Connecting the Dots !!!

Introduction

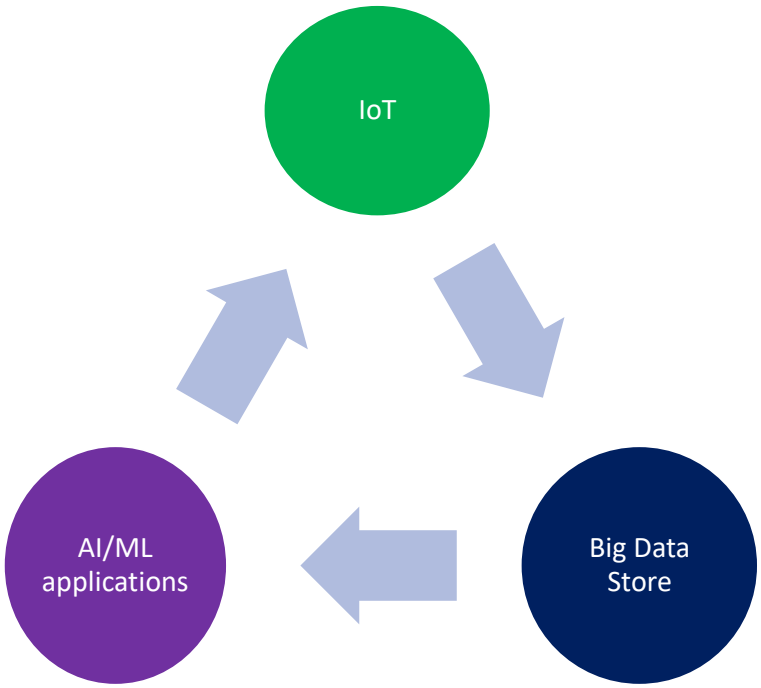
Is there a connect between the contemporary technological jargons viz. IoT, Big Data, 5G/6G and AI/ML? Aren't these technologies are orthogonal in their respective spaces?

Internet of Things (IoT) – describes the network of physical sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

Big Data – Technology to store the data and Big data is a combination of structured, semistructured and unstructured data collected by organizations that can be mined for information and used in machine learning projects, predictive modeling and other advanced analytics applications.

5G/6G – Network technology with high data throughput. As a mobile user do we really need 1Gbps link on mobile? Or maybe 10Gbps speed on mobile? Speed does it matter to the user?

AI/ML – Data Processing technology which helps to derive usage of data in the real world. Technology provides mechanism to understand the data and then use the data for decision making.



The chapter describes writer's view of technology and their inter-relationships to each other and a practical view of these technologies.

Technology evolution

Till recent past, the sensors are connected to a board for data processing using analog connections. The sensor digitization has started recent past and all the sensor manufactures are in the race of capturing the market share. Startups and MSMEs started to introduced the connected sensors to market in early 2000s leading to current revolution of connected sensors.

What does this mean? From a localized analog data collection mechanism to digitized data available on the network for any consumer to use the data produced by the sensors. For Eg: a farmer had to wait in the field for power to be made available to him at mid-night for watering the crop. Then technology enabled him to start the motor automatically when the power is available and if borewell not dry, this was achieved with localized sensors connected to the controller in the field. Now, with digitization of sensors and the advancement in the mobile technologies, a famer monitors the pump operation sitting at his home using an app on the mobile. Technology has achieved its real goal, adding value to the human life.

Does it stop here? May not, the same farmer wants to know what the water flow to each, and every plant is. Is this an overkill? Optimal utilization of the natural resources for the maximum yield is the goal. So he introduced more sensors which gives soil moisture, weather data and water flow measurement at each plant to ensure all plants get adequate resources to produce the maximum yield.

Does it stop here? May be not, further technology introduced the farmer not to worry about any plat, technology will suggest if there is a problem with any of the individual plant he will be notified. Until then he need not worry about the crop. Data produced by sensors, collected by applications for understanding the crop health and then inform the farmer for adequate actions needed.

Now, farmer all he is expected to do is to keep looking for assistance data to take care of his crop. While he gets free time enjoying with his family and spending more time on mobile.

Let us take another Urban example, Alexa – a great product which understand voice and has the ability controls every appliance at home. Technology behind is NLP and it kind of having an answer to any questions.

During our childhood, we used to ask questions to grand parents, parents, neighbors and friends to understand about a subject. We used to get different viewpoints and during this exercise we used to build relationships with family and create new friends. Then early 2000s Mr.Google entered the market with search engine. By late 2000s entire generation stopped asking questions to human and started interacting with google more, rightly so because of more knowledgeable individuals with more authentic information made available for the questions.

Similarly, mobile technology has evolved over past 20+ years. Many of you might remember, late 90s a mobile phone was bigger than walkie-talkies with each phone call was costing

around 10 rupees on both incoming and outgoing calls. Only Ultra rich used to be having ability to purchase and maintain the mobile phones.

Mobile revolution started in early 2000s with 2.5G introduction with data connectivity of 144kbps which allows to have fax kind of services on a handheld device. Then smart phone introduction made the life more exciting with emails available on hand which made sure office work follows wherever you go. Now, with introduction of 5G 1Gbps data speed on a handheld device made sure we watch movie on the move that too a $1/100^{th}$ of the cost of one call in late 90s to 1Gb data download. All these happened within 20 years.

Technology is keep changing as innovators are being working constantly with a motive to make human life more secure and easy.

5G technology overview

5G is the 5th generation mobile network. It is a new global wireless standard after 1G, 2G, 3G, and 4G networks. 5G enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices.
5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users. Higher performance and improved efficiency empower new user experiences and connects new industries.

Mobile evolution

The previous generations of mobile networks are 1G, 2G, 3G, and 4G.

First generation - 1G

1980s: 1G delivered analog voice.

Second generation - 2G

Early 1990s: 2G introduced digital voice (e.g. CDMA- Code Division Multiple Access).

Third generation - 3G

Early 2000s: 3G brought mobile data (e.g. CDMA2000).

Fourth generation - 4G LTE

2010s: 4G LTE ushered in the era of mobile broadband.

1G, 2G, 3G, and 4G all led to 5G, which is designed to provide more connectivity than was ever available before.

5G is a unified, more capable air interface. It has been designed with an extended capacity to enable next-generation user experiences, empower new deployment models and deliver new services.

With high speeds, superior reliability and negligible latency, 5G will expand the mobile ecosystem into new realms. 5G will impact every industry, making safer transportation, remote healthcare, precision agriculture, digitized logistics — and more — a reality.

Where is 5G being used?

Broadly speaking, 5G is used across three main types of connected services, including enhanced mobile broadband, mission-critical communications, and the massive IoT. A defining capability of 5G is that it is designed for forward compatibility—the ability to flexibly support future services that are unknown today.

Enhanced mobile broadband

In addition to making our smartphones better, 5G mobile technology can usher in new immersive experiences such as VR and AR with faster, more uniform data rates, lower latency, and lower cost-per-bit.

Mission-critical communications

5G can enable new services that can transform industries with ultra-reliable, available, low-latency links like remote control of critical infrastructure, vehicles, and medical procedures.

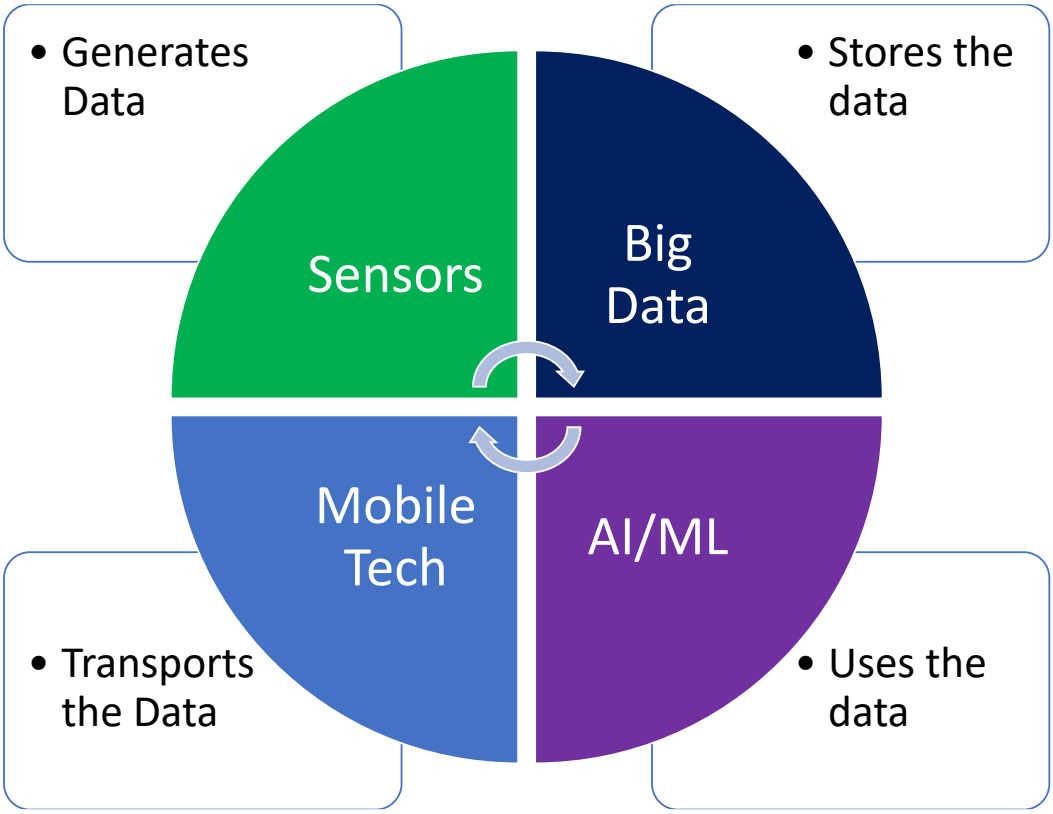
Massive IoT

5G is meant to seamlessly connect a massive number of embedded sensors in virtually everything through the ability to scale down in data rates, power, and mobility—providing extremely lean and low-cost connectivity solutions.

Ref: https://www.qualcomm.com/5g/what-is-5g

Relationships Exists?

Is there a visible relationship between the technologies listed? Let us examine the dependencies between the technologies



Picture Is self-explanatory which explains the dependencies of the technologies and thus establishing the relationships among themselves.

Practical view of Technologies

A practical view point of the technology fusion is essential for successful implementation.The data IoT sensors needs a medium / transport to reach its data store. In my opinion, 5G is a best bet since 5G offers:

- A possible dedicated path (slice of the network)
- Wireless network offers location agnostic reach without physical limitation.
- Already available technology in the market
- eSIM which allows to identify the devices uniquely without any hardware (SIM)
- 5G network can also host Big Data store for data to be be made available for different services

Essentially 5G can play a pivotal role in success of IoT technologies. For Eg: Smart city projects are more of sensor fusion and then centralized analytics, thus achieving data driven decision making. Unfortunately, Govt and its advisors have made the construction companies / infrastructure companies as the nodal agencies (System Integrators) for Smart city implementations.

At the same time, Telecom industry is going through a tough time as most of the revenue are being snatched by the OTT companies. Telecom network has been reduced to a transport layer provider for most of the OTT platforms, making telecom companies bleed. You know how expensive acquiring telecom licenses in the complex Indian ecosystem (true in global market as well). Telecom companies upfront have to make investments on licenses, infrastructure, team by the time their first rupee is earned. With CAPEX intensive industry and revenue is snatched by OTT platforms lead to the existential crisis for the industry.

With crisis situation for telecom industry on one hand and somehow IoT industry is struggling to kick-off due to lack of infrastructure / investment, a perfect marriage for these two industries would have given an opportunity of both a survival. Meaning, if GoI making these telecom service providers as the system integrators for the smart city projects, It could have been a real win-win-win for Govt, Industry and user.

According to an estimation, total size of Smart city projects is approximately around Rs.1,80,000 Crores spread across 150+ smart cities. As mart city project needed experience of handing huge money, infrastructure building capabilities, man power handling capabilities, advisors to Policy makers could have been infrastructure companies. But the key element for the criteria is technology implementation. Unfortunately, construction / infrastructure companies would have met all the criteria except the technology implementation. If technology would have been the focal point, the right fit including technology implementation would have been Telecom companies viz. BSNL, Airtel,Vodafone, MTNL and others who are operating in country.

There could have been 2 approaches to the problem, one making govt Owned telecom operators as the nodal agency or taking complete industry comprised of 5/6 operators as the nodal agencies. Writer is of the opinion, for a better implementation opting the second one is better for the country. With that assumption, each operator would have got around Rs.30,000 Crore additional revenue from the smart city market. The market is completely India centric and should have made mandatorily using “Make In India” technology to be used for the complete smart city implementation. In the financial terms, this could have given a helicopter drop effect to the industry and could have achieved the following:

- Telecom industry would have seen a new life
- This would have revived BSNL specifically which is under the backburner currently.
- IoT manufacturing / deployment could have started leading to massive exports to global market
- Big Data solution space already in a good shape with lot of startups working in the space. This would have been an opportunity for them to have Indian revenue streams
- Govt Could have had the complete data and analytics at their finger tips to make the policy decisions for the betterment of the country

- Finally last but not the least, Indian citizens could have enjoyed the world class infrastructure providing them security / good standard of living / world class services / clean cities

Finally, if the implementation was successful, Indian companies could have taken the model to the world market showcasing the success of the program. It is not just the models, it would have opened world market for Indian companies ensuring the revenue stream coming from across the globe. From a Govt standpoint, they could have facilitated the companies to go global and tax revenue would have seen multi-fold.
Now with India being in the podium position at the global stage, a successful Smart city project would have been really big. Unfortunately, Smart city project is successful only on paper as per our view and literally limited to installing CCTV cameras across the cities. The usefulness of CCTV not being questioned here, however could have been much more than CCTV could have achieved by making sure telecom companies as the nodal agencies for Smart city implementation.

What are the problems, with non-technology companies are the nodal agencies:

- It is impossible for them to understand the latest technologies needed for smart city to work.
- Infrastructure companies have legacy mindset of construction, what is the legacy mindset? – Ownership lies only up to handover of the properties, construction companies do not have lifecycle view of the project.
- Selection of right technology for the right problem, construction company will have expertise in selecting the best / cheap combination materials needed for construction however, technology?
- CCTV is the most used technology in the construction industry? May be not, however smart city projects have been predominantly limited to CCTV implementation.
- Technology companies will find it difficult to work with construction companies because of cultural issues.

Conclusion : For success of IoT is practically dependent on the policy and it is interdependent on the success of 5G. 5G and IoT technologies can be successful together with right Govt. policy and collaboration between IoT industry with 5G telecom operators.