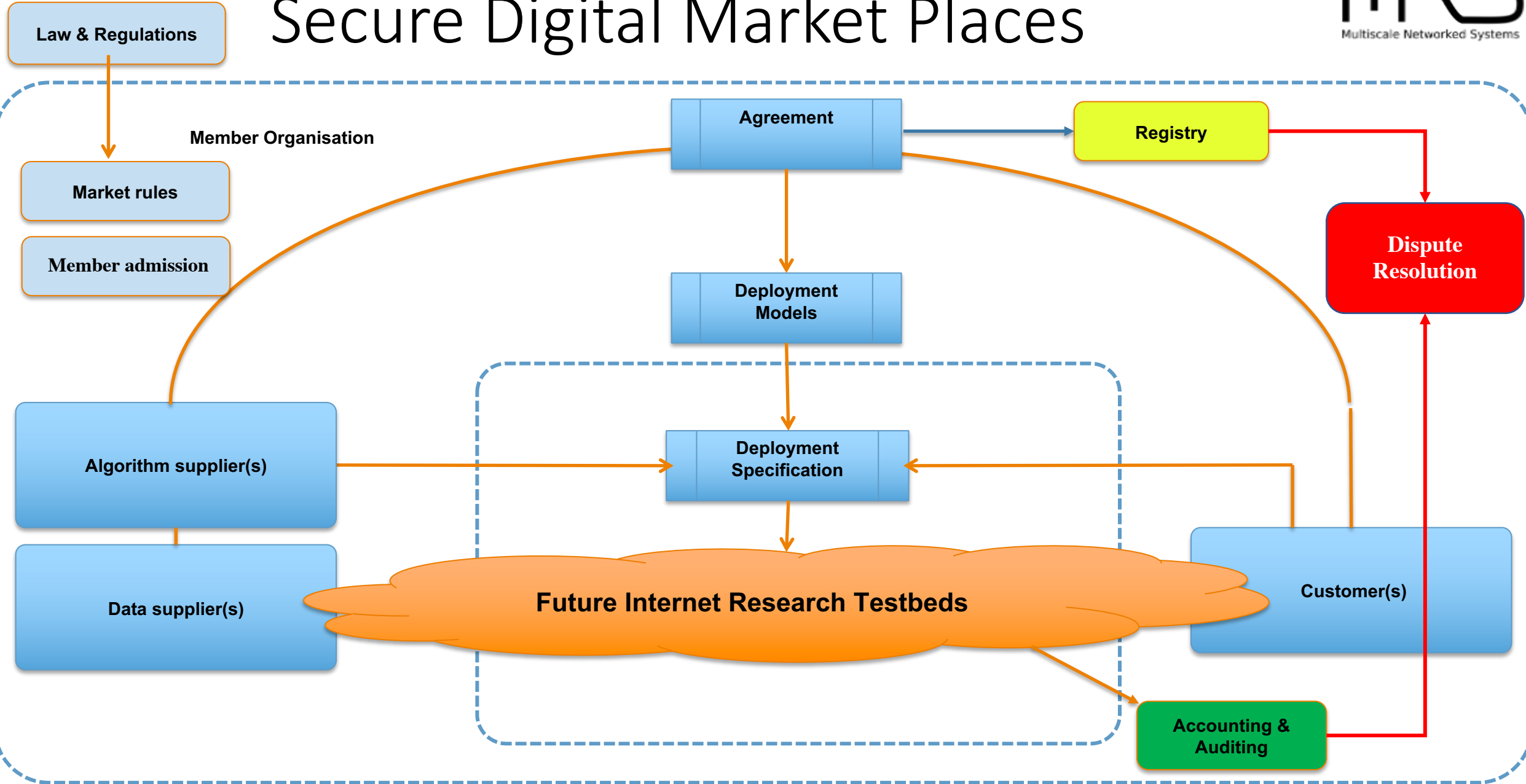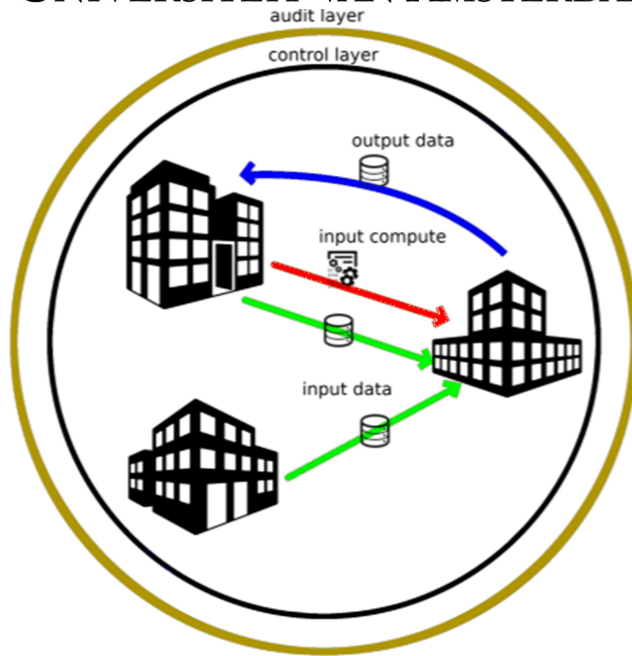
Domain B

ML training

infra   infra   infra
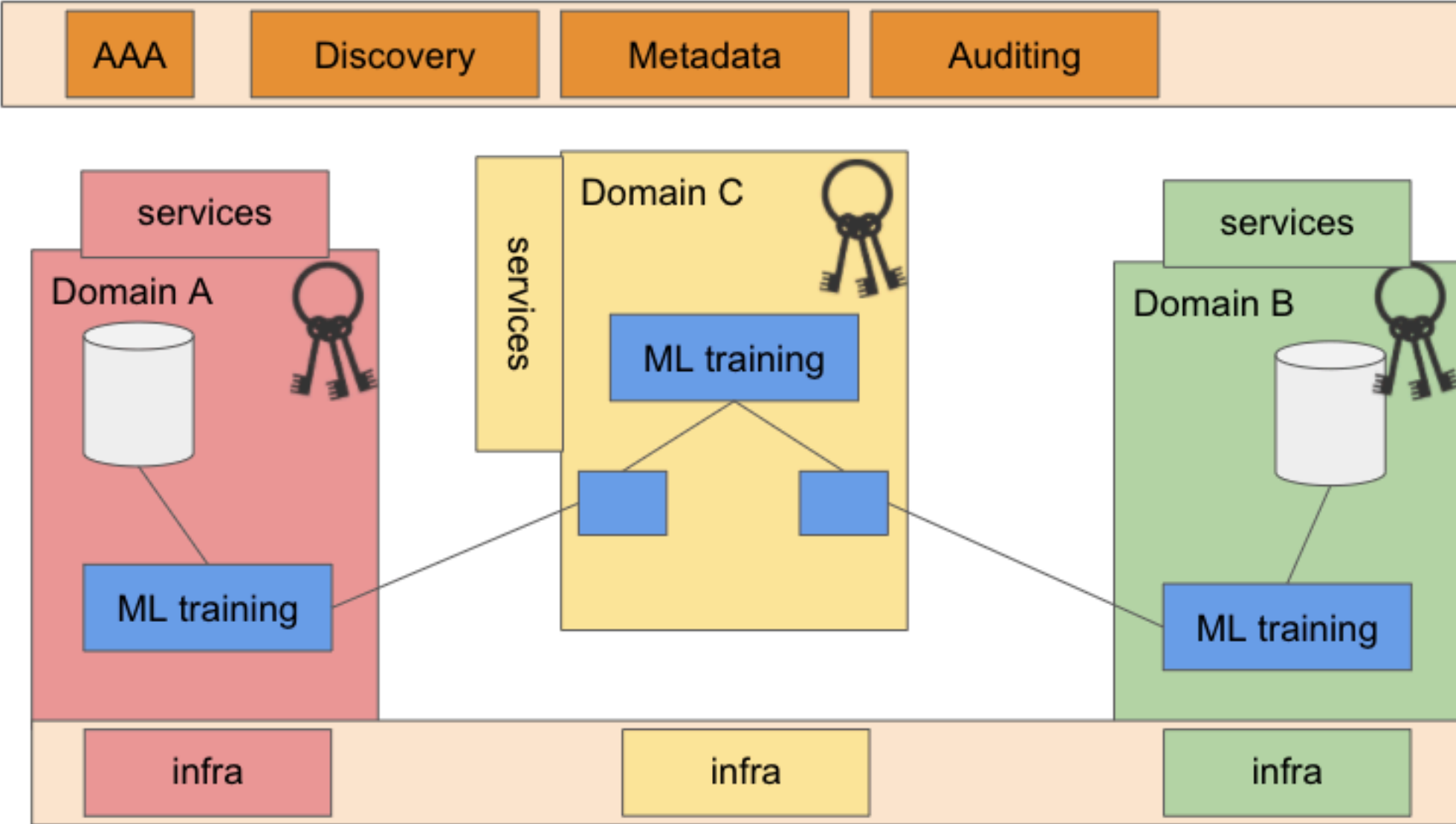
Many applications require to perform coordinated operations across domains.

Q: How do you get the required services across federated infrastructures?

Credit : dr. Reggie Cushing (UvA)

Secure Digital Market Places
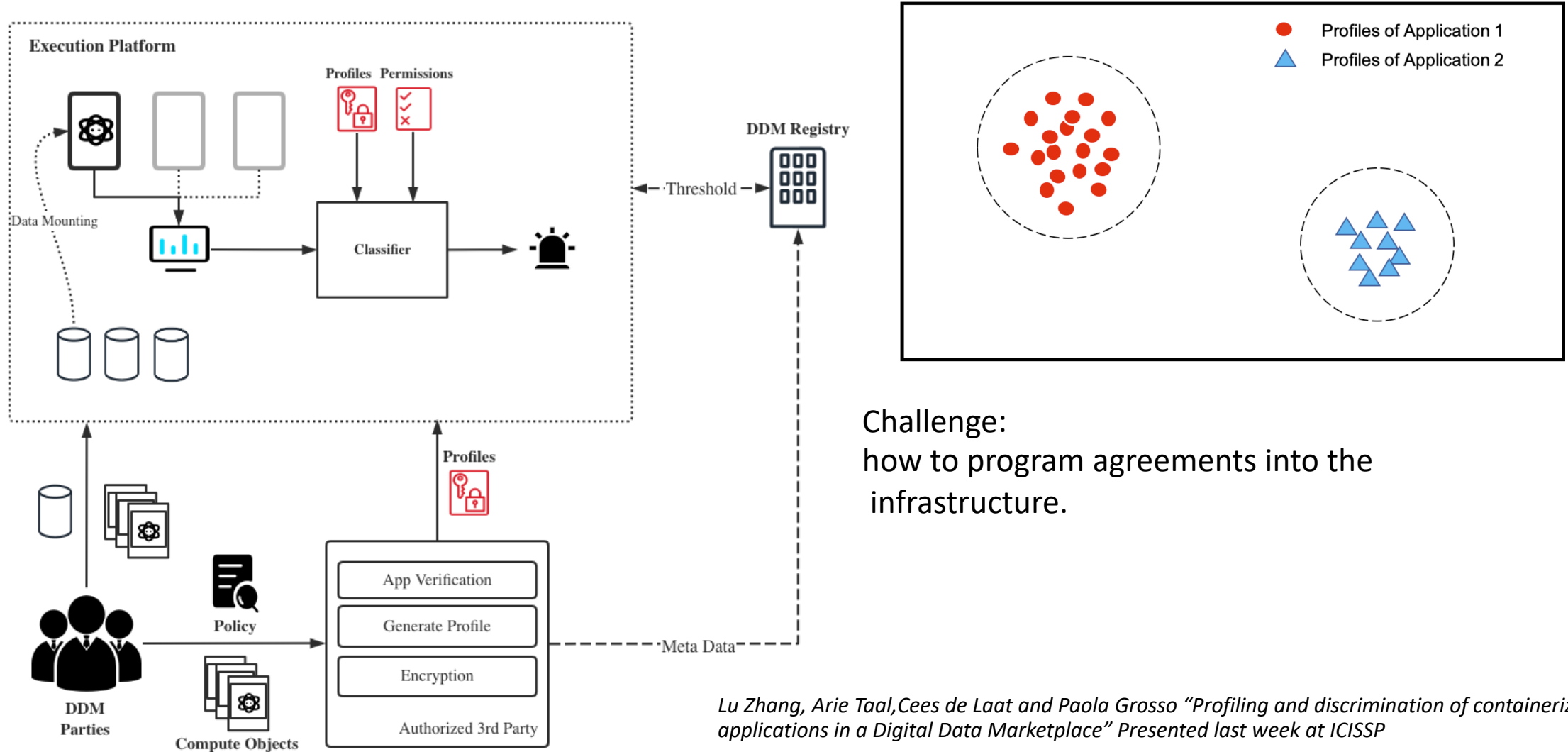
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Audible network

Demchenko, Yuri, Reggie Cushing, Wouter Los, Paola Grosso, Cees de Laat, and Leon Gommans. "Open Data Market Architecture and Functional Components." In *2019 International Conference on High Performance Computing & Simulation (HPCS)*, pp. 1017-1021. IEEE, 2019.

Cushing, Reginald, Ralph Koning, Lu Zhang, Cees de Laat, and Paola Grosso. "Auditable secure network overlays for multi-domain distributed applications." In *2020 IFIP Networking Conference (Networking)*, pp. 658-660. IEEE, 2020.

Plan A	Actions
A1: Domain1-**transfer**-Domain3	
A2: Domain2-**transfer**-Domain3	
A3: Domain3-**compute**	
......	

Requests

Signatures

Planner
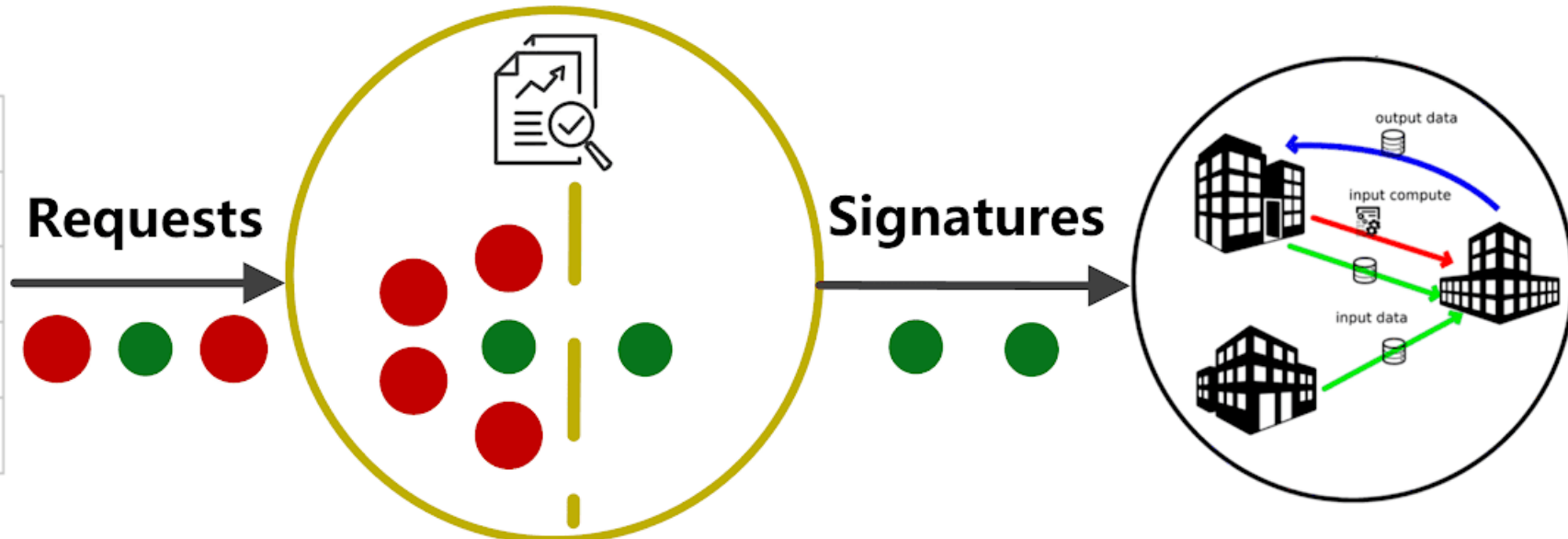
Audit layer

Control layer

Profiling and monitoring application

Challenge:
how to program agreements into the infrastructure.

Lu Zhang, Arie Taal, Cees de Laat and Paola Grosso "Profiling and discrimination of containerized ML applications in a Digital Data Marketplace" Presented last week at ICISSP

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A Responsible Internet to Increase Trust in the Digital World

Cristian Hesselman ✉, Paola Grosso, Ralph Holz, Fernando Kuipers, Janet Hui Xue, Mattijs Jonker, Joeri de Ruiter, Anna Sperotto, Roland van Rijswijk-Deij, Giovane C. M. Moura, Aiko Pras & Cees de Laat
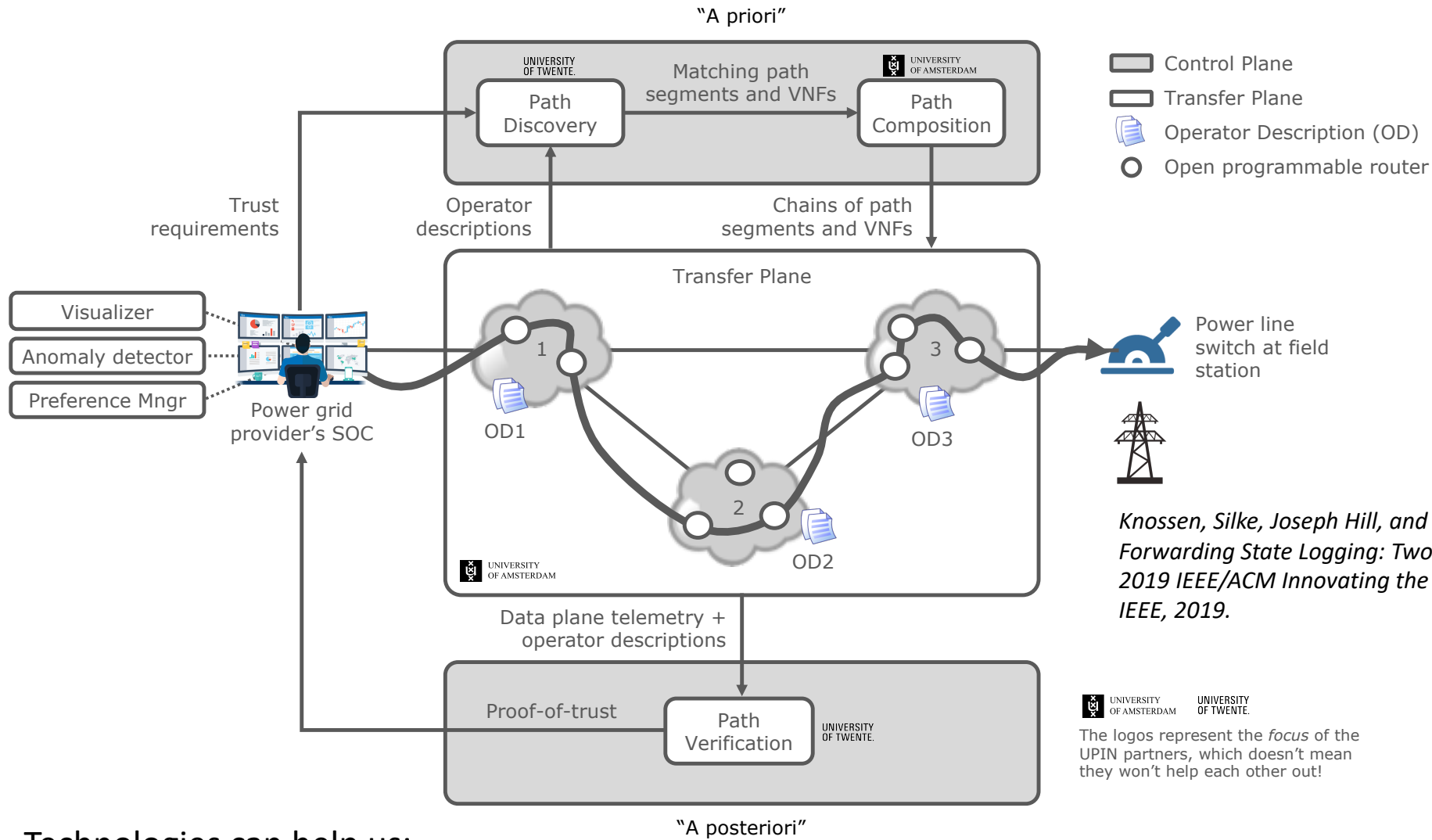
Abstract

Policy makers in regions such as Europe are increasingly concerned about the trustworthiness and sovereignty of the foundations of their digital economy, because it often depends on systems operated or manufactured elsewhere. To help curb this problem, we propose the novel notion of a responsible Internet, which provides higher degrees of trust and sovereignty for critical service providers (e.g., power grids) and all kinds of other users by improving the transparency, accountability, and controllability of the Internet at the network-level. A responsible Internet accomplishes this through two new distributed and decentralized systems. The first is the Network Inspection Plane (NIP), which enables users to request measurement-based descriptions of the chains of network operators (e.g., ISPs and DNS and cloud providers) that handle their data flows or could potentially handle them, including the relationships between them and the properties of these operators. The second is the Network Control Plane (NCP), which allows users to specify how they expect the Internet infrastructure to handle their data (e.g., in terms of the security attributes that they expect chains of network operators to have) based on the insights they gained from the NIP. We discuss research

Challenge: transparency, acccountability and controllability

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Multiscale Networked Systems

"A priori"

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Matching path segments and VNFs
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Path Discovery

Path Composition

Control Plane
Transfer Plane
Operator Description (OD)
Open programmable router

Trust requirements

Operator descriptions

Chains of path segments and VNFs

Transfer Plane

Visualizer

Anomaly detector

Preference Mngr

Power grid provider's SOC

OD1

1

2

OD2

3

OD3

UNIVERSITY OF AMSTERDAM

Power line switch at field station

Knossen, Silke, Joseph Hill, and Paola Grosso. "Hop Recording and Forwarding State Logging: Two Implementations for Path Tracking in P4." 2019 IEEE/ACM Innovating the Network for Data-Intensive Science (INDIS). IEEE, 2019.

Data plane telemetry + operator descriptions

Proof-of-trust

Path Verification

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UNIVERSITY OF AMSTERDAM   UNIVERSITY OF TWENTE.

The logos represent the *focus* of the UPIN partners, which doesn't mean they won't help each other out!

"A posteriori"

Technologies can help us:
Programmable data planes (P4); SDN;
Segment Routing

Beltman, Rutger, Silke Knossen, Joseph Hill, and Paola Grosso. "Using P4 and RDMA to collect telemetry data." In 2020 IEEE/ACM Innovating the Network for Data-Intensive Science (INDIS), pp. 1-9. IEEE, 2020.

Pointers

For more information on our projects and collaborations:

- https://dl4ld.nl
- https://enablingpersonalizedinterventions.nl
- https://mns-research.nl/open-lab/
- https://cci-research.nl/
- https://2stic.nl/
- https://www.fed4fire.eu/

QUESTIONS?