Chapter 5
Mobile Network Architecture: 3GPP Generations (UMTS, LTE, and Pre-5G)

ABSTRACT

The mobile service was globally popularized with the ease of internet access enabled with the 3rd generation of networks and the broadband wireless speeds enabled with the 4th generation known as the long-term evolution (LTE). LTE became the most popular architecture with around 600 commercially launched networks worldwide. This prompted further advancements for hundreds of gigabits per second speeds and connect tens of billions of devices worldwide. The LTE-advanced and LTE-advanced-pro were introduced as intermediary network enhancements towards the future 5th network generation. For the first time, the 3rd generation partnership project (3GPP) architectures included built-in features for conducting mobile network forensics so investigators can structure and coordinate the investigation with maximum safeguards for the quality of the evidence, users’ privacy, and network performance. To fully capitalize on the forensics features, this chapter details all the infrastructural, security, and forensics-related aspects of the modern 3GPP networks.

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INTRODUCTION

This chapter introduces the basic elements and protocols of the existing 3GPP networks, from UMTS to LTE-Advanced-Pro. The 3G Universal Mobile Telecommunication System (UMTS) architecture overview covers the improvements brought both into the radio and core network subsystems, the security functions including lawful interception, and protocols supporting packet data delivery. Similarly, the novel architectural aspects of the 4G LTE are elaborated in detail, including the LTE-Advanced and LTE-Advanced pro network upgrades. Both architectures serve more than 5 billion subscribers worldwide, with each subscriber generating on average 3.4 gigabytes per month. From a forensic perspective, the 3GPP networks possess an enormous amount of potential evidence not just in terms of traffic, but also of the associated meta-data. Knowing how these networks operate is instrumental in collecting, analyzing, interpreting, and delivering highly-quality mobile network evidence in a timely and safely manner.

3G: UNIVERSAL MOBILE TELECOMMUNICATION SYSTEM (UMTS) AND HIGH SPEED PACKET ACCESS (HSPA)

Reference Network Architecture

The third generation of mobile networks resulted from the global effort for unification of the mobile architecture and service delivery. In response to the International Telecommunication Union (ITU) request for IMT-2000, the 3GPP was formed in 1998 to produce the technical specifications for the UMTS. UMTS has evolved the Global System for Mobile (GSM)/General Packet Radio Service (GPRS) architecture to introduce a completely new radio network subsystem, called UMTS Terrestrial Radio Access Network (UTRAN). The Release 99 architecture retained the circuit and packet switched domains from the GSM/GPRS with incremental improvements in response to the demand for increased speeds on the air interface. Release 4 introduced a so-called “bearer independent circuit switched domain” where the Mobile Switching Center (MSC) functions are split between a MSC-Server (MSCS) and Media Gateway (MGW). In GSM, the MSC controls both the signaling and user traffic so the radio access capacity is dependent on the MSC circuit-
Multi-Criteria Recommender Systems: A Survey and a Method to Learn New User’s Profile
www.igi-global.com/article/multi-criteria-recommender-systems/193258?camid=4v1a

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