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# 1

## The Basics: Principles of GSM and Influences on GPRS

### 1.1 The Network Architecture of GSM

As an overview, each GSM network can be subdivided into the base station subsystem (BSS) and the network switching subsystem (NSS), as well as the mobile station. Please note that the introduction of GPRS can only expand, but must not change, the existing structure as presented in Figure 1.1, since both types of application—circuit switched and packet switched—should run via the mutual GSM/GPRS network.

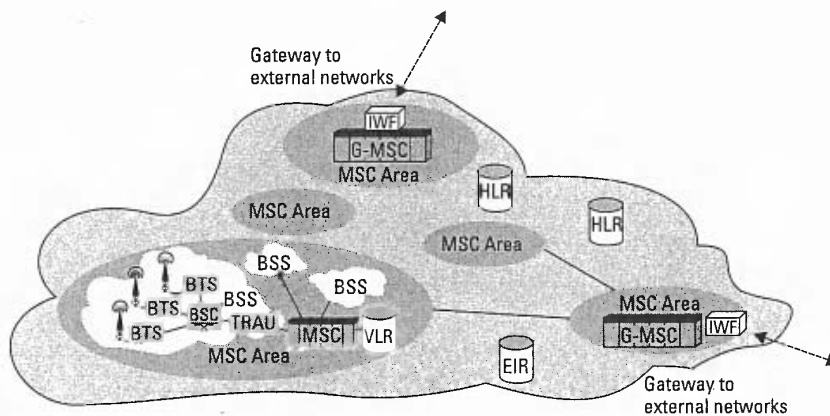


Figure 1.1 GSM network architecture.

## 1.1.1 The BSS

### 1.1.1.1 The Base Transceiver Station

The BSS consists primarily of a larger number of base transceiver stations (BTSs) that enable wireless connection of the mobile stations to the network via the  $U_m$  or air interface (Figure 1.2). Apart from transcoding rate and adaption unit (TRAU) framing, the BTS assumes all layer 1 functions in communications between the network and the mobile station. These include, amongst others, channel coding, interleaving, ciphering (only GSM, not GPRS), and burst generating. Other functions include Gaussian minimum shift keying (GMSK) modulation and demodulation, which are carried out by the base station and will be discussed in detail later.

### 1.1.1.2 The Base Station Controller

All BTSs of a BSS are connected to the base station controller (BSC) via the Abis interface (Figure 1.3). The BSC is, by definition, a circuit switching exchange in addition to the mobile services switching center (MSC), which will be discussed later. The BSC was basically viewed as a further exchange in order to relieve the MSC from all wireless-related tasks. These include, in particular, the evaluation of the measurement results from the BTS and mobile station during a live connection and the handover and power control adjustments resulting from this.

These regulatory functions are generally performed in their entirety by the BSC, although the GSM standard expressly allows preliminary prepar-

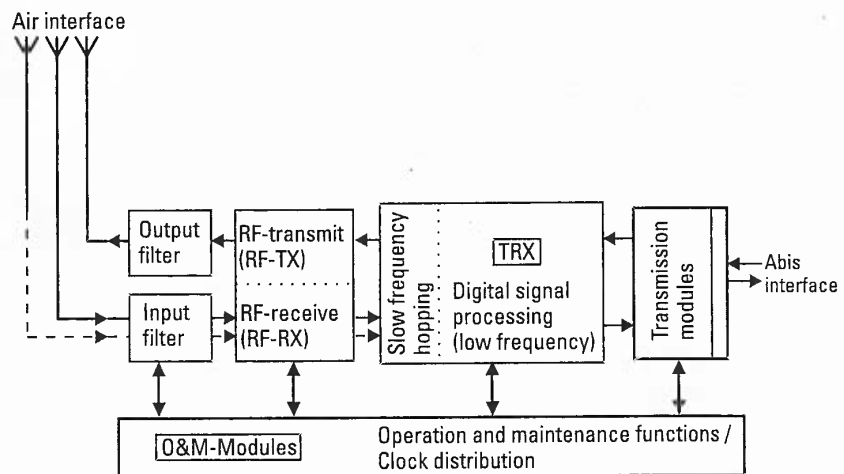
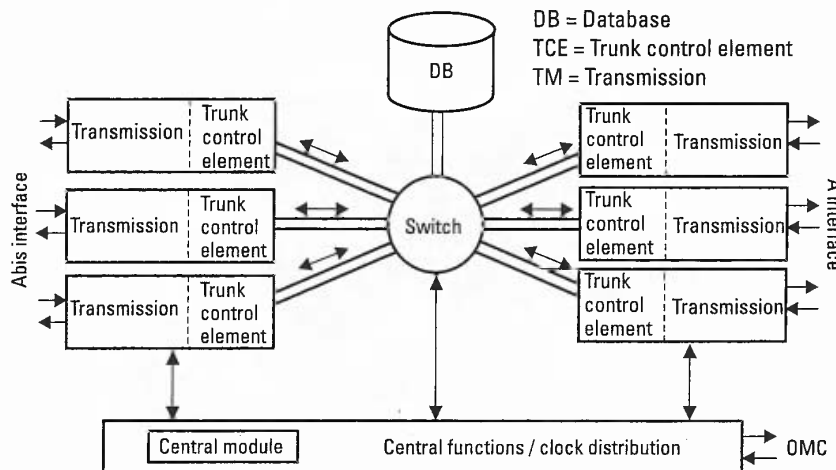


Figure 1.2 Principal schematic diagram of the base transceiver station.



**Figure 1.3** Principal circuit diagram of the BSC.

tion of the measuring results in the BTS. Additional BSC functions are the *Peer* function of the mobile station for the Radio Resource Management protocol (RR) and the resource administration on the Abis and air interface.

The BSC, as a circuit switching network element, is a considerable hindrance to packet switched services (GPRS). Its exchange functions are almost unusable for packet switched services, and the RR protocol is extremely difficult to adjust to the requirements of packet switched services. Hence, if the BSS is to be used at all for GPRS, the BSC must either be modified accordingly or a new network element or an extension of the BSC will be necessary.

#### 1.1.1.3 The Transcoding Rate and Adaptation Unit

The TRAU is the third BSS network element. The best-known task of the TRAU is speech compression from 64 Kbps to 16 Kbps (full-rate) or 8 Kbps (half-rate). The TRAU also carries out comfort noise generation while discontinuous transmission (DTX) is in operation.

What is considerably more important for a basic understanding of signal processing within GSM is another TRAU function: the conversion of all information coming from the MSC into so-called TRAU frames. This conversion is carried out for fax, data, and speech. In other words, all payload transfer between mobile station and TRAU takes place on the basis of TRAU frames. TRAU frames have a length of 320 bits. Every 20 ms a TRAU frame is transmitted or received. Consequently, there are channels of 16 Kbps.

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