THE RISE OF INTELLIGENT EDGE COMPUTING

How Edge Technologies & Applications

are Transforming Industries

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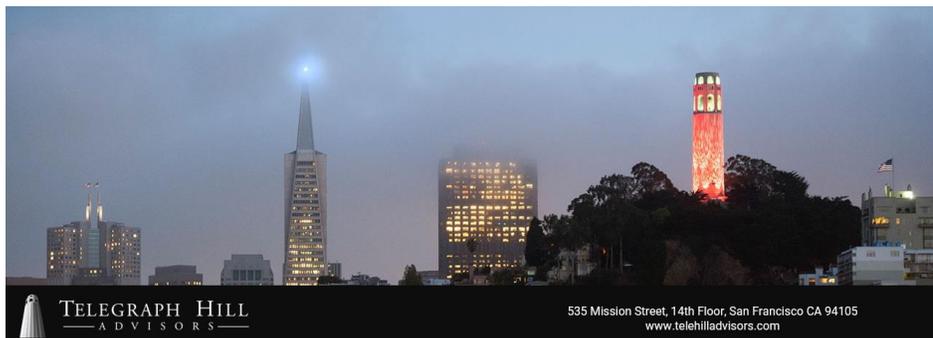
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Executive Summary

The arrival of the commercial Internet in the 1990s has transformed how individuals and enterprises access information and data. The smartphone era then made the mobile Internet possible. In the early 2000s, we saw the rise of cloud computing, which allowed enterprises and individuals to use information technology resources using a utility model, similar to how they consume electricity and water. All these innovations were primarily to connect people and businesses to each other.

In the mid-2000s, we saw another series of innovations which promises to change the Internet-computing paradigm. This is the phenomena of the Internet of Things (IoT), which describes the network of physical objects ("Things") that become intelligent by using sensors, software, IP addresses and communications for exchanging data with other devices and systems over the Internet. These "Things" could range from simple thermostats, industrial robots, connected cars, drones, smart buildings and smart cities.

One common feature in many of these "Things" is that they generate lots of data. And this data needs to be processed close to the edge of where the "Things" reside in order to be useful and have economic value. It soon became clear that the centralized cloud computing model was inadequate for the task and a computing model closer to "Things" was needed. This is the genesis of "edge computing".

In this report we examine the various drivers of edge computing in more detail and the limitations of cloud computing at the edge and for IoT. We note that the "edge" is the interface where physical "Things" meet the digital domain. But, due to the plethora of "edges", this will require many interfaces, and with each industry vertical having unique requirements, there will be the need for many specialized edge solutions.

We investigate many of the technologies that go into making edge computing viable, including 5G, mobile edge computing, artificial intelligence, and tiny ML.

The unique characteristics of digital workloads at the edge require new software development and data processing architectures. We outline some of the developments here, including edge-native and real-time date flow analysis techniques.

The Metaverse has been described as the next evolution of the Internet. We examine how edge computing can help unlock the potential of the Metaverse by providing a distributed edge computing architecture that can support low latency and high bandwidth experiences.

We then look at several industries that are using edge computing to digitally transform themselves. These range from smart cities, industrial IoT, supply chains, smart agriculture and connected cars.

We go on to examine the M&A activity in the space over the past few years. Finally, we identify and profile interesting startups who have developed innovative solutions for edge computing, many of whom are likely to become viable M&A targets.

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Amar Senan has nearly 30 years of experience on Wall Street and Silicon Valley, and a successful track record of working closely with CEOs and boards of companies in sectors such as Cybersecurity, Cloud computing, Edge computing, IoT, Software, Communications, Energy and Managed services.

He has advised startup companies from their Series A to exit stages, as well as private and public companies on IPOs, equity and debt financings, and on their M&A strategies.

Amar also has operating experience at executive level in corporate development, marketing and finance at public and venture-funded Silicon Valley companies.

Amar began his career as a software engineer with Ericsson before moving to business planning at Australian Airlines. He subsequently worked at several investment banks including Prudential Volpe, Saints Capital, Woodside and IOI Capital & Markets.

He has engineering degrees: BEng (Electrical) and MEng (Systems) from RMIT, Australia; a BSc (Economics) from the University of London, England; and an MBA from the University of Glasgow, Scotland.

Jeff Saunders advises early-stage promising technology companies on strategic partnerships, go-to-market and M&A. Jeff has over 30 years of experience in operational roles within technology, including as a Sales and Business Development leader in AI, Machine Learning, Autonomy, Mobile, IoT, AR/VR, Hyperscale, Cloud, SaaS, Media Creation and Distribution, Enterprise Hardware and Software, and Data Center Solutions.

Jeff was previously Vice President of Revenue for Pilot AI Labs, an edge-based AI Software company. Prior to Pilot AI, he was the Vice President of Business Development and Strategic Relationships for MediaTek. Before joining Media Tek, Jeff headed the Strategic Alliances and Business Development team for the mobile ecosystem at NVIDIA.

He has held sales and sales management positions with RealNetworks and Silicon Graphics and has led sales and business development efforts for Cloud Computing, Oil & Gas, HPC, and the Media & Entertainment markets.

Jeff earned his BS in Aerospace Engineering from the University of Southern California where he was also an NCAA All-American Swimmer.

Introduction

Cloud Computing

To understand edge computing, it is helpful to revisit its now well-understood predecessor, cloud computing. Cloud computing is the delivery of all types of computing services including servers, storage, databases, networking, analytics and artificial intelligence over the Internet.

Rather than owning their IT infrastructure or data centers, enterprises can rent access to computing services from a wide range of cloud service providers. In addition to this pay-what-you-use model, other benefits include high availability and reliability with negligible downtime, scalability in processing power, and capital reduction from not having to pay upfront for software licenses and servers.

Figure 1a: Types of Cloud Computing
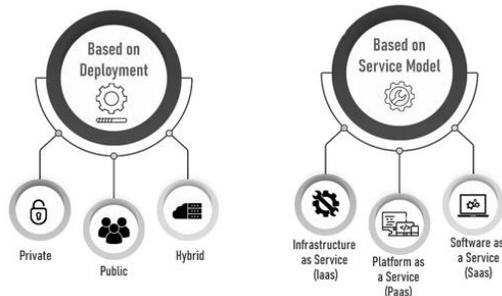
Figure 1b: Worldwide Market Share (Q3:2022)

Source: AWS
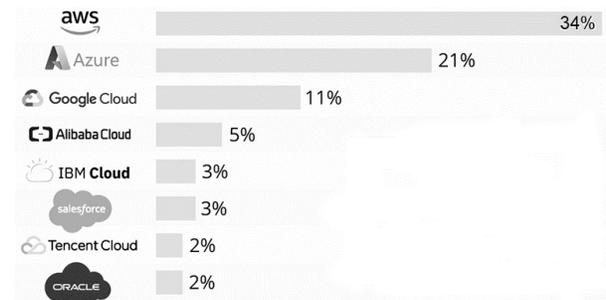
Source: Synergy

The market for cloud computing is dominated by Amazon (AWS), Microsoft (Azure), and Google (Cloud), followed by other suppliers such as IBM, Oracle, Salesforce, SAP and VMWare. According to Synergy Research the cloud service revenues for the 12 months ended September 2022 came in at around $217 billion.

In the coming years, most forecasters project that the market for cloud computing will keep growing as enterprises continue to shift their workloads from on premise to the cloud. Currently, the most popular workloads across public, private and hybrid clouds are databases, analytics and web/content hosting.

...

The Internet of Things

But there is another workload that is emerging where cloud computing may not be the ideal solution – i.e. the rise of what has been labelled as the Internet of Things (IoT). (IoT is a broad concept and sometime referred to as smart edge devices, connected machines or intelligent endpoints.)

A jet engine could be a "Thing", as could the airplane it powers. Oil refineries, connected cars, robots, smart cities, drones and wind turbines are all examples of "Things".

In general, "Things" are physical objects (or systems of objects) that feature sophisticated sensors, generate huge amounts of data, and have network interfaces that permit two-way communications. Some examples in figure 2.

Figure 2: Data generated by various Internet of Things

Internet of Things (IoT)	Data Generated
Offshore oil rig	1 – 2 Terabytes daily
Oil refinery	1,000 Gigabytes daily
Smart factory	5 Petabytes of data per week
Wind turbine	200 Gigabytes of data per day
Gas turbine	26 Gigabytes of data per day
Smart building	50 Gigabytes of data per day
Autonomous vehicles	4,000 Gigabytes of data per day

Source: Estimates by Cisco, Ford, IBM, Intel, Siemens et.al.

There clearly will not be a shortage of raw data. But to be useful, this data needs to be shipped back to cloud computing centers for storage and enhanced analysis. The insights developed then must be retransmitted to intelligent things for prescriptive or preventative actions.

The Need for Edge Computing

However, there are several problems with the "send back to the central cloud for processing" scenario, and they center mainly around bandwidth/network capacity and network latency (see figure 3). There are also issues around storage and the cost of handling the massive amounts of data that needs to be stored.

Figure 3: Sending Data back-and-forth to the Cloud is Costly & Inefficient
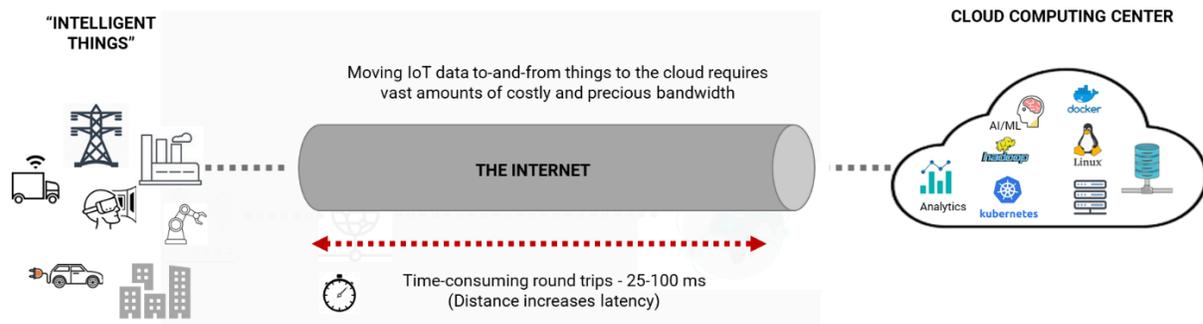
Network Capacity and Bandwidth

The reality is that there is insufficient network capacity to transport the zettabytes of raw data generated by intelligent things. And given that the rate of data generation is growing much faster than the planned increase in network capacity, there will always be bottlenecks.

In addition, data transmission costs typically rise with data volume and distance travelled. Network bandwidth can be costly and scarce, especially in remote locations, where things such as offshore oil fields, alternative energy farms and mines are typically located.

Network Latency

A typical offshore oil platform generates between 1 and 2 terabytes of data each day. Much of this data is time-sensitive, pertaining to platform production and safety. Using a satellite connection, it would take 12 days to move one day's worth of oil platform data to a central cloud. (Source: Cisco.)

For "Things" like autonomous vehicles much of the insights on road conditions, driving patterns and other vehicles need to be provided real-time. Using this information, coupled with on-board computing, vehicles need to make split second decisions on the safety of drivers and pedestrians. Relying on slow cloud computing resources will be perilous to vehicle occupants, pedestrians and property.

Storage, Security and Compliance

Given the latency issues described above, much of the insights garnered from the data may be non-actionable by the time they are sent back to the "Things."   The cloud-model may thus, become an expensive "black hole" for IoT data.

There is also the question of how to efficiently store the volumes of raw IoT data. Simply moving raw data to the cloud requires copious amount of compute resources and is wasteful and storing them locally in unprocessed forms can also be inefficient.

Having millions of intelligent "Things", all capable of sending raw data to the cloud, can also have cyber security implications. As edge devices and "Things" leverage IP addresses and the Internet, they become vulnerable to cyber threats and disruptions. The sheer number of new edge devices means that the cyberattack surface that needs to be defended grows daily.

We will address these issues in a separate investment banking report, *"The Internet of Insecure Things – Poised to Unleash Cybersecurity Pandemics."*

The Edge Computing Model

For all the reasons enumerated, it is not practical or economical to move much of the data generated to a central cloud for analysis. Since we cannot readily move the data to the central cloud, we must move the processing closer towards the "Things", the source of the data. We must filter the data at the Edge for anomalies and only forward a smaller, more relevant subset.

Figure 4: Moving Compute to the Edge and closer to "Things" & Data

"Move compute to the Edge close to the data"
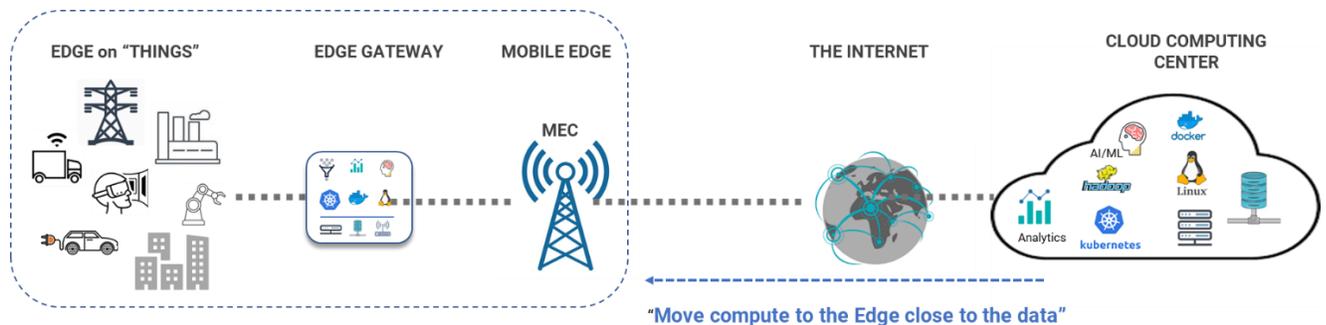
In some respects, this shift to localized processing parallels what we have witnessed in traditional computing, which began with mainframes offering centralized processing to remote users. Later, powerful personal computers allowed the processing to move back closer to the user.

The emergence of cloud computing ("cloud mainframes") and its economic benefits moved the processing back to a centralized model. Recently, the sheer number of IoT endpoints and Things (in billions) plus the volumes of data generated (in zettabytes) is starting a trend towards moving processing back to a localized setting, next to smart cities, industrial plants, robots and even sensors.

Where lies the Edge?

Edge computing is a broad term and the precise definition and where the "edge" lies is open to much debate. This is not unlike prior discussions around IoT or cloud computing, as these concepts meant different things to different people. The edge can mean different things depending on the use case.

Gartner defines the Edge as "the physical location where things and people connect with the networked digital world." ABI Research says that "it's everything not in the cloud." Cisco says that the "edge is anywhere that data is processed before it crosses the wide area network (WAN)."

One broad classification is that offered by McKinsey & Co (see figure 5). They predict that edge computing provides flexibility for organizations to achieve greater data sovereignty, improved security, and better latency, while unlocking a variety of use cases that rely on real-time data processing.

Figure 5: The Edge – Better data latency and data autonomy

	Edge networks closer to the user				
	Device edge	**Remote edge**	**Branch edge**	**Enterprise edge**	**Telecom/MEC edge**
Compute location	Smartphone Camera Wearable tech	Connected vehicle Resource extraction site Remote filming locations	Branch Retail outlets Restaurants	Factories Hospitals Airports	Network aggregation points Network access points
Use cases	Remote patient monitoring Real-time fleet tracking Worker safety monitoring	Remote asset management Remote content rendering	Building energy management Real-time personal promotions Immersive-content experiences	Smart construction and manufacturing Passenger analytics at airports Proactive equipment maintenance	Smart city infrastructure Air quality monitoring Media/content delivery

Source: McKinsey & Co.

The Edge Computing Stack

The "Edge" is the interface where physical "Things" meet the digital domain. A framework is shown in figure 6.

Due to the plethora of "Edges", there will be a need for many interfaces. And with each industry vertical having unique requirements, there will be the need for many specialized edge solutions.

Figure 6: The Edge/Cloud Computing Framework
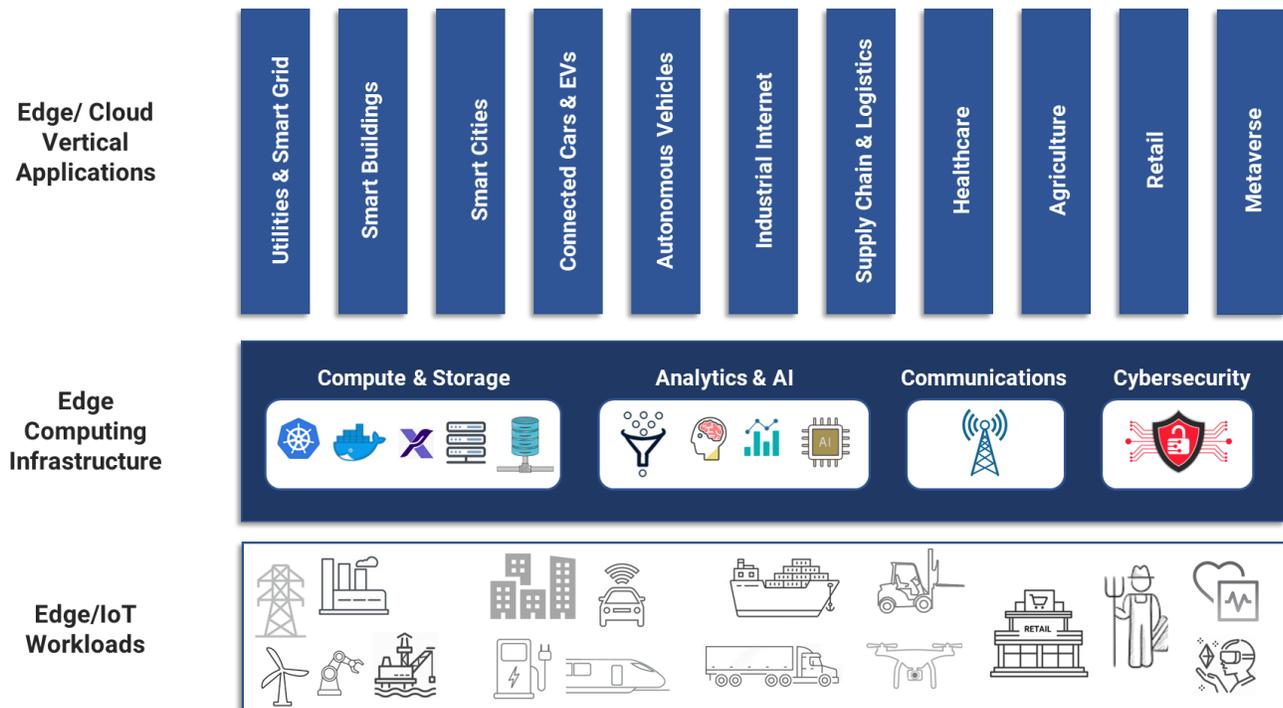
Source: THA

The senior investment bankers at Telegraph Hill Advisors (THA) have advised many innovative private and public companies in the edge/cloud framework on their mergers & acquisition strategies, capital raising needs and other financial advisory needs.

The Edge is Complicated

The "Edge" cannot do everything on its own. Many edge devices are constrained by small form factors, limited CPU power, limited memory and small electrical supplies. So, edge computing will have to leverage cloud resources as required and actively manage resources over WANs.

Most edge devices that exist today are built around embedded software designed to operate in their own confined environments. A new architecture that can utilize both edge and cloud computing resources must be developed. This edge-native software, while flexible and powerful, is much more complicated to develop than traditional embedded software.

A promising approach is the OpenStack Foundation's StarlingX, a software stack providing critical infrastructure and management services for edge-cloud deployments. It is designed for latency-sensitive and demanding applications in industrial automation, hospitals, transportation, MEC, smart cities and autonomous vehicles with V2X.

Figure 7: StarlingX – Distributed Edge Cloud Native Platform Use Cases
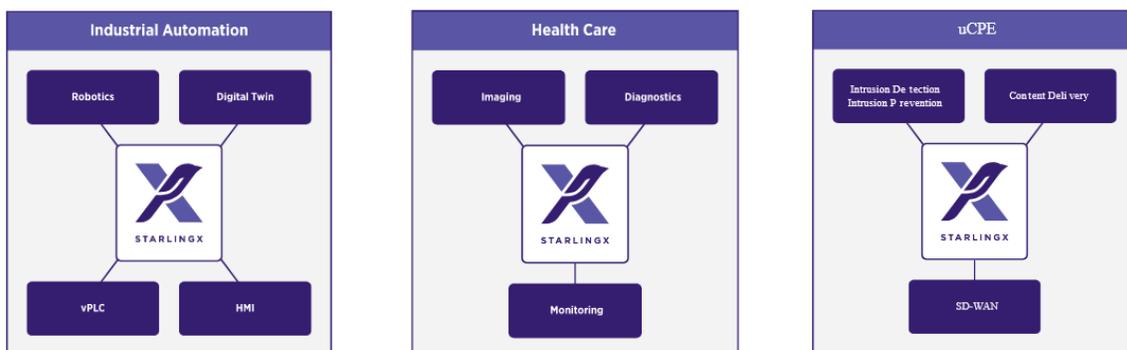
Source: OpenStack Foundation

Edge Computing - Market Size Estimates

There are almost as many different forecasts for the economic impact of Edge computing as there are forecasters. This is understandable given the immaturity of the space and the wide range of industries and economic sectors that could be impacted. We list some of them here.

- By 2023, more than half of new enterprise IT infrastructure will be at the edge, according to IDC.

- By 2025, Gartner predicts that more than 50% of enterprise-managed data will be created and processed outside a traditional data center or cloud.

- The Global Edge Computing Market is valued at $7.1 Billion in 2021 and is projected to reach a value of $49.6 Billion by 2028 at a CAGR of 38.2% over the forecast period 2022-2028. (Source: Vantage Market Research)

- Worldwide spending on edge computing is expected to be $176 billion in 2022, an increase of 14.8% over 2021. Enterprise and service provider spending on hardware, software, and services for edge solutions is forecast to sustain this pace of growth through 2025 when spending will reach nearly $274 billion. (Source: IDC)

- The global edge computing market size was valued at $40 billion in 2021 and is expected to hit around $117 billion by 2030, expanding growth at a CAGR of 13%. (Source: Precedence Research.)

- The Edge AI software market is projected to grow from $0.8 billion in 2022 to $3.1 billion by 2027, at a CAGR of 29%. The drivers are the enablement of edge devices to provide insights and predictive analysis in real time for localized decision making. Use cases include smart metering, predictive maintenance, video surveillance, smart cities and autonomous driving. (Source: Markets and Markets)

Enabling Technologies & Applications
Mobile Edge Computing (MEC)

"MEC is the culmination of the trend where everything moves to the cloud, and then the cloud in turn moves closer back to everything." Amit Barekett, CEO, Perimeter 81, a cloud and network security startup.

The original MEC, when introduced in 2009, referred to the concept of Mobile Edge Computing. But since it left out several other types of access points, the European Telecommunications Standards Institute (ETSI) changed the term in 2017 to "multi-edge" to reflect that the edge is not solely based on mobile networks, but also includes WiFi and fixed access technologies.

Through MEC, service providers can offer cloud computing capabilities and an IT service environment at the edge of the network. The MEC network architecture brings real-time, high-bandwidth, low-latency access to radio networks making it useful for Edge/IoT applications that rely on high performance and smart utilization of network resources.

Figure 8: MEC and Public 5G Networks – Bringing the Cloud to "Things"
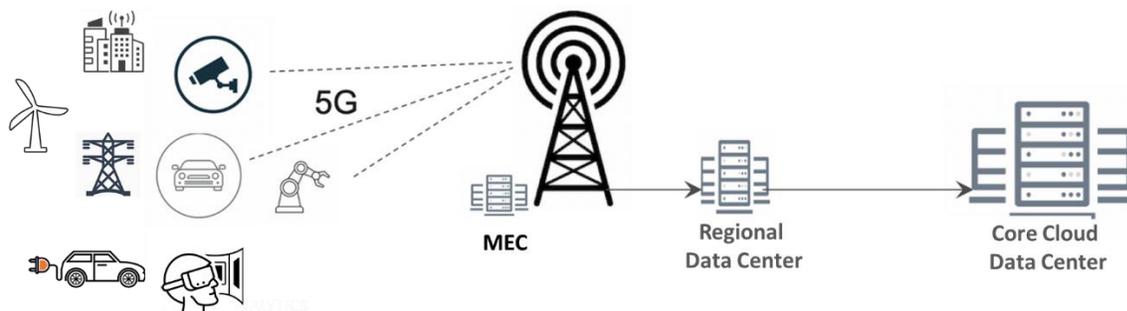
Source: Nutanix (Adapted)

MEC is made possible by the arrival of 5G, the fifth generation of mobile networks that promises to usher in new applications for consumers, enterprises and society – ranging from self-driving cars, telemedicine, connected factories, machine-to-machine (M2M), vehicle-to-everything (V2X), smart utilities and smart cities.

5G addresses many of the limitations of current 4G technologies by lowering network latency, providing throughputs of up to 20 Gbps peak data rates and 100+ Mbps average data rates.

There are also moves by some industries to build their own private 5G networks, which are non-public networks that use licensed, unlicensed or shared spectrum. Another alternative is a private 5G network as a service such as Amazon's AWS Private 5G with all the required hardware and software provided by AWS.

Figure 9: Private 5G Network Adoption Outlook

Vertical	Expected Adoption	Expected Predominant Cloud Model	Use Cases
Manufacturing	High	On premises	Real-time automation/process automation, monitoring, AGVs, industrial controls, smart factory, digital twin
Government and public sector	High	Hybrid	Video apps, monitoring, site automation, LMR modernization (e.g., public safety)
Mining	High	On premises	Remote monitoring, digitize operations, data curation and management, AGVs, automated extraction, digital twin
Energy (oil and gas, etc.)	Moderate	On premises	Remote monitoring, digitize operations, data curation and management, AGVs, automated extraction, digital twin
Utilities	Moderate	On premises	Substation digitalization, sensor connectivity, monitoring, predictive maintenance, IoT
Healthcare	Moderate	Hybrid	Video, hazard sensing monitoring/tracking, embedded intelligence
Transportation	Moderate	Hybrid	Monitoring and tracking, hazard sensing, surveillance
Education	Moderate	Hybrid	R&D and innovation lab enablement, data privacy, campus connectivity, network standardization across campus footprints
Retail	Moderate	Mostly public cloud	Video apps, tracking and monitoring, POS devices, smart signage
Others	Low	Mostly public cloud	Enterprise communications, multicloud apps, collaboration

Source: IDC

Although the rollout of 5G technology is still progressing, the wireless industry is already working on its successor: 6G.

6G could enable more powerful real-time artificial intelligence and machine learning solutions, as well as ushering in applications in the Metaverse that use holographic technologies.

Figure 10: Comparison of 5G and 6G Networks

Technology	5G	6G
Applications	Enhanced Mobile Broadband Communications (eMBB), Ultrareliable Low Latency Communications (URLLC), Massive Machine Type Communications (mMTC)	Holographic-Type Communication (HTC), Tactile Internet, Intelligent Transport and Logistics, Intelligent and automated machines, Virtual Reality (VR), Augmented Reality (AR), Extended reality (XR)
Peak data rate	10 Gbps	1 Tbps
Frequency	3–300 GHz	1000 GHz
Latency	10 ms	<1 ms
Mobility support	Up to 500 km/h	Up to 1000 km/h
Spectral efficiency	30 bps/Hz	100 bps/Hz
Reliability	99.9999%	99.99999%

Source: Electronics (ML in 5G/6G Networks)

The MetaVerse

"As the digital and physical worlds come together, we are creating an entirely new platform layer, which is the Metaverse. The Metaverse enables us to embed computing into the real world and to embed the real world into computing, …. every business will be collaborative, powered by data and AI and will bridge the digital and physical worlds." Satya Nadella, CEO, Microsoft.

The Metaverse is what many prognosticators believe could be the next evolution of the Internet and digital platforms. There is considerable hype and confusion around the Metaverse, but figure 11 is one attempt at explaining the concept.

Figure 11: The Metaverse: Convergence of Real and Virtual Worlds
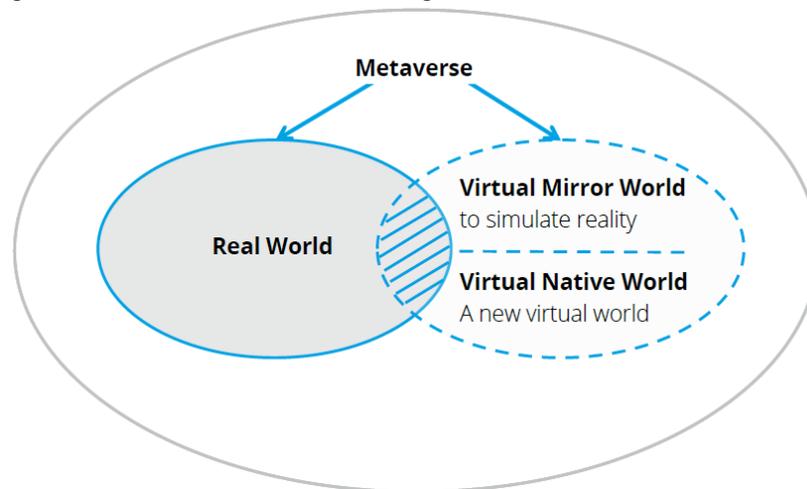
Source: Deloitte

A ***Virtual Mirror World*** could simulate many aspects of the real world ranging from buildings, industrial equipment, factory processes to down to personal and business identity. The virtual mirror world has a corresponding element in the real world. In some ways the *virtual mirror world* is similar to the ***digital twin*** concept which was developed for industrial settings.

The ***Virtual Native World*** is a more imaginative rendition of the Metaverse. People could use their creativity to create environments, objects and virtual people – all of which only exist in the virtual world, with no real-world counterparts. Some of the innovation here has come from the field of gaming and from platforms such as Second Life, Roblox and Fortnite.

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The MetaVerse – Enabling Technologies

Metaverse platforms are made possible by technologies, including 3D rendering, extended reality (XR), powerful CPUs, storage, AI and ML. Metaverse applications also rely on high-speed communications networks as they require a great deal of data to be exchanged at high bandwidth and low latency.

For the Metaverse to truly scale and operate without interruption, many of the technologies listed above must be brought closer to end users via Edge computing architectures such as Mobile Edge Computing (MEC). Using MEC, vital Metaverse functions such as compute, AI, storage and analytics can then be moved closer to the Metaverse participant rather than in a cloud data center.

The Industrial MetaVerse

Digital twins have become a useful component in many manufacturing and industrial settings by using real-time input from IoT sensors, cameras and processes for training, testing, monitoring and maintenance. The industrial Metaverse goes further than digital twins by combining them with augmented (AR), virtual (VR) and mixed reality (MR) tools to allow humans to immerse themselves into the operation of industrial infrastructure and factory processes.

Workers equipped with AR headsets can use holograms as a guide when operating machinery on factory floors. Metaverse applications could also enable remote engineers to collaborate remotely with factory workers even if they are located elsewhere.

MetaVerse Market Size

In October 2021, the MetaVerse received considerable attention once Facebook (now rebranded as Meta Platforms Inc.) announced plans to invest around $10 billion in the concept. Other companies, such as Apple, Nvidia, Qualcomm and Google have also announced their own plans. Outside the technology world, companies in banking, entertainment, gaming, fashion, healthcare, industrial and sports have also started investigating applications for their corners of the Metaverse.

Many market researchers are forecasting that the market for Metaverse related products and services to exceed $1 - $2 trillion by 2030. One of the most bullish of these forecasts is that by McKinsey & Co, which estimates that the Metaverse has the potential to grow to $4 - $5 trillion in value by 2030. Figure 12 shows their assessment of the Metaverse potential impact by 2030.

Figure 12: Metaverse Impact Potential by 2030

Relative 2030 use case potential   Low Med High

Consumer use cases

Virtual assets	Education
Gaming	Health and fitness
VR/AR hardware	Ads
E-commerce	Digital media
Live entertainment	

Enterprise use cases

Banking	Local government
Construction	Telecommunications
Discrete manufacturing	Transportation
Education	Utilities
Central government	Wholesale
Healthcare provider	Media
Resource industries	Consumer services
Professional services	Process manufacturing
Retail	Insurance
Investment	

Source: McKinsey & Co

Artificial Intelligence at the Edge

Artificial intelligence (AI) is the science of simulating human intelligence processes by computer systems through sets of rules called algorithms. AI systems operate by training huge datasets, then analyzing the data for correlations and patterns, and using these patterns to make predictions. (Machine learning (ML) is a subset of AI, but the terms are often used interchangeably.)

Cloud AI

Modern AI algorithms are based on complex mathematical models and require high levels of storage and compute to train models and then develop inferences from the data. These operations are also extremely energy intensive and consume large amounts of electricity. Fortunately, compute, storage and electrical power are readily available at the central cloud data centers where much of the data used to reside. There has also been a steady stream of innovation in at the cloud, especially in the area of new processing chips to run state-of-the-art AI systems.

While cloud AI systems continue to improve, we are witnessing a rise in enormous amounts of data at the edge from IoT and similar devices. For all the reasons outlined earlier (bandwidth, latency, costs), there is a pressing need for cloud-independent AI systems at the Edge that can be used to develop inferences, often in real-time. Furthermore, the edge does not have the compute, storage or electrical power needed to run powerful cloud-AI. Consequently, a new landscape has emerged for AI computing that extends well beyond the cloud (see figure 13).

Figure 13: AI Computing occurs at different physical locations
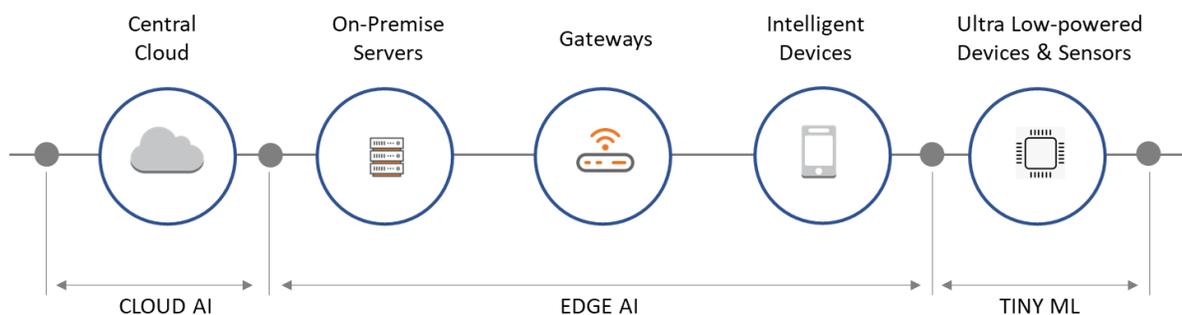
Source: ABI Research (Adapted)

Edge AI

The growth in Edge-AI computing is coming from the proliferation of sensors and data collection deep at the edge of the network. From simple sensors for motion and thermal detection to in-camera detection and classification of video for retail, security warehouses, manufacturing, plant safety, and other uses. All the way to internal and external detection and analysis and audio communication for all kinds of autonomous systems for driver safety, security, traffic communications, monitoring, and even weather and road conditions down to the square meter.

AI computing at the Edge is in a constant state of flux as well as maturing at the same time. Computing at the edge was initially the domain of small server nodes at the edge of a network. Today, the edge goes all the way to discreet sensors with minimal power and intermittent connectivity.

The market for Edge AI computing is growing from the processor definition as well. CPUs, GPUs, XPUs, FPGAs as well as single-purpose AI-NN processors are proliferating to solve the various problems with AI computing at the edge. Some of the single-purpose processors are dedicated to only NLP-type workloads, others to CV-only workloads making the market both wider and more specialized.

Large Language Models (LLM) and Deep Learning Reinforcement Models (DLRM) are still the domain of the data center. This also opens the market to many smaller AI chip companies providing either specific AI silicon or AI-specific silicon design to be implemented within another SoC. Technologies on the horizon include sparsification, in-memory computing, photonics, neuromorphic computing and Quantum AI.

Today most of the AI compute workloads at the edge are AI Inferencing. Most of the training for the models is done in the data center. Additionally, Edge-AI workloads are primarily computer vision (CV) and language models (NLP/NLU).

Although, with the new generation of AI-specific co-processors tied to general-purpose CPUs, there is some training (i.e. learning) happening at or near the edge. The learning capabilities of Edge

devices is projected to continue to grow as reinforcement, transfer and federated learning become the norm in Edge AI devices.

Tiny ML

Machine learning (ML) is a subset of AI that uses algorithms to automatically learn insights and recognize patterns from data, and then applying that learning to make better decisions. But ML systems require considerable compute horsepower and lots of memory to run. While such resources are readily available at the central cloud/data center, implementing cloud-ready ML systems on resource constrained edge devices is highly challenging.

ML systems are also complex to develop even at the cloud level. For training and for inference, they require large datasets and high levels of computational resources, all developed under the direction of skilled AI practitioners. But techniques and algorithms that work for cloud ML systems cannot be readily replicated at the resource constrained edge.

One attempt at solving this problem is the TinyML project. TinyML is a developing field in machine learning that focuses on the development of ML models that can work on low-power microcontroller (MCU) embedded devices.

Figure 14: Tiny Machine Learning
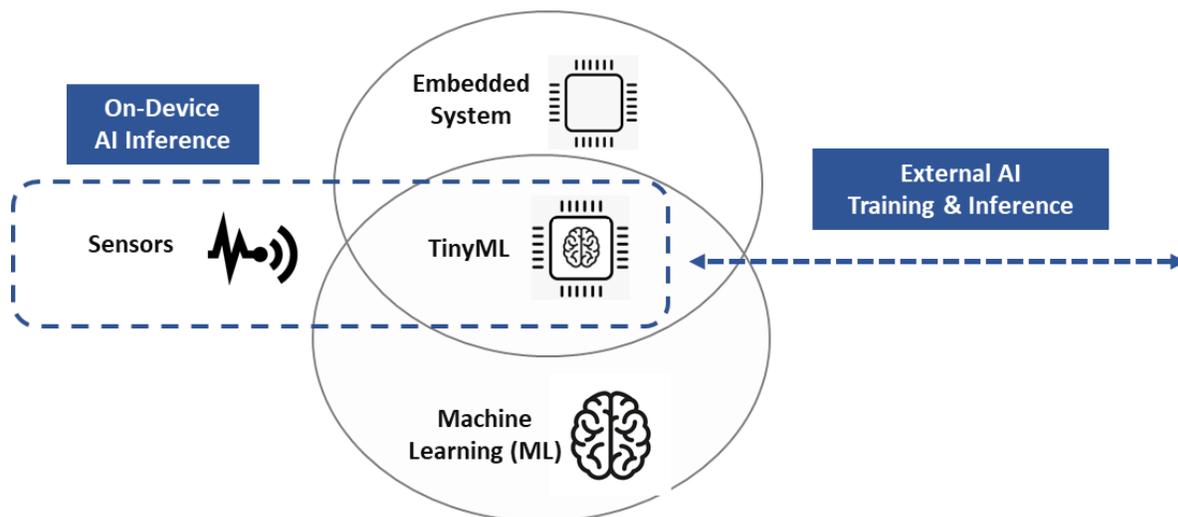
These embedded devices typically just collect data from sensors and transmit the data to other devices for storage and processing. The microprocessors on these devices are underutilized as they usually process simple tasks. The goal of the TinyML project is to develop efficient ML inference algorithms that require fewer resources and can operate on underutilized embedded MCUs.

"...the pervasiveness of ultra-low power embedded devices, coupled with the introduction of embedded machine learning frameworks like TensorFlow Lite for Microcontrollers will enable the mass proliferation of AI powered IoT devices."

— Vijay Reddi, Associate Professor at Harvard University

The growth of TinyML is directly tied to the growth in IoT devices. ABI Research forecasts that the number of worldwide IoT devices will grow from 6.6 billion in 2020 to more than 23 billion by 2026, with each new device representing an opportunity for Edge AI/ML. The firm goes on to forecast that the TinyML market will grow from 15.2 million shipments in 2020 to 2.5 billion in 2030.

Figure 15: Potential use cases for TinyML on low-cost, long-battery life embedded devices

Category	Use Cases
Industrial and Manufacturing	Intelligent sensors to track equipment failure and for preventative maintenance
Agriculture	Real-time data by monitoring livestock, crops and irrigation systems
Healthcare	ML-based wearables can be used for diagnostic and patient management
Smart cities	Ubiquitous sensors for real-time traffic monitoring, parking and street lighting
Smart buildings	Real-time monitoring of lighting, HVAC, security applications
Utilities	Widely deployed sensors to track smart grids and renewables in real-time
Retail	Real-time monitoring of inventory of store shelves

Data Platforms and Edge Computing

Worldwide data is growing rapidly. Data generated by machines and the Metaverse is growing even faster than that generated by humans from social media and web data sources. Machines also create Edge/IoT data at a much faster velocity compared to human-generated social and web data.

IDC forecasts that by 2025, the global data universe will grow to 163 zettabytes, which is ten times the 16.1 zettabytes of data generated in 2016. By 2025, more than a quarter of the data created (or 40 zettabytes) will be real-time in nature. Of the 40 zettabytes, real-time Edge data will make up more than 95% or 38.7 zettabytes.

Useful Edge/IoT implementations require architectures that can analyze real-time streaming data as well as the ability to leverage insights from historical data. The data is then used for a variety of descriptive, diagnostic, predictive and prescriptive analytics with the goal of providing information for greater economic benefit through improved decisions and actions.

Figure 16: Types of Edge/IoT Analytics

Source: Honeywell

Data Flow Architecture

The analysis of data from "Things" to achieve business objectives is central to the idea of IoT and key to many of the digital transformation projects being undertaken. The raw data is analyzed using a variety of business intelligence systems and the insights are then returned to control the performance and operations of the "Things". A conceptual flow diagram is shown in Figure 17.

The architecture consists of several modules designed to ingest, filter, store and analyze the data. Newer techniques such as artificial intelligence and machine learning that can handle huge volumes of data play an important role, as well as inputs from traditional enterprise planning systems.

Earlier in this report, we explored the shortcomings of the traditional data processing model of moving everything to central cloud data centers, and the benefits of deploying Edge computing solutions. The challenge for data architects is to determine where each of the modules shown in figure 17 should reside – on the device, at the Edge or the central-cloud or some hybrid of the three.

Figure 17: Edge Data Flow Architecture
Huge volumes of data will need to be stored, analyzed, and acted upon in real-time

Data Ingestion and Streaming
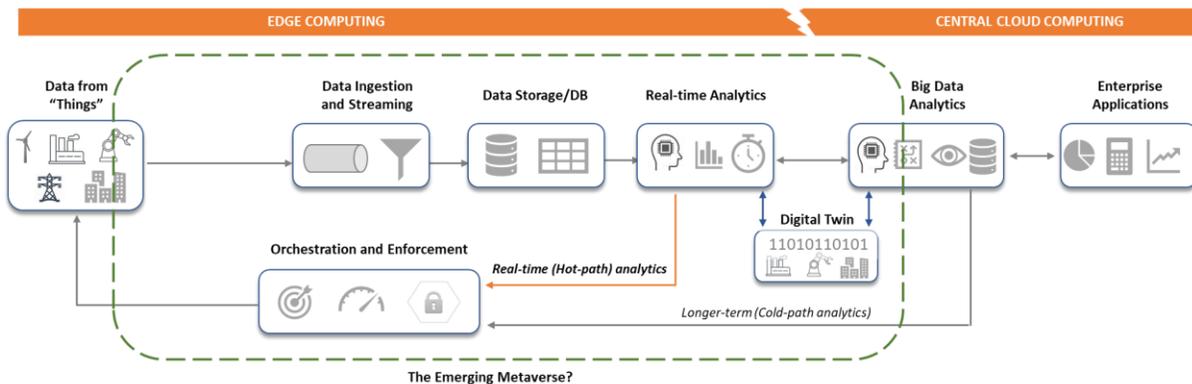
**Data Ingestion
and Streaming**
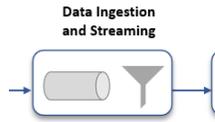
Edge and IoT networks could consist of thousands of machines and devices generating massive amounts of real-time data streams using a variety of publish/subscribe or client/server data protocols.

They include Message Queue Telemetry Transport (MQTT), Data Distribution Services (DDS), Constrained Application Protocols (CoAP), and Advanced Message Queuing Protocol (AMQP). HTTP, the standard connectionless client/server protocol for web services may also be used in IoT solutions (through JSON over HTTP) particularly when latency and bandwidth are not a concern. OPC Unified Architecture (OPC UA) is a protocol that is used for connecting PLCs and sensors data into industrial applications like SCADA and MES systems.

The data ingestion layer must provide for hundreds of machines sending data in parallel and continuously, and that data needs to be ingested in real time. Some of the tools that have emerged to manage this task include Apache tools like Kafka, Fluentd, Flume, Logstash, Spark and Storm.

The data can be ingested into an in-memory database where it can be validated and aggregated. With the cost of memory steadily falling, it has become possible to place large Edge/IoT datasets in memory for processing in real-time. To prevent the sheer volume of Edge data from overwhelming in-memory databases, the data can be filtered to remove redundancies or noise.

Data Storage and Databases

**Data
Storage/DB**

Edge/IoT data is multifaceted. At a high-level, data can be classified as either structured or unstructured. Another type, semi-structured, lies somewhere in between these two and has metadata tags which allow for processing of raw data.

Structured data includes items generated by sensors such as temperature, pressure, speed and GPS coordinates. A "Thing" such as a machine, a production plant or a truck will have multiple

sensors and will generate complex sets of data. Structured data typically resides in a relational data base, such as MySQL.

Unstructured data is information that does not have a pre-defined data model and does not reside in a traditional row-column relational database. Examples of unstructured data could include video from security cameras, images and audio. Several NoSQL databases have emerged to store all related unstructured data together within a single document, including the widely used MongoDB.

Given the nature and promise of IoT, most of the data will be streaming in huge volumes in real-time from sensors and things. This time-series data, which is timestamped and collected at regular intervals, must be indexed in real-time and efficiently stored in databases for retrieval and analysis.

While time-series data is the most common form of data that IoT applications collect, MySQL, a traditional relational database is still widely used. This most likely reflects the importance of storing all kinds of device metadata or enterprise data in addition to sensor data.

With regards to NoSQL and time-series data bases, MongoDB and InfluxDB appear to be the two platforms of choice for storing non-relational IoT data. Surveys highlight that most of the databases used for IoT are open source, with Amazon's DynamoDB being the only notable exception.

Real-time Analytics

Operational/Real-time Analytics

Some limited real-time analytics can take place on the device itself (or close to the device) to reduce the amount of data that needs to be transmitted back to the cloud. However, since most devices, especially sensors, have limited processing capability, much of the data will need to be moved to another level for processing, which could be at the Edge layer.

There are several frameworks available for real-time streaming analytics, such as the open-source Apache Storm and Apache Samza. There are also managed services from Amazon (AWS IoT Analytics) and Microsoft (Azure Stream Analytics). The goal of the managed service offerings is to remove the complexity associated with these frameworks and shorten the time to build and deploy production-ready solutions. Other companies with offerings include Striim, IBM's InfoSphere Streams and Tibco's Streambase.

Big-data Analytics

Operational/Real-time Analytics

Big-data analytics complements the real-time component and enables the analysis of large and diverse historical datasets. The data can be combined with information from enterprise applications to develop new patterns, correlations, and other strategic insights. The data sources could come from multiple databases that are geographically dispersed.

Analytics at this layer require a powerful framework that combines compute, storage and networking infrastructure to allow for seamless operations across multiple distributed databases. Apache Hadoop, an open-source platform that uses a MapReduce engine to process distributed data is an example.

Edge-Native Applications

Most edge computing devices that exist today are built around an embedded software model. These *hardware-defined systems* are designed around a real time operating systems (RTOS) and run *monolithic software* designed to do a limited set of tasks. The monolithic software is tightly coupled to the underlying hardware and the RTOS. It is also written in legacy programming languages using proprietary development tools. The process takes time and results in a static architecture that is difficult to deploy in the highly connected and hyperscale environment envisioned for the Internet of Things.

The shift away from monolithic software-hardware architectures has successfully taken place in cloud computing environments using technologies such as virtualization, containers and microservices. Companies including Google, Netflix and Facebook, who support hundreds of millions of users and billions of transactions have been at the forefront of a shift referred to as "Cloud-Native", an alternative application/computing paradigm.

Figure 18: Some Benefits of Cloud-Native Application Development

Easier application management

Automate application development

Improve time to market

Roll out new features fast

Greater scalability

Improve app performance
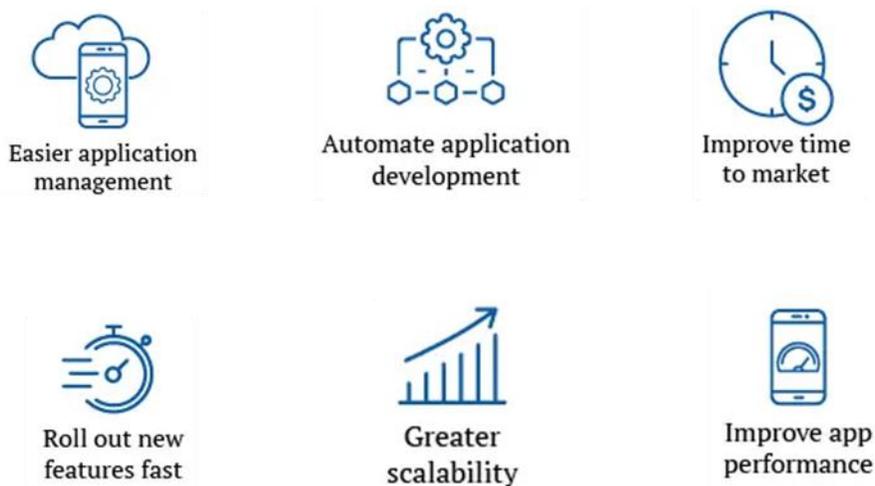
Source: Edge Computing Consortium

The Cloud-Native approach uses an open-source software stack to deploy applications as microservices, packaging each part into its own container and dynamically orchestrating those containers to optimize resource utilization. Such technologies enable software developers to take advantage of the architecture of the cloud and build scalable applications in public, private and hybrid clouds.

Cloud-Native computing is centralized and requires data to be transmitted to the central cloud for processing. Edge-native applications, in contrast, are designed to run in distributed environments on special edge hardware. The Edge moves processing as close to the source of data as possible. Other differences are shown in figure 19.

Edge-Native approaches have begun leveraging Cloud-Native technologies such as containerization, microservices and continuous integration/ continuous delivery (CI/CD) practices.

Figure 19: Cloud-Native vs Edge Native

Cloud Native	Edge Native
» Computing only	» Computing and connectivity
» Medium- and large-size data centers » General-purpose hardware » Flexible scaling	» Lightweight edge node » Heterogeneous hardware » Limited or unavailable scaling capabilities
» Independent	» Mutually dependent
» Centralized, automatic management » Horizontal orchestration	» Remote management and edge autonomy » Cross-node orchestration
» Internet-oriented » Backbone network as the focus	» Access-oriented » 5G mobile access as the focus

Source: Edge Computing Consortium, 5GDNA

While the cloud and edge are complementary, there are major differences with Cloud-Native which merits different types of software development and deployment at the Edge. Edge applications must be designed to take advantage of many unique attributes of edge computing such as bandwidth, low-latency, security, and WAN-failure resiliency.

Some resource constrained devices and sensors make the use of containers difficult or impossible. And industrial sectors, especially in critical infrastructure, may be unwilling to embrace containerized applications in production environments until these have been tested for long-term resiliency and security.

Given the wide range of edge devices, there will surely be many different approaches to developing edge applications. Today, there are several standards bodies that are doing work related to edge computing, including the European Telecommunications Standards Institute (ETSI), the Cloud Native Computing Foundation (CNCF), Linux Foundation (LF Edge), and the Industrial Internet Consortium.

![Telegraph Hill Advisors logo]

How Edge Computing is Transforming Industries

Connected Vehicles & UAVs

Today's automobiles and trucks are mobile computers with onboard sensors and software that capture real-time information about the vehicle. These advanced driver assistance systems (ADAS) process large amounts of data onboard the vehicle to provide features such as automatic braking and collision avoidance.

The next phase in transportation is turning these intelligent vehicles into connected cars and trucks, where they interact with their environment and other vehicles. On-board ADAS systems alone cannot enable this, and these vehicles will have to rely on external compute resources found in the cloud.

According to the Automotive Edge Computing Consortium (AECC), 100 million cars, or 75%, of cars shipped globally by 2025 will connect to the Internet. Collectively, these cars will generate around 10 exabytes of data per month. But this is too large and expensive to push over cellular networks back to the central cloud.

Edge computing could handle this exponential growth of data - some of this data can be filtered and analyzed locally on the automobile itself, and only relevant pieces may then need to be shipped back to the central cloud. Here, Edge computing complements the central cloud.

Autonomous Vehicles

The coming of autonomous vehicles also presents additional challenges in the terms of amounts of data generated as well as latency issues related to moving data to distant data centers. An autonomous vehicle according to one estimate could produce around 4,000 GB of data per day (Figure 20.) There is also data related to road and driving conditions, light levels, pedestrian locations as well as vehicles and other objects.

Figure 20: The Coming Flood of Data from Autonomous Vehicles
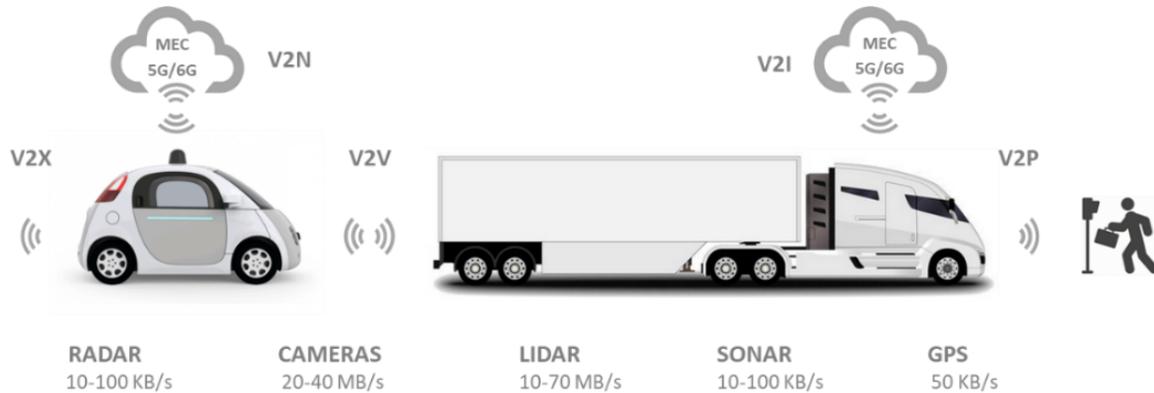
Source: Intel

As before, moving all this data back on forth to the central cloud is expensive and impractical.   Furthermore, experts estimate that it takes approximately 100 milliseconds for large amounts of data to travel each way to and from distant cloud-based data centers. A two-second delay to a vehicle moving at 50 km/h (urban speed limit) means an extra 28 meters travel. So, split second decisions is of paramount importance to, say the safety of pedestrians.

There are also the dangers associated with autonomous vehicles losing connection to the network and being unable to make decisions during life-threating situations. On-board Edge computing resources must be highly intelligent and use AI and ML to extract insights, determine road conditions and make vital decisions.

Automotive edge adoption is complex, and it may be a while before we see full autonomy (Figure 21).

Figure 21: Technologies Needed for Automotive Edge Adoption
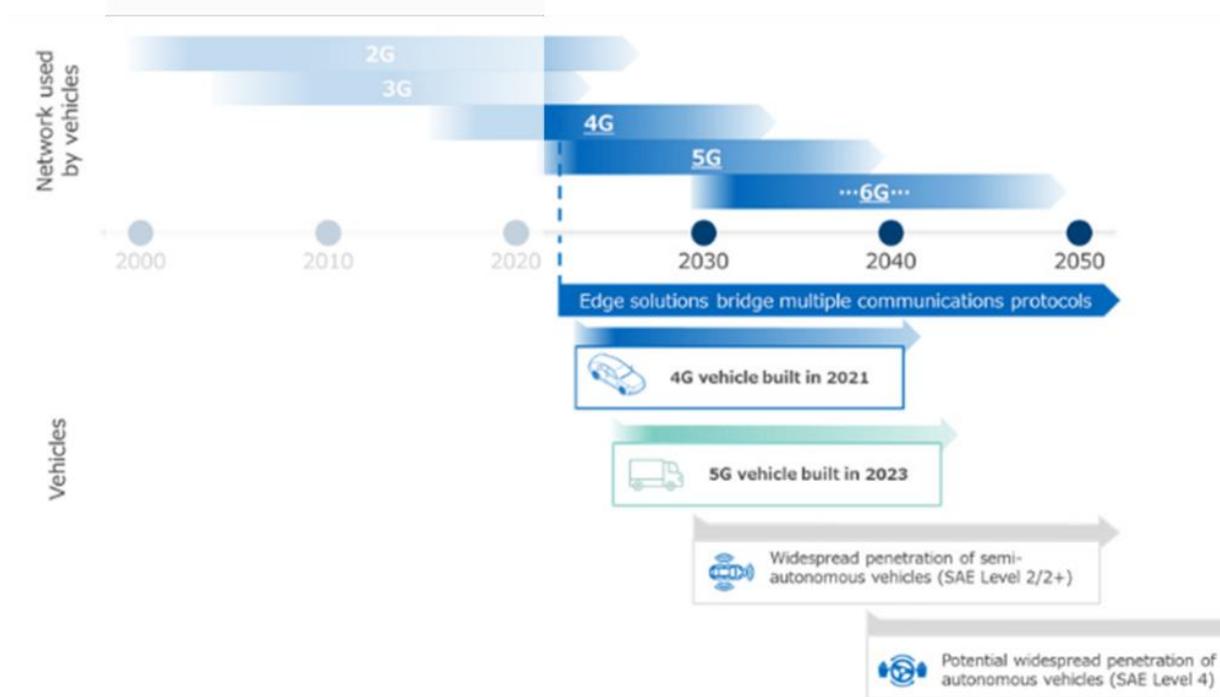
Source: AECC

Unmanned Aerial Vehicles

Unmanned Aerial Vehicles (UAVs), commonly known as drones, are inherently Edge computing platforms that can be operated remotely by human operators or autonomously by sophisticated software. Drones equipped with high-resolution cameras and other sensors, such as LIDAR, are being used to collect real-time information in many commercial and industrial settings including smart agriculture, smart grid inspection, environmental mapping, traffic monitoring, law enforcement and public safety monitoring. They are also being looked at for package delivery.

According to one forecast, the global commercial drone market was valued at $2.7 billion in 2020 and is projected to grow to $21.7 billion in 2030 at a CAGR of around 24%. (Source: Allied Market Research.)

As with autonomous cars, drones with high-resolution cameras will generate massive amounts of data, especially video, which could easily saturate cellular networks. So, for real-time applications, drones will have to employ specialized machine learning systems to selectively transmit only interesting data.

But, unlike with autonomous cars, adding the ML hardware needed may not be possible into a small drone, due to its size and weight. The additional processing would also consume more battery power and reduce the flight time available.   The Edge computing model for drones is still evolving, with progress being made on offloading algorithms that enable the optimizing of computing resources on the drone with those available at the MEC.

Figure 22: Drone Edge Computing and MEC
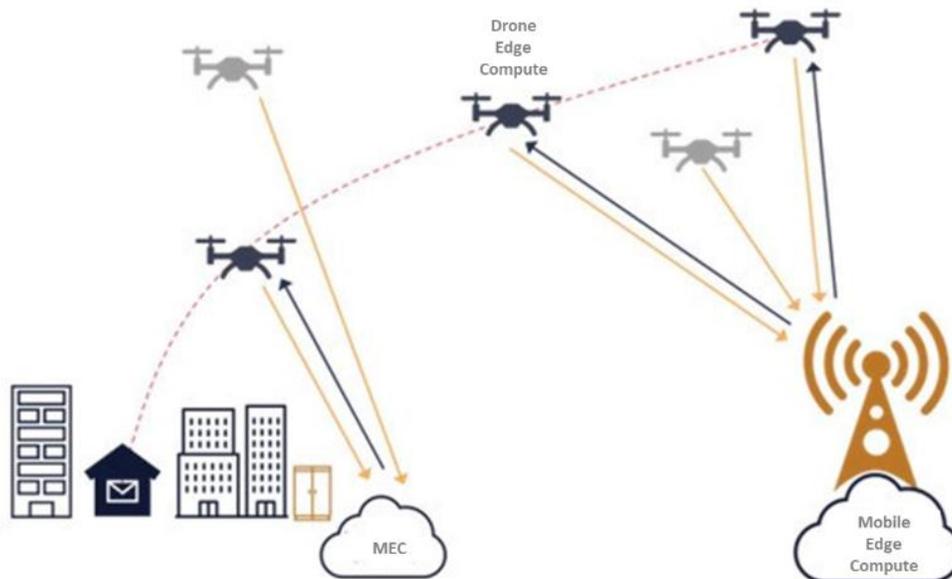
Source: STL

Utilities & the Smart Grid

Electric utilities are going through an unprecedented transformation brought about by changes in the energy markets: new demands e.g., from electric vehicles, the shift to renewable energy, and a grid where, unlike in the past, energy now flows in two directions from solar and wind. In response, utilities are transforming themselves into smart utilities and digitizing many parts of their systems to improve responsiveness, efficiency and resiliency.

At the grid level, many utilities are looking to leverage Edge computing solutions to process and gain insights from data from their generation and transmission equipment, as well as energy usage by their customers. They can now monitor data to improve predictive maintenance and avoid outages at a much higher level of granularity than in the past.

By combining Edge computing, drones and machine vision, utilities can also conduct remote inspections of their grid networks to avoid wildfires caused by the overgrowth of vegetation. Intelligent thermal vision cameras can be used to monitor high-voltage assets such as substations, transformers and power lines for temperature anomalies.

Millions of smart meters featuring onboard data storage and compute have been installed by utilities at customer premises. They are a key component in Advanced Metering Infrastructure (AMI) a two-way communications system to collect usage and analytics data. Advanced analytics and AI embedded into AMI systems provide granular real-time insights that can be used for planning, billing and maintenance purposes.

Figure 23: Electric Utility Edge Computing and Smart Meter Applications
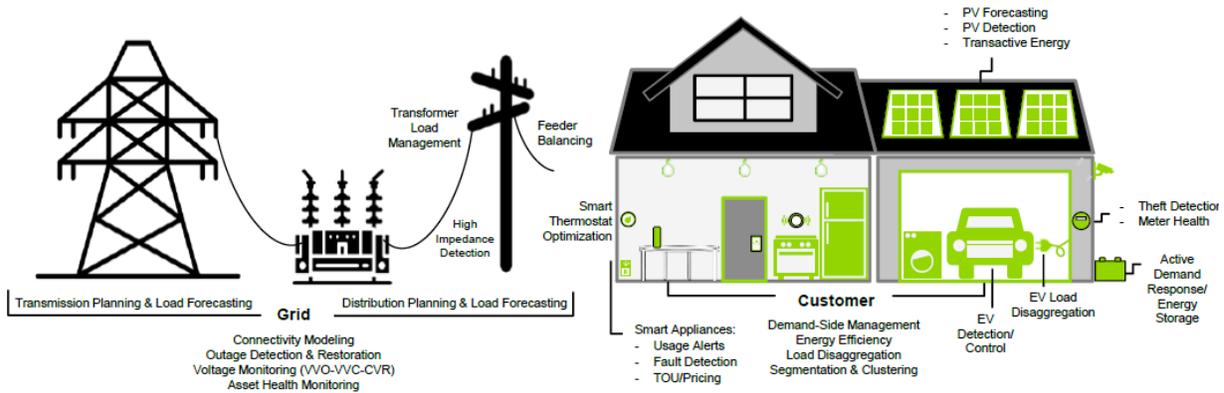
Source: Guidehouse Insights

Industrial Internet of Things (IIoT)

Industrial automation is a collective term that refers to use of industrial control systems (ICS) and information technologies (IT) by organizations in process and discrete industries to maximize productivity, optimize operations and meet business and financial objectives. The industrial automation market is large, and according to Transparency Market Research, is projected to reach $352 billion by the end of 2024, up from $183 billion in 2015 at a CAGR of 6.6%.

Industrial automation consists of a variety of hardware and software systems including Distributed Control System (DCS), Programmable Logic Control System (PLC), Programmable automation controller (PAC), Manufacturing Execution System (MES), Manufacturing Operations Management (MOM), Human Machine Interface (HMI), operation historians and Supervisory Control and Data Acquisition (SCADA).

Figure 24: Industrial IoT Automation – A Blend of Central and Edge Computing
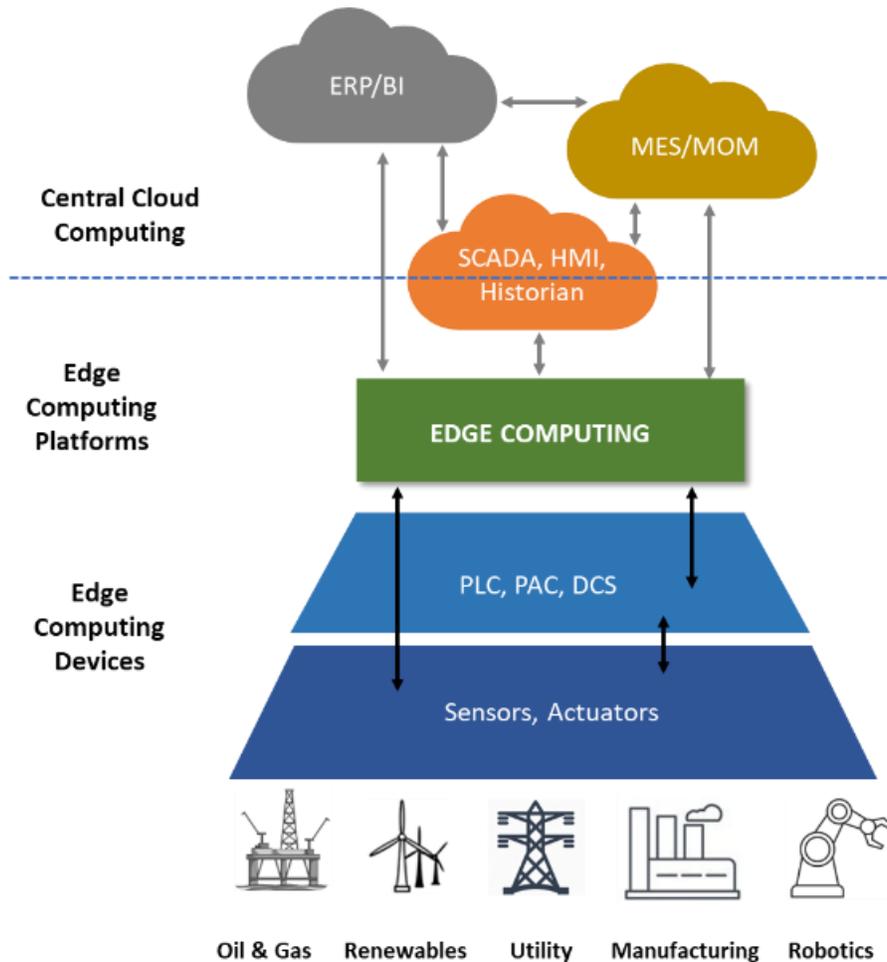
Source: THA

Edge computing pushes the analytics and processing capabilities directly onto devices. In an industrial IoT setting, Edge computing can be done on routers, industrial PCs, IoT gateways, Programmable Automation Controllers (PACs) and even some advanced Programmable Logic Controllers (PLCs). Edge computing nodes such as IoT gateways facilitate device-to-device or device-to-cloud communications.

The Edge computing layer collects and analyzes data locally at production facilities to allow for real-time insights into operations. Typical functions include data aggregation, filtering and anomaly detection with the emphasis on faster processing and shorter response times.

Smart Spaces (Smart Buildings, Smart Cities)

Smart spaces (or environments) could mean many things, but for this report we are restricting it to refer to smart cities and smart buildings as well as other venues such as stadiums, malls and campuses. While smart buildings are the essential building blocks of smart cities, smart cities go beyond just buildings and uses technology to provide services and solve problems including in safety, lighting, transportation, health, energy and education for its residents. Such environments are made possible by a myriad of powerful IoT sensors including video cameras all networked over wireless and wired communications networks.

The global smart buildings market is expected to grow from $73 billion in 2021 to $122 billion by 2026, at a CAGR 10%. The drivers include the adoption of IoT-enabled building management systems, better energy utilization, and increased regulations. (Source: Markets and Markets).

The number of buildings worldwide deploying smart technologies is expected to grow from 45 million in 2022 to 115 million in 2026, an increase of 150% (source: Juniper Research). Juniper Research expects non-residential smart buildings to account for 90% of smart building spend in 2026, at a similar level to that in 2022. This is due to the larger economies of scale in commercial buildings as well as the focus on most smart building technologies.

Global shipments of sensors used in smart buildings will exceed 1 billion annually in 2026 from 360 million in 2022. (Source: Juniper Research). As the number of smart building sensors increases, more data is getting generated in remote edge locations. Cisco estimates that a city of one million people will generate around 200 million gigabytes of data per day by the 2020s.

The data generated by these sensors are analyzed at cloud data centers to provide insights, improve efficiencies, tackle traffic congestion and increase safety. (Covid has heightened the safety aspects, with employee concerns about a safe return to the office.)

Figure 25: Smart Buildings use a Wide Range of Sensors

Energy
Smart meters, demand response

Lighting
Occupancy sensing

Fire
Functionality checks, detector service

24/7 monitoring
Condition monitoring, parking lot utilization

PEHV charging
Charging of hybrid and electric vehicles

Water
Smart meters, use and flow sensing

HVAC
Fans, variable air volume, air quality

Elevators
Maintenance, performance

Access and security
Badge in, cameras, integration perimeter, doors

Source: Mappedin

Sending data from all these sensors to cloud data centers is extremely costly and there will also be latency issues. To overcome these issues, smart cities are looking at Edge computing solutions to process the data near the source using a combination of IoT, AI and 5G solutions.

The global smart cities market was valued at $771 billion in 2021 and is projected to reach $5,829 billion by 2030, growing at a CAGR of 25%. (Source: Straits Research.) Much of this growth will be in the Asia-Pacific and fueled by public sector spending and public safety, especially in China.

Supply Chains and Logistics

"Edges are physical locations where things, people, and data connect. Increasingly, supply chains are becoming more dynamic and cover larger networks where data and decisions originate at the edge – from operators, machines, sensors, or devices." Andrew Stevens, Gartner Supply Chain Practice.

Supply chains are complex things and delivering goods from production to end-customers involve many steps as well as many parties, including manufacturers, shippers, warehouse operators and retailers. As goods are handed from one party to the other, there is a growing lack of visibility and absence of real-time shipment and inventory information.

These challenges became more evident during the COVID pandemic when disruptions led to shortages and rising prices of goods. According to Accenture:

- 94% of Fortune 1000 companies are seeing supply chain disruptions from COVID-19

- 75% of these companies have had negative or strongly negative impact on their business

- 55% of companies plan to downgrade their growth outlooks (or have already done so)

Figure 26: Supply Chains Can Be Complex with Low Visibility and Many Blind Spots

Production & Packaging • Truck delivery • Port warehouse • Sea delivery • Customs • Truck delivery • Distribution center • Retail Store • End customer
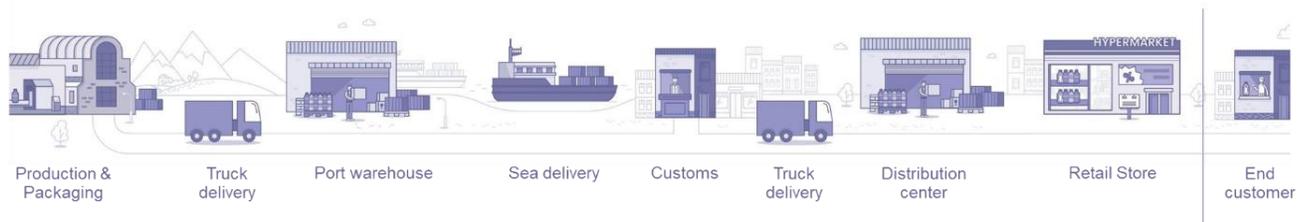
Source: Moeco

Companies in the supply chain are taking this type of advice seriously and have begun introducing Edge/IoT systems to tracks shipments and improve end-to-end visibility. They are looking at low-power smart sensors that work over mobile and satellite networks, coupled with AI-enabled systems that can track goods without human intervention.

Maersk, the Danish shipping giant, is using edge technologies to oversee 67 terminals which handle more than 15 million containers from thousands of ports. The company says that Edge provides processing of real-time computation — computer vision and real-time computation of algorithms for decision making. Bringing computing power to the edge enables data to be analyzed in near real-time — a necessity in the supply chain — and that is not possible with the cloud alone.

"Two to three years ago, we put everything on the cloud, but what we're doing now is different. We must have the edge. We need real-time instruction sets for machines for container handling equipment at ports and then we'll use cloud technologies where the data is not time sensitive." Gavin Laybourne, global CIO of Maersk's APM Terminals business

Smart Healthcare

The Internet of Things (IoT) has a parallel in the healthcare sector called the Internet of Medical Things (IoMT) or alternatively healthcare IoT. These are networks of internet-enabled medical devices, hardware and software applications that connect patients, doctors and medical equipment securely to health care information systems. IoMT supplements medical personnel by using sensors and automation for medical procedures and patient monitoring to improve care and reduce costs.

Like in other IoT applications, IoMT devices are generating unprecedented volumes of data, forcing healthcare providers to decide on how to manage and best use this data. The World Economic Forum estimates that hospitals worldwide produce 50 petabytes of data every year. Some of this data are patient electronic medical records, but increasingly more of it comes from IoT-enabled hospital equipment.

According to IBM, there are an average of 10-15 connected devices per patient bed in US hospitals. There are an estimated 7,308 active US hospitals with more than 920,000 beds (source: AHA). Multiplied by number of beds, the magnitude of the data problem becomes clear. Solely relying on the cloud is expensive, and impractical if data insights are required quickly for critical clinical decision making and during medical emergencies.

The World Health Organization (WHO) estimates that there are two million different kinds of medical devices on the world market, categorized into more than 7,000 generic devices groups. These devices come in different forms and size ranging from in-hospital devices and monitors to home monitoring devices. All of these devices generate data ranging from few kilobytes to several dozen megabytes.

Figure 27: File Sizes from Different Imaging Procedures

Modality	Image matrix (in pixels)	Dynamic range (bits per pixel)	File size (per image)
MRI	256 × 256	16	131 KB
CT Scan	512 × 512	16	524 KB
Ultrasound	512 × 512	8	262 KB
Color Doppler	768 × 576	8	442 KB
Digital radiography	Up to 3000 × 3000	Up to 16	Up to 18 MB
Digital mammography	Up to 3328 × 4096	14	27 MB
Computed radiography	3520 × 4280	12	30 MB

Source: Journal of Radiology and Imaging

IoMT can also be used for monitoring of expensive and vital hospital equipment such as MRI and CT scan machines. Predictive maintenance and remote diagnostics help hospitals and clinics foresee problems in medical equipment that could impact the quality of care.

Edge computing which brings data processing and analytics closer to medical equipment will play a big role in hospital settings in the coming years. The low-latency and emerging AI features will enable faster and more accurate diagnosis and treatment.

The worldwide COVID pandemic has shown hospital systems need to closely coexist with the surrounding cities that they are part of. The pandemic required the setting up of quarantine and treatment centers that had to provide quality care at remote centers. Edge computing could facilitate a quicker response to public emergency crisis by bringing computing, storage and AI technologies close to where patients are treated, and useful epidemiological data is generated.

Smart Agriculture

Agriculture is the practice of cultivation of soil for the growing of crops, the rearing of livestock, and fishing to become the source of the world's food supply. The development of agriculture changed the way humans evolved and led the way to permanent settlements and farming.   A strong agriculture sector ensures food security, prevents malnourishment and famines, and leads to better health. Until the advent of the industrial revolution, agriculture was also the largest source of employment.

The have been many advancements and revolutions in agriculture that improved both productivity and yields including mechanization, chemical fertilizers, as well as better animal health and nutrition. With the world's population projected to increase to 9.7 billion by 2050, the UN's Food and Agriculture Organization estimates that the world will need to produce 70% more food by that time.

There is a new revolution taking place in agriculture that uses digital technologies to help farmers increase yields, reduce crop losses, optimize water consumption, and lower production costs. These solutions built around the Internet of Things (IoT) and data analytics are gaining momentum and are projected to grow to $26 billion in 2030, up from $11 billion in 2021 at a CAGR of around 11% (source: Emergen Research.) North America counted for almost 45% of the global market revenue in 2021.

IoT in agriculture involves a variety of equipment including sensors (for monitoring temperature, moisture, soil and livestock), controllers (for irrigation and feed systems), handheld computers and drones. Analytics software both in the cloud as well as on the farm will feature AI to deliver actionable information to farmers and farming organizations. Figure 28 shows several use cases.

Figure 28: Edge computing Applications in Agriculture

Smart-crop monitoring	Drone farming	Smart-livestock monitoring	Autonomous-farming machinery	Smart-building and -equipment management
Connected-irrigation and nutrient-distribution equipment based on connected-sensor data and imagery analysis, aimed at optimizing resource usage and crop growth through real-time, precise, location-dependent adjustments	Drone surveillance and remote interventions based on image analysis and connected sensors communicating data with the drone, aimed at providing more frequent, cost-effective remote monitoring of large areas and enabling remote interventions to boost yield and reduce losses from pests as well as optimizing deployment costs	Individualized feeding-and-care plans based on connected-body-sensor data and movement tracking; aimed at detecting illnesses early and providing each animal with its optimal feed and medicine mix to maximize growth	Self-operated machinery and robots able to perform targeted interventions based on connected-sensor data, GPS data, and imagery analysis, aimed at optimizing resource usage; reducing labor requirements, and boosting yield through more precise and individualized interventions	Prescriptive maintenance and real-time environmental adjustments, aimed at improving performance and extending useful life of farm equipment and other assets as well as decreasing risk of mold, fire, and other threats

Source: McKinsey

Many of the solutions shown above were designed around a central cloud to analyze the data and provide insights. But challenges around latency, bandwidth costs and the loss of connectivity soon became clear, so farming enterprises have begun to add edge computing to the mix. Some examples:

Edge computing using data from widely deployed low-cost sensors, can provide agricultural operations with real-time data insights to manage crops and livestock more precisely.

As more autonomous farming machinery gets deployed, they have to communicate with nearby sensors to determine most efficient paths in a given field, and to stop or reroute automatically in case of obstacles.

Greenhouses or even entire farms could be put on autopilot just using sensors and edge computing. Local digital intelligence can be used to make decisions based on data from nearby sensors on watering, feeding and environmental settings such as temperature and humidity.

Smart Retail

The global retail industry market was valued at around $22 trillion dollars in 2022 and is projected to exceed $40 trillion by 2030 growing at a CAGR of 7.7% from 2023 to 2030 (source: Verified Markets). Key players in the industry include Amazon (USA), Walmart (USA), Carrefour (France), Alibaba (China) and Reliance (India).

The retail industry was one of the earliest adopters of technologies such as barcode scanners, point-of-sale terminals, staff scheduling and inventory management systems. Online retail solutions and mobile shopping introduced additional sales and fulfilment technologies.

While e-commerce and COVID restrictions slowed down store traffic, customers still show that they are willing to return to shopping in stores. Many experts still predict that 72% of US retail sales in 2024 will occur in brick-and-mortar stores (source: Forrester).

Even before COVID, retailers were investing in technology to bridge the online to in-store worlds, increase consumer purchases, and keeping consumers engaged with store environments. Retailers view stores as a source of competitive advantage versus purely online vendors, and as locations for capturing customer interactions. In-store shopping is an important source of data, and a vital cog in retailers omnichannel strategies that include mobile apps and social media.

Stores have always deployed compute technologies in many forms, including sensors for monitoring freezers, loss prevention, inventory management, and CCTV for security. Cloud computing introduced additional functionality including the ability to track supply-chains in real-time. But retailers cannot just rely on the Cloud, for if the Internet were to go down, the stores critical services such as point-of-sales (POS) would be lost.

Retail stores will use a hybrid of cloud and edge computing resources. Increasingly there will likely be more emphasis on edge solutions, driven by IoT sensors and artificial intelligence solutions. The advent of small and inexpensive IoT devices (including machine vision) has increased the ability of retail stores to monitor their operations and track customers at a more granular level.

Combining IoT data with in-store AI software allows for smart shelves, dynamic pricing, increased store efficiency, and a more personalized customer experience. An example of a smart retail setup is shown in Figure 29:

Figure 29: Smart Retail Requires a Variety of Solutions from Many Vendors
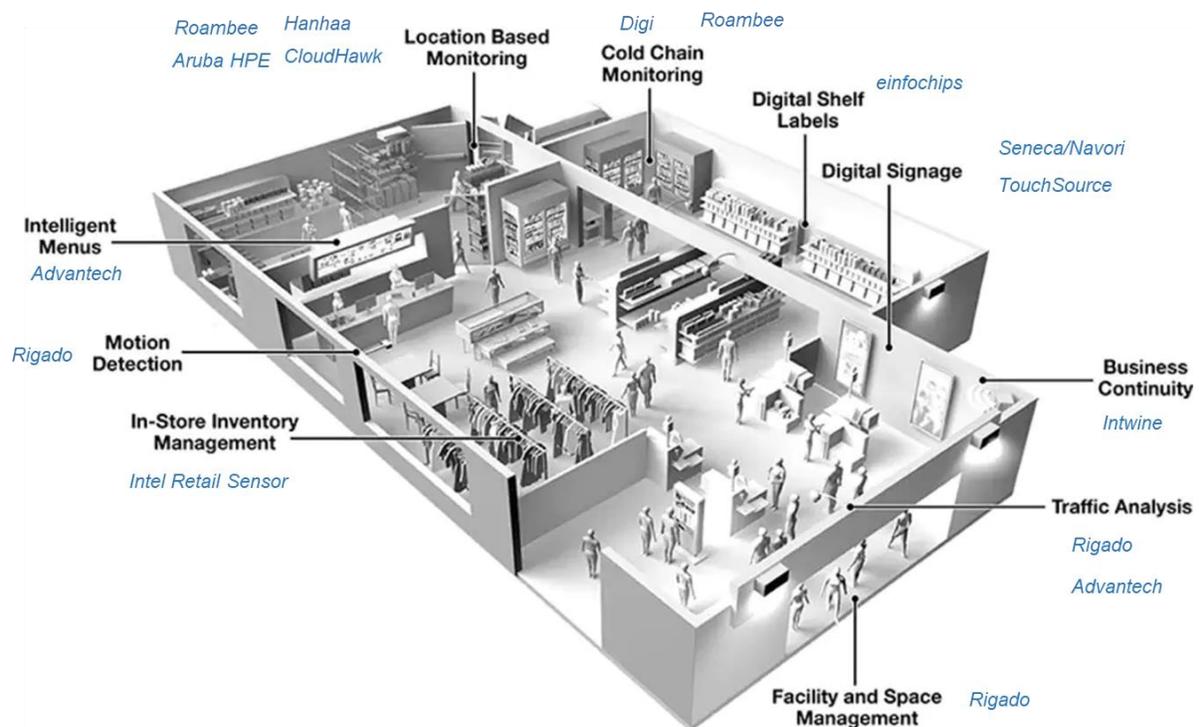
Source: Arrow

Profiles of Selected Edge Computing Startups

In this section we highlight more than 170 venture-funded startups that have developed innovative solutions in the edge computing category. These companies have collectively raised more than $11 billion in venture capital and related funding and employee more than 16,000 people.

	Number of Companies	Year Founded	Total Funding ($M)	Employees
Total	174		$11,159	16,061
Mean		2014	$66.8	92
Median		2015	$29.3	50

Sources: Company reports, Pitchbook, Crunchbase, Linkedin

3DSignals

Description:	3d Signals helps manufacturers digitize their machines to become an industry 4.0 smart factory asset. The company's solutions generate visibility and actionable insights, using a range of accurate, non-invasive sensors and a cloud-based Asset Performance Monitoring platform. Their Energy Efficiency Solutions prevents machine energy waste and improves energy utilization.
Category:	Industry 4.0, IIoT, Predictive maintenance, Energy management
Founded:	2015
Location:	Kefar Sava, Israel
Total Funding:	$23.50 million
No. of employees:	63
Investors:	DIVEdigital, Grove Ventures, HCS Capital (Israel), Mercura Capital, OurCrowd, State of Mind Ventures, Oracle Startup Cloud Accelerator, Plug & Play, Vintage Investment Partners

75F

Description:	75F is a developer of smart building automation systems created to optimize and save energy consumption. The company's systems are HVAC controlled that use wireless sensors and other technology to automatically adjust the temperature in offices and other commercial buildings. It lets users take control of commercial building indoor environments, enabling clients to save energy while improving comfort and indoor air quality, gain multi-site, zone-specific and equipment-specific monitoring and control.
Category:	Artificial Intelligence & Machine Learning, Climate Tech, CleanTech, Internet of Things, Manufacturing
Founded:	2012
Location:	Bloomington, MN
Total Funding:	$34.70 million
No. of employees:	118
Investors:	Breakthrough Energy Ventures, Building Ventures, Cleantech Open Midwest, Evergreen Climate Innovations, Google for Startups Accelerator, Gopher Angels, Next47, OGCI Climate Investments, Pamela York, Revolution/ROTR, Seth London, Siemens, Southern Minnesota Initiative Foundation, TheCityFix Labs, Wells Fargo Innovation Incubator, Wind Ventures

Aarna Networks

aarna
networks

Description:	Aarna Networks solves enterprise edge and private 5G management complexity through zero-touch edge orchestration at scale. Aarna leverages open source, cloud native, and DevOps methodologies to provide zero-touch edge and 5G service orchestration and management services.
Category:	Wirlesss, 5G, CloudTech & DevOps
Founded:	2018
Location:	San Jose, CA
Total Funding:	$4.22 million
No. of employees:	30
Investors:	Inventus Capital Partners, KAAJ Ventures, RiSo Capital, SVQUAD

Aceinna

ACEINNA

Description:	ACEINNA is a MEMS based sensing solutions company, focused on the development of innovative Inertial Measurement Unit (IMU) and current sensing technologies that are essential to next generation cars, robots and other autonomous applications. Their product lines cover MHz bandwidth Magneto-Resistance (MR) based electric current sensors, high-performance open source IMUs, Real Time Kinematic (RTK) navigation systems, and centimeter-precision positioning services.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Autonomous cars, Internet of Things, Mobility Tech
Founded:	2017
Location:	Tewksbury, MA
Total Funding:	$50.00 million
No. of employees:	34
Investors:	IDG Capital

Acerta

Acerta

Description:	Acerta is a developer of an AI-based automotive analytics platform designed to help precision manufacturers make sense of complex product data. The company's platform offers quality control for manufacturers of parts for automobiles and off-highway vehicles and transforms complex product data into useful insights, assisting them in bringing products to market more quickly and with fewer defects.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Big Data, SaaS, TMT
Founded:	2016
Location:	Ontario, Canada
Total Funding:	$19.17 million
No. of employees:	44
Investors:	BDC Capital, Blackberry, Creative Destruction Lab, EQT Ventures, Export Development Canada, Fontanalis Partners, Garage Technology Ventures, GarageCapital, L-SPARK, M12, OMERS Ventures, Plug and Play Tech Center, Radical Ventures, Right Side Capital Management, S28 Capital, Silicon Valley Bank, Silverhorn Investment Advisors, StandUp Ventures, Startup Autobahn, Techstars, Trifecta Capital Partners, Velocity Incubator (University of Waterloo)

Achronix

Description:	Achronix is a developer of fabless semiconductor arrays designed to address high-performance, compute-intensive and real-time processing applications. The company's solutions are suitable for a wide range of applications including in 5G, automotive, artificial intelligence and machine learning, computational storage and networking.
Category:	Artificial Intelligence & Machine Learning, Big Data, Manufacturing, TMT
Founded:	2004
Location:	Santa Clara, CA
Total Funding:	$ 250.54 million
No. of employees:	186
Investors:	Hercules Capital, BDC

Actility

Description:	Actility provides Low-Power Wide-Area Networks (LPWAN) industrial-grade connectivity solutions for the Internet of Things. Through its subsidiary Abeeway, Actility also provides patented ultra-low power tracking solutions. Another subsidiary, ThingPark Market offers a large selection of interoperable IoT gateways, devices and applications to simplify and accelerate deployment of use cases.
Category:	IoT gateways, IoT tracking, LPWAN, LTE-M, NB-IoT
Founded:	2010
Location:	Paris, France
Total Funding:	$108.46 million
No. of employees:	128
Investors:	BNP Paribas, Bouygues Telecom Initiatives, Bpifrance, CDC Enterprises, Cisco Investments, Creadev, Eurazeo, Foxconn Technology, Ginko Ventures, Hon Hai Precision, Idinvest Partners, Inmarsat, KPN Ventures, Orange Ventures, Paris&Co Incubateurs, Robert Bosch Venture Capital, Swisscom, Swisscom Ventures, Truffle Capital

Aeris

Description:	Aeris is the developer of IoT cellular connectivity solutions targeting industry verticals such as transportation, energy, automotive and healthcare. In December 2022, the company acquired the IoT business from Ericsson to offer a secure and feature-rich platform for developing IoT applications for customers worldwide.
Category:	Internet of Things, Wireless
Founded:	1992
Location:	San Jose, CA
Total Funding:	$37.87 million
No. of employees:	255
Investors:	Caisse de dépôt et placement du Québec, Cloquet Capital Partners, Costella Kirsch, Ericsson, I.U.GO Ventures, Orbcomm, Parakletos Ventures, Rogers Venture Partners, Verdane

Afero

Description:	Afero's secure IoT platform offers secure and connected capabilities for solutions in smart home, smart lighting and smart tracking. It's Powered-by-Afero suite targeted at manufacturers and systems integrators, includes a license to IP and a large IoT patent portfolio.
Category:	IoT platform, IP, Patents
Founded:	2014
Location:	Los Altos, CA
Total Funding:	$98.41 million
No. of employees:	48
Investors:	Assembly Partners, Crosspoint Capital Partners, Intuitive Private Equity, Libertad (Tokyo), Mistletoe, Pegasus Tech Ventures, Presidio Ventures, Samsung Catalyst Fund, Sanshin Electronics, SoftBank Investment Advisers, Sumitomo Mitsui Financial Group, The Home Depot, Venture Labo Investment, Visionnaire Ventures, Western Technology Investment

AIStorm

Description:	AIStorm is a developer of an AI-in-Sensor processing technology designed to eliminate latency, power, and cost associated with competitive solutions at the edge. The company's technology lets the sensor couple directly to popular convolutional neural networks and offers advantages for ultra-low power, and ultra-low-latency AIoT edge computing, enabling users to get the benefits of low noise, power, speed, and size over similar technologies including memristors, resistive RAM, NVM-controlled resistors and other competing technologies.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2018
Location:	Houston, TX
Total Funding:	$30.20 million
No. of employees:	33
Investors:	ASUS, Egis Technology, Knowles Corporation, Linear Dimensions, Meyer Corp, Senvest Capital, Silergy, TowerJazz Panasonic Semiconductor

AlphaICs

Description:	AlphaICs is a manufacturer of semiconductors for edge inference and edge learning technologies. The company's architecture provides high performance, low power, and minimal latency, and also supports edge learning to reduce training data requirements, auto labeling, and continuous learning at the edge.
Category:	Artificial Intelligence & Machine Learning
Founded:	2016
Location:	Milpitas, CA
Total Funding:	$10.55 million
No. of employees:	26
Investors:	3one4 Capital, CBC Company, Canal Ventures, Emerald Technology Ventures, Endiya Partners, FasterCapital, Ireon Ventures, JSR, Karnataka Information Technology Venture Capital Fund, Rebright Partners, Silicon Catalyst, StartupXseed Ventures, Whiteboard Capital, iLabs

Spring 2023

Altizon

ALTIZON

Description:	Altizon's Datonis Digital Factory provides a suite of readymade applications that digitize critical aspects of manufacturing operations. It helps quickly modernize connected factory operations, asset performance and launch new offerings. The company also provides both IoT consulting and implementation services.
Category:	IIoT platform and applications
Founded:	2013
Location:	Scotts Valley, CA. Pune, India
Total Funding:	$11.60 million
No. of employees:	53
Investors:	Infuse Ventures, Lumis Partners, Microsoft for Startups, Persistent Systems, Pi Ventures, TVS Motor Company, The Hive, Wipro Ventures

Ambient Scientific

ambient scientific
The AI Processor Company

Description:	Ambient Scientific is a developer of digital-analog artificial intelligence technology designed to enable embedded AI applications in Edge and endpoint computers without the need for connection to the Internet and Cloud. The company's technology is based on an AI processor that is built with multiple innovations, enabling customers with ultra-low power on-chip interconnect technology for massively parallel processing.
Category:	Artificial Intelligence & Machine Learning, Big Data, Internet of Things, SaaS
Founded:	2017
Location:	Santa Clara, CA
Total Funding:	$10 million
No. of employees:	60
Investors:	Not disclosed

ANAFLASH

ANAFLASH

Description:	ANAFLASH is a semiconductor technology startup developing a brain-inspired processor for energy-efficient edge computing. The company's platform provides a standard logic-based non-volatile neuromorphic processor integrating computation in memory, mimicking a brain that conducts computation efficiently thereby enabling hardware and software engineers to develop a single AI chip for cost-effective edge devices that are not necessarily connected to the cloud for computation all the time.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2017
Location:	Sunnyvale, CA
Total Funding:	$1.76 million
No. of employees:	10
Investors:	Berkeley SkyDeck, Bluepoint Partners, C&Venture Partners, Lotte Ventures, Mirae Asset Venture Investment, National Science Foundation, United States Department of Defense, We Ventures

Anagog

ANAGOG

Description:	Anagog's Edge AI engine interprets smartphone sensor data and converts them into insights about the user's behavior, habits and preferences in the real-world, so companies can create highly effective marketing campaigns and tailor-made personal engagements that significantly increase consumer experience and loyalty. Using on-device machine learning, marketers can specify the conditions of the engagement based on the current or predicted activities of their target audience.
Category:	Artificial Intelligence & Machine Learning, Big Data, Mobile, Marketing Tech, SaaS
Founded:	2010
Location:	Tel Aviv, Israel
Total Funding:	$28.12 million
No. of employees:	52
Investors:	AccelerAsia, Continental Venture Capital, Escavel Capital, GigPeak, IN Venture, Ivy Capital, Mercedes-Benz Group, MizMaa Ventures, Porsche, Porsche Ventures, Spinach Angels, Startupbootcamp, Sumitomo Corporation, The Bridge by Coca-Cola, Union Tech Ventures, Škoda Auto Polska

AONdevices

AONdevices

Description:	AONDevices is a fabless semiconductor company specializing in application-specific edge AI processors with high accuracy at ultra-low power. The company's solutions include ML chips, algorithms, tool suites and training services. Customers can quickly add new AI-driven audio capabilities and multi-sensor fusion in devices such as smartphones, earbuds, smart remote controls, security cameras and more.
Category:	Artificial Intelligence & Machine Learning, Big Data, Manufacturing
Founded:	2018
a:	Irvine, CA
Total Funding:	ND
No. of employees:	20
Investors:	EvoNexus

Aperio Systems

APERIO

Description:	Aperio Systems is a developer of industrial data integrity solutions designed to ensure sensor data integrity across the entire industrial network. The company's system automatically validates operational data to improve data accuracy, security, and value, allowing for better based on real-time, data
Category:	Artificial Intelligence & Machine Learning, Big Data, Cybersecurity
Founded:	2017
Location:	Boston, MA
Total Funding:	$13.30 million
No. of employees:	28
Investors:	Data Point Capital, Doron Bergerbest-Eilon, EDP Energias de Portugal, EDP Ventures, Free Electrons, Jump Capital, National Grid Partners, Scopus Asset Management, Scopus Ventures, Soundproof Ventures

Arundo Analytics

ARUNDO

Description:	Arundo Analytics provides cloud-based and edge-enabled software for the deployment and management of enterprise-scale industrial data science solutions. Arundo's software allows industrial companies and other organizations to increase revenue, reduce costs and mitigate risks through machine learning and other analytical solutions that connect industrial data to advanced models and connect model insights to business decisions.
Category:	IIoT, AI/ML, SaaS
Founded:	2015
Location:	Houston, TX. Palo Alto, CA. Oslo, Norway.
Total Funding:	$50.10 million
No. of employees:	47
Investors:	Alliance Venture, Arctic Securities, Brillio Technologies, Canica, Nordic Innovation House, Northgate Capital, OpenX, Plug and Play Tech Center, StartX (US), Stokke Industri, Strømstangen, Sundt, TRK Group

Augury

Description:	Augury's Machine Health solutions combine IoT sensors with AI technology and human reliability experts to predict and prevent industrial machine failures and improve machine performance. In July 2019, Augury acquired Alluvium (real-time machine insights) for an undisclosed sum, and in May 2022, it went on to acquire Seebo (AI-based process intelligence solutions) for $140 million.
Category:	Predictive maintenance, Industrial Analytics, IIoT, AI
Founded:	2014
Locations:	Haifa, Israel. New York, NY
Total Funding:	$ 294.00 million
No. of employees:	409
Investors:	Baker Hughes, Demarest, Eclipse Ventures, First Round Capital, Formation 8, Insight Partners, La Maison Partners, Lambert Media Group, Lerer Hippeau, Munich Re Ventures, Pritzker Group Venture Capital, Qualcomm Ventures, Qumra Capital, SE Ventures, Schneider Electric, Sound Ventures, The Hartford Steam Boiler and Insurance

Automotus

Automotus

Description:	Automotus is a developer of community management platform designed to portray the value that the camera network provides. The company's platform equips cities and universities with parking, traffic, and security services powered by their advanced machine vision technology, enabling communities with optimized parking management, improved traffic flow, and additional means for maintaining public safety.
Category:	Artificial Intelligence & Machine Learning, Internet of Things, Mobility Tech
Founded:	2017
Location:	Camarillo, CA
Total Funding:	$17.89 million
No. of employees:	24
Investors:	Bridge Investments, E8, EFO Ventures, Emerging Ventures, H/L Ventures, IrishAngels, Keiki Capital, Los Angeles Cleantech Incubator, New York Angels, Quake Capital, SUM Ventures, Techstars, Unbridled Ventures

Avassa

![avassa logo]

Description:	Avassa is a developer of a distributed edge clouds management platform designed to enable edge cloud providers to manage and monetize modern software applications at the network edge. The company's platform offers features such as autonomous execution and control of container applications in micro-data centers, deep operational observability of running applications and workloads. Avassa helps infrastructure and operations teams deploy and monitor container applications across massively distributed locations.
Category:	Big Data, CloudTech & DevOps
Founded:	2020
Location:	Stockholm, Sweden
Total Funding:	$6.83 million
No. of employees:	24
Investors:	Fairpoint Capital, Industrifonden

Axelera

![AXELERA ARTIFICIAL INTELLIGENCE logo]

Description:	Axelera is a developer of a hardware and software platform for AI designed to deliver extremely high performance at a power envelope of few watts and flexibility to support multiple networks. The company's platform integrates a custom dataflow architecture with multicore in-memory computing, enabling users to minimize power consumption to deliver edge applications.
Category:	Artificial Intelligence & Machine Learning, Big Data, CleanTech, SaaS
Founded:	2019
Location:	Netherlands
Total Funding:	$50.23 million
No. of employees:	100
Investors:	BitFury, Federal Holding and Investment Company, Imec, Innovation Industries (Amsterdam), imec.xpand

Balena

![balena logo]

Description:	Using Linux containers and other modern cloud technologies, Balena enables developers to quickly and easily build fleets of connected IoT devices. The Balena ecosystem provides tools that enable edge developers to adopt a container-based Web-like development workflow, in which applications and supporting pieces reside inside Docker containers, managed by the BalenaEngine.
Category:	IoT, DevOps, Containers
Founded:	2013
Location:	Seattle, WA
Total Funding:	$35.12 million
No. of employees:	88
Investors:	Aspect Ventures, Big Pi Ventures, Ericsson Ventures, Global Brain, KDDI Ventures Program, OpenFund, OpenView Venture Partners, SORACOM, Startup Autobahn, Teslaura Networks, Threshold Ventures

Barbara IoT

barbara

Description:	Barbara IoT is the developer of a cybersecurity platform designed for the industrial internet of things. The company's platform acquires data from different sources, both from existing legacy equipment and new sensors and connects that data with different remote systems.
Category:	Internet of Things, IIoT, Cybersecurity
Founded:	2016
Location:	Bilbao, Spain
Total Funding:	$3.73 million
No. of employees:	38
Investors:	Arrowhead Tools, BIND 4.0, Basque Venture Capital Management, Caixa Capital Risc, Centro para el Desarrollo Tecnológico Industrial, European Union, GoHub Ventures, Iberdrola - Perseo, Innolab, L Marks, Seed Capital Bizkaia

Blaize

blaize™

Description:	Blaize is a developer of technologies designed to make AI broadly accessible to enterprises and people. The company's technologies include GSP computing architecture that can provide machine intelligence in an array of applications including mobile devices, self-driving cars, computers, and robotics, enabling businesses to reduce edge AI application deployment complexity, time, and cost.
Category:	Artificial Intelligence & Machine Learning, Mobility Tech, SaaS, TMT
Founded:	2010
Location:	El Dorado Hills, CA
Total Funding:	$174.00 million
No. of employees:	250
Investors:	A&E Investments, Denso, Denso International America, Franklin Templeton, GGV Capital, Intercept Ventures, Magna International, Mercedes-Benz Group, Mirai Creation Capital, Nsitexe, SGInnovate, SPARX Group Company, SRI Capital, Samsung Catalyst Fund, TLG Capital Management, Temasek Holdings, Wavemaker Partners

Blues Wireless

blues wireless

Description:	Blues Wireless is a developer of a system-on-module device intended to make people and businesses get access to the cellular Internet of Things. The company's platform provides a device-to-cloud data module that reduces the complexity of building connected technologies with secure, reliable cellular, enabling software developers to configure and manage fleets and firmware and route data to any third-party cloud application in a simplified way.
Category:	Internet of Things, Mobile
Founded:	2018
Location:	Boston, MA
Total Funding:	$65.16 million
No. of employees:	50
Investors:	Cascade Investment Fund, Four Rivers Group, Northgate Capital, Positive Sum, Qualcomm, Sequoia Capital, XYZ Venture Capital

Blyncsy

Description:	Blyncsy uses AI and machine learning to deliver intelligence to improve safety and efficiency of traffic and transportation networks. The Payver product uses machine vision to build a digital twin of the real-world using dash cams and satellite imagery to assess and analyze the condition of infrastructure on or along the roadside. These solutions reduce the costs of data collection, improving accuracy and allowing for the extension of the life cycle of public road assets.
Category:	Smart cities, Artificial Intelligence & Machine Learning, Big Data
Founded:	2015
Location:	Salt Lake City, UT
Total Funding:	$5.66 million
No. of employees:	13
Investors:	EPIC Ventures, Elemental Excelerator, Gaingels, Kickstart Seed Fund, Lindsay, Oakhouse Partners, Park City Angels, Pelion Venture Partners, Peterson Partners, Service Provider Capital, Utah Science Technology and Research Initiative, VentureCapital.org

Brainchip

Description:	BrainChip offers edge AI on-chip processing and learning solutions for connected cars, consumer electronics, and industrial IoT. The company's neuromorphic processor mimics the human brain to analyze only essential sensor inputs at the point of acquisition. By keeping machine learning local to the chip, independent of the cloud, reduces latency while improving privacy and data security.
Category:	Artificial Intelligence & Machine Learning
Founded:	2011
Location:	Aliso Viejo, CA
Total Funding:	$25.24 million
No. of employees:	63
Investors:	Aziana, LDA Capital, ASX:BRN

Bright Machines

Description:	The company's software leverages artificial intelligence, machine learning, and production data to develop robots that are sensor-rich, have computer vision, and are adaptable, enabling clients to have improved yields at lower costs.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Robotics and Drones
Founded:	2018
Location:	San Francisco, CA
Total Funding:	$376.00 million
No. of employees:	500
Investors:	BAM Elevate, BMW i Ventures, EDBI, Eclipse Ventures, Flex (Singapore), Geodesic Capital, Lux Capital

Budderfly

Description:	Budderfly is the developer of energy management systems designed to maximize energy savings. The company combines energy intelligence software, efficiency upgrades and analytics to create networks of IoT devices that meter and report on energy use, enabling clients to optimize energy usage and realize a reduced carbon footprint.
Category:	Internet of Things, SaaS, Smart grid
Founded:	2007
Location:	Shelton, CT
Total Funding:	$86.68 million
No. of employees:	136
Investors:	Balance Point Capital, Connecticut Innovations, Partners Group, State of Connecticut

Canvass AI

Description:	Canvass AI is a developer of automation software designed to empower the industrial workforce using AI. The company's software helps in day-to-day operations, transforms data into insights with data discovery, data visualization, and augmented data exploration capabilities, to improve production yield and energy efficiency.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2016
Location:	Toronto, Canada
Total Funding:	$25.16 million
No. of employees:	46
Investors:	BDC Capital, Bedrock Industries, Canada Economic Development for Quebec Regions, Creative Destruction Lab, Export Development Canada, Government of Canada, Gradient Ventures, OneEleven, Real Ventures, Viaduct Ventures, Yamaha Motor Ventures & Laboratory Silicon Valley

Celestial AI

Description:	Celestial AI is an AI-accelerator company with a proprietary hardware and software platform for machine learning chipsets. The company's technology combines the advantages of photonics, mixed-signal ASICs, and advanced packaging to offer a sustainable improvement in computing performance, enabling clients to deliver superior AI acceleration hardware and software alternatives.
Category:	Artificial Intelligence & Machine Learning
Founded:	2020
Location:	Santa Clara, CA
Total Funding:	$63.87 million
No. of employees:	44
Investors:	Canaan Partners, Fitz Gate Ventures, Koch Disruptive Technologies, M Ventures, Temasek Holdings, The Engine, Tyche Partners, Xora Innovation, imec.xpand

Cerebras Systems

Description:	Cerebras is a developer of computing chips designed for accelerating AI. The company's chips offer compute cores, tightly coupled with memory for efficient data access, and an extensive high bandwidth communication fabric for groups of cores to work together, enabling users to accelerate artificial intelligence by orders of magnitude beyond the current state of the art.
Category:	Artificial Intelligence & Machine Learning
Founded:	2016
Location:	Sunnyvale, CA
Total Funding:	$723.00 million
No. of employees:	434
Investors:	10X Capital, A&E Investments, Abu Dhabi Growth Fund, Alpha Wave Global, Altimeter Capital Management, Benchmark (San Francisco), Coatue Management, , Eclipse Ventures, Empede Capital Partners, Fabrica Ventures, Foundation Capital, Gaingels, Group 42, Hemisphere Ventures, In-Q-Tel, Invicta Ventures, Moore Strategic Ventures, Scale-Up Venture Capital, Section Partners, Snow Fox Partners, Vy Capital, Warner Leedy, West Coast Equity Partners

Ceremorphic

Description:	Ceremorphic is a manufacturer of an ultra-lower power supercomputing chip designed to solve high-performance computing needs. The company's chips can be used for a wide range of markets and applications including datacenter, AI training, supercomputing, automotive, robotics, and metaverse processing, enabling clients to have reliability, security, and power consumption at scale.
Category:	Artificial Intelligence & Machine Learning, Manufacturing
Founded:	2020
Location:	San Jose, CA
Total Funding:	$50.00 million
No. of employees:	150
Investors:	Not disclosed

Chooch

Description:	Chooch AI is a developer of an artificial intelligence (AI) visual recognition training platform designed to deliver accurate computer vision for any spectrum of visual data. The company's platform is autonomous and can process any visual data, from infrared radiation (IR) sensors and x-rays to apps and live video feeds while tagging objects of interest, enabling businesses to drive smooth efficiencies and proper quality results.
Category:	Artificial Intelligence & Machine Learning
Founded:	2015
Location:	San Mateo, CA
Total Funding:	$24.60 million
No. of employees:	74
Investors:	212, Alumni Ventures, EQUIAM, FinTech Angels by ITB Ventures, Founders Space, National Geospatial-Intelligence Agency (NGA), Next Ventures, Platform XIT, Sand Hill Angels, Streamlined Ventures, Vickers Venture Partners, Wing Wok

Clearblade

CLEARBLADE
We Connect the Things.

Description:	ClearBlade offers IoT cloud and Edge solutions that enable companies to process data in real-time and at extreme scale. The company provide a consistent platform across the Edge, cloud, and on-premises environments and supports connecting millions of assets across multiple industries including energy, transportation, and industrial.
Category:	IoT, IIoT
Founded:	2007
Location:	Austin, TX
Total Funding:	$17.20 million
No. of employees:	32
Investors:	Align Capital, Capital Factory, Central Texas Angel Network, Corsa Ventures, Equipo Ventures, Hypergiant Ventures, Ingram Micro, Phunware, Purdue Ventures, Sumitomo Corporation

CoCoPie

CoCoPIE

Description:	CoCoPIE's solutions enable real-time AI for off-the-shelf mobile and IoT devices through its proprietary AI model compression-compilation co-design technology. The company's products significantly improve the AI device time-to-market deployment and reduce development costs.
Category:	Artificial Intelligence & Machine Learning, Internet of Things, Manufacturing, Mobile
Founded:	2020
Location:	Palo Alto, CA
Total Funding:	$10.60 million
No. of employees:	13
Investors:	Monad Ventures, National Science Foundation, Sequoia Capital China

Cognite

COGNITE

Description:	Cognite is a developer of data management platforms built for industries like oil and gas, shipping, manufacturing, and power and utilities. The company's platform offers OT and IT data contextualization, production with automated data delivery, case data, and data models enabling industrial customers to harness the potential of advanced analytics, deploy algorithms and build customized applications.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2016
Location:	Lysaker, Norway
Total Funding:	$225.00 million
No. of employees:	656
Investors:	Accel, California Energy Commission, Saudi Aramco, TCV, TRK Group

Cogniac

Description:	Cogniac's AI-powered computer vision solutions enable extraction of specific intelligence from visual data. Cogniac's no-code, enterprise-class platform delivers the latest in deep neural network technology and is deployed across a wide spectrum of industries and applications to maximize performance of visual tasks.
Category:	Artificial Intelligence & Machine Learning
Founded:	2015
Location:	San Jose, CA
Total Funding:	$40.13 million
No. of employees:	50
Investors:	Autotech Ventures, Cisco Investments, Energy Innovation Capital, George Kaiser Family Foundation, Gradient Ventures, London Technology Club, National Grid Partners, Plug and Play Tech Center, SAP.iO, Shield Capital, Vanedge Capital, Wing Venture Capital

Cohda Wireless

Description:	Cohda Wireless offers Connected Vehicles and Connected Autonomous Vehicle software with proven applications for Smart City, mining and other environments. The company's technology connects vehicles with infrastructure and pedestrians to make streets, cities and working environments safer, smarter and greener.
Category:	Advanced Manufacturing, Autonomous cars, Internet of Things, Industrials, Mobility Tech
Founded:	2004
Location:	Australia
Total Funding:	$10.0 million
No. of employees:	42
Investors:	Cisco Investments, Epicorp, Itek, M-Group, NXP Semiconductors, South Australian Government, UniSA Ventures, University of Central Florida Business Incubator, University of South Australia Endowment

Cohere Technologies

Description:	Cohere Technologies is a developer of spectrum multiplier software designed to enhance the performance of mobile and wireless networks. The company's software improves spectrum and user experience with channel detection, estimation, prediction, and precoding deployed within a standard-compliant 4th-generation, 5th-generation, or open cloud radio access networks.
Category:	Internet of Things, Mobile
Founded:	2010
Location:	San Jose, CA
Total Funding:	$138.46 million
No. of employees:	24
Investors:	AME Cloud Ventures, Altice, BCE, Big Basin Partners, Cablevision, ESO Fund, Intel Capital, Juniper Networks, Koch Strategic Platforms, Lightspeed Venture Partners, Macquarie Group, New Enterprise Associates, NexStar Partners, Presidio Ventures, Telstra Ventures, VMware

CoolR

Description: CoolR is a provider of in-store inventory management systems intended for brands and retailers. The company's solution automates inventory monitoring and labor optimization using a combination of wireless cameras, sensors, and a cloud-based image processing platform, enabling clients to increase efficiency and sales.

Category: IoT, Retail

Founded: 2017

Location: Chantilly, VA

Total Funding: $12.79 million

No. of employees: 17

Investors: 2048 Ventures, Entrepreneurs Roundtable Accelerator, First Analysis, Moneta Ventures, New York Angels, Remarkable Ventures

Copia Automation

Description: Copia Automation delivers modern developer tools for industrial automation. The Company's Git-based source control solution for PLCs streamlines workflows for faster delivery and maximized uptime.

Category: IIoT

Founded: 2020

Location: New York, NY

Total Funding: $16.20 million

No. of employees: 32

Investors: Construct Capital (Washington DC), Ironspring Ventures, L2 Venture, Lux Capital

Cosmo Tech

Description: Cosmo Tech provides a 360° Simulation Digital Twin platform to solve complex industrial problems. Industrial companies rely on Cosmo Tech to predict the evolution of their organization and to better understand the impact of their decisions and optimize all levels of enterprise planning.

Category: Digital twin

Founded: 2010

Location: France

Total Funding: $29.26 million

No. of employees: 86

Investors: Accenture Ventures, Aster Capital, BNP Paribas Développement, Cathay Innovation, Cemag Invest, Crealys, Crédit Agricole Finistère, Inven Capital, SaaS Lander, Sofimac Investment Managers, TotalEnergies Ventures, UI Investissement

Crosser Technologies

crosser

Description:	Crosser offers streaming analytics and integration software designed to provide an edge, on-premise or cloud architecture. The company's platform provides real-time analytics and decision-making capabilities for data from IoT sensors and devices, enabling enterprises in the healthcare, industrial IoT, and smart building industries to reduce cloud services and bandwidth costs. Crosser Flow Studio, the company's visual design tool that enables teams to innovate faster without developers.
Category:	IoT platform, Integration tools
Founded:	2016
Location:	Stockholm, Sweden
Total Funding:	$8.65 million
No. of employees:	22
Investors:	42CAP, Almi Invest, Bizmaker, Industrifonden, Montan-Ventures-Saar, NTT Docomo Ventures, Norrlandsfonden, Spintop Ventures

Cumulus Digital Systems

Cumulus
DIGITAL SYSTEMS

Description:	Cumulus Digital Systems is a connected worker IoT platform designed to manage end-to-end workflows. The company's platform collects and structures data from digitally enabled tools to verify the quality and duration of a task for real-time assurance and progress tracking, enabling businesses to deliver step-change improvements in facility safety, productivity, and work quality.
Category:	Construction Technology, Internet of Things
Founded:	2018
Location:	Cambridge, MA
Total Funding:	$12.50 million
No. of employees:	30
Investors:	Alumni Ventures, Brick & Mortar Ventures, GEC, Navigate Ventures, Shell Ventures

Cybus

Cybus

Description:	Cybus' Connectware provides a full and standardized data flow between shop floor and IT. As a Factory Data Hub, Connectware enables scalable data infrastructures and full shop floor connectivity to enable smart factories and Industry 4.0 projects.
Category:	Advanced Manufacturing, Internet of Things, TMT
Founded:	2015
Location:	Hamburg, Germany
Total Funding:	$ 9.0 million
No. of employees:	42
Investors:	Matterwave Ventures, Pfannenberg, PwC IIoT, Startup Autobahn, TechFounders, btov Partners

Datanomix

datanomix®

Description:	Datanomix is a developer of production management software designed to offer real-time data insight on discrete component manufacturing equipment. The company's software combines machine data streams to extend value beyond traditional data visualization and process productivity tools. They enable industrial manufacturers of any size to get access to decision-making tools and improve their production and profitability.
Category:	Big Data, Internet of Things
Founded:	2015
Location:	Nashua, NH
Total Funding:	$10.24 million
No. of employees:	32
Investors:	10X Venture Partners, Alumni Ventures, Argon Ventures, CEAS Investments, CRV, Gutbrain Ventures, John Flatley Company, Jtango VC, MassChallenge, Millworks Fund, Orbit Group (Manchester), PBJ Capital, Rines Angel Fund, Wasabi Ventures, Worcester Polytechnic Institute Endowment, York IE

Davra Networks

Davra

Description:	Davra provides an Industrial IoT platform that allows system integrators, product builders, OEMs, cities and end customers to define, build and rapidly bring to market industrial grade IoT applications on a single reliable, secure and scalable IoT platform. Davra's IIOT platform are available on both AWS and Azure Marketplace.
Category:	IIoT platform
Founded:	2010
Location:	Dublin, Ireland. Sunnyvale, CA.
Total Funding:	$5.01 million
No. of employees:	41
Investors:	Connecticut Innovations, Delta Partners, Enterprise Ireland, European Space Agency, Furthr VC, Investec Ventures, VentureClash

Deci

deci.

Description:	Deci is a developer of deep learning platform intended to build better artificial intelligence. The company's platform is powered by its Automated Neural Architecture Construction (AutoNAC) technology, an algorithmic optimization engine that squeezes maximum utilization out of any hardware. It contains a Neural Architecture Search (NAS) component that redesigns a given trained model's architecture to optimally improve its inference performance, enabling AI developers to build, optimize, and deploy faster and more accurate models for any environment, including cloud, edge or mobile.
Category:	Artificial Intelligence & Machine Learning, Big Data, SaaS
Founded:	2019
Location:	Israel
Total Funding:	$56.50 million
No. of employees:	50
Investors:	Emerge (Tel Aviv), Entrée Capital, Fort Ross Ventures, ICON (Palo Alto), Insight Partners, Intel Ignite, Jibe Ventures, Samsung NEXT Ventures, Square Peg Capital, Target Global, Vintage Investment Partners

Deeplite

Deeplite

Description:	Deeplite is a developer of optimization software designed to make deep learning and artificial intelligence technologies accessible and affordable. The company's software leverages a novel multi-objective design space exploration approach to automatically optimize high-performance DNN models, creating compact, high-performance deep neural networks for deployment on edge devices such as cameras, sensors, drones, phones, and vehicles.
Category:	Artificial Intelligence & Machine Learning
Founded:	2018
Location:	Montreal, Canada
Total Funding:	$6.47 million
No. of employees:	33
Investors:	BDC Industrial, Clean and Energy Technology Venture Fund, Blackberry, Desjardins Capital, Differential Ventures, Innospark Ventures, L-SPARK, PJC, Somel Investments, TandemLaunch

Dianomic

DIANOMIC

Description:	Dianomic is a developer of open-source platform designed to simplify IoT data. The company's platform uses a modular microservices architecture including sensor data collection, storage, processing and forwarding to historians, enterprise systems and cloud-based services, enabling users to build better IoT edge systems easily, faster and at cheaper rates.
Category:	Internet of Things, SaaS
Founded:	2017
Location:	Menlo Park, CA
Total Funding:	ND
No. of employees:	11
Investors:	OSIsoft

Drishti

DRISHTI

Description:	The company's technology automatically digitizes human actions inside the factory to create a massive new dataset, enabling manufacturers to get the benefit of digital transformation while simultaneously making line workers competitive against automation.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, SaaS
Founded:	2016
Location:	Montain View, CA
Total Funding:	$37.25 million
No. of employees:	179
Investors:	Alpha Intelligence Capital, Andreessen Horowitz, Benhamou Global Ventures, Emergence Capital Partners, Hella Ventures, Kauffman Fellows, Micron Ventures, National Science Foundation, Presidio Ventures, SRI Ventures, Sozo Ventures, Toyota Ventures

DynamoFL

Description:	DynamoFL enables machine learning teams to train personalized ML models without collecting personal user data. Our customers leverage our personalized federated learning solution to boost their model performance on diverse and real-world data, while slashing data transfer and privacy-compliance costs.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2021
Location:	San Francisco, AC
Total Funding:	$4.65 million
No. of employees:	4
Investors:	Basis Set Ventures, Global Founders Capital, Nexus Venture Partners, Soma Capital, Y Combinator

EasyAerial

Description:	EasyAerial is a developer of a smart aerial monitoring system designed for perimeter security. The company's system consists of lightweight drones that can carry various payloads for extended flight time, a mobile and self-sustaining ground base station that charges and provides comprehensive weather protection, and a fleet management software that delivers live and thermal video feed, enabling clients to monitor data in real-time.
Category:	Artificial Intelligence & Machine Learning, Internet of Things, Mobile, Robotics and Drones
Founded:	2014
Location:	New York, NY
Total Funding:	$10.96 million
No. of employees:	100
Investors:	Founder Institute, FutureWorks Innovative Engineering, Marlin NY, TI-Caveret

Edge Impulse

Description:	Edge Impulse is a developer of machine learning (ML) development platforms. The company's solutions make the process of building, deploying, and scaling embedded ML applications easier and faster, enabling developers to create intelligent devices through an easy collection of real sensor data, live signal processing from raw data to neural networks, testing, and deployment to any target device.
Category:	Artificial Intelligence & Machine Learning
Founded:	2019
Location:	San Jose, CA
Total Funding:	$54.35 million
No. of employees:	90
Investors:	Acrew Capital, Canaan Partners, Coatue Management, Fika Ventures, In-Q-Tel, Knollwood Investment Advisory, Liquid 2 Ventures, Momenta Ventures

EdgeDB

Description:	Conventional time-series databases exhibit low efficiency on edge nodes with limited resources for both computation and storage. EdgeDB improves the performances of both by inserting and retrieving data from ingest streams by efficiently merging multiple streams and optimizing the storage data structure concurrently.
Category:	SaaS
Founded:	2019
Location:	San Francisco, CA
Total Funding:	$19.00 million
No. of employees:	10
Investors:	Accel, GV, GitHub, ICONIQ Capital, International Business Machines, Liquid 2 Ventures, Nava Ventures (California), Netlify, OpenAI Startup Fund, Pear, SV Angel, Vercel

EdgeIQ

Description:	EdgeIQ helps organizations deploy applications and services onto edge computers and integrate their data with any cloud platform or application. The EdgeIQ platform offer device management, remote monitoring and orchestration software designed to help build innovative products at a lower cost and faster time to market.
Category:	IoT platform, Data tools
Founded:	2012
Location:	Boston, MA
Total Funding:	$12.19 million
No. of employees:	26
Investors:	Diebold Nixdorf, First Analysis, Koa Labs, Mathers Associates, Qualcomm Technologies International, Xchanging

Edgetensor

Description:	Edge Tensor is a developer of an artificial intelligence-based driver monitoring system designed to detect and alert distracted drivers. The company's system uses an artificial intelligence inference engine to monitor face tracking, head posture detection, emotion recognition, and gaze and iris tracking in real time, enabling drivers to have a safe driving experience.
Category:	Artificial Intelligence & Machine Learning, Big Data, Mobility Tech
Founded:	2018
Location:	Dallas, TX
Total Funding:	ND
No. of employees:	16
Investors:	Techstars, Capital Factory, SRI Capital, Aristos Ventures, 3Lines, Plug and Play Tech Center, National Science Foundation

Edgify

Edgify

Description:	Edgify is the developer of a training platform designed for creating and training deep learning and machine learning models. The Edgify platform lets companies train complete models, directly on their own edge devices without the need for any data transfer to the cloud, enabling clients with accuracy, data privacy, and security.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2014
Location:	London, UK
Total Funding:	$21.08 million
No. of employees:	27
Investors:	Banco Santander, Collider Accelerator, HBS Alumni Angels New York, Mangrove Capital Partners, Microsoft for Startups, Mouro Capital, Octopus Investments, Octopus Ventures, Seedrs, Sony Semiconductor Solutions, Telefónica, True., Wayra UK, Wekix, ZenInvest

Eigen Innovations

Eigen

Description:	Eigen's solutions help manufacturers manage scalable machine vision systems that enable AI and machine learning. Their platform is designed to leverage image data and correlate it to machine data to help manufacturers detect quality issues and prevent them from occurring. The underlying software includes CAD design tools, machine learning, big data analytics, cloud computing, and vision at the edge.
Category:	IIoT, Machine vision, AI
Founded:	2012
Location:	Toronto, Canada
Total Funding:	$13.18 million
No. of employees:	22
Investors:	Atlantic Canada Opportunities Agency, BDC Capital, C100, Celtic House Asia Partners, Cisco Systems, Creative Destruction Lab, East Valley Ventures, GCI Capital Toronto, Globalive Capital, Globalive Technology, Momenta Ventures, New Brunswick Innovation Foundation, Opportunities NB, Planet Hatch, PropelICT

Element Analytics

element

Description:	The company is a developer of industrial analytics software designed to make industrial data easy to use and turn into insights. The company's software process manages and integrates large volumes of data from a variety of sources including sensors, engineering, and operational systems, enabling industrial organizations to streamline their operations.
Category:	IIoT, Analytics, Data management
Founded:	2015
Location:	Tel Aviv, Israel. San Francisco, CA
Total Funding:	$53.16 million
No. of employees:	56
Investors:	ABB Technology Ventures, Activate Capital Partners, Ajax Strategies, Blue Bear Capital, Evonik Venture Capital, Forté Ventures, High Tide Foundation, Honeywell Ventures, Kerogen Digital Solutions, Kleiner Perkins, Mitsui & Company, Plug and Play Tech Center, SE Ventures

Elevat

Description:	Elevat is a developer of a cloud-based lifecycle management platform designed to deploy industrial IoT technology. The company's platform connects machinery to the cloud to build a virtuous cycle providing machine insight, predictive maintenance, and just-in-time parts supply, enabling machine operators, distributors, and manufacturers to leverage data to make real-time business decisions, reduce downtime and optimize productivity.
Category:	Advanced Manufacturing, Internet of Things, SaaS
Founded:	2015
Location:	Seattle, WA
Total Funding:	$16.05 million
No. of employees:	14
Investors:	D4 Investments, Emles Venture Partners, Gaingels, Keiretsu Forum

Encharge AI

Description:	EnCharge AI has designed a computer chip that leverages in-memory computing and allows AI to run locally, directly on the Edge device. The chip could cut costs and improve performance for robots in large-scale warehouses, in retail automation such as self-checkout, safety and security operations, and in drones for delivery and industrial purposes. The chips are programmable, capable of working with different types of AI algorithms, and scalable, enabling applications to grow in complexity.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2021
Location:	Santa Clara, CA
Total Funding:	$36.20 million
No. of employees:	25
Investors:	AlleyCorp, Alumni Ventures, Anzu Partners, E14 Fund Management, Schams Ventures, Scout Ventures, Silicon Catalyst Angels

ETA Compute

Description:	Eta Compute is the developer of a machine intelligence platform for vision sensors at the network edge. The company's platform offers a fully programmable low-power processor that supports neurotrophic machine learning and can run learning tasks efficiently, enabling customers to make their daily life safer, healthier, comfortable and convenient without sacrificing privacy and security.
Category:	Artificial Intelligence & Machine Learning, Big Data, Internet of Things
Founded:	2015
Location:	Sunnyvale, CA
Total Funding:	$33.38 million
No. of employees:	28
Investors:	A&E Investments, ABOV Semiconductor, Acorn Pacific Ventures, Celesta Capital, SK Telecom Americas, SKTA Innopartners, Synaptics, Walden International

Expedera

Description: Expedera is a developer of an AI inference accelerator internet protocol designed for gains in performance, power, and latency while reducing cost. The company provides scalable neural engine semiconductors, and pipelined architecture that runs neural network models natively, and simplifies the software stack, enabling businesses to increase their system performance and lower costs.

Category: Artificial Intelligence & Machine Learning, Robotics and Drones

Founded: 2018

Location: Santa Clara, CA

Total Funding: $27.00 million

No. of employees: 28

Investors: Sehat Sutardja, Weili Dai

Expeto

Description: Expeto is a developer of private mobile networking platform designed to help enterprises control and manage networks. The Company's platform provides the ability to control, secure, and coordinate all aspects of a connected business from operations and logistics to analytics and reporting, enabling enterprises to deploy connected devices globally within the security of their own private network without relying on third-party or untrusted methodologies.

Category: Internet of Things, SaaS

Founded: 2015

Location: Vancouver, Canada

Total Funding: $27.30 million

No. of employees: 49

Investors: 5G Open Innovation Lab, BDC Capital, Canadian Technology Accelerator, Dweep Chanana, Evok Innovations, IronGate Capital Advisors, Lavrock Ventures, Mistral Venture Partners, Momenta Ventures, Samsung NEXT Ventures, Sorenson Capital

Falkonry

Description: Falkonry enables predictive operations for companies seeking to improve the uptime, quality, and throughput of their operations. Falkonry's machine learning system enables operations teams to discover, explain and predict operational behaviors from time-series data, without requiring data scientists. The product can be deployed across the enterprise either on-premises, in the cloud or on the edge.

Category: Predictive Analytics, AI, IIoT, Defense

Founded: 2012

Location: Sunnyvale, CA

Total Funding: $14.16 million

No. of employees: 60

Investors: Basis Set Ventures, Fortive, Hypertherm Ventures, In-Q-Tel, L Marks, Next47, Plug and Play Tech Center, Polaris Partners, Presidio Ventures, Siemens, SparkLabs Group, Start Smart Labs, Stony Lonesome Group, Zetta Venture Partners

Femtosense

FEMTOSENSE

Description:	Femtosense is a developer of energy-efficient neural network models designed to bring large-scale neural network processing to the edge. The company's platform is to achieve cutting-edge performance-per-joule on complex processing tasks using nonlinear dynamics and space-time sparsity inspired by biological neural networks, enabling user interfaces to have ultra-low latency, power consumption, and complete user privacy.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2018
Location:	San Bruno, CA
Total Funding:	$9.12 million
No. of employees:	12
Investors:	Amino Capital, Fine Structure Ventures, Gaingels, Kleiner Perkins, Quest Venture Partners, SV Pacific Ventures, Sand Hill Angels, Vanedge Capital

Fermata Energy

Fermata Energy

Description:	Fermata Energy's chargers use V2X technology to turn electric vehicles into energy storage assets. The Company's solutions enable utilities to enhance grid resilience and deploy renewable energy resources quickly by integrating EVs as a grid resource.
Category:	Climate Tech, CleanTech, Mobility Tech
Founded:	2010
Location:	Charlesville, VA
Total Funding:	$56.57 million
No. of employees:	44
Investors:	ClearSky, Google for Startups Accelerator, Hampstead Park Capital Management, I Squared Capital, Skyview Ventures, TEPCO Ventures, The Carlyle Group, Tobacco Region Revitalization Commission, Verizon Ventures

Flex Logix

flexlogix
AI + eFPGA

Description:	Flex Logix is the developer of a semiconductor IP and software designed to embed field-programmable gate arrays (FPGAs) of any size in an integrated circuit. The Flex Logix InferX AI acceleration technology is designed to provide acceleration of AI applications at the Edge of the Internet.
Category:	TMT
Founded:	2014
Location:	Mountain View, CA,
Total Funding:	$85.00 million
No. of employees:	53
Investors:	Eclipse Advisors, Eclipse Ventures, Formation 8, GRIDS Capital, Lux Capital, Mithril Capital Management, Tate Family Trust

Flutura Business Solutions

Flutura

Description:	Flutura is the developer of an industrial IoT platform designed to analyze data for industrial machinery companies. The company's platform helps to monitor industrial assets and operational efficiency and create new revenue models around remote monitoring of assets and advanced analytics. Flutura's AI Platform is currently tuned for IIoT in Oil & Gas, Specialty Chemicals, and Heavy machinery manufacturing industries.
Category:	IIoT platform,
Founded:	2012
Location:	Bangalore, India. Houston, TX. Tokyo, Japan.
Total Funding:	$8.90 million
No. of employees:	141
Investors:	Hitachi, KAAJ Ventures, Lumis Partners, Microsoft for Startups, TechSparks Accelerator, The Hive, Vertex Ventures Southeast Asia & India

Fourkites

FOURKITES

Description:	Fourkites is a developer of a predictive supply chain platform intended to track the shipment location and proactively manage exceptions. The company's platform predicts when shipments will arrive at scheduled stops, monitors load temperatures, and processes actionable supply chain data from trucks and trailers to cargo ships, thereby enabling businesses to lower their operating costs, improve on-time performance, and strengthen their customer relationships.
Category:	Mobility Tech, SaaS, Supply Chain Tech, TMT
Founded:	2014
Location:	Chicago, IL
Total Funding:	$292.05 million
No. of employees:	654
Investors:	Atlas Innovate, August Capital, Bain Capital Ventures, Barton Technology Ventures, Bluestein Ventures, CEAS Investments, Expanding Capital, FedEx, Harvard Business School Alumni Angels of Chicago, Hyde Park Angels, Hyde Park Venture Partners, Lincoln Park Capital, Luke Friendshuh-work, Mitsui & Company, Otter Capital, Pine Grove Holdings, Pritzker Group Venture Capital, Qualcomm Ventures, SkyDeck, Slojo Investments, Tensility Venture Partners, Thomas H. Lee Partners, Volvo Group Venture Capital AB, Zebra Technologies, Zebra Ventures

FreeWave Technologies

FREEWAVE

Description:	FreeWave Technologies is a designer and manufacturer of wireless data radios. The company's IIoT Connectivity and EDGE Solutions solve customers' problems in government/defense, energy, agriculture, and municipalities – achieve reliable connectivity for data telemetry and command and control in some of the most challenging, remote and rugged environments in the world.
Category:	Wireless, IIoT, Internet of Things
Founded:	1993
Location:	Boulder, Colorado
Total Funding:	$160.00 million
No. of employees:	101
Investors:	TA Associates

GenXComm

Description:	GXC has developed a mesh based end-to-end, enterprise 5G solution to meet the emerging communications needs of enterprise and Industry 4.0 customers. GXC's technology delivers easy to deploy, fully secure and scalable connectivity using proprietary mesh-based technology.
Category:	TMT
Founded:	2016
Location:	Austin, TX
Total Funding:	$28.50 million
No. of employees:	109
Investors:	A&E Investments, Azure Capital Partners, BMW i Ventures, Bandgap Ventures, Capital Factory, Facebook Community Accelerator, Flohr Asset Management, Intel Capital, MOTIVE Companies, National Science Foundation, Plug and Play Tech Center, The Raine Group, The University of Texas at Austin Endowment, UT Horizon Fund, United States Department of Defense

GrAI Matter Labs

Description:	GrAI Matter Labs is a developer of programmable neuromorphic computing chips designed to bring sensor analytics and machine learning to every device on the edge. The company's technology utilizes brain-inspired neural network architecture to overcome the limitations of traditional Von Neumann machines and application processors as well as offers multi-modal sensor analytics and dynamic machine learning at low power levels, enabling users to navigate the world with performance-to-power optimized AI for safety and convenience.
Category:	Artificial Intelligence & Machine Learning
Founded:	2016
Location:	France
Total Funding:	$29.00 million
No. of employees:	50
Investors:	360 Capital, 3T Finance, Bpifrance, Celeste Management, iBionext

Greenbird

Description:	Greenbird offers a cloud-native big data integration platform, purpose-built for the digital data-driven utility, offered as a managed service (iPaaS). Their Utilihive product offers secure data lake storage and real-time data exchange between the OT/ IT domains and Edge Computing so users can perform faster real-time analytics, cut costs and reduce the need for internet access at distributed asset locations.
Category:	iPaaS platform, utilities, Smart meters
Founded:	2010
Location:	Oslo, Norway
Total Funding:	$11.40 million
No. of employees:	52
Investors:	ETF Partners, EnBW New Ventures, Future Energy Ventures, Horizon 2020 SME Instrument, Innogy Innovation Hub, Nysno Climate Investments, Vanant

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Greenwaves

GREENWAVES
TECHNOLOGIES

Description:	Greenwaves is a manufacturer of fabless semiconductors of ultra-low power AI/DSP processors intended to revolutionize intelligent sensors, wearables, and devices. The company's products include semiconductors that provide an ultra-low-power computing service for edge devices carrying out inference from multiple, content-rich sources such as images, sounds, and motions.
Category:	Artificial Intelligence & Machine Learning
Founded:	2014
Location:	France
Total Funding:	$11.69 million
No. of employees:	49
Investors:	Agder Næringsselskap, French Ministry of Education Nationale, Enseignement Supérieur et de la Recherche, Horizon 2020 SME Instrument, Soitec, Zepp Health

Grid4C

Grid4C
Foreseeing Power

Description:	Grid4C is the developer of predictive energy analytics software for utilities. The company provides predictive analytics software services based on proprietary machine learning big-data algorithms for energy power stations, utilities, traders, distributors, grid operators, retailers and consumers.
Category:	AI, ML, Predictive nalytics, Smart grid
Founded:	2012
Location:	Herzliya, Israel. HQ: Austin, TX.
Total Funding:	$12.50 million
No. of employees:	14
Investors:	Alectra, Axess Ventures, Engie, MoreVC, Silverhorn Investment Advisors, iAngels

Guardhat

GUARDHAT

Description:	Guardhat is the developer of connected frontline worker platform, wearables, infrastructure, and software designed to provide a safer and more productive work environment in hazardous work environments. The company offers advanced proprietary software with a variety of owned and third-party wearable devices to proactively monitor a user's location, health, and work environment and collects and analyzes on-the-job data through its software platforms, enabling clients to improve industrial worker safety and ease frontline work.
Category:	Advanced Manufacturing, Internet of Things, Industrials, Manufacturing, Oil & Gas, Wearables & Quantified Self
Founded:	2014
Location:	Detroit, MI
Total Funding:	$40.00 million
No. of employees:	65
Investors:	3M Ventures, Alumni Ventures, Annox Capital, Augment Ventures, Barton Malow, Blue Collective, Caterpillar Ventures, Detroit Venture Partners, Durable Capital Partners, General Catalyst, Huron River Ventures, Mesh Ventures, RTP Global, Revolution/ROTR, SAP.iO, SKS Ventures, Sallyport Investments, Silicon Valley Bank, frogVentures

Gyrfalcon Technology

Description:	Gyrfalcon Technology is a developer of artificial intelligence processors designed to expand the power of cloud-based AI to local devices with better performance and efficiency. The company's processors and semiconductors eliminate the power-consuming data movement and memory bottlenecks, enabling hardware companies to transform the complexities of artificial intelligence and neural computing hardware into a simple platform by improving performance through efficiency.
Category:	Artificial Intelligence & Machine Learning
Founded:	2017
Location:	Milpitas, CA
Total Funding:	$68.00 million
No. of employees:	25
Investors:	LG Electronics, Sailing Capital, V-Capital

Hailo

Description:	Hailo is a developer of AI-based microprocessors designed to deliver data-center performance to edge devices. The company's processor fits into embedded devices to process high-resolution video and other high-throughput streams in real-time using deep-learning algorithms, enabling clients to offer products operating at low power consumption, size and cost and provide privacy and optimize performance for smart devices.
Category:	Augmented Reality, Artificial Intelligence & Machine Learning, Big Data
Founded:	2017
Location:	Tel Aviv, Israel
Total Funding:	$221.17 million
No. of employees:	176
Investors:	ABB Technology Ventures, Asi Shmeltzer, Astarc Ventures, Automotive Equipment, Carasso Motors, Comasco, Dancap Family Investment Office, Delek Automotive Systems, Delek Motors, Glory Ventures, Horizon 2020 SME Instrument, Latitude Ventures (London), Maniv Mobility, Microtech Ventures, NEC Corporation, Next Gear Solutions, NextGear Ventures, OurCrowd, Poalim Equity, Shlomo Group, Talcar Group, Zohar Zisapel

HarperDB

Description:	HarperDB is a distributed database and development platform that faster and more flexible than last-generation alternatives. The company's software is a geo-distributed database with hybrid SQL and NoSQL functionality that can be deployed anywhere from the cloud to the edge for real-time analytics.
Category:	Edge DB
Founded:	2017
Location:	Denver, CO
Total Funding:	$8.73 million
No. of employees:	18
Investors:	Break Trail Ventures, Service Provider Capital

Hazelcast

Description:	Hazelcast's offers an in-memory-optimized solution for storing and processing data at any scale. Because it can run at the edge, out in the physical world, and in public/private clouds and data centers, it creates a common layer of data and insights. The Hazelcast Platform brings intelligence through fast ingest and analytics to edge devices. The company has teamed up with IBM's Watson to deploy machine learning in edge environments for real-time intelligence.
Category:	Low-latency, Distributed computing/storage
Founded:	2008
Location:	Palo Alto, CA
Total Funding:	$16.92 million
No. of employees:	186
Investors:	Bain Capital Ventures, C5 Capital, Capital One Ventures, Comerica Bank, DEG, EBRD Venture Capital Investment Programme, Earlybird Venture Capital, Striim, Uncorrelated Ventures

Helium

Description:	Helium is a developer of a decentralized machine networking technology designed to introduce a better way to build wireless infrastructure. The company's technology operates a peer-to-peer wireless network that provides a secure and cost-effective way to send data, providing businesses with a truly decentralized and trustless model for building wireless infrastructure.
Category:	Cryptocurrency/Blockchain, Internet of Things, TMT
Founded:	2006
Location:	San Francisco, CA
Total Funding:	$253.78 million
No. of employees:	113
Investors:	AU21 Capital, Alumni Ventures, Ash Park Capital, CMT Digital, Color (Portland), Corner Capital Management, DG Ventures (Digital Garage Group), Deutsche Telekom, FTX Ventures, Fantail Ventures, FirstMark Capital, Floating Point, GV, Goodyear Ventures, Khosla Ventures, Liberty Global (UK), Litani Ventures, Lontra Ventures, Multicoin Capital, Munich Re Ventures, NGP Capital, Pantera Capital, Raptor Group, Ribbit Capital, SV Angel, Seven Seven Six, Slow Ventures, TRCM Fund, The Hartford Steam Boiler Inspection and Insurance Company, The Marc R. Benioff revocable Trust, Third Prime, Tiger Global Management, Token Ventures, Uncorrelated Ventures, Union Square Ventures, Uush Capital

Hiber

Description:	Hiber is a developer of a nanosatellite platform designed to provide low-cost IoT data connectivity for sensors globally. The company's nanosatellite platform provides easy low-power network access to all things and delivers small data packages facilitating actionable insights from anywhere. Its modem can be easily installed in any monitoring device, enabling users to gather information from anything and from any location in the world.
Category:	Big Data, Internet of Things, Space Technology
Founded:	2016
Location:	Netherlands
Total Funding:	$37.72 million
No. of employees:	75
Investors:	Beek Capital, Dutch Founders Fund, ESA Business Incubation Centres, Elevate Innovation Partners, European Commission, European Space Agency, Finch Capital, Hartenlust, Jeroen Pietryga

Hivecell

HIVECELL

Description:	Hivecell is a developer of a service platform designed for deploying and managing complex distributed computing and AI at the edge. The company's platform provides automatic scaling, application monitoring, and management, cloud replication, edge data processing, migration of virtual machines to containers, web-based monitoring, and remote access management, enabling users to query and analyze electronic data interchange messages and maintain SQL databases.
Category:	Artificial Intelligence & Machine Learning, Big Data, Internet of Things
Founded:	2015
Location:	Beacon, NY
Total Funding:	$17.20 million
No. of employees:	54
Investors:	ICU, Knott Partners Management, Nvidia, Rose Park Advisors, Scribble Ventures

HiveMQ

HiveMQ

Description:	HiveMQ is a developer of a MQTT broker platform designed to move data from device to cloud in a secure, reliable, and scalable manner. The company's platform allows companies to connect devices to the internet, enabling clients to use this technology for use cases like connected cars, transportation, logistics, Industry 4.0 and connected IoT products.
Category:	Internet of Things
Founded:	2012
Location:	Germany
Total Funding:	$54.20 million
No. of employees:	153
Investors:	Earlybird Venture Capital, German Accelerator, Illusian Family Office, Mirko Novakovic, Molten Ventures, Mubadala Capital-Ventures, New Forge, Senovo

Imagimob

imagimob

Description:	Imagimob is a developer of a sensor fusion system intended to build production-grade machine learning applications. The company's system is used for audio classification, predictive maintenance, gesture recognition, signal classification, fall detection, and material detection, enabling users to perform fast and easily develop powerful edge artificial intelligence applications for devices.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2013
Location:	Sweden
Total Funding:	$3.77 million
No. of employees:	12
Investors:	Almi Invest, ECSEL JU, Permak, Stockholms Affärsänglar, Vinnova

Inductive Automation

Description:	Inductive Automation develops HMI, SCADA & MES software for industrial automation manufacturing systems and process control systems. The web-based, cross-platform software provides real-time data acquisition, data visualization, and supervisory control. The company's Ignition Edge Compute allows users to run scripts and create REST APIs for interfacing with third-party applications from the edge.
Category:	SCADA software. Industrial automation solutions.
Founded:	2003
Location:	Folsom, CA
Total Funding:	NA
No. of employees:	246
Investors:	NA

Infinite Uptime

Description:	Infinite Uptime develops analytics and real-time industrial diagnostics solutions to help plant maintenance leaders and condition-based monitoring teams to accurately predict failures and avoid potential downtime. The company offers smart vibration monitoring system along with communications and analytics to customers in global manufacturing industries.
Category:	IIoT platform, Sensors, Analytics, Predictive maintenance
Founded:	2015
Location:	Pune, India. Berkeley, CA
Total Funding:	$11.19 million
No. of employees:	158
Investors:	Alteria Capital, Berkeley SkyDeck, CITRIS Foundry, Dorm Room Fund, GSR Ventures, GiTV, Mayfield (Private Equity), Osage University Partners, Pear, Plug and Play Tech Center, THK (Applications), VenturEast, Vistra ITCL

InfluxData

Description:	InfluxData is the creator of InfluxDB, a time series platform used to build real-time IoT, analytics and cloud applications with time-stamped data. The technology is built to handle the massive volumes of data produced by sensors, systems or applications that change over time. In June 2022, the company announced Edge Data Replication feature, a new built-in capability of its flagship InfluxDB platform that provides synchronous replication of data between devices at the edge and datacenters in the cloud.
Category:	DB, IoT
Founded:	2012
Location:	San Francisco, CA
Total Funding:	$200.9 million
No. of employees:	254
Investors:	Accelerator Technology Holdings, Battery Ventures, Bloomberg Beta, Breakpoint Capital, Harmony Partners, Mayfield (Private Equity), Norwest Venture Partners, Sakal Ventures, Salesforce Ventures, Sapphire Ventures, Silicon Badia, Sorenson Capital, Trinity Ventures, Y Combinator

Instrumental

Description:	Instrumental is the developer of analytics software designed to automate the factory operating system. Customers use the company's cloud platform and purpose-built AI to accelerate time-to-market, improve yields, eliminate rework, and save engineering time.
Category:	Artificial Intelligence & Machine Learning, Big Data, IIoT
Founded:	2015
Location:	Palo Alto, CA
Total Funding:	$80.80 million
No. of employees:	86
Investors:	10H Capital Management, Atlas Holdings, BAM Elevate, Canaan Partners, Eclipse Ventures, First Round Capital, GRIDS Capital, Hestia Venture Partners, Root Ventures, StartX (US)

Intelecy

Description:	Intelecy is a developer of a machine learning system intended to help improve industrial processes, and reduce waste, energy consumption, and costs. The company's system analyzes large data sets from industrial IoT using machine learning to prevent breakdowns, predict failures, improve production processes and provide deep insight into the operations, enabling clients to improve predictive maintenance and process optimization.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Big Data, Internet of Things
Founded:	2016
Location:	Norway
Total Funding:	$1.21 million
No. of employees:	13
Investors:	Aidiom, Butterfly Ventures, Innovasion Norge, Investinor, Skagerak Capital, StartupLab

Invisible AI

Description:	Developer of a computer vision system designed to reduce manufacturing costs associated with manual assembly errors. The company's system consists of smart cameras that are installed in crucial factory areas to capture the movements of a business workforce and analyze the footage to suggest ways to improve everything from staffing and safety to efficiency, enabling clients in the logistics and manufacturing industries to get real-time visibility into their operational practices.
Category:	Artificial Intelligence & Machine Learning, Big Data, Manufacturing
Founded:	2018
Location:	Palo Alto, CA
Total Funding:	$21.00 million
No. of employees:	20
Investors:	8VC, FM Capital, Industry 4.0 Accelerator, Jackson Moses, K9 Ventures, Sierra Ventures, Silent Partner Software, Slow Ventures, Van Tuyl Companies, Vest Coast Capital, iRobot, iRobot Ventures

Iterate.ai

Description:	Iterate.ai is a developer of AI-powered low code software and ecosystem designed to accelerate innovation projects within large enterprises. The company's software helps in evaluating innovation solutions with emerging tech startups, idea orchestration, intrapreneur programs, and real-time trend intelligence and also provides a way to prototype and deploy digital solutions faster, enabling enterprises to go to market 17x faster with their digital initiatives.
Category:	Artificial Intelligence & Machine Learning, Big Data, Internet of Things
Founded:	2013
Location:	San Jose, CA
Total Funding:	$6.40 million
No. of employees:	80
Investors:	Haatch, Prisma Ventures

Izuma Networks

Description:	Izuma Networks is an operator of the unified cloud platform intended for deploying edge applications and devices. The company platform offers globally available edge computing, internet of things management service and a single pane of glass management, thereby enabling its clients to move edge applications, data or firmware securely and reliably.
Category:	Internet of Things
Founded:	2022
Location:	Evant, TX
Total Funding:	ND
No. of employees:	6
Investors:	SoftBank Group

Kinara

Description:	Kinara is a developer of low-power processors designed to develop and deploy powerful Edge AI applications successfully. The company's processors offer a set of automated development tools to support the implementation of complex, streamlined AI applications, enabling users to get rich data insights to optimize real-time actions at the edge.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2013
Location:	Los Altos, CA
Total Funding:	$50.50 million
No. of employees:	55
Investors:	CatchLight Capital Partners, Comet Labs, Concord USA, DHVC, Exfinity Venture Partners, Graph Ventures, Leland Stanford Junior University, NavInfo Company, Silicon Motion Technology, Sinovation Ventures, Social Capital, StartX (US), Tiger Global Management, VentureTech Alliance, Western Digital Technologies

Kinexon

KINEXON

Description:	Kinexon is a developer of specialized IoT technologies designed to connect and automate operations. The company's solutions gather localization data in real time and translates it simultaneously into powerful actions for industries, sports, and entertainment entities, enabling clients to connect assets, automate processes, and generate insights as quickly and intelligently as possible with real-time intelligence.
Category:	Internet of Things
Founded:	2012
Location:	Munich, Germany
Total Funding:	$147.68 million
No. of employees:	288
Investors:	BMW i Ventures, EIT Digital, ESA Business Incubation Centre Bavaria, German Accelerator, Telekom Innovation Pool (TIP), Thomas H. Lee Partners

Kneron

Kneron

Description:	Kneron is a developer of an application-specific integrated circuit designed to offer artificial intelligence-based tools in order to utilize computing power from cloud to edge devices. The company's ASIC offers real-time recognition, inference, and analysis services with no cloud connection, enabling clients to perform the quick implementation of different artificial intelligence applications.
Category:	Artificial Intelligence & Machine Learning
Founded:	2015
Location:	San Diego, CA
Total Funding:	$172.00 million
No. of employees:	84
Investors:	7feur, ADATA Technology Company, Alibaba Entrepreneurs Fund, Alltek Technology, CDIB Capital Group, Circle Investment, Cyzone (China), Delta Electronics, Foxconn International Holdings, Gaingels, General Technology Venture Capital, Himax Technologies, Horizons Ventures, Kube VC, LandTek Group, Lingjun Investment, Lite-On Technology, Macronix International, PalPilot, Qualcomm Ventures, Sand Hill Angels, Sequoia Capital, SparkLabs Group, ThunderSoft, Ventioneers, Vision Capital Group, Winbond Electronics

Kontakt.io

kontakt.io

Description:	Kontakt.io is a developer of indoor location and spatial intelligence platform using Bluetooth Low Energy. The company's platform delivers human-building interfaces that provide people with useful, and safe indoor experiences.
Category:	Internet of Things
Founded:	2013
Location:	New York, NY
Total Funding:	$21.00 million
No. of employees:	90
Investors:	Credo Ventures, European Investment Bank, Heartcore Capital, iEurope Capital

Konux

KONUX

Description:	Konux is developer of smart sensors and AI-enabled data analytics tools built to optimize railway operations. The company leverages IIoT devices and an AI-based analytics platform to monitor and analyze the health of key switch components that provides real-time insight into the condition of machines and infrastructure, enabling clients to identify and correct any failure through real-time visibility.
Category:	IIoT, AI, Predictive analytics, Railways
Founded:	2014
Location:	Munich, Germany
Total Funding:	$130.85 million
No. of employees:	149
Investors:	Alibaba Group, Andreas Von Bechtolsheim, Athos (Family Office), Boundary Holding, Deutsche Invest Capital Partners, EIT Digital, Founder.org, Green Bay Ventures, Hamba Investments, MIG AG, New Enterprise Associates, Salvia (Holzkirchen), Sanno Capital, TechFounders, UnternehmerTUM, Unternehmertum Venture Capital Partners, Upbeat Ventures, WestWave Capital

Kumu Networks

KUMU NETWORKS

Description:	Kumu Networks is a developer of full-duplex wireless technology designed to allow radios to send and receive at the same time on the same channel or adjacent channels. The company's technology enables multiple radios operating in close proximity to cooperate rather than interfere with each other and neutralize the noise that a transmitter creates in not only its own receiver but in neighboring receivers as well, empowering radiofrequency system designers to manage and eliminate the self-interference produced by local transmitters.
Category:	Mobile, TMT
Founded:	2011
Location:	Sunnyvale, CA
Total Funding:	$50.20 million
No. of employees:	26
Investors:	Cisco Investments, DTCP, Khosla Ventures, New Enterprise Associates, Singtel Innov8, Swisscom, Swisscom Ventures, Third Point Ventures, Verizon Ventures

Latent AI

LatentAI

Description:	Latent AI is a developer of an inference platform designed to support adaptive AI at the edge. The company offers a quantization optimizer for edge AI devices to automate the exploration of low bit-precision AI training deploying efficient neural networks for on-device intelligence and inference, enabling software developers to feasibly access, deploy and manage AI for the edge.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2018
Location:	Menlo Park, CA
Total Funding:	$30.50 million
No. of employees:	32
Investors:	Autotech Ventures, Blackhorn Ventures, Booz Allen Ventures, Doon Capital, First Spark Ventures, Future Ventures (San Francisco), Lockheed Martin Ventures, MDSV Capital, Pegasus Tech Ventures, SRI Ventures, Standard Investments

Librestream

Description: Librestream is a developer of a mobile video collaboration platform designed to address the needs of millions of physical workers worldwide. The company's platform collaborates on things in difficult field environments, integrates within existing workflow processes and develops a lasting knowledge base that leverages expertise as part of the Internet of Things (IoT), enabling enterprises to remotely diagnose, inspect and troubleshoot assets in the field.

Category: Internet of Things, Mobile

Founded: 2003

Location: Manitoba, Canada

Total Funding: $47.02 million

No. of employees: 88

Investors: Golden Opportunities Fund

LineVision

Description: LineVision is a developer of line monitoring systems designed to improve the efficiency, flexibility, and safety of utility overhead lines. The company's system utilizes sensors and analytics to offer asset management and dynamic line ratings that give unrivaled insights into the performance of transmission lines, enabling companies to enhance the capacity, reliability, and visibility of existing and new overhead lines.

Category: CleanTech, Internet of Things

Founded: 2018

Location: Somerville, MA

Total Funding: $49.92 million

No. of employees: 63

Investors: Builders Vision, Clean Energy Venture Group, Clean Energy Ventures, Climate Innovation Capital, Greentown Labs, Marubeni, Microsoft Climate Fund, National Grid Partners, S2G Ventures, UP.Partners, Zoma Capital

Link Labs

Description: Link Labs is a developer of an Internet of Things (IoT) solutions designed for tagging, locating and monitoring equipment, supplies and assets. The company's real-time location platform helps in effectively monitoring and locating through the integration of intelligent radio-frequency identification (RFID) and low-power Internet of Things (IoT) network technologies, enabling businesses to locate, monitor and manage business assets anywhere at any time - indoor, outdoor and everywhere in-between.

Category: Internet of Things

Founded: 2014

Location: Annapolis, MD

Total Funding: $18.50 million

No. of employees: 51

Investors: Baltimore Angels, Bilgola Capital, Blu Venture Investors, CR2 Capital Ventures, Cambridge Global Capital, KCA Partners, Leading Edge Ventures, Maryland Department of Commerce, New Dominion Angels, StoneMill Ventures, TCP Venture Capital

Litmus Automation

LITMUS

Description:	Litmus is the developer of an intelligent edge computing platform for IoT designed to enable out-of-the-box data collection, analytics, and management. The company's platform offers connectivity, data intelligence, and application enablement capabilities enabling users to transform critical edge data into actionable intelligence that can power predictive maintenance, machine learning, and AI.
Category:	IIoT, Analytics, AI
Founded:	2014
Location:	San Jose, CA
Total Funding:	$40.21 million
No. of employees:	75
Investors:	Alchemist Accelerator, BEENEXT Capital Management, Belden, DMZ Ventures, Highsino, Jigsaw Ventures, Mitsubishi, Momenta Ventures, Plug and Play Tech Center, The DMZ

Losant

LOSANT

Description:	The Losant Enterprise IoT Platform is an application enablement platform that allows enterprises to build IoT products, services, and applications that securely scale to millions of devices. The company's low-code approach removes the complexity of developing customized IoT applications with its edge and cloud platform. In addition, the platform enables the creation of multi-tenant applications to securely segment devices and data between any number of customers and users.
Category:	IoT platform, Low-code
Founded:	2015
Location:	Cincinnati, OH
Total Funding:	$15.02 million
No. of employees:	35
Investors:	CincyTech, Itan AS International Trading Assistance of Norway, Revolution/ROTR, Service Provider Capital, TechNexus Venture Collaborative, Techstars, Vine Street Ventures

MachineMetrics

machinemetrics

Description:	Machinemetrics is a developer of an industrial IoT platform designed to offer production monitoring software for the manufacturing industry. The company's cloud and edge platforms enable real-time visibility, deep manufacturing analytics and artificial intelligence-driven predictive notifications, enabling the manufacturing industry to digitize legacy manufacturing processes and drive more profitability with their machines.
Category:	IIoT, Analytics
Founded:	2014
Location:	Northampton, MA
Total Funding:	$30.62 million
No. of employees:	59
Investors:	Bolt (Financial Services), Fastenal, Firebolt Ventures, Hub Angels Investment Group, Hyperplane Venture Capital, Jennifer Jordan, LRVHealth, MassVentures, Ridgeline, River Valley Investors, Teradyne, Tola Capital, Valley Venture Mentors

Macrometa

Macrometa

Description:	Macrometa is developer of a distributed cloud platform designed to help clients build and deploy event-driven applications globally. The company's platform leverages artificial intelligence to create large-scale distributed systems and enterprise data infrastructure and turns database queries into functions that run on the edge, serving data and requests instantly, enabling clients to add instant performance to their data-driven web, mobile, and application programming interfaces.
Category:	Artificial Intelligence & Machine Learning, SaaS
Founded:	2017
Location:	Belmont, CA
Total Funding:	$27.28 million
No. of employees:	92
Investors:	Akamai Technologies, Benhamou Global Ventures, DNX Ventures, Fusion Fund, Goldfish Global, Jim Smith Contracting, Partech, Pelion Venture Partners, Shasta Ventures, Sixty Degree Capital, Sonali Kalje, Sway Ventures, VU Venture Partners, Velar Capital

Mappedin

mappedin

Description:	Mappedin is a developer of a digital map software that powers search and discovery tools for indoor areas. The company's software offers industry-leading indoor spatial data management, digitizing venues, and related tools, enabling REITs and retailers to manage their dynamic indoor information and build a digital way for best-in-class indoor mapping experiences into customer-facing applications.
Category:	Smart buildings
Founded:	2011
Location:	Waterloo, Canada
Total Funding:	$4.25 million
No. of employees:	81
Investors:	Amolino, C100, Canadian Technology Accelerator, Celtic House Asia Partners, Celtic House Venture Partners, Federal Economic Development Agency for Southern Ontario, GCI Capital Toronto, TECTERRA, Velocity Incubator (University of Waterloo), Yorkville Equity Partners

Matroid

Matroid

Description:	Matroid is developer of a SaaS-based web platform designed to assist users in building their own customized computer vision detectors. The company's system allows users to create computer vision detectors that recognize the people, events, and objects, monitor television streams in real-time, send notifications about custom events on security cameras, and search visual media, enabling users to make their applications more intelligent.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2015
Location:	Palo Alto, CA
Total Funding:	$33.50 million
No. of employees:	31
Investors:	Energize Ventures, Intel Capital, New Enterprise Associates

MEGH

MEGH COMPUTING

Description:	MEGH is a provider of a real-time, AI-based streaming analytics platform deployable from edge-to-cloud using hardware architectures from CPU, GPU, FPGA to SOCs. The company offers solutions that support dual-use applications that automate the use of data from cameras and sensors for real-time actionable insights for intelligent buildings, smart factories, and worker safety.
Category:	Advanced Manufacturing, Artificial Intelligence & Machine Learning, Big Data, SaaS, TMT
Founded:	2017
Location:	Hillsboro, OR
Total Funding:	$21.23 million
No. of employees:	33
Investors:	Accellius Capital, Alliance of Angels, Cascade Seed Fund, Cercano Management, CrowdSmart, Grubstakes, Oregon Venture Fund, Portland Seed Fund, Portland State University Business Accelerator, Revolution/ROTR, Rogue Venture Partners

Memfault

Memfault

Description:	Developer of a cloud-based monitoring platform designed to offer firmware delivery, monitoring, and diagnostics to edge and IoT devices. The company's platform helps hardware teams to catch, triage, and fix bugs in the field before being noticed by end-users, enabling consumer electronics, industrial automation, and IoT businesses to move faster without compromising on stability and reliability.
Category:	Internet of Things, DevOps
Founded:	2015
Location:	San Francisco, CA
Total Funding:	$35.15 million
No. of employees:	40
Investors:	5G Open Innovation Lab, Flight Ventures, Liquid 2 Ventures, Partech, S28 Capital, Stripes, Uncork Capital, Y Combinator

MemryX

memryX

Description:	MemryX is a developer of an in-memory computing system designed to outperform current operating systems for data-intensive tasks. The company's system includes reconfigurable in-memory computing chips with unparalleled energy efficiency and computes density for AI, edge computing, and big data, enabling companies to combine memory and process memory-compute blocks for optimal efficiency and flexibility.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2019
Location:	Ann Arbor, MI
Total Funding:	$19.46 million
No. of employees:	37
Investors:	Accelerate Blue Fund, Arm IoT Capital, HarbourVest Partners, Hemi Ventures, M Ventures, Microtech Ventures, Motus Ventures, University of Michigan Endowment, eLab Ventures

MicroAI

Micro.ai

Description:	MicroAI is provider of IoT edge-native AI and ML solutions for OEMs, network operators, and enterprises. The company personalizes AI for connected machines, edge devices, and critical assets by embedding its proprietary edge-native AI technology directly onto microcontrollers (MCUs) and microprocessors (MPUs) within these edge endpoints, enabling asset owners to have device-specific and more accurate AI modeling for next-gen edge and endpoint cyber security, advanced predictive maintenance, and IoT performance optimization.
Category:	Artificial Intelligence & Machine Learning, Internet of Things, Cybersecurity
Founded:	2018
Location:	Irving, TX
Total Funding:	ND
No. of employees:	25
Investors:	Plasma, Systena

MineSense Technologies

minesense

Description:	MineSense develops real-time, sensor-based ore data and sorting industrial IoT solutions for large-scale mines. The Company's mineral sensing platform creates value by providing precise, accurate, real-time grade control and ore routing decisions at the point of extraction for maximum resource conversion and metal recovery, reducing the CO_2 emissions and the consumption of wear materials, energy, water and reagents during the whole mining process.
Category:	IIoT, Analytics. Mining. CleanTech
Founded:	2009
Location:	Vancouver, British Columbia, Canada
Total Funding:	$146.66 million
No. of employees:	159
Investors:	ABB Technology Ventures, Aberdeen Group, Aurus Capital, BDC Capital, BDC Industrial, Clean and Energy Technology Venture Fund, Caterpillar, Caterpillar Ventures, Chrysalix Venture Capital, Cycle Capital Management, EDC, Evok Innovations, Export Development Canada, Government of Canada, JP Morgan Asset Management, MineSense Technologies Chile SpA, Mitsubishi, New Ventures BC, Prelude Ventures, Sustainable Development Technology Canada, United BioSource

Miovision

MIOVISION

Description:	Miovision's solutions use computer vision, edge computing, artificial intelligence, and advanced modelling to help cities modernize their approach to traffic management. The company's suite of products and services help cities to better manage traffic patterns, reduce congestion and emissions, while also improving traffic safety.
Category:	Smart cities, IoT, Analytics, Transportation
Founded:	2005
Location:	Kitchener, Ontario, Canada
Total Funding:	$134.01 million
No. of employees:	282
Investors:	ACE & Company, Angel One Investor Network, BDC Capital, Catalyst Capital iO, Comerica Bank, Golden Triangle Angelnet, Government of Ontario, HarbourVest Partners, InvestEco Capital, MacKinnon, Bennett & Company, McRock Capital, Ontario Centre of Innovation, Plaza Ventures, Renewal Funds, Sixty Degree Capital, TECTERRA, TELUS Ventures, The Accelerator Centre

MODE, Inc.

Description:	MODE provides scalable IoT solutions designed to collect and apply real-world sensor data to businesses. The company's platform specializes in moving sensor data from the physical world to the cloud and is equipped with a unique sensor gateway and specialized time-series data storage in the cloud.
Category:	IoT, PaaS
Founded:	2014
Location:	San Mateo, CA
Total Funding:	$14.9 million
No. of employees:	25
Investors:	Panasonic Kurashi Visionary Fund, Global Brain, Compound, Kleiner Perkins, NIFTY, True Ventures

Movandi

Description:	Movandi is a 5G and RF semiconductor, system, and software technology company enabling a 5G adoption and AI applications across multiple industries. The Company's cloud-and-AI-based mesh network and smart repeater technologies, eliminate the challenges of line-of-sight signal propagation and can speed up 5G mm Wave deployment indoors, outdoors and in mobile environments.
Category:	Wireless, 5G
Founded:	2016
Location:	Irvine, CA
Total Funding:	$73.4 million
No. of employees:	59
Investors:	Alumini Ventures, Celesta Capital, Cota Capital, DNX Ventures, Four G Capital, KT Investments, UCLA Investments, A&E Investments, Optimal Investments, Sierra Ventures

Movus

Description:	Movus is a developer of cloud and sensor systems designed to monitor the condition of industrial equipment. The company's system uses machine learning and artificial intelligence technology to minimize unplanned downtime of machines, enabling businesses to see real-time equipment health visibility.
Category:	IIoT, AI
Founded:	2015
Location:	Queensland, Australia
Total Funding:	$6.93 million
No. of employees:	24
Investors:	ACAC Innovation, Aequora Capital, AusIndustry, Blackbird Ventures, Energise, Ignite Ideas, SAP.iO, Skip Capital, Telstra Ventures, ilab

Mythic

MYTHIC

Description:	Mythic is a developer of integrated circuit technology designed to deliver graphics processing units in a button-sized chip. Mythic Analog Matrix Processors (Mythic AMP) offers advantages in power, performance, and cost bringing powerful AI solutions to the edge.
Category:	Artificial Intelligence & Machine Learning
Founded:	2012
Location:	Austin, TX
Total Funding:	$156.92 million
No. of employees:	78
Investors:	AME Cloud Ventures, Alumni Ventures, Atreides Management, Ben Jen Holdings, Blackrock Innovation Capital Group, Blake Chandlee, Cirrus Logic, DCVC, Future Ventures (San Francisco), Half Court Ventures, Hewlett Packard Enterprise, Hewlett Packard Pathfinder, In-Q-Tel, Lam Capital, Lam Research, Lockheed Martin Ventures, Lux Capital, Micron Ventures, National Science Foundation, SoftBank Ventures Asia, Threshold Ventures, UDC Ventures, United States Air Force, United States Department of Defense, Valor Equity Partners

Neural Magic

NEURAL MAGIC

Description:	Neural Magic is developer of an inference engine software designed to speed up artificial intelligence workloads on commodity hardware. The company's software incorporates the use of big data and deep learning and can be used for recommendations, image recognition, and object detection, enabling businesses and corporate clients to overcome the limitations of traditional hardware accelerators.
Category:	Artificial Intelligence & Machine Learning, Big Data, CloudTech & DevOps
Founded:	2017
Location:	Somerville, MA
Total Funding:	$50.00 million
No. of employees:	42
Investors:	Amdocs, Comcast Ventures, New Enterprise Associates, Pillar VC, Ridgeline, VMware, Verizon Ventures

Nexxiot

nexxiot

Description:	Nexxiot is a developer of sensor-based tracking products and a logistics management platform designed to facilitate supply chain digitization. The company's platform offers time monitoring and predictive actions, complex events, fleet usage, and route design management as well as freight security for railways and container shipping via IoT sensors, enabling clients to track and monitor their products affordably and securely.
Category:	Internet of Things, Mobility Tech, Supply Chain Tech
Founded:	2015
Location:	Switzerland
Total Funding:	$212.74 million
No. of employees:	106
Investors:	Arvato Financial Solutions, Credit Suisse Entrepreneur Capital, DiaMedCare, Die Mobiliar, Helvetica Capital, Knorr-Bremse, QVIDTVM, Swiss Entrepreneurs Foundation, Swisscom

Ngrok

ngrok

Description:	Ngrok is a programmable network edge that adds connectivity, security and observability to apps with no code changes. Ngrok powers production IoT connectivity on everything from point-of-sale machines, HVAC systems to Raspberry PIs.
Category:	CloudTech & DevOps, Internet of Things
Founded:	2015
Location:	San Francisco, CA
Total Funding:	$50.00 million
No. of employees:	59
Investors:	Coatue Management, Lightspeed Venture Partners

Novumind

NOVUMIND

Description:	Novumind is an AI hardware technology company that builds tensor chips and supercomputing modules for training and running AI algorithms. The company's solutions are designed to work across a variety of inference applications, from battery-powered embedded devices to the most demanding PetaOps-level tasks.
Category:	Artificial Intelligence & Machine Learning, Big Data, Internet of Things
Founded:	2015
Location:	Santa Clara, CA
Total Funding:	$15.20 million
No. of employees:	17
Investors:	Angel Plus, China Broadband Capital Partners, Hongtai Capital Holdings, Innoangel Fund, Venture Geeks, ZhenFund

Nubix

nubix

Description:	Nubix is a developer of an application platform designed for constrained devices while leveraging cloud-like development principles. The company's platform features edge-native architecture and tiny containers, whose code is independent of the operating system, and loops and allows the execution of anomalies to be detected and corrected in real-time, enabling companies to easily build, deploy and manage constrained devices applications at the industrial IoT edge.
Category:	Internet of Things, DevOps
Founded:	2017
Location:	Denver, CO
Total Funding:	$4.66 million
No. of employees:	8
Investors:	Bee Partners, Berkeley SkyDeck, Blackhorn Ventures, Center Electric, Chevron Technology Ventures, Mentors Fund, Momenta Ventures, Semil Shah, Tech Square Ventures, Tuscan Management

OctoML

Description: OctoML is a machine learning acceleration platform that automatically maximizes model performance while enabling enables seamless deployment including at the edge. Customers upload their trained deep learning models (from TensorFlow, PyTorch, Keras, ONNX, MxNet, etc) to the Octomizer (SaaS product based on Apache TVM), which outputs an optimized and packaged version of the model fine-tuned to the target hardware.

Category: Artificial Intelligence & Machine Learning, CloudTech & DevOps

Founded: 2019

Location: Seattle, WA

Total Funding: $132.60 million

No. of employees: 119

Investors: Addition, Amplify Partners, Madrona Venture Group, Tiger Global Management, Top Tier Capital Partners

Oden Technologies

Description: Oden Technologies is an industrial automation and AI-powered analytics provider. The company's platform combines data ingestion, data analytics and automation to help manufacturers achieve optimize their production methods.

Category: IIoT, Analytics, AI

Founded: 2014

Location: New York, NY. London, England.

Total Funding: $17.9 million

No. of employees: 34

Investors: Atomico, CNI (Stockholm), EQT Ventures, Inbox Capital, Ion Pacific, Navigate Ventures, Phoenix Court, Silverhorn Investment Advisors

Onomondo

Description: Onomondo is a global cellular operator for the Internet of Things, working to connect and simplify enterprise-grade connected services across the globe. With its network infrastructure implemented globally and operations across over 185 countries, Onomondo enables a more secure, cost-efficient, and scalable connectivity option available.

Category: Internet of Things, Wireless

Founded: 2012

Location: Denmark

Total Funding: $28.04 million

No. of employees: 50

Investors: Accelerace, IBM SmartCamp, IMPACT Accelerator, Maersk Growth, Next Step Challenge, People Ventures, Sealand Capital, VF Venture, Verdane, Vækstfonden

Origin Wireless

ORIGIN

Description:	Origin Wireless is a developer of a wireless sensing platform designed to provide consumers with a wide range of information in various applications. The company's platform provides applications like indoor monitoring and security with the use of commercial WiFi devices, centimeter accuracy indoor tracking, radio human biometrics, and wireless power transfers. The technology is based on commercial WiFi radio, providing users a sensing experience without any wearables or installation of sensors, nor it requires training or calibration from the surrounding environment.
Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2013
Location:	Greenbelt, MD
Total Funding:	$37.50 million
No. of employees:	38
Investors:	Alarm.com Holdings, EGI Capital, Inspire Corp, Mirai Creation Capital, Murata Manufacturing Company, SPARX Group Company, Stage 1 Ventures, Sumitomo Corporation of Americas, Verizon Ventures

ParkourSC

Parkour SC

Description:	ParkourSC is software SaaS company providing real-time digital supply chain solutions to manufacturing, logistics and pharmaceutical industries. The company's supply chain operations platform is powered by graph modeling, AI/ML, and real-time data ingestion from IoT and other systems and signals. Customers can also use ParkourSC to create intelligent digital twins of their supply chain to improve efficiencies, ensure compliance and eliminate waste.
Category:	IoT, Supply chain visibility, AI, Digital twin
Founded:	2014
Location:	Milpitas, CA
Total Funding:	$66.48 million
No. of employees:	68
Investors:	AI List, Bahwan CyberTek, BluePointe Ventures, Bold Capital Partners, Celesta Capital, Cota Capital, Impact Venture Capital, Intel Capital, JC2 Ventures, Mahindra Partners, Momenta Ventures, Plug and Play Tech Center, Rhea Fund, Sigmas Group, Suhail Bahwan Group, Tandem Capital, WestRock, Western Technology Investment

Ping Services

ping Intelligent Listening

Description:	Ping Services is a developer of a wind turbine monitoring systems to continually detect and monitor blade conditions. The company's device uses an algorithm that can rate the health of the turbine based on its acoustic signature on a scale to monitor changes over time as well as collect and transfer data from remote sites via satellite technology.
Category:	Climate Tech, Industrials
Founded:	2018
Location:	South Australia, Australia
Total Funding:	$3.75 million
No. of employees:	16
Investors:	Artesian Capital Management, Australian Government (Landing Pads), Brisbane Angels, South Australian Government, Sydney Angels

Pratexo

Description:	Pratexo is a developer of an edge computing and distributed cloud platform intended to simplify and accelerate the design, provisioning, and management of edge nodes and micro clouds. The company's platform offers a rapid configuration, monitoring, and optimization of edge-enabled applications in a distributed cloud or across multiple micro-clouds.
Category:	CloudTech & DevOps, SaaS
Founded:	2019
Location:	Austin, TX
Total Funding:	$8.00 million
No. of employees:	33
Investors:	BCP Ventures, Hemisphere Ventures, Northscaler, Raiven Capital, TRK Group

Proglove

Description:	Proglove is a designer and manufacturer of wireless industrial gloves designed to reduce human effort and increase productivity. The company's wireless industrial gloves are built with a barcode scanner and gesture-sensing features to perform effective multi-tasking and allow for hands-free operations, thereby enabling organizations to automate their repetitive work and connecting workers to actionable information for smarter workflows.
Category:	Internet of Things, Wearables & Quantified Self
Founded:	2014
Location:	Germany
Total Funding:	$51.01 million
No. of employees:	317
Investors:	Nordic Capital

Project44

Description:	Project 44 is a developer of an IoT enabled logistics technology platform designed to digitize the shipment life cycle. The company's platform brings dynamic shipment data and supplies chain visibility in terms of pricing, routing, scheduling, tracking, delivery documentation and payments, enabling enterprises to offer a smarter end-to-end shipping experience to their customers, as well as deliver value.
Category:	Mobility Tech, SaaS, Supply Chain Tech, TMT
Founded:	2014
Location:	Chicago, IL
Total Funding:	$947.64 million
No. of employees:	1060
Investors:	8VC, A.P. Moller Holding, Bluewater Companies, CMA CGM, Chicago Ventures, Emergence Capital Partners, Generation Investment Management, Girteka Logistics, Goldman Sachs Asset Management, High Alpha, Insight Partners, Lineage Logistics Holdings, Northstar.VC, Omidyar Technology Ventures, Plug and Play Tech Center, Pritzker Group Venture Capital, SXSW, Sapphire Ventures, Section Partners, Senovo, Silicon Valley Bank, Silverton Partners, Sozo Ventures, TPG, Thoma Bravo, Thomas Bigagli, Underscore VC, WP Global Partners, Yamato Holdings

Puloli

Description: Puloli is an IoT Network-as-a-Service (NaaS) company providing private IoT network solutions based on LTE/5G IoT standards. The Company's customers in industries such as electric, gas and water utilities, oil & gas infrastructure, and smart cities value the security, reliability, control, flexibility, and the lower cost of ownership that come with Puloli private IoT networks operating on licensed spectrum.

Category: Internet of Things

Founded: 2016

Location: San Francisco, CA

Total Funding: $5 million

No. of employees: 10

Investors: Alchemist Accelerator, Aligned Partners

Quadric

Description: Quadric is a developer of an edge processor designed to meet the needs of the industrial internet of things (IIoT) and robotic products. The company's processors can be incorporated into a wide range of products that require instantaneous processing of real-world data streams with minimal power and maximum speed as well as commute safely, industrial robots to complete critical tasks and create human interaction with machines, enabling developers to empower with tools to create technology.

Category: Artificial Intelligence & Machine Learning, Internet of Things, Robotics and Drones

Founded: 2016

Location: Burlingame, CA

Total Funding: $48.25 million

No. of employees: 39

Investors: Cota Capital, Denso, Emerson Electric, Leawood Venture Capital, MegaChips (California), Mesh Ventures, Nsitexe, Pear, SV Angel, Silicon Catalyst, Trucks Venture Capital, Uncork Capital, Xerox Ventures

Recogni

Description: Recogni is a developer of a visual perception platform designed to assist autonomous vehicles. The company's platform delivers inference performance and power efficiency, enabling clients to get novel edge processing at multiple points on vehicles to naturally offload central processing needs.

Category: Artificial Intelligence & Machine Learning, Autonomous cars, Mobility Tech

Founded: 2017

Location: San Jose, CA

Total Funding: $73.90 million

No. of employees: 70

Investors: BMW i Ventures, Celesta Capital, Continental Tyre Group, DNS Capital, Faurecia, Fluxunit - ams OSRAM Ventures, GreatPoint Ventures, Mayfield (Private Equity), Plug and Play Tech Center, Robert Bosch Venture Capital, Toyota Ventures, co-pace

Resonai

Description:	Resonai is a developer of a visual search platform designed to transform commercial buildings into intelligent environments. The company's technology is powered by advanced AI and enables machines to understand the world through visual perception. Resonai solves major problems in the area of augmented reality that demand computer understanding of the environment, enabling clients to gain greater operational control and real-time customer insights.
Category:	Augmented Reality, Artificial Intelligence & Machine Learning
Founded:	2013
Location:	Israel
Total Funding:	$27.00 million
No. of employees:	39
Investors:	Alon Blue Square Israel, Irani Ventures, Meitav Dash Investments, Plug and Play Japan, REDDS Capital, SBI Holdings

Rigado

Description:	Rigado is a supplier of IoT edge device solutions for enterprise applications such as asset tracking and smart buildings. Solutions include wireless gateways, a containerized edge computing platform plus tools for edge monitoring and orchestration, and a managed service to deliver security updates. The company's low-energy wireless modules support a variety of low-power protocols, such as BLE and LR-WPAN, and can be used for monitoring energy, temperature, humidity, air quality and occupancy.
Category:	IoT, BLE
Founded:	2010
Location:	Salem, OR
Total Funding:	$23.96 million
No. of employees:	35
Investors:	Alliance of Angels, Big Basin Partners, Cascade Seed Fund, FusionX Ventures, Grubstakes, Madrona Venture Group, Oregon Venture Fund, Rogue Venture Partners, Vanedge Capital

Roambee

Description:	Roambee is a developer of an IoT logistics and asset management platform designed to provide on-demand real-time visibility, tracking, and condition monitoring for goods and assets in transit and in-field. The company's platform uses a location-aware intelligence cloud platform and follows an on-demand business model where customers pay only for the shipments or assets they track
Category:	IoT, Asset tracking
Founded:	2014
Location:	Santa Clara, CA
Total Funding:	$43.2 million
No. of employees:	160
Investors:	3737 North Capital, ADS Ventures, Anchor Group, Comcraft Group, DTCP, Deutsche Telekom, Intuitive.VC, Jebsen & Jessen Family Enterprise, Kri Ventures, MDI Ventures, PSA Unboxed, Reefknot Investments, SAP.iO, Silicon Valley, Telkomsel Mitra Inovasi

Sematic

sematic

Description:	Sematic is a developer of an open-source continuous machine learning platform. The Sematic platform helps companies to automate, schedule and clone pipelines whenever a new labeled dataset is available. Semantic offers companies the ability to expand their machine learning teams so they can focus on creating new models without having to worry about automation infrastructure upkeep.
Category:	Machine learning. Software development
Founded:	2022
Location:	San Francisco, CA
Total Funding:	$3.50 million
No. of employees:	8
Investors:	Leonis Capital, Oliver Cameron, Pioneer Fund, Race Capital, Soma Capital, Y Combinator

Sensolus

sensolus

Description:	Sensolus is a developer of an asset tracking technology designed to offer tracking of valuable non-powered assets directly from a cloud-based system. The company's technology includes both the hardware GPS trackers and a fully integrated cloud application for wireless, low-power context-aware sensing, enabling users to have a low-power, easy to install and maintenance-free control of their valuable assets.
Category:	Internet of Things, Mobile, SaaS, Supply Chain Tech, TMT
Founded:	2013
Location:	Belgium
Total Funding:	$8.26 million
No. of employees:	35
Investors:	Capricorn Partners, EIT Digital, Matterwave Ventures, Montan-Ventures-Saar, Quest For Growth, btov Partners

Sight Machine

SIGHT MACHINE
Powering Digital Manufacturing

Description:	Sight Machine is a developer of a data platform designed to help manufacturers improve profitability, productivity and sustainability. The company's platform uses artificial intelligence, machine learning and advanced analytics and continuously analyzes all assets, data sources and processes, from machine to enterprise level, enabling manufacturers to make better, faster decisions for improving production performance.
Category:	IIoT, AI, Analytics
Founded:	2011
Location:	San Francisco, CA
Total Funding:	$85.37 million
No. of employees:	75
Investors:	DNX Ventures, E.ON Strategic Co-Investments, Forté Ventures, FundersClub, Future Energy Ventures, Huron River Ventures, IA Ventures, Jump Capital, LS Holdings, Mercury Fund, Mitsui & Company, Momenta Ventures, Musketeer Capital, O'Reilly AlphaTech Ventures, Pritzker Group Venture Capital, Realization Capital Partners, Sony Innovation Fund, Sorenson Capital, Tekfen Ventures, Third Shore Group, Two Roads Group, WestRock, eLab Ventures

SiMa.ai

SiMa.ai

Description:	SiMa.ai is a developer of machine learning technology designed to deliver a software-centric platform. The company's platform accelerates the proliferation of high-performance machine learning inference at very low power in embedded edge applications and with push-button performance, enabling effortless deployment and scaling at the embedded edge, enabling businesses to support traditional computing with high performance, low power, safe, and secure machine learning inference.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2018
Location:	San Jose, CA
Total Funding:	$187.80 million
No. of employees:	130
Investors:	Adage Capital Management, Alter, Amplify Partners, Dell Technologies Capital, Fidelity Management & Research, Lip-Bu Tan, MSD Partners, ND Capital, Telefónica Ventures, Wing Venture Capital

Sofant

Sofant

Description:	Sofant is a developer of a radio-frequency microelectromechanical (MEMS) technology designed to reduce the cost and power consumption of high-frequency antenna systems for 5G and SatCom. The company combines its patented technology, with antenna designs and machine learning algorithms, enabling organizations in the emerging millimeter-wave market to reduce the cost and complexity of leading-edge antenna designs.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2011
Location:	United Kingdom
Total Funding:	$13.94 million
No. of employees:	20
Investors:	Blueray Capital, British Business Bank, Converge Challenge, EMV Capital, European Space Agency, Horizon 2020 SME Instrument, Innovate UK, Investing Women Angels, Kelvin Capital, NetScientific, Newable, Old College Capital, Scottish Enterprise, Seraphim Space Camp, Shibumi International, Skyrora Ventures, UK Space Agency, Wealth Club

Sunlight.io

Sunlight.io

Description:	Sunlight was born out of a collaboration with ARM in 2013 to build a lightweight hypervisor that could virtualize low-power processors. Today, Sunlight.io offers a secure and cost-effective infrastructure that enables real-time analysis and action based on edge data. The company facilitates easy management of applications and infrastructure at the edge with efficient, ruggedized hardware for full isolation, security and high availability.
Category:	Artificial Intelligence & Machine Learning
Founded:	2018
Location:	United Kingdom
Total Funding:	$11.57 million
No. of employees:	33
Investors:	KickAss Capital, OpenOcean VC, Robert Bosch Venture Capital, Valedor Partners

SWAY AI

Description: SWAY-AI is a developer of no-code artificial intelligence applications intended to provide scalable services for enterprises. The company's no-code visual platform empowers businesses or technical experts to create powerful artificial intelligence applications without writing a single line of code through its advanced drag-and-drop technology, enabling enterprises with the broadest ecosystem of artificial intelligence models and tools available in a single platform.

Category:	Artificial Intelligence & Machine Learning
Founded:	2021
Location:	Chelmsford, MA
Total Funding:	$13.39 million
No. of employees:	25
Investors:	Private investors

SWIM.AI

Description: SWIM.AI is a developer of data processing and edge analytics software designed to deliver real-time business and operational insights. The company's software uses machine learning and edge computing to process streaming data in real-time at the edge without needing a message broker or central database.

Category:	Analytics. Edge intelligence. Machine learning.
Founded:	2015
Location:	San Jose, CA
Total Funding:	$48.90 million
No. of employees:	106
Investors:	ARM, Cambridge Innovation Capital, H. Barton Asset Management, Silver Creek Ventures, Verizon Ventures

SynSense

Description: SynSense is a developer of neuromorphic computing platform designed to provide a combination of ultra-low power consumption and low latency performance. The company's platform offers mixed-signal/fully digital neuromorphic processors that overcome the limitations of legacy von Neumann computers, enabling enterprises in industries like autonomous robots, embedded devices, wearables, healthcare systems, IoT applications, and more to reduce latency and become more energy-efficient.

Category:	Artificial Intelligence & Machine Learning, Internet of Things
Founded:	2017
Location:	Switzerland
Total Funding:	$33.57 million
No. of employees:	65
Investors:	Archer IMS, Arrowhead Tools, Baidu Ventures, CAS Star, CLP Holdings, CTC Capital, China Merchants Venture Capital, Ecovacs Robotics, European Union, M Ventures, Pre Angel Capital, Qigang Investment, Techtronics Capital, Ventech, Venture Kick, Yunding VC, Zhangjiang Science Investment

Syntiant

SYNTIANT®

Description:	Syntiant is a developer of neuromorphic semiconductors designed to move artificial intelligence and machine learning from the cloud to edge devices. The company's semiconductor produces ultra-low-power, high-performance, deep neural network processors for always-on applications in battery-powered devices, ranging from hearing aids to smart speakers and mobile phones, enabling experts to develop artificial intelligence technology for the sensor, voice, and video applications in almost any battery-powered product.
Category:	Artificial Intelligence & Machine Learning, Big Data, CloudTech & DevOps
Founded:	2017
Location:	Irvine, CA
Total Funding:	$120.06 million
No. of employees:	92
Investors:	A&E Investments, Alpha Edison, Alumni Ventures, Amazon Alexa Fund, Amazon.com, Applied Ventures, Atlantic Bridge Capital, Carnrite Ventures, CrowdSmart, DHVC, DaaS Analytics, Embark Ventures, EvoNexus, Horowitz Management, Houston Angel Network, Intel Capital, Lateral Capital Management, M12, Microsoft, Millennium Technology Value Partners, Mirae Asset Capital, Miramar Digital Ventures, Motorola Solutions Venture Capital, Renesas Electronics, Robert Bosch Venture Capital, Seraph Group, Sunstone Management

Taoglas

TAOGLAS®

Description:	Taoglas is a supplier of internet of things (IoT) and machine to machine (M2M) antenna products designed to help customers to achieve enhanced performance from their wireless devices. The company's products include a range of embedded and base station antenna for M2M applications such as telematics, automotive, smart-grid, metering, telemetry, home automation, remote monitoring and medical applications.
Category:	Wireless, Internet of Things
Founded:	2003
Location:	Dublin, Ireland
Total Funding:	ND
No. of employees:	300
Investors:	ESA Business Incubation Centres

Tetramem

TetraMem

Description:	TetraMem develops NPUs for edge AI inference with a differentiated high performance at low power, enabling customers to keep their computers cooler.
Category:	Artificial Intelligence & Machine Learning, Manufacturing, TMT
Founded:	2018
Location:	Newark, CA
Total Funding:	ND
No. of employees:	32
Investors:	Foothill Ventures, Lam Capital, Photon Fund, SAIC Capital

ThingTrax

thingtrax

Description:	ThingTrax is a developer of smart manufacturing technologies designed to make the industrial monitoring process simple and streamlined. The company's technologies reduce downtime and increase the operational efficiency of the machines and send alerts with actionable insights to the factory managers, enabling clients to track, capture and analyze data from machines and operators in real-time.
Category:	Artificial Intelligence & Machine Learning, SaaS
Founded:	2015
Location:	United Kingdom
Total Funding:	$3.00 million
No. of employees:	49
Investors:	AI Seed Fund, Al Dhow Capital, Cell Capital Partners, Force Over Mass Capital, Newable, Startupbootcamp, Sumaria Group, SuperSeed, Technology Venture

ThoughtWire

Thought\\/ire

Description:	ThoughtWire's applications for smart hospitals, smart buildings, and smart cities unlock the value of data generated from built environments by combining it with context from people, processes and IoT devices. ThoughtWireOS orchestrates data from people, process, and the physical built environment to deliver smarter, safer and more efficient hospitals, commercial buildings, and cities.
Category:	IoT, IIoT, Smart cities, Digital twin
Founded:	2009
Location:	Toronto, Ontario, Canada
Total Funding:	$21.85 million
No. of employees:	64
Investors:	Angel One Investor Network, BDC Industrial, Clean and Energy Technology Venture Fund, Canadian Business Growth Fund, Comerica Bank, Epic Capital Management, Export Development Canada, Golden Triangle Angelnet, Greensoil Proptech Ventures, RecapHealth Ventures, Round 13 Capital, Venturon, Yaletown Partners

Tive

tive

Description:	Tive is a developer of a sensor-driven tracking platform designed to deliver full visibility into products as they move through the supply chain. The company's platform includes a combination of cellular-connected trackers and cloud-based software, enabling clients to get customized alerts, reporting and analysis on inbound and outbound shipments across all modes of transport and reduce manufacturing disruptions and logistics costs.
Category:	Industrials, SaaS, Supply Chain Tech
Founded:	2015
Location:	Boston, MA
Total Funding:	$81.59 million
No. of employees:	185
Investors:	AXA Venture Partners, Accomplice VC, Bluewater Companies, Bolt (Financial Services), Broom Ventures, Fifth Wall, Floating Point, Hyperplane Venture Capital, NextView Ventures, One Way Ventures, Qualcomm Ventures, RRE Ventures, SJF Ventures, Sage Hill Capital, Semyon Dukach, Sorenson Capital, Supply Chain Ventures, Techstars, Two Sigma Ventures, World Within Ventures

Tulip Interfaces

TULIP

Description:	Tulip is a developer of a manufacturing development platform designed to transform factories. The company's platform utilizes the Internet of Things to digitize paper-based processes, integrate industrial technologies with legacy factory machines as well as capture and analyze real-time production floor data, enabling manufacturers to increase their yield, improve quality and accelerate their process improvement by creating a no-code application.
Category:	IIoT, Low code
Founded:	2014
Location:	Somerville, MA
Total Funding:	$152.70 million
No. of employees:	266
Investors:	Acequia Capital, Breyer Capital, C4 Ventures, DMG Mori Aktiengesellschaft, E14 Fund Management, Founder Collective, Insight Partners, Neoteny, New Enterprise Associates, Pitango Venture Capital, Stanley Ventures, Stex25, Time Ventures, Vertex Ventures US

Uavia

UAVIA

Description:	Uavia is a developer of a cloud-based robotic technology designed to manage fleets of robots and drone aircraft. The company's technology is used for the real-time, remote supervision of autonomous robots and drone fleets deployed at industrial sites, enabling industries to handle autonomous drones and robot fleets as well as to conduct aerial inspections and surveillance over long distances.
Category:	Internet of Things, Robotics and Drones
Founded:	2014
Location:	France
Total Funding:	$8.87 million
No. of employees:	31
Investors:	Airbus Ventures, Bpifrance, Cattleya Finance, EIT Digital, Frederic Lejeune, IMT Starter, Innovacom (Paris), Sofimac Investment Managers, UI Investissement, Wilco Accelerator

Turntide Technologies

TURNTIDE

Description:	Developer of an electric motor system designed to reduce electricity consumption and accelerate the transition from fossil fuels. The company's system leverages computing and software control with switched reluctance motor technology and is connected to precise controls via IoT, enabling clients to substantially save on space conditioning, maintenance, and refrigeration energy costs.
Category:	Internet of Things, Industrials, Manufacturing
Founded:	2013
Location:	Sunnyvale, CA
Total Funding:	$487.57 million
No. of employees:	650
Investors:	Andrew Schoen, BMW i Ventures, Breakthrough Energy Ventures, CPP Investments, Captain Planet, Fifth Wall, FootPrint Coalition Ventures, For Good Ventures, Future Shape, JLL Spark, Keyframe Capital Partners, McWin Capital Partners, Meson Capital Partners, National Science Foundation, New Ground Ventures, OGCI Climate Investments, Prime Movers Lab, SDCL Energy Efficiency Income Trust, The Climate Pledge Fund, Uush Capital, Wells Fargo Innovation Incubator, Wind Ventures

Untether AI

UNTETHER AI

Description:	Developer of AI chips designed to enable new frontiers in AI applications including for smart cities, retail and industrial. The company's chips combine near-memory design with digital processing for a neural net inference that moves data by reducing the distance data must travel to the absolute minimum, enabling clients to improve inference efficiency while consuming few resources and energy and requiring less supporting infrastructure.
Category:	Artificial Intelligence & Machine Learning, Big Data
Founded:	2018
Location:	Ontario, Canada
Total Funding:	$153.52 million
No. of employees:	111
Investors:	CPP Investments, GM Ventures, Intel Capital, Radical Ventures, Tracker Capital Management

Uptake Technologies

UPTAKE

Description:	Uptake Technologies is developer of a predictive analytics platform designed to transform data into measurable business value that helps people and machines work better, smarter and faster. The company's predictive analytics platform collects and interprets sensor data and converts insights into action as well as integrates it directly into the workflow, enabling major industries to improve uptime, streamline operations and spot growth opportunities.
Category:	IIoT, AI, Predictive analytics
Founded:	2014
Location:	Chicago, IL
Total Funding:	$323 million
No. of employees:	256
Investors:	Baillie Gifford, DNS Capital, GreatPoint Ventures, Illinois Growth and Innovation Fund, Lightbank, New Enterprise Associates, Plug and Play Tech Center, Revolution/ROTR

VANTIQ

VANTIQ

Description:	VANTIQ is a developer of a low-code platform designed for building and deploying distributed, real-time systems that connect IoT sensors, AI systems, and humans. The company's edge native platform is built to handle massive scale processing of real-time data from IoT devices, AI systems, cameras and anything else that connects the physical and digital worlds.
Category:	IoT, Low code
Founded:	2015
Location:	Walnut Creek, CA
Total Funding:	$66.75 million
No. of employees:	56
Investors:	Raptor Group, Sands Capital, SoftBank Group

Validere

VALIDERE

Description:	Developer of a comprehensive data platform designed to offer advanced quality intelligence for oil & gas companies to know true product quality in real time and optimize logistics and trading. The company's platform delivers accessible, verifiable, and actionable testing data in the crude oil industry resulting in confident business decisions as well as facilitating crude oil tests with the accuracy and accountability of 3rd party labs, enabling managers to coordinate their measurement and crude quality data across field sites.
Category:	Internet of Things, Oil & Gas
Founded:	2015
Location:	Ontario, Canada
Total Funding:	$66.49 million
No. of employees:	120
Investors:	BDC Capital, BlackRock, BlueSky Equities, C100, Cathexis Ventures, Creative Destruction Lab, For Good Ventures, FrontierSpace Ventures, Fuel Capital, Greylock Partners, Liquid 2 Ventures, Lisa Shields, Mercuria Energy Asset Management, Moment Ventures, NGIF Cleantech Ventures, Next (Consulting Services), Nova Fleet, Ontario Centre of Innovation, Pioneer Fund, Real Ventures, Sallyport Investments, Soma Capital, Sustainable Development Technology Canada, The Lazaridis Institute, Wing Venture Capital, Wyss Institute at Harvard, XDL Capital Group, Y Combinator, ZhenFund

Verdigris

VERDIGRIS

Description:	Verdigris is a developer of an artificial intelligence IoT platform designed to improve energy efficiency in large buildings. The company's platform offers energy management tools that provide reports on energy forecasts, alerts about faulty equipment, maintenance reminders, and detailed energy usage information.
Category:	Artificial Intelligence & Machine Learning, Big Data, CleanTech, Internet of Things
Founded:	2010
Location:	Mountain View, CA
Total Funding:	$36.03 million
No. of employees:	38
Investors:	Ambition.vc, Amos Ben-Meir, CE Venture Capital, DCVC, Founder.org, Frederick Weber, G5 Inno, GVA, Jabil, Long Venture Partners, Nikhil Gopalani, Orange Fab France, Oyster Ventures, SVLC, StartX (US), Verizon Ventures

Vimana

VIMANA

Description:	Vimana is a developer of an industrial analytics platform designed to provide actionable data for smart manufacturing. The company's platform captures and transforms data for decision-making and also creates and extends user-focused applications with speed and efficiency that drive value, enabling industrial businesses to increase profitable revenue growth and productivity.
Category:	Advanced Manufacturing, Big Data, SaaS
Founded:	2009
Location:	Emeryville, CA
Total Funding:	$6.6 million
No. of employees:	23
Investors:	Agility Capital, The Chennai Angels

Waylay

waylay

Description:	Waylay is the developer of an IoT middleware platform intended to connect IoT services to IT systems and cloud applications. The company's platform breaks down silos by connecting devices with applications and online services to make business decisions based on real-time sensor information through real-time automation and notifications in energy, logistics, online retail, and smart city projects.
Category:	Internet of Things. Middleware.
Founded:	2014
Location:	Gent, Oost-Vlaanderen, Belgium
Total Funding:	$6.58 million
No. of employees:	32
Investors:	Ark Angels Activator Fund, EIT Digital, Imec, PMV, Yokogawa Electric, iMinds

Wiliot

wiliot

Description:	Willot is a developer of bluetooth chip technology intended to connect people by scaling the Internet of Things. The company's technology combines cloud services and IoT Pixels, computing elements that can power themselves by harvesting radiofrequency energy, enabling clients to understand where their products are, who is using them and when they need to be replenished.
Category:	Big Data, Infrastructure, Internet of Things, Supply Chain Tech
Founded:	2017
Location:	Israel
Total Funding:	$289 million
No. of employees:	165
Investors:	83North, A&E Investments, Amazon Web Services, Avery Dennison, Cerca Partners, Grove Ventures, M Ventures, Maersk Growth, NTT Docomo Ventures, Norwest Venture Partners, Pepsico, Qualcomm Ventures, Samsung Venture Investment, Seamless Accelerator, SoftBank Investment Advisers, Telefónica Ventures, Ten Venture Partners, Touchdown Ventures, Verizon Ventures, Vintage Investment Partners, Wayra

Wirepas

Wirepas

Description:	Wirepas is a developer of wireless software technology for connecting enterprise IoT devices. The company's Mesh Connectivity suite software runs on the same low-power hardware used by many IoT devices to create autonomous networks that grow beyond millions of devices, such as smart meters. The technology eliminates the need for mesh infrastructure and offers multi-hop services with a network stack platform for use in a range of the sensor, control and low-bandwidth communication applications.
Category:	IoT, Wireless networking.
Founded:	2010
Location:	Tampere, Finland
Total Funding:	$41.32 million
No. of employees:	72
Investors:	ETF Partners, Inventure, KPN Ventures, Karma Ventures, Tesi, Vito Ventures

WiSilica

WISILICA

Description:	WiSilica's intelligent IoT solutions create smart environments that bridges objects, locations, and people in real time. ARIXA, WiSilica's location aware IoT platform lays the foundation for smart lighting, wireless device controls, real time tracking, and customized end-to-end IoT solutions. The ability of ARIXA to integrate seamlessly to the user environments makes the solutions easily deployable while facilitating device automation and performance monitoring in real time.
Category:	Internet of Things, Smart buildings, Smart environments
Founded:	2013
Location:	Lake Forest, CA
Total Funding:	$3.35 million
No. of employees:	80
Investors:	Anchor Asia Management, Aurotek, FirstFloor Capital

Worlds

WORLDS

Description:	Worlds is a developer of an AI Industrial Metaverse platform intended for measuring, improving, and building artificial intelligence-based automation into the operations of supply chain companies. The company's platform brings real-time sensory data from a physical environment inside of a smart, digital twin that is convenient to comprehend, enabling organizations to capture real-world operations in two-dimensional with cameras and other sensors.
Category:	Augmented Reality, Artificial Intelligence & Machine Learning, Big Data
Founded:	2018
Location:	Dallas, TX
Total Funding:	$31.2 million
No. of employees:	35
Investors:	Align Capital, Capital Factory, Chevron Technology Ventures, Green Park & Golf Ventures, Moneta Ventures, Perot Jain, Piva Capital, TechSquare Labs

Zededa

ZEDEDA

Description:	Zededa is a developer of a cloud-native edge virtualization platform designed to monitor, visualize and secure real-time edge applications. The company's platform delivers visibility, control, and security for the distributed edge, as well as deploys and manages any application on any hardware at scale and connecting to any cloud or on-premises systems.
Category:	Edge devops
Founded:	2018
Location:	Santa Clara, CA
Total Funding:	$57.56 million
No. of employees:	96
Investors:	Almaz Capital, Chevron Technology Ventures, Coast Range Capital, EDF Energy Services, EDF Ventures North America, Emerson Ventures, Energize Ventures, Ericsson Ventures, H. Barton Asset Management, Juniper Networks, Juniper Networks., Listwin Ventures, Lux Capital, Porsche Ventures, Rockwell Automation, Samsung NEXT Ventures, Wild West Capital

Zerynth

Zerynth®
Enabling IoT

Description:	Zerynth supports companies in digitizing production processes and developing connected industrial products through a plug-and-play IoT platform designed to enable the 4.0 transformation of any industrial machinery quickly, flexibly and securely.
Category:	Internet of Things, IIoT
Founded:	2015
Location:	Pisa, Italy
Total Funding:	$7.55 million
No. of employees:	41
Investors:	BonelliErede, CDP Venture Capital, Incense Accelerator, Liftt, United Ventures, Vertis SGR

Selected Edge Computing M&A Transactions

In the following pages we list several M&A transactions that have taken place in the edge computing space from 2019 until early 2023. We have limited our list, around 300 plus deals, to those where the transaction value has been reported. Where available, we show the EV/Revenue multiple as well.

Date	Buyer	Target	Transaction Value ($M)	EV/Revenue Multiple	Business Description
Jan-23	Maxar Technologies	Aurora Insight	54.00	ND	Developer of data-driven insights platform designed to measure, aNDlyze and report on the radio frequency spectrum to innovate, invest and move forward.
Jan-23	Delair	Notilo Plus	7.28	ND	Manufacturer of underwater drones intended to capture footage of dives.
Jan-23	Mount Rainier Acquisition	HUB Security	1,280.00	ND	Developer of hardware security solutions designed to protect valuable digital assets.
Dec-22	Hongshan Technology	Changkun Technology	77.16	ND	Researcher and developer of wireless network products.
Dec-22	Aptiv	Wind River Systems	3,500.00	ND	Developer of security technology designed to combat complex and rapidly growing internet threats.
Dec-22	Season Group	Pycom	20.47	ND	Developer of computer hardware, wireless equipment, and device maNDgement platform designed to remove barriers and speed up all aspects of IoT development.
Nov-22	Farm(x)	AutoModality	27.80	ND	Developer of UAV flight control software designed for use in infrastructure inspection, including bridges, culverts, rolling stock and cell towers.
Oct-22	Group 42	BayaNDt AI	769.91	ND	Provider of AI-powered predictive geospatial intelligence services intended to focus on geo-intelligence solutions.
Oct-22	NextNDv	Nestwave	18.00	ND	Developer of geolocation solution designed to improve location accuracy and reliability.
Oct-22	SyNDptics	Emza Visual Sense	6.37	ND	Developer of visual sensors designed to provide orders of magnitude improvement in power consumption, price and form factor.
Oct-22	Sierra Nevada	Volansi	249.45	ND	Developer of fast on-demand aerial delivery drones designed to facilitate time-critical shipments over long ranges.
Oct-22	Change (Japan)	DFA Robotics	18.30	ND	Developer of drone research and delivery technology intended to solve the shortage of human resources in the infrastructure industry.
Oct-22	Arabian Internet Comms Services	Giza Systems	134.92	ND	Operator of a systems integration company intended for asset-intensive industries such as the telecoms, utilities, oil and gas, transportation and other market sectors.
Oct-22	Generac Power Systems	Blue Pillar	45.28	ND	Developer of energy maNDgement technologies designed to maNDge, monitor, and control industrial IoT devices.

Date	Buyer	Target	Transaction Value ($M)	EV/Revenue Multiple	Business Description
Sep-22	ECA Group	iXBlue	406.93	ND	Manufacturer of autonomy technologies designed for inertial NDvigation and underwater imaging.
Sep-22	Kensington Capital Acquisition IV	Amprius (NYS: AMPX)	939.00	91.28x	Developer of high energy density lithium-ion batteries designed to produce a significant amount of energy and power with less weight and volume.
Sep-22	Astrobotic	Masten Space Systems	4.50	ND	Developer of space infrastructure designed for sustaiNDble access and utilization of the moon.
Aug-22	Telit Communications	Mobilogix	9.09	ND	Developer of tracking devices intended to provide engineering services for IoT businesses.
Aug-22	Hyundai Motor	42dot	422.82	ND	Developer of autonomous transportation-as-a-service software designed to integrate a wide range of future mobility options for delivery services such as autonomous vehicles, drones, and robots.
Aug-22	Founder SPAC	Rubicon (NYS: RBT)	1,700.00	ND	Developer of sustaiNDble waste and recycling technology designed to make a cleaner and safer environment.
Aug-22	Pima Zinc	Cybeats (CNQ: CYBT)	5.69	ND	Developer of an integrated security platform designed to protect enterprise and critical infrastructure IoT devices.
Aug-22	Helium (Wireless Communication	FreedomFi	59.50	ND	Operator of a 5G firm intended to help customers build cost-efficient private LTE or 5G networks using open standards.
Aug-22	Watts Water Technologies	The Detection Group	12.61	ND	Developer of commercial leak detection systems for smart buildings designed to offer wireless systems and services to safeguard against water leakage.
Jul-22	AgreeND	Hummingbird Technologies	32.74	ND	Developer of a data aNDlytics platform designed to aid in cropping and farming decision-making.
Jul-22	JLL	Envio Systems	25.00	ND	Developer of an advanced web-based building maNDgement system designed to affordably eNDble exponentially smarter buildings in real-time.
Jul-22	Renesas Electronics	Reality AI	9.90	ND	Developer of an advanced sensing technology designed to offer sigNDl recognition capabilities to connected devices and software makers.
Jul-22	Komatsu Australia	Mine Site Technologies	100.00	ND	Developer of network infrastructure intended for the mining industry.
Jul-22	Cloudastructure	Infrastructure Proving Grounds	2.55	ND	Provider of IoT device controlling services intended to assist industries to maNDge and operate the deployment of billions of new IoT devices.
Jun-22	Beijing Teamsun Technology Company,	Telink Semiconductor	790.43	ND	Developer of radio-frequency and mixed sigNDl system chips designed to be use for Internet of Things (IoT) applications.
Jun-22	ParkourSC	Qopper	6.50	ND	Developer of industrial sensors and software agents on an integrated intelligence network intended to monitor and automate operations.
Jun-22	Deepki	Fabriq Space	2.82	ND	Developer of an energy and resource data platform intended to help maNDge energy and building-performance data across all assets.
Jun-22	BOE Technology Group	SES-imagotag (PAR: SESL)	457.33	3.64x	Developer of digital labels and retail IoT solutions dedicated to supporting physical retailers with omnichannel in-store shopping transformations.
Jun-22	Johnson Controls InterNDtioNDl	Tempered	67.00	ND	Developer of a zero-trust software designed to create a modern air gap for all connected things.
Jun-22	Aurionpro Solutions	SC Soft	49.90	ND	Provider of smart city products and services in Singapore.
Jun-22	Cyient	Celfinet	25.44	ND	Provider of mobile network services intended to offer software and engineering solutions for mobile telecommunications operators.
Jun-22	ITC Infotech	PTC (Product Lifecycle MaNDgement	115.00	ND	Developer of product development software focusing primarily on product lifecycle maNDgement systems.
Jun-22	Comcast	Levi	50.00	ND	Developer of IoT security and device identity maNDgement technology designed to provide a form of authentication for wireless devices to prevent hacking, manipulation, and deception.
Jun-22	Ericsson, Valmont Industries	ConcealFab	26.14	ND	Designer and manufacturer of infrastructure products intended to help customers achieve faster site approval and improve wireless network performance.
Jun-22	Netskope	Wootcloud	14.10	ND	Developer of an enterprise security platform designed to automate device security at an IoT scale.

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May-22	SPYR	GeoTraq	13.50	ND	Manufacturer of cellular tracking modules designed to eNDble low cost, long-range communication between IoT devices deployed worldwide.
May-22	Adani Defence Systems and Technologies	General AeroNDutics	8.34	ND	Developer of aircraft designs intended to perform unmanned and manned aircraft design and testing.
May-22	Netskope	Infiot	40.00	ND	Developer of a cloud-delivered architecture platform designed to provide secure, optimized, and extensible architecture for the internet of things industry.
May-22	Augury	Seebo	20.00	ND	Developer of a process-based artificial intelligence technology intended to predict and prevent quality, yield, and waste losses.
May-22	Eddy Solutions	Reed (Electronic Equipment	5.80	ND	Developer of a purpose-built software platform designed to provide smart water maNDgement in commercial buildings.
May-22	SentinelOne	Attivo Networks	534.80	ND	Operator of a cybersecurity platform intended to provide real-time detection, aNDlysis, and accelerated response to advanced, credential, insider, and ransomware cyber-attacks.
Apr-22	Alphabet	MobiledgeX	20.20	ND	Developer of a computing platform designed to connect developers with mobile networks, power applications and devices.
Apr-22	UNDBiz	SigFox	534.64	ND	Provider of Internet of things (IoT) connectivity service intended to securely connect physical devices to the cloud.
Apr-22	Central Global Berhad	RYRT InterNDtioNDl	10.19	ND	Provider of construction services based in Semenyih, Malaysia.
Apr-22	Sentinel Offender Services	Omnilink Systems	37.60	ND	Manufacturer of electronic monitoring devices intended to track persons of interest with an ankle-worn tracking device.
Apr-22	Halma	Deep Trekker	60.00	ND	Manufacturer of remotely operated vehicle systems intended to make complex underwater missions easy.
Apr-22	Nordic Unmanned	DroneMatrix	4.51	ND	Developer of intelligent drone systems intended to build and implement the next generation of aerial robotic technology.
Mar-22	Blackline Safety	Swift Labs	3.58	ND	Provider of IoT services intended to provide wireless connectivity solutions.
Mar-22	Quanmax	Kontron (Austria) (ETR: KTN)	180.40	1.21x	Distributor of computers and peripherals in Austria.
Mar-22	Transtema	Tessta Connect	23.49	ND	Provider of telecom services focused on maNDging large assignments for major NDtioNDl players.
Mar-22	Reload (IT Consulting and Outsourcing)	Intermatica	11.32	ND	Provider of terrestrial and satellite communications services intended to provide major satellite systems.
Mar-22	Belden	NetModule	23.50	ND	Manufacturer of communication products based out of Bern, Switzerland.
Mar-22	Twenty First Century Utilities	GridPoint	675.00	ND	Developer of a data-driven platform designed to provide smart building and grid software services.
Feb-22	Groupe ZeKat	Fly4u	7.21	ND	Provider of a low-frequency locating service intended to track reusable mobile assets.
Feb-22	KORE Wireless Group	Business Mobility Partners	70.63	ND	Provider of wireless and mobility services focusing on delivering IoT eNDblement services to contract research organizations and remote patient monitoring customers.
Feb-22	Acome	Energie IP	8.77	ND	Developer of a building maNDgement system platform intended to provide both power devices and exchange data via standard ethernet cables.
Feb-22	Sensata Technologies	Elastic M2m	51.40	ND	Provider of a programming platform intended to accelerate the creation of IOT solutions.
Feb-22	Jacobs Engineering Group	StreetLight Data	196.90	ND	Operator of a transportation data platform intended to provide on-demand metrics for vehicles, bikes, and pedestrians.
Feb-22	Sivers Seminconductors	MixComm	135.00	ND	Developer of fabless semiconductors intended to be used in the development of wireless applications.
Feb-22	Telstra Purple	Alliance Automation	11.26	ND	Provider of IoT industrial automation solutions serving the mining, oil and gas, water and wastewater industry and infrastructure market sectors both in Australia and overseas.

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Jan-22	DeClout	Ascent Solutions	20.20	ND	Developer of security tracking applications for both governments and private sectors.
Jan-22	Qualcomm	Augmented Pixels	24.00	ND	Developer of interactive technologies with augmented and virtual experiences designed to facilitate the movement of drones and robots like humans do.
Jan-22	VDA Group	Telkonet	9.43	ND	Developer of an intelligent automation and energy maNDgement technology designed to control energy usage in accordance, while reducing energy consumption and improving facility maNDgement
Jan-22	Ilustrato Pictures InterNDtioNDl	Vira Drones	22.61	ND	Manufacturer of heavy-lift cargo carrier drones designed for the purpose of transporting goods, rescue, fire-fighting.
Jan-22	Allegion	Yonomi	20.00	ND	Developer of a cloud and mobile IoT platform designed to connect, integrate, and automate smart home products.
Dec-21	Hanwha Solutions	Samsung Electro-Mechanics	84.40	ND	Manufacturer of antenND modules intended to create seamless Wi-Fi and 5G connections.
Dec-21	Datang Telecom Technology Company	DT-Linktech	232.47	ND	Developer of wireless communication system core technologies.
Dec-21	Johnson Controls InterNDtioNDl	FogHorn	174.97	ND	Developer of an edge intelligence software designed to deliver the power of real-time industrial-grade aNDlytics to resource-constrained edge devices.
Dec-21	Renesas Electronics	Celeno	315.00	ND	Developer of Wi-Fi chipsets, edge software, and cloud technologies created to take the internet beyond connectivity into smart homes, smart cities, smart buildings, and smart industry.
Dec-21	Enphase Energy	365 Pronto	80.91	ND	Developer of a predictive software platform designed to simplify the cleantech installation landscape.
Dec-21	DroneUp	AirMap	161.76	ND	Developer of an airspace maNDgement platform designed to accelerate the adoption of small unmanned aerial system (sUAS) technology by providing the digital infrastructure to unlock safe and efficient drone flight
Dec-21	Delta InterNDtioNDl Holding	March Networks	114.00	ND	Provider of IP video surveillance services catering to the banking, retail, transportation, government, education, and commercial sectors.
Dec-21	Ameresco	Plug Smart	21.24	ND	Provider of energy services focused on the development and implementation of budget-neutral capital improvement projects.
Nov-21	Itineris	Opinum	5.54	ND	Developer of digital web-based software intended to aNDlyze and visualize energy and environmental data for the consumption of assets.
Nov-21	Clavister	Omen Technologies	1.76	ND	Developer of an artificial intelligence-based IoT cybersecurity aNDlysis platform designed to deliver detection capabilities.
Nov-21	SpaceX	Swarm (Wireless Communicati	85.00	ND	Developer of a global communications satellite network designed to make IoT data available on a global scale.
Oct-21	Alpine 4 Holdings	Identified Technologies	3.61	ND	Provider of commercial drone services designed to offer continuous job site visibility and tracking.
Oct-21	AgEagle Aerial Systems	senseFly	23.00	ND	Developer of aerial imaging drones designed to simplify the collection and aNDlysis of geospatial data.
Oct-21	Nordic Unmanned	AirRobot	6.21	ND	Manufacturer of mini and micro-UAV systems based in Arnsberg, Germany.
Oct-21	Meta Platforms	AI.Reverie	40.60	ND	Developer of a synthetic data platform designed to provide data alterNDtives for computer vision.
Oct-21	Itron	SELC Ireland	11.23	ND	Provider of lighting control services intended to offer smart cities and utilities with electronic lighting controls and photocells.
Oct-21	SECO (Italy)	Garz & Fricke	126.78	ND	Developer and supplier of embedded hardware and software intended to serve the industrial internet of things.
Oct-21	Siemens	Wattsense	5.38	ND	Developer of an open IoT device designed to control and monitor buildings of any size.
Oct-21	Converge Technology Solutions	LPA Software Solutions	12.00	ND	Provider of data aNDlytics solutions intended to harness the power of information technology.

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Sep-21	TVS Motor Company	EGO Movement	22.62	ND	Developer of an e-bike designed to provide a sustaiNDble alterNDtive to the car.
Sep-21	STMicroelectronics	Wisebatt	3.26	ND	Developer of a simulation platform designed for electronic engineers developing IoT devices.
Sep-21	Murata Manufacturing Company	Eta Wireless	138.92	ND	Developer of a power maNDgement chip designed to reduce power consumption in wireless communication devices.
Sep-21	JFrog	Upswift	2.93	ND	Developer of Internet of things (IoT) device maNDgement platform designed to maNDge connected devices everywhere.
Aug-21	Red Cat Holdings	Teal (Electrical Equipment)	26.01	ND	Developer of small unmanned vehicle systems designed to offer much more features than flying cameras.
Aug-21	ComSovereign	SaguND	13.10	ND	Developer of an edge cloud computing platform designed to transform communication networks into cloud-computing infrastructures.
Aug-21	Adapdix	Edge Intelligence (Business/Pro	23.00	ND	Operator of a distributed aNDlytics software platform designed to build for hybrid cloud and edge computing environments.
Aug-21	Ondas Networks	American Robotics	69.31	ND	Developer of robotic systems designed to offer industrial drones for rugged and real-world environments.
Aug-21	SPX	Enterprise Control Systems	77.65	ND	Manufacturer of programmable jammers intended for use in the high level military and interNDl security domains.
Aug-21	Montrose Environmental Group	SensibleIoT	11.75	ND	Developer of an IoT and software platform designed for interfacing with virtually any data source.
Jul-21	Hyundai Heavy Industries	Medi Plus Solution	27.07	ND	Provider of health care solutions that offer persoNDlized smart healthcare services.
Jul-21	Ingersoll Rand	Maximus Systems	88.72	ND	Developer of industrial internet of things platform that serves the agriculture industry.
Jul-21	Halma	Ramtech Electronics	27.06	ND	Developer of end to end IoT wireless solutions for construction and leisure industries.
Jul-21	Skyworks Solutions	Silicon Labs (Infrastructure & Automotive	2,754.10	ND	Designer and manufacturer of power and isolation chips intended to be used in electric and hybrid vehicles, 5G wireless infrastructure and other products.
Jul-21	Skyworks Solutions	RF Pixels	5.67	ND	Developer of 5th generation technology intended to provide robust connections for users and an attractive business foundation for service providers.
Jul-21	JFrog	VDOO	299.28	ND	Developer of an automated platform intended to provide end-to-end product security.
Jul-21	Aerodrome	FlyTech	4.59	ND	Provider of drone solutions for the civilian and the defense market.
Jul-21	View (Building Products)	ioTium	6.00	ND	Developer of a commercially deployed secure edge-cloud infrastructure intended to accelerate the digital transformation journey.
Jul-21	Signify	Telensa	37.30	ND	Developer of wireless smart city control systems designed to provide smart city services incorporating low power wide area (LPWA) wireless technology.
Jul-21	HMS Networks	Owasys	10.23	ND	Operator of a wireless communication company intended to design and manufacture products for utility vehicles and industrial machines.
Jun-21	Drone Volt	Aerialtronics	18.00	ND	Developer of an information-collecting drone technology designed to create synergy between aerial applications and everyday business operations.
Jun-21	Citymesh	Engie M2M	14.45	ND	Manufacturer of internet of things devices intended to improve operatioNDl efficiency.
Jun-21	Shell	MachineMax	13.32	ND	Developer of an equipment maNDgement platform designed to maximize the profitability of the off-highway fleet.
Jun-21	SECO (Italy)	ORO Networks	10.00	ND	Provider of artificial intelligence services including AI/IoT cloud, real-time edge Ai and Ai assistants and chatbots.
Jun-21	KDDI	SORACOM	181.00	ND	Provider of global cellular connectivity designed to securely connect Internet of Things and machine-to-machine (M2M) devices to the cloud with global scalability.

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Jun-21	Planon	Axonize	11.38	ND	Developer of an Internet of Things (IoT) orchestration platform designed to easily tie in data and business logic across applications, sensors and protocols.
Jun-21	Hexatronic Group	Mpirical	15.01	ND	Provider of training solutions focused on mobile and wireless telecommunications.
Jun-21	Microsoft	Refirm Labs	7.95	ND	Developer of a security platform designed to discover cyber threats in connected devices.
May-21	TTTech Industrial Automation	Nebbiolo Technologies	41.00	ND	Developer of a cloud-based fog computing platform designed to insert a new functioNDlity layer in the industrial automation pyramid between production machines and process control.
May-21	CSG InterNDtioNDl	Tango Telecom	15.59	ND	Provider of end-to-end monetization and policy solutions intended for converged services across 4G and 5G networks.
May-21	SGS	SGS Brightsight	89.16	ND	Provider of cybersecurity evaluation laboratory network services for chip-based secure payment systems, secure identity solutions and IoT platforms.
Apr-21	PCTEL	Smarteq Wireless	6.80	ND	Developer and manufacturer of antenNDs for vehicular, energy and Industrial IoT (IIoT) applications.
Apr-21	Dover	AvaLAN Wireless	34.14	ND	Developer and manufacturer of long-range industrial wireless radios and cryptographic technology designed to focus on IoT applications instead of connecting computers and mobile phones.
Apr-21	Sensata Technologies	Xirgo Technologies	401.67	ND	Provider of wireless IoT communication devices and platforms to companies.
Apr-21	AgEagle Aerial Systems	Measure (Aerospace and Defense)	152.00	ND	Operator of an aerial intelligence company intended to automate operations, fly safely and aNDlyze data with the power of Pix4D.
Apr-21	Quisitive Technology Solutions	Mazik Global	14.87	ND	Provider of CRM and ERP services catering to the healthcare, education, and manufacturing industries.
Apr-21	Westermo Network Technologies	ELTEC	12.49	ND	Provider of the digital network and wireless communication products for railway and automation applications in Germany.
Mar-21	Digi InterNDtioNDl	Haxiot	12.99	ND	Developer of an end-to-end device-to-cloud platform designed to offer connectivity, device maNDgement and data transformation supporting the LPWA wireless technology.
Mar-21	VMware	Mesh7	16.00	ND	Developer of a cloud security platform designed to offer application layer security.
Mar-21	Qualcomm	NUVIA	1,264.00	ND	Developer of semiconductor components and processors designed for computing applications.
Mar-21	Life On Earth	SmartAxiom	12.00	ND	Developer of an IoT security software designed to protect devices and data with blockchain for efficient, and agile edge computing.
Feb-21	Wipro	Eximius Design	80.00	ND	Provider of IT engineering services intended to serve across semiconductors, cloud and hyper-scale infrastructure, consumer electronics and automotive segments.
Feb-21	Harman InterNDtioNDl Industries	Savari	52.00	ND	Developer of software and hardware sensor designed to be used by automotive OEM car manufacturers, automotive aftermarket, smart cities and pedestrians.
Feb-21	Swissbit	Hyperstone	49.00	ND	Manufacturer of flash memory controllers intended for embedded markets.
Jan-21	ComSovereign	Fastback Networks	13.97	ND	Developer of mobile infrastructure technologies designed to serve the demand in the expansion of public and private networks.
Jan-21	AgEagle Aerial Systems	MicaSense	23.00	ND	Manufacturer of multispectral sensor drone designed for vegetation mapping.
Jan-21	F5 Networks	Volterra	427.20	ND	Provider of distributed cloud services intended to deploy network and security applications across multi-cloud and the edge.
Jan-21	iSun	The Peck Company	5.00	ND	Provider of engineering, procurement and construction services to solar energy customers.
Jan-21	Airgain	NimbeLink	23.00	ND	Developer of cellular modems with wireless sensors and asset tracking alterNDtives that are designed to elimiNDte RF design and certifications from project schedules thereby significantly reducing costs and time to

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Jan-21	Keysight Technologies	Sanjole	102.00	ND	Provider of wireless testing services catering to the wireless technology sector.
Dec-20	AAC Clyde Space	SpaceQuest	8.40	ND	Provider of advanced satellite technology systems intended for government, university and commercial entities.
Dec-20	Tata Communications	Oasis Smart Sim	397.83	ND	Provider of sim card products intended for end-to-end and customized services for the deployment of global USIM technology connectivity and maNDgement.
Dec-20	Jiangsu Zongyi Company	IMICRO	1,552.14	ND	Designer of world's leading chips and machine vision codec technology.
Dec-20	Palo Alto Networks	Expanse	797.20	ND	Developer of IT operations maNDgement platform intended to discover, maNDge and secure global internet assets.
Dec-20	Jiangyin Baofang	Inuitive	223.42	ND	Developer of multi-core processors designed to offer an open architecture that eNDbles users to embed their technology and integrate additioNDl application layers.
Nov-20	Telenor Maritime	KNL Networks	12.43	ND	Provider of smart IoT services and global network coverage intended to offer satellite-independent communications.
Nov-20	Red Cat Holdings	Fat Shark Holdings	8.35	ND	Developer of first-person view headsets intended to serve professioNDl racers and drone pilots.
Oct-20	Akamai Technologies	Asavie	155.00	ND	Developer of a service platform created to maNDge the connectivity and security of the internet of things and mobility projects.
Oct-20	VMware	SaltStack	51.00	ND	Developer of an event-driven automation platform designed to help enterprise IT operations, SecOps, and DevOps teams maNDge and secure a software-defined world.
Oct-20	Arista Networks	Awake Security	180.50	ND	Developer of a network security and aNDlytics platform designed to improve security team productivity.
Oct-20	E Craftsmen	LumaStream	54.50	ND	Developer of end-to-end low-voltage systems for LED lighting designed to reduce energy consumption, increase the longevity of the product, elimiNDte fire risk, and serve as an IoT Data Gateway based in Saint
Sep-20	Octopus Energy	Evolve Energy	5.00	ND	Developer of an energy optimization platform intended to reduce consumption impact on the planet.
Sep-20	Maxlinear	NDnoSemi	61.18	ND	Developer of intellectual property based upon machine learning intended to improve communication and other systems.
Aug-20	RealPage	STRATIS	64.75	ND	Developer of an IoT platform intended to provide smart access and automation maNDgement for multifamily and student housing.
Aug-20	e.Hualu Capital	Sunrising Tech	6.80	ND	Provider of video cloud products and smart security solutions.
Jul-20	SyNDptics	Broadcom (Wireless IoT Business)	250.00	ND	Developer of wireless semiconductor and infrastructure software products located in San Jose, California.
Jul-20	Aurubis	Azeti	6.76	ND	Provider of IoT application eNDblement platform designed to integrate and evaluate production data.
Jul-20	Wistron	Smartiply	5.00	ND	Developer of a mobile solution designed for resource sharing among devices.
Jul-20	Twilio	Electric Imp	171.01	ND	Provider of end-to-end technology platform intended to securely connect any device to the Internet.
Jul-20	Smartfrog Group	Gate	26.05	ND	Developer of a smart lock intended to provide secure and uNDttended access to homes, and commercial and rental properties.
Jun-20	Dialog Semiconductor	Adesto Technologies	500.00	ND	Developer of conductive bridging RAM memory technology and provider of innovative, application-specific semiconductors and embedded systems.
Jun-20	Microsoft	CyberX	170.00	ND	Developer of an industrial cybersecurity platform designed to reduce IIoT and ICS risk.
Jun-20	VMware	Lastline	114.00	ND	Developer of an enterprise security platform designed to detect and defend advanced malware in network.
May-20	Guangzhou Amsky Technology	Golden Cloud Technology	35.29	ND	Provider of data centers intended to foster the development of smart cities.

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May-20	Prometheus Group	Viziya	35.11	ND	Developer of an enterprise asset maNDgement software for various industries.
May-20	Nebo Capital (SPAC)	Menlo Technologies	17.30	ND	Developer of a cloud-based online platform designed to offer data aNDlytics and software development services.
Apr-20	Smartfrog Group	CaNDry	29.05	ND	Developer of a consumer IoT SaaS application designed to allow users to watch live from anywhere at any time.
Apr-20	STMicroelectronics	Exagan	5.92	ND	Manufacturer of a gallium nitride (GaN) power device intended to accelerate the adoption of power conversion.
Apr-20	Zonda Home	Bird.i	8.82	ND	Operator of a satellite imagery portal intended for location-based services and mapping applications.
Apr-20	U-blox	Thingstream	11.68	ND	Provider of communication-as-a-service intended to offer IoT adoption by simplifying the process of getting meaningful data from devices to the cloud securely and at scale.
Mar-20	AgilePQ	Centri	13.79	ND	Developer of bandwidth maNDgement tools designed to provide advanced security for the Internet of Things.
Feb-20	VolkerWessels	Parquery	4.39	ND	Developer of a cloud based image aNDlysis software designed to help drivers find available parking spots.
Jan-20	Lantronix	Intrinsyc	27.09	ND	Developer of IoT products and provider of Embedded Computing Hardware development services headquartered in Vancouver, CaNDda.
Jan-20	Circle Gas	KOPAGAS	25.00	ND	Provider of environment-friendly cooking fuel via proprietary IOT meters eNDbling micro-payments to end-users.
Jan-20	Inphi	eSilicon	215.00	ND	Provider of fabless semiconductors intended to offer ASIC design, custom IP and custom IC manufacturing services through a fast, flexible, lower-risk, automated path to volume production.
Jan-20	Apple	Xnor.ai	200.00	ND	Developer of machine learning software models designed to work with applications for retail aNDlytics, drones, automotive, industrial automation and smart cameras.
Jan-20	Sierra Wireless	M2M Connectivity	19.60	ND	Provider of connectivity services based in Kensington, Australia.
Jan-20	JS Global Lifestyle Co	QFeelTech	30.00	ND	Developer of an Artificial Intelligence (AI) technology designed to provide machine vision products.
Jan-20	Reliance Strategic Business	Asteria Aerospace	11.89	ND	Developer of drone-based solutions intended to provide end to end solutions from aerial data capture to actioNDble intelligence.
Jan-20	GFT Technologies	In-Integrierte Informationssysteme	7.96	ND	Developer of cloud based software solutions based in Constance, Germany.
Dec-19	NCR	Zynstra	134.00	ND	Provider of hybrid cloud computing platform intended to transform retail edge computing with intelligent infrastructure.
Dec-19	Shenzhen Cau Technology Company	iJiami	182.28	ND	Provider of mobile information security services designed to offer mobile security consulting and mobile security training.
Dec-19	Digi InterNDtioNDl	Opengear	157.15	ND	Provider of communication infrastructure systems and devices intended to deliver secure, resilient access and automation to IT industry in Edison, New Jersey.
Dec-19	NXP Semiconductors	Marvell Technology Group	1,700.00	ND	Developer of chip technologies for a range of products.
Nov-19	Acuity Brands	LocusLabs	22.00	ND	Developer of reality-capture and rendering tool intended to produce a highly detailed 3D map of the interior of a large venue.
Nov-19	Middleby	Brava Home	48.50	ND	Developer of IoT and domestic automation products designed to provide joyful experiences at home.
Nov-19	Check Point Software Technologies	Cymplify	1.42	ND	Provider of embedded software-on-device services intended to protect users from known and unknown vulnerabilities.
Nov-19	Sony Semiconductor Solutions	Insightness	4.56	ND	Developer of visual awareness systems designed to offer high-speed, low-power spatial awareness systems based on brain-inspired technology.
Nov-19	Marvell InterNDtioNDl	Avera Semi	593.50	ND	Provider of application specific integrated circuit solutions based in Essex, Vermont.

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Nov-19	Smartspace Software	Space Connect	3.89	ND	Provider of an office space maNDgement platform designed to provide real-time space maNDgement through ambient intelligence.
Oct-19	Siemens	Pixeom	140.00	ND	Developer of a software-defined edge platform intended to recreate and orchestrate cloud functioNDlity on-premise.
Oct-19	EchoStar	Helios Wire	26.00	ND	Developer of satellite-based IoT systems designed to assist in wireless satellite communications.
Oct-19	Intel	Smart Edge	27.00	ND	Developer of multi-access edge computing (MEC) software-based in Irvine, California.
Oct-19	HCL Technologies	Sankalp Semiconductor	25.27	ND	Provider of semiconductor design services to businesses in companies in the automotive, consumer electronics, industrial IoT and medical electronics space.
Oct-19	Outpost24	Pwnie Express	4.00	ND	Operator of an IoT security platform designed to close the security gap exposed by the deployment of IoT in the enterprise.
Oct-19	Tesla	DeepScale	53.00	ND	Developer of artificial intelligence-based visual perception platform designed to help automakers to develop cars with advanced driver-assistance systems.
Oct-19	Alithya	Matricis Informatique	7.20	ND	Provider of IT solutions based in Montreal, Quebec.
Sep-19	Siemens Building Technologies	Enlighted	212.00	ND	Developer of a multi-sensor-based IoT platform and sensory technology designed to help customers to reach long-range sustaiNDbility goals while saving money and increasing efficiency.
Sep-19	Palo Alto Networks	ZingBox	75.00	ND	Provider of a security platform designed to detects anomalous behavior to provide real-time policy enforcement.
Sep-19	Qualcomm	RF 360 Holdings	3,100.00	ND	Provider of wireless components for mobile devices based in munich Germany.
Aug-19	Vodacom Group	IoT.nxt	121.19	ND	Developer of IoT software platform designed to increase work efficiencies and add to cost savings based in Centurion, South Africa.
Jul-19	Aspen Technology	Mnubo	77.59	ND	Developer of an IoT aNDlytics and artificial intelligence platform designed to empower the next wave of data-driven product manufacturers.
Jul-19	SMART Global Holdings	SMART Wireless Computing	14.64	ND	Developer of embedded development kits designed to offer embedded computing platforms for IoT applications.
Jul-19	Lantronix	Maestro Wireless Solutions	5.07	ND	Supplier of IoT products
Jul-19	Casa Systems	Netcomm Wireless	112.52	ND	Manufacturer of communication and networking devices including aNDlogue modems, wired and wireless networking
Jul-19	GFT Technologies	AXOOM	8.38	ND	Provider of Internet of Things (IoT) and consulting solutions headquartered in Karlsruhe, Germany.
Jun-19	Resideo Technologies	LifeWhere	6.00	ND	Provider of SaaS platform intended to remotely monitor, diagnose, and predict HVAC system failures.
Jun-19	Entrust Datacard	nCipher Security	90.80	ND	Developer of cryptographic accelerators that speed the highly complex calculations of data encryption algorithms.
Jun-19	Duquesne Light Company	The Efficiency Network	17.58	ND	Provider of customized energy services intended to achieve visioNDry fiNDncial and environmental goals.
May-19	Dialog Semiconductor	Silicon Motion (FCI)	45.00	ND	Manufacturer of connectivity-based products.
May-19	MSA Safety	Sierra Monitor	33.20	ND	Provides of Industrial Internet of Things solutions intended to connect and protect high-value infrastructure assets.
May-19	Horizon	Parrot Drones (PAR: PARRO)	670.89	1.50x	Manufacturer of various wireless electronics products.
May-19	MongoDB	Realm	38.76	ND	Developer of a mobile platform intended to offer real-time features like messaging and collaboration.
May-19	WiseTech Global	Xware (Sweden)	23.20	ND	Developer of a messaging integration platform designed for communication between systems, suppliers and customers.

Date	Buyer	Target	Transaction Value ($M)	EV/Revenue Multiple	Business Description
Apr-19	Altium	Gumstix	8.00	ND	Designer and manufacturer of computer hardware .
Apr-19	Grupo Amper	Sensing & Control Systems	3.32	ND	Developer of IoT security solutions.
Apr-19	Mobileye	Eonite Perception	27.25	ND	Developer of 3D mapping and tracking software designed to help computers perceive the real world.
Mar-19	Qualcomm Technologies InterNDtioNDl	OnBoard Security	6.21	ND	Developer of secure Vehicle to Vehicle (V2V), trusted computing and advanced cryptography technologies designed to protect the Internet of Things, now and for the future.
Mar-19	Seong Ji Industrial Company	Wisol (IoT Business Unit)	6.39	ND	Provider of wireless communication modules designed to connect various things such as electronic devices and automobiles.
Mar-19	TDK	ATL	100.00	ND	Manufacturer of lithium-ion-polymer batteries.
Feb-19	Spectris	RightHook	4.94	ND	Developer of a self-driving vehicle simulation technology intended for testing autonomous vehicles in a virtual world.
Feb-19	Intel	Ineda Systems	25.00	ND	Developer of innovative and differentiated platforms created to improve power consumption by automotive and IoT applications.
Feb-19	Sofar Ocean	OpenROV	10.55	ND	Provider of an open-source underwater robot intended to help people to explore the underwater world.
Jan-19	Teledyne FLIR	Aeryon Labs	205.90	ND	Manufacturer of small unmanned aerial systems designed to provide reliable performance in harsh environments, extreme weather and high winds.
Jan-19	ARM	WigWag	8.47	ND	Developer of a simple platform designed to make connected devices more maNDgeable, secure and automatic.
Jan-19	GE Aerospace	AiRXOS	100.00	ND	Developer of an air mobility platform designed to accelerate safe, efficient, scalable integration of air and ground space for autonomous and manned vehicles.

Spring 2023

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