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- Poliovirus
- How we grow taller at night ??
- How do tropical storms and hurricanes get their names?
- Why Hurricane Beryl unique ??
- AI and Digital jurisprudence
- The Access Network (AN) and the Core Network (CN)
- Mains



By saurabh Pandey





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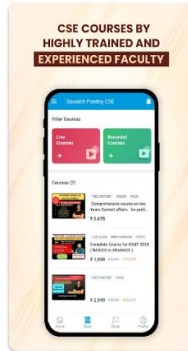
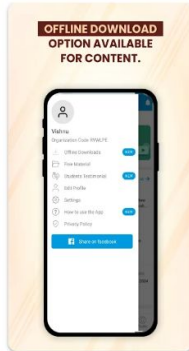
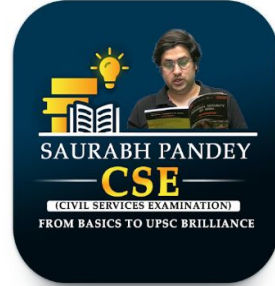
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Batch-1

Two vaccines that brought us to the brink of eradicating polio

While the poliovirus is today restricted to rural pockets of Afghanistan and Pakistan, it is beginning to reappear in big cities in these two countries thanks to vaccine hesitancy. The WHO's Global Polio Eradication Initiative is thus set to miss its deadline of eradicating polio by the end of 2024

Arun Panchapakesan

In 1948, microbiologists John F. Enders, Thomas Weller, and Frederick Robbins were trying to find a method to grow different viruses in cell cultures. In a routine experiment involving human muscle and skin cells, they decided to test one more virus along with the ones they were already testing, since a vial containing that virus was in their freezer. To their surprise, the virus proliferated and grew well with their method. Their work eventually solved one of the most important scientific problems of the time. They had just managed to find a way to grow the poliovirus in non-nerve cells.

A major roadblock

In the mid-20th century, researchers widely believed the poliovirus could only be grown in cultures of nerve cells. This misconception was propagated by their inability to infect rhesus macaques by the oral route, and only by directly injecting the virus into the nervous system. At the time, they didn't know the problem was with the poliovirus strains they were using.

The poliovirus has only one natural host – humans – and many of the early strains of the virus were isolated from humans and wouldn't infect non-human primates. Since scientists kept passing the virus through the brain tissues of macaques, it adapted to that mode of infection.

The inability to culture polio in non-nerve cells was a major roadblock to developing a polio vaccine. But thanks to Enders and his team, the poliovirus could now be mass-produced for vaccine research.

Eradication target missed

Polio eradication is one of the top priorities of the World Health Organisation (WHO). Since Africa was declared polio-free in August 2020, the wild poliovirus has been restricted to rural pockets of Afghanistan and Pakistan. But according to a recent report in Science, the virus is beginning to reappear in big cities in these two countries.

This reemergence is a result of vaccine hesitancy due to misinformation, conflict, poverty, and limited access to these isolated regions. The WHO's Global Polio Eradication Initiative is thus set to miss its deadline of eradicating polio by the end of 2024.

The initiative's failure in Afghanistan and Pakistan casts a long shadow on an otherwise remarkable achievement – polio having been eradicated everywhere else. This feat was driven by two vaccines, both



A health worker (right) administers polio vaccine drops to a child during a vaccination campaign in Karachi, AfP

invented within a year of each other. They are administered differently, provide distinct levels of protection, contain different components, and target different compartments of the immune system. Yet they both played equally invaluable roles in the global fight against polio.

The systemic and the mucosal

In late 1949, Enders received a letter requesting the starting material and the procedure his team had perfected to grow the poliovirus in culture. At the time, Enders & Co. were discussing their own future work. While his younger colleagues, Weller and Robbins, wanted to use the method to foray into vaccine research, Enders said such a job was ill-suited for basic science researchers like themselves. They handed over the sample and the procedure to the letter's author, the director of the Virus Research Laboratory at the University of Pittsburgh, Jonas Salk.

Salk made the first successful vaccine for polio. He grew the virus using the method Enders and his team had developed, inactivated it by treating it with formaldehyde, and injected it into his test subjects. The fragments of the inactivated virus were able to induce immunity in their bodies. Importantly, since the vaccine was introduced into the muscle, it generated systemic immunity.

The immune system has two main parts: the systemic and the mucosal. The systemic component includes the blood, the brain, and all other organ systems. The mucosal component includes the



John F. Enders, Thomas Weller, and Frederick Robbins solved one of the most important scientific problems of their time. They managed to find a way to grow the poliovirus in non-nerve cells

inner linings of the digestive and respiratory systems, the urogenital tract, and the eyes. These regions are lined with mucous membranes that provide an additional layer of protection, as they frequently come into contact with the external environment.

Striking at ground zero

Soon after Salk made his inactivated polio vaccine (IPV), Albert Sabin developed another vaccine that contained live polio strains weakened by growing them serially in macaque cells, making them unfit for human infection. Since Sabin's vaccine contained live virus particles, it had to rely on its natural mode of infection and was therefore administered orally. This was the oral polio vaccine (OPV).

Since the OPV went into the stomach, it induced a powerful protective mucosal immune response right where the virus would have to begin its infection.

The OPV had multiple advantages over the IPV. First, the vaccine induced a protective response at the viral entry site – the gut – allowing it to provide a much

greater degree of protection relative to the IPV. Second, the OPV was administered orally and didn't require syringes or trained personnel for its administration.

A one-two punch

But there was a catch. Occasionally, the weakened virus in the OPV would revert, and do the very job it was designed to prevent: cause polio. On the other hand, the IPV, while being a less potent vaccine, contained inactivated virus particles and carried no risk of causing vaccine-induced polio.

The world has used both vaccines in the fight against polio. While some countries, such as Norway, Sweden, Finland, and Iceland, relied exclusively on the IPV, most countries have used a combination of the two. The latter countries prefer the OPV for its superior protection and ease of administration. When the number of natural polio cases drops to zero, they switch to IPV for its enhanced safety.

Despite the many differences between the Salk and Sabin vaccines, they share one crucial feature that armed the WHO in its fight against polio: both Jonas Salk and Albert Sabin chose not to patent their vaccines. When asked who owned the patent on his vaccine, Salk famously replied: "Well, the people, I would say. There is no patent. Could you patent the sun?"

(Arun Panchapakesan is an assistant professor at the Y.R. Gaitonde Centre for AIDS Research and Education, Chennai.)

THE GIST

▼ The inability to culture polio in non-nerve cells was a major roadblock to developing a polio vaccine. Enders and his team made it possible for the poliovirus to be mass-produced for vaccine research

▼ Salk made the first successful vaccine using Enders' method to grow the virus. He inactivated the virus by treating it with formaldehyde, and injected it into his test subjects. The fragments of the inactivated virus were able to induce immunity

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Poliovirus



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Vaccine development



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How we grow taller at night

The Hindu Bureau



Q: Are we measurably taller in the morning than when we go to bed?

A1: We are all indeed taller in the morning. There are two

components to this. In a growing child, the growth hormone is secreted in pulses overnight. This acts through several intermediary steps to cause lengthening of the bones at the end-plates (epiphyses). Accurate measurements of the forearm or lower leg using specialised apparatus or X-rays can record this night-time growth.

The most marked effect, however, which occurs even after growth has ceased, is caused by postural compression of the spine under the effect of gravity. This was recognised in mediaeval French folklore: it was common practice to apply for recruitment to the army first thing in the morning in order to appear taller. In 1724, Reverend Joseph Wasse from Aynho in Northamptonshire, U.K., measured a loss of up to 15 mm through the day. This was more marked in young and active labourers.

A2: Another factor concerns the inherent curvatures of the spinal column. This has a convexity backwards in the thoracic or chest region, called a kyphosis, and a concavity in the lumbar region or base of the back called a lordosis. These



A pencil illustration of the vertebral column and the spinal cord. H.G. WETSELAAR, UNIVERSITAIRE BIBLIOTHEKEN LEIDEN

curves vary with body weight and position. As a result, the spinal column tends to press downwards when in an upright position, altering these curvatures, and hence shortening the spinal length. When lying down, the reverse happens and the column lengthens again.

The combination of disc and curvature factors causes height change and is about 16 mm during the course of the day in the average adult.

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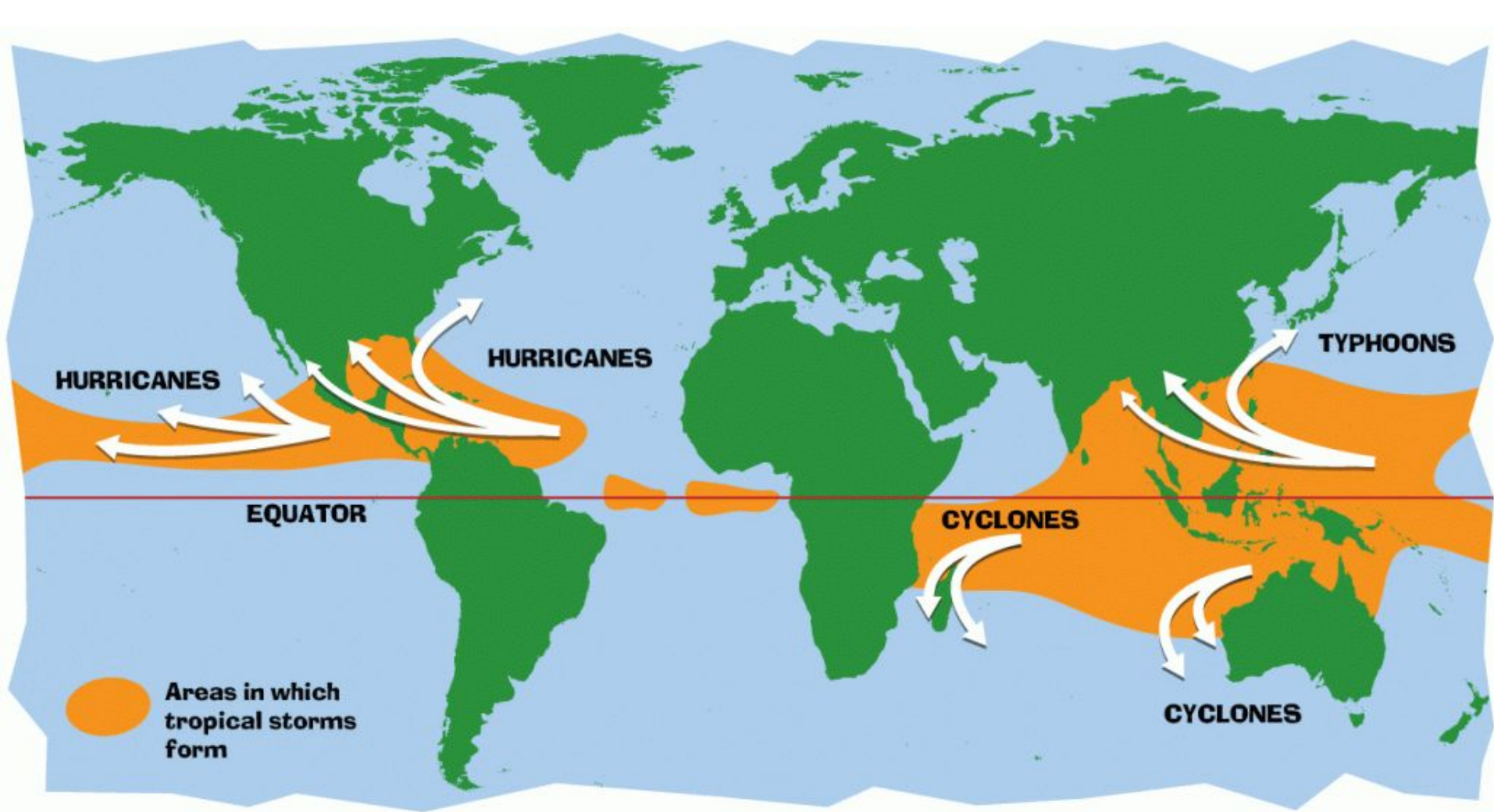
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- These curves vary with body weight and position

BIG SHOT



▲ A pier at high tide after the passage of Hurricane Beryl in Oistins near Bridgetown, Barbados, on Monday. Hurricane Beryl brought devastating winds and heavy rain to several Caribbean islands on the day as the earliest-ever Category 4 storm on record churned westward. AFP



How do tropical storms and hurricanes get their names?

- According to the [World Meteorological Organization](#), there are six alphabetical lists of names for Atlantic storms and hurricanes that are rotated every six years. This means the 2024 list will be used again in 2030.
- The list, which is maintained by the WMO, covers only 21 letters of the alphabet, as “it is difficult to find six suitable names (one for each of the 6 rotating lists) starting with Q, U, X, Y and Z,” per the WMO.

- **The first storm of the season, which ends on Nov. 30, is given a name that begins with A, the second B, the third C and so on.**
- **The next storm or hurricane of the 2024 season will be called Debby, with the list ending in William.**
- **According to the WMO, assigning names to hurricanes and storms is done to make tracking and discussing specific storms more straightforward.**

- **“Naming also helps to avoid confusion among meteorologists, media, emergency management agencies and the public,”**
- **“Additionally, naming tropical cyclones can aid historical record-keeping and research on storm behaviour and impacts.**
- **A developing cyclone is named when it officially becomes a tropical storm, meaning it has sustained winds of at least 39 mph,**



- **A tropical storm becomes classified as a hurricane once maximum sustained winds reach 74 mph.**
- **The National Hurricane Center began keeping a list of names in 1953, per the [WMO](#).**
- **Only female names were initially used before male names were introduced, alternating with the female ones, in 1979. The six current lists have been in rotation since then, with a few names having been retired and replaced.**
- **The decision to remove names is determined at a committee meeting.**

But what happens if the list of alphabetical names runs out?

- During a particularly active hurricane season, the WMO uses a supplemental list of names in lieu of the Greek alphabet, which was used until 2021.
- According to the WMO, extra names have only had to be used twice — in 2005 and 2020.

BIG SHOT



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Hurricane wind scale: What 1 to 5 looks like

	Category	Winds (MPH)
	1	74 to 95
	2	96 to 110
	3	111 to 129
	4	130 to 156
	5	Over 157

NOTE Saffir-Sampson hurricane wind scale

Why Hurricane Beryl unique ??



- the hurricane became the earliest major hurricane in the Atlantic in 58 years, as well as the only hurricane in June to reach Category 4 intensity.
- Experts say the chart-topping hurricane forming so early into the season—which spans June to November—is due to climate change-linked rising ocean temperatures.
- Warm sea surface temperatures are conducive to providing the lower atmosphere the heat and moisture that fuel tropical storm systems.”

Polar Cyclone

Form in middle latitude belt of westerlies and move west to east

Active mainly in winter

Frontal in character

Isobars are oval shaped

Generally moderate pressure gradient

Strong winds are equator-ward and reach gale force of ≥ 39 mph

Heavy rain near the center

Decay after occlusion

Spiraling of wind may go upto 20 km

No eye in the center

Not associated with tidal wave

Less destructive in nature

Cannot become tropical cyclone

Tropical Cyclone

Form in belt of Tropical easterlies and move east to west

Form in transition period i.e., transition summer to winter, winter to summer

Non frontal vortex

Isobars are circular in shape

Steep to very steep pressure gradient

Strong winds are pole ward, exceed gale force, may reach hurricane force ≥ 74 mph

Heavy rain in SE quadrant

Rapidly weaken after striking coast due to land friction

Spiraling of wind not beyond 14 km

May develop an eye in the center

Accompanied with tidal wave storm/surge

Very destructive on sea and coast

May become extra-tropical cyclone



Digital jurisprudence in India, in an AI era



Even though Generative AI (GAI) stands as a transformative force, wielding power to revolutionise society in ground-breaking ways, existing legal frameworks and judicial precedents that have been designed for a pre-AI world may struggle to effectively govern this rapidly-evolving technology.

Safe harbour and liability fixation

One of the most persistent and contentious issues in Internet governance has been the fixing of liability on “intermediaries” for content hosted by them. The landmark *Shreya Singhal* judgment addressed this by upholding Section 79 of the IT Act which grants intermediaries ‘safe harbour’ protection against hosting content, contingent upon meeting the due diligence requirements outlined in Section 3(1)(b) of the Information Technology (Intermediaries Guidelines) Rules. However, its application to Generative AI tools remains challenging.

There are contrasting views on the role of GAI tools. Some argue that they should be considered intermediaries since they are used almost like a search engine even though they do not host links to third-party websites. Others argue that they are mere “conduits” for user prompts, where altering the prompt leads to changes in output – essentially making the generated content akin to third-party speech, and, therefore, attracting lesser liability for the content generated.

In *Christian Louboutin Sas vs Nakul Bajaj and Ors* (2018), the Delhi High Court held that safe harbour protection applies solely to “passive” intermediaries, referring to entities functioning as mere conduits or passive transmitters of information. However, in the context of Large Language Models (LLMs), making a distinction between user-generated and platform-generated content is increasingly challenging. Additionally, liability in the case of AI chatbots arises once the information is reposted on other platforms by the user; mere response to a user prompt is not considered dissemination.

Generative AI outputs have already led to legal conflicts in various jurisdictions. In June 2023, a



Amar Patnaik

a former Member of Parliament (Rajya Sabha) from Odisha and now an advocate by profession. He was a former CAG bureaucrat

This rapidly-evolving technology does pose a challenge to existing legal frameworks and judicial precedents that have been designed for a pre-AI world

radio host in the United States filed a lawsuit against Open AI, alleging that Chat GPT had defamed him. The ambiguity in classifying GAI tools, whether as intermediaries, conduits, or active creators, will complicate the ability of courts to assign liability, particularly in user reposts.

The copyright conundrum

Section 16 of Indian Copyright Act 1957 specifically provides that “no person” shall be entitled to protection of copyright except by the provisions of the Act. As in India, reluctance persists regarding the provisions of copyright protection to works generated by AI globally.

The critical questions are: should existing copyright provisions be revised to accommodate AI? If AI-generated works gain protection, would co-authorship with a human be mandatory? Should recognition extend to the user, the programme itself, and by extension, the programmer, or both? The 161st Parliamentary Standing Committee Report found that the Copyright Act of 1957 is “not well equipped to facilitate authorship and ownership by Artificial Intelligence”.

Under current Indian law, a copyright owner can take legal action against anyone who infringes on his/her work with remedies such as injunctions and damages. However, the question of who is responsible for copyright infringement by AI tools remains unclear. As previously argued, classifying GAI tools, whether as intermediaries, conduits, or active creators, will complicate the courts’ ability to assign liability. ChatGPT’s ‘Terms of Use’ attempt to shift liability to the user for any illegal output. But the enforceability of such terms in India is uncertain.

The landmark *K.S. Puttaswamy* judgment (2017) by the Supreme Court of India established a strong foundation for privacy jurisprudence in the country, leading to the enactment of the Digital Personal Data Protection Act, 2023 (DPDP). While traditional data aggregators or consent managers raise privacy concerns during the collection and distribution of personal

information, Generative AI introduces a new layer of complexity.

The DPDP Act introduces the “right to erasure” as well as “right to be forgotten”. However, once a GAI model is trained on a dataset, it cannot truly “unlearn” the information it has already absorbed. This raises a critical question. How can individuals exercise control over their personal information when it is woven into the very fabric of a powerful AI model?

Steps to pursue

First, learning by doing. Consider granting GAI platforms temporary immunity from liability following a sandbox approach. This approach allows responsible development while gathering data to identify legal issues that could inform future laws and regulations.

Second, data rights and responsibilities. The process of data acquisition for GAI training requires an overhaul. Developers must prioritise legal compliance by ensuring proper licensing and compensation for the intellectual property used in training models. Solutions could include revenue-sharing or licensing agreements with data owners.

Third, licensing challenges. Licensing data for GAI is complex as web-data lacks a centralised licensing body similar to copyright societies in the music industry. A potential solution is the creation of centralised platforms, akin to stock photo websites such as Getty Images, which simplify licensing, streamline access to necessary data for developers and ensure data integrity against historical bias and discrimination.

The jurisprudence around Generative AI (GAI) is hazy and yet to be evolved. It demands a comprehensive re-evaluation of existing digital jurisprudence. A holistic, government-wide approach and judicious interpretations by the constitutional courts are essential to maximise the benefits of this powerful technology, but safeguarding individual rights and protecting them against unwelcome harm all the while.

AI and Digital jurisprudence

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Steps to pursue

- **First, learning by doing. Consider granting GAI platforms temporary immunity from liability following a sandbox approach.**
- **Sandboxes allow AI technologies to be tested in a real-world setting under regulatory oversight. -**
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On improving rural mobile connectivity

Even though cellular networks seem omnipresent, their deployment and use vary significantly between urban and rural areas. According to the latest Telecom Subscription Data, urban tele-density in the country is 127% while rural tele-density is 58%

EXPLAINER

Pranav Jha

Mobile devices have become an integral part of our lives. We use them to communicate with our friends and family, conduct financial transactions through UPI, connect to the Internet, etc. The connectivity for these devices is enabled via a cellular (mobile) wireless network. A cellular network, such as a 5G network, includes a set of network equipment connected by communication links. They work together to move data between different devices and to other networks such as the Internet. A cellular network can be divided into two sub-networks: the Access Network (AN) and the Core Network (CN).

What are access and core networks?

The AN consists of base stations that provide wireless connectivity to mobile devices in a limited geographical area,

Connecting to the remote

The IEEE 2061-2024 standard defines a wireless network architecture for affordable broadband access in rural areas. It was approved on June 6 by the Institute of Electrical and Electronics Engineers (IEEE)



THE GIST

▼ An important factor impeding the deployment and/or use of cellular networks in rural areas is the relatively lower income of the people here. A big chunk of the rural population finds mobile services unaffordable.

▼ The IEEE-2061 standard proposes the use of a multi-hop wireless middle-mile network to extend connectivity to areas where optical-fibre links are not available.

▼ If adopted, IEEE 2061 can help provide affordable connectivity to rural populations. Its novel concepts, including the CN bypass, and integrated AN control may also pave the way towards a scalable mobile

The Access Network (AN) and the Core Network (CN)



- **The connectivity for mobile devices is enabled via a cellular (mobile) wireless network.**
- **A cellular network, such as a 5G network, includes a set of network equipment connected by communication links.**
- **They work together to move data between different devices and to other networks such as the Internet**
- **. A cellular network can be divided into two sub-networks: the Access Network (AN) and the Core Network (CN)**

What are access and core networks?



- **The AN consists of base stations that provide wireless connectivity to mobile devices in a limited geographical area, called the coverage area.**
- **A network operator usually installs base stations across the length and breadth of the region to be covered.**
- **These stations can be seen in the form of towers with boxes with antennae on top.**
- **The CN of a cellular network has equipment that provides connectivity to other networks, such as the Internet.**

- **Unlike AN base stations, the CN operates in a central location, and possibly far from any of the base stations.**
- **The CN is linked to a base station by an optical □ Fibre link called the backhaul.**
- **Data from a user's device must pass through both a base station and the CN to reach its desired destination, such as the Internet or another user's device.**
- **Even if two users are nearby and are connected to the same or adjacent base stations, the data must pass through the central CN.**
- **The CN is essential to support user mobility, a key feature offered by cellular networks.**



What impedes rural connectivity?

- According to the latest Telecom Subscription Data from the Telecom Regulatory Authority of India, urban tele-density in the country is 127% while rural tele-density is 58%.
- Put another way, on average, an urban user has one or more mobile connections (1.27) whereas only one out of two rural users (0.58) is connected. This data suggests an urban-rural digital divide.
- The situation in most other developing countries is similar or worse.

- **An important factor impeding the deployment and/or use of cellular networks in rural areas is the relatively lower income of the people here.**
- **A big chunk of the rural population ☐ Finds mobile services unaffordable.**
- **Other relevant characteristics of rural areas are lower population density, populations distributed in clusters (villages) often separated by vast empty spaces, and remoteness.**
- **Taking ☐ fibre infrastructure to a far-of village, say, in the Himalayas, to connect the base station there may neither be cost-effective nor easy**

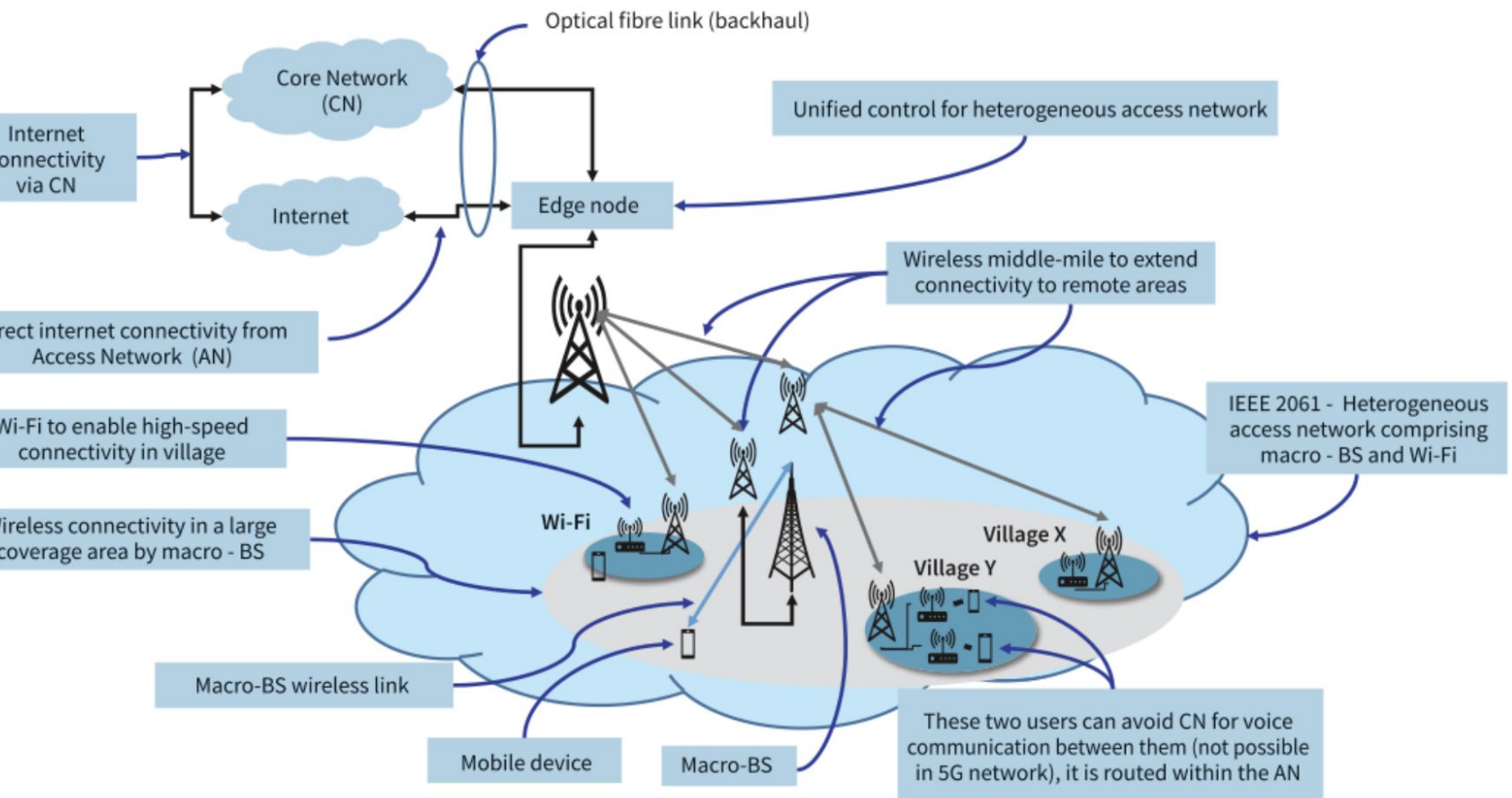
What is the IEEE 2061-2024 standard?



- **The standard defines a wireless network architecture for affordable broadband access in rural areas.**
- **It was approved on June 6 by the Institute of Electrical and Electronics Engineers (IEEE).**
- **The IEEE-2061 network also includes a CN and AN similar to cellular networks.**
- **However, the IEEE-2061 AN is heterogenous wherein different types of base stations coexist: it includes base stations covering large coverage areas — called macro-BS — supplemented by small coverage area Wi-Fi.**
- **It is different from the 5G network, where the AN is homogeneous comprising base stations of the same type and typically smaller coverage area.**

- **The macro-BS in IEEE-2061 can be built with any cellular technology that can support a large coverage area.**
- **While the macro-BS provides large-area coverage but possibly lower data rate, Wi-Fi is deployed within villages to provide high-speed connectivity.**
- **A key capability of the system is that it allows a device to move from a Wi-Fi based connectivity to a macro-BS connectivity without any service disruption.**
- **This is enabled by an integrated AN control functionality in the IEEE-2061 network.**

IEEE 2061 Network (Frugal 5G network)



What is a middle-mile network?



- **Further, the IEEE-2061 standard proposes the use of a multi-hop wireless middle-mile network to extend connectivity to areas where optical-fibre links are not available.**
- **A multi-hop wireless middle-mile provides cost-effective connectivity over long distances, eliminating the need for costly and difficult-to-deploy optical fibres.**
- **An IEEE-2061 network can flexibly use one or more technologies like satellites, or long-range Wi-Fi for the middle-mile.**
- **The IEEE-2061 AN also has a direct and alternate path to the Internet, unlike the (4G/5G) network, where Internet connectivity is possible only via the CN.**



KEYWORD

How can state capacity be measured?

Prashanth Perumal

State capacity refers to the ability of any state to successfully deliver what are generally considered to be public goods and services to its citizens. State capacity is considered by many public policy experts to be the major factor that explains why some countries are rich or developed while other countries remain underdeveloped. The most common way in which the capacity of a state to deliver on its commitments is measured is by the way of its ability to collect a sufficient amount of tax revenues. This is because any state requires tax revenues to deliver public goods and services. By this measure, countries with a higher tax to GDP ratio, which typically turn out to be rich countries, may be considered to possess greater state capacity than other countries with lower ability to generate tax revenues. Many also urge developing countries like India to boost their tax to GDP ratio so as to build state capacity.

Power in numbers

Public policy experts may also look into other indicators such as the number of people employed by a certain state to measure its capacity. So, for example, the number of police officials per capita could be seen as an indicator of the capacity of the state to maintain law and order. States with a very low number of police officials per capita, it is believed, may be unable to establish monopoly of violence in their territory, leading to instability that adversely affects their economy. Similarly, the number of courts and judges per capita can be seen as an indicator of how well a state can deliver justice to citizens.

Some critics, however, caution against the definition of state capacity in terms of the ability of a certain state to collect tax revenues or the number of staff it can hire to deliver essential public goods and services to its citizens. This is because more efficient states may be able to deliver essential public goods with lower taxes and fewer staff than less efficient ones. Critics, therefore, argue that the number of people employed by a certain state and the amount of taxes collected by it only reflect its size and not the state's effectiveness in delivering essential public goods and services.

Critics such as U.S. economist Bryan Caplan also point out that state capacity, as defined by the size of the state, is claimed by public policy experts to be the reason behind the success of certain countries without establishing the necessary causal link between the two. In other words, they argue that the success of rich countries is tautologically attributed to strong state capacity the same way that the failure of poor countries is attributed to weak state capacity. They point out that it could well be that strong economic growth allowed developed countries to fund states that are large in size. In that case, the economic success of the developed world cannot really be attributed to a larger state. A better way to measure state capacity, critics believe, is to gauge the ability of a certain state, regardless of its size as measured by its tax collections or headcount, to uphold the rule of law by delivering efficient justice to citizens.

Word of the day

Truculent:
defiant; aggressive

Usage: It was a truculent speech against the new government.

Pronunciation: bit.ly/truculentgro

International Phonetic Alphabet: /tɹʌkjələnt/





State Capacity

- **State capacity refers to the ability of any state to successfully deliver what are generally considered to be public goods and services to its citizens.**
- **State capacity is considered by many public policy experts to be the major factor that explains why some countries are rich or developed while other countries remain underdeveloped.**
- **The most common way in which the capacity of a state to deliver on its commitments is measured is by the way of its ability to collect a sufficient amount of tax revenues.**

- **This is because any state requires tax revenues to deliver public goods and services.**
- **By this measure, countries with a higher tax to GDP ratio, which typically turn out to be rich countries, may be considered to possess greater state capacity than other countries with lower ability to generate tax revenues.**
- **Many also urge developing countries like India to boost their tax to GDP ratio so as to build state capacity**

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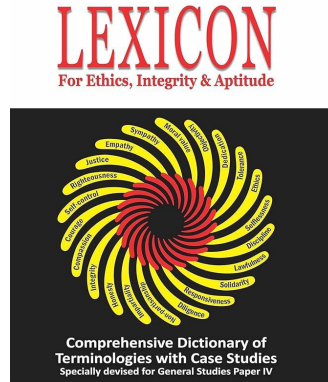
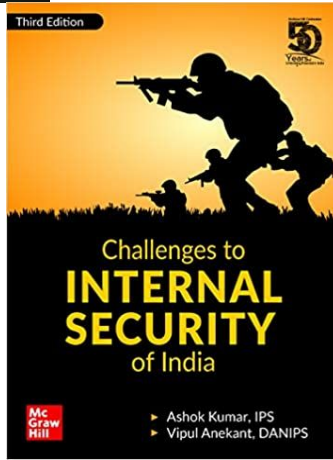
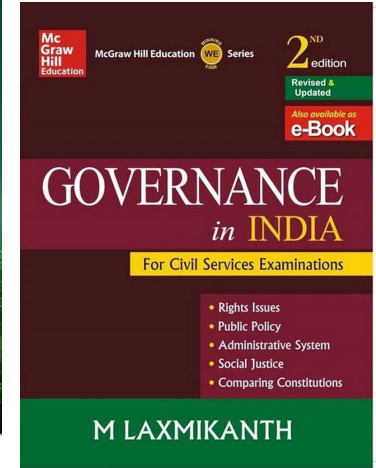
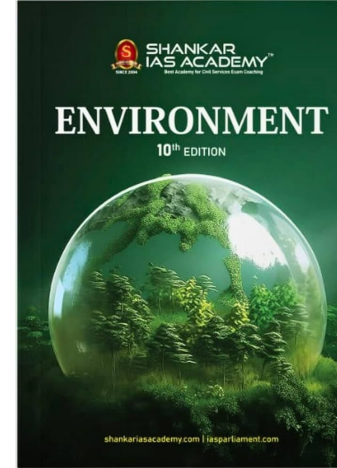
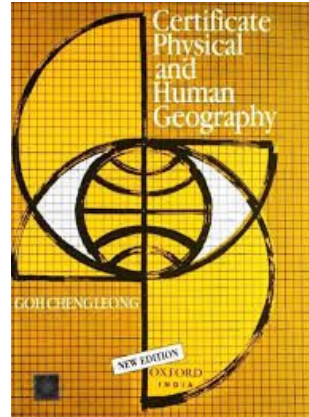
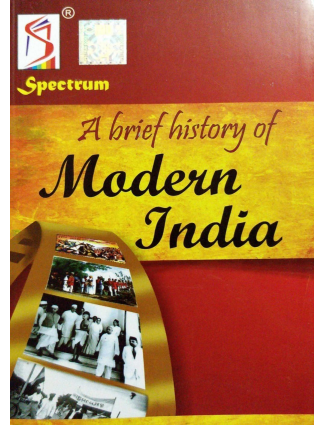
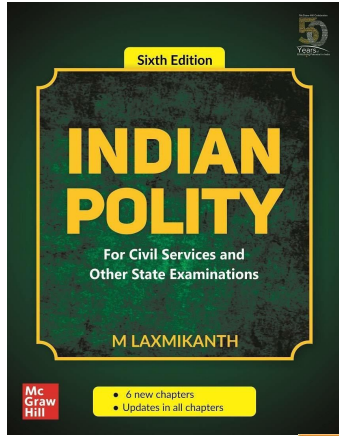
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Q What role digital governance can play in improving "state capacity" ??

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