

# WHY REAL-TIME DECISIONS ARE CRITICAL FOR IoT DEPLOYMENTS

```
mirror_mod.use  
mirror_mod.use  
elif_operation  
mirror_mod.use  
mirror_mod.use  
mirror_mod.use  
#selection  
mirror_ob.select=1  
modifier_ob.select=1  
bpy.context.scene.ob  
print("Selected" + s  
mirror_ob.select  
time + bpy.context  
time + bpy.context
```



Your industrial and business IoT deployments are only as good as your real-time decisioning engine.

We're aware that this may sound like a bold, if ambiguous, statement, but we plan to use this paper to break down exactly why this is the case.

The mass interconnectivity enabled by the Internet of Things has ushered in a whole new era of industrial automation and fast, intelligent business decisions. Real-time decision-making allows for immediate responses and actions based on the data generated by IoT devices. This capability underpins the core value of IoT, driving efficiency, safety, and innovation.

Let's explore the critical role of real-time decision-making in IoT deployments, including the current IoT landscape, the significance of real-time decisions, the challenges faced around real-time decisioning for IoT, and fundamental strategies for overcoming security and privacy concerns.







## The Current IoT Landscape

At its core, IoT is the interconnection of everyday objects and devices, allowing them to collect and exchange data through the Internet. These “smart” devices can range from consumer gadgets like smart thermostats and wearable fitness trackers to industrial sensors and autonomous vehicles.

However, the real opportunity in IoT lies in the industrial spaces.

By harnessing the valuable insights provided by IoT-driven performance management, businesses can embark on a journey of transformation. This entails fine-tuning processes, amplifying operational efficiency, trimming down costs, and uncovering novel prospects. A noteworthy example of this is the use of IoT data for predictive maintenance, which enables companies to proactively schedule maintenance tasks, thereby minimizing downtime and prolonging the lifespan of their equipment.

IoT-fueled performance management equips organizations with the ability to make informed choices grounded in data. These choices pave the way for innovation and sustainable growth within their operations, as well as the ability to seize fresh opportunities for success.

By scrutinizing both historical and real-time data (including AI/ML data), enterprises can act on emerging trends, foresee market demands, and craft new products and services that cater precisely to customer needs. Such data-backed decisions are the driving force behind organizations staying competitive in swiftly evolving markets while fostering a culture of ongoing improvement.

## KEY IoT INDUSTRIES AND APPLICATIONS

IoT's impact extends across various industries, with applications limited only by imagination. Some key sectors where IoT is making a significant impact include:

**Manufacturing:** IoT-driven automation enhances production processes, reduces downtime, and optimizes resource allocation.

**Supply Chain:** End-to-end monitoring and visibility has become a major challenge in today's increasingly complex supply chains. IoT technology helps with quality assurance and theft and loss prevention through the entire supply chain.

**Healthcare/pharmaceuticals:** IoT enables remote patient monitoring, improved diagnostics, and smart medical devices for better patient care.

**Transportation:** Connected vehicles and traffic management systems enhance road safety and traffic flow, while logistics companies benefit from real-time tracking and route optimization.

**Agriculture:** IoT helps farmers make data-driven decisions, improving crop yield and resource management through smart irrigation and monitoring systems.

**Energy:** Smart grids and IoT sensors contribute to efficient energy distribution, reducing waste and costs.

**Smart Cities:** IoT technologies facilitate urban planning, traffic flow and safety, and public services, making cities more livable and sustainable.

## GROWTH AND ADOPTION OF IoT TECHNOLOGIES

The growth of IoT has been explosive, driven by advancements in technology, falling hardware costs, and the pursuit of data-driven insights. The number of connected devices continues to climb and is now projected to surpass 75 billion by 2025.

This rapid adoption is due to the real-world benefits IoT offers, including:

- Improved operational efficiency.
- Enhanced user experiences through personalized services.
- Data-driven decision-making.
- Increased safety through real-time monitoring and alert systems.





## IT/OT CONVERGENCE

One of the critical trends in the IoT landscape is the convergence of Information Technology (IT) and Operational Technology (OT). IT deals with digital data, while OT handles physical processes and machinery.

The ultimate aim of IT/OT convergence is to ensure that the right data is delivered from the operational edge to the decision-makers within OT and across the entire organization, empowering informed actions. This, however, requires a seamless transition from OT-controlled networks to IT-controlled ones.

In many organizations, these two worlds, IT and OT, have long operated as separate entities, often making decisions without regard for each other, or sometimes even at cross-purposes. But with digital transformation becoming a high priority for many if not most organizations, the importance of convergence has never been more evident.

### BENEFITS OF IT/OT CONVERGENCE

The convergence of IT and OT opens the door to several advantages, including:

**Real-time Visibility and Control:** It provides immediate, direct access to your OT environment, granting real-time insights.

**Streamlined Processes:** Operations become more efficient and straightforward.

**Lower Operational Costs:** Increased system efficiency and reduced scheduled maintenance translate into cost savings.

**Reduced Unplanned Downtime:** The capability to predict and prevent system breakdowns decreases unexpected downtime.

**Informed Decision-Making:** It allows for smarter planning and decisions based on real-time and historical data.

### CHALLENGES OF IT/OT CONVERGENCE

While IT/OT convergence offers numerous benefits for the OT domain, there are challenges to be mindful of. One significant point of friction revolves around OT cybersecurity. Traditional OT systems, mostly offline, have minimal exposure to cyber threats. However, connecting factory equipment to networks for remote monitoring elevates the risk of cyber-attacks if adequate protection is not in place.

Some older OT systems might lack the necessary security features to ward off cyber threats. When considering OT applications, a security-first mindset should be applied, and this is exactly where real-time decisions and actions can help by thwarting attacks before they do damage.

## EDGE/IoT CONVERGENCE

Another convergence is that of edge and IoT. IoT thrives on having computational power in close proximity to the physical devices or data sources it relies on. This is often referred to as co-locating data and decisions. For IoT data to respond swiftly and address issues effectively, it's crucial to analyze it at the edge, right where it's generated, instead of sending it all the way back to a central location for processing.

Combining IoT and edge computing yields a host of benefits:

**Reduced Latency:** Communication between IoT devices and central IT networks becomes nearly instantaneous.

**Faster Response Times:** Operations become more efficient, thanks to quicker data analysis and decision-making.

**Optimized Network Bandwidth:** Bandwidth is used more efficiently.

**Offline Operation:** IoT devices can continue functioning even when they lose network connectivity.

**Local Data Processing:** Data can be aggregated and analyzed at the edge using analytics algorithms and machine learning, enabling rapid decision-making.

**Data Flow Flexibility:** IoT gateways can send data either to the cloud or a centralized data center or process it locally at the edge.

**Sustainability:** Processing data where it is created means that much of it can be discarded, which reduces data center volumes, leading to lower transmission costs and energy usage.

The clouds plays a pivotal role in the Edge-IoT relationship.

Edge devices require network connectivity with central locations for various purposes, including remote management, automation instructions, telemetry traffic forwarding for analytics, and transmitting data for storage and analysis in databases to achieve business goals.

Cloud services can facilitate the transfer of data from an edge device through the cloud to a data center. Alternatively, it can involve the edge device sending logs of its decisions back to the data center for data storage, management, processing, and extensive analysis.

## KEY IoT-EDGE USE CASES

Industrial IoT (IIoT) finds its application in industrial settings, such as factory machinery. Take, for instance, the lifecycle of heavy equipment in a factory. Various factors can strain these machines differently over time, and breakdowns are part of the operational landscape.

IoT sensors can be integrated into the equipment's vulnerable components. Data collected from these sensors can be analyzed to enable predictive maintenance, ultimately reducing downtime.

Autonomous vehicles serve as a prime example of why IoT and edge computing are a dynamic duo. An autonomous vehicle on the road must continuously collect and process real-time data on traffic, pedestrians, road signs, and signals, all while monitoring its own systems.

In situations where immediate actions are required to prevent accidents, transmitting data back and forth between the vehicle and the cloud for processing is simply too slow. Edge computing extends cloud services to the vehicle itself, enabling IoT sensors to process data locally in real time, ensuring safety and accident avoidance.





## CHALLENGES IN IoT DEPLOYMENTS

While the potential benefits of IoT are substantial, challenges persist. Some of the prominent issues include:

**Interoperability:** With a wide array of devices and communication protocols, ensuring seamless communication between different IoT components can be complex.

**Data Management:** Handling vast amounts of data generated by IoT devices, ensuring its quality, and analyzing it effectively is a substantial challenge.

**Scalability:** As IoT networks grow, maintaining performance and reliability across large deployments becomes more challenging.

**Security:** As we'll get into below, IoT systems are susceptible to cyber threats, and securing them against data breaches and unauthorized access is paramount.

**Privacy:** Data privacy concerns arise as personal and sensitive data is collected and transmitted by IoT devices, necessitating robust privacy protections and compliance with regulations.

Companies must meet the challenges of interoperability, data management, scalability, security, and privacy to realize the full potential of IoT.



# Real-Time Decision-Making in IoT

Real-time decisions refer to the process of making immediate choices and taking actions based on the data generated by IoT devices. We define “immediate” as however fast the decision needs to be to meet your particular latency SLAs. This could be anywhere from single-digit milliseconds to upwards of half a minute.

The point is you’re optimizing your IoT and edge resources to make the most and best use of your data for the sake of your business’s bottom line. In the context of IoT, this means analyzing data as it is produced and acting swiftly to optimize operations, enhance safety, and capture time-sensitive opportunities.

Real-time decision-making is of paramount importance for several reasons:

- **Immediate Responses:** In dynamic and time-critical situations, real-time decisions enable instant responses to changing conditions, ensuring that actions are taken promptly.
- **Operational Efficiency:** Real-time decision-making enhances operational efficiency by minimizing delays, reducing downtime, and streamlining processes.
- **Safety and Security:** For applications like autonomous vehicles and industrial control systems, real-time decisions can prevent accidents and protect against threats in real-time.
- **User Experience:** In consumer IoT, real-time decisions improve user experiences by tailoring services to individual preferences and needs, such as adjusting home climate control or suggesting the best route during navigation.

## The Role of Data in Enabling Real-Time Decisions

Data is the lifeblood of real-time decision-making in IoT. To enable these quick and accurate decisions, several key functions come into play:

- **Data Collection:** IoT devices continuously generate data, from environmental sensors to wearables, feeding the decision-making process.
- **Data Analysis:** Advanced analytics and algorithms are applied to the data to identify patterns, anomalies, and trends that can inform decisions.
- **Data Interpretation:** Once analyzed, the data must be interpreted in context, allowing decision-makers to understand its significance and relevance.
- **Data Storage:** Real-time decisions often rely on historical data for context, requiring secure and accessible storage solutions.

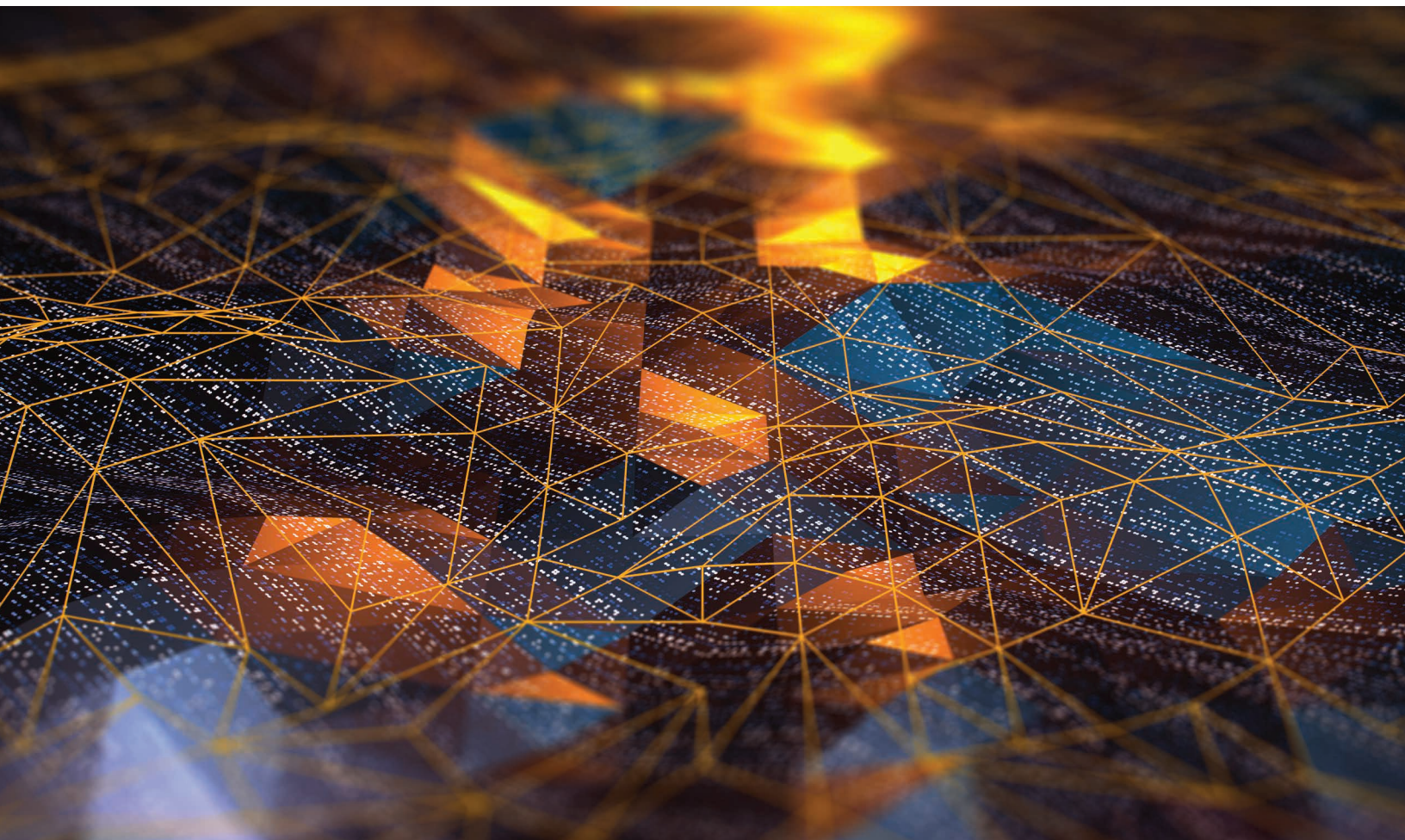


## TECHNOLOGIES ENABLING REAL-TIME DECISIONS

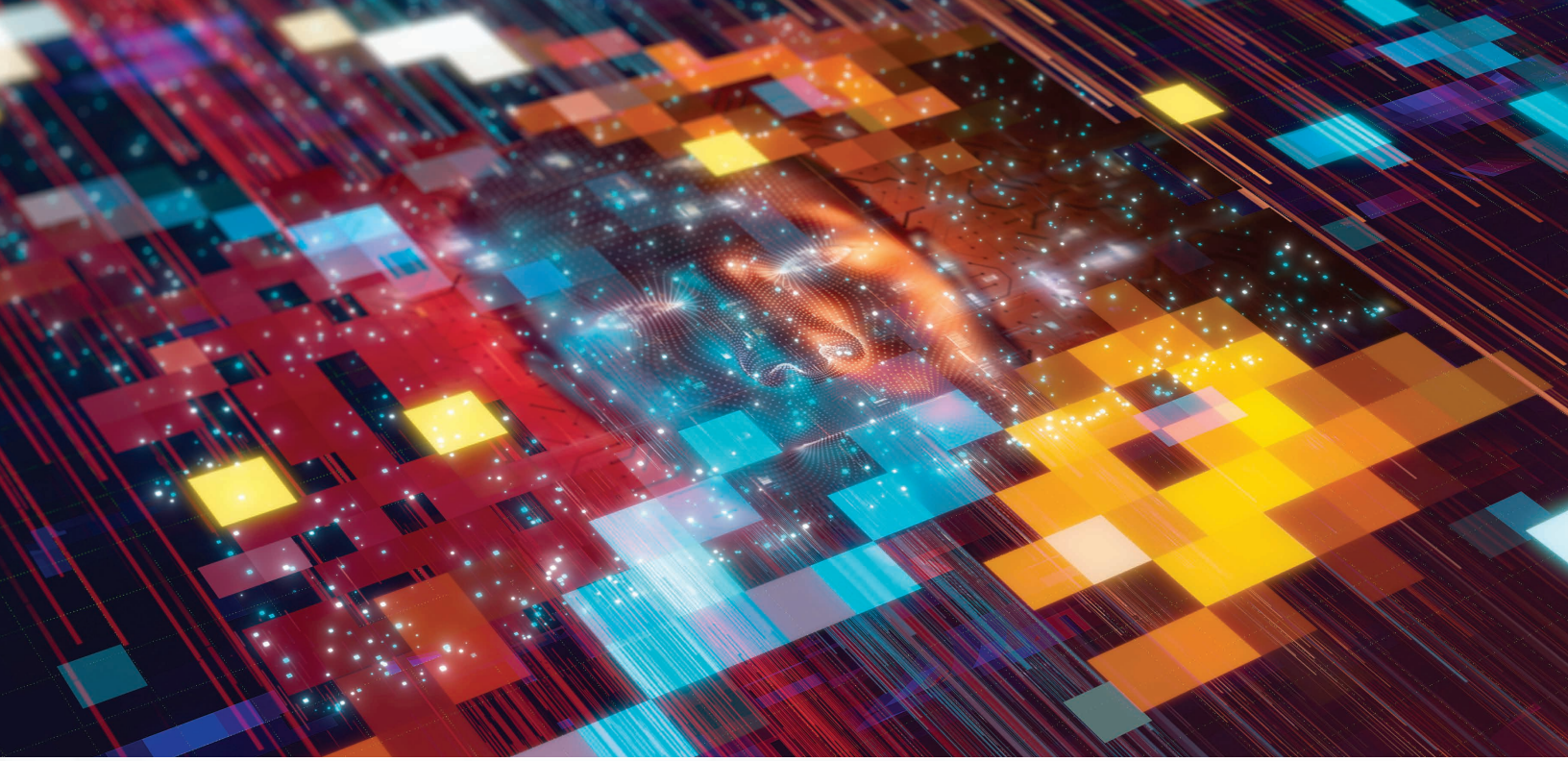
A variety of technologies play a pivotal role in enabling real-time decision-making in IoT:

- **Edge Computing:** Edge computing decentralizes data processing, allowing it to occur closer to the data source, reducing latency and enabling real-time decisions.
- **ML and AI:** These technologies analyze data, recognize patterns, and make predictions, allowing IoT systems to adapt and respond in real time.
- **Connectivity:** Low-latency communication technologies, like 5G, play a crucial role in ensuring that data can be transmitted and received quickly.
- **Automation:** Automated systems can act on real-time decisions, such as adjusting thermostat settings, redirecting traffic, or sending alerts for preventive maintenance.
- **Data Streaming Platforms:** Unlike regular solutions that ingest, process, and structure data before it can be acted upon, streaming data platforms enable consuming, storing, enriching, transforming, and analyzing data as it is generated.

In conclusion, real-time decision-making is the linchpin of IoT, driving its ability to deliver real-world benefits. The significance of immediate response, enhanced operational efficiency, and improved user experiences cannot be overstated. As the IoT landscape continues to expand, real-time decision-making will remain a cornerstone, shaping how we interact with the digital and physical worlds and paving the way for innovative applications across industries.







## IoT Security and Privacy Concerns

The increased connectivity of IoT comes with a host of security and privacy concerns, including:

**Unauthorized Access:** Weak or default passwords and inadequate access controls can lead to unauthorized access to IoT devices, potentially compromising sensitive data or control over critical systems.

**Data Breaches:** Data generated by IoT devices can include personal and sensitive information. Breaches can result in the exposure of this data, leading to privacy violations and identity theft.

**Device Manipulation:** Attackers may exploit vulnerabilities to manipulate IoT devices, causing them to perform unintended actions, such as altering settings, disabling security measures, or disrupting operations.

**Botnets:** IoT devices can be harnessed to form botnets, which can be used for Distributed Denial of Service (DDoS) attacks, overwhelming websites and services, rendering them inaccessible.

**Lack of Device Updates:** Many IoT devices lack the ability to receive firmware updates or patches, leaving them exposed to known vulnerabilities.

**Data Sharing:** Data generated by IoT devices may be shared with third parties for various purposes, including marketing and analytics, raising questions about consent and data ownership.

**Compliance:** Regulations like the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA) impose strict data protection requirements on organizations deploying IoT devices. Non-compliance can result in hefty fines.



## STRATEGIES FOR SECURING REAL-TIME IOT SYSTEMS

To ensure the security of real-time IoT systems, organizations should implement a combination of strategies, including:

**Access Controls:** Implement strong access controls, ensuring that only authorized personnel can interact with IoT devices.

**Encryption:** Encrypt data both at rest and in transit to protect it from unauthorized access or interception.

**Firmware Updates:** Ensure that IoT devices can receive firmware updates to patch vulnerabilities and improve security.

**Intrusion Detection:** Employ intrusion detection systems to identify and respond to suspicious activities in real time, before the threat or intrusion transpires.

**Security by Design:** Build security into the design of IoT devices from the outset, considering security measures at every stage of development.

## COMPLIANCE WITH REGULATIONS AND STANDARDS

Ensuring compliance with relevant regulations and standards is crucial for IoT deployments. Organizations must respect data subject rights, provide transparency in data processing, and ensure lawful data collection and processing. Companies handling personal data in California must comply with CCPA requirements, which include data access, deletion, and opt-out provisions. Also, adherence to IoT security standards, such as ISO/IEC 27001 and NIST Cybersecurity Framework, can help organizations establish robust security practices. Consider getting third-party audits and certifications to validate compliance with security and privacy regulations.

In short, IoT security and privacy concerns are significant challenges that require attention, investment, and ongoing vigilance. As the IoT ecosystem continues to grow and evolve, securing real-time IoT systems and safeguarding data privacy become paramount. Organizations must be proactive in identifying threats, implementing security measures, and complying with regulations to ensure the integrity, availability, and confidentiality of IoT data. Failure to do so not only jeopardizes the safety and privacy of individuals but also exposes organizations to legal and reputational risks.

# Why Volt for IoT Deployments

Real-time decisions are pivotal in harnessing the full potential of IoT. They drive efficiency, safety, and innovation across various industries.

But making true real-time decisions requires a special kind of data platform.

By enabling single-digit millisecond intelligent decisions on relevant data without compromising on latency, accuracy, consistency, or resiliency, the Volt Active Data Platform was built for the IoT age.

Volt allows companies to simply plug the real-time decision engine into their information infrastructure, thereby pulling everything together in one place.

Volt can run on IoT-edge locations because of its small footprint. This way, the platform is able to provide ultra-low latency, especially in machine-controlled processes where the platform needs to detect anomalies to stop a machine or trigger an alarm. This also makes the platform an independent service that can be employed offsite locations or in environments where there is no connection to the cloud.

Volt applies a rule-based detection approach to find anomalous activity and invoke preventative action. These rules are dynamic because Volt can integrate with machine learning platforms such as data lakes and data warehouses to update these rules as new triggers and patterns emerge. This allows systems built on this solution to continually adapt to the attack surface coverage

The platform uses real-time intelligence, machine learning, and complex event processing from multiple channels to analyze thousands of attributes—including subscriber behavior, geolocation, device information, transaction type, etc—across multiple channels in real time. These attributes are compared to correct behavior and statistical anomalies are picked out as events occur to head off fraudsters before they even have a chance to act.

As the only data platform on the market capable of maintaining state and making decisions at the same time at scale, Volt is uniquely positioned to help global enterprises across verticals take full advantage of IoT deployments.

To try Volt, [click here.](#)

## ABOUT VOLT ACTIVE DATA

The Volt Active Data Platform enables companies to unlock the full value of their data and applications by making it possible to have scale without compromising on speed, accuracy, or consistency. Based on a simplified stack and an ingest-to-action layer that can perform sub 10-millisecond decisioning, Volt's unique, no-compromises foundation gives enterprises the ability to maximize the ROI of their 5G, IoT, AI/ML, and other investments, ensure "five 9's" uptime, prevent fraud and intrusion, deliver hyper-personalized customer engagement, and save on operational costs.

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