Full-Stack Development Platform for the Internet of Things
Introduction

C3 IoT offers the world’s first full-stack development platform for next-generation enterprise Internet of Things (IoT) applications and business processes.

The C3 IoT Platform™ is platform as a service (PaaS) for the design, development, deployment, and operation of next-generation applications and business processes. The applications apply advanced machine learning to recommend actions based on real-time analysis of petabyte-scale data sets, dozens of enterprise and extraprise data sources, and telemetry data from tens of millions of endpoints.

The C3 IoT Platform is currently in large-scale production at more than 20 leading enterprises worldwide. Customer successes include saving tens of millions of dollars annually from improved fraud detection and reduced equipment failure; increasing customer engagement by 30 percent through real-time segmentation; and significantly lowering enterprise energy costs and greenhouse gas emissions.

C3 IoT™ provides a suite of pre-built, cross-industry applications, developed on its platform, that facilitate IoT business transformation for organizations in energy, manufacturing, aerospace, automotive, chemical, pharmaceutical, telecommunications, retail, insurance, healthcare, financial services, and the public sector. C3 IoT cross-industry applications are highly customizable and extensible.

Pre-built applications are available for predictive maintenance, sensor health, enterprise energy management, capital asset planning, fraud detection, CRM, and supply network optimization. Customers can also use the C3 IoT Platform to build and deploy custom applications.

“C3 IoT plays an important role at the forefront of enabling some of the world’s largest enterprises, across all verticals, to realize the immediate business benefits of elastic cloud computing in ways that were unimaginable even a few years ago. C3’s work ensures their customers can focus their valuable resources on delivering innovative IoT solutions to their end users, instead of managing the heavy lifting of the underlying IT infrastructure platform needed to support it.”

— Mike Clayville, Vice President Worldwide Commercial Sales, Amazon Web Services, Inc.
The Fourth IT Revolution is Under Way

New technologies are shifting the platform of computing. The shift this time is to scale-out architecture on distributed computing platforms such as Amazon Web Services (AWS), which can accommodate big data from connected devices and other sources.

To make sense of and act on an unprecedented volume, velocity, and variety of data in real time, companies are applying the sciences of big data, advanced analytics, machine learning, and cloud computing. Products themselves are being redesigned to accommodate connectivity and low-cost sensors, creating a market opportunity for adaptive systems, a new generation of smart applications, and a renaissance of business process reengineering.

The new IT paradigm will reshape the value chain by transforming product design, marketing, manufacturing, and after-sale services. The McKinsey Global Institute estimates the potential economic impact of new IoT applications and products to be as much as US$3.9–$11.1 trillion by 2025.1 Other industry researchers project that 50 billion devices will connect to the Internet by 2020.

C3 IoT offers a new generation of smart, real-time applications, overcoming the development challenges that have blocked companies from realizing that potential. Proven in more than 20 enterprise-scale production environments, the C3 IoT Platform is PaaS for the design, development, deployment, and operation of next-generation IoT applications and business processes.

The Convergence of New Technologies Enables a New Generation of Business Processes and Applications

Multiple technologies are converging to enable a new generation of smart business processes and applications—and ultimately replace the current enterprise software applications stack. The number of emerging processes addressed will likely exceed by at least an order of magnitude the number of business processes that have been automated to date in client-server enterprise software and modern software-as-a-service (SaaS) applications.

The component technologies include:

- Nearly free and unlimited compute capacity and storage in scale-out cloud environments such as AWS
- Big data and real-time streaming
- IoT devices with low-cost sensors
- Smart, connected devices
- Mobile computing
- Data science: big data analytics and machine learning to process the volume, velocity, and variety of big data streams

This new computing platform will enable capabilities and applications not previously possible, including precise predictive analytics, massively parallel computing at the edge of the network, and fully connected sensor networks at the core of the business value chain. The number of addressable business processes will grow exponentially and require a new platform for the design, development, deployment, and operation of next-generation, real-time, smart, and connected applications.

Data are strategic resources at the heart of the emerging digital enterprise. The new IoT infrastructure software stack will be the nerve center that connects and enables collaboration among previously separate business functions, including product development, marketing, sales, service, support, manufacturing, finance, and human capital management.

C3 IoT is unique in the IoT market as it has developed a full-stack IoT platform that enables the design, development, provisioning, and operation of large-scale enterprise applications. C3 IoT is distinguished from the myriad of IoT market offerings that address a small subset of the solution requirement—for example, device connection, data persistence, or SQL-like access—by addressing the full problem with a comprehensive, cohesive, end-to-end IoT platform.”

— K.R. Sridhar, CEO, Bloom Energy

The new infrastructure software stack will be the nerve center that connects and enables collaboration among previously separate business functions, including product development, marketing, sales, service, support, manufacturing, finance, and human capital management.

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**Fourth IT Wave Is Under Way**

![Diagram](image)

C3 IoT: Full-Stack Development Platform for the Internet of Things

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The emerging market opportunity is broad. At one end are targeted applications that address the fragmented needs of specific micro-vertical markets—for example, applying machine learning to sensor data for predictive maintenance that reduces expensive, unscheduled downtime. At the other end are a new generation of core ERP, CRM, and human capital management (HCM) applications, and a new generation of SaaS applications.

These smart and real-time applications will be adaptive, continually evolving based on knowledge gained from machine learning. The integration of big data from IoT sensors, operational machine learning, and analytics can be used in a closed loop to control the devices being monitored. Real-time streaming with in-line or operationalized analytics and machine learning will enhance business operations and enable near-real-time decision making not possible by applying traditional business intelligence against batch-oriented data warehouses.

Smart, connected products will disrupt and transform the business value chain. They require a new class of enterprise applications that correlate and aggregate data, and apply advanced machine learning to perform real-time analysis of data from sensors, extraprise data (such as weather, traffic, and commodity prices), and all available operational and enterprise data across supplier networks, logistics providers, manufacturing, dealers, and customers. These new IoT applications will deliver a step-function improvement in operational efficiencies and customer engagement, and enable new revenue generation opportunities.

IoT applications differ from traditional enterprise applications both by their use of real-time telemetry data from smart, connected products and devices and also by operating against all available data across a company’s value chain and applying machine learning to continuously deliver highly accurate and actionable predictions and optimizations.

Sample IoT Use Cases By Lines of Business

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<tr>
<th>Line of Business</th>
<th>Use Case</th>
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<tbody>
<tr>
<td>Product development and manufacturing: “Industry 4.0”</td>
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  • Identify and resolve quality problems based on customer use data  
  • Detect and mitigate manufacturing equipment malfunctions |
| Supply networks and logistics             |  
  • Continuously track product components through supply and logistics networks  
  • Anticipate and mitigate delivery delays due to internal or external factors |
| Marketing and sales                       |  
  • Deliver personalized customer offers and after-sale service through mobile applications and connected products  
  • Develop, test, and adjust micro-segmented pricing  
  • Deliver “product as a service,” such as power-by-the-hour engines |
| After-sale service                        |  
  • Shift from reactive to predictive maintenance  
  • Increase revenue with new value-added services—for example, extended warranties and comparative benchmarking across a customer’s equipment, fleet, or industry portfolio |
| Next-generation CRM                       |  
  • Extend CRM from sales to support, for a full customer lifecycle engagement system  
  • Increase use of data analysis in marketing and product development |

These real-time, anticipatory, and adaptive learning applications apply across industries to: predict heart attacks; tune insurance rates to customer behavior; anticipate the next crime location, terrorist attack, or civil unrest; anticipate customer churn or promote a customer-specific wireless data plan; or optimize distributed energy resources in smart grids, micro grids, and buildings.
The market growth and size projections for IoT applications and services are staggering. The utility industry was one of the first to adopt sensors and smart devices across its value chain. While global IoT services spending in that sector is forecasted to grow 113 percent between 2015 and 2020, according to Gartner, other industries are expected to grow more. Manufacturing and oil and gas industry IoT spending is projected to grow 201 percent during this same period, and the banking, government, healthcare, retail, and transportation sectors will see spending grow by 286 percent, for a cumulative industry spending total of $165.7 billion by 2020.2

McKinsey Global Institute asserts “the hype may actually understate the full potential of the Internet of Things.” McKinsey estimates a potential economic impact of $3.9 to $11.1 trillion per year in 2025 for IoT applications, with business-to-business (B2B) applications generating nearly 70 percent of that value. Most IoT data are not currently used, according to McKinsey. “For example, only one percent of data from an oil rig with 30,000 sensors is examined. The data that are used today are mostly for anomaly detection and control, not optimization and prediction, which provide the greatest value.”3

Harvard Business School’s Michael E. Porter declared that smart, connected products – “made possible by vast improvements in processing power and device miniaturization and by the network benefits of ubiquitous wireless connectivity” – have disrupted value chains and unleashed a new era of competition.4 Porter and other thought leaders have concluded that IoT is driving the biggest IT-driven transformation yet, spurring increases in innovation, productivity, and economic growth. Ultimately, IoT represents an entire replacement market in global IT. Organizations that move aggressively to embrace the opportunity stand to lead and benefit accordingly.

However, operationalizing IoT is much harder than it looks. Many IoT platform development efforts to date – internal development projects as well as industry-giant development projects – are attempts to develop a solution via acquisition of multiple piece parts or from the many independent software components that are collectively known as the open-source Apache Hadoop stack. Despite the marketing claims surrounding these projects, a close examination suggests that there are few examples, if any, of enterprise production-scale, elastic cloud, big data, artificial intelligence, and machine learning IoT applications that have been successfully deployed in any vertical market except for applications addressed with the C3 IoT Platform.

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3 McKinsey Global Institute, “The Internet of Things: Mapping the Value Beyond the Hype,” June 2015
Companies often expect that installing the Apache Hadoop open-source stack will enable them to establish a “data lake” and build from there. However, the investment and skill level required to deliver business value from this approach quickly escalates when developers face hundreds of disparate software components in various stages of maturity, designed and developed by more than 350 different contributors using different programming languages while providing incompatible software interfaces. A loose collection of independent, open-source projects is not a true platform, but rather a set of independent technologies that need to be somehow integrated and maintained by developers. Instead, companies need a comprehensive IoT application development platform.

Investors have poured over $2 billion into businesses built on Hadoop...Yet companies that have tried to use Hadoop have met with frustration.”

— Elizabeth Dwoskin, Wall Street Journal

Apache Hadoop repackagers provide technical support but have failed to integrate their Hadoop components into a cohesive software development environment. As a result, to date, there is no successful large-scale enterprise IoT application deployments using the Apache Hadoop technology stack. Adoption is further hampered by complexity and a lack of qualified software engineers and data scientists. Gartner concludes that Hadoop adoption remains low as firms struggle to articulate Hadoop’s business value and overcome a shortage of workers who have the skills to use it. A Gartner survey of 284 global IT and business leaders in May 2015 found that, “The lack of near-term plans for Hadoop adoption suggests that despite continuing enthusiasm for the big data phenomenon, specific demand for Hadoop is not accelerating.”

Developing next-generation applications with measurable value to the business requires a scalable, real-time platform that works with traditional systems of record and augments them with sophisticated analytics and machine learning. But the risk of failure is high. IoT is new technology to most enterprise IT-oriented development organizations, and expertise may be difficult to acquire. Time to market is measured in years. Costs are typically higher than anticipated, often hundreds of millions to billions of dollars.

If you just dump data into a lake, what you get is an uncurated data swamp. That essentially has no value. Curation is where all the action is going to be, and it’s hard and costly... data curation is a huge, huge deal...”

— Dr. Michael Stonebraker, Professor, MIT, and 2014 Turing Award Winner

Only about 5% of the problems that anybody’s interested in are embarrassingly parallel. So basically, MapReduce is this insignificant little corner case and is a terrible internal interface for a higher-level system...”

— Dr. Michael Stonebraker, Professor, MIT, and 2014 Turing Award Winner

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9 Forrester, “An Interview with the 2014 Turing Award Winner: Dr. Michael Stonebraker,” July 2015
Next-generation IoT applications require a new enterprise software platform. Requirements extend well beyond relatively small-scale (by Internet standards) business activity tracking using transactional/relational databases, division-level process optimization using limited data and linear algorithms, and reporting using mostly offline data warehouses. Next-gen IoT applications manage dynamic, petabyte-size datasets consisting of unified data images of all relevant data across a company’s value chain, and apply machine learning to make predictions in real time as those data change. These applications require cost-effective Internet/cloud-scale distributed computing architectures and infrastructures such as those from AWS, Microsoft, and Google. These public clouds are designed to scale out—not up, like traditional compute infrastructures—by taking advantage of millions of fast, inexpensive commodity processors. Google, for example, uses a distributed computing infrastructure to process more than 26PB per day at rates of one billion data points per second.

Distributed infrastructure requires new distributed software architectures and applications. Writing application software to take advantage of these distributed architectures is non-trivial. Without a cohesive application development platform, most enterprise-caliber IT teams and system integrators do not have the qualifications or experience to succeed.

IoT Platform Requirements

### Capabilities

<table>
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<tr>
<th><strong>Real-time communication and control of sensor networks</strong></th>
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<tr>
<td>Bi-directional communication and control of sensor networks and over-the-air delivery of commands to remotely:</td>
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<tr>
<td>• Connect and disconnect</td>
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<td>• Upgrade firmware/software</td>
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<td>• Adaptively switch devices on/off</td>
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<td>• Ensure the health and proper functioning of sensors, devices, and supporting network equipment</td>
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<tr>
<th><strong>“System of systems” or unified cloud data image</strong></th>
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<tr>
<td>Sensing and tracking the state of the end-to-end company value chain by generating a unified, federated cloud data image and keeping it current in near-real time. This requires integrating a multitude of disparate extraprise, enterprise, and operational systems, and sensor network data.</td>
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<th><strong>Elastic cloud computing</strong></th>
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<td>Cost-effective storage and real-time processing of petabyte-scale dynamic data sets growing at tens or hundreds of terabytes per day and bursting at millions of messages per second.</td>
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<th><strong>Cloud-scale, real-time, and iterative data analysis</strong></th>
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<td>Analysis of all data, including telemetry data with sampling frequencies ranging from minutes to kilohertz, and enterprise and operational data. This requires a combination of:</td>
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<tr>
<td>• Real-time stream processing</td>
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<td>• Near-real time contextualized data analysis</td>
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<td>• Batch data analysis</td>
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<td>• Fast, iterative data processing to support machine learning-based data exploration</td>
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<th><strong>Anticipatory and adaptive applications</strong></th>
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<tr>
<td>Integrated machine learning to analyze data across the value chain by interpreting changes to the unified data image in real time, identifying anomalies, and updating predictions and optimizations accordingly. Self-tuning algorithms continuously adapt predictions and optimizations based on feedback from customer, distributor, manufacturer, and supplier interactions and data from connected products and sensor networks.</td>
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Avoid Market Discontinuity By Linking Traditional and Modern Infrastructure Stacks

For an innovative company willing to invest in the development of a new generation of mission-critical enterprise applications, the first requirement is a comprehensive and integrated infrastructure stack. The goal is PaaS: a modern, scale-out architecture leveraging big data, open-source technologies, and data science.

Vendors of existing enterprise and SaaS applications face the risk that these disruptive technologies will create market discontinuity—a shift in market forces that undermines the market for existing systems. It should be anticipated that emerging SaaS vendors will indeed disrupt the market. However, there is also a high potential to address the emerging market opportunities with an architecture that can link the two platforms together—traditional systems and modern, big data, scale-out architecture—in a complementary and non-disruptive fashion.

Market incumbents, legacy application vendors, and SaaS vendors have an advantage because of their enterprise application development expertise, business process domain expertise, established customer base, and existing distribution channels.

Application and SaaS vendors can increase the value of their systems of record by complementing them with a new IoT, big data, and machine learning PaaS infrastructure stack, unifying the two stacks into a comprehensive and integrated platform for the development and deployment of next-generation business processes. This approach extends existing applications at the same time it allows for the development of entirely new applications that are highly targeted and responsive to the explosion of new business process requirements.

C3 IoT is clearly the most advanced company in this field on planet Earth. It has proven technology. It has delivered projects for multiple customers around the world, and specifically projects with huge volumes of data. I wanted to pick a partner that knows it, that has done it, and C3 IoT was the most convincing of all.”

— Yves Le Gelard, CIO & Chief Digital Officer, ENGIE

Given the complexity of the platform for next-generation application design, development, provisioning, and operations, it’s important to understand the effects of the build-versus-buy decision on costs and time to market.
C3 IoT Platform: Proven Enterprise IoT Application Development and Deployment Platform

Over the past eight years, C3 IoT has designed, developed, and brought to market the C3 IoT Platform, a cohesive application development PaaS that enables IT teams to rapidly design, develop, and deploy enterprise-scale applications. These applications exploit the capabilities of streaming analytics, IoT, elastic cloud computing, machine learning, and mobile computing—integrating dynamic, rapidly growing petabyte-scale data sets, scores of enterprise and extraprise networks with tens of millions of endpoints.

The C3 IoT Platform is deployed at more than 20 large enterprises worldwide. These companies use the platform's SaaS applications that integrate and process highly dynamic petascale data sets, gigascale sensor networks, and enterprise and extraprise information systems. The C3 IoT Platform monitors and manages tens of millions of sensors and devices throughout the value chain—applying machine learning to loop back and control devices in real time and integrating with legacy systems of record.

Since its beginnings in the energy industry, C3 IoT has broadened its focus by developing a range of next-generation applications for horizontal markets such as CRM, predictive maintenance, and sensor health, and verticals including manufacturing, oil and gas, retail, computer software, discrete manufacturing, aerospace, and telecommunications.

Enterprises can also use the C3 IoT Platform and its enhanced application tooling to build and deploy custom applications and business processes. Systems integrators can use C3 IoT to build out a partner ecosystem and drive early network effect benefits. New applications made possible by C3 IoT and other big data sources will likely drive a renaissance of business process reengineering.

Production use cases at enterprise scale include the U.S. Department of State, Pella, Enel, ENGIE, Exelon, Eversource, AEP, and others. One customer credits C3 IoT applications with $20 million in annual savings from smarter fraud detection. Another company reduced equipment failures between scheduled maintenance by 50 percent, lowering costs and downtime. One large enterprise lowered energy costs by 10 percent and another reduced greenhouse gas emissions by 14 percent.
Time to market is critical as next-generation computing platforms emerge. C3 IoT is a proven, scalable, production and development environment that provides what others have so far failed to deliver. Other than C3 IoT, there are no large-scale IoT applications deployed in the market, managing tens of millions of smart, sensor-enabled devices. The time-to-market advantage of a proven, scalable architecture can be leveraged to gain early network effects and competitive differentiation in the next big wave of computing and industrial automation.

Overall, competitors such as GE and Siemens are likely at least 2-3 years behind C3 IoT from a product development standpoint, while all of C3 IoT’s competitors have a huge amount of catching up to do in terms of customers and devices under management. C3 IoT is clearly miles beyond its established competitors.”

— Harry Pascarella, Research Analyst, Harbor Research

C3 IoT: The Only Proven IoT Application Development Platform Available Today

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<tr>
<th>Feature</th>
<th>Description</th>
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<tr>
<td>Open platform</td>
<td>Standards-based APIs (REST, JSON etc.) allow users to integrate third-party software</td>
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<td>Complete, cohesive IoT application software services</td>
<td>Uniform programming language, complete set of data processing services for real-time, batch, and iterative processing and machine learning</td>
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<td>Consistent, integrated platform services accessed using a uniform, standard development language</td>
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<td>Distributed, scalable architecture leveraging infrastructures such as AWS; demonstrated more than 1.5 million transactions per second</td>
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<tr>
<td>Highly productive application development platform</td>
<td>Integrated development environment and visual application development tools (C3 Tools™)</td>
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<tr>
<td>Scalable</td>
<td>Demonstrated steady-state processing of more than 650,000 sensor messages per second (1.5 million writes per second)</td>
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<td>Proven</td>
<td>More than 20 large-scale production deployments</td>
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<td>Future proofs investment in applications</td>
<td>Software services abstract technology components, allowing components to be substituted over time</td>
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<td>Standards-based APIs (REST, JSON, etc.) allows users to integrate third-party software</td>
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<tr>
<td>Rapid application development, resulting in production pilots in 4 - 16 weeks</td>
<td>Metadata-driven application configuration with visual development tools (C3 Tools)</td>
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<td>Less code to develop and debug to express application business logic, less code to maintain over time</td>
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<tr>
<td>Embedded machine learning environment allows data scientists to quickly develop, test, and deploy models into production</td>
<td>Enables data scientists and app developers to work with the same software services and operate against all relevant data through a distributed in-memory data store</td>
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<tr>
<td></td>
<td>Removes necessity for data scientists to establish and maintain their own redundant compute infrastructure, ETLs, and data cleansing and preparation routines</td>
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From Energy to Internet of Things

Founded in 2009 as C3 Energy, C3 IoT rebranded in early 2016 to reflect its expansion into the broader IoT application software and development platform markets. Initially targeting electric utility IoT use cases, C3 IoT has since demonstrated the value of its application platform and framework across multiple industries, including manufacturing, oil and gas, retail, computer software, discrete manufacturing, aerospace, and telecommunications.

Led by veterans in enterprise software management, software engineering, and data science, C3 IoT has a deep bench of experts in distributed computing, machine learning, user interface design, and enterprise systems architecture.

The C3 IoT Platform is designed for industrial leaders, infrastructure-as-a-service (IaaS) providers, software platform players, software application companies, and systems integrators. Industrial leaders see a comprehensive IoT platform as a means of establishing an early market lead, building network effects, and maintaining a strategic competitive advantage in the coming Industry 4.0 world.

C3 IoT is working with manufacturing companies to license the platform for predictive maintenance and supply chain management; enterprise software vendors interested in building their own next-generation applications on the C3 IoT Platform; and telco, financial services and healthcare companies that require next-generation applications to address new market opportunities and rapid time to market for competitive differentiation.

“C3 Energy was ahead of its time in recognizing the inevitable convergence of IoT with energy markets. The C3 IoT Platform has changed the way energy producers think about the future of the smart grid infrastructure. C3’s platform appears well positioned to have a similar impact upon government, intelligence, and commercial markets.”

— Hon. Spencer Abraham, Former U.S. Secretary of Energy
Conclusion

The Internet of Things and advanced data science are rewriting the rules of competition. The advantage goes to organizations that can convert petabytes of freshly arrived and historical data into predictions—more quickly and more accurately than their competitors. Payoffs include better product and service design, promotion, and pricing; optimized supply chains that avoid delays and increase output; reduced customer churn; higher average revenue per customer; and predictive maintenance that avoids downtime for vehicle fleets and manufacturing systems while lowering service costs.

Capitalizing on the potential of IoT requires a new kind of technology stack that can handle the volume, velocity, and variety of big data and operationalize machine learning at scale. Existing attempts to build an IoT technology stack from open-source components have failed—due to the complexity of integrating hundreds of software components developed with disparate programming languages and incompatible software interfaces.

C3 IoT has successfully developed a comprehensive technology stack from scratch for the design, development, deployment, and operation of next-generation applications and business processes.

The C3 IoT Platform is the industry’s only IoT platform proven in full-scale production. More than 20 enterprise customers report measurable ROI, including improved fraud detection, increased uptime as a result of predictive maintenance, improved energy efficiency, and stronger customer engagement. Customers can use pre-built C3 IoT applications, adapt those applications using the platform’s toolset, or build custom applications using C3 IoT’s platform as a service. C3 IoT supplies the technology; you bring the business vision.

Energy Industry as Proving Ground for C3 IoT Platform

Amazon.com processes 500 transactions per second during its busiest periods. By contrast, an energy company with millions of smart meters processes hundreds of thousands of messages per second. The C3 IoT Platform is proven in this high-volume environment.

A large utility in Europe, for example, uses C3 IoT applications for predictive grid maintenance and advanced power fraud detection. The first phase of C3 IoT’s rollout established one of the largest and most productive enterprise analytic IoT system deployments to date. In the first eight months, achievements included:

- 13 unique data source systems integrated
- 1.5 million writes per second
- 8+ million predictions per day
- >99.99% uptime
- 550+ billion sensor and device reads
- 2,500+ analytics processing in near real-time

Baltimore Gas & Electric (BGE), a subsidiary of Exelon, uses C3 IoT applications to monitor network health and detect fraud across its two million smart meters with up to 99% percent accuracy. Since deployment, the solutions have met or exceeded all business performance targets. Improved fraud detection and sensor health monitoring are on target to save more than $20 million annually for BGE and its customers.

“C3 IoT has demonstrated a unique ability to rapidly design, provision, and deploy scalable, elastic cloud, enterprise big data analytics and machine learning capability into highly-functional and beneficial enterprise applications.”

— Fabio Veronese, Head of Infrastructure and Technological Services, Enel Group

PROVEN RESULTS IN WEEKS, NOT YEARS

Complete a low-cost, low-risk production trial of the C3 IoT Platform in just 4-16 weeks. Validate the economic value and other benefits to your organization before expanding into full production use.

For more details, visit www.c3iot.com