

TCP/IP and Cellular Networks of GSM

Chinnaraji Annamalai
School of Management, Indian Institute of Technology, Kharagpur, India
Email: anna@iitkgp.ac.in
<https://orcid.org/0000-0002-0992-2584>

Abstract: Cellular network is a telecommunication technology for mobile phones or mobile stations. The mobile station (MS) consists of a cellphone equipment such as the radio transceiver, the digital signal processor, and the SIM card. The paper focuses on TCP/IP with cellular networks.

Keywords: mobile station, cellphone tower, mobile number, SIM card

1. Introduction

A cell phone, mobile phone, or mobile station (SM) is a portable telephone that is used to make and receive calls at anytime and from anywhere. A mobile phone uses the GSM network and works on the radio frequency for receiving and transmitting information such as text message, voice message, and audio-video information. An MSISDN (Mobile Station International Subscriber Directory Number) is a cell phone number or mobile phone number associated with a single SIM card. The MSISDN is used to identify a cellphone user when the user makes a call or sends an SMS.

2. Cellular Networks and TCP/IP

Mobile phones use TCP/IP (Transmission Control Protocol/Internet Protocol) to communicate with people over cellular networks [1,2] such as 3G, 4G, or 5G.

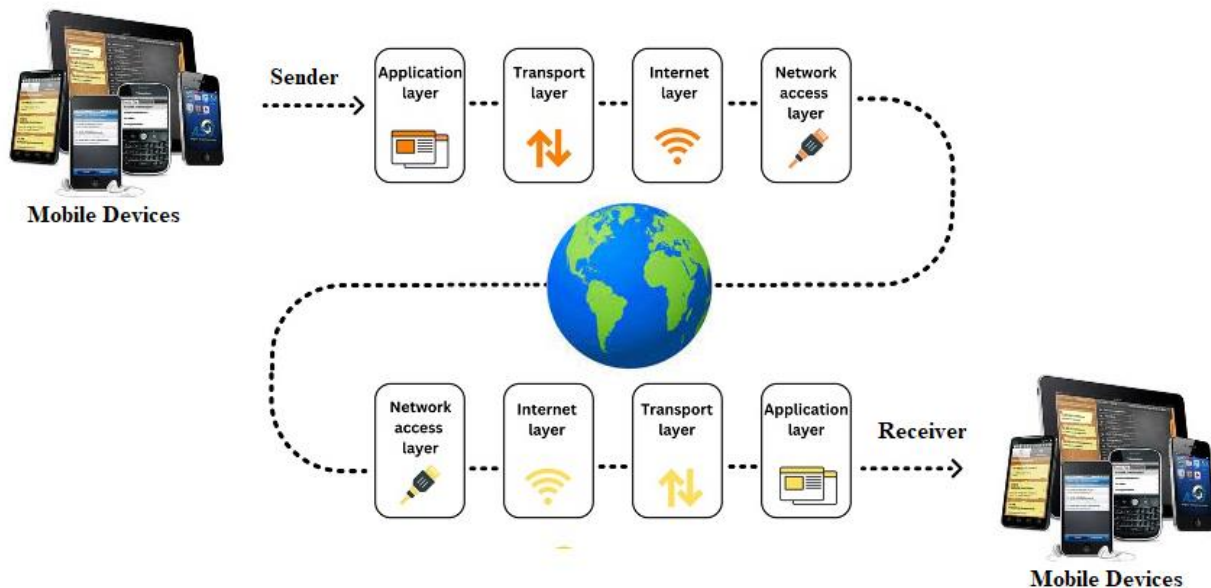


Figure 1. TCP/IP for Mobile phone/Computer



Figure 2. Cellular Tower

TCP/IP [3] shown in Figure 1 consists of four layers: Application Layer, Transport Layer, Internet Layer, and Network Access Layer. Each has its protocols and specific function, which enable communication between two endpoints on cellular networks or other different networks reliably and efficiently. A cellular network shown in Figure 3 is a radio network distributed over land areas called cells. Each cell is served by at least one fixed-location transceiver, known as a base station, cell site, or cellular tower shown in Figure 2. The Mobile Telephone Switching Office (MTSO) is

a crucial component of cellular network that acts as a bridge between the cellular network and the PSTN (Publish Switched Telephone Network) for routing cellphone calls.

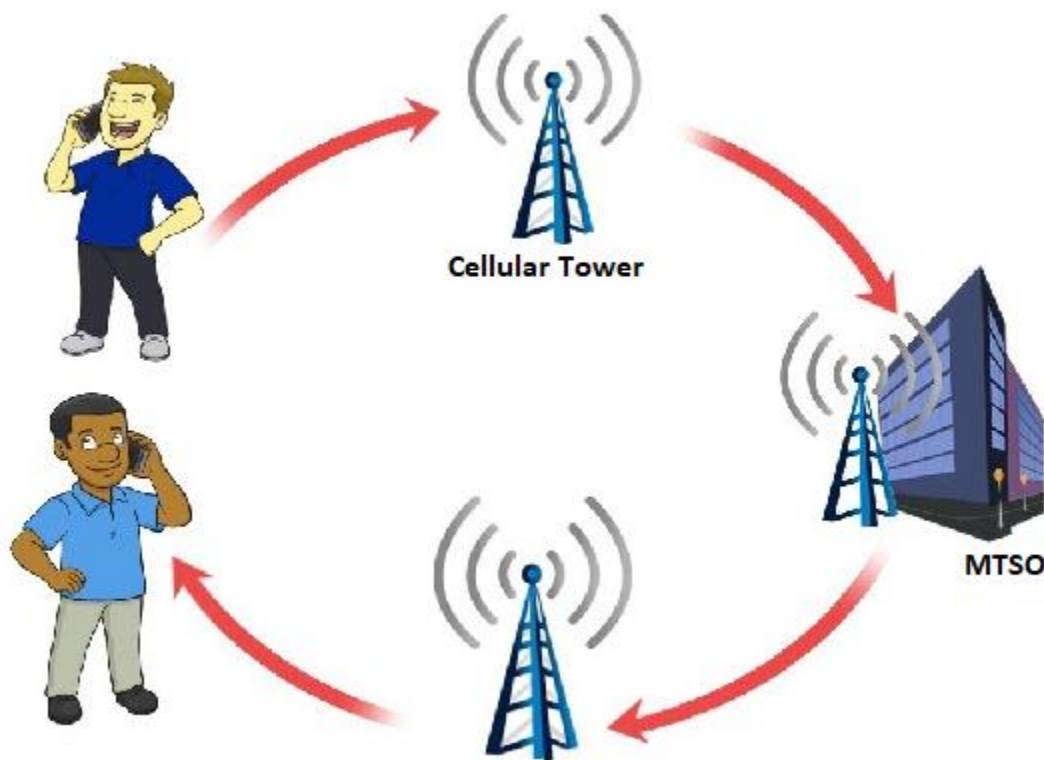


Figure 3: Cellular Network

3. Network Architecture of GSM

The GSM network architecture shown in Figure 4 is comprised of three subsystems (RSS, NSS, and OSS). The Radio Subsystem (RSS) is composed of the mobile terminals [mobile phone or mobile station (MS)] and Base Station Subsystem (BSS). The BSS is responsible for handling the mobile phone signaling including speech, text and video. Each BSS contains several cell/mobile phones, the Base Transceiver Station (BTS), and the Base Station Controller (BSC). The Transceiver (TRX) is a combination of a radio transmitter and receiver. The BTS is a fixed cell/mobile tower. The BSC allocates radio channels, receives measurement from mobile devices, and controls BTS to BTS handover and call setup.

The Network Switching Subsystem (NSS) is a core component in GSM architecture that handles the switching of calls between external networks, for example, public switched telephone network (PSTN), and the BSCs in the radio subsystem. The NSS is comprised of the Mobile Switching Center (MSC), the Home Location Register (HLR), and the Visiting Location Register (VLR).

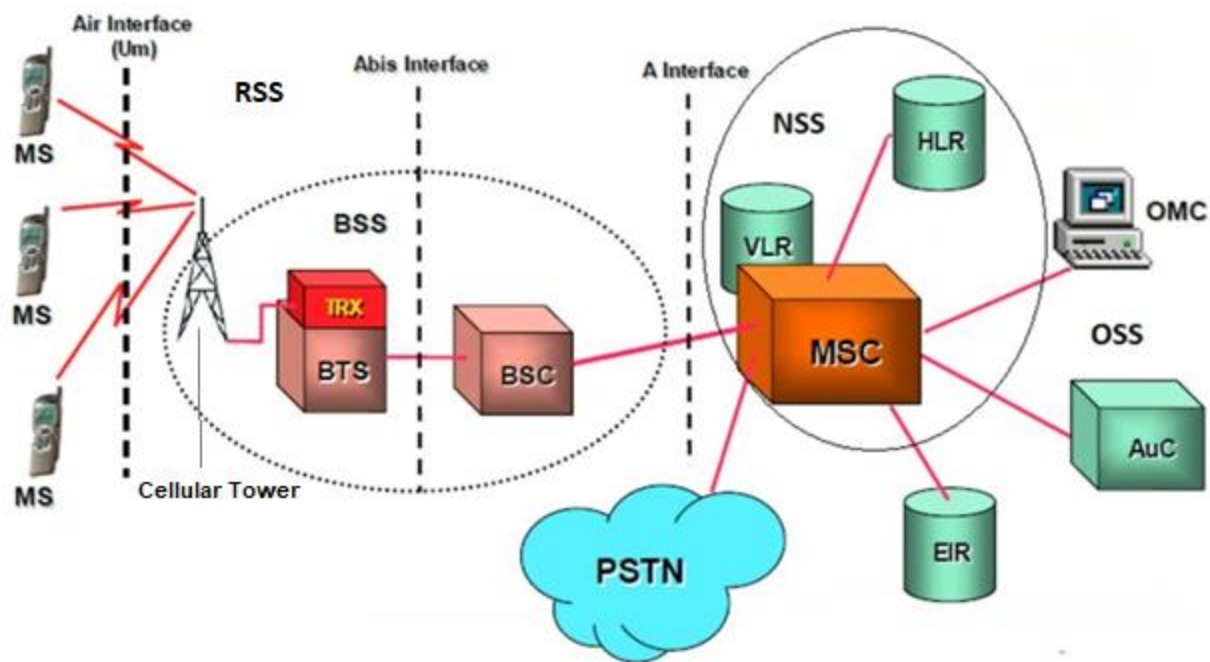


Figure 4. GSM Architecture.

The Operation Subsystem (OSS) consists of the Operation and Maintenance Center (OMC), the Authentication Center (AuC), and the Equipment Identification Register (EIR). The OMC monitors and maintains the performance of each MS, BTS, BSC, and MSC. The OMC has three main functions: to maintain all telecommunications hardware and network operations; to manage all charging and billing procedures; and to manage all mobile equipment. The AuC generates and securely stores a shared secret known as the authentication key for each subscriber in the HLR. The EIR stores lists of International Mobile Equipment Identity (IMEI). The HLR is a database that store details relating to every cellphone number connected the GSM network across the world. The VLR is a database that contains the information about subscribers roaming within the MSC location area.

The cellular tower (base station) shown in Figure 2 has electronic equipment and antennas that is used to send and receive calls between the cell phones. The base station is a part of the GSM architecture [1]. The global system for mobile communication (GSM) [2] consists of three subsystems: the radio subsystem (RSS), the network switching subsystem (NSS), and the operation subsystem (OSS). In the author's previous paper, these subsystems (RSS, NSS, OSS) were explained precisely.

4. Conclusion

In this article, a cellular network of GSM has been described as a telecommunication technology and how it works with TCP/IP and with SIM card. GSM architecture. A cell phone, mobile phone, or mobile station (SM) is a portable telephone that is used to make and receive calls at anytime and from anywhere.

References

- [1] Annamalai, C. (2024) Wireless and Cellular-Mobile Communication Architecture. *CERN* <https://doi.org/10.5281/zenodo.10668786>.
- [2] Annamalai, C. (2024) Cellular-Mobile Network in Global Communication. *CERN*. <https://doi.org/10.5281/zenodo.10674873>.
- [3] Rahnama, M. (2023) Overview of The GSM System and Protocol Architecture. *IEEE Communications Magazine*. 31(4), 92-100. <https://doi.org/10.1109/35.210402>.