

The Connected Future. How to drive value by leveraging the Internet of Things (IoT)



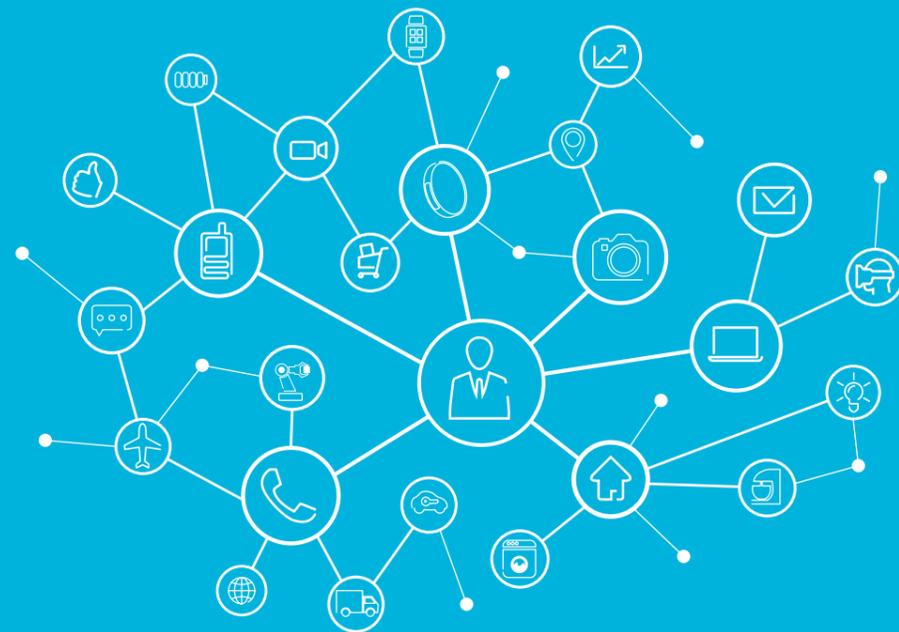
Introduction

The IoT remains on the peak of inflated expectations for the third year in a row as vendors push the hype even higher, but most companies struggle to find use cases beyond proof-of-concept¹.

This hype has primarily been fuelled by: the manufacturers' innovation in building cheaper better sensors, software companies thronging the market with IoT platforms, System Integrators by forging alliances and building knowledge base in an otherwise intricate ecosystem, cheaper development boards for prototyping, and of course the start-ups pushing the boundaries with new possibilities and challenging the status quo. And yet amidst all the amplified anticipations, we believe what's possible with IoT is only limited by our imagination. We have only just begun!

International Data Corporation (IDC) predicts that the global spend on IoT will grow at 15.6% (CAGR) reaching \$1.29 trillion in 2020². This clearly speaks of the big opportunity that lies ahead of us. The sooner we embark on the IoT journey, the better we will be positioned to reap the results.

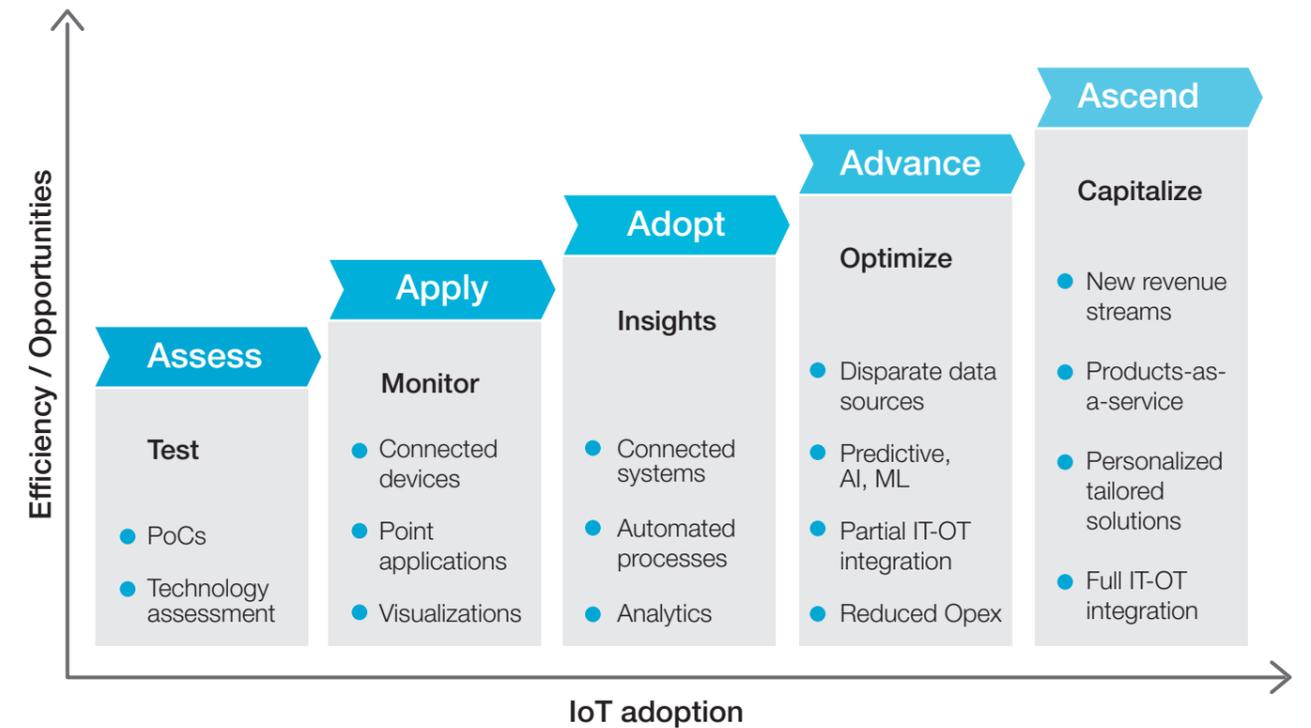
There are, however, pragmatic considerations when building IoT solutions and business cases around them with most investments understandably going towards the low hanging fruits. Nevertheless, on the other end of horizon there are organizations that have completely transformed themselves leveraging IoT and analytics. These IoT-ified companies are driven by data, have leaner operations, and successfully enabled and leveraged new business models. This white paper lays down an IoT maturity model and discusses different steps and stages in the journey leading up to becoming digitally revolutionized.



¹Gartner Smarter With Gartner, November 2, 2016, "7 Technologies Underpin the Hype Cycle for the Internet of Things, 2016" <http://www.gartner.com/smarterwithgartner/7-technologies-underpin-the-hype-cycle-for-the-internet-of-things-2016/>

²"Internet of Things Spending Forecast to Grow 17.9% in 2016 Led by Manufacturing, Transportation, and Utilities Investments", IDC, 2017 accessed on March 2017 at <http://www.idc.com/getdoc.jsp?containerId=prUS42209117>

Steps for an organization to become fully IoT-enabled



These steps and attributes of each of these are discussed in subsequent sections.

1. Assess

Assessment is the first stage on the IoT journey. Here the organization starts building the proof of concepts and assessing underlying technologies. The prototypes are (usually) built by the innovation team(s) in sprints of 6-8 weeks following an agile and iterative development methodology. Some of the questions one aims to answer during this phase are: Would the chosen technology seamlessly marry with existing enterprise software and products? How stable is the prototype in the field environment?

The outcomes include extrapolating the complexity of the solution, performance and most importantly the ROI for business case. The decisions like 'build versus buy' can also be taken here. Usually the prototypes are built using open source software, off the shelf sensors, and easily available programmable hardware such as Raspberry Pi, Arduino boards etc.

Exercises such as these are an excellent way for organizations to begin their IoT journey with low costs and quick tangible results.

It may be noteworthy to mention that only a few prototypes graduate to the next level. However the failures are just as important as successes to experiment, understand, build knowledge and grow ones' IoT fabric.

Test:

- PoCs / MVPs
- Technology assessment
- ROI



Examples:

A fleet management company building a rudimentary track and trace solution using a GPS sensor on Raspberry Pi.

Or, a bank testing NFC payments with EMV (Europay, Mastercard and Visa) chips integrated inside a wearable.

Or a retailer plotting a heat map of the customers in one of the stores by using occupancy sensors in their aisles.





2. Apply

The organizations in the second stage of IoT maturity move from exploration to implementation albeit limited in scope. After having built IoT prototypes, a few ideas are funnelled based on their alignment to business, simplicity of implementation, technical success as a prototype, marriageability with existing hardware and software, but more importantly with a perceivable ROI.

The solutions/applications built here are industry grade, complying with enterprise software specifications. From software integration perspective, here a complete IoT stack implementation is done. It is recommended (but not necessary) that an IoT platform is used at this stage. Though it reduces the complexity and time to market.

The solution almost always automates a part or whole process, allowing instrumentation and giving a near-real time view of process parameters. This aids in a more objective, analytical and effective decision making. If the built application is customer facing, it builds customer-excitement and increases perceived innovation-quotient towards the brand.

Monitor:

- Connected devices
- Point applications
- Visualizations



Examples:

A water utilities company deploying a water leakage detection solution using sensors in its network sending data (possibly wirelessly) to a cloud platform.

Or a Silo monitoring system used by an agricultural business organization to have quick and clear view into their stored inventory in silos.

For Retailers it could mean putting Bluetooth beacons in the store that interact with their customers providing offers dynamically.

3. Adopt

The next step is moving from (one or many) point solution(s) to a connected systems approach. The organizations recognise a larger IoT strategy as a part of which they aim to bring together the solutions and the associated data on one single platform. With this consistency and commonality, it becomes possible to leverage the larger data set for further automation.

The organizations may also cross-pollinate and connect IoT apps with other process flows and enterprise software, such as an automated ticketing system or management dashboard.

The data collected from these applications, when analysed over a common platform leads to better actionable insights via advanced analytics. At this stage of the IoT journey there is a perceivable return of investment which only further increases with the IoT quotient of the organization(s).

Insights:

- Connected systems
- Automated processes
- Advanced analytics



Examples:

Two applications, one a real-time resource monitoring solution, and second an inventory management solution, can leverage each others data to further optimize and predict stock requirements by feeding into each other.

Financial institutions can help their customers get more contextualized and relevant offers by marrying the geo-location data with historical data on customers spends and preferences.

For a mining organization it could mean correlating the asset data with weather data to better plan scheduled maintenances. The equipment can be serviced when (extreme) weather forces a downtime at a mining site.



4. Advance

In the Advance stage, an organization has a fairly developed IoT quotient. They have realised the benefits of IoT such as driving efficiency, reducing costs and increasing automation through the IoT solutions they have built in the past. One of the many potential steps at this stage is IT-OT (Information technology and Operational Technology) integration. By unifying the data from both these technologies it is possible to make smart, timely, informed decisions using data which was sitting in different systems before. This enables the organizations to **bring the operations and business closer**.

At this juncture, organizations have a clear data strategy which more often is big data. With devices, assets and processes sending data in real time to a cloud IoT platform, critical decisions can be made when it matters the most. The anomalies are captured and any intermittent abnormal behaviour is objectively noticed before a leak becomes a catastrophe.

The 'Advance' stage is marked by a unified holistic data footprint of the whole organization. With all the data collected overtime it is easier to build predictive analytical models which further reduces the potential downtime and weeds out unpleasant surprises.

Since the operations become a lot more transparent and leaner, customer value is significantly realised. This also clearly demarcates company from its competition.

Optimize:

- Disparate data sources
- Predictive, AI, ML
- Partial IT-OT integration
- Reduced OPEX



Examples:

A heavy machine equipment working in an oil rig (where a downtime of even a few hours can cost millions). Data from these machines can be collected and analysed on the edge to predict how the machine will behave (using machine learning and predictive modelling).

For a car rental company, it could mean providing a fully automated end to end keyless entry and access solution to its customers. The telematics data from the vehicles is used for enhancing customer experience, provide additional services (say based on geo location), profiling customers, provide dynamic pricing, and predictive maintenance of the fleet.

5. Ascend

This stage is the Holy Grail and eventual goal for any organization on the road to becoming truly IoT-ified. By now company's systems, assets, operations are fully connected, and Information Technology - Operational Technology (IT - OT) integration is complete. There is a 'digital twin' operating as a complete logical software entity that can predict and prescribe the next set of events. This is essentially possible given to all the data flowing in the platform and being analysed in context of the entire organization in real time. Since there is real-time two-way communication, it is possible to automate most operational decisions. The Artificial Intelligence and Machine Learning algorithms make the 'digital twin' more intelligent and enabled with time.

The companies at this stage venture out in new business models, for example Product-as-a-Service where one no longer sells products but leases them with strict SLAs and benchmarked KPIs. For example GE leases its aircraft engines and charges on miles the engine flies. The tyre manufacturer Michelin now leases tyres to airplane companies and charges on the number of landings. Both GE and Michelin monitor their assets using sensors in real time, and can detect any upcoming problems even before they occur. Monitoring not just the assets, but capturing the context and ambience is just as important.

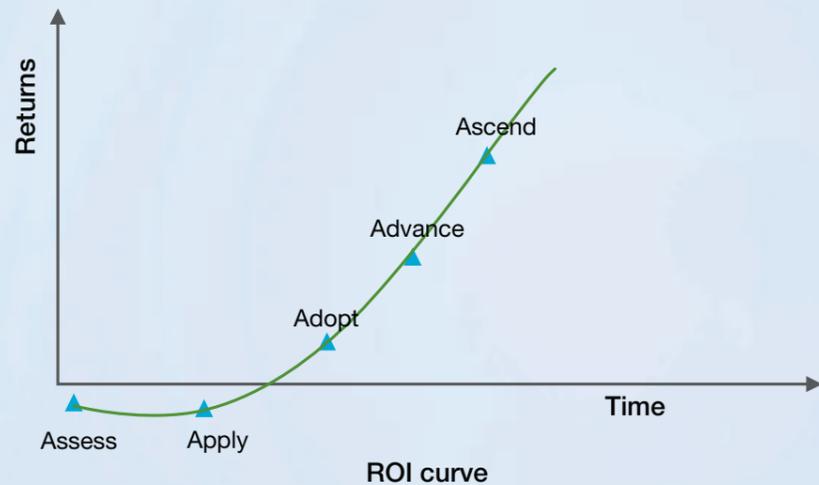
Capitalize:

- New revenue streams
- Product-as-a-service
- Commoditized personalised solutions
- Complete IT-OT integration



Maturity Matrix

	ASSESS	APPLY	ADOPT	APPLY	ASCEND
	Test	Monitor	Insights	Optimize	Capitalize
Technologies	Rudimentary hardware Open source software	Industry grade hardware and software SLAs	IoT platform [Optional big data platform]	Cloud and Big data Real time streaming	Real-time analytics, feedback and actuation
Connectedness	PoCs Technology Assessment	Connected devices	Connected processes	Partially integrated systems	Connected enterprise
Integration	NA	Complete stack implementation (point solution)	Cross-integration of point solutions	Selective integration with enterprise systems Partial IT-OT integration	Comprehensive enterprise integration Complete IT-OT integration
Analytics	Basic statistical tools	Dynamic visualizations	Analytics and insights Partial automation	Advanced analytics. Some predictive analytics	AI and machine learning Predictive and prescriptive analytics
Business	Low investment	Investment	Reduced Op-Ex	Further reduced Op-Ex	Increased Revenue New business models (e.g. Product as a service)
Customer Experience	NA	Excite	Excite	Customer Value	Customer delight Personalization



Summary

It is important to determine where one is in the IoT journey, in order to chart the path forward. In most organizations there are departments and pockets where IoT PoCs / projects are being run. Many a time, these pockets are siloed which causes possible duplication, and also leads to an uncoordinated effort. When IoT is driven as an initiative at a larger organizational level, it is possible to organize and combine the forces to effectively realise the IoT benefits, especially by going after the low hanging fruits. Not only does this give quick returns but also increases the IoT quotient of the organization propelling them towards an IoT-ified and digitally revolutionized future.

Possibilities with IoT are umpteen, only limited by ones' imagination. With the impact IoT is set to have on humanity, it is not the question of WHY, but WHEN; the HOW will become clearer during the journey.

The sooner one takes these steps, the better they are placed to exploit what lies ahead. And, the only way to succeed is to "DO".

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