

Tharindu Ranathunga, PhD

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Summary

Postdoctoral researcher with expertise in cyber-physical systems security, decentralised architectures, and trustworthy AI. Research spans agentic and adversarial AI, data-centric security, federated learning, and distributed ledger technologies, with applications across critical infrastructure, manufacturing, energy, and IoT ecosystems. Proven experience in EU-funded research, doctoral supervision, interdisciplinary collaboration, and translating foundational research into real-world testbeds and standards-aligned solutions.

Education

Doctor of Philosophy (PhD) in Electronic & Electrical Engineering 2018 - 2023

Munster Technological University, Ireland

Thesis: A DLT-based Trust Framework for IoT Ecosystems

Bachelor of Science Honors in Computer Science 2013 - 2017

University of Colombo School of Computing, Sri Lanka

Honours: Second Class (Upper Division) GPA: 3.32/4

Professional Experience

Senior Researcher, Nimbus Research Centre, MTU, Cork, Ireland *Jan 2023 - Present*

- **Led development of European and National Funded Projects** that advances cyber physical systems, IoT and decentralized ecosystems and AI driven innovations to address industry and societal challenges.
- Led **funding acquisition** and proposal-writing activities for Horizon Europe in collaboration with European consortia and strategic stakeholders.
- **Spearheaded technical design and delivery of** Data Space Architectures, Distributed Ledger Integrations, Trust Management Services and a Edge-Cloud Testbed.
- **Defined AI/ML/FL/GenAI technical direction** aligning with the EU's vision for a human-centric AI-driven Smart Society, focusing on ethical, secure, and responsible AI adoption.
- **Collaborated with industry leaders** such as IBM, DELL, Gilead, and Analog Devices, as well as EU data space stakeholders like IDSA and GaiaX to pilot use cases, discuss architectural designs, and align project deliverables with EU standards.
- **Standardised CI/CD pipelines**, user and service roles, contained CI creation, model consumption, and software testing methodologies to achieve Technology Readiness Level (TRL) of 7.
- **Engaged a broader tech community** to help in research publications and presentations on the practical application of data space platforms, machine learning, and data space architecture to drive business value and widespread adoption.

Organisation Admin, Ceylon Computer Science Institute (C2SI), Remote *Dec 2017 - Dec 2024*

- **Managed multiple open-source software projects**, such as ASSET and Bassa that provide low cost sustainable solutions to problems in developing countries.
- **Excelled in overseeing administration of Google Open-Source programs** (GSoC and GCI) and mentoring students on software development skills and techniques.
- **Steered adoption of open source and C2SI solutions** by organising outreach programs and promoting the technologies.

Researcher, Nimbus Research Centre, MTU Cork, Ireland *Apr 2019 - Dec 2023*

- **Drove R&D activities on DLT** to improve quality, overall efficiency, records management, and risk mitigation across supply chain, energy and facility management domains.
- **Accelerated the blockchain adoption** by developing a decision support toolkit to evaluate the necessity of blockchain integration and guide optimal design and technical decisions.
- **Conducted research on the convergence of DLT and AI** by leveraging trusted off-chain execution workflows to enhance trust and security in off-chain processes.

- **Supported creation of feasibility analyses, project requirement specifications, and white papers** in support of Research & Development activities.

Software Engineer, London Stock Exchange Technology, Colombo, Sri Lanka

Mar 2017 - Aug 2018

- **Implemented feature requests and addressing issues** in front running stock exchange product as per the clients requests.
- **Introduced rigorous automated testing practices** in controlled environments before going live, hence reducing software bugs and accelerating the software release cycle.
- **Led the implementation** of a code quality (dynamic & static) assessment tool for all the projects in the company.

Research Projects

CyberUnite Ireland

Jan 2026 – Present

An all-island Ireland–Northern Ireland research programme developing **AI-driven, zero-trust and cyber-digital-twin** technologies to enhance the **cyber-resilience of critical infrastructure systems**.

- Contribute to the design and implementation of **data-centric and zero-trust security architectures** for cyber-physical and IIoT systems targeting cross-border critical infrastructure.
- Design and prototype components for secure **telemetry collection, policy enforcement, and compliance-aware data sharing** within CPS environments.
- Support the integration of **AI-driven threat detection** and autonomous response mechanisms within a Cyber-Digital Twin testbed for realistic attack simulation and resilience evaluation.
- Collaborate in cross-institutional and industry co-creation activities, contributing to **architecture design, experimentation, and validation** of research outcomes.

CORDS: Collaborative Data Space for Manufacturing

Jan 2023 – Jan 2026

A **federated learning** platform built on top of the **International Data Space Protocol** aimed at self-sovereign cross party machine learning model training orchestration for manufacturing domain.

- **Led the design & implementation of a minimal viable data space** software infrastructure (Python, JavaEE, SPARQL, Apache Camel, OPCUA, Docker, Kubernetes) and **semantic library** for machine learning workflows. (Python, ML Flow, RDF, Protege).
- **Designed & Implemented a Decentralized & Federated Machine Learning Service** on top of the **Data Space Protocol** (SARIMA, Python, Kafka, Pytorch, Flower.AI, ML Flow).

SmartQC: Smart Contracts for Automated Batch Release

Apr 2021 - Sept 2023

A blockchain-based supply chain management platform for medical device manufacturing to enhance traceability while minimising reconciliation complexities.

- **Designed a protocol (Layer 2) to enhance data integrity, veracity and provenance** of transactions that goes into a DLT/Blockchain.
- **Led implementation of fullstack solution** to demonstrate the potential the proposed design (Java, Hyperledger Fabric, Chaincode, Bigchain DB, Algorand, Algorand, VueJs).

A DLT-based Trust Framework for IoT Ecosystems

Dec 2018 - Jan 2023

A framework to address the challenges of managing trust across IoT edge cloud ecosystems by leveraging DLT based architectural design and a ML based trust reputation model.

- **Designed DLT-based architecture** for decentralised IoT Ecosystems (Hyperledger Fabric) and off-chain **ML-based trust computation** mechanism for edge-cloud continuum (PyTorch, ScikitLearn, TensorFlow, Cooja Contiki, DLT, Chaincode, Ethereum Trusted Execution Workflow, GoLang, Raft, PBFT).
- **Conducted simulated experiments** to analyze the impacts of design decisions on **security, decentralization and scalability**

DigiBlocks: DLT for Smart Energy Communities

Jan 2019 - Mar 2021

A DLT based platform to manage smart energy communities to enable developers implement DApps to address existing challenges.

- Designing a platform to consolidate energy related transactions from multiple stakeholders.
- Implementing DApps for Energy Certification Generation and KPI calculations

RADAR

Mar 2017 - Aug 2017

The Radar is a central source to aggregate metrics from all dynamic and static code quality used to improve the quality of a large scale code based related to mission critical fintech solutions.

Technology Stacks

Languages: Python, Java, C, C++, Go, R, JavaScript

Blockchains: Hyperledger Fabric, Ethereum, Algorand, Chainlink, Caliper, Chaincodes, BigChainDB, Litecoin, Smart Contracts, Foundry

Microservices and APIs: RESTful, MQTT, APIFairy

Data Pipelining: Kafka, OPCUA, MQTT

Frameworks/Tools: Docker, Kubernetes, Swarm, MEAN, Vue.js, Node.js, D3.js, Flask, Elasticsearch, AWS, GCP, SQL

AI & Machine Learning: LLM Fine Tuning, LangChain, MCP, Pytorch, ScikitLearn, Flower.AI, MLFlow, ML Semantics

Scholarships & Awards

Open Data Hackathon, Ireland 3 rd Place.	2021
SFI and SEAI PhD Scholarship	2018
IEEE DCOSS, Canada, Best Paper Award	2017
Google Summer of Code SCoReGroup	2016
CERT Cyber Security Quiz, Winner Sri Lanka	2015
Code4Good Hackathon, Finalist	2015
University Colors, Hockey, University of Colombo	2014
SLIIT Codefest, Silver Medal	2013
Innovative Students' Software Competition, Merit Award	2009

Invited Talks and Tutorials

IEE Blockchain UK & Ireland Section Webinar	2021
<ul style="list-style-type: none"> • Navigating Enterprise Blockchain Solutions – From Design to Deployment 	
Axiata Digital Labs Tech Talk	2023
<ul style="list-style-type: none"> • Navigating Enterprise Blockchain Solutions – From Design to Deployment 	
BlockW Micro Learning Webinar	2023
<ul style="list-style-type: none"> • Enterprise Blockchain Use Cases: Smart Quality Control 	
Irish Computer Society Webinar Series	2024
<ul style="list-style-type: none"> • Enterprise Blockchain Use Cases: Smart Quality Control 	
Open Data Hub 2025, Bolzano, Italy	
<ul style="list-style-type: none"> • Beyond Data Sharing: Enabling Federated Learning Services in Data Spaces with IDSA Protocol 	2025

Supervisions & Mentorships

Primary Supervisor, PhD Researcher: *Kavishka Fernando*

Adversarial Agentic AI for Cyber-Physical Systems

Co-supervising doctoral research on the design and evaluation of adversarially robust, agentic AI techniques for security and resilience in cyber-physical systems.

List of Publications

T Ranathunga, S Barathi, A McGibney; Policy-Driven Federated Learning: Operationalising Governance, Trust, and Compliance in Cross-Organisational AI: IEEE European Symposium on Security and Privacy, (Under Review)

I Dhanapala, T Ranathunga, S Barathi, A McGibney, Susan Rea, A Secure Data Ecosystem Testbed, 2025 IEEE International Conference on Smart Computing (SMARTCOMP), Cork Ireland, 2025.

T Ranathunga, A McGibney, S Barathi; Enabling Secure and Self-Sovereign Machine Learning Model Exchange in Manufacturing Data Spaces: Journal of Industrial Information Integration, Elsevier, 2024

T Ranathunga, S Barathi, A McGibney; Integrating Distributed Ledger Technologies Into Data Spaces: An Architectural Pattern: International Congress on Blockchain and Applications, Salamanca, 2024

T Ranathunga, S Barathi, A McGibney; A Semantic Interoperability Toolkit for Sharing Energy Data and Models in a Manufacturing Data Space: Workshop on Semantic Interoperability in Data Spaces, Budapest, 2024

S Barathi, T Ranathunga, I Dhanapala, S Rea, A McGibney; Machine Learning Economy for Next Generation Industrial IoT: A Vision under Web 3.0: The International Conference on Management of Digital Eco Systems (MEDES), Springer CCIS 2023

T Ranathunga, A McGibney, S Barathi; Blockchain based Decentralised Model Aggregation for Cross-Silo Federated Learning in Industry 4.0: IEEE Internet of Things Journal 2022

T Ranathunga, A McGibney, S Rea; The convergence of Blockchain and Machine Learning for Decentralized Trust Management in IoT Ecosystems: 19th ACM Conference on Embedded Networked Sensor Systems BlockSys 2021 Workshop, Portugal

T Ranathunga, R Marfievici, A McGibney, S Rea; A Distributed Ledger Based Platform for Automated Energy Performance Assessment: IEEE 2021 Third International Conference on Blockchain Computing and Applications, BCCA 2021, Estonia

T Ranathunga, R Marfievici, A McGibney, S Rea; A DLT- based trust framework for IoT Ecosystems: IEEE Cyber Security Conference 2020, Dublin, Ireland.