

SCIENCE AND TECHNOLOGY**INTEGRATING LEO SATNETS WITH TERRESTRIAL 5G**

CONTEXT: Recently, it has been observed that Integrating terrestrial 5G networks with LEO satellite networks is the next step in communication infrastructure.

Major Points

- As terrestrial 5G mobile networks are being rolled out across countries, there is a renewed interest in integrating Non-Terrestrial Networks, the primary one being the low latency Low Earth Orbit (LEO) satellite networks (SatNets), as a complement to terrestrial networks.
 - Towards this, Starlink, operated by the Elon Musk-owned SpaceX, and OneWeb, promoted by Bharti Global, have launched about 2,500 and 648 LEO satellites respectively at an altitude of about 1,200 km with the objective of promoting global broadband connectivity.

Low-Earth orbit

- It (often known as LEO) encompasses Earth-centred orbits with an altitude of 2,000 km (1,200 mi) or less.
- For the purposes of the Commercial Use Policy, low-Earth orbit is considered the area in Earth orbit near enough to Earth for convenient transportation, communication, observation and resupply.
 - This is the area where the International Space Station currently orbits and where many proposed future platforms will be located.

What is 5G Technology?

- It is the latest upgrade in the Long-Term Evolution (LTE) mobile broadband networks with reduced latency than 4G.
- 5G technologies offer an extremely low latency rate, the delay between the sending and receiving information.

Utility

- There are primarily three main use cases for integrating LEO SatNets with terrestrial 5G networks:
 - Service continuity to provide seamless transition between terrestrial networks and SatNets in case of public safety, disaster management and emergency situations.
 - Service ubiquity to provide 5G services in unserved and underserved areas of the world, thereby bridging the digital divide.
 - Service scalability that utilises the unique capabilities of SatNets in multicasting and broadcasting similar content over a large geographical area.
 - The LEO SatNets can provide service not only to stationary but also to in-motion users.

Integration process

- Satellites and terrestrial networks have always been considered two independent ecosystems, and their standardisation efforts have proceeded independent of each other.
- In view of the above advantages, standard-setting organisations such as the Third Generation Partnership project (3GPP), comprising telcos and equipment manufacturers around the world, started integrating SatNets in the standardisation process.

Extension

- As an extension to terrestrial networks, satellites were first mentioned in a deployment scenario of 5G in 3GPP Release 14.
 - This was to provide 5G communication services for areas where terrestrial coverage was not available and also to support services that could be accessed more efficiently through satellite systems, such as broadcasting services and delay-tolerant services.
 - Interestingly, wireless communications through LEO satellites over long distances is proven to be 1.47 times faster than communication over the same distance through terrestrial optic fibre.
 - It is this advantage along with global coverage that provide a strong use case for LEO SatNets to complement terrestrial optic fibre networks.

Issues to be addressed

- There is a need to address issues around frequencies to be allocated for satellite broadband, the methodology of allocation, the relatively higher cost of consumer equipment and the placement

and interconnections of SatNets with terrestrial public landline/ mobile networks at the ground stations.

- The other major challenge in LEO SatNets is the cost of user terminal and access charges to the end users.

Governments Efforts in this direction

- **National Digital Communications Policy**
 - Realising the advantages, the Government, in its National Digital Communications Policy 2018, has indicated a number of areas including the development of an ecosystem for local manufacturing of satellite communication systems and promoting participation of private players for the strengthening of satellite communication infrastructure in the country.
- **New Space India Limited (NSIL)**
 - Accordingly, the New Space India Limited (NSIL), a public sector enterprise, was established in 2019 under the administrative control of the Department of Space, to reorient space activities from a 'supply driven' model to a 'demand driven' model, thereby ensuring optimum utilisation of the space assets.
- **IN-SPACe**
 - The Department of Space also established in 2020 a new regulatory body named the Indian National Space Promotion and Authorisation Centre (IN-SPACe).
 - It aims to provide a level playing field for private companies to use Indian space infrastructure and to promote and guide the private industries in space activities through encouraging policies and a friendly regulatory environment.

Conclusion

- All these, along with the proposed revisions to the Satellite Communications Policy of the Government, will provide the required fillip to LEO SatNets to become an integral part of the communication infrastructure of the country.
- A recent research analysing both Starlink and OneWeb concludes that the standalone LEO SatNets have a distinct cost advantage only if the density is less than 0.1 person per square km compared to terrestrial broadband networks.
- Hence it is to the advantage of LEO SatNet providers to integrate their networks with terrestrial 5G networks to improve the cost economies.

PRELIMS

1. Solid Waste Management

CONTEXT: Recently, with burgeoning population and even faster urbanisation, there has been an explosion in the generation of municipal solid waste (MSW) in Indian cities.

About Solid waste management

- Solid waste means any garbage or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, resulting from industrial, commercial, mining, and agricultural operations, and from community activities.
- Solid-waste management means collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. It also offers solutions for recycling items that do not belong to garbage or trash.

Pune's women-driven SWaCH model

- The Kagad Kach Patra Kashtakari Panchayat (KKPKP) a trade union of informal waste-pickers and waste-buyers in Pune and Pimpri-Chinchwad was formed in 1993 and got occupational identity in 2007.
- SWaCH is a joint project of KKPKP and the Pune Municipal Corporation (PMC) the first such entity created through municipal action.

Waste management Policy

- **Until 2000**, we didn't even have any law concentrating on how to deal with MSW.
- **Municipal Solid Wastes (Management and Handling) Rules, 2000:**
 - The 2000 rules were applicable on "every municipal authority responsible for the collection, segregation, storage, transportation, processing, and disposal of municipal solid wastes".

- **Solid Waste Management Rules, 2016:**
 - The Government has revamped the Municipal Solid Wastes (Management and Handling) Rules 2000 and notified the new Solid Waste Management Rules, 2016.
 - They expanded the scope of application of MSW rules by including places of pilgrims, airports, special economic zones, ports and harbours, defence establishments and every domestic, institutional, commercial and any other non-residential solid waste generator under its ambit.
 - The Rules for the first time prescribe the duty of MSW generators. A Central Monitoring Committee is to be constituted for monitoring the implementation. Criteria for land filling and waste-to-energy plants are also provided.
 - The Central Pollution Control Board will have to coordinate with the State Pollution Control Board, review environmental standards, monitor implementation, publish guidelines and prepare an annual report on implementation.

Steps taken by India in this regard

- **Conducting Swachh Survekshan**
 - Various rounds of Swachh Survekshan (SS) were conducted by the MoHUA to encourage citizen participation, ensure sustainability of initiatives taken towards garbage-free and open-defecation-free cities, institutionalise existing systems through online processes, and create awareness amongst all sections of society.
- **Star Rating of Garbage-Free Cities**
 - To ensure continued scientific management of solid waste and motivate cities to achieve increased cleanliness, the MoHUA launched the Star-Rating Protocol of Garbage-Free Cities in 2018. The rating protocol is an outcome-based tool, not a process-based one.
- **Swachhata Hi Sewa Campaign**
 - It aims to ensure cleanliness through the various stakeholders in the “Jan Andolan” (National Movement).
 - **Sewa Diwas:** A nationwide shramdaan (volunteering for cleanliness service) by stakeholders
 - **Samagra Swachhata:** Shramdaan by citizens at large, municipal bodies, SBM ambassadors and corporates
 - **Sarvatra Swachhata:** Massive cleanliness drives at iconic spots
- **Compost Banao, Compost Apnao Campaign**
 - The aim is to encourage people to convert their kitchen waste into compost for use as fertiliser and to reduce the amount of waste going to landfill sites. This campaign is an attempt to encourage citizens to contribute towards making their city clean.

2. China Pakistan Economic Corridor(CPEC)

CONTEXT: Recently, India slammed the move by Pakistan and China to involve third countries in CPEC projects.

More about the news

- **About:**
 - China and Pakistan extended a welcome to any country joining the multi-billion dollar economic corridor for "mutual beneficial cooperation".
 - This proposal was made at a meeting of the CPEC Joint Working Group on International Cooperation and Coordination (JWG-ICC).
- **India's stand:**

The Ministry of External Affairs has reiterated that the China-Pakistan Economic Corridor (CPEC) is an 'inherently illegal, illegitimate, and unacceptable' endeavour, and any new nation participating in it would be infringing on India's geographic sovereignty.
- **Significance:**

The invitation by Pakistan and China to countries comes after reports emerged of the project stalling due to ground-level corruption, resistance by locals in places like Balochistan, and attacks on Chinese engineers and workers by Islamic fundamentalists and terrorists.

China-Pakistan Economic Corridor (CPEC)

- **About:**
 - The CPEC is a collection of infrastructure projects that have been under construction throughout Pakistan beginning 2013.
 - The CPEC is part of China's larger Belt and Road Initiative, which aims to spread Chinese investments in trade and connectivity infrastructure to bring Central Asian and European markets closer.
- **Details:**
 - The CPEC is a 3,000 km route of infrastructure projects that seek to create a series of contiguous economic and trade hubs with road and rail infrastructure.
 - It will link places like China's restive western province of Xinjiang Uyghur Autonomous Region and the new Gwadar port in Pakistan's equally unquiet Balochistan state.
- **Funding:**
 - Originally valued at \$47 billion, the value of CPEC projects bumped up to \$62 billion as of 2020.
- **Mutual Benefit for China and Pakistan:**
 - For China, the project will bypass the Strait of Malacca, which can be a choke point in case of a conflict with the US or other adversaries.
 - On the other hand, Pakistan expects CPEC to be a lifeline for its deteriorating economy, leading to a multiplier effect on production and employment generation and sustainable economic growth.

3. Private Sector Investment in Space Industry

CONTEXT: Recently, the government is seen making efforts to increase private sector participation in the space industry.

More about the news

- The Indian government would soon come up with a new space policy that could initiate the rise of India's own "SpaceX-like ventures".
 - SpaceX is Elon Musk's private space transportation company.

Significance of the Space industry

- **Assessing & recording weather information:**
 - Satellites provide more accurate information on weather forecasts.
 - It can also assess (and record) long-term trends in the climate and habitability of a region.
 - For example, by monitoring the long-term impact of climate change at regional, territorial, and national scales, governments would be able to devise more pragmatic and combative plans of action for farmers and dependent industries.
- **Real-time tracking :**
 - Satellites can serve as real-time monitoring and early-warning solutions against natural disasters such as earthquakes, tsunamis, floods, wildfires, mining etc.
 - Real-time tracking can also serve multiple purposes in defence.
- **Communication and connectivity:**
 - As for connectivity, satellite communication can reach more remote areas where conventional networks would require heavy complimenting infrastructure.
 - Additionally, as to the reliability, the World Economic Forum(WEF) stated that satellite communication can help connect 49% of the world's unconnected population.
 - In this light, it must be noted that satellite communications, which are used to facilitate telecommunication services, are among the major categories for investment in the space technology sector.
 - Other prominent categories include spacecraft and equipment manufacturing.
- **Benefits to other sectors:**
 - The space avenue is an integration of the aerospace, IT hardware and telecom sectors.
 - It is thus argued that investment in this arena would foster positive carryover effects to other sectors as well.

4. Bank Nationalisation

CONTEXT: Recently, it was the 53rd anniversary of Prime Minister Indira Gandhi nationalising 14 banks.

Background on nationalisation of Banks

- **History:** The Congress government had nationalised 14 banks in 1969 and then followed it up with nationalising another 6 in 1980.
 - a. Nationalisation essentially meant that the government took over the ownership of certain private banks.
- **Aim:** The government's aim was to take away the control from a few private players and expand the banking coverage to rural India so that sectors such as agriculture and small industries could get better credit facilities, thus creating a new class of entrepreneurs.
- **Need?**
 - a. India was predominantly an agrarian economy at that time with very high levels of poverty (over 50%) and low levels of financial inclusion.
 - b. Nationalisation was seen to be the quick way to ensure all the above objectives were met; private bankers would never have expanded for such social development reasons.

Arguments against nationalisation of Banks

- **Less strategic and operating freedom:** The key difference between the state-owned PSBs and private banks is that PSBs enjoy less strategic and operating freedom because of majority government ownership.
 - The government **exercises significant control** over all aspects of PSB operations ranging from policies on recruitment and pay to investments and financing and bank governance including board and top management appointments.
- **Forced Loans:** Public sector bank officials can be forced to extend loans when such loans don't make economic sense.
- **Rising NPAs:** PSB officials come under the scrutiny of agencies such as the Central Vigilance Commission and the Comptroller Auditor General. This holds them back from taking risks in lending or in renegotiating bad debt due to fears of harassment from the same investigative agencies.
- **Lack of result:** the central point of nationalising banks was to do what no right-thinking, profit-maximising private bank will do in the first place. If one appreciates this social or developmental objective of PSBs, the results were nothing short of transformative.

Arguments in favour of nationalisation of Banks

- **Rural bank branches:** The number of rural bank branches increased ten-fold from about 1,443 in 1969 to 15,105 in 1980 compared to a two-fold increase in urban and semi-urban areas from 5,248 to 13,300 branches.
- **Credit to rural areas:** credit to rural areas increased from Rs 115 crore to Rs 3,000 crore, a twenty-fold increase and deposits in rural areas increased from Rs 306 crore to Rs 5,939 crore, again a twenty-fold increase.
- **Credit to agriculture:** Between 1969 and 1980, credit to agriculture expanded forty-fold from Rs 67 crore to Rs 2,767 crore, reaching 13 percent of GDP from a starting point of 2 per cent.
- **Farmers:** This growth represents a significant correction to the undersupply of credit to farmers that drove nationalisation. Both rural bank deposit mobilisation and rural credit increased significantly after the 1969 nationalisation.

5. Insider Trading

CONTEXT: Several Indian-origin persons have been charged in the US with insider trading in two separate alleged schemes in which they made more than five million dollars in illegal profits.

About Insider trading

- It basically refers to the buying, selling or trading of shares or other securities (such as bonds or stock options) of a listed company using unpublished price-sensitive information (UPSI) that can affect the stock price that has not been disclosed yet.
- Insider trading hurts the integrity of capital markets.

Measures

To prevent such acts and to promote fair trading in the market for the interest of common investors, the stock market regulator Sebi (the Securities and Exchange Board of India) has prohibited the firms from purchasing their own shares from the secondary market.

Unpublished price-sensitive information (UPSI)

- UPSI refers to a piece of exclusive information related to a firm's stock prices, quarterly results, acquisition deals, mergers or any kind of sensitive activities that have not been shared with the public at large.
 - When insiders are able to access the UPSI, they illegally conduct trade dealings for personal gains.

'Insider'

- SEBI regulations define an 'insider' as someone who is a connected person or has access to UPSI.
 - A connected person can be anyone who during the six months preceding the insider trade has been associated with the company in some way.

This could be a company director or employee or their close relatives, or a legal counsel or banker to the company or even an official of the stock exchanges or trustees or employees of an asset management company who interacted with the company.

ANSWER WRITING

Q. Internal migration can be drive by push/pull factors. Highlighting the issues related with internal migration in India, discuss the need for national policy on internal migration. (150 words)

Introduction

Migration is the movement of people from one place to another. It can be over a short or long distance, be short-term or permanent, voluntary or forced, intra-national or international. According to Economic Survey 2016-17 in the last five years from 2011 to 2016, an average of nine million people migrated between states within India every year for either education or work.

Body

Push and pull factors

- A pull factor is a feature or event that attracts a person to move to another area.
- Pull factors include things like better opportunities in that area like educational, job prospects, higher quality of life, security, freedom etc. The core pull factors of migration are employment and marriage
- Push factors are those that drive people away from that place such as war, famine, natural hazards such as earthquakes, tornadoes, and hurricanes, threat to life, repressive state, no job or educational facilities, difficult and harsh living conditions etc.
- Insurgency, Naxalism, terrorism and militant groups in modern times force people to move out of their home.

Benefits of migration

- The areas of destinations benefit due to the reduction in the cost of production, availability of the human resource, rising productivity, size of consumer and capital market.
- At the same time, areas of origin also benefit through the flow of remittances, information, and innovations influencing the households and people left behind.

Issues related to migration

- **Low quality jobs:** Migrants mostly dominate the low-paying, hazardous and informal market jobs in key sectors in urban destinations, such as construction, hotel, textile, manufacturing, transportation, services, domestic work etc.
- **Access to employment:** Certain states have introduced domicile requirements with regard to employment. This puts migrants at a disadvantage.
- **Housing and sanitation:** One of the key issues with regard to housing is poor supply, for both ownership and rental. Short-term migrants do not have access to short-duration accommodation. So migrants live in overcrowded colonies in unhygienic conditions.
- **Exploitation and intimidation:** Usually migrants are exploited at the behest of majoritarian native population, they are target of social profiling, stereotyping, abuse and are made to work under exploitative conditions with no social security cover. For ex: Gujarat migrant crisis.

Need for national migration policy

- To address the issues related to migration it is necessary to have a national policy on migration.
- A national policy will help in addressing the issues related to the working condition of the migrants, their wages.
- It will help ensure social protection and medical benefits to migrants workers in the place they migrated to.
- It will help in addressing the issue of access to benefits such as PDS under legal and social entitlements (such as PDS) at their source location.
- National Policy will help in addressing not only the housing problem which migrants face. But also access to basic services water supply, electricity, and sanitation.

MCQs

- 1) Consider the following statements about China Pakistan Economic Corridor (CPEC):
1. The CPEC is a collection of infrastructure projects that have been under construction throughout Pakistan beginning 2013.
 2. The CPEC is part of China's larger Belt and Road Initiative, which aims to spread Chinese investments.
 3. The CPEC is a 3,000 km route of infrastructure projects that seek to create a series of contiguous economic and trade hubs with road and rail infrastructure.
- Which of the above statement(s) is/are correct?
- a. 1 and 2 only
 - b. 2 and 3 only
 - c. 1 and 3 only
 - d. 1, 2 and 3**
- 2) Consider the following statements regarding Pakistan Occupied Kashmir (PoK):
1. It was under the control of the Pakistani forces when the ceasefire line came into effect on January 1, 1949.
 2. The capital of PoK is Srinagar.
- Which of the above statement(s) is/are correct?
- a. 1 only**
 - b. 2 only
 - c. Both 1 and 2
 - d. Neither 1 nor 2
- 3) Consider the following statements regarding Nationalisation of Banks:
1. Nationalisation essentially meant that the government took over the ownership of certain private banks.
 2. It may lead to increase in number of branches of rural banks.
 3. Union Bank of India is the first nationalized bank of India.
- Which of the above statement(s) is/are correct?
- a. 1 and 2 only
 - b. 2 and 3 only
 - c. 1 and 3 only**
 - d. 1, 2 and 3
- 4) Consider the following statements about Insider Trading:
1. It basically refers to the buying, selling or trading of shares or other securities of a listed company using unpublished price-sensitive information (UPSI) that can affect the stock price that has not been disclosed yet.
 2. Insider trading hurts the integrity of capital markets.
 3. SEBI regulations define an 'insider' as someone who is a connected person or has access to UPSI.
- Which of the above statement(s) is/are correct?
- a. 1 and 2 only
 - b. 1 and 3 only
 - c. 3 only
 - d. All are correct.**
- 5) Consider the following statements about Lumpy Skin Disease:
1. It is caused by infection of cattle or buffalo with the poxvirus Lumpy skin disease virus.
 2. The World Organisation for Animal Health (OIE) has declared it as a notifiable disease.
- Which of the above statement(s) is/are correct?
- a. 1 only
 - b. 2 only
 - c. Both 1 and 2**
 - d. Neither 1 nor 2
- 6) Consider the following pairs:
- | Indigenous tribal games | States |
|--------------------------------|---------------|
| 1. Mallakhamb | Maharashtra |
| 2. Silambam | Tamil Nadu |
| 3. Kalaripayattu | Kerala |
| 4. Gatka | Gujarat |
| 5. Thang Ta | Manipur |
| 6. Yogasana | Uttar Pradesh |
- Which of the above pairs are matched correctly?
- a. 1, 2, 3, 4 and 5 only
 - b. 1, 2, 3 and 5 only**
 - c. 2, 3, 4, 5 and 6 only
 - d. 2, 4, 5 and 6 only
- 7) Consider the following statements:
1. Rule 373 of the Rules of Procedure and Conduct of Business of Rajya Sabha allows the chairman to suspend the Members.

2. Rule 256 of the Rules of Procedure and Conduct of Business of Lok Sabha allows the speaker to suspend the Members.

Which of the above statement(s) is/are correct?

- a. 1 only
b. 2 only
c. Both 1 and 2

d. Neither 1 nor 2

- 8) Consider the following statements:

1. The framework for the Social Stock Exchange (SSE) is meant to serve the private and non-profit sectors by providing greater capital to them.
2. Under the framework, corporate foundations, and political and religious organizations are identified as social enterprises.
3. The framework is the brainchild of the department of revenue, the Ministry of finance.

Which of the above statement(s) is/are correct?

- a. 1 only
b. 2 and 3 only

c. 1 and 2 only

- d. 1, 2 and 3

- 9) Consider the following statements:

1. The Energy Conservation Act, 2001, empowers the Centre to specify norms and standards of energy efficiency for appliances, with a connected load over 100 kilo Watts (kW).
2. The Energy Conservation (Amendment) Bill, 2022, defines the minimum share of renewable energy to be consumed by industrial units or any establishment.

Which of the above statement(s) is/are correct?

- a. 1 only
b. 2 only

c. Both 1 and 2

- d. Neither 1 nor 2

- 10) Consider the following pairs

Ramsar Sites

1. Karikili Bird Sanctuary
2. Pallikaranai Marsh Reserve Forest
3. Sakhya Sagar
4. Pala Wetland

States

- Kerala
Tamil Nadu
Gujarat
Odisha

How many of the above pairs are matched correctly?

- a. **Only one pair**
b. Only two pairs
c. Only three pairs
d. All four pairs