

# Advent of the Data Centre Era

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**Abstract -- Data centres are building blocks of modern technical world. Transition of telecommunications providers (telcos) to high-speed 4G LTE and the soon to come 5G wireless technologies presents a huge demand for the data center infrastructure in India.**

**Post pandemic online shopping, video calls, e-classes, usage of more apps, streaming movies -- all resulted generation of mind-blowing amount of digital data, boosting demand for Data Centres, the warehouses of digital world. Corporates accelerated adoption of cloud computing, further enhancing demand. Meanwhile driven by government's localization push, companies are rushing to set up data centres. Large real estate companies view the data centre business as a sunrise segment. Needless to say, Data centre players find themselves in the middle of a revenue windfall.**

**With over 175 zettabytes of data to be handled by 2025, data centers will continue to play a vital role in the ingestion, computation, storage, and management of information. India ranks next to the US in operational datacenters, attracting strategic investments.**

*Keywords: Data centres, Cloud computing, Server stacks, Data protection bill, Environment footprint, Hyperscale*

## I. INTRODUCTION

OFTEN hidden in plain sight, data centers are the backbone of internet. They store, communicate, and transport the information we produce every single day. The more data we create, the more vital data centers become. Cloud computing -- that ethereal place where companies store data has a physical presence -- in hundreds of giant data centres, the factories of the digital age. These mostly windowless, featureless boxes are scattered across the globe -- from Bangalore to Las Vegas, and Noida to Reykjavik. They run the planet's digital services. Their construction alone costs around \$20 billion a year worldwide.

Enterprises depend on data for competitive advantage. This is driving increased demand for data storage, which is resulting in continuous expansion of the global datacenter market. The global data center construction market will grow at a Compound Annual Growth Rate (CAGR) of 9.3%. India is witnessing insatiable demand for data centres. The Indian data centre market which accounts for 1%–2% of the global market share, is projected to reach \$4.5 billion by 2025.

The government has made e-invoicing mandatory for companies with annual turnover of at least ₹100 crore. This

implies there would be more demand for servers and data centres. Sovereign and pension funds are reportedly evaluating data centres as a potential yield investment.

A data center, as defined in TIA/EIA-942, Telecommunications Infrastructure Standard for Data Centers, is a building or portion of a building whose primary function is to house a computer room and its support areas. The main functions of a data center are to centralize and consolidate information technology (IT) resources, house network operations. Equipment here not only stores but also helps process and distribute data, making data centres the warehouse of the digital world.

Data centers can be classified as either enterprise (private) data centers or co-location (co-loc)/ hosting(public) data centers. Enterprise data centers are privately owned and operated by private corporate, institutional or government entities. Enterprise data centers support internal data transactions and processing, as well as Web Services and are supported and managed by internal IT support. Co-loc data centers are owned and operated by telcos or unregulated competitive service providers and offer outsourced IT services. Services that data centers typically provide include Internet access, application or web hosting, content distribution, file storage and backup, database management, fail-safe power, HVAC controls, security and high-performance cabling infrastructure.



Figure 1. India's largest Data Center building, Yotta NM1, Navi Mumbai.

Falling data rates in India is causing consumer demand for online services. It is also leading to a data explosion. Due to the involvement of multiple entities in a consumer transaction, multiple copies of the same data are maintained. For instance, in the telecom industry, when a consumer makes a call, the Call Data Record (CDR) is processed seven times for different purposes such as billing, CRM, data warehouse, analytics, etc. So multiple copies of the data set need to be maintained. And this is mandated by the telecom regulator. The overall India public cloud services market is likely to touch \$7.4 billion by 2024 growing at a CAGR of 22.2% for 2020-24.

Yotta launched Asia’s Largest Uptime Institute certified Tier IV Datacenter in Navi Mumbai in July 2020; Web Werks launched its fourth data center in Pune in August 2020; NxtGen is providing transformational services with DevCloud, Machine Learning (ML) and Artificial Intelligence (AI), ESDS is providing smart city solutions and AI services, and a lot more.

Interestingly, India’s data centers are also more power-efficient than data centers elsewhere in the world. And data centers like Yotta and CtrlS have alternate sources of energy from solar farms and gas turbines, which they own. The per consumer data center megawatt in India is 15 times less than in Europe. So, we only consume 500 MW in our data centers for 500 million-plus users as against Europe, where they are burning 8,600 MW for 600 Million users.

TABLE 1 -- TOP 10 COUNTRIES HOSTING DATACENTRES

US	277
India	50
Australia	42
UK	35
Ireland	27
China	26
Canada	23
Singapore	23
Germany	21
Malaysia	10
Netherlands	10

India received \$977 million of private equity and other strategic investments in the data centre industry since 2008. Of this, \$396 million came in 2020, until September. The market for data centres is anticipated to be fuelled by impending data sovereignty laws, government-backed initiatives and rise in data traffic. High volumes of data and the need to protect it from cyber threats definitely puts India on the verge for quicker engagement with global giants to speedily accomplish the task of developing the critical assets of IT sector. India has some distance to cover before it becomes a global data centre hub.

Infrastructure bottlenecks and local permissions could stymie this power-hungry industry.

Many of these organizations are also becoming more concerned about data centers’ power usage and carbon footprint. The global green data center market, with Europe and the U.S. historically leading it, is expected to reach or exceed \$55 billion by end-2021, growing an overall CAGR of 14 percent according to an assessment by Technavio. This focus on energy and carbon emissions is exemplified by several green initiatives, such as the Better Buildings Challenge, an initiative of the U.S. Department of Energy (DOE) designed to improve energy performance of the data center industry by driving leadership in energy innovation.

**Anatomy of a Data Centre in Noida**

The ochre and steel-coloured building in a dusty industrial area of Noida has no signboard. The building stores humongous amounts of consumer and corporate data and must be guarded against any disruption. After all, this is an industry that thrives on secrecy, perhaps even paranoia.

The site, operated by Web Werks India Pvt. Ltd, a data centre company, has six layers of security checks and 40 cameras staring at visitors and employees at all times. Cables are like arteries, pumping in and out packets of data and must therefore be protected against rats, not just men. There are ultrasonic rodent repellent systems, water leak detectors, and smoke sensors monitoring the campus. In case of fire, walls and doors of the data centre are designed to withstand flames for two hours.

The data is stored in servers placed on hundreds of racks lined after one another, much like books kept at a library. There are cages for customers who need a dedicated space. Life Insurance Corporation Of India (LIC), a Web Werks customer, has its computing and networking equipment in one such cage.

Data centres are at the intersection of three industries—technology, real estate and power. India today has about 126 third-party data centres, spanning over 7.5 million sq. ft, a recent study by Mace, a construction company, and Anarock, a real estate services company, found. Now, leveraged capital of nearly \$10 billion is waiting to be pumped in, according to the Mace-Anarock report.

The capacity, nevertheless, is concentrated among the top 12 data centre companies and this isn’t enough considering India’s growing data consumption. According to the report, India’s data centre capacity per million internet users totals less than one megawatt (MW) today compared to eight MW in the US and 21 MW in Europe.

II. COVID-19 IMPACT

In the past year, the uptake of data centres accelerated primarily because of the covid-19 environment. According to IDC India, a technology advisory firm 80% of organisations would increase their co-location services in the next 12 months (companies that rent racks/servers in third-party data centres to store data).

Datacenter are the heart of the internet. Every bit of information is coming from some server, seating in some datacenter of the world. As more and more datacenter are opening up, India is catching up with the world at a high pace. More and more data centers are opening up in India. India has a GDP of \$2.6 trillion, and the country’s top service providers include Sify, Tata Communications, and Airtel. The nation has 29 internet users per 100 citizens, while its connectivity ecosystem is made up of 122 colocation data centers, 348 cloud service providers, and 8 network fabrics.

2020 has been a challenging year, to say the least. While it has negatively impacted most businesses, the net impact on the data center industry has been mixed. On the downside, companies are tightening budgets and delaying large capital expenditures. That is making data center sales cycles longer. On the upside, COVID-19 has reminded companies of the importance of having regularly-updated disaster recovery and business continuity plans. Data centers factor heavily into those plans. As part of the updating process, many companies are taking the opportunity to offload data center assets from their books, consolidate their data center presence, and backup critical data in more geographically safe and affordable locations.

III. DATA PROTECTION BILL

Growth of the digital economy has expanded the use of data as a critical means of communication between persons. Right to privacy is a fundamental right and it is necessary to protect personal data as an essential facet of informational privacy.

The Lok Sabha introduced the Personal Data Protection Bill (PDP), 2019 to provide for protection of the privacy of individuals relating to their personal data, specify the flow and usage of personal data, create a relationship of trust between persons and entities processing the personal data, protect the rights of individuals whose personal data are processed, to create a framework for organizational and technical measures in processing of data, laying down norms for social media intermediary, cross-border transfer, accountability of entities processing personal data, remedies for unauthorised and harmful processing, and to establish a Data Protection Authority of India.

A big trigger is expected once this Bill becomes an Act of Law. The Act is likely to mandate that companies store critical data of Indians within the country. Most social media companies currently store user data outside India. As they scout for local

data centres, it could make data centres the hottest alternative real estate asset in India. Every e-commerce player, social media companies, over-the-top (OTT) players have to bring data back to India. So will foreign insurance, healthcare and supply-chain companies

IV. POWER AND BACKUP

Data centers should have the systems to maintain uptime in the event of a system failure with right equipment in place a good DC will provide you with continuous power supply, and some data center in India is better prepared than others.

A data center with a primary system (N) (Normally a power supply provided by the local grid) and one backup power system (1) can avoid downtime during planned or unplanned power outages.

DC which provide 2 power systems which are always active is called (2N) which dramatically improves uptime. A Power system control point with one additional device in the event of a device failure. Still better is DC over with 2 complete power system paths that are always active to minimize downtime + 1 more backup equipment.

N+1	2N	2N+1
A common Power system control point with one additional device in the event of a device failure	DC over here have 2 complete power system paths that are always active to minimize downtime	As the name suggests it has 2 complete system paths just like 2N + more backup equipment is available.

Figure 2. Back-up power configurations in data centres for minimizing downtime.

Understanding Tier’s: Tier’s is a method to standardise redundancy. Companies like Uptime Institute provides third-party verification of data center tiers certification.

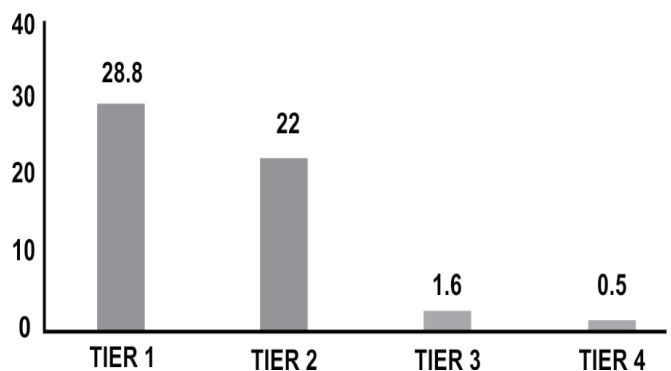


Figure 3. Downtime by Tier (hours per year).

Most of the datacenters in India are Tier 3 Certified but we also have Tier 4 DC.

V. DATACENTERS SERVICES IN INDIA

Indian Datacenters provide all and up to the mark services just like any other DC in the world. These services are:

*Colocation Services:* A colocation facility or as some people call it colo.

Colo, a data center facility (provided with most of the DC in India) is a service in which a company/ individual can rent physical space for servers and other computing hardware. The DC provides the building infra, cooling system, power and backup, bandwidth and physical security, while the customer provides servers and storage. The Datacenter charges you for space.

Expected annual growth rate of the colo market: 45%
80% of enterprises will have shut down their traditional data center by 2025
Expected size of the global colo market by 2022-end: \$ 51 billion
Over 50% of globally utilized racks will be located off-premises by 2024

Figure 4. Colocation trends: Expected annual growth rate.

*Suites and Cages:* Suites are a datacenter inside a datacenter; also called private datacenter suites. Suites are flexible and can be modified according to customer specifications, including high-density cabinets, hot/cold aisle containment solutions. Cage colocation is a fully customizable solution that allows one to license a secure area of any data centre enabling ideal space, security and deployment configuration with the secure confines of a floor to ceiling enclosure.

*Rack cabinets:* A rack server, also called a rack-mounted server is a computer dedicated to use as a server and designed to be installed in a framework called rack cabinet. They contain multiple mounting slots called bays, each designed to hold a hardware unit secured in place with screws.

*Dedicated servers:* This is more flexible than shared hosting, as organizations have full control over the servers including choice of the operating system and hardware.

VI. TEN TOP DATA CENTER OPERATORS IN INDIA

*CtrlS:* CtrlS is an ANSI/ITA-942 certified Datacenter and managed services provider headquartered in India. CtrlS operates one million square feet of data center space across seven state-of-the-art facilities, including Hyderabad, Mumbai, Noida, and Bangalore. As per CtrlS, it is serving 60 of the Fortune 500 global multinationals. Mumbai data center facility

of CtrlS is LEED Platinum certified v4 O+M data center by United States Green Building Council (USGBC). Its Mumbai DC2 is a Rated-4 facility. It is covered by solar panels generating 1 MW of power. Its Noida set-up is 100% quake proof and pollution free data center facility. CtrlS has started working on its plan of expanding its footprint by 5 million square feet. It has acquired the land for constructing 2 million square feet hyperscale data center park in Navi Mumbai; 2 million square feet hyperscale data center park in Hyderabad; and plans are in wings for a 1 million square feet facility in Chennai.

*ESDS* Founded in 2005, ESDS is a leading managed data center service and auto-scalable cloud solution provider. ESDS is working steadfastly towards establishing a huge customer base. It provides managed data center services, managed cloud solutions, virtualization, and disaster recovery hosting, backed with technical support. ESDS has its presence in the following industry verticals – Banking & Finance, Manufacturing, Education, Energy & Utilities, Healthcare, eCommerce, Agriculture, IT, Entertainment & Media, Telecom, Government, and Travel & Tourism.

*GPX Global Systems Inc.* GPX develops and operates private, carrier-neutral, state-of-the-art Tier 4 data centers in emerging, but fast-growing commercial markets within the MENA and South Asia markets. GPX’s data centers are thriving carrier-neutral internet ecosystems, and home to the largest carriers, cloud service providers, content providers and internet providers. GPX offers secure and highly reliable carrier-neutral data centers to both domestic and international clients looking to colocate their crucial business infrastructure. Its first data center was in Cairo in 2007. It opened its second Egyptian data center in early 2016, a 3000 m<sup>2</sup>, Tier 4 facility located in New Cairo, Egypt. GPX opened the first Tier 4 facility in South Asia in June 2012. It was a 3000 m<sup>2</sup> data center in Mumbai. Due to rising demand for high-quality facilities and service levels in India, GPX has announced its second Mumbai data center, GPX Mumbai 2 – a 6000 m<sup>2</sup>, Tier 4 facility with 16 MW total power operational in Q2 2019. GPX’s customers include Telcos, Cloud Service Providers, Internet Service Providers, CDNs, e-businesses and enterprise clients.

*Netmagic* (An NTT Communications Company): Netmagic, a wholly-owned subsidiary of NTT Communications, is a leading managed hosting and multi-cloud hybrid IT solution provider with 9 carrier-neutral, state-of-the-art hyperscale and high-density data centers. It serves more than 2000 enterprises globally. Netmagic, headquartered in Mumbai, also provides Remote Infrastructure Management (RIM) services to various enterprise customers globally including NTT Communication’s customers across Americas, Europe and Asia-Pacific region. Netmagic was the first in India to launch services including cloud computing, managed security, Disaster Recovery-as-a-Service (DRaaS) and software-defined storage.

**NxtGen:** NxtGen enables its customers to build their digital business without investing and managing complex IT infrastructure, by leveraging its hyper-converged infrastructure. Headquartered in Singapore, NxtGen, is an emerging leader providing completely managed datacenter and cloud services across India and Singapore. NxtGen deploys and offers IT infrastructure services from both or a combination of on-premise resources and its own facilities – Infinite Datacenter™, empowering its customers to adopt the latest hybrid computing model.

**Nxtra Data Limited:** Nxtra Data Limited was formed to run Bharti’s business of Data Center Managed Services. Nxtra now manages 10 Tier III and ISO 27001 certified data centres at Manesar, Noida, Chennai, Mumbai, Bangalore, Bubhaneshwar and Pune. The total facilities provide an approx. 200,000 sq. ft. of floor space. Nxtra offers an integrated portfolio of data center managed services including co-location, managed hosting, managed services, managed security, managed back-up & storage, virtual compute and cloud along with both domestic and international network connectivity.

**Sify Technologies:** Sify is a leading integrated ICT Solutions and Services organization in India. It offers a wide range of solutions and products that are delivered over a common telecom data network infrastructure reaching over 1550 cities and towns in India. Sify’s telecom network presently connects 45 data centers across India, including Sify’s 6 concurrently maintainable data centers across the cities of Delhi, Mumbai, Chennai and Bengaluru. In 1998, Sify was the first Indian ISP that helped millions experience the internet for the first time on its network. It was the pioneer of Internet café, data and voice services for international call centers. Today, it has expanded to the United States, with headquarters in California’s Silicon Valley. It has over 8500 enterprise customers.

**Tata Communications :** Tata Communications Limited, with its subsidiaries (Tata Communications), is a leading global provider of A New World of Communications. Tata Communications utilizes its advanced solutions capabilities and domain expertise across its global network for delivering managed solutions to multi-national companies and communications service providers. Its global network includes an advanced and largest submarine cable network and a Tier-1 IP network with connectivity to over 240 countries and territories across 400 PoPs, as well as approximately 1 million square feet of data centre and colocation space across the globe. Tata Communications’ reach in the emerging markets includes leadership in Indian enterprises.

**Yotta:** Powered by the Hiranandani Group, Yotta designs, builds and operates infinitely scalable Data Center Parks. Yotta’s 50+ Acres of Data Center Parks offer 11 Data Center buildings with options ranging from a single rack to an entire building, or

even customized DC, supported with a wide range of managed services. Yotta has a highly experienced (150+ man years) and certified Data Center design team. They claim to have some of the best minds in electrical, mechanical, HVAC, automation, fire fighting and physical security working with them.

VII. ENVIRONMENT FOOTPRINT

The gigantic data centers that power the internet consume vast amounts of electricity and emit as much CO<sub>2</sub> as the airline industry. To change that, data companies need to turn to clean energy sources and dramatically improve energy efficiency.

They are housed in huge buildings that are the treasuries of the new industrial kings: the information traders. The five biggest global companies by market capitalization this year are currently Apple, Amazon, Alphabet, Microsoft and Facebook, replacing titans such as Shell and ExxonMobil. Although information factories might not spew out black smoke or grind greasy cogs, they are not bereft of environmental impact. As demand for Internet and mobile-phone traffic skyrockets, the information industry could lead to an explosion in energy use.

Creating sustainable facilities is essential to ensuring reliability and agility, two of the most important factors for mission critical facilities. Information and communications technology are responsible for 2% of global CO<sub>2</sub> emissions and are experiencing unprecedented growth, so improving the sustainability performance of this sector is more important than ever.

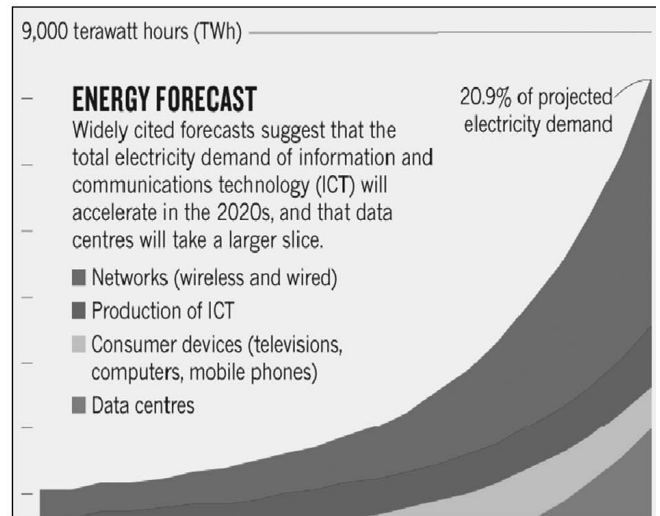


Figure 5. World Energy demand from Data centres relative to other segments.

VIII. HYPERSCALE DATA CENTRES

A hyperscale data center is defined as one that offers a portfolio of highly scalable applications and storage services to businesses. According to IDC, a hyperscale data center offers upwards of 5,000 servers with an aggregated space of

at least 10,000 sq.ft. across floors and buildings within the same campus.

Hyperscale data centers can scale up the provisioning of compute, storage, networking/connectivity, and power resources for a customer, on-demand. Hence, these specialized data centers are designed and constructed with expansion in mind. The architects or data center builders need to “think big” at the beginning, even before the foundation stone for the building is cast. They need to plan for redundant and ample resources such as power, connectivity, and cooling. Apart from drawing power from the electricity grid, they also need to consider alternative sources of power, such as solar energy. Data center architects also need to have enough real-estate to build more buildings to support future expansion.

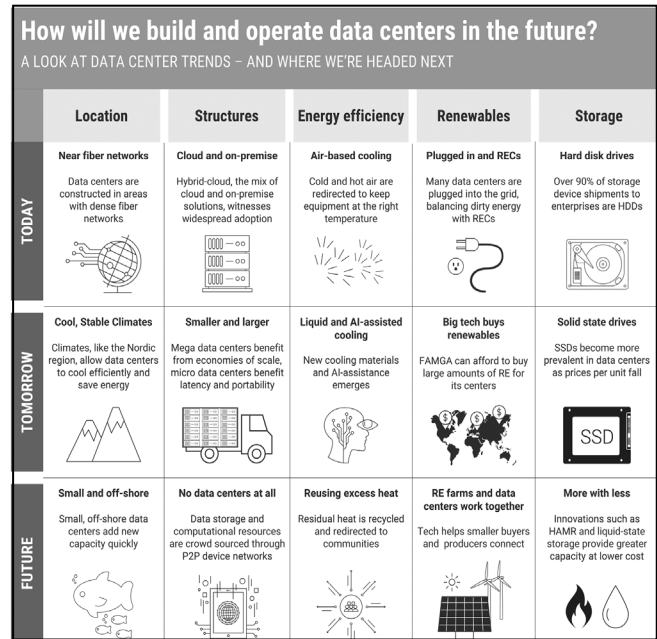
The demand for hyperscale data centers and managed services has surged in the past two years as more businesses move their IT infrastructure to the cloud. A key driver is consumer demand for app-based and OTT services running on the cloud. Increased digitalization efforts of the Indian government and plans for smart cities is another driver. Data localization mandates driven by the government has also led to increased regional presence by the MNCs and big tech companies—Google, Apple, Amazon/AWS, Microsoft, Facebook, as well as e-commerce giants. Large enterprises like banking institutions, telecom companies, retail/e-commerce companies and MNCs servicing clients in India need hyperscale data centers. These specialized data centers are different from the regular data centers and more challenging to build, especially in areas where real estate and power are scarce or expensive.

According to Report Linker, the global hyperscale data center market is expected to grow at a CAGR of over 9 percent till 2024. The report cites three key factors that will contribute to this growth during the forecast period, namely: Data regulation to Increase facilities investment, increasing procurement of renewable energy for new facilities, increase in deployment of software-defined data center (SDDC).

Until two years ago, the demand for (and the construction of) hyperscale data centers were mainly in the US Today, there are approximately 450 hyperscale data centers in the world. These are coming up in other regions such as the UK, Germany, China & Hong Kong, Ireland, Brazil, Canada, the Netherlands, Singapore, Japan, South Korea, Australia, India, France, Denmark, Sweden and Norway. The adoption of cloud-based services and big data are driving the hyperscale data center surge.

**IX. THE FUTURE OF DATA CENTER DEVELOPMENT**  
Most types of data center development are trending up and will continue to do so for the foreseeable future. Certainly edge and

hyperscale have bright futures. One downward development trend is companies building their own data centers. CBInsights makes a bold prediction in the graphic below that in the distant future we may not need physical data centers at all, at least not how we know them today. We can be quite sure however that physical data centers will remain mission-critical assets for enterprises of all types for the foreseeable future.



**Dr Ranjit Singh, FIETE** (b. 17 Aug 1948) obtained BTech, MTech. and PhD degrees from Indian Institute of Technology, Kanpur in 1969, 1971 and 1975 respectively specializing in the area of Electronic circuits and devices. Has abiding passion for research and innovative approach to teaching. Guided BTech, MTech and PhD scholars. He is founding Editor-in-Chief of the ‘AKGEC International Journal of Technology’, which is running in twelfth volume.

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Delivered Keynote address in the Seminar on ‘Mobile Computing’ in 2014 and Guest Lectures on:-

- Security Issues in Wireless Communications ( Nov 2016)
- Big Data: Challenges and opportunities (Feb 2017)
- Smart Cities (April 2017)
- Lure of ISM Band (July 2017)
- Lithium Ion Batteries: Answer to Communications Energy Crunch (May 2018).

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