



## SIM Cards

**For Prelims:** SIM Cards, Smartphones, [Climate Change](#), [Antimicrobial Resistance](#), International Mobile Subscriber Identity (IMSI), Global System for Mobile Communications (GSM), Universal Integrated Circuit Card (UICC), Mobile Equipment (ME), eSIM.

**For Mains:** Impact and relevance of eSIM cards in fulfilling the objectives of [Digital India Mission](#) while taking care of privacy and security.

[Source: TH](#)

### Why in News?

In contemporary times, the usage of smartphones have outgrown other electronic devices so much that an important component of smartphones, i.e. **Subscriber Identification Module (SIM) Cards** need apt description.

### What is a SIM Card?

#### ▪ About:

- A SIM card is a tiny [integrated circuit or microchip](#) that plays a **vital role in identifying subscribers on a cellular network**. It can be thought of as an individual's ID card within the vast city of a cellular network.
- This ID card carries a unique identification number known as the **international mobile subscriber identity (IMSI)**, which is used to locate and confirm the identity of the subscriber when others try to reach them on the network.

#### ▪ Essential Role in Network Access:

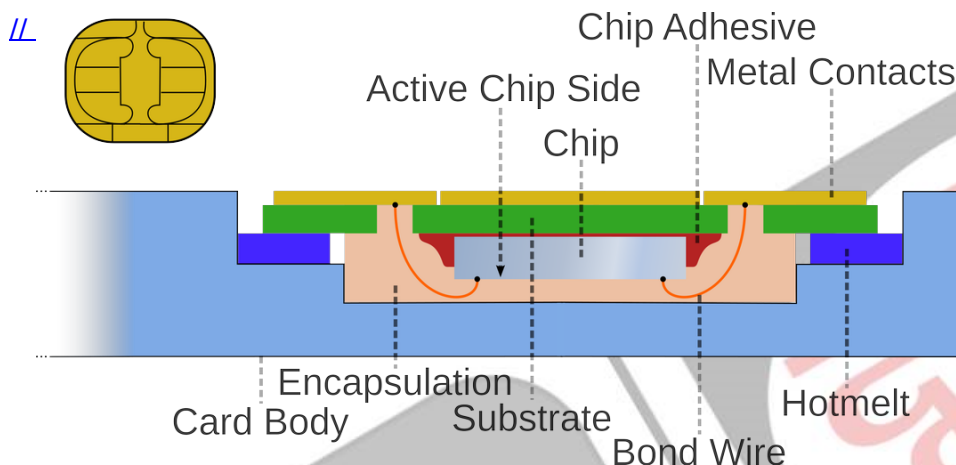
- When it comes to connecting a mobile phone to a cellular network adhering to the **Global System for Mobile Communications (GSM)** standard, a SIM card is mandatory. This connection relies on a **special authentication key (SAK)** that serves as a digital lock and key mechanism.
  - Each SIM card stores SAK, but **it's inaccessible through the user's phone**. Instead, when the phone communicates with the network, it 'signs' the signals using this key, allowing the network to verify the legitimacy of the connection.
    - It's important to note that **duplicating a SIM card is feasible by accessing and copying this authentication key** onto multiple cards.

#### ▪ Information Storage:

- Beyond its primary role in network access, a **SIM card also serves as a storage unit for various data**. It stores **not only the IMSI but also the integrated circuit card identifier**, the subscriber's location area identity, and a list of preferred networks for roaming.
- Additionally, **SIM cards can contain essential emergency contact numbers, and, space permitting, store the subscriber's contacts and SMS messages**.
- This compact chip plays a pivotal role in the **functionality and security of mobile communication on GSM-based networks**.

## How Does a SIM Card Work?

- **SIM Card Standard:**
  - SIM cards adhere to the **ISO/IEC 7816** international standard, which is **overseen by the International Organisation for Standardisation and the International Electrotechnical Commission**.
- **Pin Functions and Standards:**
  - The metal contacts on a **SIM card are segmented into pins, each serving a specific purpose**. These **roles for each pin are defined by the ISO/IEC 7816-2 standard**
    - In fact, there are **15 pins in total**, each specifying various functions of the SIM card.
- **SIM Card's Network Role:**
  - When a subscriber dials a recipient's number, **the phone sends data through the network, authenticated by the key on the SIM card**.
  - This data is then sent to a telephone exchange. If the recipient is connected to the same exchange, their identity is confirmed, and the call is directed to them.



## How have SIM cards changed?

- **Evolution of Smart Cards:**
  - The history of smart cards, which include SIM cards, traces back to the late 1960s. Over the years, these smart cards underwent significant changes in size and architecture, spurred by the advancements in technology **described by Moore's law**.
    - **Moore's law** is the observation that the **number of transistors in an integrated circuit (IC) doubles about every two years, making computers faster and cheaper over time**.
- **SIM Card Standards and Development:**
  - The European Telecommunications Standards Institute (**ETSI**) **played a pivotal role by formulating the GSM Technical Specification for SIM cards**.
  - It covered aspects ranging from **physical features like operating temperature and contact pressure to authentication and data access characteristics**.
- **Transition and Compatibility:**
  - The term 'SIM card' once referred to both the hardware and software, up until the 2G networks. However, **with the arrival of the Universal Mobile Telecommunications System and 3G networks, a shift occurred**.
  - 'SIM' came to represent only the software, while the hardware was labeled the Universal Integrated Circuit Card (UICC).

## What is an eSIM?

- **Evolution of SIM Cards: From Physical to eSIM:**
  - Unlike its physical predecessors, the **eSIM's software is loaded onto a permanent, non-removable UICC in the mobile device during the manufacturing process**.

Notable devices, like **Google Pixel 2, 3, 4, and the iPhone 14 series, support eSIM functionality.**

- With eSIM, **users no longer need to physically replace SIM cards when switching or joining networks.** Instead, network operators can remotely reprogram the eSIM.
- **Different Benefits of eSIM Technology:**
  - eSIM technology offers several advantages. Firstly, **it's considered environmentally friendly because it eliminates the need for additional plastic and metal for physical SIM cards, due to its reprogrammable nature.**
  - Secondly, eSIMs enhance security **by preventing separate access to the SIM application and making duplication more challenging** for potential malicious actors.

### UPSC Civil Services Examination Previous Year Question (PYQ)

**Q. Which among the following do/does not belong/ belongs to the GSM family of wireless technologies? (2010)**

- (a) EDGE
- (b) LTE
- (c) DSL
- (d) Both EDGE and LTE

**Ans: (c)**

**Q. With reference to communication technologies, what is/are the difference/differences between LTE (LongTerm Evolution) and VoLTE (Voice over Long-Term Evolution)? (2019)**

1. LTE is commonly marketed as 3G and VoLTE is commonly marketed as advanced 3G.
2. LTE is data-only technology and VoLTE is voice only technology.

**Select the correct answer using the code given below:**

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Ans: (d)**