IOT ANALYTICS
MARKET INSIGHTS FOR THE INTERNET OF THINGS

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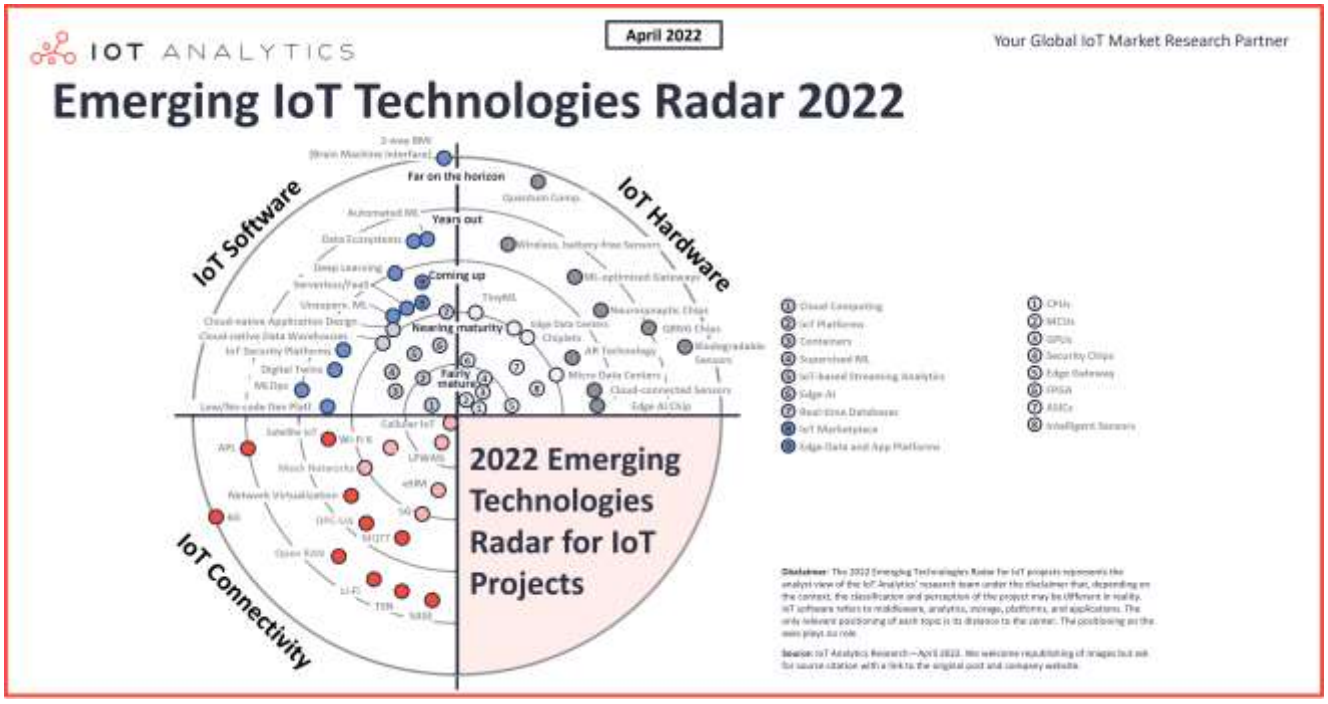
INSIGHTS RELEASE

55+ emerging IoT technologies you should have on your radar (2022 update)

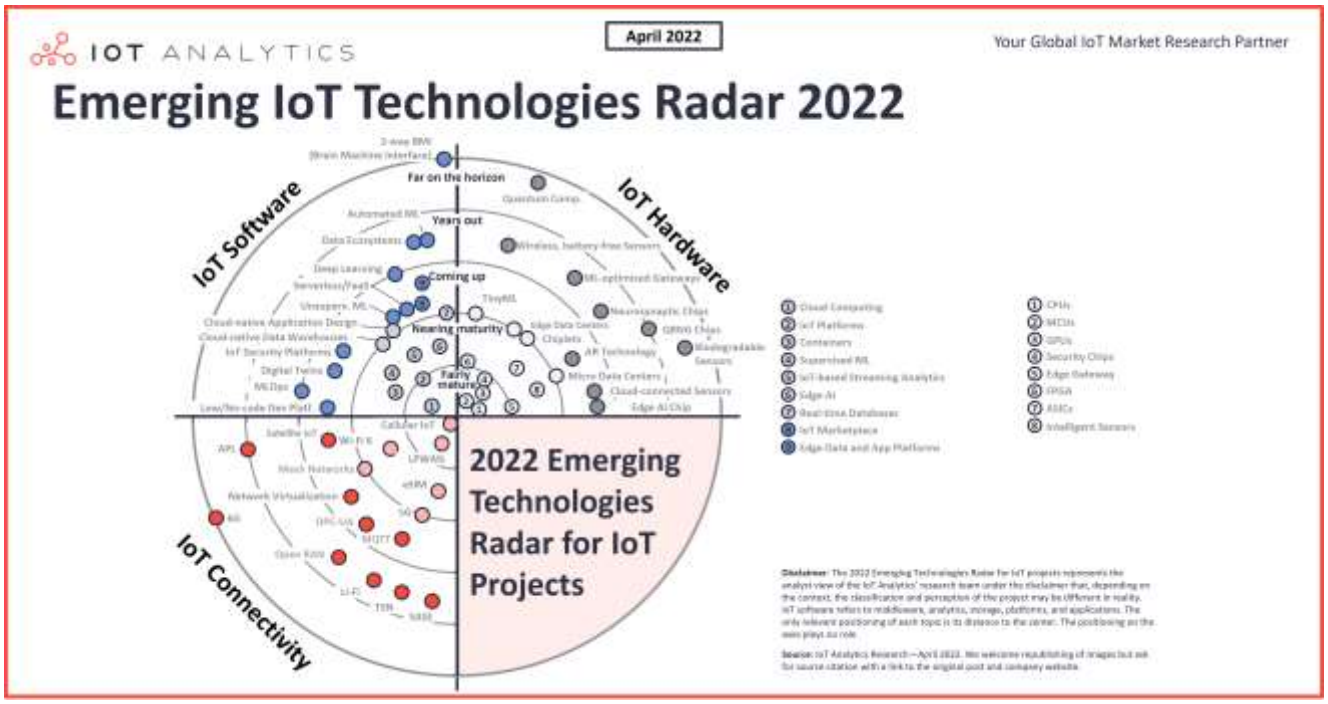


Key Quotes

Knud Lasse Lueth, CEO at IoT Analytics says: *"Many of the technologies available to IoT practitioners have matured significantly in the last 3 years. That is why we are currently witnessing increased adoption of IoT across the board and more and more projects that are scaling up. Nonetheless, there is still so much technology on the horizon which, once more mature, will mean another step-change for the Internet of Things."*
Satyajit Sinha, Senior Analyst at IoT Analytics adds: *"Wi-Fi 6, GPUs, and intelligent sensors were the fastest adaptive technologies in the last three years. The quick deployment of hardware components, expansion to new applications, and extensive updates on existing technology were key factors for higher adoption."*

Hamburg/Germany, April 06, 2022: IoT Analytics, a leading global provider of market insights and strategic business intelligence for the Internet of Things (IoT), AI, Cloud, Edge, and Industry 4.0, today released the 2022 Emerging Technologies Radar for IoT Projects. Alongside the radar, the company also published a report titled "Emerging IoT Technologies Report 2022" which highlights the current

state of emerging IoT technologies, including latest developments and key vendors for each technology.



The analyst team at IoT Analytics handpicked 58 of the most promising technologies relevant to IoT projects globally and ranked them according to their perceived maturity. The resulting **Emerging IoT Technologies Radar** will help anyone working in IoT-type environments and projects understand which technologies they should be watching, evaluating, and perhaps deploying. The full report is available to IoT Analytics corporate subscription clients here: **Emerging IoT Technologies Report 2022.** The report contains additional details, such as market statistics, major vendors, and recent trends, for each of the highlighted IoT technologies, which are anywhere between "coming up" and "mainstream." The report is an update to the 2019 analysis on emerging IoT technologies.

SELECTED HIGHLIGHTS

IoT Software. Eight IoT technologies are nearing maturity, including edge AI, IoT-based streaming analytics, and supervised and unsupervised machine learning.

IoT Hardware. Six IoT technologies are now classified as fairly mature or mainstream: CPUs, MCUs, GPUs, security chips, FPGA, and edge gateways.

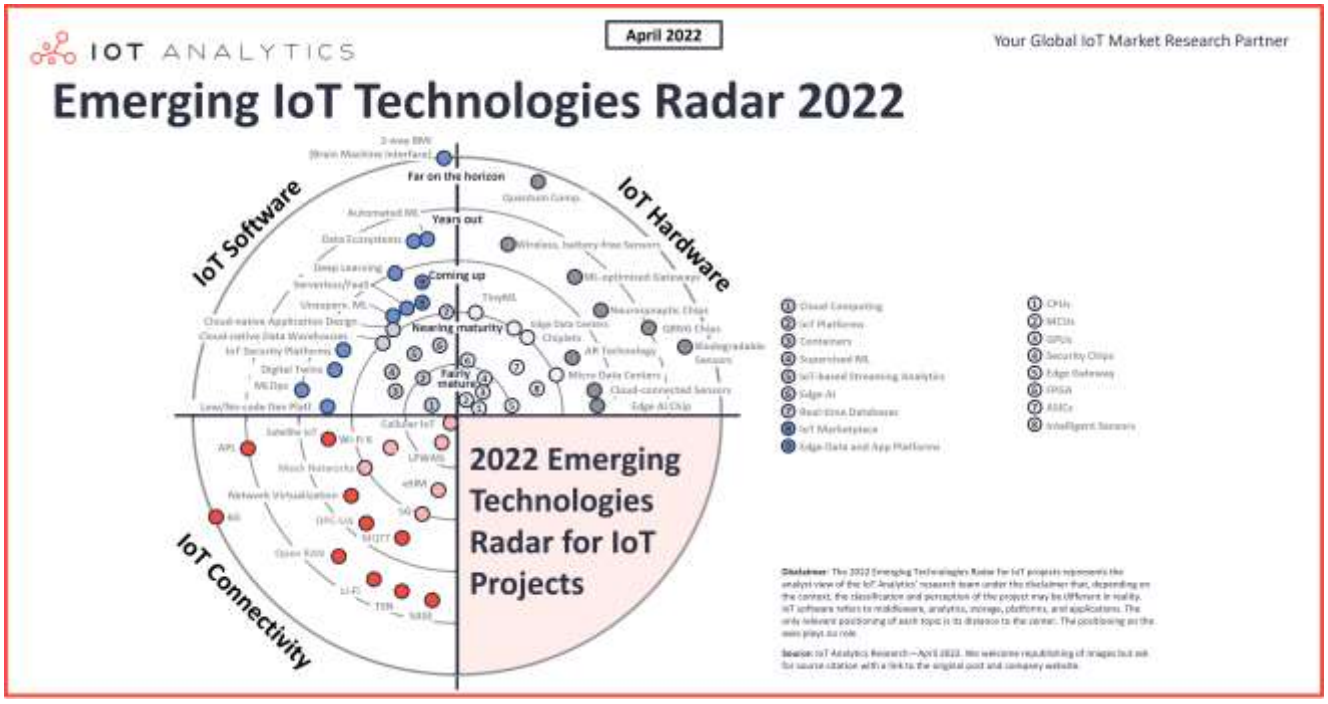
IoT Connectivity. Four IoT technologies are close to maturity: eSIM, mesh networks, 5G, and Wi-Fi 6.

The technologies maturing the fastest

Of the 40 technologies that were highlighted in the 2019 radar, three technologies stand out as the fastest movers that advanced the most in three years: **Wi-Fi 6, GPUs, and intelligent sensors.**

- **Wi-Fi 6**. The deployment of Wi-Fi 6 chipsets at an early stage and the significant specification upgrade from earlier Wi-Fi versions led to a fast adoption by device players, especially in devices such as routers. Thanks to this adoption, Wi-Fi 6 has been extremely quick to move from “coming up” to “fairly mature.” Wi-Fi 6 significantly increases the speed and the network’s capacity to provide optimal throughput to access points. The upgrade from older Wi-Fi versions to Wi-Fi 6 opens the door for new applications, with almost four times higher throughput capacity than Wi-Fi 5. Routers, gateways, and customer-premises equipment (CPEs) were key devices for the quick adoption of Wi-Fi 6 in the last three years.
- **GPUs.** The optimization of GPUs to train AI deep learning models to process multiple computations simultaneously for IoT applications and the adoption of GPUs into data centers due to their parallel processing capabilities have led to faster maturity.
- **Intelligent sensors.** The last three years have seen an upsurge in technology developments around sensors that aim to solve problems related to latency, data throughput, and security for various edge applications. In contrast to older generation sensors, these new sensors are embedded with data processing capabilities that enable data to be processed closer to the sensor and respond to the user interface or actuators. The key applications driving the adoption of intelligent sensors were wearable medical devices, such as blood glucose monitors, and AI-based quality control.

Here is a complete list of all software, hardware, and IoT connectivity technologies (ranked by maturity):



A. IOT SOFTWARE TECHNOLOGIES

Technology	Description	Classification	Adoption Rate

Cloud Computing	Cloud computing is the delivery of different services through the internet. These resources include tools and applications related to data storage, servers, databases, networking, and software.	Mainstream	
IoT Platforms	IoT platforms are software tools for building and managing IoT solutions. They also simplify coding and deploying applications for IoT solutions and enable efficient edge-to-cloud communications.	Fairly mature	
Edge AI/Analytics	Edge AI is a combination of edge computing and AI. AI algorithms are processed locally, either directly on the device or on a server near the device.	Nearing maturity	
Containers	A container is a standard unit of software that packages up code and all its dependencies, so the application runs quickly and reliably from one computing environment to another.	Nearing maturity	
IoT-based Streaming Analytics	Streaming analytics is the processing and analysis of fast-moving live data from various sources, including IoT devices, to raise automated, real-time actions or alerts.	Nearing maturity	
Supervised ML	Supervised ML is a subcategory of ML and AI. It is defined by its use of labeled datasets to train algorithms to classify data or predict outcomes accurately.	Nearing maturity	
Cloud-native Application Design	A cloud-native application is a program designed for a cloud computing architecture. These applications are run and hosted in the cloud.	Nearing Maturity	
Cloud-native Data Warehouses	A cloud-native data warehouse is a database delivered in a public cloud as a managed service that is optimized for analytics, scale, and ease of use.	Nearing Maturity	
Real-time Database	A real-time database is a database system that uses real-time processing to handle workloads whose state is constantly changing.	Nearing Maturity	
Low-code/No-code Development Platforms	A low-code/no-code development platform provides a development environment to create application software through a graphical user interface.	Nearing Maturity	
Unsupervised ML	Unsupervised ML is a type of ML in which the algorithm is not provided with any pre-	Coming up	

	assigned labels or scores for the training data.		
Serverless/FaaS	Function-as-a-Service, or FaaS, is a cloud computing service that allows developers to build, run, and manage application packages as functions without having to maintain their infrastructure.	Coming up	
Deep Learning	Deep learning is part of a broader family of ML methods based on data representations, as opposed to task-specific algorithms.	Coming up	
IoT Marketplaces	An IoT marketplace is a type of application marketplace where customers can go to an online storefront to find, purchase, and manage applications for their IoT devices.	Coming up	
Digital Twins	A digital twin is a digital representation of a physical object, process, or service.	Coming up	
IoT Security Platforms	An IoT security platform includes software security solutions for many layers of the IoT tech stack.	Coming up	
IoT Edge Data & Application Platforms	Edge application platforms enable analytics application management at the edge. Edge data platforms are software tools to manage applications running on multiple edge compute resources.	Coming up	
ML Ops	ML Ops (also called DevOps for ML) is an engineering discipline that aims to combine ML systems development and deployment.	Coming up	
Automated ML	Automated machine learning is the process of automating the tasks of applying machine learning to real-world problems.	Years out	
Data ecosystems	A data ecosystem is the secure connection between different stakeholders of a process (e.g., vendors, suppliers, etc.) that share data in a way that has clearly defined rules for data access and privacy for everyone involved.	Years out	
2-way BMI (Brain Machine Interface)	Bidirectional brain-machine interfaces (BMIs) establish a two-way direct communication link between the brain and the external world	Far on the horizon	**New entry**

B. IOT HARDWARE TECHNOLOGIES

Technology	Description	Classification	Adoption Rate
CPU	CPUs are electronic circuitry that execute instructions that make up a computer program.	Mainstream	
MCU	Microcontrollers are integrated circuits that contain a processor, memory, and other peripherals.	Mainstream	
GPUs	Graphic processing unit	Mainstream	
Security Chips	Security-enhancing, low-powered modules, include various security-sensitive functions	Fairly mature	
Edge Gateways	Physical devices that serve as the connection point between the cloud and controllers, sensors, and intelligent devices.	Fairly mature	
FPGA	Field programmable gate array	Fairly mature	
Intelligent Sensors	Sensors that take some predefined action when they sense the appropriate input.	Nearing maturity	
ASIC	Application-specific integrated circuit	Nearing maturity	
Chiplets	Chiplets are a new design philosophy that allows multiple chips with different process node sizes to be used in a single package or on a single substrate.	Nearing maturity	
TinyML	TinyML is a field of study in ML and embedded systems that explores models you can run on small, low-powered devices, like microcontrollers.	Nearing maturity	
Edge + Micro Data Centers (MDCs)	Edge data centers are located close to the edge of a network (where the network meets the endpoint layer). An MDC is for computer workloads not requiring traditional facilities.	Nearing maturity	
Cloud-connected Sensors	Cloud-connected sensors use physical sensors to accumulate data and transmit them into a cloud computing infrastructure.	Coming up	
AR Technology	AR technology is a technology that combines virtual information with the real world.	Coming up	

Edge AI Chip	Edge AI chipsets refer to computational chipsets focusing on AI workloads that are typically deployed in edge environments.	Coming up	
Neurosynaptic Chips	Brain-inspired computer chip, in which transistors simulate neurons and synapses.	Years out	
QRNG Chips	QRNG refers to quantum driven secure chip design which can be integrated into current silicon design and manufacturing processes.	Years out	
Wireless, Battery-free Sensors	Sensors that can generate the energy that they need to function by themselves, i.e., they do not need to be powered by an external source.	Years out	
ML-optimized Gateways	Controllers that are optimized for ML algorithms.	Years out	
Quantum Computing	Computation using quantum-mechanical phenomena, for example superposition entanglement.	Far on the horizon	
Biodegradable Sensors	Biodegradable sensors are designed and developed to detect various body signals, which can help track post-treatment prognosis.	Far on the Horizon	New entry

C. IOT CONNECTIVITY TECHNOLOGIES

Technology	Description	Classification	Adoption Rate
Cellular IoT (2G/3G/4G)	Provides connectivity to IoT applications via traditional cellular networks	Mainstream	
LPWAN	Low-power, wide-area connectivity for IoT applications (e.g., Sigfox, LoRa, NB-IoT, and LTE-M)	Mainstream	
eSIM	A SIM-card embedded into mobile devices enables remote SIM provisioning, which allows storing multiple operator profiles simultaneously and switching between them remotely.	Nearing maturity	
Mesh Networks	A mesh network is a group of devices that act as a single Wi-Fi network, so there are multiple sources of Wi-Fi around your house instead of just a single router.	Nearing maturity	

5G	The fifth generation of cellular networks, commercially launched in 2019	Nearing maturity	
Wi-Fi 6	The newest version of the Wi-Fi protocol, also known as IEE 802.11ax	Nearing maturity	
Network Virtualization	Abstracts network elements and resources into a logical virtual network that runs independently on top of a physical network	Coming up	
MQTT	MQTT is a lightweight, publish-subscribe network protocol that transports messages between devices.	Coming up	
OPC Unified Architecture (UA)	OPC UA is a machine-to-machine communication protocol for industrial automation from the OPC Foundation.	Coming up	
Satellite IoT	Provides connectivity to IoT applications via satellite networks	Coming up	
TSN	Time-Sensitive Networking is a set of standards defined by the IEEE for the time-sensitive transmission of data over deterministic Ethernet networks.	Years out	
Li-Fi	Wireless communication technology that uses light to transmit data	Years out	
Open RAN	Open RAN (Open Radio Access Networks or O-RAN) is the disaggregation of RAN functionalities through network virtualization and software-defined network technologies.	Years out	
Advanced Physical Layer (APL)	Developing industrial Ethernet standard that seeks to leverage the work of the IEEE 802.3cg (10BASE-T1L) task force to achieve a single twisted-pair industrial Ethernet standard for hazardous areas	Years out	
Secure Access Service Edge (SASE)	SASE is a new security model specifically to address the security challenges of the new reality organizations are facing.	Years out	
6G	The sixth generation of cellular networks	Far on the horizon	

 **= Very fast movers**

 **= Fast movers**

 **= Slow movers**

WHAT THE RADAR DOES AND DOES NOT MEASURE

Technology maturity. The radar shows a subjective measure of maturity as put together by the analyst team at IoT Analytics. The maturity scores are developed based on expert interviews, vendor briefings, secondary research, and conference attendances. The radar targets IoT practitioners that deploy IoT.

The IoT. IoT Analytics defines the IoT as a network of internet-enabled physical objects. Objects that become internet-enabled (IoT devices) typically interact via embedded systems, some form of network communications, and a combination of edge and cloud computing. The data from IoT-connected devices is often (but not exclusively) used to create novel end-user applications. Connected personal computers, tablets, and smartphones are not considered IoT, although these may be part of the solution setup. Devices connected via simple connectivity methods, such as RFID or QR codes, are not considered IoT devices.

Relevance of individual technologies. Not every technology is relevant for a given IoT context. Some technologies may only be used in specific IoT settings (e.g., low-power WAN [LPWAN] for remote, low-power applications), while others are used in settings where IoT only plays a minor role (e.g., cloud computing, which is also used in many non-IoT scenarios). IoT Analytics is aware that many other technologies exist that could be highlighted on such a radar.

MORE INFORMATION AND FURTHER READING
www.iot-analytics.com/research-blog

FOR FURTHER INQUIRIES
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