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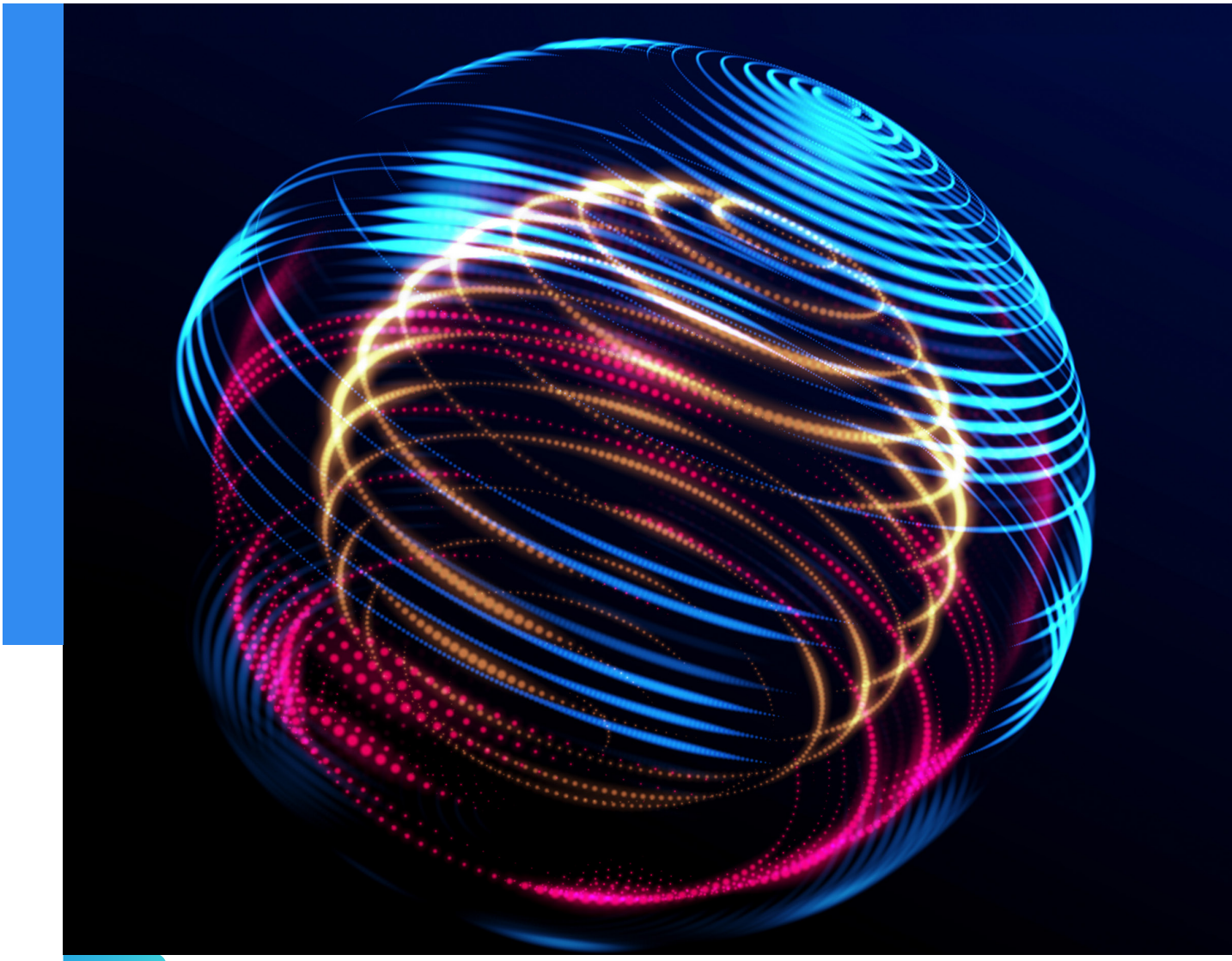
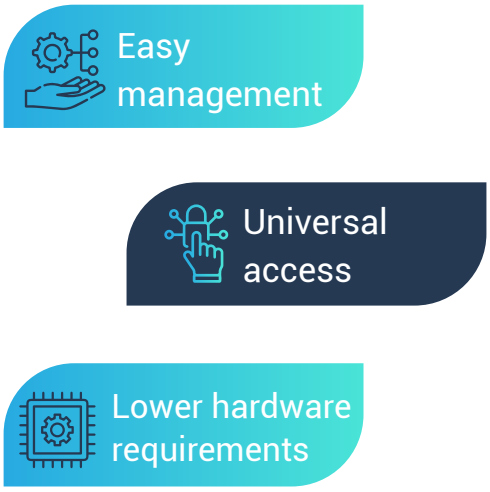


Ensure Low Latency to Process IoT Data with the Right Cloud Architecture

A Whitepaper

Internet of Things devices is becoming quite ubiquitous. So much so that by 2027, the IoT market size is expected to grow from $520 billion in 2022 to more than $2 trillion annually. Technology, service providers, and investors across the board are also likely to invest around $1 trillion into IoT technology by 2022.

The ease with which the IoT devices deliver digital services to consumers and businesses is one of the reasons for its growing adoption across sectors. The devices also provide other benefits such as:



> Indium Software's teX.ai listed as **One of the Top Ai Products and Top 15 Big Data Development Companies** in India and the USA, 2020

Statista also reveals that some of the industries that are leading investors in IoT at around $40 billion include:

- Discrete manufacturing
- Transportation and logistics
- Utilities

They were followed by B2C enterprises such as retail, healthcare, government, and insurance.

Challenges of Latency

The IoT devices provide businesses and users with many advantages, including:

- Improved productivity with lower manual intervention.
- Operation management efficiency.
- Optimal resource and asset utilization.
- Operational cost-effectiveness.
- Increased work safety.
- Fruitful marketing and business development.
- Greater customer satisfaction and retention.
- Increased business opportunities.
- Enhanced reputation.

However, to realize the full potential of IoT data, two of the biggest challenges include:

- Communication latency is caused by a high physical and logical distance between the server resources and the end nodes.
- Network vulnerability along long routes.

This results in lags in connecting and impacts user experience. To overcome this, the enterprise needs to deploy a cloud architecture that is agile and flexible and can be updated without disruptions.

Getting the Cloud Architecture Right

Some of the key features of a good cloud architecture that can reduce latency for faster processing of IoT data include:

Make it Agile: An agile IoT architecture lets users continue to use features even as the data processing functions are being improved.

Application Engineering consumer grade, modular applications that can connect, communicate and collaborate across platforms for rich customer experience enabling organizations to be truly digital.

Create Functional Layers: A good IoT cloud architecture has different layers through which data flows. At each layer, the data's functionality for analysis and insights is furthered. Though the layers can differ for different organizations, some of the common layers include:

- The Internal Aggregate Layer is the first layer where all data for processing is made ready and contains public information obtained from IoT, SaaS platforms, and other cloud sources.
- The Ingestion Framework Layer is the channel, allowing unstructured, semi-structured, and structured data to flow into the reporting layer.
- The Reporting Layer can have multiple zones and varies according to the needs of the organization.
- The Outbound Services/Storage Layer is made of APIs allowing managed access to enable information sharing with both internal and external parties.

Edge Computing: Bringing Power to the Devices

IoT requires latency of fewer than ten milliseconds but the public cloud cannot offer such latency. Edge Computing is fast becoming an important trend combined with 5G adoption, which will provide the speed and reliability required for IoT data.

Edge computing reduces the latency for data processing by providing a distributed network model that can work parallel to cloud data depositories. While cloud computing relies on a single data center, the distributed network of edge computing improves real-time responsiveness and local authority.

According to a Gartner report, 30% of the new industrial management systems are expected to include analytics and AI-based edge inference capabilities by 2025, while in 2021, it was less than 5%. By 2023, nearly 75% of greenfield IoT projects have containerized applications for life cycle management at the edge, against the 30% in 2021.

An optional 5G module is expected to be available in at least 50% of high-end industrial IoT gateways by 2024 while less than 10% offer it in 2021.

The Gartner report reveals that the I&O leaders are preferring edge computing solutions to process data closer to the source of generation to meet their need for:

- Real-time insights and localized action.
- Regulatory requirements.
- Network constraints.
- Volume and velocity of data generated from sensors and endpoints.

The currently available edge computing solutions revolve around the aggregation of data and event filtering capabilities near the source of data generation, though the roadmap is to provide real-time analytics and control at the edge.

Best Practices for Lowering Latency for IoT

Some of the best practices Gartner recommends for lowering latency include:

01

Support local data processing and control and reduce sending all data to the cloud by implementing edge computing solutions near the source at the edge.

02

Data analytics teams and business units to develop use cases together, with a roadmap and edge architecture.

03

Meet computing requirements at the edge by ensuring secure data processing in the device, providing a gateway or edge server, or both based on need.

04

Deploy a modular edge computing solution for easy management and scalability for additional use cases at minimum investments.

Key Features of Edge Computing

Some of the key features of the edge computing solution for industrial IoT include:

- Aggregating data generated from endpoint devices.
- Normalizing it for ingestion by analytics platforms.
- Processing data near the source of generation.
- Executing artificial intelligence (AI) inference models with analytics.
- Taking actions locally based on incoming events and data.
- Providing local and remote visualization capabilities.
- Storing data locally.
- Transmitting and receiving data to and from any data center including the cloud and operating autonomously even if there is a network disruption.

The Right Edge Computing Architecture for Low Latency for IoT Devices

An edge computing solution architecture depends on the use case and will vary according to the enterprise's goals and needs. A typical edge computing infrastructure stack should include:

- Device connectors
- Data processing engine
- Application and device life cycle management modules
- Security module
- Local application/dashboards

An edge computing infrastructure is complete with the following:

Sources of Data: Sensors embedded in the different devices.

IO Modules: The modules, embedded in PLCs, edge servers, or IoT gateways, are the interfaces that convert the data generated by the endpoints to digital outputs that is used for further processing.

Industrial Connectivity Software: Industrial protocols such as Modbus RTU are converted by the device drivers provided by industrial connectivity software to IoT-friendly formats such as OPC/UA or MQTT.

Application Life Cycle Management Software: From the development of the application to its packaging and delivery is enabled by the life cycle management software. It includes lightweight applications or XML files that include specific execution logic for containerizing and delivering the apps to the endpoints through IoT platforms. An agent hosted by the edge infrastructure orchestrates this activity.

Hardware for Data Aggregation and Processing: The compute power required determines the kind of hardware to be deployed including microcontrollers, edge servers or edge server clusters, and IoT gateways.

Hardware Life Cycle Management Software: Provided with the hardware, it facilitates updates to OS, device driver, and security and for monitoring the hardware infrastructure health.

Data Processing Software: The data aggregated from the various endpoints in the IoT gateway or edge server is normalized by the data processing software that labels, filters, and adds metadata.

The data then is processed and the insights published.

Data Storage Infrastructure: The analyzed data sometimes needs to be stored locally offline analysis or because of bandwidth constraints. A time-series database at the edge can be used for storing such data.

Edge Colocation Infrastructure: Microdata centers interconnect the edge with the cloud and address latency issues by hosting edge applications and analytics platforms near the source of data generation.

Indium to Design the Best Fit Cloud Infrastructure for Low Latency in Your Organization

Indium Software provides expertise in Cloud Engineering to empower businesses with a reliable platform that can help them to confidently innovate and grow.

From cloud modernization to the development of cloud-native applications and implementing optimum and cost-effective cloud infrastructure, Indium provides end-to-end cloud engineering and management services best suited to your organization. Our bespoke solution architecture leverages the latest technologies while protecting your existing investments while ensuring performance, cost, and security.

To know more about Indium's cloud computing services and how we can help you ensure low latency for processing IoT data with edge computing, visit: https://www.indiumsoftware.com/cloud-engineering/

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