IEEE MASS'25 PANEL

Data-driven IoT Systems: Emerging Verticals, Challenges, and Opportunities

Time: 2:00-3:15pm, Tuesday, Oct. 7, 2025
Location: Auditorium, Conviser Law Center, Illinois Institute of Technology

Shiwen Mao
Auburn University, Auburn, AL
(Moderator)

Falko Dressler
Technische Universität Berlin

Xinwen Fu
UMass Lowell

Jelena Misic
Toronto Metropolitan University

Aaron Striegel
University of Notre Dame

Guoliang Xing
The Chinese University of Hong Kong

A Timeline of Major Developments in IoT

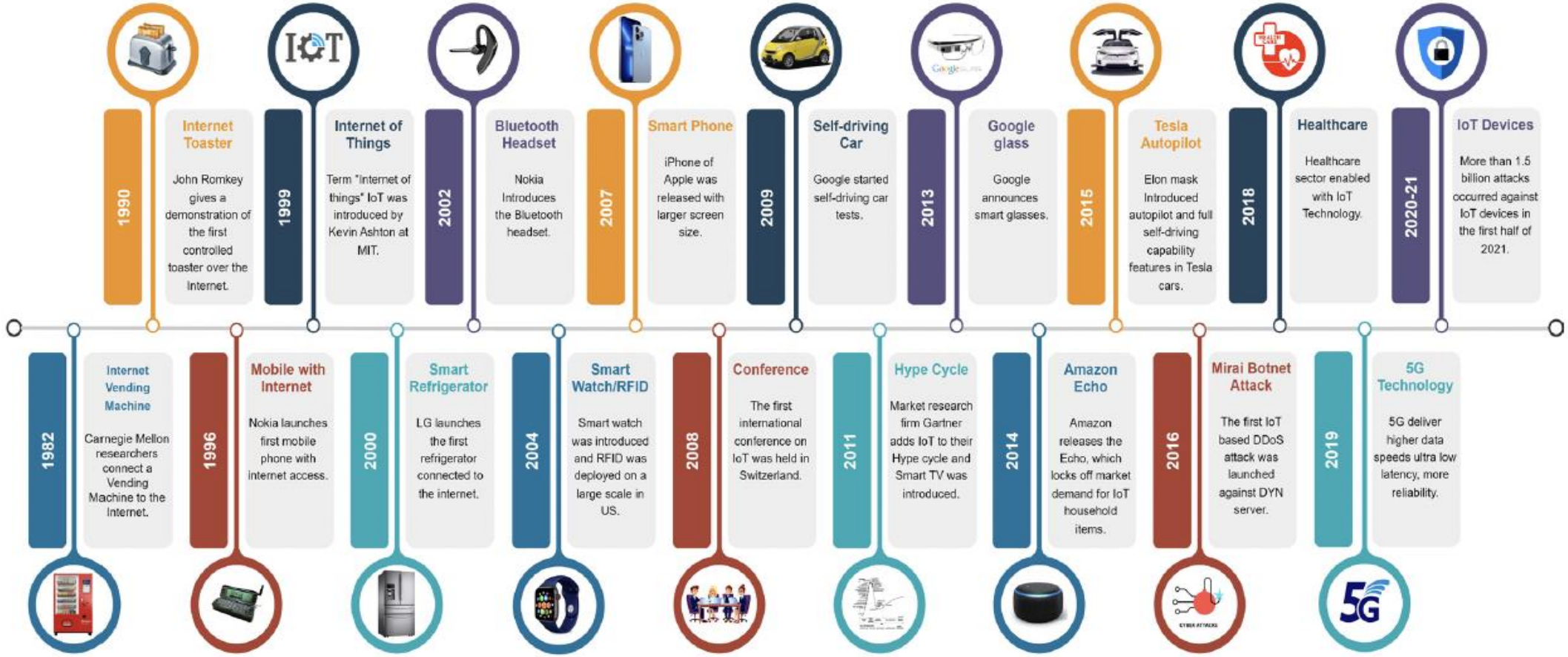

Image source: P. Shukla, C.R. Krishna, and N.V. Patil, "IoT traffic-based DDoS attacks detection mechanisms: A comprehensive review," *The Journal of Supercomputing* (2024) 80:9986–10043.

Use-inspired Fundamental Research & Verticals-Driven Technology Development, Demonstration, and Translation

Unique Features

Use-inspired & Verticals-driven

- Use-inspired research
  - Not driven purely by technology, but by practical problems and real-world needs
  - Focus is on application pull (what users, industries, or cities need) rather than just technology push
  - Examples: smart homes, wearables, smart agriculture
- Verticals-driven development, demonstration, and translation
  - Highly domain-specific: different industries (verticals) have unique requirements, architectures, and data needs
  - Each vertical tailors IoT technologies to sector-specific goals, regulations, and challenges
  - Examples: Healthcare, Manufacturing, Transportation & Logistics, Smart Cities, Agriculture

Data-intensive and Data-driven

- IoT systems are inherently data-centric
  - Billions of devices continuously sense, generate, transmit, and process information
  - High volume of data, high velocity, high variety, noisy and sparse data
  - Security and privacy
- Data-driven design
  - Data at the center of decision-making and architecture, enabling adaptive, intelligent, and efficient IoT systems
  - Data-centric architecture: designed around pipelines for collection → processing → analytics → action
  - Design by data insights
  - Machine learning & AI integration: exploit the advances in ML/AI for data analytics and more effective IoT system design

Data-driven IoT Systems: Emerging Verticals, Challenges, and Opportunities

Meet the Panelists – Falko Dressler

Falko Dressler
Technische Universität Berlin

- Professor and Chair for Telecommunication Networks
- Associate EiC for IEEE Trans. on Network Science and Engineering, IEEE Trans. on Mobile Computing, and Elsevier Computer Communications
- Chairing conferences such as IEEE INFOCOM, ACM MobiSys, ACM MobiHoc, IEEE VNC, IEEE GLOBECOM
- IEEE Distinguished Lecturer and ACM Distinguished Speaker
- An IEEE Fellow, an ACM Fellow, and an AAIA Fellow. A member of the German National Academy of Science and Engineering (acatech)
- On the IEEE COMSOC Conference Council and the ACM SIGMOBILE Executive Committee
- Next generation wireless communication systems in combination with distributed machine learning and edge computing for improved resiliency. Application domains include the IoTs, cyber-physical systems, and the internet of bio-nano-things

Meet the Panelists – Xinwen Fu

Xinwen Fu
UMass Lowell

- Professor in the School of Computer & Information Science, University of Massachusetts Lowell
- Computer and network security and privacy
- Published at prestigious conferences and journals
- Won multiple best/distinguished paper awards including one at IEEE ICDCS 2024 and honorable mention at USENIX Security 2025
- Spoke at various technical security conferences including Black Hat
- Research reported by various Media including CNN, Wired, Huffington Post, Forbes, Yahoo, MIT Technology Review, PC Magazine and aired on CNN Domestic and International and the State Science and Education Channel of China (CCTV 10)

Meet the Panelists – Jelena Misic

Jelena Misic
Toronto Metropolitan University

- Professor in the Department of Computer Science at Toronto Metropolitan University, Canada
- An internationally recognized expert in the areas of IoT, blockchain, wireless networking and network security
- Published four books, 190+ journal papers, 24 book chapters, and 240+ conference papers
- Chaired more than a dozen major international events and guest-edited more than a dozen special issues of various journals
- Serves on the editorial boards of IEEE Transactions on Vehicular Technology, IEEE Internet of Things Journal, …
- An IEEE Fellow, ACM member, IEEE VTS distinguished lecturer and chair of IEEE Communication Society awards committee

Meet the Panelists – Aaron Striegel

Aaron Striegel
University of Notre Dame

- Professor of Computer Science and Engineering at the University of Notre Dame and also serves on the Executive Committee of the Wireless Institute at Notre Dame
- Research focused on instrumenting wireless networking, optimizing network performance, wireless-enabled sensing, and network security
- Flagship projects—NetSense, NetHealth, and Tesserae —involve the instrumentation and analysis of data from hundreds of smartphones and wearables over a ten year period of continuous data streaming
- Extensive funding from NSF, NIH, DARPA, IARPA, Keck Futures Institute, and numerous industrial entities (Google, Sprint, Nokia, Intel, HP, Sun) —NSF CAREER award in 2004
- Chaired numerous conferences (including INFOCOM 2025), and served on many editorial boards

Meet the Panelists

Guoliang Xing
The Chinese University of Hong Kong

Featured ACM Member: Guoliang Xing

Guoliang Xing is a Professor and Director of the AIoT Lab at the Chinese University of Hong Kong (CUHK). His research spans embedded AI, AI for health, autonomous driving, and cyber-physical systems. Highlights of his work include leading the development and field deployment of large-scale systems for roadside infrastructure–assisted autonomous driving, early clinical diagnosis and treatment of Alzheimer's disease, and real-time volcano monitoring. His work has received seven Best Paper Awards, five Best Demo/Poster/Artifact Awards, and seven Best Paper Finalist distinctions at top-tier international conferences.

Xing serves as an Associate Editor for *ACM Transactions on Computing for Healthcare* and *ACM Transactions on Sensor Networks*, and has served as general or program co-chair for multiple ACM conferences. He was recently named an ACM Fellow for contributions to embedded AI and mobile computing systems.

Some Topics for Discussion

- Emerging verticals, challenges and opportunities
  - Industries or sectors that have not so far been heavily reliant on the IoT but are increasingly integrating next-generation networking/IoT capabilities
  - Applications that have been envisioned conceptually but not fully realized
  - Verticals that are significantly influenced by regulatory policies
- What are the theoretical and technological gaps
- Should we rely on domain knowledge, or hand off to machine learning models
- Evaluation of IoT works
  - Benchmark and datasets
  - Contributions of a customized design
- How to train our students/workforce, to make them successful in this domain
- Protocol architectures for IoT, e.g., CoAp and blockchain architectures
- Industrial Internet of Things – Adoption / obstacles / testbeds / datasets
- Opportunities and challenges in autonomous driving, healthcare: V2X, LLM, …

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