



IoT Analytics Platform

Faster Analytics • Smarter Actions
Better Outcomes Faster

Big Data

**Intelligent
Actions**

**Prescriptive
Analytics**

**Streaming
Analytics**

**Predictive
Analytics**

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I. Introduction/Summary

Internet of Things (IoT), Big Data, and Analytics are all emerging areas of growth and promise. While the market value and potential is high and the use cases seem apparent, businesses are looking to improve the real business results and value generated in IoT projects. There is a need for new kinds of analytics platforms and tools to help them achieve their objectives quickly.

IoT brings a different level of challenge. In IoT we will end up dealing with an enormous amount of data that has a high degree of variance over speeds, feeds and data cycles. As we see millions and billions of devices in IoT being connected, each passing moment we see an overwhelming amount of new data generated which can bring more insights. Operations managers would like to leverage this data to detect anomalies, predict problems early, mitigate any disruption of service, and provide new customer experiences.

In addition to the explosion of data, the business environment and conditions are changing more quickly. Real-time decision-making and rapid responses to competitive and operational challenges are required in this new environment. Organizations need to take action and be nimble to react to the environment and address IoT challenges to find insights and value.

To address these trends, managers must address the need for faster analytics overall all types of data — fast, slow, and in-between — due to the nature and variety of data types in IoT. Overcoming the challenges in IoT will require:

- Faster Analytics tools and services are needed to handle the time critical nature of IoT challenges. New forms of unified analytics platforms are also required to deal with the variety and volume of big data at massive scale within IoT.
- Analysts and application development teams need to be empowered with self-service and model-driven development tools and automation so they can build faster and produce analytics applications rapidly.
- Unifying historical, real-time streaming, and predictive analytics to provide broader “big picture” context for business operations managers to act quickly. It is critical to leverage advancements across all types of analytics to accelerate through the analytics value chain and have the greatest impact on business value.

SELF-SERVICE TOOLS LEAD TO FASTER OUTCOMES = RAPID INNOVATION

Self-Service tools leading to better outcomes empower analysts to rapidly define drivers & performance indicators for new IoT applications in minutes, not months

These faster, unified analytics provide broader context that will in turn deliver timely insights that enable smarter actions and better business outcomes. The greatest value is created by building up rich context using all types of analytics in order to understand the full complexity in any IoT scenario. With that in place, it is possible to then take the next best action to address the situation – be it reducing operational risks/costs, driving new revenue, or improving operating efficiency.

SMARTER ACTIONS

Building value in IoT Analytics is accomplished by unifying multiple data streams & analytics types to take the best possible actions for business operations

The Vitria IoT Analytics Platform is a new platform with a novel conceptual approach to analytics and its associated software architecture. The focus of the platform is on addressing the challenge of rapidly delivering better business outcomes and value in IoT initiatives and projects.

It accomplishes this goal by providing a cloud-enabled IoT analytics platform that:

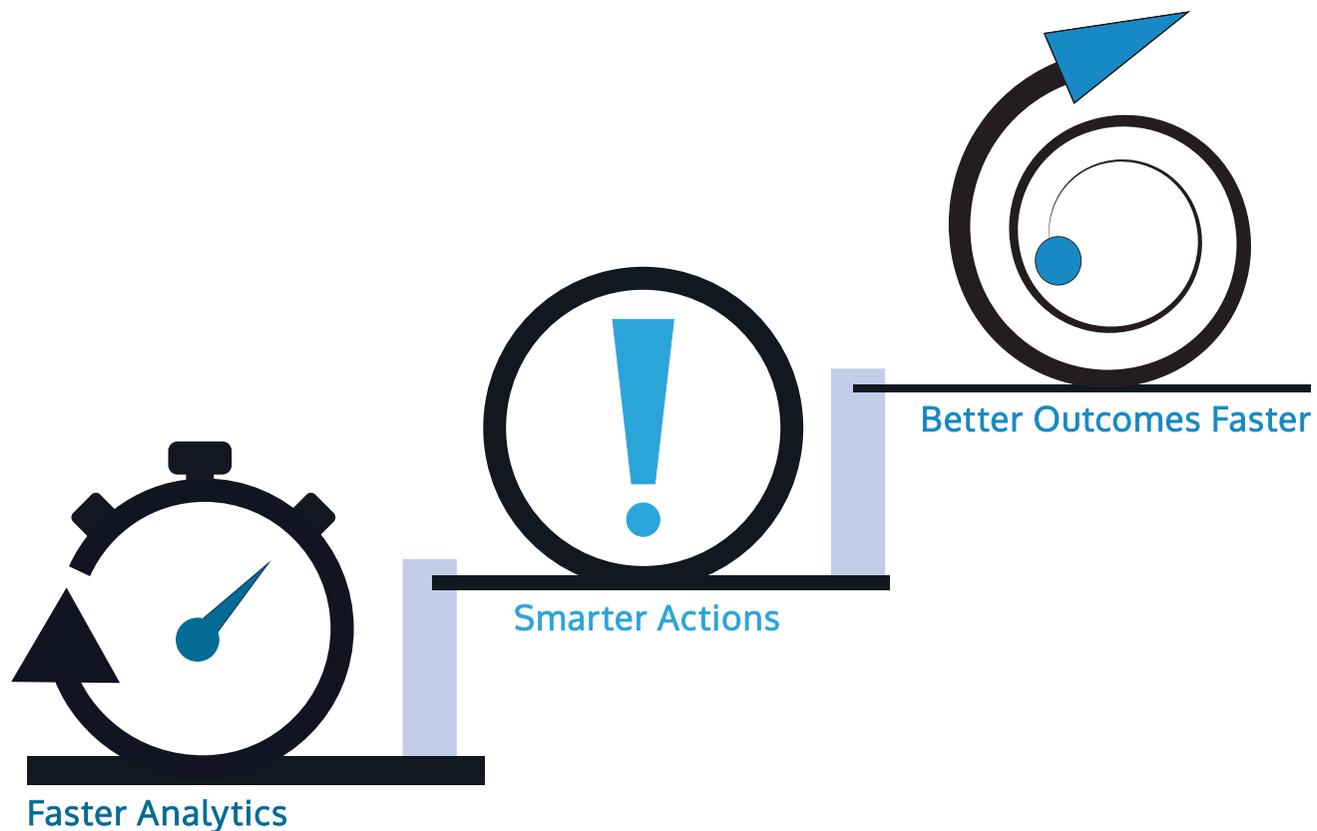
- Delivers faster analytics in real-time with a unique methodology that integrates the analytics value chain across streaming, historical, predictive, and prescriptive analytics with relevant contextual and situational data to improve the quality of actions that lead to better business outcomes and results.
- Unifies native and 3rd party predictive and prescriptive analytical models via a complete and open platform that complements the core analytic engine.
- Accelerates application development via a set of self-service & model-driven tools and automation that empowers analysts to create faster analytics in minutes vs. months.

TIME-TO-VALUE

Rapid time-to-solution enabled by self-service & model-driven approach to development

Unified architecture for the analytics value chain accelerates time-to-solution

The platform's faster analytics provide a rapid path to insights and actions that empower organizations to take smarter actions that lead to faster and better business outcomes.



II. Market Potential

The interest in advanced platforms for IoT Analytics is being stimulated by a number of market trends, sheer economic scale, and business imperatives that are emerging in the IoT era of business.

Value Potential & Use Cases

The industry estimates over 25 billion IoT devices by 2020¹ and \$15 trillion of global GDP by 2030². Directionally these numbers are huge and even a fraction of that is too big to ignore. The proliferation of such IoT devices will be across industrial, enterprise and consumer segments. Whether it's a smart grid or smart home, the data from sensor or device is continuously flowing to the network and to the end-user, and in some situations back to the device.

This connectivity of devices, equipment, factories, products and supply chain to the network or to the cloud is leading to massive volumes of data every second. It is these volumes of data combined with the advancements in the technological capabilities of advanced analytics to provide insights and patterns that can bring timely outcomes across 3 major segments of IoT (see Figure 1 below) – industrial, enterprise and consumer:

**MASSIVE IoT DATA
VOLUME & VELOCITY**

Harnessing all this new data to deliver better outcomes faster requires new approaches, unified analytics, technology, & platforms

1. Secure & Safe Environment – This is the mission-critical aspect for all segments of IoT addressing cyber security, physical security, fraud detection and personal safety.
2. Operational Efficiency – In the Industrial IoT alone, 1% of improvement in operational efficiency, such as predictive maintenance and asset optimization, translates into \$300 billion savings over 15 years.
3. Revenue Growth – With new business models and services, service providers can enable better customer engagement models and predictive 1-1 marketing to provide end-user centric services based on the lifestyle of target consumers.

1 — Gartner
2 — General Electric, Wikibon

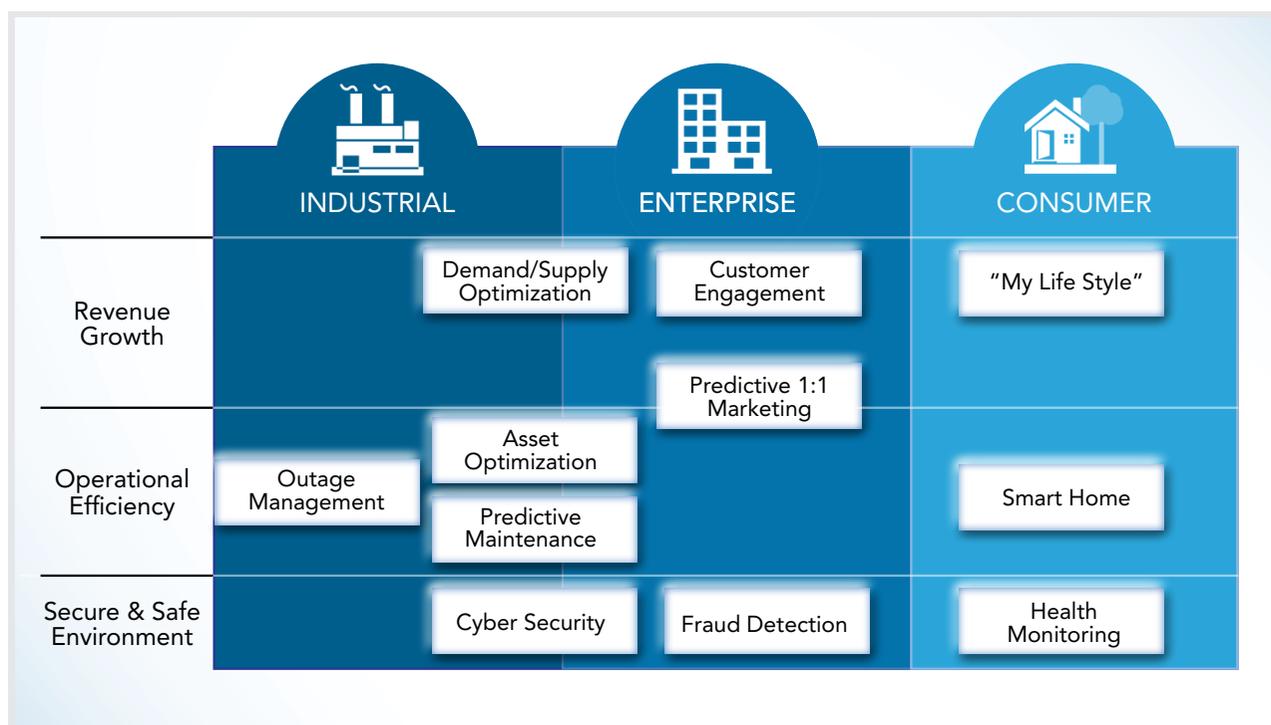


Figure 1: IoT Use Cases Across Market Segments

III. Business Imperatives in IoT: Timely Action and Faster Time-to-Value

a) Timely Action

Over the past 20 years, response time of 2-3 days to resolve customer issues in a supply chain was considered the norm. However, with the advancements of IP-based technologies for ubiquitous connectivity, mobility and cloud services, customers are expecting 24x7 always-on service availability with minimal service disruption. More importantly, time to act in real-time is also becoming a key SLA (service level agreement) for many use cases. With IoT the window for time to act is going to shrink from days to minutes to seconds to milliseconds, and the value of any particular action will diminish rapidly beyond that time window.

For example, as shown in Figure 2 below:

- In providing electric service, the time window to detect an electricity shortfall and respond will be less than 30 minutes.
- In a customer contact center, the time window to act on information from connected devices will be less than 30 seconds.
- In a smart grid, the time window to detect and respond to a cyber-security breach will be in milliseconds.

Time to Action Defines the Business Value in IoT

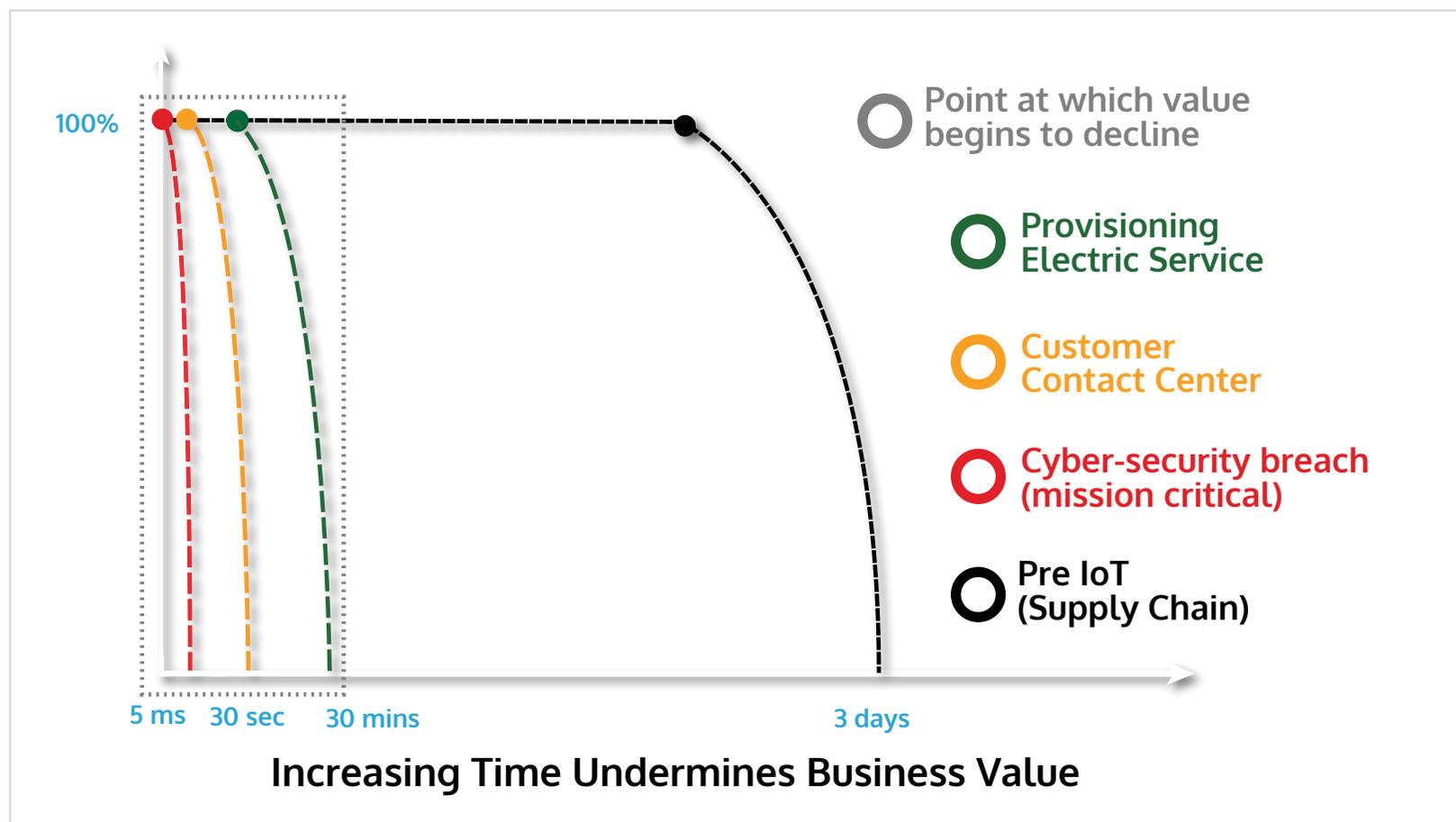


Figure 2: Time to Action is Critical – Defining the Business Value in IoT

With the growing volume of real-time big data in IoT and with the reduced time for decision making, companies need to leverage advanced real-time analytics with predictive and historical models to rapidly assess situations of opportunity or threat before they occur. Broader and richer context is required for this level of timely action. Enabling this type of capability will require new types of analytic methodologies and unification of disparate software components and data acquisition technology. Traditional approaches that use one-off projects to assemble a solution are unlikely to meet the business imperative outlined above.

The difficulty is a major problem not only for the scenarios described above, but is also a major hurdle for software development and operations teams who are looking to meet these business requirements. Time-to-value is a major challenge with these projects.

b) Time-to-Value

Reducing the development and implementation timelines for IoT projects is another critical business imperative. The typical approach of building analytic models and Key Performance Indicators (KPIs) over months is not viable in the

IoT era. The uses cases and applications often involve unifying new data and sources that have previously not been integrated in any way. Development teams need advanced self-service analytics tools and model-driven automation technology that will streamline the development of the core analytical building blocks of an application. Furthermore, these tools must be accessible to analysts and not confined to data science specialists and advanced users or developers.

TIME-TO-SOLUTION

Development teams need advanced self-service analytics tools and model-driven automation technology that will streamline the development of the core analytical building blocks of an application.

IV. A New Vision & Solution is Needed for IoT Analytics

a) Roles

In considering a new approach to analytics, the first step is to focus on users and their roles. In the traditional model, there are typically three distinct roles or groups involved, and often there is not a clearly defined business owner. Sometimes data scientists or analytics professionals are primary and focus on technical capabilities that solve narrow problems within their domain. As shown in figure 3 below, these roles are often not unified around business problems within IoT analytics.

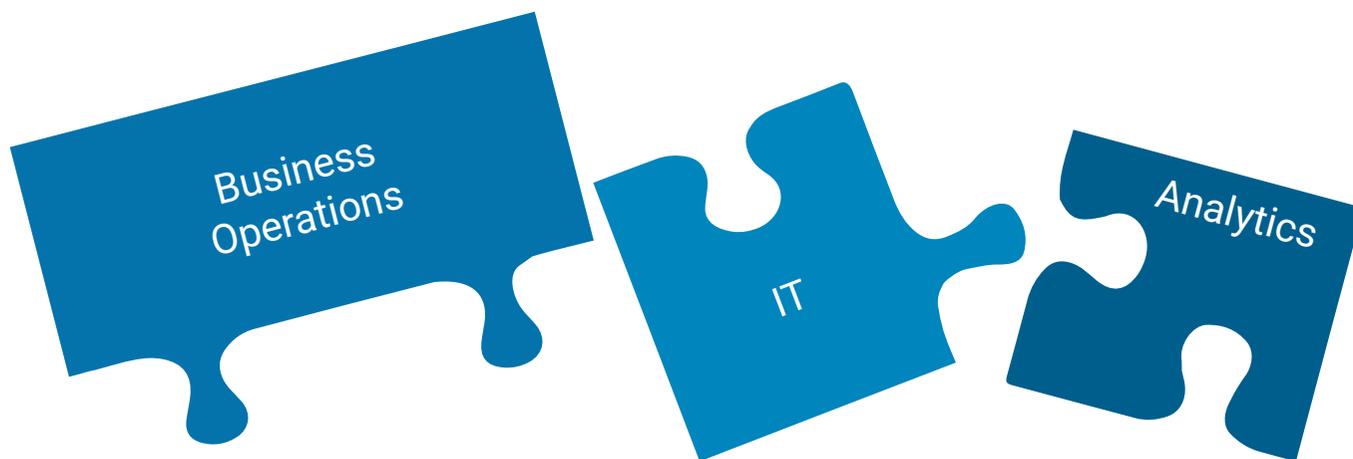


Figure 3: Traditional Roles: Analytics Not A Strategic Asset

Often information Technology (IT) is a driver and will focus on applications and data that is central to their job. Business Operations is often focused on the Operational Technology (OT) part of IoT.

The challenges of IoT require a re-thinking of the roles as shown in Figure 4 below. Business operation managers and leaders are now primary in the decision-making process, and are responsible for driving business outcomes. This is significant as it will drive a new focus on business value for IoT analytics projects. IT and Data Scientists remain very important and will enable the capabilities and applications needed to support business operations. They will also need new tools and capabilities to meet the challenges of IoT application development.

EMPOWER BUSINESS OPERATIONS
In IoT Analytics, Business operations becomes the key driver of applications & projects. They need better analytics tools for rapid development and innovation.

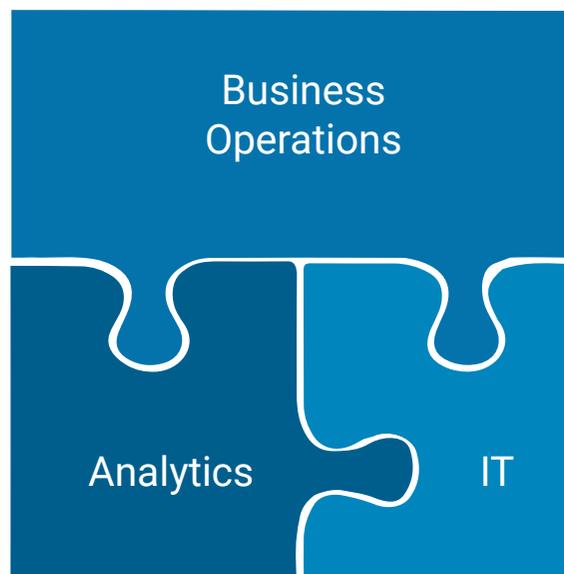


Figure 4: New Approach for IoT: Analytics a Key Strategic Asset

b) Analytics Approach for IoT

The other major consideration in assessing the model of analytics needed for IoT is the various types of analytics and sources of data used in an application. Figure 5 below shows one version of the traditional model. Descriptive and diagnostic analytics (sometimes grouped as historical analytics) are often developed independently and have multiple connection points to the various sources of data. The structured, semi-structured, and unstructured data that is often stored in different data warehouses and logical locations is connected independently and requires multiple connectors to consolidate all the relevant information. This is time and cost prohibitive and makes it difficult to build IoT Analytics applications quickly and meet business imperatives for timely action. It also significantly delays time to value and is not scalable from an economic point of view.

ANALYTICS AND DATA SILOS
The wide array of analytics tools and diversity & complexity of data lead to myopic views and ultimately poor actions and outcomes

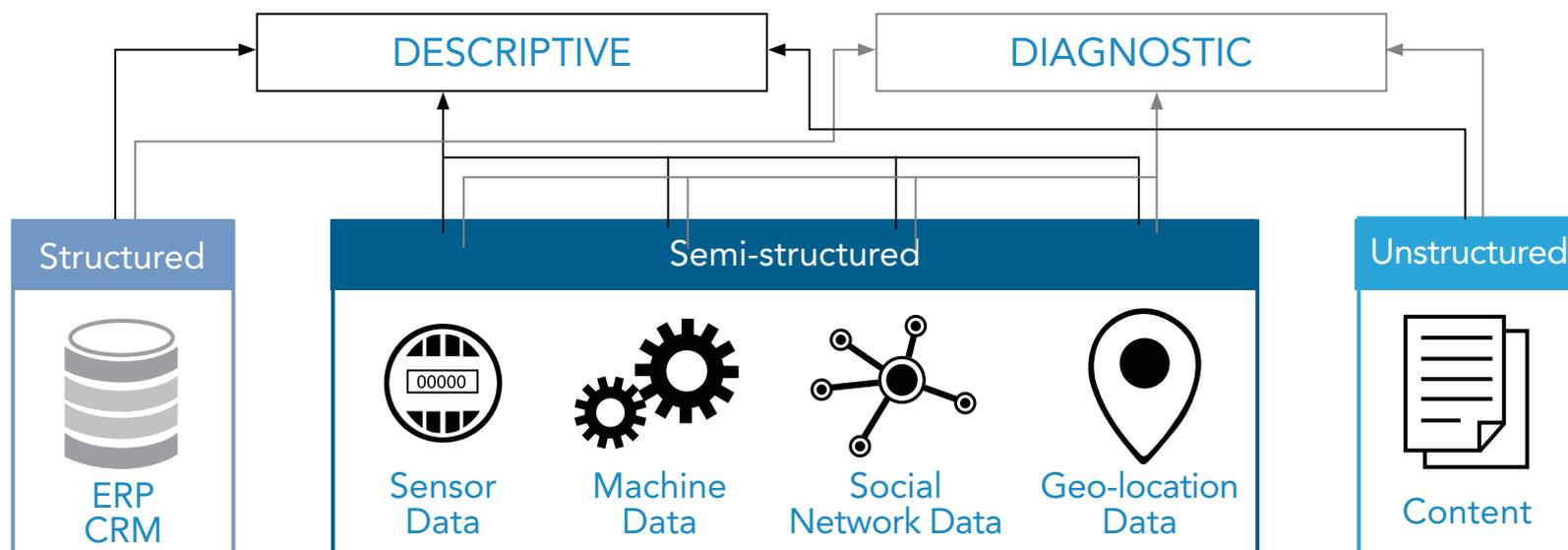


Figure 5: Traditional Approach For Analytics

The first step in designing a new approach is to simplify the process by integrating all the data for an IoT application. That includes all the structured, unstructured, and semi-structured data in the picture. This range of data must be integrated for the analytics that will be run on the data. Better business outcomes are achieved when these silos are removed and analytics are used across a broad spectrum of valuable data.

The second key step in the streamlining process is to unify the analytics layer. In the traditional model, descriptive and diagnostic analytics made the problem challenging because of the “siloed” approach to data access. This issue will multiply rapidly in scale and become much more serious with the addition of predictive and prescriptive analytics. The problem is more acute and unworkable for IoT applications. This traditional heterogeneous and one-off approach to types of analytics will not suffice for IoT because it will take significant time and effort for data management vs. focusing on delivering outcomes based on the analytics. The explosion of data in all forms in IoT requires a more robust and broader lens in order to enable smarter timely actions and better outcomes.

ANALYTICS FOR IoT

Analytic tools and data must be integrated to meet the challenge of IoT data rates and volume

All the types of analytics must be unified into a single engine (as shown in Figure 6 below) to ensure scalability and real-time performance. This includes historical analytics (descriptive & diagnostic), real-time streaming analytics, predictive analytics, and prescriptive analytics. In addition, a design philosophy of openness and unification is needed to help customers get results rapidly. Businesses looking to deploy IoT applications cannot be expected to “rip and replace” their existing investments, and need approaches to leverage their existing analytics and data investments and migrate them into a larger unified framework. The payoff is that users will now be able to spend more time on insights and business outcomes that matter most and avoid the time and distraction of creating or managing a complex infrastructure.

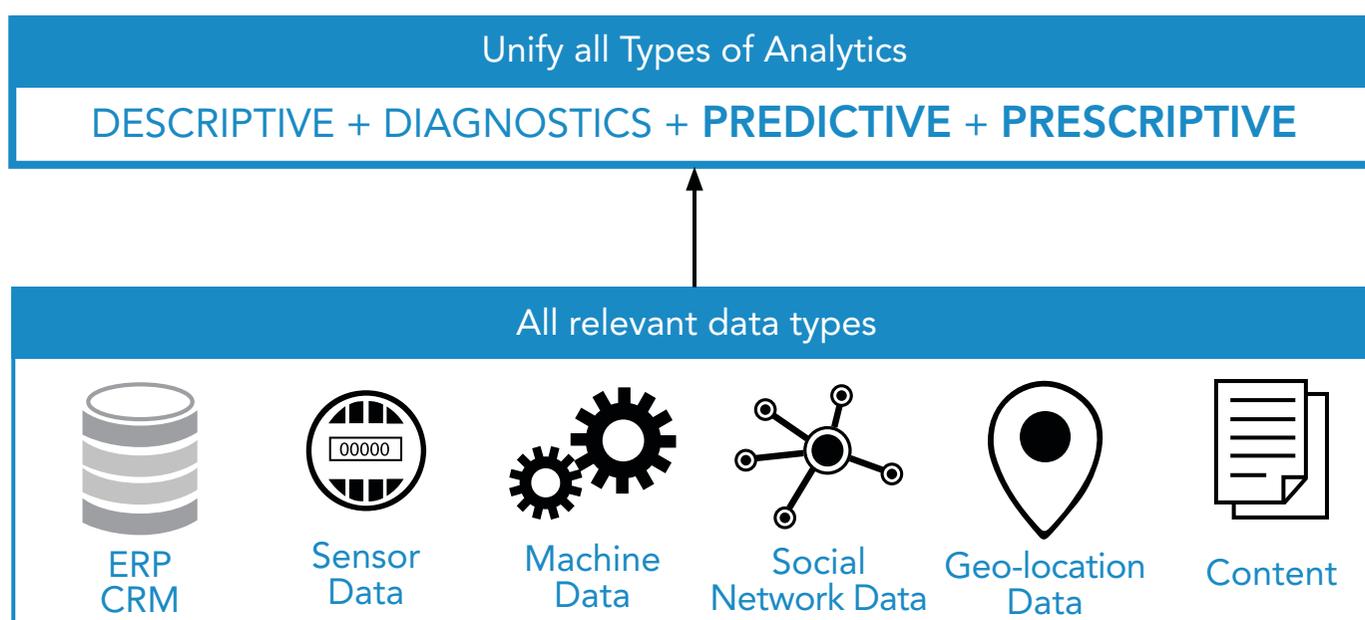


Figure 6: Analytics Approach For IoT

c) The Analytics Value Chain

The approach to analytics outlined above is a good first step for IoT. However, it is the ability to execute analytics in real-time across the analytics value chain (streaming, historical, predictive, and prescriptive analytics) with relevant contextual and situational data that addresses the critical “last mile” for timely outcomes. This is then combined with the ability to take the next best action in any particular scenario that creates the greatest value. The increasing value chain depicted in Figure 7 below shows how each step in the process refines the data and adds more value and context.

- Ingesting data at speed and volume sets the stage for additional processing.
- Real-time Streaming Analytics processes incoming streams of data from IoT sensors and devices.
- This refined data is then correlated with contextual and historical data to provide a baseline for advanced analytics. Contextual data can include information like GIS (geographic information systems) data relating to an IoT application.
- The next step is to predict failures, anomalies, or patterns using predictive analytics that are based on machine learning over historical and situational data such as external events like weather.
- The final step in the analytics value chain is to apply prescriptive analytics to determine the next best action to take. This next best action could be a wide variety of actions associated with lowering risks, addressing an outage, or making a real-time offer to a customer to capture a sales opportunity in retail.

**FASTER ANALYTICS
ACROSS THE VALUE CHAIN**

Achieving results in the complex IoT world requires a methodology and technology to move through all the steps of the analytics value chain to take the critical actions needed to meet business imperatives.

Analytics that can run rapidly and continuously in memory, using incremental algorithms to deliver insights for the next best actions is what creates the greatest value in IoT.

The important point is that specific actions based on a rich understanding of history and context must be taken NOW in order to capture that value. New tools are needed to achieve this ambitious goal for IoT.

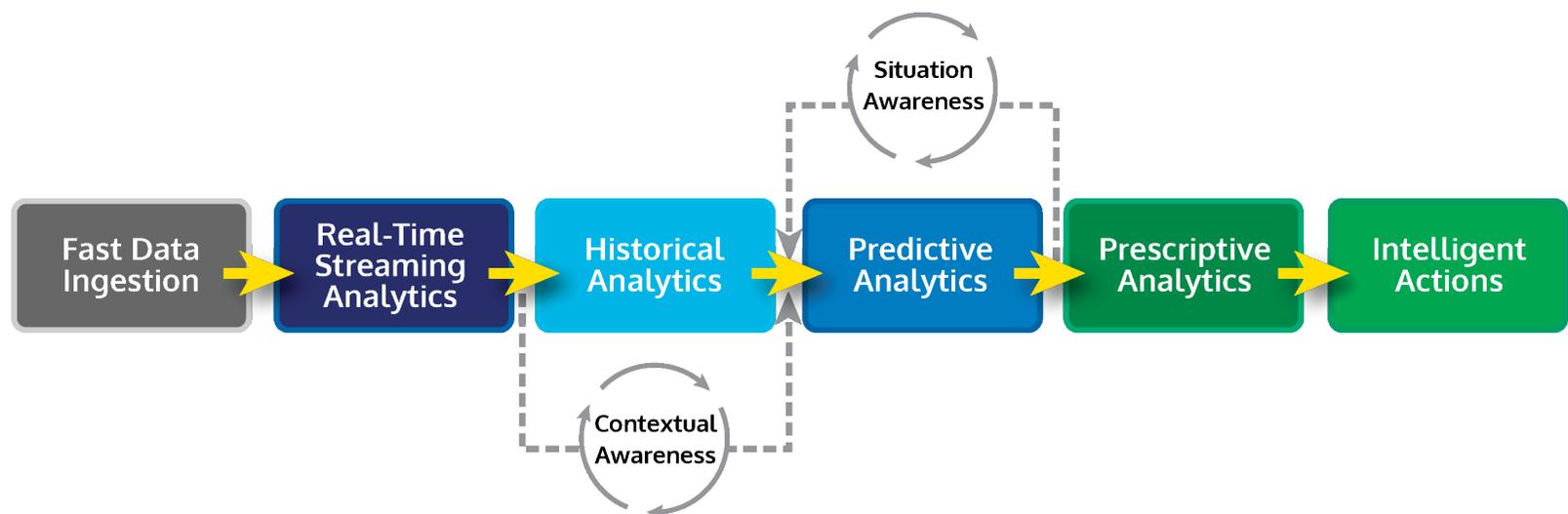


Figure 7: Analytics Value Chain

V. The Vitria IoT Analytic Platform

The Vitria IoT Analytic Platform (figure 8 below) is designed to empower business operations to effectively deliver business outcomes that address IoT business imperatives. The platform starts with a comprehensive view of the needs for IoT analytics and applications at both a 'full stack' level as well as the core analytics process itself.

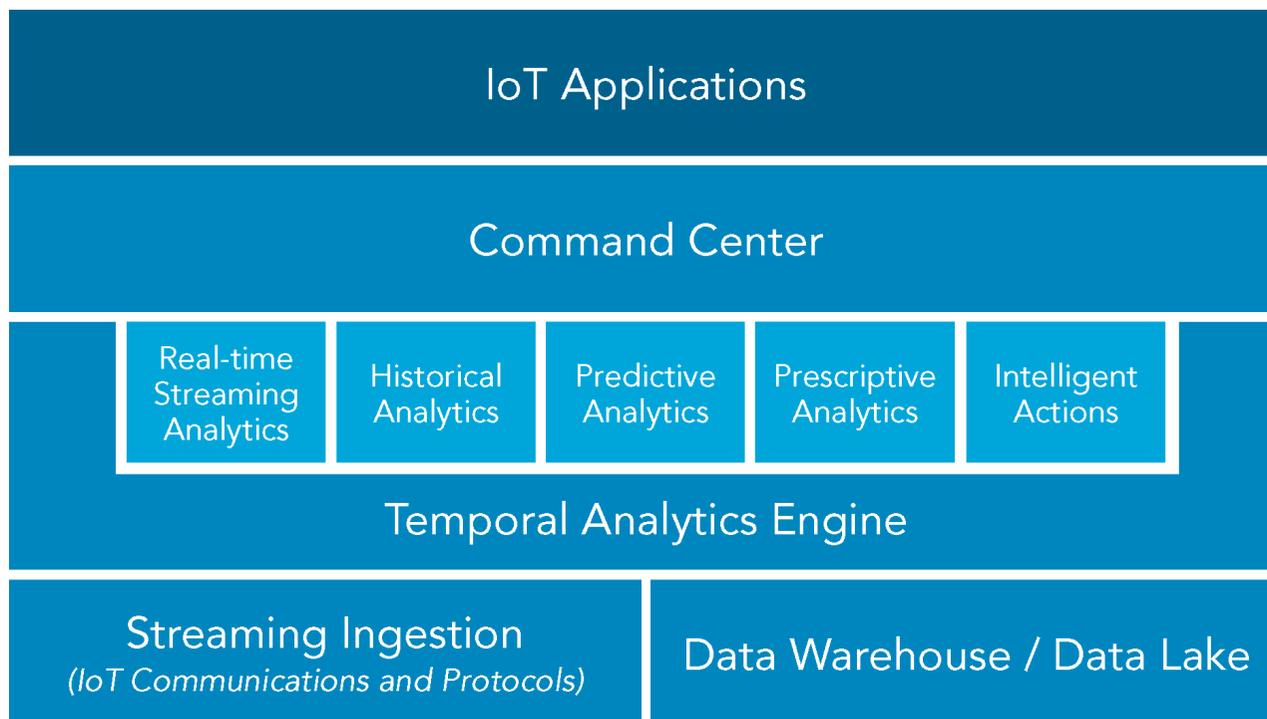


Figure 8: The Vitria Analytics Platform

a) Streaming Ingestion

Any analytics platform begins with the challenge of acquiring data from multiple sources. In IoT, this challenge is complicated further by the need for continuous ingestion of real-time streaming data from a multitude of devices. Vitria's platform addresses this challenge with its streaming ingestion capability.

The platform's Streaming Ingestion capability leverages IoT communications and protocols to deliver a fast ingestion of data from IoT devices to the higher layers of the platform. Vitria's Stream Builder self-service tool includes an auto-discovery capability that rapidly builds a formal schema that is then used in production environment. Auto-discovery ensures the right data is in the data model at great speed and accelerates the time-to-value for any IoT application. This capability has been built with the specific business imperatives and data explosion challenges of IoT in mind and is one of the foundational capabilities for faster analytics.

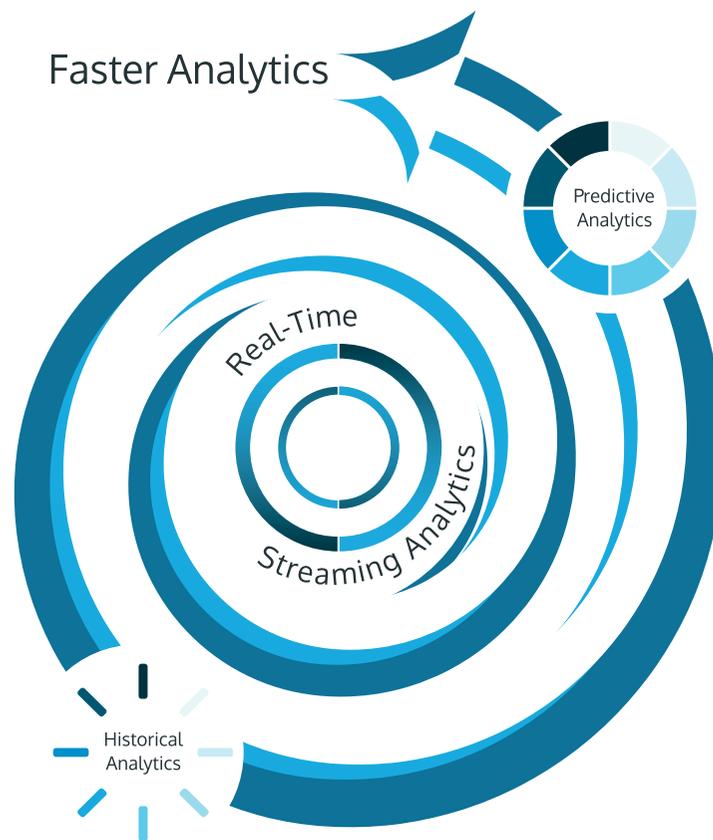
b) Data Warehouse/Data Lake

In addition to access to streaming data, the other key foundational capability at the data access layer is access to historical data warehouses and data lakes found in many organizations. In this domain, the platform has an open approach that enables customers to leverage their existing data warehouses or data lake solutions. These existing data management solutions then become unified into the broader Vitria platform for comprehensive analytics processing.

Vitria's platform creates a "thing" definition and schema that provides a consistent baseline for the other layers of the platform and IoT applications based on it. This approach to data management is another one of the foundational building blocks for faster analytics.

c) Temporal Analytics Engine

The heart of the platform's differentiation is the Temporal Analytics Engine and its complementary components. Vitria's Temporal Analytics Engine delivers **faster analytics** in real-time with a unique methodology that integrates the analytics value chain across streaming, historical, predictive and prescriptive analytics with relevant contextual and situational data. This "pan-temporal" capability that blends analytics across time frames in real-time is not found in any other IoT analytics platform. The net result for business operations specialists is that they have a 360 degree context that provides the fastest and best possible basis for real-time smarter actions that improve business outcomes and value generation.



Vitria's Temporal Analytics Engine blends these analytics into a continuous and unified process that goes further by offering the potential over time for prescriptive analytics which can recommend specific actions to accomplish certain outcomes.

The Intelligent Actions capability delivers the crucial ability for workflow logic, alerts, and notifications to enhance the ability of business operations leaders to take smarter actions that lead to improved business outcomes. The Command Center in the platform and IoT applications can then leverage this capability to visualize analytics scenarios and provide dashboards to streamline review and action.

INTELLIGENT ACTIONS CAPABILITY

Vitria's Intelligent Actions capability delivers the final key step of the ANALYTICS VALUE CHAIN – taking action based on the unified analytics in real-time

Another important capability of the engine is its ability to define indicators more broadly than traditional key performance indicators, or KPIs. This powerful self-service capability enables analysts to rapidly build Business Value Indicators. It combines traditional KPIs with pattern and anomaly detection. This creates a combined view of the key drivers of particular outcomes. The tool significantly accelerates time-to-value for IoT projects. These capabilities empower analysts to be nimble to react to business challenges and create solutions with the platform that enables timely action, implementing complex analytics faster in minutes, not months, and thereby improve business outcomes faster.

**TEMPORAL ANALYTICS ENGINE—
FASTER ANALYTICS IN REAL-TIME**

Vitria's Temporal Engine is the key to achieving maximum value with IoT applications – faster analytics in real-time combined with Intelligent Actions delivers the ultimate value.

The engine's unified and continuous real-time processing and the new approach to indicators is a potent combination that delivers unified and faster analytics. It enables Business Operation managers to meet the dramatically reduced time for action and time-to-value that is required for new IoT applications.

Vitria's Temporal Analytics Engine is the key missing link in accelerating the pace through the analytics value chain identified in our "traditional vs. IoT" analytics discussion above in section 4. Each step in the process adds increasing value and ultimately leads to concrete actions. In addition, moving through the value chain requires a unified overall platform that simplifies the process. Assembling disparate technology pieces to traverse the value chain is not a path to a solution.

As shown in Figure 9 below, by unifying ingestion, all types of analytics, real-time contextual awareness, situational awareness, and intelligent actions, Vitria's engine and platform enable organizations to build applications that will meet the challenges of IoT scenarios. This unification is important not only for performance reasons, but also because the unification between each of the layers requires careful design and engineering to meet the demands of real-time business. Vitria's Temporal Engine was built with these imperatives in mind.

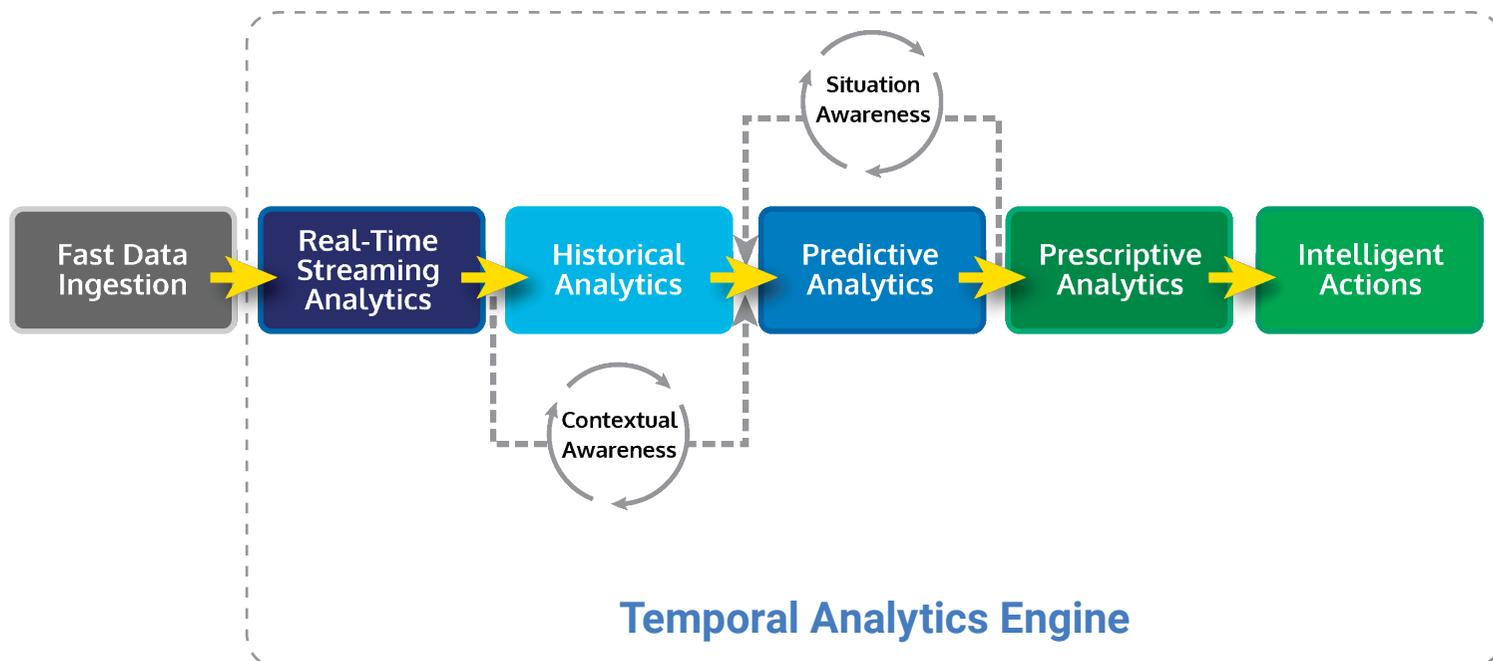


Figure 9: Vitria Temporal Analytics Engine

d) The Command Center

The Command Center of the platform includes a series of dashboards and visualization features that enable business operations managers to easily manage and take **smarter actions** to improve **business outcomes faster** and create value quickly for their organizations. Reducing time-to-value is a key goal of the capabilities built into the Command Center.

- The Status Board and dashboard builder tool in the command center provide a view of the overall network of things in any particular IoT application. This 'pan temporal' view unifies streaming real-time, historical, and predictive analytics into a singular view. The unification is fundamental to the rapid time-to-action business imperative. This view also includes a playback feature that enables analysts and managers to leverage the Pan Temporal capability to look across a time series from past to present to future. This provides instantaneous and broad context for smarter actions in real-time. The business imperatives of the IoT era can only be met with this type of instant big picture context that feeds actions and outcomes.
- The Executive Scorecard capability within the Command Center provides a higher level summary view of the IoT application and network for business operations managers. This view is ideal for business managers who need a bird's eye view of their network, devices, and application and can drill down as needed to manage issues and learn more about the details. The ability to predict the behavior of IoT networks at a macro level and rapidly find insights at the device level enables analysts and managers to pinpoint cause and effect issues in a network or distributed system.
- The Business Value Indicator capability driven by the Temporal Analytics Engine is visualized in the Command Center with a comprehensive dashboard. It displays an overall view of devices, various groupings, status at the device level, and multi-dimensional analysis of the key drivers of value in any IoT application. These indicators become the basis for smarter actions and better, faster business outcomes.

BUSINESS VALUE INDICATOR = RAPID TIME-TO-VALUE

The self-service capability to build business value indicators shown in the Command Center dramatically shrinks development time and brings valuable IoT applications into production quickly

e) Unification & Openness

All the specific functional capabilities of the layers in the platform are important, but more is required to meet the business imperatives of IoT. The specific capabilities need to be unified into a complete platform. As discussed in the "Analytics Approach for IoT" section, a key theme of the IoT era is that previously disparate approaches will not suffice or scale for IoT. User interface and visualization tools, analytic engines, data access, and streaming pieces must all work in harmony for IoT analytics to meet business goals.

The Vitria platform is unified and was designed from the outset to address analytics at the scale and range to meet IoT challenges. It is also an open platform that can interoperate with various other forms of predictive analytics and data warehouse technologies customers are using in today's environment. The platform is designed to accommodate these existing pieces and seamlessly work with them to deliver the unified solution for the next generation of IoT applications.

UNIFICATION = RAPID TIME-TO-SOLUTION

The platform's unified and open architecture eliminates the need to assemble disparate components and enables solutions to be built in a fraction of the time compared to traditional analytics

VI. Innovation & Faster Business Outcomes - The Vitria Platform

Achieving faster and better business outcomes in IoT can only be done if the intelligence and associated action is executed in seconds, or in some cases, sub-seconds. Vitria's platform provides faster analytics in real-time via its unique Temporal Analytics Engine. The analytics value chain (figure 10 below) shows how the pieces of the Vitria platform leverage the faster analytics to build value.

The ultimate value comes when prescriptive analytics and intelligent actions are used to take action to effect business outcomes. Such value cannot be achieved without a unified analytics platform with self-service and model-driven tools and services. The platform combines rapid application development, broad analytical context for real-time IoT scenarios, and the ability to take action at the right time. Furthermore, the combination of rapid development tools and unified analytics sets the stage for teams to build innovative new IoT applications.

The unified analytics provide new insights for potential smarter actions and the tools enable rapid testing of new applications based on those insights.

FASTER TIME-TO-VALUE = INNOVATION

Vitria's Platform provides a faster time-to-solution that enables rapid innovation and ultimately faster time-to-value. It will foster the development of many new types of IoT applications that enable real transformation of business operations.

Business Value with Temporal Analytics Engine

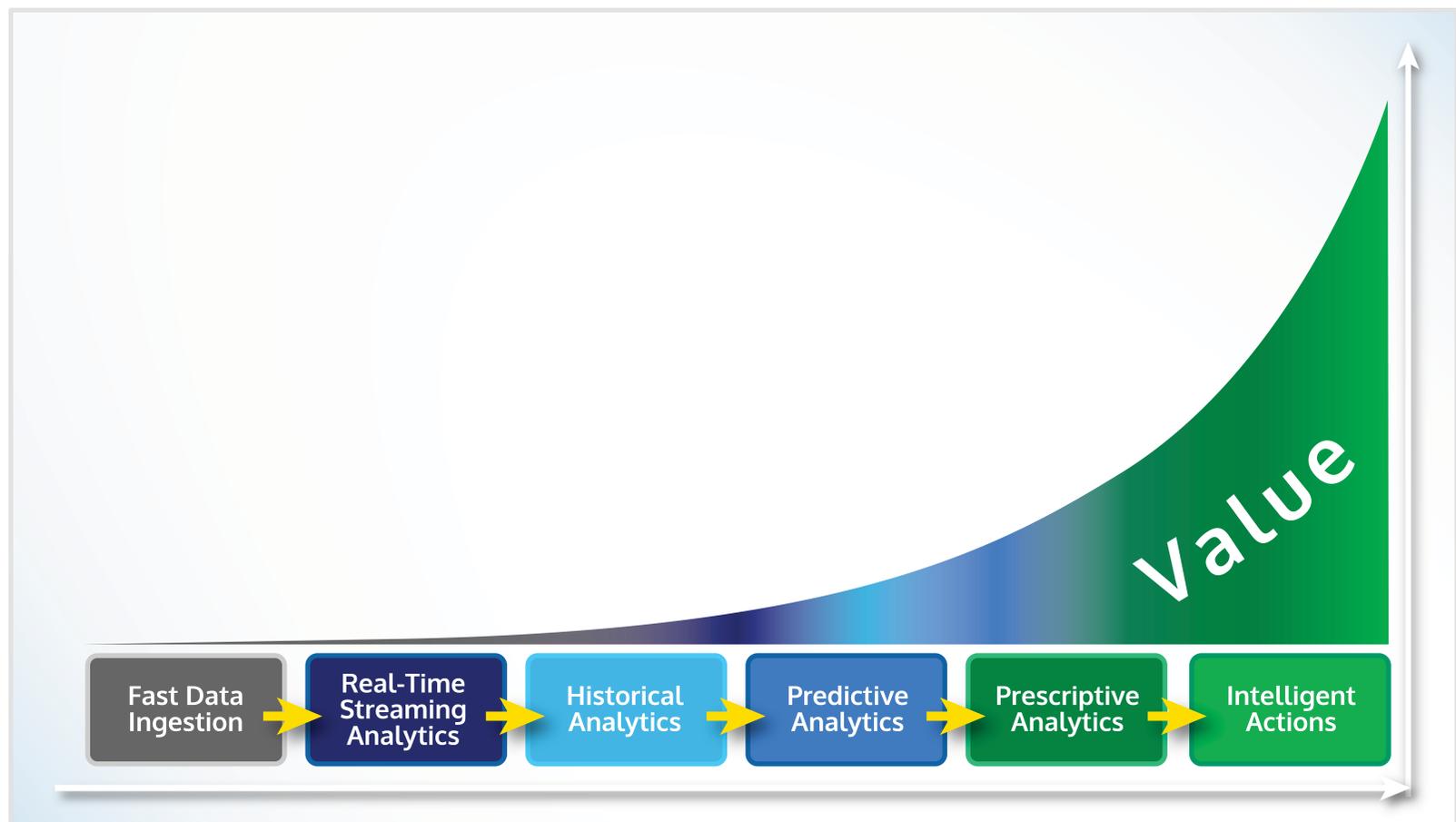


Figure 10: Business Value With The Vitria IoT Analytics Platform

VII. Summary/Conclusion

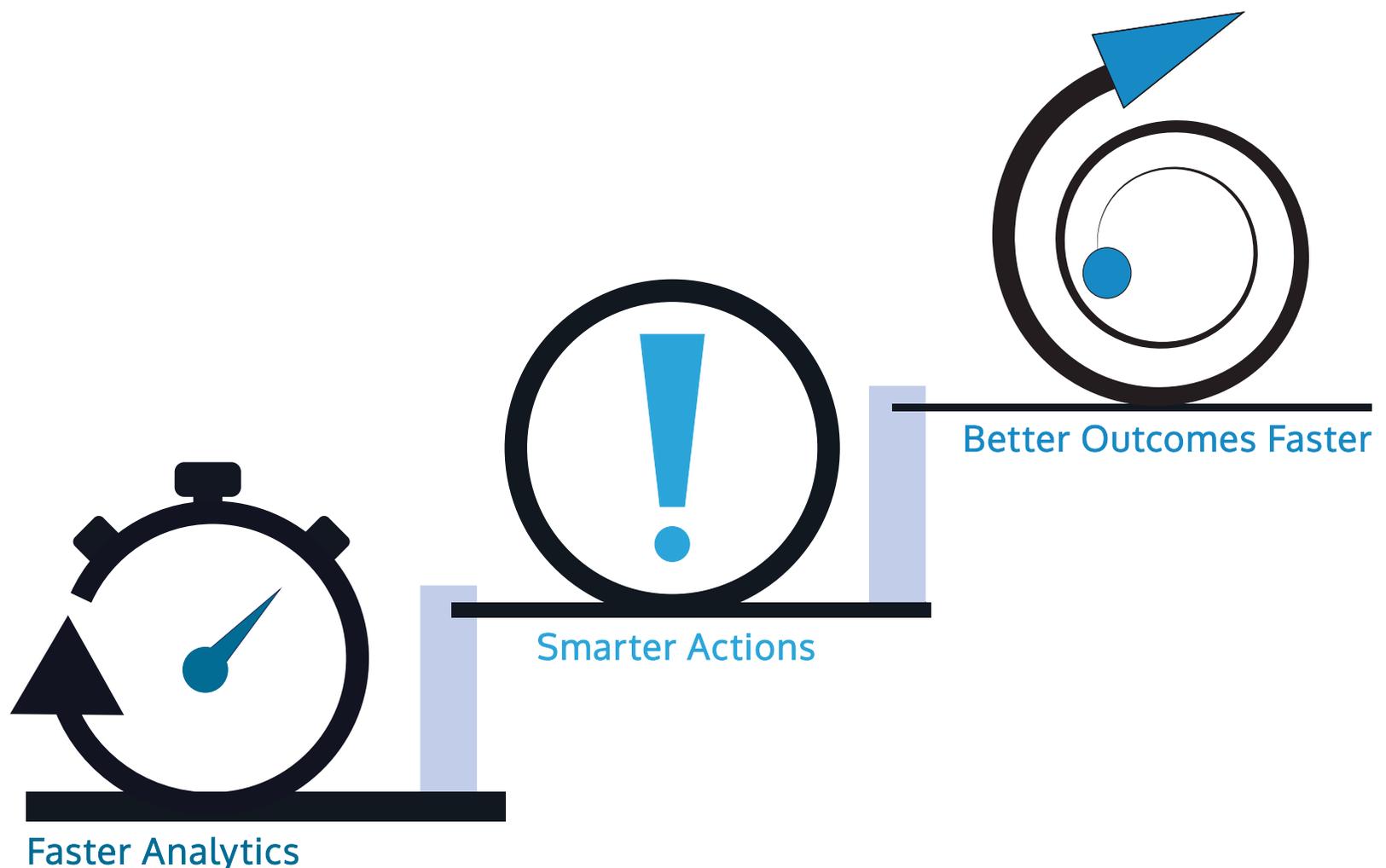
The IoT market is in a very dynamic phase with great potential in new applications. But the time has come for operations leaders to leverage data and analytics as a key strategic asset and demand more from their technology solution providers across the board. Analytics needs to move out from its traditional role in the backroom to the front office. Doing this will require many changes – including re-thinking roles, new processes that leverage existing investments, and new technology. New kinds of unified software platforms will be needed to meet the major challenges of IoT.

Today's competitive environment and the demands of IoT applications require dramatic reductions in the time to develop and gain value from IoT projects. This is true for both project timelines as well as "time-to-action" scenarios in the specific applications. Development teams, analysts, and operations staff need automation and new tools to empower them to get results in minutes. Relying on specialists is no longer scalable and cannot meet the business imperatives of the IoT era.

In IoT applications, time is more critical than ever and business value slips away. Capitalizing on the value in IoT means having the ability to know key indicators and patterns as they are happening, and delayed decision-making is often very costly after a short delay and can sometimes be catastrophic to business operations.

Vitria's platform is the first of its kind to address this IoT world that demands rapid implementation time-frames and systems that enable intelligent real-time actions that deliver business outcomes quickly. It offers a careful and intelligent balance of a unique and powerful Temporal Analytics Engine that is the core of a broader and open platform that will work with a wide range of software and databases in place today. It provides powerful self-service tools and a model-driven development environment that accelerates time-to-value for even the most complex IoT applications.

This platform offers much more than just new technical approaches or faster "speeds and feeds." It is a new kind of platform for business operation managers that accelerates projects through the analytics value chain and delivers better business outcomes faster for IoT initiatives and applications.



Creating Value out of Things
www.vitria.com/iot/