IoT83

Full IIoT Product Line Value Creation

A Product Manager's Guide
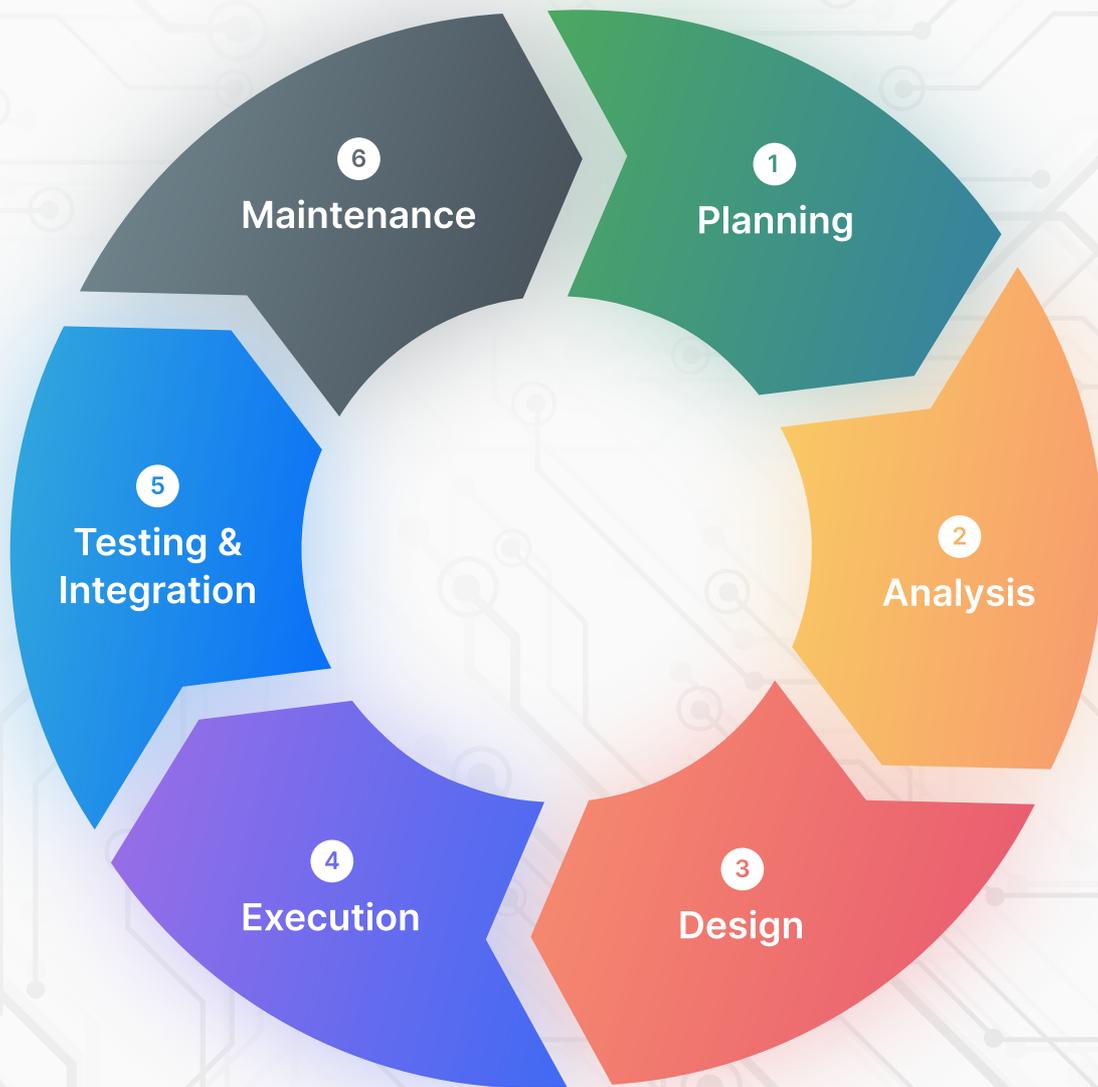

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Full IIoT Product Line Value Creation – A Product Manager's Guide

In the current industrial marketplace, marked by continuous innovation and dynamic shifts, industrial OEMs are facing an unprecedented opportunity – and challenge – for long term differentiation. With enterprise customer demand for the economic advantages of Internet of Things (IoT) and Smart Product solutions now at full maturity, the Original Equipment Manufacturers (OEMs) that achieve strategic differentiation with such solutions can lock-in a long-term competitive advantage.

This whitepaper delves into the transformative power of IoT adoption for OEMs, exploring how it shapes their competitive edge.

Lee House, Founder and CEO at IoT83, lends his visionary insights to this exploration. With a track record of recognizing technology trends and delivering game-changing enterprise solutions, Lee provides OEMs with a pragmatic guide as to the importance of this IoT mega-trend and the alternatives available to OEMs move ahead of their competition.

Lee's leadership spans GM and VP positions at GE, IBM, 3Com, and various Silicon Valley companies, backed by an MSEE and MBA from Duke University. Lee's role as a thought leader in the IoT domain positions him to guide OEMs into a future where connectivity and innovation redefine the industrial landscape.

Lee House

Founder & CEO at IoT83

With the huge projections for IIoT adoption by Industrial Enterprises, savvy Product Managers already know the importance of integrating smart systems across their product lines. There is also a considerable urgency here, as based on multiple industry surveys, Industrial Enterprises have already built the financial benefits of IIoT into their long-term strategic plans for operational efficiency and new value creation. With all of this IIoT activity, we are now well beyond the "Gartner Hype Curve" into the "Plateau of Productivity". Understanding this, for industrial Product Owners, the race is on to not only enhance – but also protect their portfolios by embracing this "Mega-Trend".

Still, while Product Owners understand the criticality of building this new value across their portfolios, the historical challenges of development costs, time to market, and the complexity of building true enterprise-grade IIoT solutions have held many back. This guide unfolds the challenges of the past and shines light on changes in the IIoT ecosystem that truly streamline OEM Product Management's goals of complete IIoT product line transition to deliver the full value and promise of IIoT, and importantly, to avoid being left behind.

Gartner "Hype Cycle" for Industrial IoT
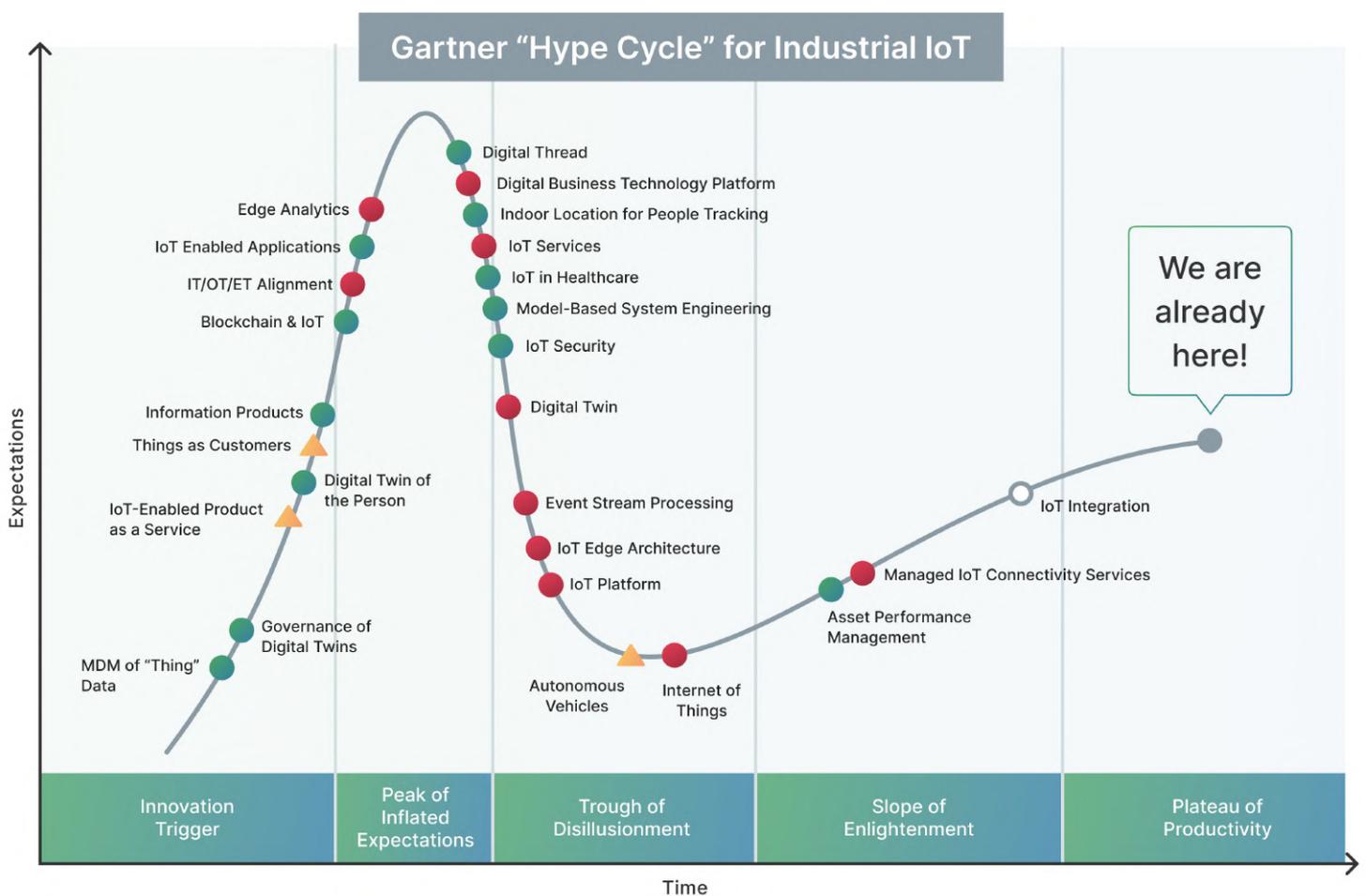
- *Mckinsey & Co. Predicts USD 5-12 Trillion in New Value by 2030.*

- *Enterprise Customers now Expect IIoT Solutions as a Part of Strategic Operational Planning.*

- *And, What is Strategic for OEM Customers, must be Strategic for Industrial OEMs!*

It All Starts at the Edge – Sensor Data and Connectivity

Data about what is happening with industrial assets and processes at the "edge" is always at the heart of IIoT. And because industrial OEM core products are either the edge assets themselves, directly touch these assets, or directly drive the coordination of broad industrial processes, it is essential that OEMs have a solid strategy for gathering edge asset and process data, and then securely encapsulate, manage, and transport this data as a foundation for any IIoT solution. The diagram below provides a minimalist view of this.
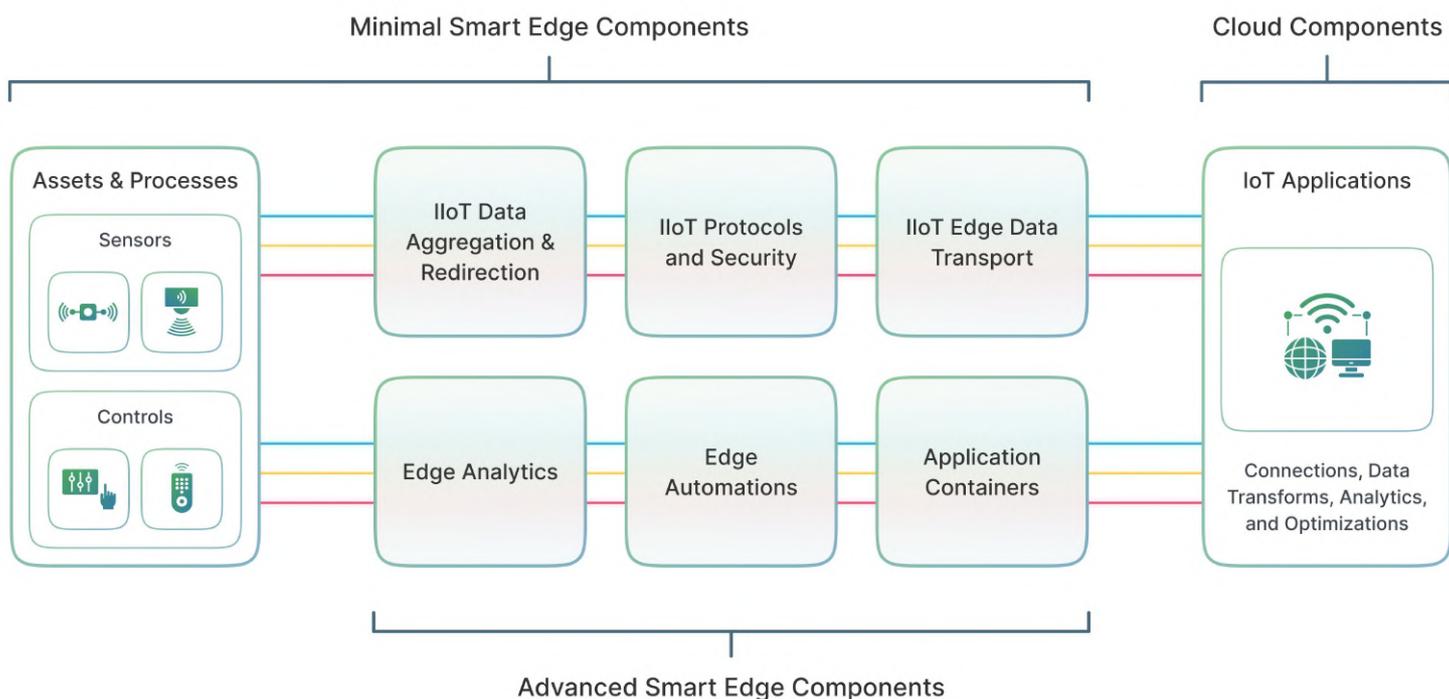
While building edge IIoT solutions is well understood from a technology and engineering perspective, until recently building edge IIoT intelligence has been a somewhat involved process. Identifying and integrating the appropriate sensors, selecting a suitable CPU and connectivity architecture, building a secure embedded processing engine, and managing secure connections to whatever cloud IIoT Platform services used required significant investment and expertise.

And while this still requires considerable care in execution, with the advances in the IIoT hardware ecosystem, the availability of new IIoT edge solution modules, and the availability of a rich open-source community (on GitHub, for example), building this foundational set of capabilities has recently become far more streamlined. Further, once a working IIoT solution has been established for one product, this can often be directly re-used across the OEM product line with minor changes depending on the nuances of that edge component.

To elaborate further on the advances in the IIoT edge ecosystem:

- Silicon OEMs, such as ARM, Texas Instruments, ST Micro, and others have made major advancements in providing not only hardware reference designs (including both CPU and wireless connectivity), but also intuitive embedded software creation tools and templates (including the necessary cyber-security protections), needed for reliable IIoT edge solutions.

- These reference designs and associated software also include tools and templates to integrate diverse sensor elements with reference designs to simplify implementation.

- Other OEMs ranging from Intel, to Belden, to GE, have continued to enhance turn-key and enterprise-grade gateways that can be readily used to aggregate multiple edge assets and securely connect that data using diverse protocols to IIoT cloud solutions.

- Finally, other OEMs such as Particle, Blues.io, Telet, and Sierra Wireless are providing complete IIoT embedded subsystems that can be integrated into industrial OEM product lines to simplify and accelerate the process of smart product line transformations.

Certainly, the creation of an OEM's foundational smart edge still requires care and diligence to be sure that the reliability, sustainability, and cost management of the solution are all well thought out. However, these advancements provide industrial OEMs with huge benefits from a development cost, time to market, and sustainability perspective.

These advancements are so important due to the foundational importance for OEMs to own their own edge solutions from a technology, functionality, and evolution perspective. This is essential because the IIoT edge intelligence solution itself ultimately becomes an integral component to the OEM industrial product line itself. As such, OEMs need the ability to directly develop, enhance, and evolve these solutions over time to maintain currency and strategic advantage. And, as only the OEM fully understands the full nuance of their own products, expertise with the IIoT edge technology itself becomes critical to innovation and new value creation. Given all of this, too much dependence on third-party expertise and execution for Smart Edge subsystems can prove to be a great strategic risk.

Regardless, the implementation of IIoT edge intelligence across the key elements of an OEM's product line is the foundational and essential "table stakes" component for IIoT new value creation. Without this component nothing else can proceed.

The Critical Value Inflection Points: Transforming Edge Data into IIoT Solutions

Ironically, the implementation of the "table stakes" IIoT edge intelligence alone is not enough to let OEMs harvest the full value for their investment. The "Value Curve" transition diagram below highlights this. As can be seen in this diagram, zero investment in the Smart Edge actually leads to product line value loss. Conversely, by implementing foundational Smart Edge intelligence OEMs clearly add both value and projected profits to their portfolios.

But what follows is essential - Because only once the OEM's Smart Edge data is aggregated into IIoT Applications and Solutions will OEMs enjoy the major profit, revenue, and customer value potential of their investments. And where an OEM does not provide such IIoT aggregation Applications and Solutions, they are abandoning the Application and Solution revenue and profit, key value inflection points, to the next player in the value chain that does provide them. These inflection points are where the real end-user value is created and what industrial customers actually want to pay for. This is because only once the IIoT data is aggregated into overall Applications and Solutions do investment in the Smart Edge provide the full IIoT end-customer value. Without this added investment the Smart Edge IIoT data is stranded.
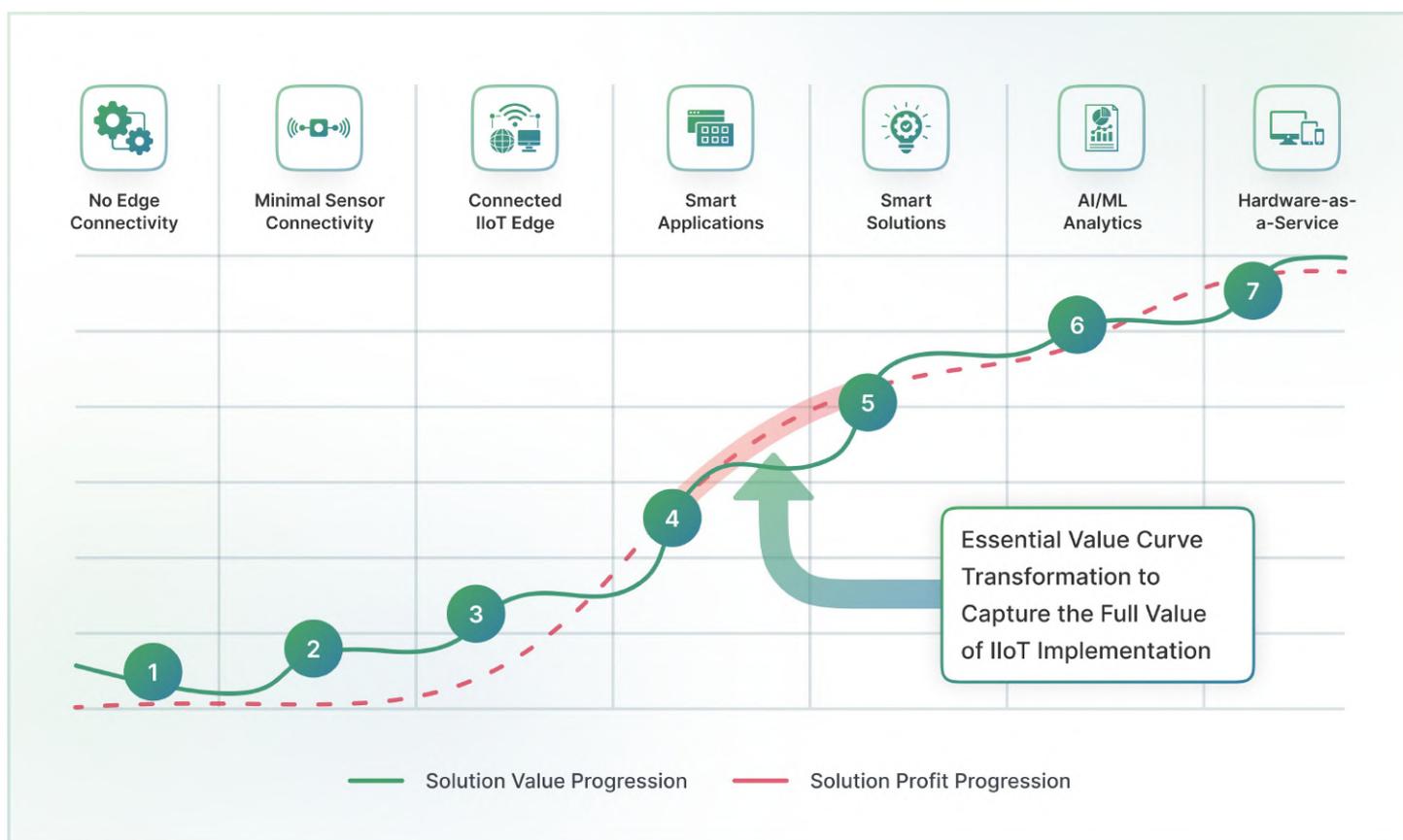
So, in the industrial Product Owner's path to building enterprise-grade IIoT value, building these Applications and Solutions incorporating Smart Edge IIoT data has to be the next step.

The other value inflection points shown above continue to add to the IIoT solution depth. Once the platform and infrastructure are in place, adding AI/ML Analytics, Custom Business Logic, or the creation of advanced solutions such as Hardware-as-a-Service can then be layered into OEM solutions to continue to climb the value curve based on the OEMs innovation and customer or market demands.

However, the problem that facing industrial Product Owners is that until recently climbing this value curve has been incredibly difficult for multiple reasons. First, while industrial OEMs teams are expert in their vertical markets and the products they produce, many do not have deep expertise in the technologies needed to produce enterprise-grade big data applications. These technologies are complex and require specialty skills to provide the scalability, reliability, cyber-security, and strategic versatility required for such solutions. As a result, most OEMs have had little choice but to leverage third party platforms to deliver IIoT Applications and Solutions.

But the choices available to OEMs have been historically very limited and not particularly favorable. In short, the alternatives have been:
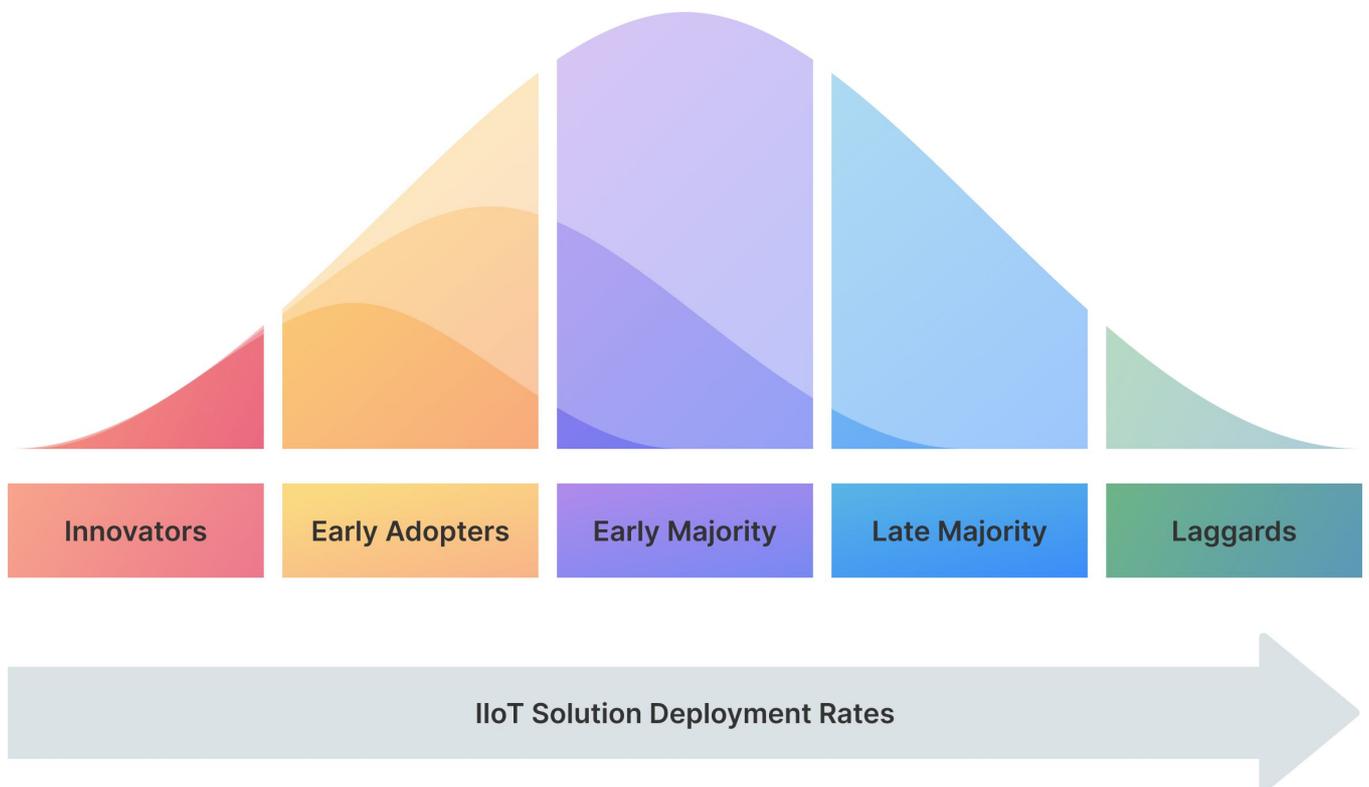
1. The "Mega" Platforms from major equipment multi-nationals;

2. The IoT-as-a-Service (IoTaaS) solutions from AWS or Azure;

3. Low-Code / Rapid Application Creation solutions that leads to high vendor lock-in.

Unfortunately, each of these alternatives have proved problematic from a cost to execute, time-to-market, and strategic flexibility perspective:

• The "Mega" Platforms are very expensive and are primarily focused on the enablement of the products that the solution provider itself produces. For example, GE's solutions have amazing depth of support for its own jet engines but is very challenging and cost prohibitive for most custom application creation.

• Alternatively, by using the IoTaaS components from AWS or Azure OEMs can build virtually anything due to the depth of these components. However, the specialty skills needed, long learning curves, and very high development costs to build enterprise-grade platforms (let alone the application itself) proves highly impractical for most OEMs.

- By contrast the Low-Code Rapid Application Development platforms can seem to be a very attractive alternative. But in many cases after going beyond initial MVP and initial deployments, OEMs find that these alternatives don't provide sufficient flexibility to meet the diverse needs OEM will require to serve as strategic long-term solutions. And further, these platform providers are not in the business of customizing their platforms for individual customers in such a way to remove this obstacle.

As a result of this mismatch between the pragmatic needs of industrial OEMs and the IIoT Platform ecosystem, many industrial Product Owners have had little choice but to hold back on climbing the IIoT value curves in a complete and meaningful way. Given this mismatch, only those OEMs with the willingness and determination to invest heavily have fully realized the potential that IIoT can bring to their businesses.

| Innovators | Early Adopters | Early Majority | Late Majority | Laggards |

IIoT Solution Deployment Rates

The diagram above shows the classic new technology adoption curve for IIoT, and overlays both tier-1 and tier-2 OEM progression along this continuum. What the graph does not show is the multitude of investments that have been made that did not prove successful as a result of the mismatch between what OEMs need and what the IIoT Platform ecosystem has provided in the past. The bottom line here is that while OEMs recognize the upside of "climbing the value curve" with IIoT Applications and Solutions, realizing this reality has been significantly delayed.

However, there is very good news for OEM Product Owners today, because IIoT Platform market has continued to evolve. Today, the best of the next generation of IIoT Platforms are transcending these limitations, and now provide OEM Product Owners with a far more streamlined path to realize the full potential of IIoT Application and Solution ownership, and the economic benefits this provides.

IIoT Cloud Application Ecosystem Evolution

Largely due to the complexity of industrial-grade or enterprise-ready IIoT Platforms it has taken the market quite some time to evolve to alignment with the pragmatic needs of most OEMs. Looking at the diagram below we can see this evolution.

IIoT Platform	IoTaaS	Low-Code / RAD	Advanced AEP
1st On The Scene	*2nd To Market*	*3rd To Market*	*Evolved Solution*

Constraint: Limited Long-Term Flexibilities & Scale

Constraint: High Development Cost, Long Time to Market

Constraint: Excessive Cost for Implementation

Enabler: Opening Platform Core Services & Applications

Enabler: Introduction of Low-Code Rapid Development

Enabler: Multiple Scalable Big-Data Cloud Services

IIoT Platform Evolution and Inflections

To understand the dynamics of the evolution we see here, each IIoT Platform type had very definite limitations that led to the platform innovation, or evolution, of the next major platform wave.

First on the market were the "Mega" platforms, here simply called IIoT Platforms. From very large companies such as GE, Siemens, and others, these platforms provided scalability, security, and extensive functionality, but they were extremely expensive and almost exclusively suited to managing resources from that company. But when using large CapEx equipment from the provider, such as GE's jet engines, they provide great results. Still, the very significant "constraint" of these solutions ultimately is high cost and inflexibility.

Next, IoTaaS solutions from AWS and Azure became widely accepted and adopted. With the depth of IoTaaS solutions OEMs could build virtually anything. So, for a time IoTaaS fueled OEM innovation. But, as OEMs began to move their innovations beyond MVPs and PoCs, the very high cost of constructing enterprise-grade platform capabilities, with all the needed security, reliability, and serviceability, became apparent. The learning curves, specialty skills, development costs, and time to market of IoTaaS drove the total cost of ownership to unacceptable levels.

The next evolution in the IIoT Platforms ecosystem was the introduction of Low-Code or Rapid Application Development (RAD) Platforms. These platforms provided OEMS with a basic IIoT workflow, and using Low-Code tools these workflows can produce OEM use-case-specific IIoT solutions. For some OEMs this proved to be an adequate solution. However, for other OEMs, the constraints of these "canned" workflows proved too limited to allow creation of the rich solutions they envisioned. And, as generally "closed systems", long-term strategic flexibility and vendor lock-in proved to be a major issue for many OEMs.

The final IIoT Platform evolution highlighted, responds to each of the platform systems that came before. The latest evolution is IoT83's Application Enablement Platform, or AEP. Branded as the OEM & Enterprise Domain Cloud (OEDC) Platform, this advanced solution provides the flexibility of IoTaaS by providing a rich set of core platform services at the heart of the platform. But because these core services are well documented with APIs that are easily accessible via associated SDKs, the steep learning curves to use these rich capabilities is virtually eliminated. The OEDC also provides very rich "baseline" IIoT applications, complete with the most widely used IIoT Design Patterns and functional components, making new application creation a highly streamlined process.
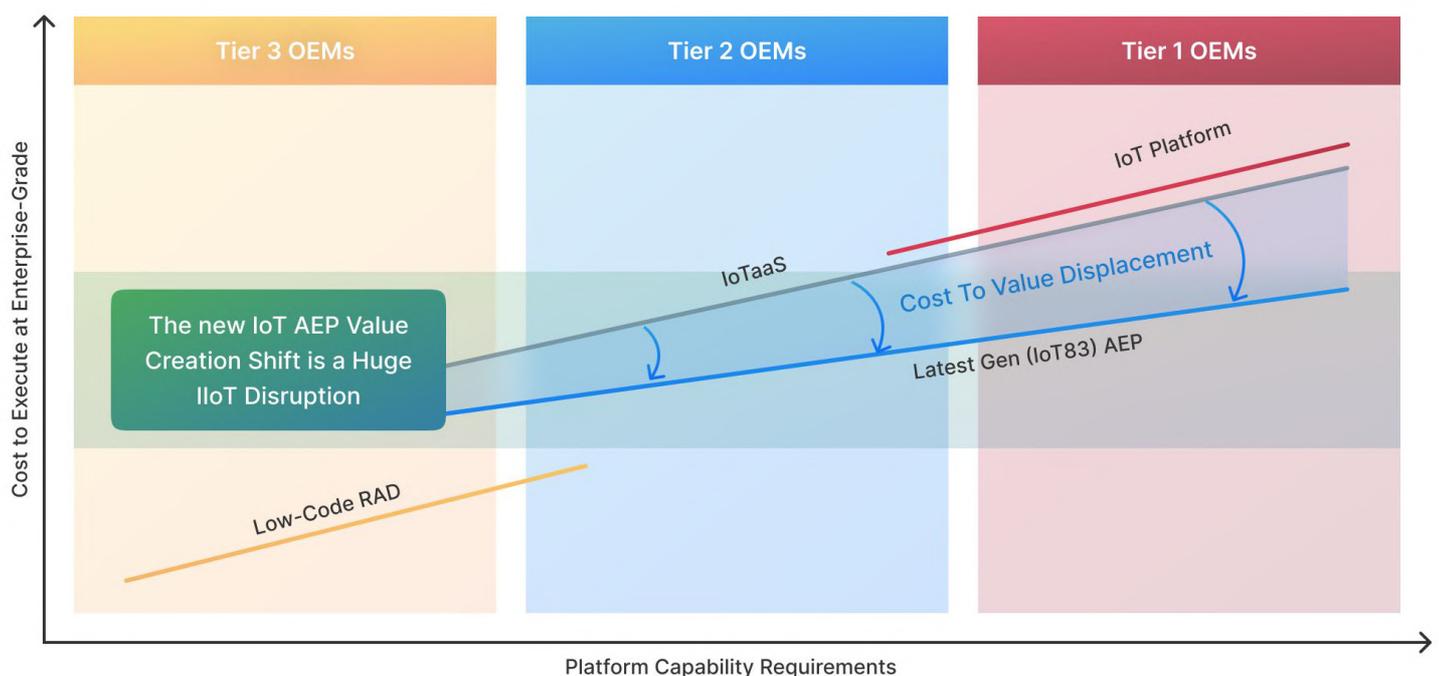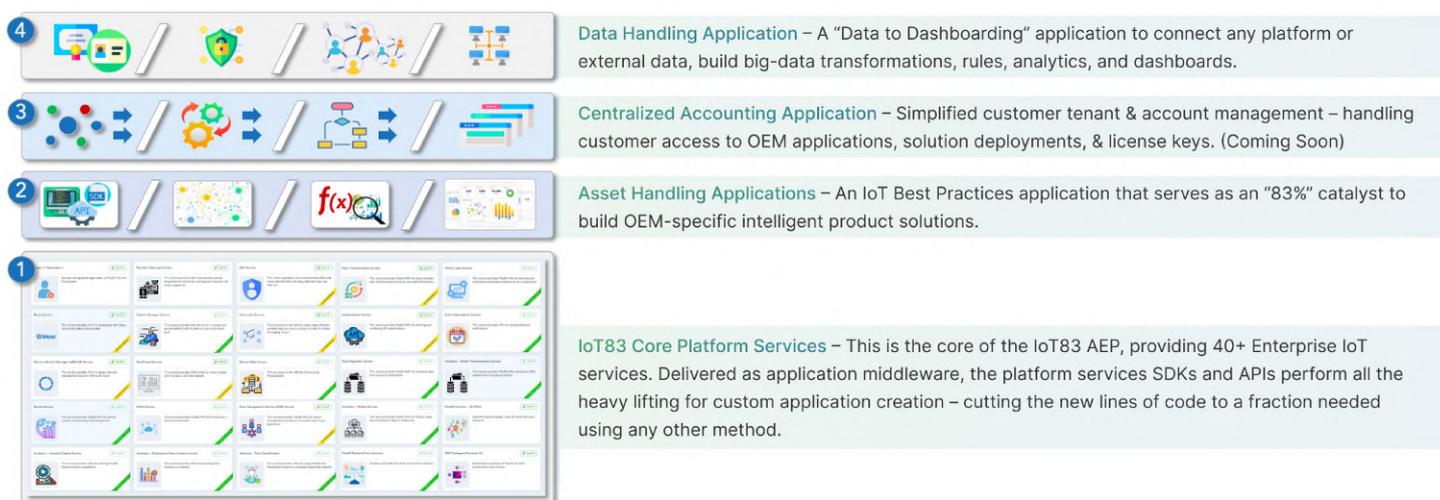
With the OEDC, IoT83 has completely disrupted the Platform ecosystem. The OEDC is the most pragmatic and easy to use solution available, while still letting OEMs build "virtually anything", but in a development cost constrained platform environment. This disruptive value curve displacement is illustrated in the diagram above.

The IoT83 OEM and Enterprise Domain Cloud (OEDC)

As discussed above, IoT83's OEDC Platform provides everything an OEM needs to rapidly build completely customized, extensible, and enterprise-grade solutions. Contrasted with "Mega" IoT Platforms, the OEDC provides a developer-friendly set of APIs and SDKs giving OEM teams full access to the underlying core platform services for complete flexibility. And, unlike IoTaaS alternatives, the OEDC provides Asset Handler and Data Handler applications (below) that translate the underlying core services into a coherent enterprise-grade platform instance. These applications serve as an OEM's "catalyst application" for the streamlined creation of OEM context-specific solutions. Finally, unlike alternative Low-Code RAD platforms, new application construction is never limited by pre-existing or canned workflows. Instead, OEMs can leverage the full power of the catalyst applications as well as the underlying core services to, again, build virtually anything, but now in a cost-constrained and pragmatic platform infrastructure.

The diagram below provides an overview of the components of the OEDC solution. At the core (#1 below) are the extensive platform services that developers can use to accelerate the creation of virtually anything. Above that (#2 below) is the Asset Handling Application, which is loaded with existing Smart Product / Application features and capabilities. Above that is the Data Handling Application (#3 below) that provides "Data to Dashboarding" tools to enable operators to discover new insights to optimize operations. And finally, the Centralized Accounting Application (#4 below) makes it easy for OEMs and Enterprises to manage solution deployment to their customers. The flexibility and power of this approach is unparalleled in the AEP world.

Data Handling Application – A "Data to Dashboarding" application to connect any platform or external data, build big-data transformations, rules, analytics, and dashboards.

Centralized Accounting Application – Simplified customer tenant & account management – handling customer access to OEM applications, solution deployments, & license keys. (Coming Soon)

Asset Handling Applications – An IoT Best Practices application that serves as an "83%" catalyst to build OEM-specific intelligent product solutions.

IoT83 Core Platform Services – This is the core of the IoT83 AEP, providing 40+ Enterprise IoT services. Delivered as application middleware, the platform services SDKs and APIs perform all the heavy lifting for custom application creation – cutting the new lines of code to a fraction needed using any other method.

A key point of OEDC differentiation is this: With the OEDC, OEMs and Enterprises are investing directly in Application and Solution creation, and not in the underlying platform. Using alternative approaches, the creation of the underlying Platform and Platform Technology costs roughly 80% of an OEM or Enterprise's investment and time. Yet, from the OEM's perspective the underlying platform and technology is more or less a commodity, if not a necessary evil. Now, using the OEDC approach OEMs and Enterprises can focus roughly 100% on value creation only, and implementing the specialized know-how and expertise of their teams into unique Smart Applications and Smart Systems – building a moat of differentiation between them and their competitors.

For years the IoT83 team has understood that what most industrial OEMs need is the flexibility to build custom applications that are fully tailored to the value proposition that their products provide to industrial customers. Time and time again, we have seen that Low-Code or RAD solutions are not up to this task. As a result, our focus with the OEDC has been to enable advanced levels of flexibility, to make this as simple and cost-constrained as possible, but still ensuring enterprise-grade security, reliability, and maintainability in the final results. This is exactly what the OEDC Platform provides via the detailed documentation, the underlying core service SDKs and APIs, and the rich Asset Handler and Data Handler "catalyst" applications.

Taking this to another level, the OEDC "catalyst" applications contain a very rich set of IIoT "Design Patterns" and "Functional Services" that can be efficiently tailored into new OEM specific contexts and functionality that maximizes value for industrial OEM customers. To better understand this, consider the following diagram:

IIoT Application Components	Technology Transition Options	IIoT Asset Monitoring	Remote Asset Monitoring	Predictive Maintenance	Analytics & Services	Life-Cycle Management
	Device Connector Services					
	Data Transformation Services					
	Data Storage Management					
	Rules & Thresholds					
	Alarm & Alert Management					
	Event Scheduling Services					
	Reporting Services					
	Application Performance Management					
	IAM/RBAC Management					
	Application Deployment Management					
	Other Platform Services					

Each of these "Design Patterns" represents a prototypical set of IIoT capabilities that in turn uses a set of "Functional Services". While a given OEM's application-specific need for these Design Patterns can vary, the heart of each remains generally consistent across different solution implementation needs. Each of these sets of capabilities, and the functional components and core services they are made from are fully exposed and available for modification and transformation depending on the specific application or solution requirements. And, leveraging the OEDC Platform, these customizations and transformations are always cost and time constrained, minimizing extensive and expensive new lines of code generation and unnecessary complexity in development, validation, and deployment.

Such constrained cost management becomes even more important as OEMs build multiple applications to accommodate the nuanced requirements across their full product lines. And, using this approach, OEMs can maximize application and solution re-use to minimize development costs and time to market.

Using the OEDC as an Iterative and Evolving Value Creation Engine

An extremely important reality to the journey of adding Smart Edge and then Smart Applications and Solutions to an industrial portfolio is this: Once a complete single full enterprise-grade instance of the IIoT solution has been created, enhancing, duplicating, and perpetuating these capabilities across the portfolio is far easier. This is why IoT83 encourages Product Owners to identify a high value but limited set of initial goals and then build from there.

And, once the initial end-to-end solution is in place, with secure connections to Smart Products, cyber-secure user access and data controls, application-specific rules and analytics, basic layers of custom business logic, and core Asset Monitoring/Management functions, this becomes the foundation for incremental enhancements and replication of this IIoT capability across multiple product line components. This in turn paves the way to integrating multiple "point applications" into a powerful portfolio-wide solutions that produces a new "network effect" level of value to end customers. This also aligns with another key recommendation, which is to align, as tightly as possible, investments in IIoT with the time horizon of returns on these investments.

And this is exactly what the IoT83 OEDC enables. Using the OEDC, Product Owners can build powerful IIoT solutions quickly and take them to market for a fast ROI. This then serves as their foundation for expansion of that solution and for replication across their portfolio. Built for such iterative innovation and re-use, the OEDC is a powerful engine for ever evolving, long-term, and strategic value creation.

The Product Manager's Dream Come True

The premise of this guide is that the savvy Product Manager understands the huge value and differentiation that adding enterprise-grade IIoT power to their portfolio provides. But until recently, the cost, commitment, and time-to-market to fully realize this has been challenging at best, and prohibitive at worst. Our message to Industrial OEM Product Managers is that this is no longer the case.

The IoT83 OEDC provides a truly disruptive new alternative in IIoT Platforms that enables rapid, but enterprise-grade, application and solution creation. The OEDC Platform enables highly efficient and cost-constrained execution for fast value creation and long-term strategic growth.

At IoT83, we understand that IIoT Platform selection is a strategic process that warrants a deep discovery process for confidence in decision making. We welcome this process, and the opportunity to showcase the power and disruptive difference that the OEDC can provide to your OEM portfolio and to build new business value.

Speak To Us

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