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THE INTERNET OF THINGS
WITHOUT COMPROMISE

It's tempting to think about the Internet of Things (IoT) as a vast and formless universe of connectable devices and free-floating data. If we can connect to a large number of devices and capture and store large quantities of data via the IoT, perhaps we'll find ways of improving the efficiency of our businesses. Because we are also tempted to think that bigger is better, the more device connections we can make and the more data we can store for analysis, the more likely we will be to discover something significant.

It's a lot to take on. The challenge is that no one vendor can provide an end-to-end platform that covers all the components needed to support a complete IoT strategy. Even if they did, would you want to be locked into a single vendor?

At Software AG, we're taking a different approach, focused on ensuring you deliver on the unique vision of the IoT you have for your business. Our modular set of IoT Platform Services, aligned with key functional areas of an IoT platform, can all be integrated with products from other vendors—giving you a best-of-breed, extensible solution that can deliver real business value.

Read on to learn how you can deliver an IoT framework without compromising on your goals.

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What is the right approach to building an IoT framework?

When we talk about the IoT, implicitly it's about a world in which we can capture data from and interact, at some level, with an enormous range of "things"—from the Fitbit® on your wrist, to the sensors in your car and phone, to the heating system in your office and the traffic cameras at the intersections. That list doesn't even begin to scratch the surface, though. Factor in every "thing" from smart coffee pots to nuclear power plants and you begin to grasp the scope of the IoT. ABI Research projects that by 2020 the IoT will consist of more than 24 billion connections—among devices we use at home, at work, on the farm, in the factory, on vacation, everywhere[1]. Cisco places the number of connections above 50 billion by the same date. Indeed, wherever there is activity there is data, and wherever there is data, there's a very good chance that someone is already trying to snap an Application Programming Interface (API) onto it to bring it into the IoT[2].

IoT is a huge opportunity for every business. But where do you start to make sense of it all? Understandably, many CIOs feel they should focus on vendors that claim to have an end-to-end solution. The challenge with the IoT, though, is that—because there are so many possibilities and use cases—it is impossible for a single vendor to cover all the bases.

Choosing one solution from one vendor on the surface may appear to remove complexity but it's not without risks and compromises:

• Inevitably, you will need to compromise on the functionality of your IoT platform to fit the solution offered by the vendor
• Having your IoT platform locked into a single vendor creates long-term risks and dependencies that will be difficult and expensive to unravel when necessity demands

Software AG believes the right approach is to develop your own IoT framework that clearly addresses your goals and scope for your unique organization. Then, by forming strategic partnerships, you can gain access to the skills needed to source technology from across a wide range of vendors to deliver your IoT vision without compromise.

Essentially, you must have a clear vision of how and why connecting to IoT devices will make a difference. Otherwise, you may be putting the solution before the problem—and the history of high tech is littered with great solutions that failed because the problem they were solving had not been fully identified or understood.

Real business applications for the IoT

Think of the many devices that could provide data to deliver real business value for your business. Whether it's a sensor on a machine, GPS data on a delivery truck or sensors monitoring environmental conditions, there are countless possibilities for the application of IoT data. Truth is, every situation and process we encounter in a business setting could be improved with a little more insight.

Here are just a few examples of where the correct application and analysis of IoT data to a business problem could improve efficiency or the experience for customers. Within each, there may be innumerable discrete opportunities and solutions. But across them all, there are commonalities.

Predictive maintenance—In any business that relies on machinery, uptime is critical. The traditional approach is a fixed maintenance schedule. But imagine using the continuous analysis of machines, equipment or infrastructure, alongside other data sources to predict when equipment should be taken offline for maintenance. With predictive maintenance via the IoT, you can monitor for performance deviations through sensor data and receive early warning signs before a fault occurs. You can manage a machine's maintenance schedule in a way that doesn't unexpectedly impact the overall production schedule.

[1] ABI Research, IoT Analytics: Using Big Data to Architect the Products and Services of Tomorrow
[2] Cisco, The Internet of Things: How the Next Evolution of the Internet is Changing Everything

Connected customer—In this application, you'd capture and enhance data from sources that are intimately related to an individual. A connected-customer event might be triggered when a sensor detects a network beacon from a mobile phone. The moment that phone connects to the network in a shopping mall, the office, a train or even an amusement park, a number of processes might be triggered to bring up historical data from any number of feeds—internal databases, streaming weather data or social media, for example. These data points would be analyzed in real time to perform actions for that person or to present individually targeted offers.

By interacting with the data, you could enhance the customer experience or influence decisions to shop at your store. Either outcome should improve customer loyalty and brand satisfaction.

Smart logistics—Imagine the business opportunities you could create with real-time insights into the movement and location of assets. The assets could be anything from a taxi on the street to a tanker on the high seas, a delivery or service vehicle, or even a collection of individuals with very specialized skills who can't all be in all places at once. When you combine real-time awareness of asset locations with relevant situational data, you can improve decisions about next steps. You can identify and seize fleeting opportunities to engage a customer in a meaningful way. In the end, capturing and using data from the IoT can help you make better logistics decisions to save money. You can deliver streamlined services that are more flexible and more honed to customer satisfaction for an excellent customer experience.

These are all real-world situations, already at work today, delivering performance improvements or increasing revenue for a number of companies. In all of them, multiple real-time data points are captured, analyzed and create actions in other systems that positively influence the outcome.

Model, capture, analyze & act

IoT use cases involve information from many different sensors and sources. Some data may come from industrial controls, while other comes from mobile phones and bar code scanners. Some may arise from local sources, others from sources scattered around the world.

What connects each scenario is the need not just to capture the data but also to analyze it in very specific ways before an action can be taken. There are many moving parts—and any successful IoT framework needs to accommodate all of them.

Modeling
Fundamental to the success of any IoT implementation is having a clear understanding of how the business processes, IoT devices and applications all relate to one another— how they communicate and should communicate in an ideal world. Are there silos of information, duplication or even processes and decision trees that could create unwanted feedback into earlier parts of the system? Modeling your processes, which can be aided by technology, will ensure you don't under- or over-engineer your IoT framework.

Capturing the data
Companies have been struggling to bring data from one machine or service into another throughout the history of data processing. With increased reliance on open or industry standards (such as the MQTT or AMQP protocols), more devices are capable of producing data for consumption by other machines (and vice versa). Even data from sources that are unstructured—like social network feeds—can be drawn into the analytical mix. Conventions and tools can help you understand how to integrate the data in those feeds.

Viewed this way, data capture is largely a matter of integration. Moreover, it is only one area of integration among many that will be crucial. You will likely need to integrate a number of enterprise systems, whether on-premises or cloud based. After all, most IoT data adds value when combined with other more conventional data—such as data on orders, shipments, payments and so on. Integration with enterprise data ensures you don't mistakenly send a technician to fix a machine replaced by the customer the week before.

Analyzing the data

Data analysis poses more challenges and far fewer proven solutions. Until just a few years ago, data analysis focused largely on the search for trends, patterns and answers to specific, challenging questions that could be found in vast pools of static historical data. With more data, it was assumed, we could get better answers, so we developed databases, data warehouses and data marts.

Analytical frameworks, such as Hadoop® came into play, enabling us to look for answers in large pools of data yet without the overhead required by specialized data analysis tools and architectures developed up to that point. Analytical databases and technologies like Hadoop play an important role in the IoT. They help you:

• See patterns and trends that might not normally be visible

• Segment a user population into smaller groups to analyze behavior at a highly granular level

• Plow through large volumes of sensor outputs to discover trends and patterns that are lost in the noise of the signal itself

With those insights, you can understand—for example—what to look for when implementing a predictive maintenance play or even a smart metering and manufacturing solution. What those technologies can't do, however, is to analyze in real time the stream of data rushing in from all the devices being monitored for predictive maintenance or smart metering, for example. Hadoop is a batch-mode tool best used for analysis of static data. It can analyze vast pools of data very quickly but cannot analyze real-time data to spot the trends or patterns it can see in static data.

It's important to remember that analysis doesn't need to happen as part of a large database implementation or in the data center. With the power of sensors and other small computing devices, analysis now also occurs at the sensor—it's what we call edge analytics. Putting analysis "at the edge" can substantially improve response time and overall performance since sensors can run algorithms and models to make decisions about how to act in the moment.

Coordinating many moving parts—the right way at any moment

This combination of sensors, captured data, existing business systems, and historical and real-time analytical tools can position you to act effectively in a variety of IoT use cases—from smart metering and manufacturing to the connected customer and smart logistics scenarios. To be successful, you need to:

• Connect to the appropriate sensors

• Have some idea of what you are looking for

• Have a mechanism for watching for those events or indicators in real time

• Then have a plan that can be executed when those events or indicators are discovered in the course of real-time analysis of the data stream
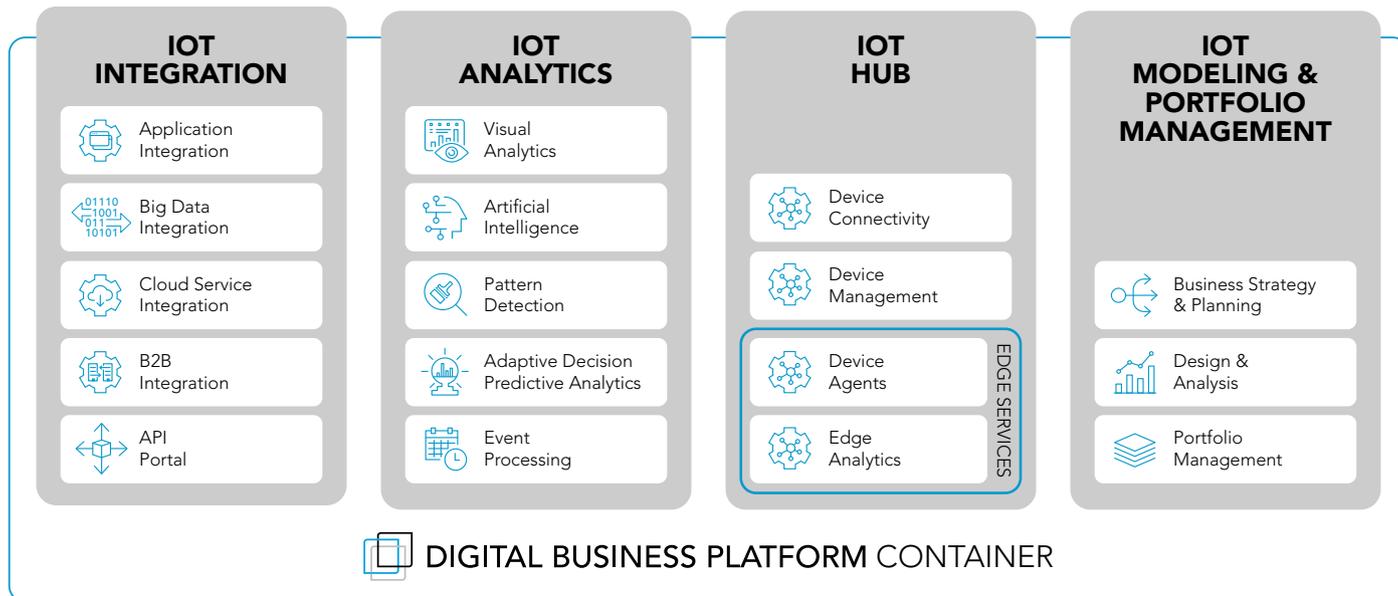
There are many moving parts. If your streaming analytical tools detect that a known customer joins a Wi-Fi hotspot in one of your stores, your IoT tools will need to enrich that data point with the known history of that customer's interaction and any relevant profiling. You can do that with Software AG. Our Digital Business Platform architecture incorporates capabilities for in-memory data management, ad-hoc historical analytical, predictive analytics and complex event processing. Combined, these tools provide the means to trigger actions based upon the detection of specified patterns, trends and data points within the streams of data arriving from IoT devices.

In addition, Software AG offers agile business process management tools and visual analytics—so you can present visually the significance of an event.

Now you can begin to appreciate how many components are required, all working together in a coherent, efficient and organized manner, to act in real time, in just the right way, at any given moment.

The four pillars of Software AG IoT Platform Services

Software AG has identified four critical pillars for tools and services to integrate and enrich data from different sources: IoT Integration, IoT Analytics, IoT Hub and IoT Modeling & Portfolio Management. These pillars comprise our modular IoT Platform Services built on Software AG's Digital Business Platform.

IOT INTEGRATION	IOT ANALYTICS	IOT HUB	IOT MODELING & PORTFOLIO MANAGEMENT
Application Integration	Visual Analytics	Device Connectivity	
Big Data Integration	Artificial Intelligence	Device Management	Business Strategy & Planning
Cloud Service Integration	Pattern Detection	Device Agents	Design & Analysis
B2B Integration	Adaptive Decision Predictive Analytics	Edge Analytics	Portfolio Management
API Portal	Event Processing	EDGE SERVICES	

DIGITAL BUSINESS PLATFORM CONTAINER

Digital Business Platform—Platform Services for the Internet of Things

Let's look at each pillar in more detail:

IoT Integration
Ensures your IoT implementation connects with all your existing enterprise solutions—whether they are the latest ERP or database solutions, or perhaps a more obscure legacy piece of software. Whether those systems are in the cloud or at distributed physical sites, data must be transformed and delivered without fail—speed, resilience and scalability are key.

Software AG's Digital Business Platform includes a Universal Messaging bus that supports a wide range of industry standards, including AMQP, HTTP, Java® Message Service (JMS), LDAP and MQTT. This capability coupled with one API and one server dramatically simplifies deployment and management for both developers and IT operations staff.

IoT Analytics
Take fast-moving IoT data and turn it into valuable, actionable insights that can be acted on automatically and intelligently the instant an event (or combination of events) takes place. IoT Analytics includes capabilities for visualization, predictive analytics, in-memory data and streaming analytics.

With streaming analytics, you can process and analyze data events in order to detect complex business events or patterns of behavior and then respond to them automatically, the moment they happen. Real-time insights can be derived from "data in motion" to give a competitive edge to agile organizations that want to act on them before they lose their value.

Software AG's event-driven Apama Streaming Analytics enables you to exploit perishable insights immediately. You can make informed decisions quickly and at scale by integrating real-time analytics and decision making into your organization's transaction-executing systems.

IoT Hub
Connect devices and create IoT applications to operationalize data easily, quickly, securely and at scale. Your devices can be managed remotely and data streams injected directly into IoT Analytics or integrated with solutions from other vendors. Connectors for new device types can also be created quickly in the IoT Hub, rapidly cutting development time.

You can connect and manage any "thing" over any network with Software AG. Our Device Integration Platform makes the connection and management of devices fast and easy. In addition, using Apama, you can put analytics on edge devices and gateways to make the right decision at the right moment.

IoT Modeling & Portfolio Management
A process is not just something your business does, processes are your business. However, in many organizations, processes are not clearly identified or they operate in ineffective departmental silos. This can dramatically impact the success of your IoT strategy. Products and services for IoT Modeling & Portfolio Management allow you to better understand and manage your IoT infrastructure and its related business processes.

Software AG's ARIS software allows you to design and review processes, increasing their agility, removing redundancy and ultimately improving efficiency. You can simulate changes to key business processes before they "go wild" and report against specified KPIs.

Making a success of the IoT

With more than 400 vendors in the IoT space, it's clear no single provider can satisfy the breadth and depth required of a complete IoT solution. The secret to success is building an extensible framework that allows best-of-breed IoT solutions to be used as your foundation for innovation.

With Software AG IoT Platform Services, you have access to a modular set of services to build an IoT framework that's optimized to your business needs. No compromises here. Each pillar offers components that deliver best-of-breed performance and functionality, giving you:

• Clarity and understanding of your IoT infrastructure and related business processes

• Tight integration with internal systems and external data sources, bringing together all the context needed for interpreting and reacting to IoT sensor data at high speed

• Optimized real-time streaming analytics and visualization tools for rapid decision making

• Remote IoT device configuration, monitoring and management tools for any device or location

You can tailor our IoT Platform Services to support any number of scenarios. Build your powerful IoT framework on-premises, in the cloud or in a hybrid environment by combining a rich range of data collection tools and capabilities from our ecosystem partners. Rely on Software AG's IoT experts to help you implement your infrastructure in a modular, staged manner that takes into consideration the realities of existing infrastructure investments as well as your evolving business and financial plans.

Take the next step

Contact your Software AG representative today to see how to make the most of the Internet of Things and transform your organization to meet the dynamic demands of the 21st century.

Learn more at www.softwareag.com.

ABOUT SOFTWARE AG

The digital transformation is changing enterprise IT landscapes from inflexible application silos to modern software platform-driven IT architectures which deliver the openness, speed and agility needed to enable the digital real-time enterprise. Software AG offers the first end-to-end Digital Business Platform, based on open standards, with integration, process management, in-memory data, adaptive application development, real-time analytics and enterprise architecture management as core building blocks. The modular platform allows users to develop the next generation of application systems to build their digital future, today. With over 45 years of customer-centric innovation, Software AG is ranked as a leader in many innovative and digital technology categories. Learn more at www.SoftwareAG.com.

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