Chapter 4
Mobile Network Architecture: Pre-3GPP Generations (GSM, GPRS, and EDGE)

ABSTRACT

Critical for identification of the potential sources of evidence in every network forensics investigation is the definition of the system architecture. The mobile network architecture has two main definitions, one concerning the network deployments before the 3GPP consolidated the mobile standardization, and one for the 3GPP networks onwards. Forensic investigators need to know both of them; the real-world network deployments include elements from different generations, so the uncovering of mobile network evidence requires knowledge of how every generation operates in practice. This chapter provides a detailed overview of the pre-3GPP network architecture, defining the critical elements for recognizing, acquiring, analyzing, and interpreting potential mobile network evidence.

INTRODUCTION

This chapter introduces the basic elements and protocols from the pre-3GPP networks. The Global System for Mobile (GSM) as the de-facto second generation (2G) standard is described in terms of the reference network architecture, user and network identifiers, wireless radio interface, security aspects, and protocols supporting mobile telephony delivery. The enhancement

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introduced for GSM to support packet data in form of a 2.5G evolution with the General Packet Radio Service (GPRS) and 2.75G with Enhanced Data rates for Global Evolution (EDGE) are also described. The resulting architecture provides useful insights into the mobile network operations that retained to a great extent in the later 3GPP generations. Both GSM and GPRS/EDGE are of significant forensics importance because they layout the fundamental principles of mobile service operations.

2G: GLOBAL SYSTEM FOR MOBILE COMMUNICATION (GSM)

Reference Network Architecture

The GSM system was design as an extension of the fixed landline networks so the early network deployments are referenced as Public Land Mobile Networks or PLMNs. Figure 1 shows the GSM reference network architecture specified in TS 23.003 V4.3.0 technical specification, Section 5 (3rd Generation Partnership Project, 2002). GSM has three subsystems: Base Station Subsystem (BSS), the Network Subsystem (NSS), and the Intelligent Network Subsystem (IN). The BSS in fact is the Radio Access Network (RAN) while the NSS and IN together form the core network (3rd Generation Partnership Project, 2005). Each element in the network performs certain functions and is logically connected over an *interface* with the other network elements. The interfaces are reference points that implement certain types of protocols for either control or user traffic realization.

The BSS consist of Base Station Transceivers (BTS) and Base Station Controllers (BSC) that communicate over the *Abis* interface with each other. In the radio segment, BTSs represent the network cells and communicate over the *Um* interface with the mobile stations. The BSCs on the other side communicate with the NSS over the *A* interface. The mobile station represents a mobile user that in the GSM is referenced as a *subscriber* to indicate the need for a subscription (in the form of a Subscriber Identity Module - SIM card) for using the mobile service. Throughout this book, the terms “subscriber” and “user” will be used interchangeably, with both referring to the same entity as seen from the network, that is, the mobile user.

The NSS consists of the following elements:

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