



PERFORMANCE EVALUATION OF PRIVATE AND PUBLIC BLOCKCHAINS FOR MULTI-CLOUD SERVICE FEDERATION

Adam Zahir (UC3M)
Milan Groshev (UC3M)
Kiril Antevski (AXo solutions)
Carlos J. Bernardos (UC3M)
Constantine Ayimba (UC3M)
Antonio de la Oliva (UC3M)

GOAL OF THE WORK

INVESTIGATE how Public and Private Blockchain platforms affect the negotiation and execution of multi-cloud service federation

SHOWCASE the integration with a production-ready orchestration solution

EVALUATE the performance

RELATED WORK:

- Blockchain-based federation in Dynamic Environments [1]
- Blockchain-based federation for Edge Robotics [2]

[1] Kiril Antevski and Carlos J. Bernardos. "Federation in Dynamic Environments: Can Blockchain Be the Solution?". IEEE Communications Magazine (2022)

[2] Kiril Antevski, Milan Groshev, Gabriele Baldoni and Carlos J. Bernardos. "DLT federation for Edge robotics". IEEE NFV-SDN (2020)

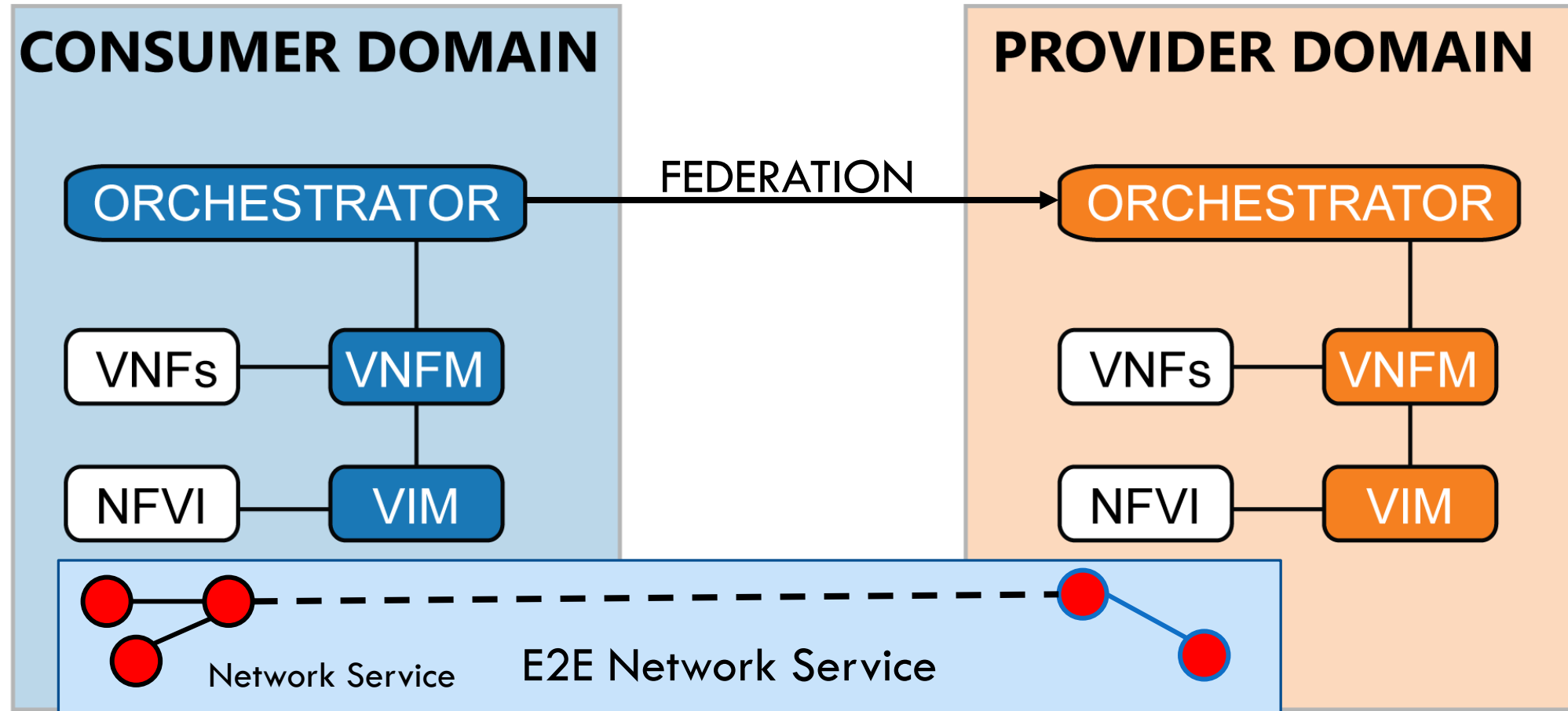
OVERVIEW

- What is: Federation as a concept
- What is: Blockchain
- Public and Private Blockchains

Experiments & Results

Conclusions and Future Work

FEDERATION IN NFV



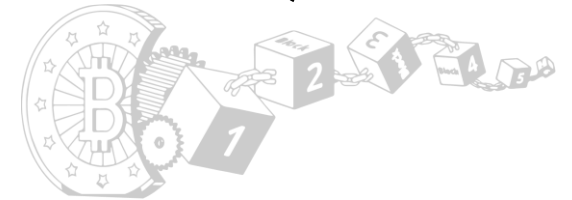
BLOCKCHAIN

BLOCKCHAIN is a DLT (Distributed Ledger Technology)

Layer 1

Blockchain

- Chain of blocks (filled with transactions)
- **CONSENSUS** mechanism
- **SMART CONTRACTS**



Layer 0

Blockchain NETWORK

- P2P network
- Public or private



PUBLIC AND PRIVATE BLOCKCHAINS

PUBLIC:

- **Openness:** Open participation
- **Transparency:** Public on-chain data
- **Trade-offs:** Slow processing times, limited concurrent ADs

PRIVATE:

- **Control:** Restricted, verified access
- **Efficiency:** Faster consensus
- **Privacy:** Confidential data
- **Trade-offs:** Limited on-chain interactions, potential centralization

EXPERIMENTS AND RESULTS

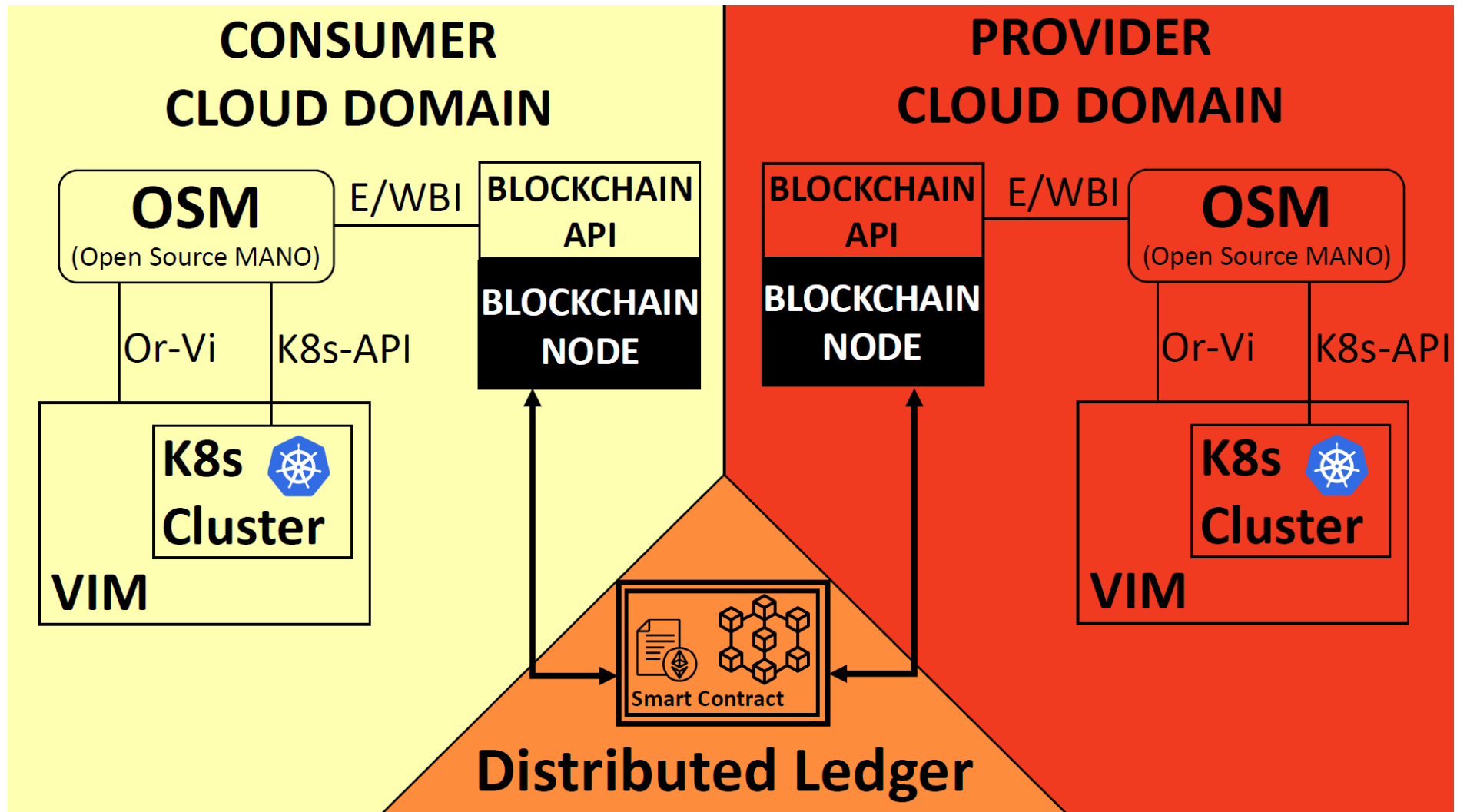


Figure 1: Experimental setup

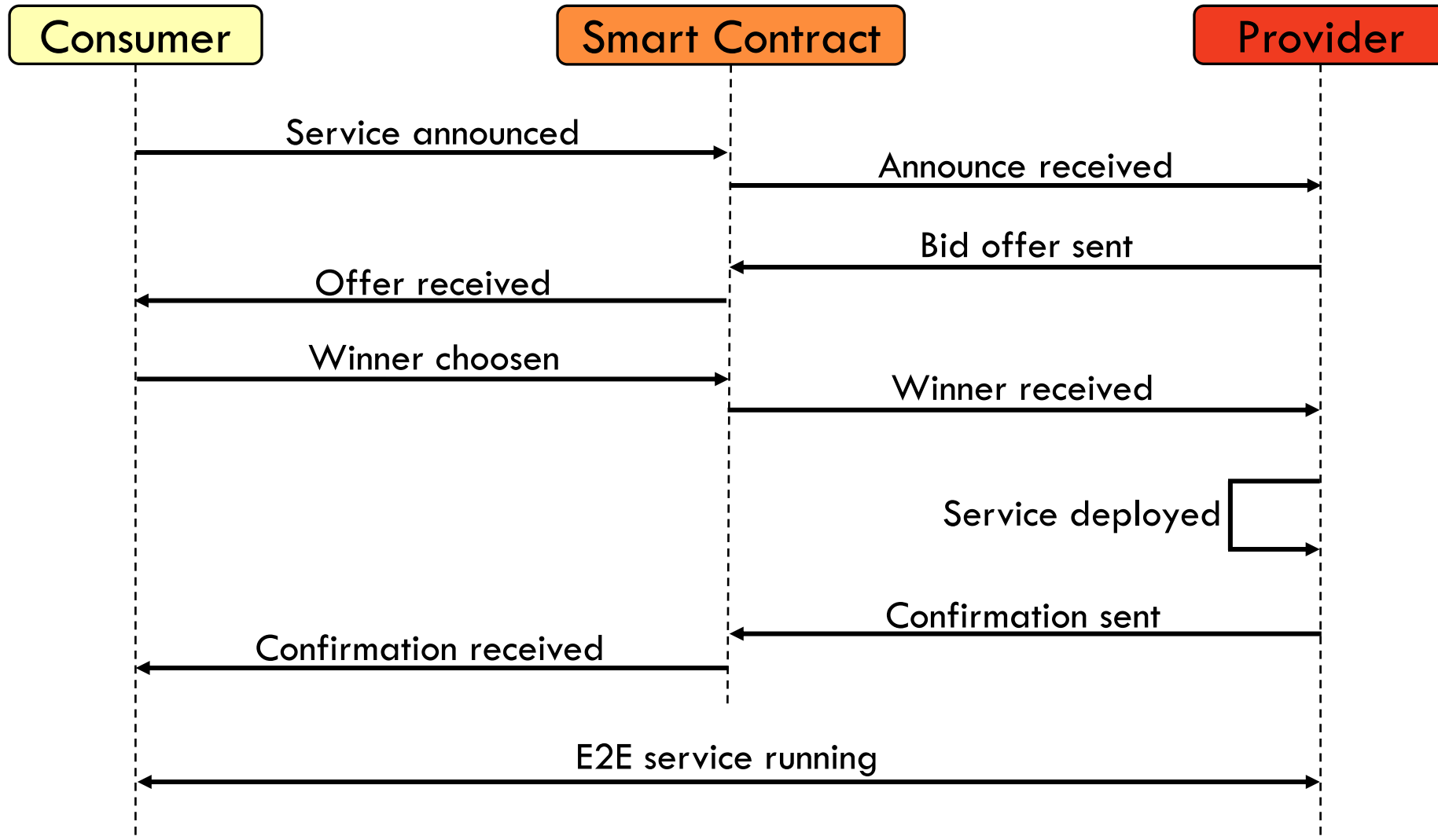
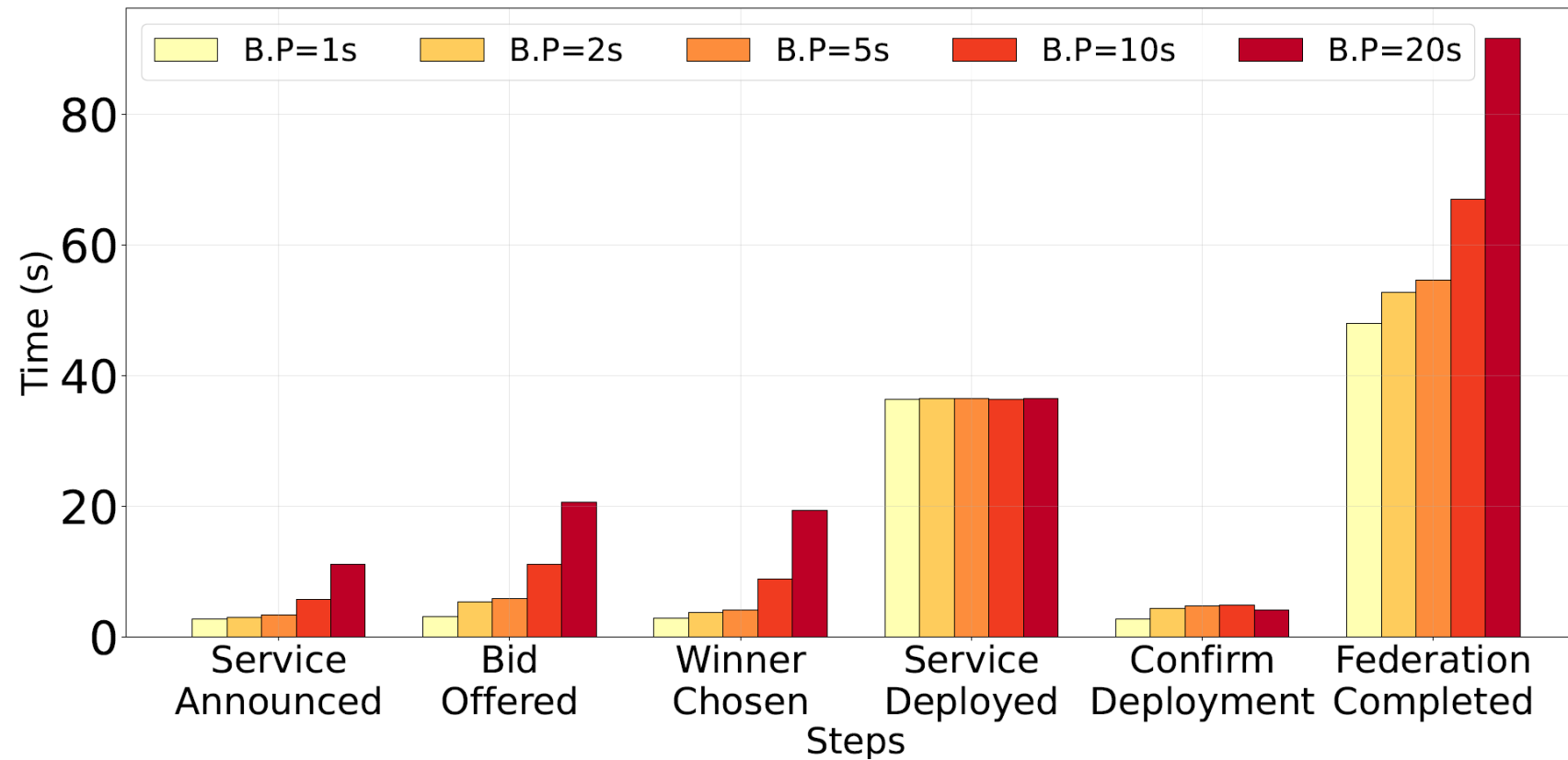


Figure 2: Sequence diagram of Experimental setup

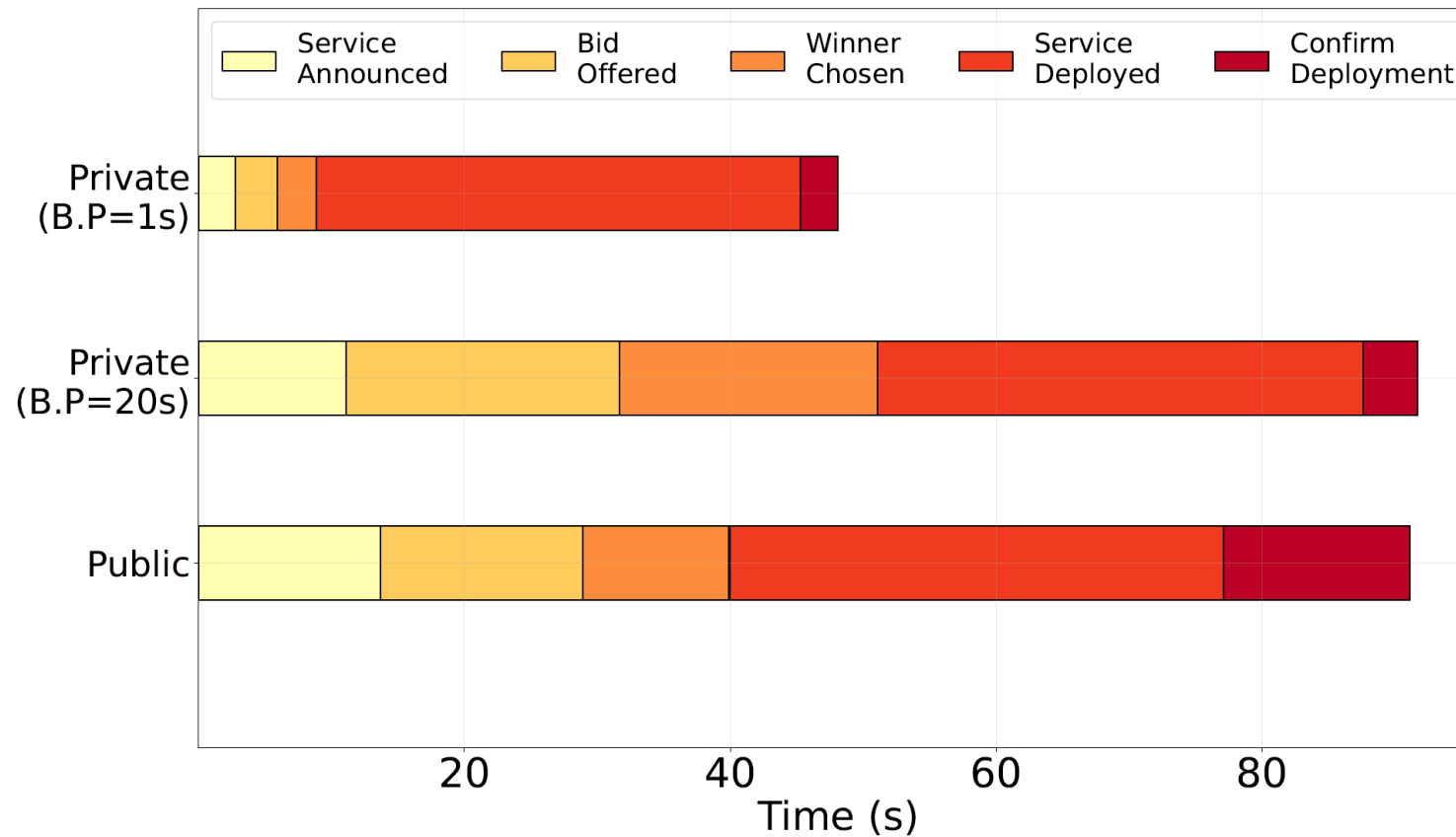
RESULTS

Figure 3: Federation process duration on a **Private Blockchain**



RESULTS

Figure 4: **Comparison** between the most and least favorable private block periods in relation to the public blockchain



CONCLUSION & FUTURE WORK

First work that conducts a performance analysis of multi-cloud federation using public and private blockchain platforms.

Public Blockchains: Used by everyone for everything, open interface to be integrated with the application

Private Blockchains: Controlled networks, dedicated only to telco entities

- Integration of Blockchain-based federation feature with real-world application
- Expand federation features for Telco operations (e.g., healing, migration)
- Optimize the OSM Blockchain-federation deployment time

ACKNOWLEDGEMENTS



This work has been partly funded by the European Commission Horizon Europe SNS JU DESIRE6G project (grant no. 101096466),



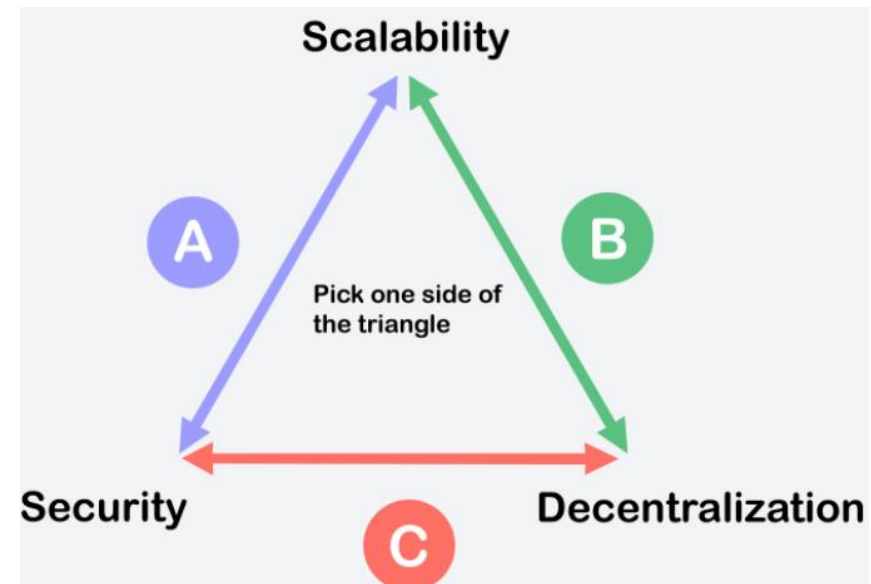
and the Spanish Ministry of Economic Affairs and Digital Transformation and the European Union-NextGenerationEU through the UNICO 5G I+D 6G-EDGEDT and 6G-DATADRIVEN



SECURITY AND SCALABILITY IN BLOCKCHAIN TECHNOLOGY

SECURITY and **SCALABILITY** issues are primarily related to the consensus protocol

BLOCKCHAIN TRILEMMA: high scalability and decentralization but weak security vs high decentralization and security but weak scalability



SERVICE DEPLOYMENT TIME

ISSUE: Long OSM instantiation time in federated services

PROPOSED STRATEGY: Pre-deployment of services by provider domains, enabling direct consumer access upon federation agreement