UNDERSEA CABLE: ECONOMY/ INFRASTRUCTURE

NEWS: Why are undersea cables important?

WHAT'S IN THE NEWS?

India's digital infrastructure is expanding with the landing of major undersea cables like SEA-ME-WE 6 and 2Africa Pearls, enhancing global connectivity and internet capacity. However, challenges like repair delays, regulatory hurdles, and disruption risks threaten the efficiency and security of this vital infrastructure.

India's Undersea Cable Infrastructure

1. Why in News:

- In 2024, India witnessed the landing of **two major undersea cable systems**:
    - **2Africa Pearls**, supported by **Meta (formerly Facebook)**.
    - **SEA-ME-WE 6 (Southeast Asia – Middle East – Western Europe 6)**.
- These systems landed at **Mumbai and Chennai**, India's two key submarine cable landing stations.
- These developments mark a major leap in **expanding India's international bandwidth capacity** and strengthening global internet connectivity.

2. What Are Undersea Cables?

- **Undersea cables**, also known as **submarine cables**, are long **fiber optic cables** laid on the ocean floor that connect two or more countries across continents.
- They form the **foundation of the global internet**, enabling data transmission between continents in milliseconds.
- These cables:
    - Consist of **glass fibers** that transmit data as **light signals**.

    - Are protected by several layers of **insulation and armor** to survive harsh underwater environments including high pressure, saltwater corrosion, and physical threats.

- Most cables are **only 2–3 inches thick**, yet they carry **about 90% of global internet data traffic**.

3. Importance of Undersea Cables:

- **High Data Transmission**: Capable of carrying vast volumes of data at extremely high speeds, essential for real-time global communication.
- **Economic Backbone**:
    - Power **international trade**, **banking**, **stock exchanges**, and **cloud services**.
    - Approximately **80% of global trade transactions** are routed through undersea cables.
- **Reliability Over Satellites**:
    - Provide **lower latency** and higher capacity than satellite communications.
    - Are more **cost-efficient** for long-term, large-scale data use.
- **Strategic Infrastructure**:
    - Crucial for **national security**, **defense communications**, and **emergency services**.
    - Any disruption can cripple communications, financial systems, and digital services.

4. SEA-ME-WE 6 (SMW6) Cable System – Detailed Overview:

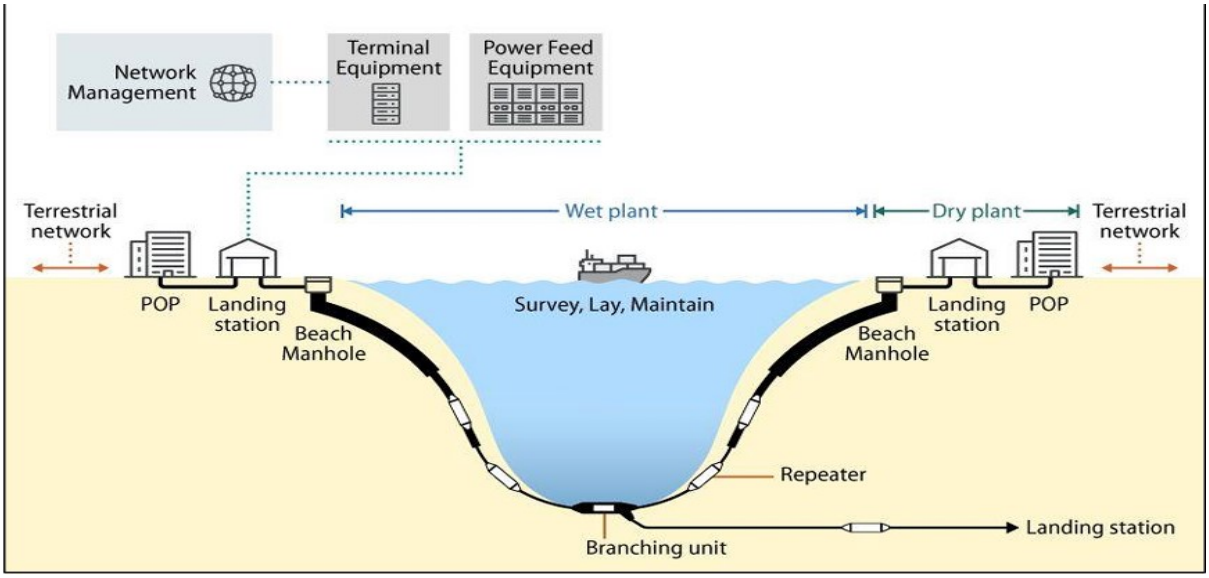
- **Full Name**: Southeast Asia – Middle East – Western Europe 6.
- **Length**: Approximately **21,700 kilometers**.
- **Route**:

    - Starts from **Singapore**, passes through **the Middle East** and **Egypt** (via a land route), and ends in **Marseille, France**.

- **Countries Involved in Consortium**:
    - **South and Southeast Asia**: India, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, Sri Lanka.
    - **Middle East**: Pakistan, Saudi Arabia, Qatar, Oman, UAE, Yemen.
    - **Africa and Europe**: Egypt, Djibouti, Turkey, Italy, France.
- **Purpose**:
    - To increase **redundancy**, **speed**, and **reliability** of international internet routes.
    - Reduce **dependency on a few chokepoints** like the Red Sea.

5. India's Existing Cable Infrastructure:

- **Main Landing Points**: Mumbai (West coast) and Chennai (East coast) serve as India's two primary **submarine cable gateways**.
- **Total Cables**: 17 international undersea cable systems currently land in India.
- **Domestic Submarine Projects**:
    - **CANI (Chennai–Andaman and Nicobar Islands)**:
        - Extends high-speed internet from mainland India to the Andaman & Nicobar Islands.
        - Boosts development, education, health services, and e-governance in remote islands.
    - **KLI (Kochi–Lakshadweep Islands)**:
        - Similar objective to provide robust digital access to Lakshadweep islands.



6. Project Waterworth by Meta – Key Highlights:

- **Overview**:
    - A massive subsea cable initiative led by Meta to support global digital growth.
- **Scope**:
    - Aims to lay approximately **50,000 km of submarine cable**, making it the **longest subsea cable project in the world**.
- **Global Focus Areas**:
    - Prioritizes developing and emerging markets including **India, Brazil, South Africa**, and parts of **Southeast Asia** and the **United States**.
- **Objective**:
    - To expand access to **AI infrastructure**, **cloud services**, and **high-speed data** for billions of users.
- **Investment**:
    - Involves a **multi-billion-dollar investment**.

- Will be implemented in **phases over multiple years**.

- **Relevance for India**:
    - Enhances digital infrastructure to support:
        - National AI and data economy goals.
        - Digital public goods (e.g., UPI, DigiLocker).
        - Increased internet access in Tier 2 and Tier 3 cities.

7. Technical Aspects of Undersea Cables:

- **Laying Depth**:
    - Can be laid at **depths of up to 7,000 meters** (deeper than Mount Everest's height).
- **Cable Design**:
    - Multiple layers: optical fiber core, protective jelly, copper tube, steel armor, and external waterproofing.
- **Installation**:
    - Requires advanced ships called **Cable-Laying Vessels**.
    - Navigation and marine geology are studied in advance to avoid fault zones.
- **Security Measures**:
    - In areas prone to damage (anchors, trawling, earthquakes), cables are buried under the seabed or covered with protective casing.

8. Major Challenges and Concerns:

- **Limited Repair Capability in India**:
    - India does not have **local repair vessels**; it depends on **foreign ships**, causing delays in repairs and restoration.

- **Disruption Risks**:
    - With 570 global cables, any break (e.g., in Red Sea or Suez Canal region) could affect **25% of India's internet**.
    - Vulnerability is high due to **geopolitical tensions**, **natural disasters**, or **sabotage**.
- **Regulatory Hurdles**:
    - Companies face excessive **permissions from multiple authorities** (environment, port, telecom) to lay or maintain cables.
    - Leads to project delays and discourages private investments.
- **Fishing and Dredging Threats**:
    - In shallow waters, **trawling and dredging** operations often damage unprotected cables.
    - Lack of **cable corridors** increases accidental cuts.

9. International Cable Protection Committee (ICPC):

- **Founded**: 1958
- **Nature**: Non-governmental, multi-stakeholder forum for undersea cable operators and governments.
- **Mission**:
    - Share technical, legal, and environmental knowledge to ensure the **safety and sustainability** of subsea cables.
    - Promote **best practices** in laying, maintenance, and environmental compliance.
    - **Collaborate with UN agencies and maritime laws** for protecting cables as critical global infrastructure.

10. Suggestions for Improvement in India:

- **Classify Cables as Critical Infrastructure**:
    - Recognize undersea cables as **critical telecom infrastructure**.
    - Enables **tax exemptions, simplified clearances**, and investment incentives.
- **Create Dedicated Cable Corridors**:
    - Mark zones in Indian seas for **safe routing of cables**, preventing damage from fishing or dredging.
- **Develop Indigenous Cable Repair Capacity**:
    - Invest in building **India-based cable repair ships and teams**.
    - Reduces dependency on foreign vessels and shortens response times.
- **Regulatory Simplification**:
    - Establish a **single-window clearance system** for undersea cable permissions.
    - Coordinate roles between ministries like MoEFCC, DoT, Ports, and Defense.
- **Public-Private Collaboration**:
    - Encourage **private sector investment** in cable laying, landing stations, and maintenance under Digital India and Make in India.
- **Focus on Security**:
    - Integrate cable infrastructure in **cybersecurity and maritime defense** planning.

11. What Are Optical Fibers?

- **Definition**:
    - Thin strands of **ultra-pure glass or plastic** used to transmit data using **light signals**.

- **Key Features**:
    - Diameter: Roughly the thickness of human hair (~125 microns).
    - Used in **telecom, internet, medical imaging**, and more.
- **Advantages**:
    - High speed.
    - Long-distance transmission with low signal loss.
    - Immune to electromagnetic interference.

How Optical Fibers Work – Total Internal Reflection (TIR):

- **Core**: The inner light-carrying region with a **higher refractive index**.
- **Cladding**: The outer layer with a **slightly lower refractive index**.
- **Mechanism**:
    - Light enters the fiber at an angle and reflects entirely inside the core due to **TIR**, allowing it to travel long distances without escaping.
    - Ensures **minimal data loss** and high-efficiency transmission.

Source: https://www.thehindu.com/sci-tech/technology/why-are-undersea-cables-important-explained/article69408007.ece