

Convergence of 5G, AI and IoT Holds the Promise of Industry 4.0

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ABSTRACT

The Information and Communications Technology (ICT) industry across the globe is at the forefront of major transformations that are poised to impact the way industries work. In today's ultra-competitive markets, organizations across industries rely upon next generation ICT technologies to create and deliver game changing value propositions which are market disruptive in nature. Today, the ICT industry evolution has reached a stage where majority of ICT players (i.e. communications service providers, IT service providers, software makers and OEMs) are in a race to ride the much awaited 5G, AI and IoT waves to gain from the first mover advantage and find avenues for generating new revenue streams while obtaining thought leadership in this new marketplace. Among these players, especially, the communications service providers are betting big on these 3 emerging technologies as their traditional revenue streams from voice and data have shrunk in the recent past due to intense competition, commoditization of services, increasing spectrum costs and price pressures (decreasing ARPU). A wide range of IoT applications will be empowered by 5G backbone augmented using AI driven algorithms which can deliver the promise of a smart, ultra-fast, automated and data intelligence driven use cases across industries and ultimately realize the vision of Industry 4.0.

Keywords: ICT, 5G, IoT, AI, Industry 4.0

1. INTRODUCTION

The Information and Communications Technology (ICT) industry across the globe is at the forefront of major transformations that are poised to impact the way industries work. In today's ultra-competitive markets, organizations across industries rely upon next generation ICT technologies to create and deliver game changing value propositions which are market disruptive in nature.

ICT industry has witnessed a phenomenal growth and rapid evolution of technologies over the past two decades i.e. since the days of proliferation of one-way pager devices of the late 90's to today's web, mobile, social media messaging, video conferencing, IP based unified communications capabilities and AI driven chat-bots.

1.1. Objective

To highlight the importance of convergence of 5G, AI and IoT technologies which in many ways will be a facilitator and accelerator of the next generation industrial revolution, often referred to as Industry 4.0.

2. LITERATURE REVIEW

Last few years has seen a tremendous highlight of digital technologies such as 5G, AI, IoT, Data analytics, Big data etc. as the quantity of data generated over the years has exploded. However, the application of these technologies in isolation provides lesser value compared to when these technologies orchestrate together (Research and Markets, 2020). The technologies have the potential to add to new revenue streams. Hence organizations other than CSP's are also embracing the change. The convergence of these technologies has varied use cases that leads to a paradigm shift to Industry 4.0. This research tries to study how the use cases with convergent technologies working in tandem leads to Industry 4.0 by studying as-is condition to the to-be condition.

2.1. Riding the Next Big Waves in ICT Industry: The 'Trinity Waves' of 5G, AI and IoT

Today, the ICT industry evolution has reached a stage where majority of ICT players (i.e. communications service providers, IT service providers, software makers

and OEMs) are in a race to ride the much awaited 5G, AI and IoT waves to gain from the first mover advantage and find avenues for generating new revenue streams while obtaining thought leadership in this new marketplace. Among these players, especially, the communications service providers are betting big on these 3 emerging technologies as their traditional revenue streams from voice and data have shrunk in the recent past due to intense competition, commoditization of services, increasing spectrum costs and price pressures (decreasing ARPU) (Middleton & Contu, 2020).

2.2. Convergence of the 'Trinity Waves' is the Way Forward

Earlier this year, at Mobile World Congress in Barcelona, 5G was discussed in combination with AI and IoT. The potent combination of these technologies will empower industries to truly embrace digital transformation in the years ahead.

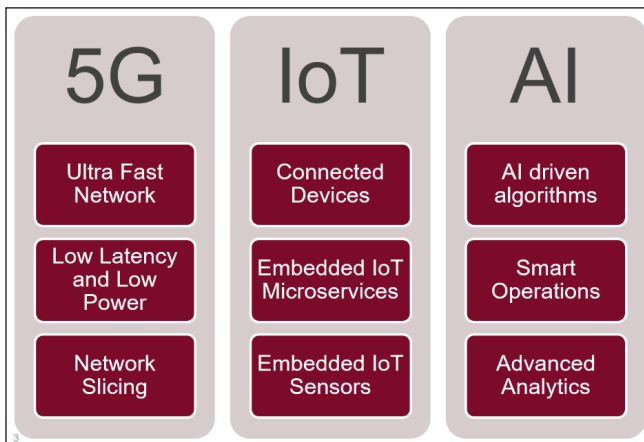


Fig. 1

With the promise of unprecedented speed ($40\times > 4G$ LTE), ultra-low latency, innovative network slicing capability, and unmatched reliability; advent of 5G is poised to have a material impact on widespread success and proliferation of industrial IoT frameworks. As per Gartner forecast, IoT will account for 1/4th of the global 41 million 5G connections in 2024 [(Muralidhar Somisetty, 2018)].

3. KEY CATALYSTS FOR 5G ROLL OUT AND ADOPTION

- *Use of Millimeter Wave (> 6 GHz) Spectrum:* Enables high bandwidth capacities (~1Gbps) but

dictates denser deployment footprint due to coverage and propagation limitations.

- *Massive Densification:* Results from use of millimeter wave and dictates operators to double the number of radio access locations [Muralidhar Somisetty (2018)].
- *Multi-Access Edge Computing (MEC):* Multi-access edge computing brings compute/network/storage capabilities of the cloud directly into the radio access network (Q.Pharm et al., 2020). MEC will be key to enable operators to rapidly provision new services quickly using cloud like deployment techniques.
- *SDN/NFV:* To enable network slicing, which allows highly granular QoS and QoE for separate users, devices and applications – all over same physical network.
- 5G is the next major step in the world of wireless connectivity and poised to be a game changer for telecom players. 5G will elevate the role of wireless connectivity in society and lead to a hyper-connected world. A wide range of IoT applications will be empowered by 5G backbone augmented using AI driven algorithms which can deliver the promise of a smart, ultra-fast, automated and data intelligence driven use cases across industries and ultimately realize the vision of Industry 4.0.

4. IOT BASED ANALYTICS – A MAJOR 5G ENABLED USE-CASE

IoT based analytics is key to success of Industry 4.0 and 5G is critical from network back bone perspective (Research and Markets (2020)). Here are top use-cases with regards to Industry 4.0:

Table 1: Use Cases for 5G, AI, IoT

Analytics Use Case (delivered by 5G, AI and IoT 'Trinity')	Industry 4.0
Context Sensitive	Asset Management
Predictive	Predictive Maintenance, Output Forecasting, Revenue Forecasting
Prescriptive	Energy Efficiency, Job Scheduling
Cognitive	Control & Automation

With advent of 5G, Telcos will need a holistic approach to collecting, processing, analyzing and visualizing data – network device data, network inventory data, network management systems, ERP and CRM data, and other relevant logs – and then applying predictive algorithms to forecast a hardware failure. In virtual environments, it will be necessary to ensure that NFV vendors provide adequate access to real-time operational data (Compare, Baraldi & Zio, 2020). Predictive systems must be able to conduct cross-vendor and domain correlation based on metrics for service availability and health. IoT sensors would be crucial for data collection and a combination of edge and centralized data processing would be required on case to case basis. Need for AI algorithms would be more than ever to reap benefits of intelligent automation of industrial processes (Deloitte, 2018). Today, every industry is betting big on automation as one of the key ingredients to improving efficiencies and accelerate time to market for their products and services. However, for a large spectrum and organization wide adoption of automation, it needs to encompass every sphere of the enterprise architecture and utilize relevant mix of AI and IoT platforms which can be further augmented by capabilities of 5G (Tony Joseph, 2018).

Connected Cars is a great example of the need for the said convergence. In recent years, global automobile giants have started building their own connected cars frameworks. Top 3 enablers for these frameworks include an ultra-fast & low latency communications network, AI driven edge analytics, embedded IoT sensors and cloud data services. Players such as Daimler, Ford, PSA Group, Deutsche Telekom, Ericsson, Huawei, Intel, Qualcomm and Samsung have all backed 5G as the preferred standard for their connected cars initiatives.

This convergence of the trinity will hold the key in delivering a unique technology framework which I would like to term as the Trinity Convergence Framework which can be readily consumed by enterprises across industries to design and deliver a range of smart and efficient, new-age solutions and services for industrial use cases.

5. TRINITY CONVERGENCE FRAMEWORK AND THE ROLE OF GLOBAL SYSTEM INTEGRATORS

World's largest Global System integrator (GSI) organizations have vast knowledge-base and intellectual properties (IP) across the ICT ecosystem of products,

platforms and technologies as well as have deep expertise around integration and deployment of complex technology architectures. These unique capabilities naturally qualify them to be the best contenders who can provide end to end services around this massive convergence opportunity.

6. INDUSTRIAL IMPACT OF 5G, IOT AND AI CONVERGENCE

Convergence of 5G, AI and IoT can significantly impact the way industries operate today. The benefits attained could help organizations take a giant leap towards:

- Ability to carry predictive maintenance of equipments.
- Better resource monitoring and allocation (using IoT sensor monitoring and AI driven automatic resource allocation).
- Reduction of manufacturing waste and defects.
- Reduction of human errors.
- Improving quality of goods produced and services delivered (by virtue of gaining real time insights).
- Machine to Machine (M2M) collaboration due to smart connectivity and AI algorithms.



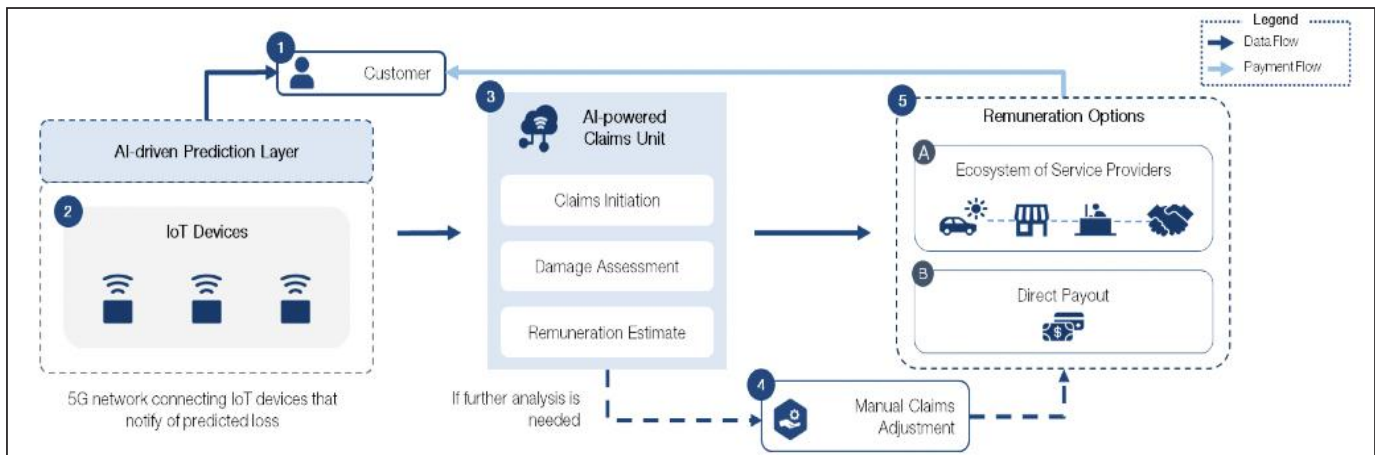
Fig. 2: Researchers Exploring 5G use Cases with a Robotic Arm at the Silicon Valley Research Center

With this being said, the giants of 5G and IoT such as Huawei, Ericsson and Hitachi are working in collaboration to cater to industry use case that requires 5G enabled IoT end node solutions to meet pipeline demand as 5G adoption increases (Hitachi, 2020). One such use case would be real time collaboration between skilled workers and machines. We can appreciate how 5G edge AI technology in collaboration with multi access edge computing servers provide a scenario for optimal control of onsite sensors.

With optimal utilization of large capacity sensor data from onsite premises, AI driven advanced analytics can be applied to supplement the decision making process by human.

Another compelling example from the field of finance services- a pervasive insurance plan can open up a plethora of opportunities in this domain. By creating an

ecosystem wherein products and service providers offer well distinguished and attractive claims can be backed by the likes of 5G, AI and cloud enabled solutions. This claiming experience can create more personalized insurance plans depending on historical data of the customers (Drew Propson, 2020). This experience will result in increased customer loyalty and back end efficiency.



Source: World Economic Forum

Fig. 3: Process Flow for a Connected Post-Claims Experience

More specifically, if we deep dived into auto insurance, we can appreciate how an insurance company would be notified automatically if the vehicle met with an accident. High calibre sensor devices are embedded in the car and these devices provide immediate information about the vehicle's whereabouts (Stephen Gossett, 2019). Based on data points such as airbag deployment, impact of accident, break failure, the software can determine the extent to which the damage occurred and claims can be made available spontaneously, all without the intervention of human. Also, the sensors embedded in the car can automatically send a message to the nearby hospital for medical assistance (Krasniqi & Hajrizi, 2016).

7. CONCLUSION

Many complex business problems across various industries can be addressed with a digital transformation approach which involves a holistic approach by right sizing the mix of cutting edge technologies such as AI, 5G and IoT.

The dream of Industry 4.0 cannot be truly realized until there is a robust integration and co-ordination between

the technological advancements manifested in form of digital technologies such as AI, 5G and IoT as well as operational technologies on the ground. It has been long observed that individual technologies seldom operate in isolation and a right mix is always required to create and deliver the desired value.

Organizations across industries are keen for this giant leap of transformation leveraging the trinity of 5G, AI and IoT.

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