



Alliance for IoT
and Edge Computing
Innovation

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Blockchain & Edge IoT for Economy of Scale in Wind Industry

Singh, P., Holm, K., Beliatas, M. J., Ionita, A., Presser, M., Wolfgang, P., & Goduscheit, R. C. (2022). Blockchain for Economy of Scale in Wind Industry: A Demo Case. In *Global IoT Summit* (pp. 175-186). Cham: Springer International Publishing.

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Background and Aims

- Understand the relevant perspectives, and challenges for wind turbine supply chain operations.
 - Identify and map components/processes with potential benefits from Blockchain technology.
 - Focus on bolts and fasteners life-cycle oriented digital traceability, cross-organizational data sharing, and quality assurance/validation.
- Development of a demo Blockchain, QR/Bar codes, IoT, Node-Red, and Edge computing to give tangible evidence.

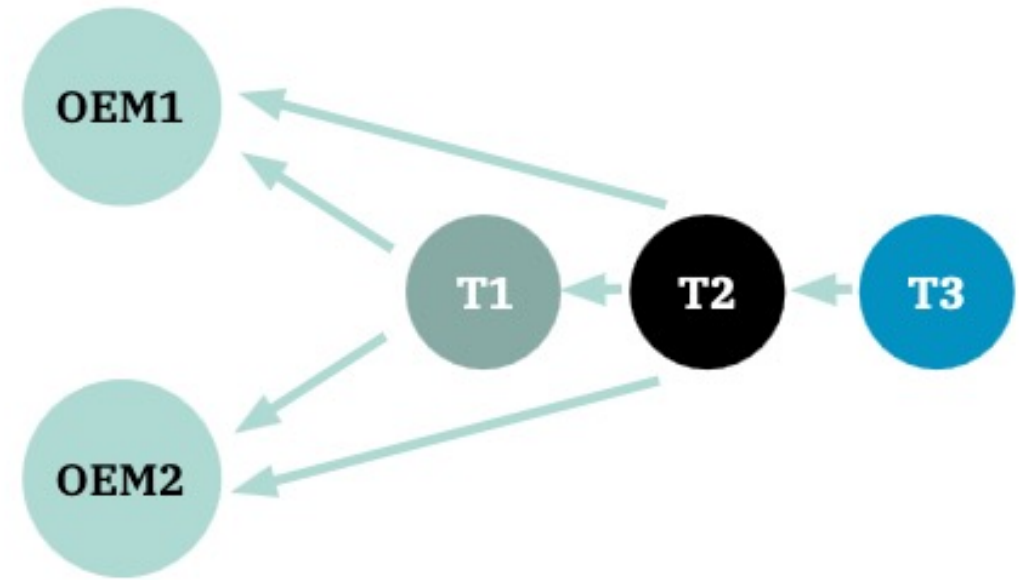


Challenges

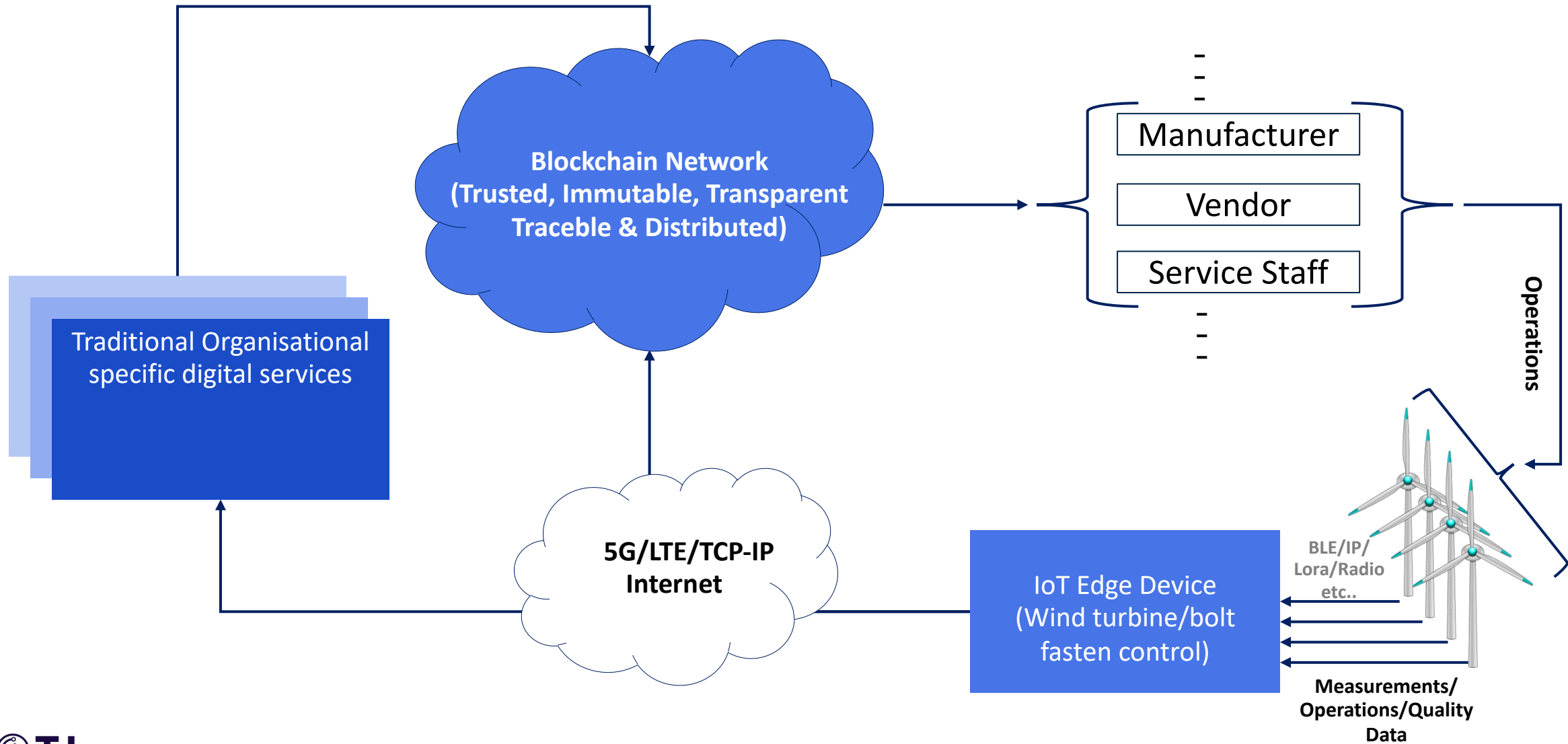
- Complex Buyer-Supplier relationship
- Heterogeneity among wind industry components
- Lack of digital traceability

Specifically:

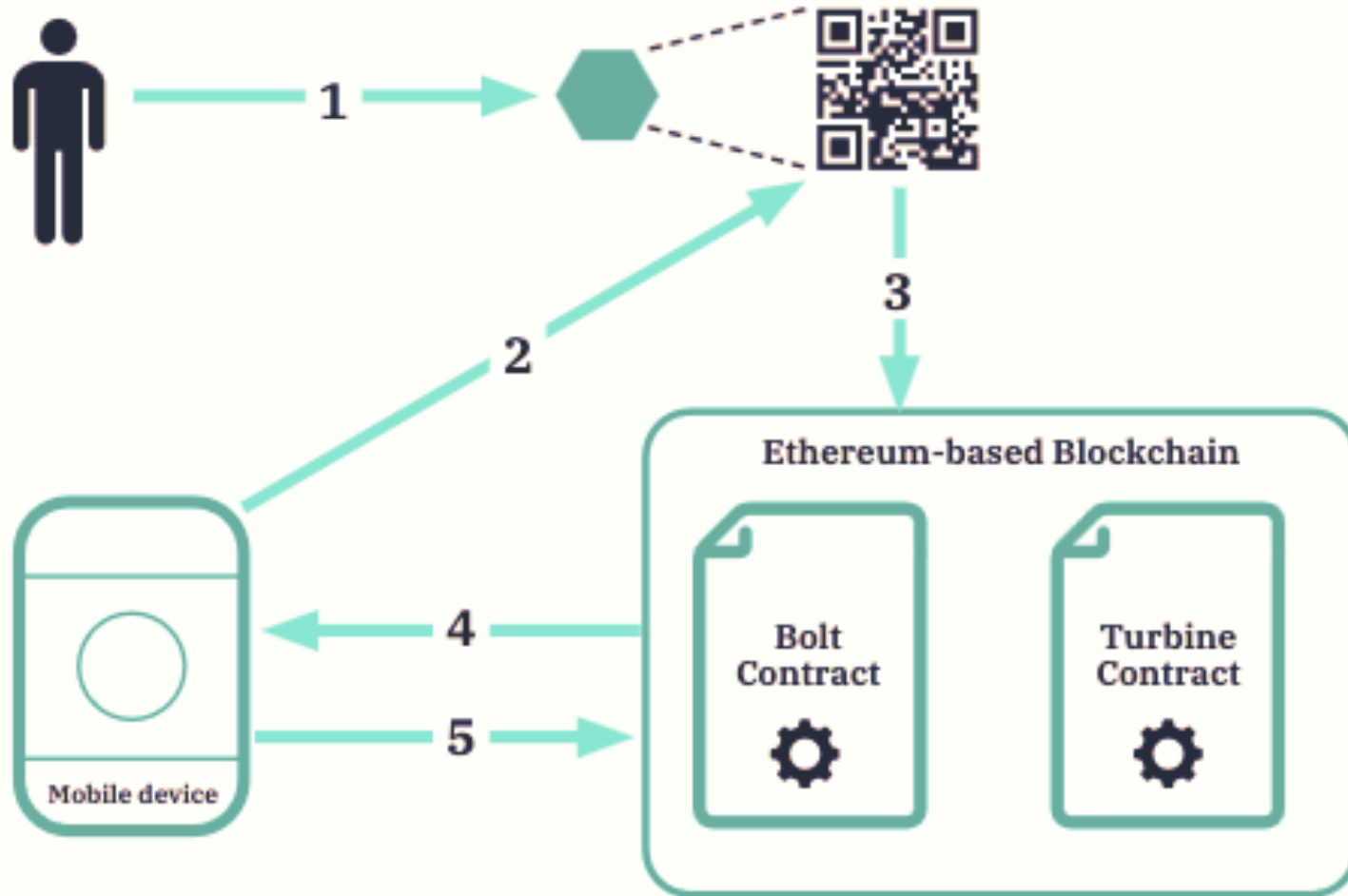
- Flow of trusted, transparent, and quality information among value-chain stakeholders.
- Registration of each event in the commodity components lifecycle.
- Contribute to the sustainability of manufacturing and maintenance operations.



Solution - Architecture



Prototype



- Register Id**
 - QR Codes for Turbine and Bolt Identification
 - Ethereum based Application APIs provides QR code generation
- Digital Tagging**
 - Tag Turbine and Bolt with QR codes
 - Physical asset mapping to digital traceability in Blockchain
- Device Register**
 - Turbine, Batch of Bolts (using QR Code)
 - Scanner & Digital Wrench Device
- Action Mapping**
 - Perform bolt fasten operation using digital wrench on bolt.
 - Real time Torque measurements monitoring started.
- Tracing**
 - Data/Metadata is collected and processed in IoT application.
 - Application sends data to blockchain network accessible to all stakeholders in transparent, secure and trustable manner.

Benefits

- Digital identification of physical assets in the chain and semantic mapping to the relevant events.
- IoT-enabled real-time data-driven and error-prone operations.
- During the maintenance phase, any anomalies in components such as broken bolts can be identified, traced back to suppliers, and correlated for proactive actions.
- Blockchain is providing the capability of:
 - digital traceability of wind turbine events in its life cycle.
 - transparent data sharing in a trustable manner among different stakeholders
 - improvement in quality assurance/validation during operations
 - guaranteed immutability of information.
 - event associated decisive ownership in a multistakeholder environment.



Conclusions

- Blockchain (along with digital technologies such as IoT) is found to be value-adding in the wind industry supply chain by:
 - Bringing digital traceability, cross-organizational/stakeholder data sharing, and relevant quality assurance/validation of events.
 - Building a transparent, trustable, immutable, and decisive ownership environment.
 - Providing economy of scale over operations execution on commodity products and related supply chains in the wind industry.



Thank you