JULES MARTIAL YIN-BELTA MBARA

SCIENTIFIC CURRICULUM VITAE — POSTDOCTORAL APPLICATION

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SCIENTIFIC PROFILE

My academic journey has progressively developed around computer networks, telecommunications and cybersecurity. After completing a Bachelor's degree in Networks and Telecommunications at the University of Bangui (2016–2019), I pursued a Master's degree in Information Technology, with a concentration in management, innovation and collaborative systems technologies, at the University Politehnica of Bucharest in Romania, where my thesis focused on wireless network security. I am currently pursuing a PhD in Computer Science at Université du Québec à Chicoutimi (UQAC), where I am a member of the Institutional Research Chair in Cyberdefense and Personal Data Protection (CYBPRO). My doctoral work focuses on industrial cybersecurity and the design of trust architectures for industrial digital twins. I investigate verifiable data integrity, secure interoperability, distributed governance, resilience and decision auditability using blockchain, distributed ledger technologies, IPFS, IoT/IIoT and cyber-physical systems. My background combines experimental research, funded collaborative projects, cybersecurity assessments of industrial organizations, peer-reviewed publications and university teaching in IoT security.

RESEARCH AREAS

Industrial cybersecurity · Trustworthy industrial digital twins · IoT/IIoT and cyber-physical systems · Blockchain and distributed ledger technologies (Hyperledger Fabric, Solana, Corda) · IPFS and distributed storage · Secure industrial interoperability · Cyber resilience · Governance and auditability · AI and federated learning applied to cybersecurity.

EDUCATION

PhD in Computer Science — Université du Québec à Chicoutimi (UQAC)

- Fall 2023 – Fall 2026 (doctoral defense)
- **Thesis** — *Decentralized Trust Architectures for Industrial Digital Twin Ecosystems*
- Supervisor: Prof. Fehmi Jaafar (UQAC) | Co-supervisor: Prof. Pierre-Martin Tardif (Université de Sherbrooke)

Master's Degree in Information Technology — University Politehnica of Bucharest, Romania

- 2020 – 2023
- Concentration: Management, Innovation and Collaborative Systems Technologies — 120 ECTS credits
- **Master's thesis** — *Wireless Network Security System*

Bachelor's Degree in Networks and Telecommunications — University of Bangui

- 2016 – 2019

RESEARCH EXPERIENCE AND FUNDED PROJECTS

Researcher — Cybersecurity and Backend Development, Cogni-Actif Project

Université du Québec à Chicoutimi (UQAC), Quebec, Canada — December 15, 2025 – December 15, 2026

Research project carried out through a CAD 22,000 research scholarship awarded for my involvement in the Cogni-Actif project. The project is funded by the Ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), Fonds SOVAR and Studio ExeCo.

- **Cybersecurity lead:** analysis and security of the project architecture, including application components, authentication and access-control mechanisms, data flows and exchanges between the various services.

- Identification of risks and vulnerabilities, definition of security requirements and integration of Security by Design principles into the evolution of the solution.
- Development, restructuring and evolution of the Cogni-Actif platform backend to facilitate the secure integration of the system's different services and components and prepare the architecture for future versions of the game; improvement of modularity and maintainability, integration of communication interfaces with the game platform, and adaptation of the architecture to new features.
- Definition and validation of protection measures aimed at ensuring data confidentiality, integrity and availability; documentation of architectural choices and security mechanisms in collaboration with project partners.

Cybersecurity Specialist Intern — Mitacs Mandate, ERAC Gaspésie

Quebec, Canada — October 2024 – March 2025 (six-month mandate)

Applied cybersecurity research mandate carried out through the Mitacs program with several partner companies in the Gaspésie region.

- Assessment of the cybersecurity posture of participating organizations: analysis of security policies and practices, identification of vulnerabilities and protection gaps, and evaluation of existing security mechanisms.
- Work covering access controls, authentication mechanisms, IT infrastructure security, data protection, incident management and organizational cybersecurity practices.
- Formulation of technical and organizational recommendations adapted to SME realities and development of incident response plans aimed at improving prevention, detection and response capabilities.
- This field experience contributed to the empirical dimension of my research on cybersecurity and digital trust challenges faced by industrial organizations operating with limited technical and human resources.

UNIVERSITY TEACHING EXPERIENCE

Lecturer — 8INF917-11: Computer Security for the Internet of Things

Université du Québec à Chicoutimi (UQAC), Chicoutimi, Quebec — Winter 2026, 45 hours

- Instructor for the university course 8INF917-11 — Computer Security for the Internet of Things, dedicated to cybersecurity issues specific to IoT environments.
- Preparation and delivery of course content: threats and vulnerabilities affecting connected devices, authentication and access-control mechanisms, communication security, data protection and IoT architecture security strategies.
- Design of assignments, projects and assessments, student supervision, and evaluation of their ability to analyze risks, identify vulnerabilities and propose protection mechanisms suited to IoT systems.

DOCTORAL SCIENTIFIC CONTRIBUTIONS

C1 — Empirical Assessment of Industrial SME Cybersecurity

Assessment of thirty industrial SMEs located in an isolated region of Eastern Canada using questionnaires, semi-structured interviews, on-site technical assessments and organizational analysis. This contribution highlights a structural digital trust deficit affecting, among other areas, network segmentation, exposed ports, firewalls, cybersecurity policies and infrastructure obsolescence.

C2 — TwinIpfsChain: Real-Time Verifiable Integrity

Design of an architecture combining a private Solana network and IPFS to ensure verifiable integrity of real-time digital twin data. The experimental evaluation reports an average transaction latency

of approximately 218 ms, a maximum measured throughput of 26,457 transactions per second, and detection of all injected cases of data tampering, cryptographic hash manipulation and replay.

C3 — SecDT: Secure and Decentralized Management of Industrial Digital Twins

Development of an architecture combining Hyperledger Fabric 2.5, a five-node private IPFS deployment, permissioned multi-organizational governance, smart contracts, encrypted off-chain storage and access-control mechanisms. The prototype was evaluated on fourteen virtual machines using the NASA C-MAPSS FD001–FD004 datasets.

C4 — Decentralized Cross-Organizational Industrial Interoperability

Design of an inter-organizational data-sharing architecture combining Corda, IPFS and an integration layer supporting REST, MQTT, OPC UA and legacy systems. The experimental environment represents five organizations and studies provenance, authorization, traceability and distributed governance beyond simple protocol compatibility.

C5 — Auditable Decision Governance for Digital Twins

Development of a framework combining FA3ST/AAS, Hyperledger Fabric and IPFS to preserve a reconstructible relationship between digital twin state, policy context, decision mode, action, off-chain evidence and on-chain commitment. The approach distinguishes autonomous, human-in-the-loop and manual override modes while separating low-latency local execution from the distributed audit path.

METHODOLOGICAL AND EXPERIMENTAL APPROACHES

Design of prototypes and distributed testbeds · multi-virtual-machine deployments · reproducible experimental protocols · performance and scalability analysis · latency and throughput measurements · controlled failure and stress scenarios · validation of integrity, traceability, confidentiality and access control · comparison with centralized or distributed reference architectures.

RESEARCH FUNDING

- **Excellence Scholarship — Department of Computer Science and Mathematics (DIM), UQAC** CAD 2,000, awarded twice (2024 and 2026), for the same amount of CAD 2,000 each time.
- **Research Scholarship — Cogni-Actif Project, UQAC** CAD 22,000 | December 15, 2025 – December 15, 2026. Funding: Ministère de l'Économie, de l'Innovation et de l'Énergie (MEIE), Fonds SOVAR and Studio ExeCo.
- **Research Financial Support — MITACS Accelerate and NSERC** CAD 20,000 | August 1, 2026 – July 31, 2027. Funding from a MITACS Accelerate grant and an NSERC Discovery Grant to support continued doctoral research in cybersecurity and the implementation of blockchain-based data-security methods.

SCIENTIFIC PUBLICATIONS

Journal Articles

- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*SecDT: A Secure and Decentralized Approach for Industrial Digital Twins Using Blockchain and IPFS.*" IEEE Internet of Things Journal. IEEE, 2026. DOI: 10.1109/JIOT.2026.3704519
- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*Auditable Decision Governance for Industrial Digital Twins Using Hyperledger Fabric and IPFS.*" IEEE Transactions on Industrial Informatics, 2026 (accepted for publication).

Conference and Workshop Papers

- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*Cross-Organizational Data Governance for Industrial Digital Twins Using Blockchain and IPFS.*" Proceedings of the 8th International Workshop on Software Engineering Research and Practices for the IoT (SERP4IoT '26). ACM, 2026. DOI: 10.1145/3786159.3788474

- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*A Decentralized Architecture for Industrial Data Interoperability Using Blockchain and IPFS.*" 2025 IEEE Conference on Dependable, Autonomic and Secure Computing (DASC). IEEE, 2025. DOI: 10.1109/DASC68382.2025.00013
- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*TwinIpfsChain: Ensuring Decentralized Data Integrity in Real-Time Digital Twins for Industry 5.0 Using Blockchain and IPFS.*" 2025 7th International Conference on Blockchain Computing and Applications (BCCA). IEEE, 2025. DOI: 10.1109/BCCA66705.2025.11229546
- Mbara, Jules Martial Yin-Belta, Fehmi Jaafar and Pierre-Martin Tardif. "*Security Evaluation of Industrial Organisations in an Isolated Region.*" 2025 11th International Conference on Control, Decision and Information Technologies (CoDIT). IEEE, 2025. DOI: 10.1109/CoDIT66093.2025.11321624

Other Peer-Reviewed Publication

- Pierre, Tom, Jules Martial Yin-Belta Mbara and Fehmi Jaafar. "*Solana–IPFS Architecture for Scalable, Low-Cost, and Secure Digital Identity Management in Real Estate Transactions.*" IEEE Access, vol. 14, pp. 99094–99111, 2026. DOI: 10.1109/ACCESS.2026.3706191

SELECTED PRIOR TECHNICAL EXPERIENCE

- Administration of systems and network infrastructures, account and update management, backups, workstation security and technical incident resolution.
- Installation and maintenance of network equipment, firewall and server administration, backups, security mechanisms and user support.

SCIENTIFIC AND TECHNICAL SKILLS

- **Industrial cybersecurity and critical systems** — risk and vulnerability analysis; integrity, confidentiality and access control; tampering and replay detection; resilience; incident response; security of cyber-physical systems and IoT/IIoT environments.
- **Blockchain and distributed trust** — Hyperledger Fabric 2.5, Solana, Corda, smart contracts, permissioned governance, cryptographic anchoring, provenance, traceability and auditability.
- **Digital twins and distributed storage** — Industrial Digital Twins, FA3ST/AAS, IPFS, content-addressed storage, off-chain evidence, state management and history reconstruction.
- **Interoperability and protocols** — MQTT, OPC UA, REST, TCP/IP, CoAP/DTLS, BLE; integration of heterogeneous industrial systems and legacy systems.
- **Programming, data and experimentation** — Python, Java, C++, JavaScript/TypeScript, Node.js, FastAPI, MySQL, PostgreSQL; distributed deployments, virtual machines, benchmarking, latency and throughput analysis, failure testing and controlled stress scenarios.

SCIENTIFIC AFFILIATIONS

- IEEE — Student Member
- Member of the Institutional Research Chair in Cyberdefense and Personal Data Protection (CYBPRO), Université du Québec à Chicoutimi

REFERENCES

Prof. Fehmi Jaafar

- Associate Professor, Department of Computer Science and Mathematics, Université du Québec à Chicoutimi (UQAC) — Chairholder of the Institutional Research Chair in Cyberdefense and Personal Data Protection (CYBPRO)
- PhD Supervisor
- Phone: 418 545-5011, ext. 2606 | Email: fjaafar@uqac.ca

Prof. Pierre-Martin Tardif

- Associate Professor, Department of Information Systems and Quantitative Management Methods, School of Management, Université de Sherbrooke — Research Associate at the Université de Sherbrooke Interdisciplinary Cybersecurity Research Centre (CRICUS)
- PhD Co-Supervisor
- Email: Pierre-Martin.Tardif@USherbrooke.ca

LANGUAGES

French: native language | Sango: national language | English: upper-intermediate | Romanian: intermediate

ADDITIONAL ACADEMIC WORK

- "*Security Vulnerabilities in Artificial Intelligence Systems*" — academic work completed under the supervision of Prof. Fehmi Jaafar (UQAC) and Prof. Pierre-Martin Tardif (Université de Sherbrooke).