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INSTITUTE OF COMPUTER SCIENCE



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## Session 4: QoS 1



**IP PARIS**

# CCDUI: A Software Overlay for Cross-Federation Collaboration between Data Spaces

Nikolaos Papadakis, **Georgios Bouloukakis**, Kostas Magoutis

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# Data spaces around us: The imminent rise of smart cities



## Rise of the global megacity

### World's most populated urban areas



### Urbanization around world



Source: UN Department of Economic and Social Affairs

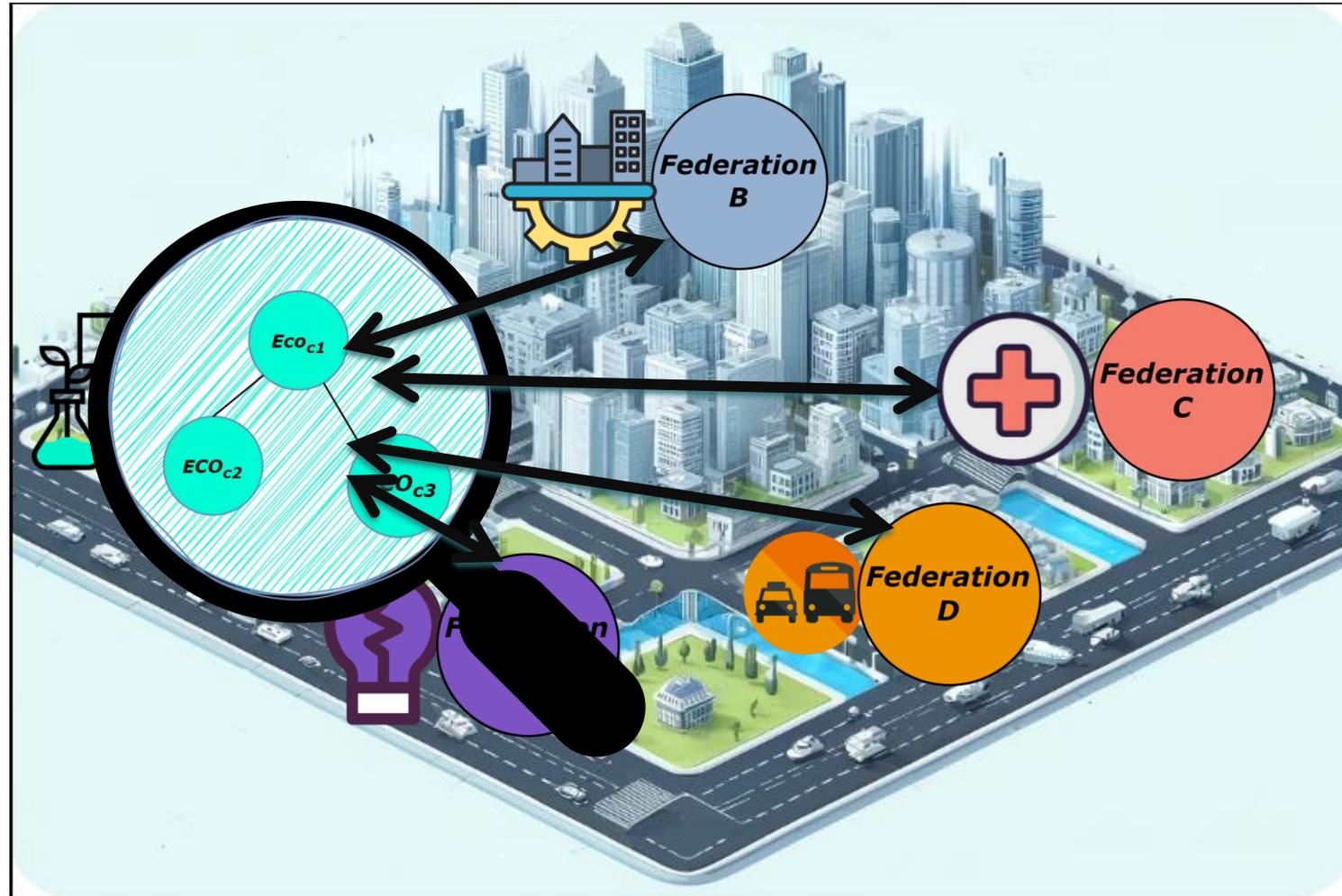
Efficient

Sustainable

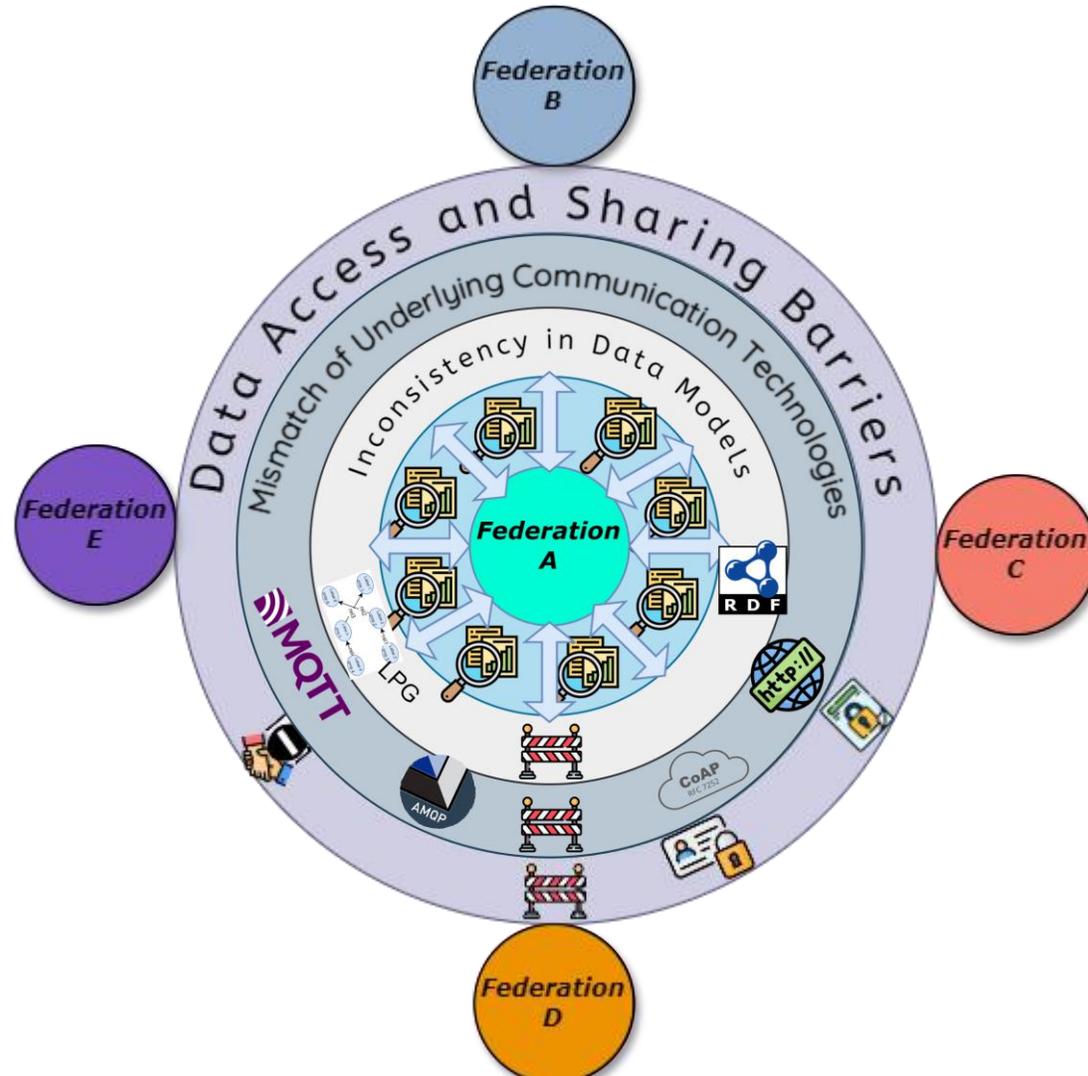
Safe

How easy is this?

# Motivating Scenario: Integrating Federated Data Spaces in a Smart City



# Challenges in Seamless Data Exchange Across Heterogeneous Data Spaces



*How can we overcome these barriers?*



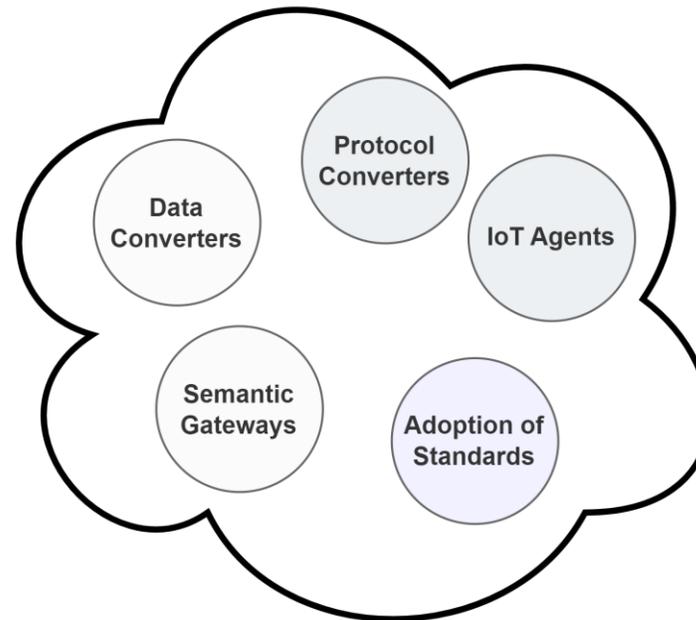
# Current Approaches (A)



Inconsistency in Data Models [1]



[1] Ref.  
Kotis et al. CISIS, 2012.  
Zyrianoff et al. SMARTCOMP, 2021

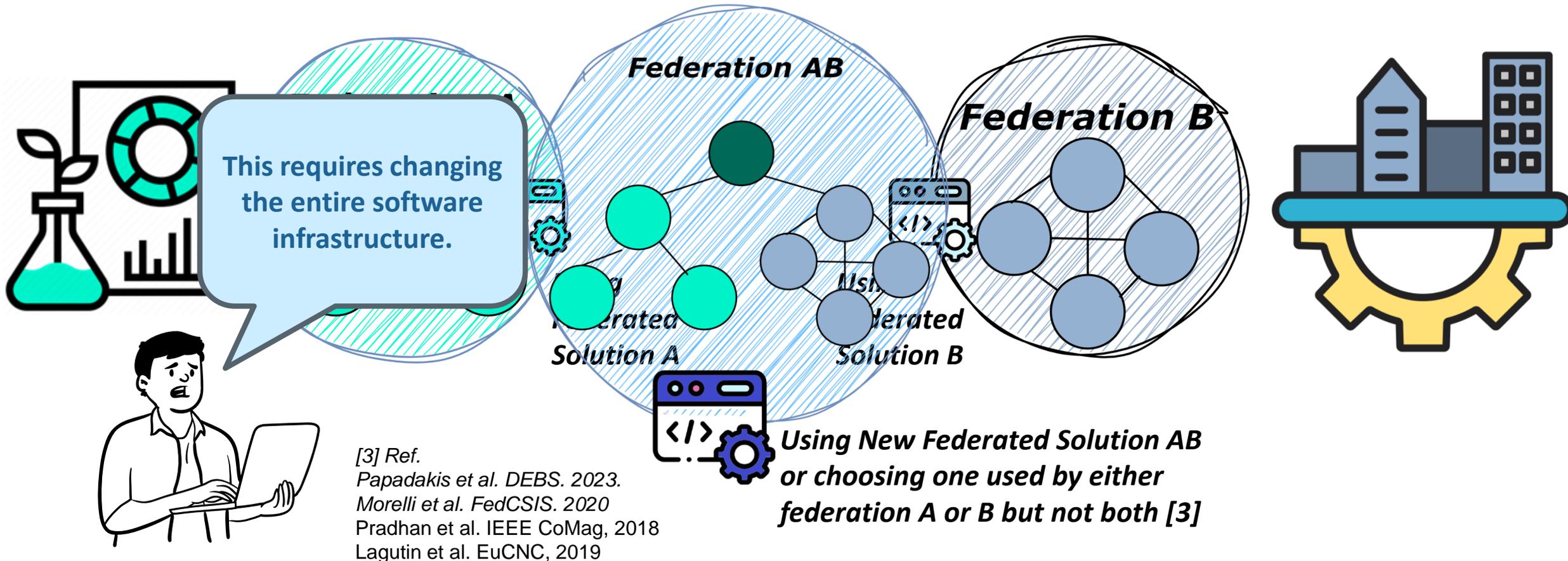


Mismatch of Underlying  
Communication Technologies [2]

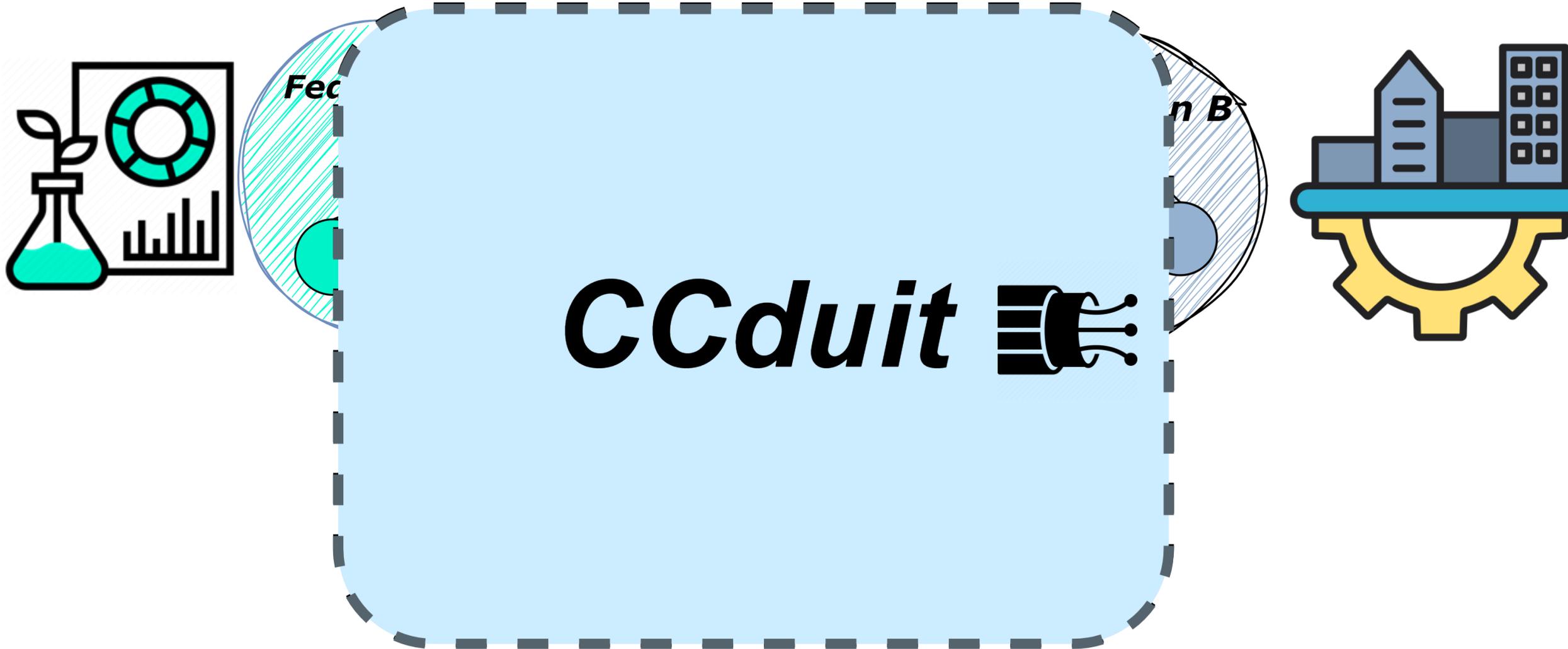


[2] Ref.  
Akasiadis et al., Sensors, 2019  
Kim et al. ICTC, 2019.

# Current Approaches (B)



# Unified Framework Without Altering Native Technologies?



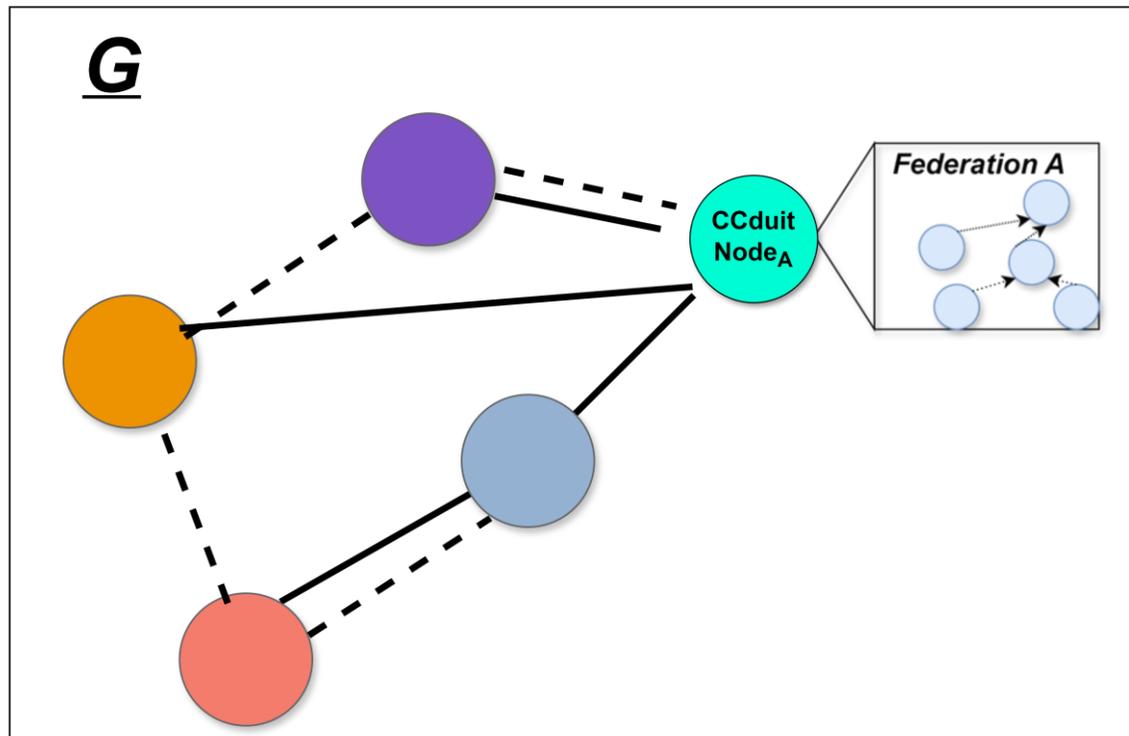
# Introducing CCduit: Formal High-level view



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**CCDUIT** is a software overlay designed to seamlessly bridge diverse federations



**Data Exchange (DE) Edges:** Actual data being shared between federations.

**Labels:** Detail the type of data, its format, and the protocol used.

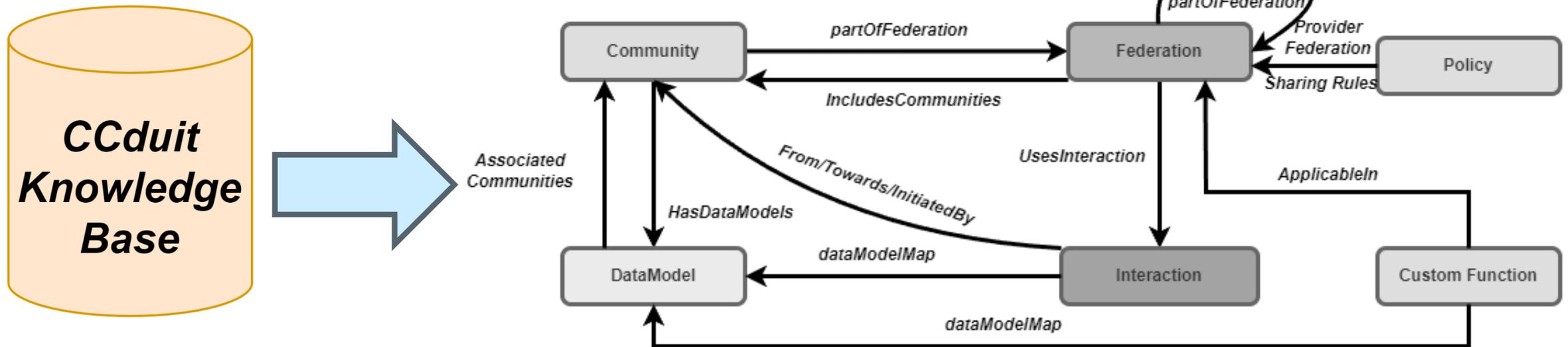
**Simplified Example:** "Customer Data, JSON, HTTP"

**Context Exchange (CE) Edges:** exchange of contextual information that guides and enables data sharing.

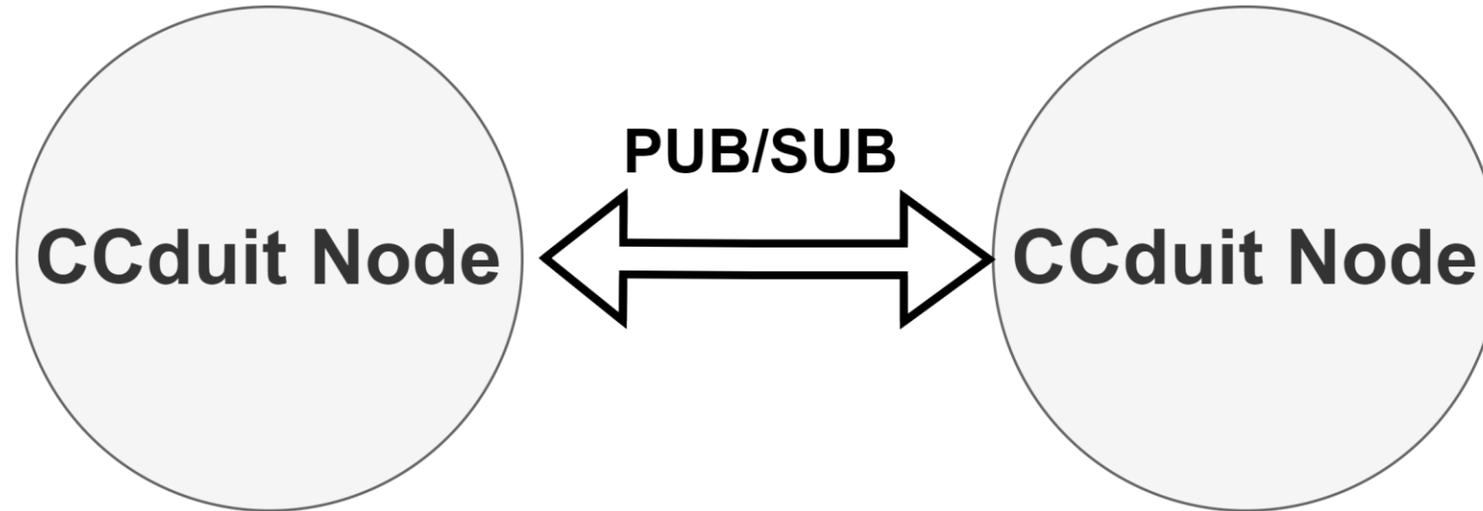
**Labels :** Policies, such as data sharing rules and compliance requirements.

**Simplified Example:** "GDPR Compliance, Encryption Required, no 3<sup>rd</sup> party access"

# Introducing CCduit: The CCduit Context Data Model



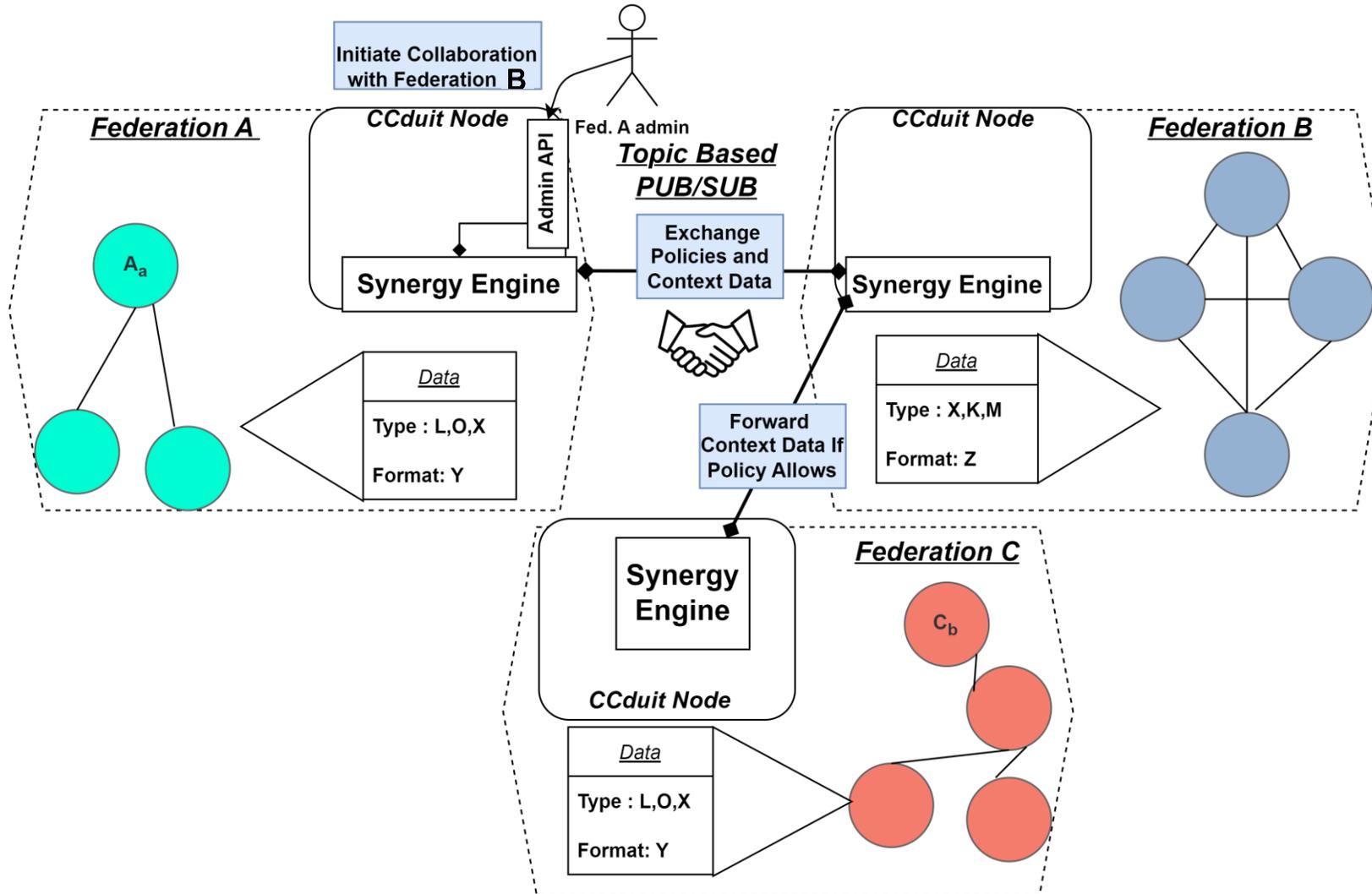
# Introducing CCduit: The CCduit context exchange communication schema



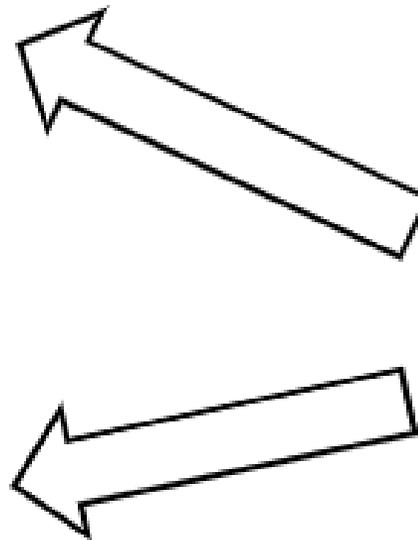
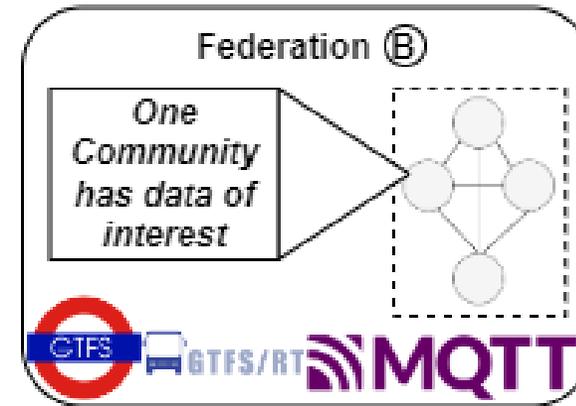
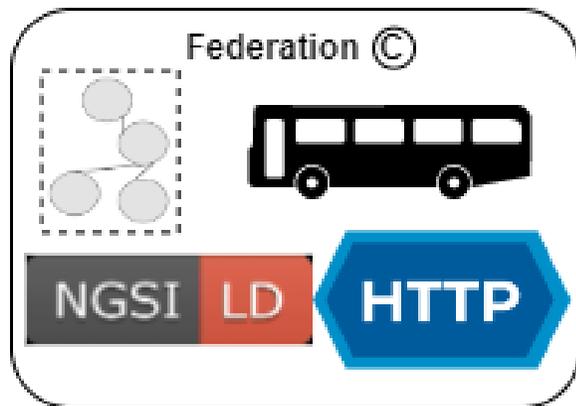
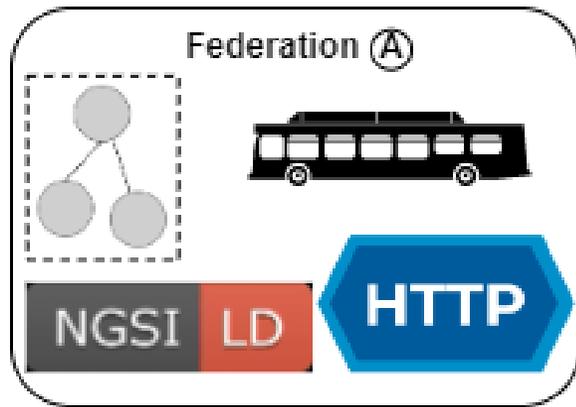
The schema of context exchange (pub/sub topic) is structured as follows:

***Federation/Federation\_ID/Policy\_ID/Data\_type***

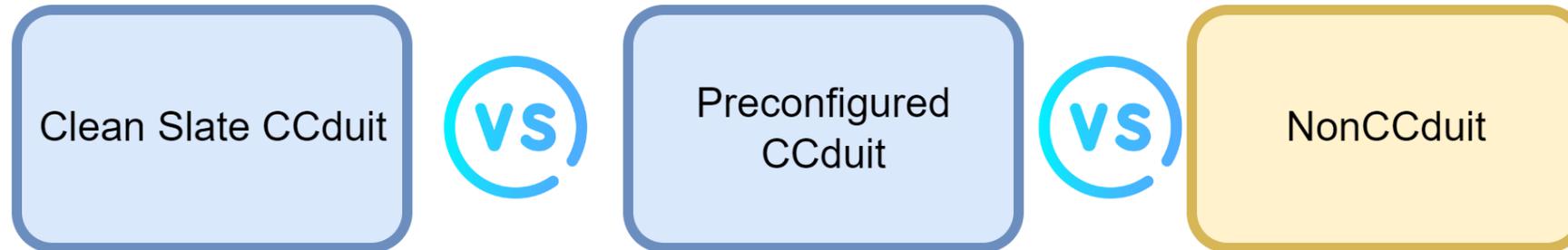
# Introducing CCduit: Example of how it works



# CCduit Evaluation: Test Scenario



# CCduit Evaluation: Compared Setups


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## COMPARATIVE ANALYSIS OF EFFORT IN LINES OF CODE (LoC)

Approach	Value LoC
Clean-Slate CCDUIT	1518
Pre-Configured CCDUIT	738
Non-CCDUIT	1420

**Artifact Available**



**zenodo**

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# Questions?



## Thank you for your time.

**Contact Us:**

[nikolaos.papadakis@telecom-sudparis.eu](mailto:nikolaos.papadakis@telecom-sudparis.eu)

Try out our Scalability Simulation for CCDUIT  
Federated Networks

 **GitHub** <https://github.com/satrai-lab/ccduit-simulator/>

Check out  
more of our  
works:

