SEAMS 2025

FORTH INSTITUTE OF COMPUTER SCIENCE

ÉCOLE NATIONALE DES PONTS ET CHAUSSÉES IP PARIS

TELECOM SudParis IP PARIS

UNIVERSITY OF CRETE

Di-Hydro

Session 7: Applications

Artifact Track

Adaptive and Interoperable Federated Data Spaces: An Implementation Experience

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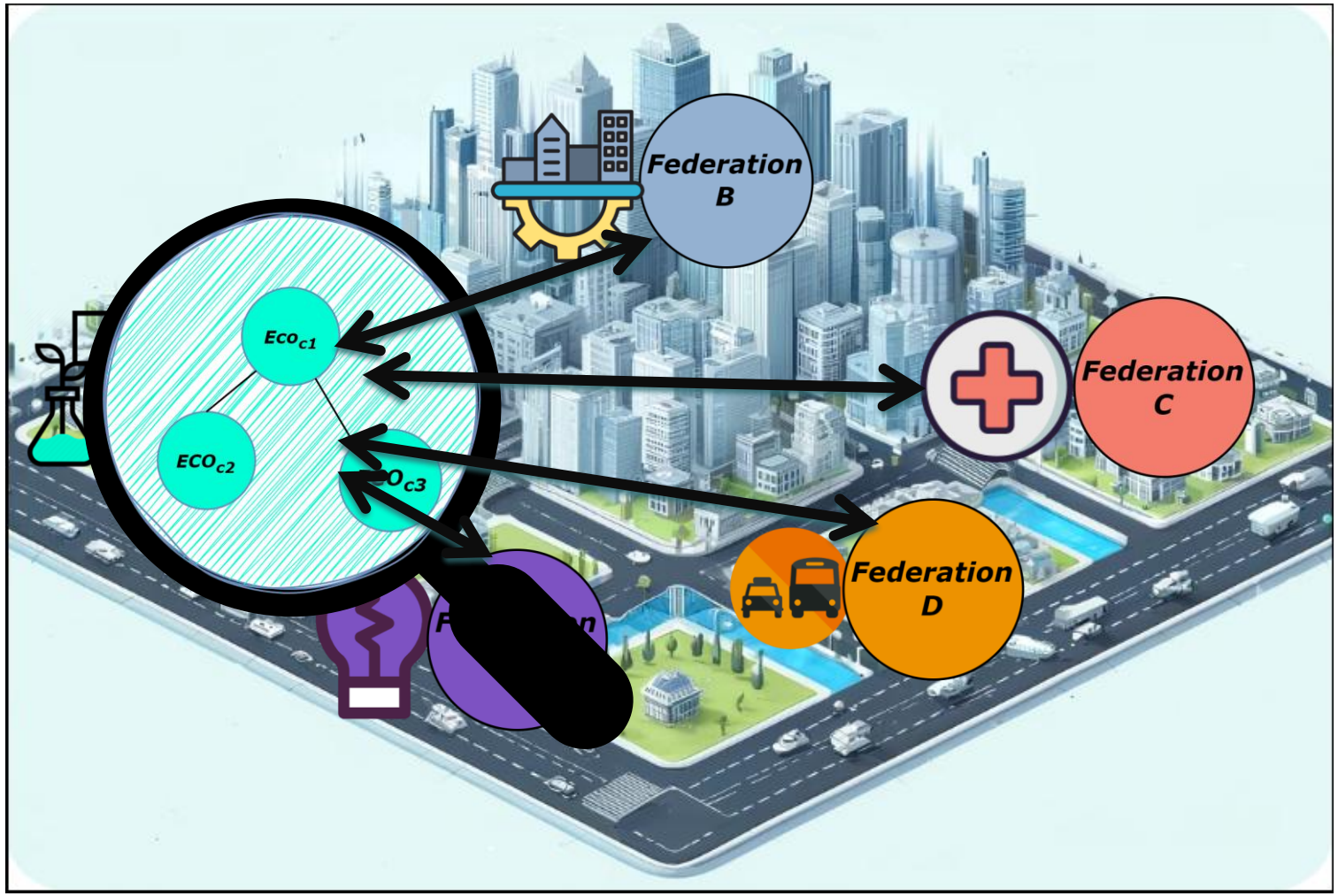
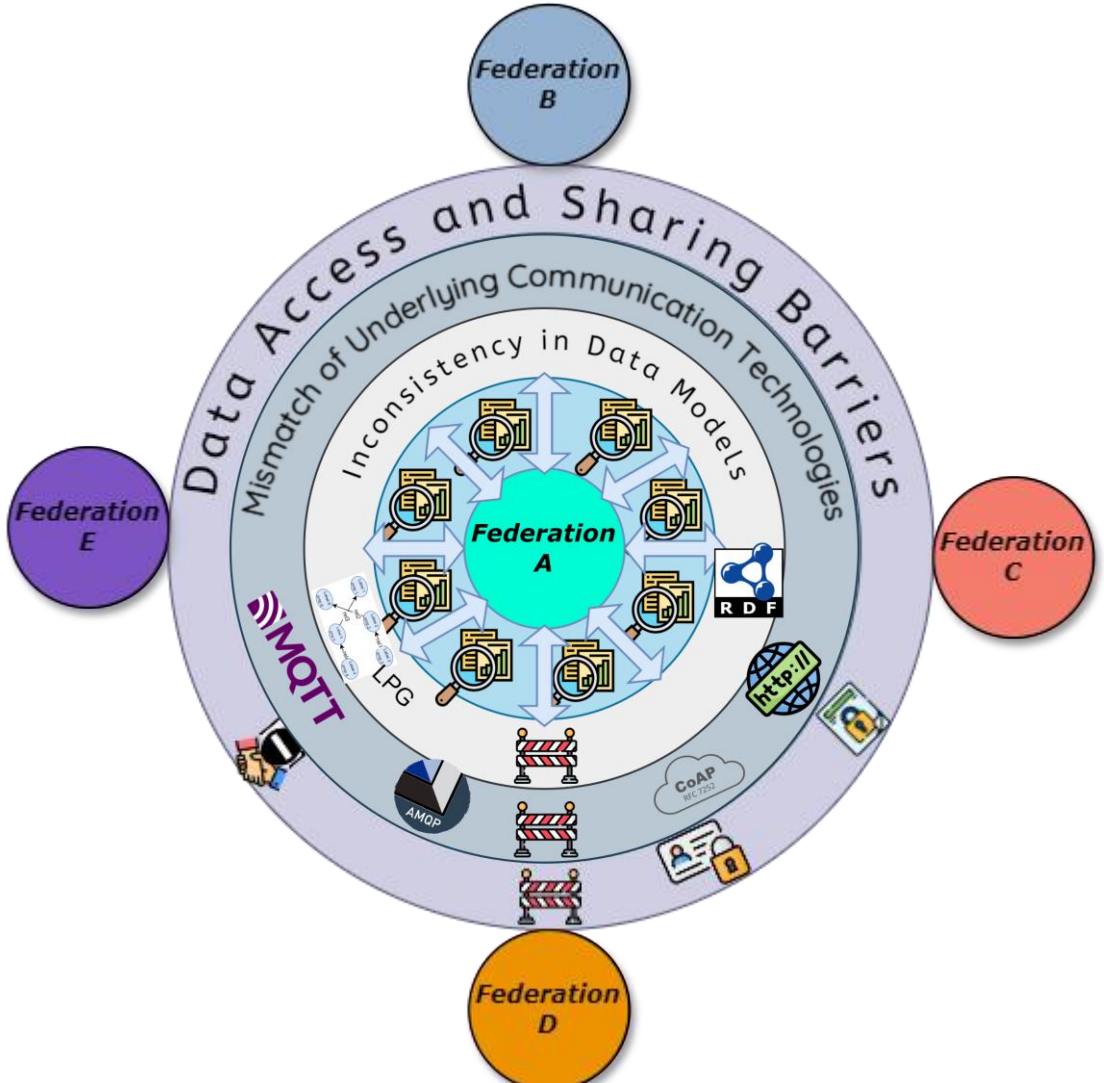
Motivating Scenario: Integrating Federated Data Spaces in a Smart City

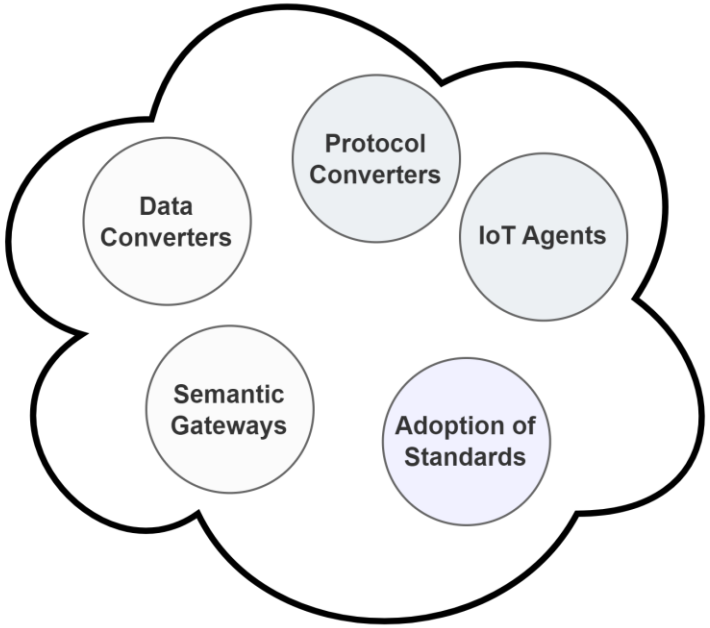


Challenges in Seamless Data Exchange Across Heterogeneous Data Spaces



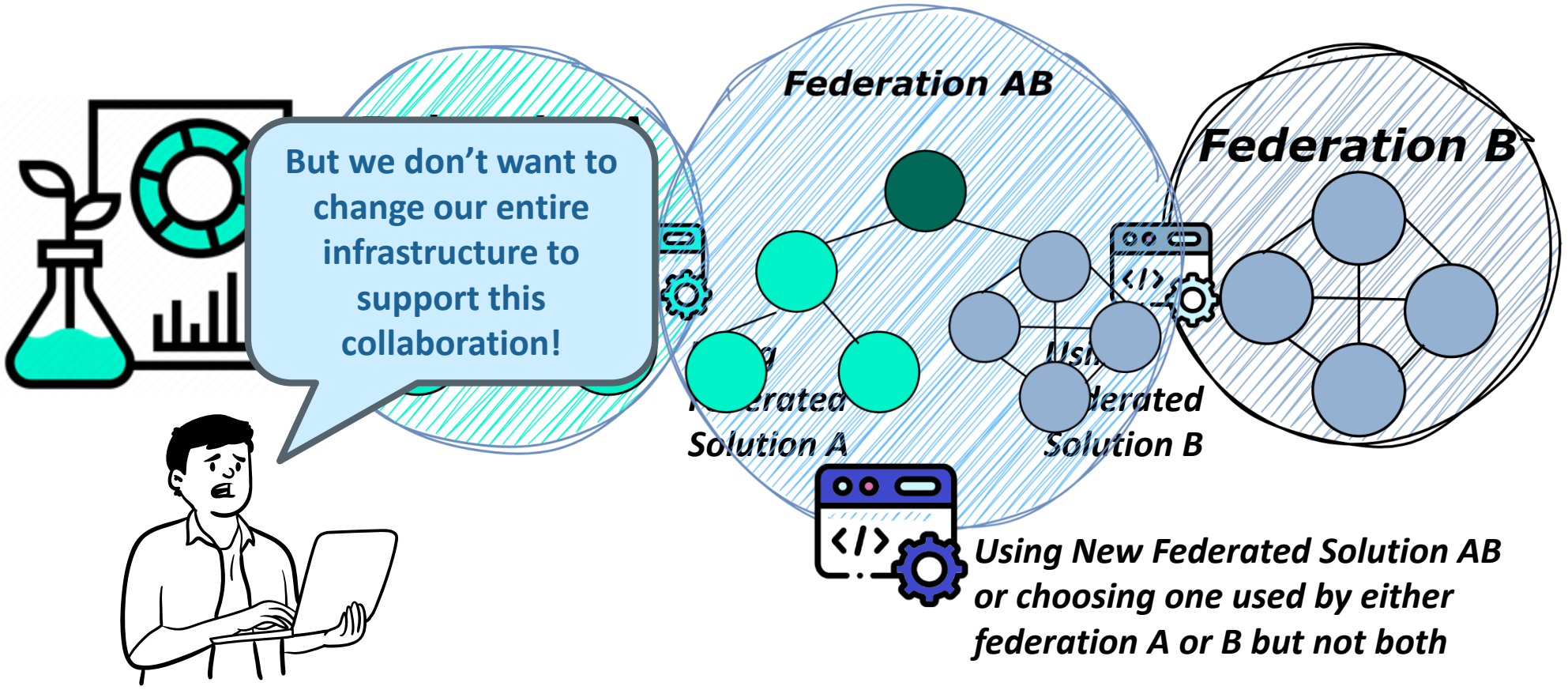
Current Approaches (A)

Inconsistency in Data Models

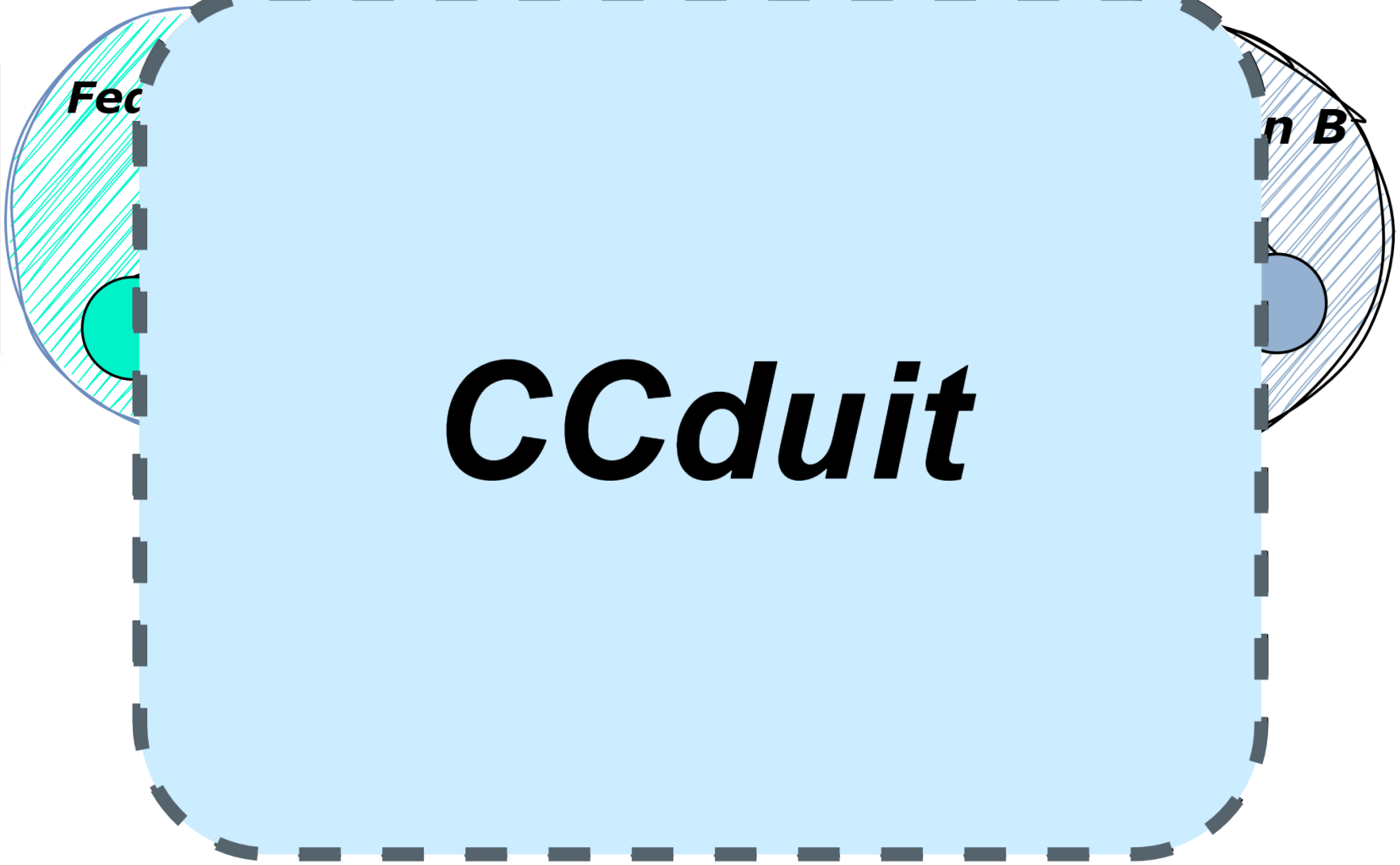


Mismatch of Underlying Communication Technologies

Current Approaches (B)

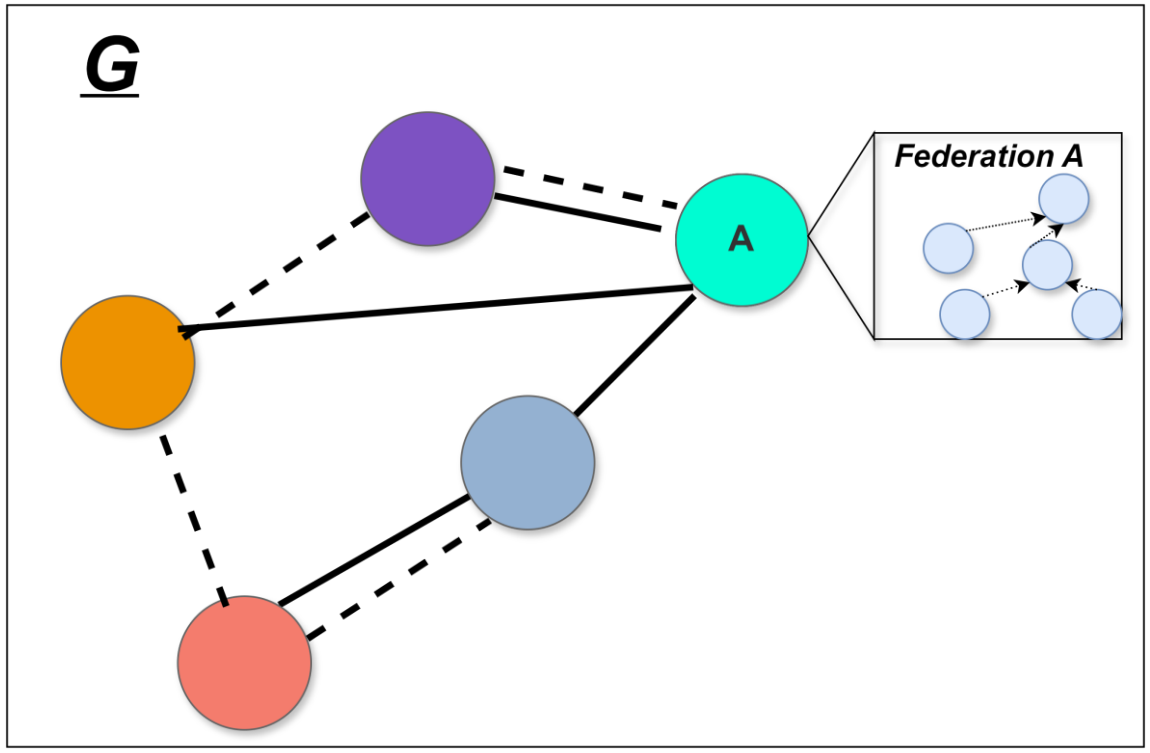


Unified Framework Without Altering Native Technologies?



Introducing CCduit: Formal High-level view

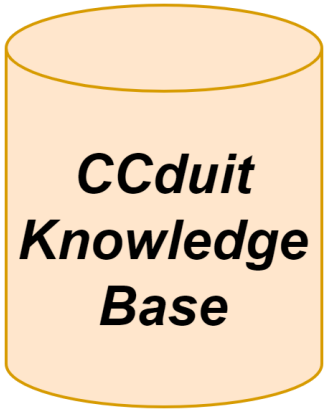
CCDUIT is a software overlay designed to bridge the communication gaps between diverse federations.

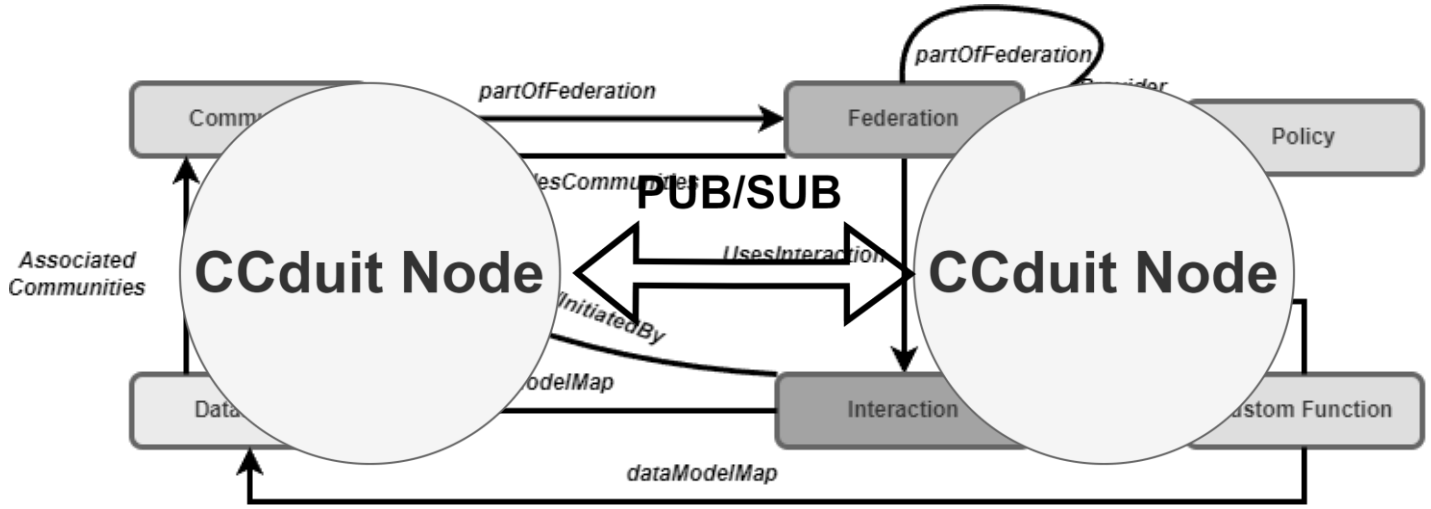


Data Exchange (DE) Edges: E_d representing the actual data exchange interactions between federations. The labels of these edges, $l_d(e)$, include specific details of the data exchange, such as the nature of the data, format, and the protocol used for the exchange.

Context Exchange (CE) Edges: E_c, symbolizing the exchange of contextual information, crucial for enabling and guiding the data exchanges. The labels on these edges, $l_c(e)$, represent the policies that direct these context exchanges, encompassing aspects like data sharing rules and compliance requirements.

Introducing CCduit: The CCduit data model and communication schema





The schema of context exchange (pub/sub topic) is structured as follows:

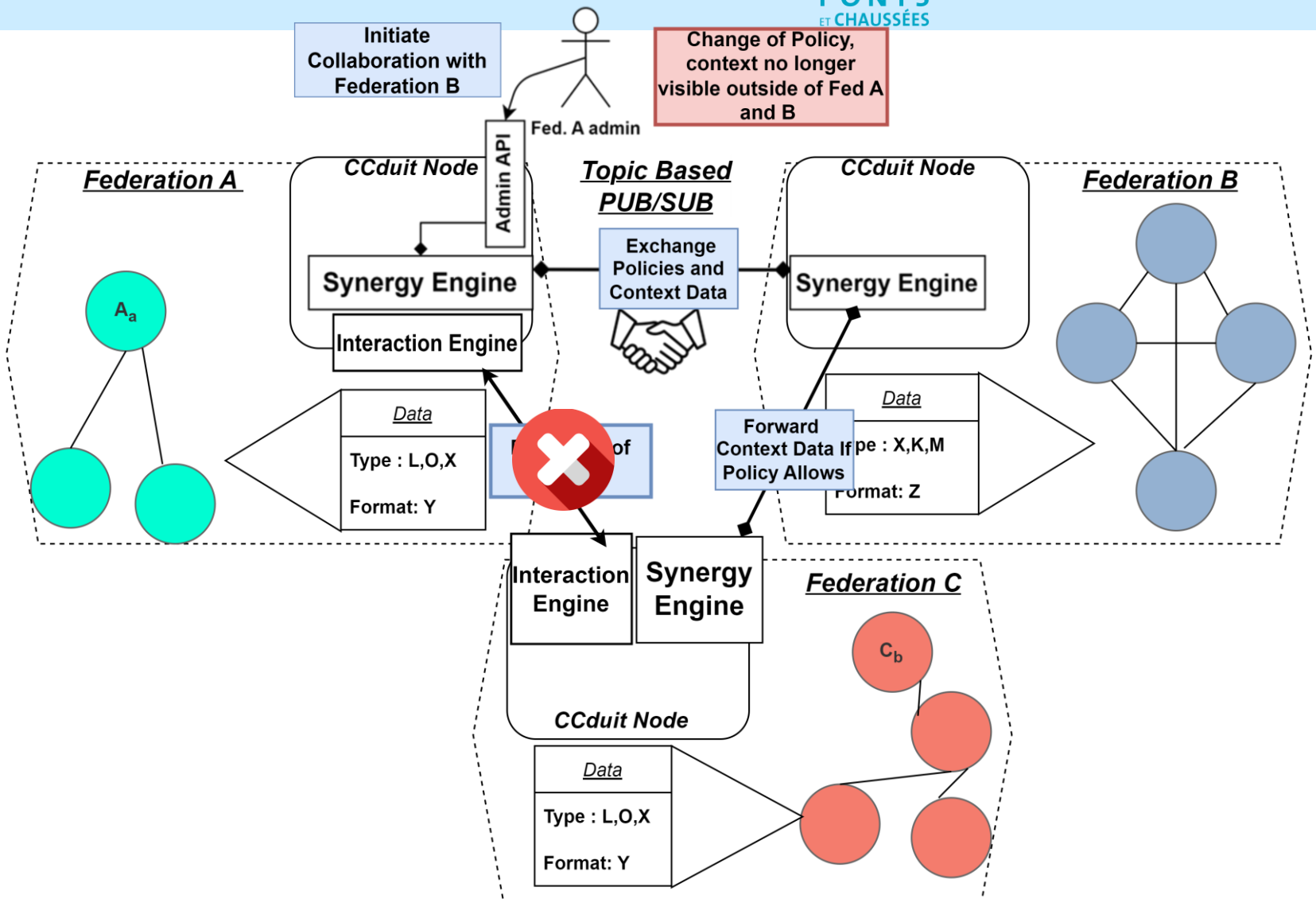
Federation/Federation_ID/Policy_ID/Data_type

– **Federation ID:** Uniquely represents each federation, ensuring that data and policies are correctly attributed.

– **Policy ID**: Policies governing data sharing and usage are associated with specific identifiers, allowing for stream-lined policy management and enforcement.

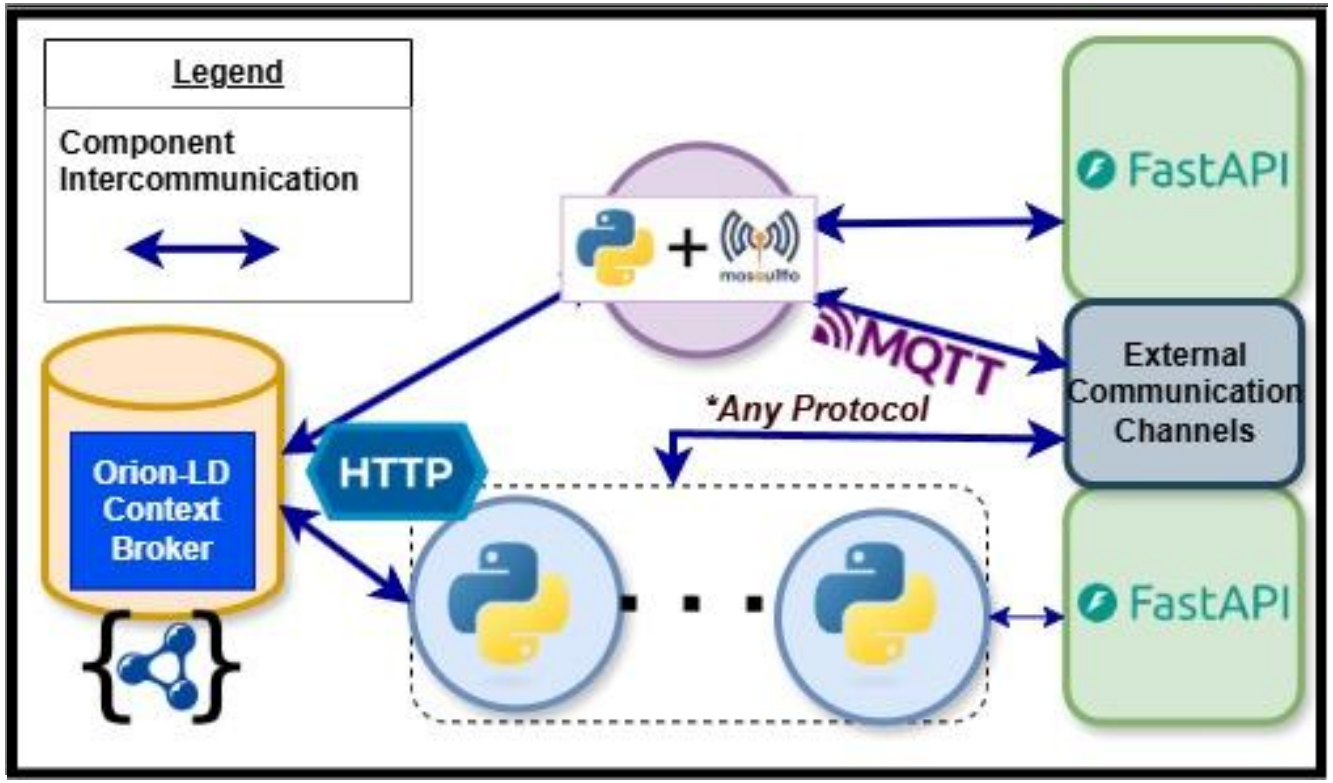
– **Data Type:** Data being exchanged is categorized under specific data types

Introducing CCduit: Example of how it works

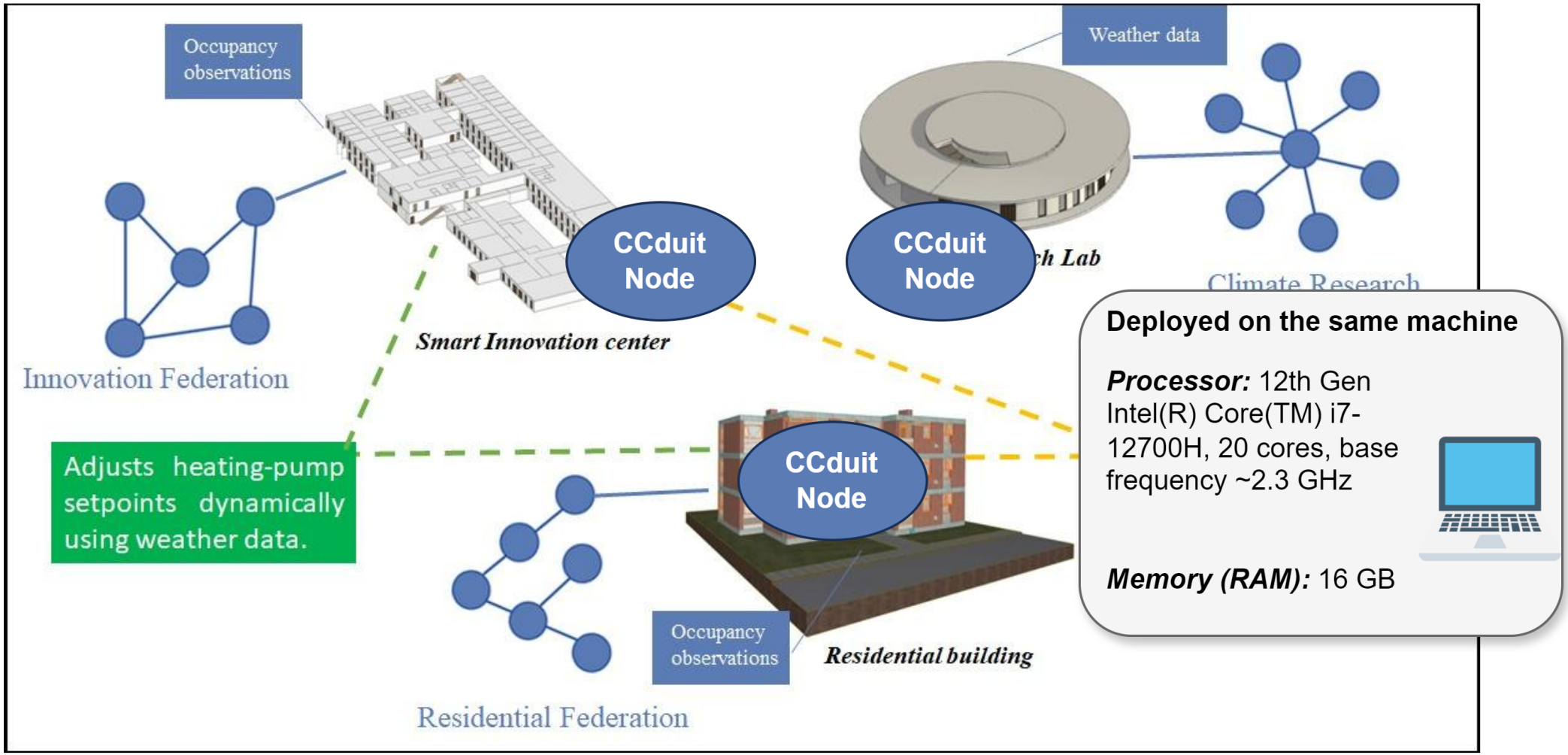


Brief Breakdown of CCDUIT Node Components

Artifact



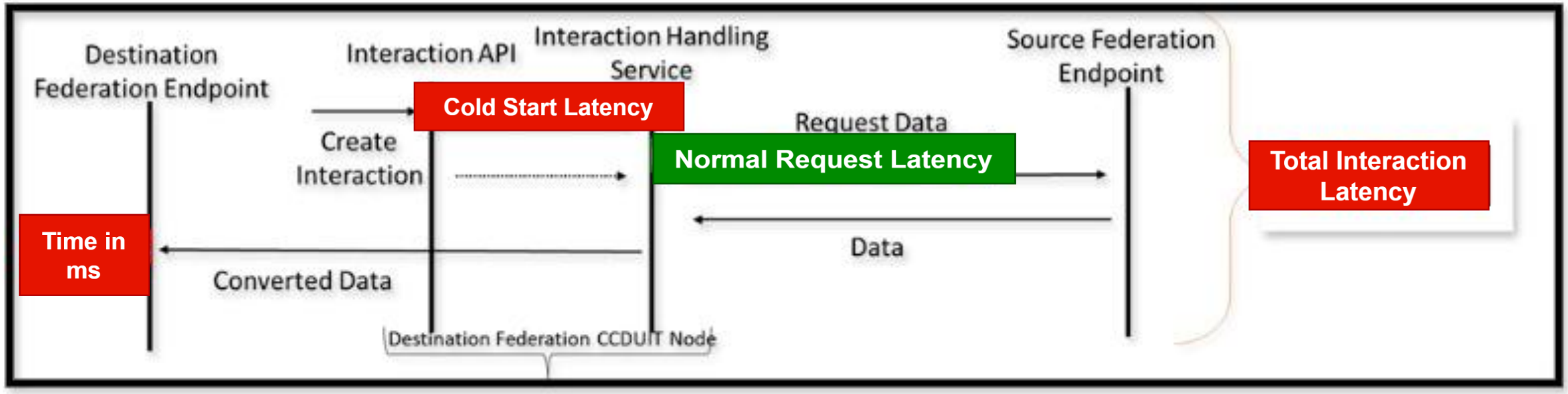
CCduit Evaluation: Test Scenario



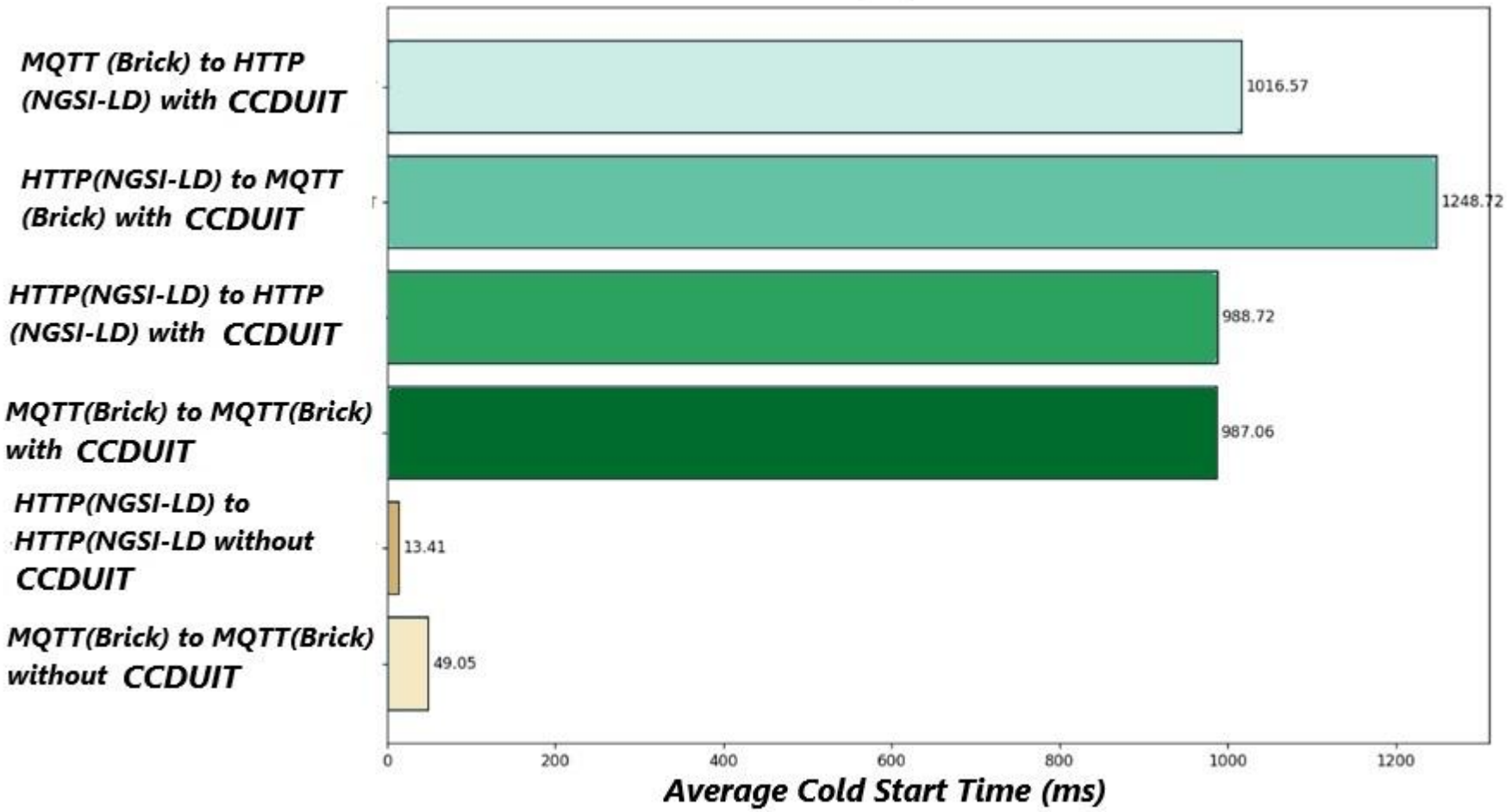
CCduit Evaluation: Tested Combinations

From	To	Using CCduit	Not Using CCduit
HTTP	HTTP	✓	✓
HTTP	MQTT	✓	✗
MQTT	HTTP	✓	✗
MQTT	MQTT	✓	✓

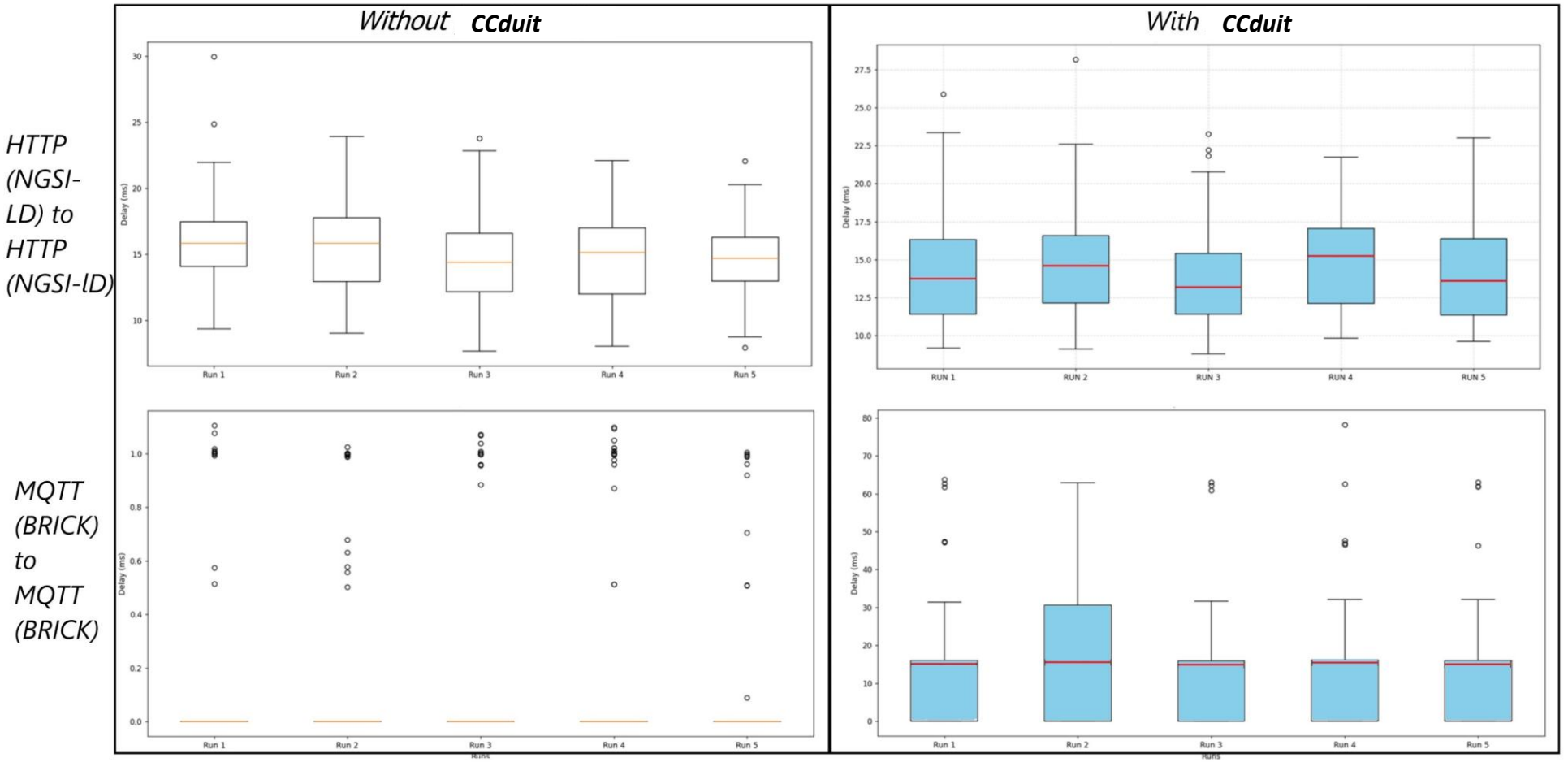
CCduit Evaluation: Latency Exploration



CCduit Evaluation: Latency Exploration Results

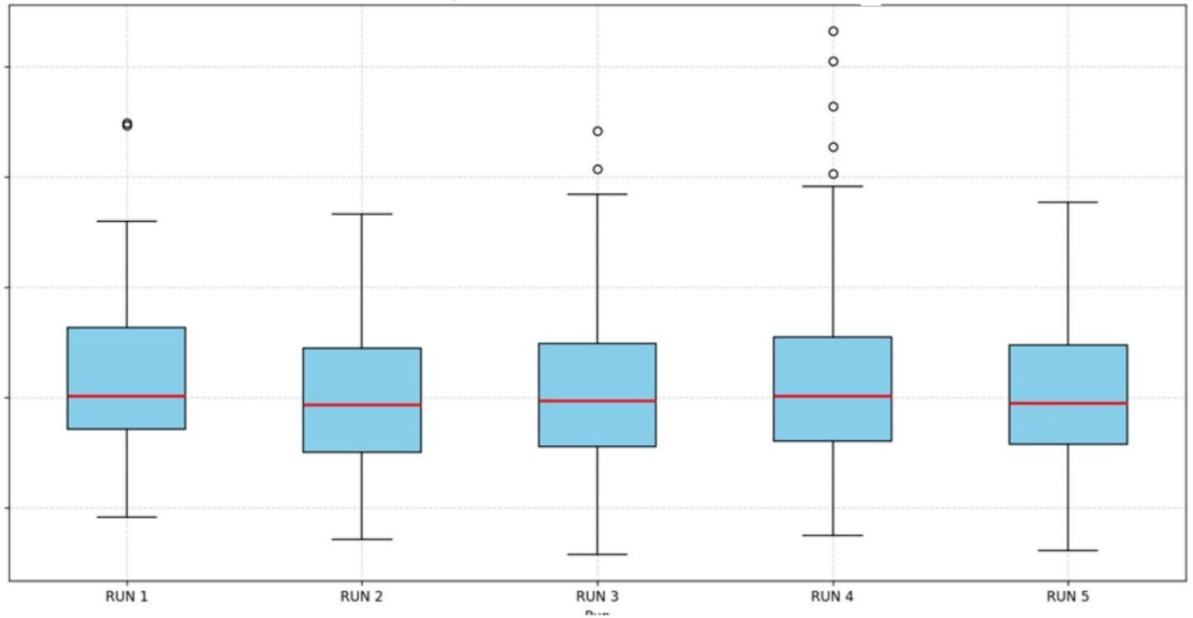


CCduit Evaluation: Latency Exploration Results

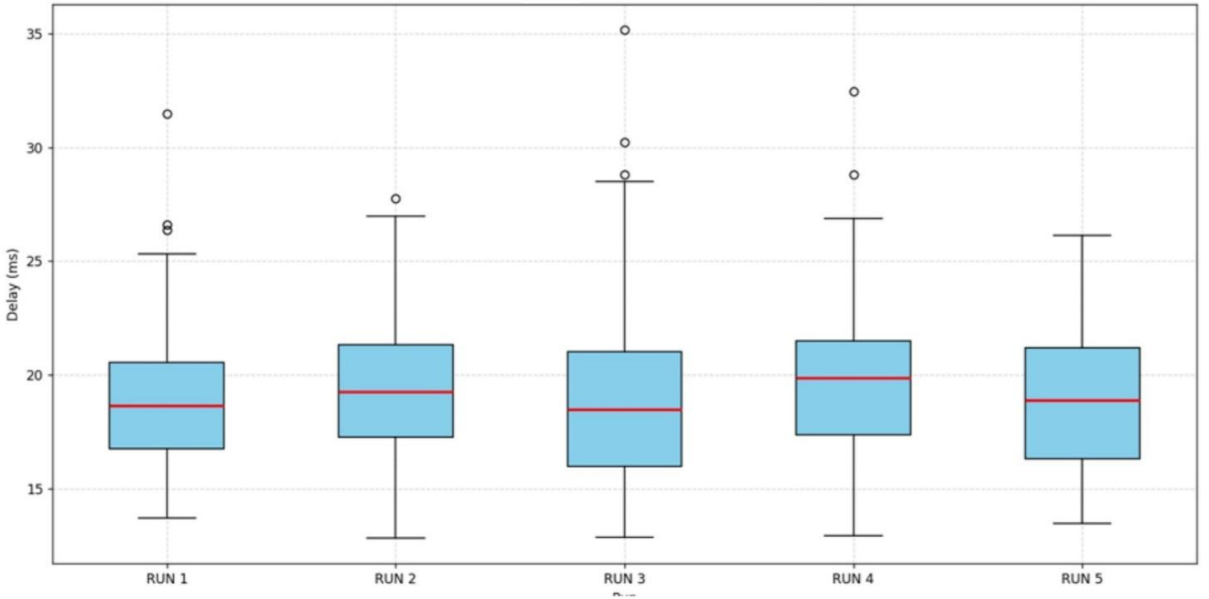


CCduit Evaluation: Latency Exploration Results

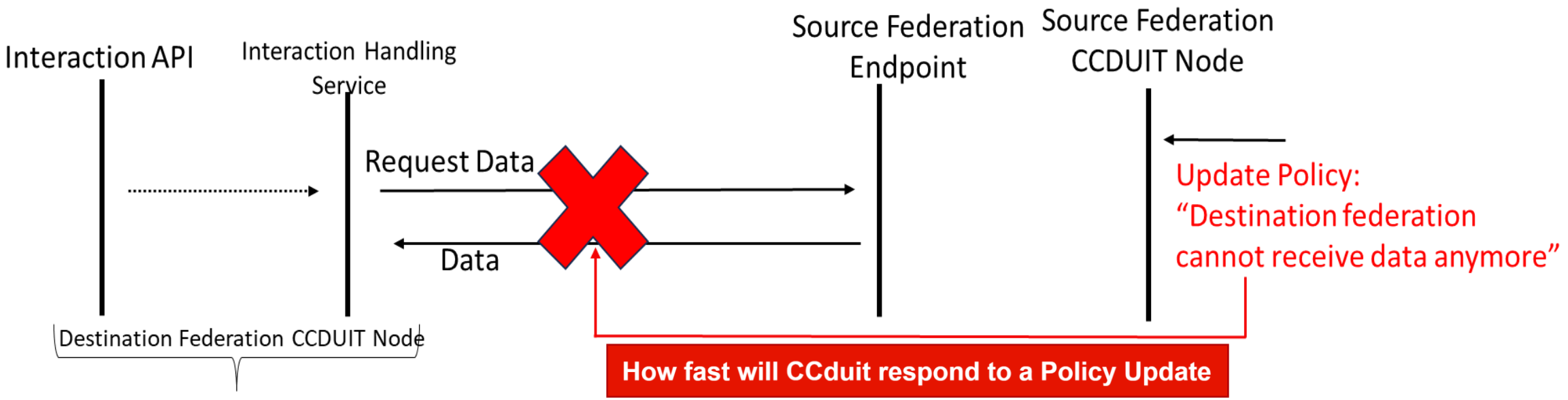
MQTT(BRICK) to HTTP(NGSI-LD) with ***CCduit***



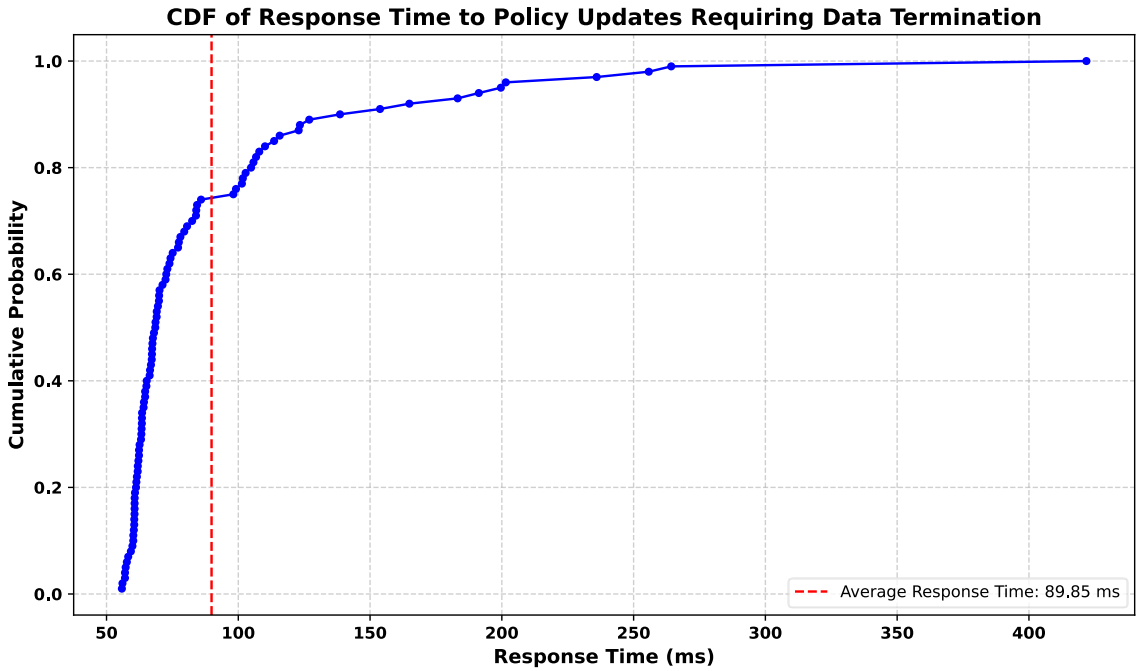
HTTP(NGSI-LD) to MQTT(BRICK) with ***CCduit***

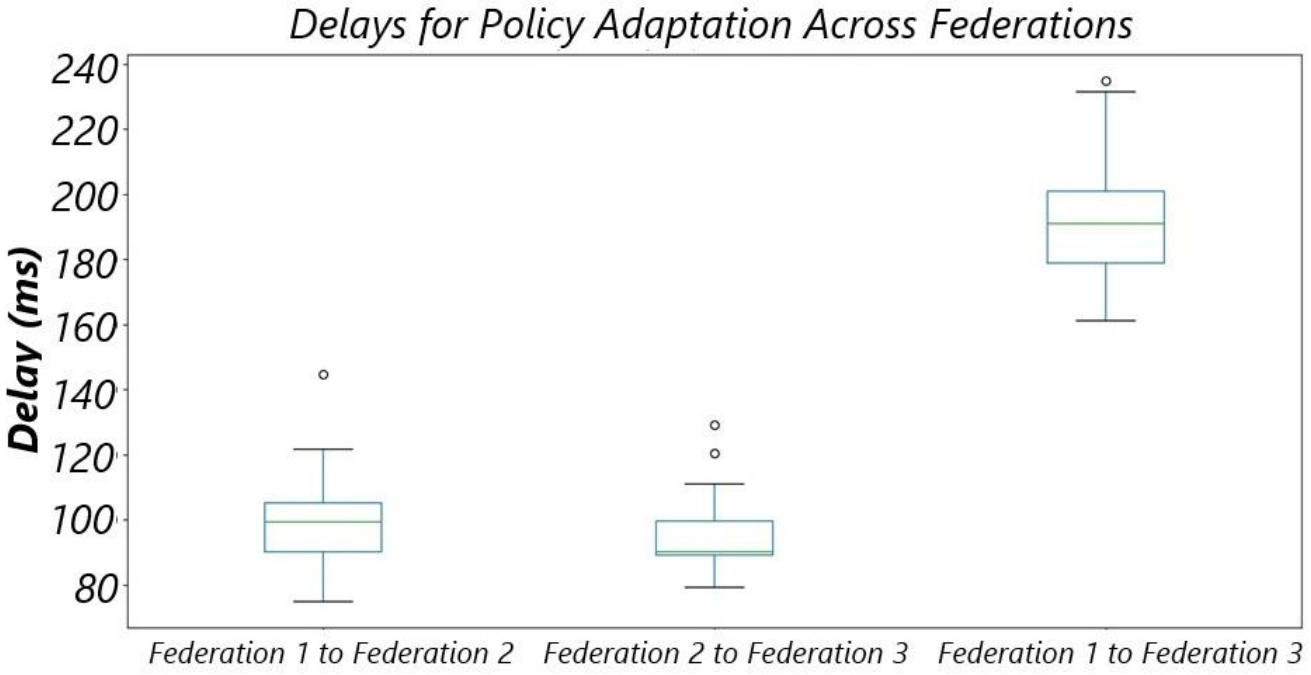


CCduit Evaluation: Adaptation Exploration

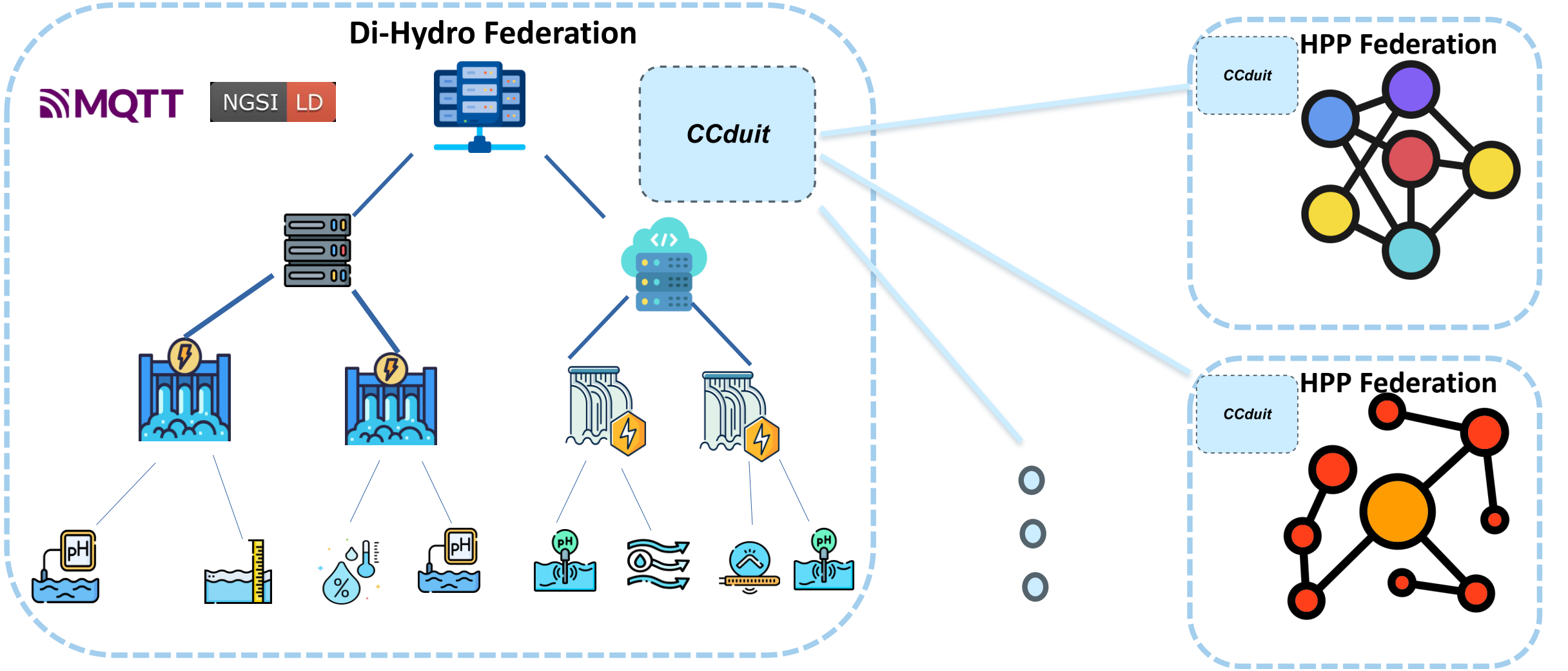


CCduit Evaluation: Adaptation Exploration Results





CCduit in practice: Di-Hydro project



Questions?

Thank you for your time.

Check out more of our works:

Contact Us:
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Contact

Try out CCduit!

GitHub https://github.com/satrai-lab/ccduit/