



Monthly

e-Newsletter

November - 2022



Never stop learning, Because life never stop Teaching

**“I am the master of my failure...
If I never fail how will I ever learn.”**

:- C.V. Raman

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READER'S CENTER

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FOG COMPUTING

Fog computing is a decentralized computing infrastructure or process in which computing resources are located between the data source and the cloud or any other data center.

Overview

To achieve real-time automation, data capture and analysis has to be done in real-time without having to deal with the high latency and low bandwidth issues that occur during the processing of network data. Although the cloud provided a scalable and flexible ecosystem for data analytics, communication and security challenges between local assets and the cloud lead to downtime and other risk factors.

To mitigate these risks, fog computing and edge computing were developed. These concepts brought computing resources closer to data sources and allowed these assets to access actionable intelligence using the data they produced without having to communicate with distant computing infrastructure.

Fog computing vs. edge computing

For every new technological concept, standards are created and they exist to provide users with regulations or directions when making use of these concepts. In the case of the edge and fog computing, while edge computing refers to bringing compute closer to data sources, fog computing is a standard that defines its operation and application in diverse scenarios.

Fog computing was coined by Cisco and it enables uniformity when applying edge computing across diverse industrial niches or activities. This makes them comparable to two sides of a coin, as they function together to reduce processing latency by bringing compute closer to data sources.

Fog computing and the cloud

Intel estimates that the average automated vehicle produces approximately 40TB of data every 8 hours it is used. In this case, fog computing infrastructure is generally provisioned to use only the data relevant for specific processes or tasks. Other large data sets that are not timely for the specified task are pushed to the cloud.

The cloud provides the extended computing resources needed for storing the vast amount of data that edge devices produce but do not use. It also provides more computing resources for further analysis, which makes the cloud a complementary ecosystem for fog computing applications.

How Fog Computing Works

A fog computing framework can have a variety of components and functions depending on its application. It could include computing gateways that accept data from data sources or diverse collection endpoints such as routers and switches connecting assets within a network.

The process of transferring data through fog computing architecture in an IoT environment includes the following steps:

Signals from IoT devices are read by an automation controller.

The controller executes the system program needed to automate the IoT devices. The control system program sends data through to a standard OPC Foundation server or through other gateway protocols. (OPC is the interoperability standard for data exchange in IoT.)

This data is converted into a protocol understood by internet-based service providers such as MQTT or HTTP(S). Once converted, the data is sent to a fog node or IoT gateway. These endpoints collect the data for further analysis or transfer the data sets to the cloud for broader use.

Examples of Fog Computing

The use of automated guided vehicles (AGV) on industrial shop floors provide an excellent scenario that explains how fog computing functions. In this scenario, a real-time geolocation application using MQTT will provide the edge-compute needed to track the AGVs movement across the shop floor.

The geolocation app works by querying data from the sensors attached to the AGV as it navigates an area. The sensor maintains a connection with a broker and the broker is notified in intervals about the location of the AGV. The notification message is sent via periodic MQTT messages as the AGV continues its movement. The regular updates from the AGV can then be used for diverse purposes including tracking the location of inventories or materials being transported across specified zones.

Thus, the option of processing data close to the edge decreases latency and brings up diverse use cases where fog computing can be used to manage resources. One such example is its application in energy management. Here, a real-time energy consumption application deployed across multiple devices can track the individual energy consumption rate of each device.

Sensors within the device periodically notify the broker about the amount of energy being consumed via periodic MQTT messages. Once a device is consuming excessive energy, the notification triggers the app to offload some of the overloaded device's tasks to other devices consuming less energy.

Key Takeaways

Fog computing is defined by its decentralization of computing resources and locating these resources closer to data-producing sources.

Processing data close to the edge leads to decreased latency and a reduction in the amount of computing resources used.

Fog computing platforms like StackPath can be used to install an MQTT broker on the edge and send low latency data to it.

Insp/T Ram Ayodhya Mishra

DIGITAL GOLD



Digital gold is an alternative to buying the yellow metal in its physical form. One can purchase gold online, and an equivalent amount of that is kept as physical gold in an insured vault. The minimum amount one can buy is as low as one rupee.

What is Digital Gold?

Buying physical gold certainly has its downsides. There are issues of identifying its legitimacy and purity, then there are problems of safekeeping and storage. One more issue is that we are in the midst of a pandemic. It is not quite ideal to go out to gold dealers or jewellery stores. Digital gold, on the other hand, can be bought online and is stored in insured vaults by the seller on behalf of the customer. It also helps us overcome all the aforementioned issues of physical gold purchases. All you require is Internet/mobile banking and you can invest in gold digitally anytime, anywhere.

How digital gold works?

You can invest in digital gold from several mobile e-wallets such as Paytm, Google Pay and PhonePe. Brokers such as HDFC Securities and Motilal Oswal also have an option for digital gold investing.

Currently, there are three companies that offer digital gold in India-

1. Augmont Gold Ltd.
2. MMTC-PAMP India Pvt. Ltd. a joint venture between state-run MMTC Ltd. and Swiss firm MKS PAMP.
3. Digital Gold India Pvt/ Ltd with its SafeGold brand.

Apps and websites like Paytm, G-Pay etc only provide a platform for metal trading companies SafeGold and MMTC PAMP. Once you invest in digital gold, these trading companies purchase an equivalent amount of physical gold and store it under your name in secured vaults. But is the process actually as easy and convenient as it sounds? Let's take a look at how you can invest in Digital Gold

How to trade in digital gold?

First, you visit any of the platforms which offer digital gold investments such as Groww, Paytm, HDFC Securities, G-Pay, Motilal Oswal etc.

Once you are on their platform, you perform the following steps:

1. Enter an amount in INR or grams – You can buy gold of a fixed worth, or buy by weight at the live market rate.

2. Choose your payment method – Once you complete the KYC process, you will have multiple payment options to choose from such as an account, card, or wallet.
3. Store your gold in a secured locker – Your account is updated instantly, and can be accessed 24/7.
4. Sell whenever you want – You can choose to sell your gold digitally itself to the platform whenever you want.
5. Take physical delivery of the gold – In case you chose to not sell the gold, you can request for a doorstep delivery of your gold in the form of coins or bullion. Note: Delivery fees are applicable.

Benefits of Investing in Digital Gold:

- You can take physical delivery of the gold at your doorstep.
- You can invest an amount as low as Re.1.
- Digital Gold can be used as collateral for online loans.
- Digital Gold is genuine and the purity is 24K 99.5% for SafeGold and 999.9 in case of MMTC PAMP purchases.
- Your purchase is stored safely and is also 100% insured.
- You can exchange digital gold for physical jewellery or gold coins and bullion.

Disadvantages of Investing in Digital Gold:

- Limit of Rs.2 lakhs for investment on most platforms.
- Lack of an official government-run regulating body such as RBI or SEBI.
- Delivery and making charges are further applied to the price of gold.
- In some cases, companies only offer a limited storage period, after which you either have to take physical delivery or sell the gold.

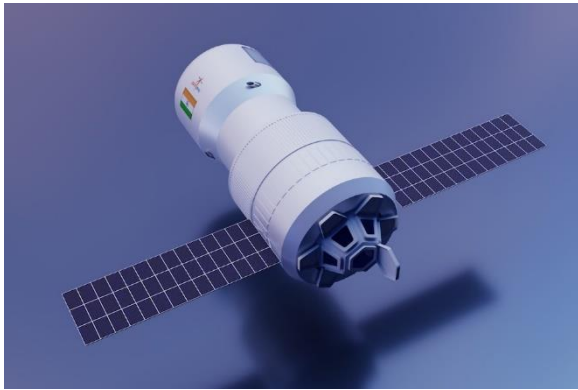
Gold acts as a safety net during times of crisis

Let us take the recent Covid19 crisis as an example to corroborate the former statement. A nationwide lockdown meant furloughs and increased debt burden for consumers and businesses alike. To keep the economy growing, the government and the Reserve Bank of India had to increase spending while limiting growing debt levels. Such measures came by way of a Fiscal Stimulus and Atma Nirbhar Bharat packages.

ASI/RO Ashok Kumar Singh

CHANDRAYAAN-3

ISRO to Launch Chandrayaan-3, Its Third Mission to Moon, in June 2023



ISRO plans to launch Chandrayaan-3, its third mission to the moon, in June next year with a more robust lunar rover onboard which is crucial for future inter-planetary explorations. The space agency has also lined up the first test flight of the 'abort mission' for Gaganyaan, the country's first human spaceflight, early next year. "Chandrayaan-3 (C-3) launch will be in June next year onboard the Launch Vehicle Mark-3 (LVM3),"

What is Chandrayaan-3 Mission ?

- The Chandrayaan-3 mission is a follow-up of Chandrayaan-2 of July 2019, which aimed to land a rover on the lunar South Pole.
- The subsequent failure of the Vikram lander led to the pursuit of another mission to demonstrate the landing capabilities needed for the Lunar Polar Exploration Mission proposed in partnership with Japan for 2024.
- will have an orbiter and a landing module. However, this orbiter won't be loaded with scientific instruments like the Chandrayaan-2.
- Its job will only be confined to carry the lander to the moon, oversee the landing from its orbit and communicate between the lander and the earth station."

Importance of Chandrayaan-3 Mission

- The Chandrayaan-3 mission is a follow-up of Chandrayaan-2 of July 2019, which aimed to land a rover on the lunar South Pole. It was sent aboard the country's most powerful geosynchronous launch vehicle, the GSLV-Mk 3.

Achievement of chandrayaan mission

- The discovery of presence of water molecules in the lunar soil.
- Chandrayaan-1 confirmed that the Moon was completely molten once.
- Chandrayaan-1 has recorded images of the landing site of the US space-craft Apollo-15 and Apollo-11.
- It has provided high-resolution spectral data on the mineralogy of the Moon.

FIFTH-GENERATION TECHNOLOGY

STANDARD FOR BROADBAND CELLULAR NETWORKS



In telecommunications, 5G is the fifth-generation technology standard for broadband cellular networks, which cellular phone companies began deploying worldwide in 2019, and is the planned successor to the 4G networks which provide connectivity to most current cellphones. 5G networks are predicted to have more than 1.7 billion subscribers and account for 25% of the worldwide mobile technology market by 2025, according to the GSM Association and Statista.

Like its predecessors, 5G networks are cellular networks, in which the service area is divided into small geographical areas called cells. All 5G wireless devices in a cell are connected to the Internet and telephone network by radio waves through a local antenna in the cell. The new networks have higher download speeds, eventually up to 10 gigabits per second (Gbit/s). In addition to 5G being faster than existing networks, 5G has higher bandwidth and can thus connect more different devices, improving the quality of Internet services in crowded areas. Due to the increased bandwidth, it is expected the networks will increasingly be used as general internet service providers (ISPs) for laptops and desktop computers, competing with existing ISPs such as cable internet, and also will make possible new applications in internet-of-things (IoT) and machine-to-machine areas. Cellphones with 4G capability alone are not able to use the 5G networks.

5G networks are cellular networks, in which the service area is divided into small geographical areas called cells. All 5G wireless devices in a cell communicate by radio waves with a cellular base station via fixed antennas, over frequency channels assigned by the base station. The base stations, termed nodes, are connected to switching centers in the telephone network and routers for Internet access by high-bandwidth optical fiber or wireless backhaul connections. As in other cellular networks, a mobile device moving from one cell to another is automatically handed off seamlessly. 5G is expected to support up to a million devices per square kilometer.

The industry consortium setting standards for 5G, the 3rd Generation Partnership Project (3GPP), defines "5G" as any system using 5G NR (5G New Radio) software - a definition that came into general use by late 2018.

Several network operators use millimeter waves called FR2 in 5G terminology, for additional capacity and higher throughputs. Millimeter waves have a shorter range than the lower frequency microwaves, therefore the cells are of a smaller size. Millimeter waves also have more trouble passing through building walls. Millimeter-wave antennas are smaller than the large antennas used in previous cellular networks. Some are only a few centimeters long.

The increased data rate is achieved partly by using additional higher-frequency radio waves in addition to the low- and medium-band frequencies used in previous cellular networks. For providing a wide range of services, 5G networks can operate in three frequency bands – : low, medium, and high.

5G can be implemented in low-band, mid-band or high-band millimeter-wave 24 GHz up to 54 GHz. Low-band 5G uses a similar frequency range to 4G cellphones, 600–900 MHz, giving download speeds a little higher than 4G: 30–250 megabits per second (Mbit/s). Low-band cell towers have a range and coverage area similar to 4G towers. Mid-band 5G uses microwaves of 1.7–4.7 GHz, allowing speeds of 100–900 Mbit/s, with each cell tower providing service up to several kilometers in radius. This level of service is the most widely deployed, and was deployed in many metropolitan areas in 2020. Some regions are not implementing the low band, making Mid-band the minimum service level. High-band 5G uses frequencies of 24–47 GHz, near the bottom of the millimeter wave band, although higher frequencies may be used in the future. It often achieves

download speeds in the gigabit-per-second (Gbit/s) range, comparable to cable internet. However, millimeter waves (mmWave or mmW) have a more limited range, requiring many small cells. They can be impeded or blocked by materials in walls or windows. Due to their higher cost, plans are to deploy these cells only in dense urban environments and areas where crowds of people congregate such as sports stadiums and convention centers. The above speeds are those achieved in actual tests in 2020, and speeds are expected to increase during rollout. The spectrum ranging from 24.25–29.5 GHz has been the most licensed and deployed 5G mmWave spectrum range in the world.[citation needed]

Rollout of 5G technology has led to debate over its security and relationship with Chinese vendors. It has also been the subject of health concerns and misinformation, including discredited conspiracy theories linking it to the COVID-19 pandemic.

Application areas

The ITU-R has defined three main application areas for the enhanced capabilities of 5G. They are Enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and Massive Machine Type Communications (mMTC). Only eMBB is deployed in 2020; URLLC and mMTC are several years away in most locations.

Enhanced Mobile Broadband (eMBB) uses 5G as a progression from 4G LTE mobile broadband services, with faster connections, higher throughput, and more capacity. This will benefit areas of higher traffic such as stadiums, cities, and concert venues.

Ultra-Reliable Low-Latency Communications (URLLC) refer to using the network for mission critical applications that require uninterrupted and robust data exchange. The short-packet data transmission is used to meet both reliability and latency requirements of the wireless communication networks.

Massive Machine-Type Communications (mMTC) would be used to connect to a large number of devices. 5G technology will connect some of the 50 billion connected IoT devices.[11] Most will use the less expensive Wi-Fi. Drones, transmitting via 4G or 5G, will aid in disaster recovery efforts, providing real-time data for emergency responders.[11] Most cars will have a 4G or 5G cellular connection for many services. Autonomous cars do not require 5G, as they have to be able to operate where they do not have a network connection.[12] However, most autonomous vehicles also feature teleoperations for mission accomplishment, and these greatly benefit from 5G technology.

HC/RO Lalatendu Satapathy

Acknowledgement

We are highly thankful for reading out this compilation and hope it will be useful for you in day to day professional and personal life. We would like to hear your interest areas, suggestions from you to make this newsletter more informative and interesting. Your views will definitely help us to create this newsletter as an effective medium to reach you with latest development in the fields of communication and technology.

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