



GSM Architecture and Protocols

Course Code: **MB2600** Duration: **3 days** Technical Level: **3**

GSM and GPRS courses include:

- essential GSM
- GSM System Overview
- GSM Architecture and Protocols
- GSM Air Interface
- Cell Planning for GSM Networks
- 2G/3G Indoor Coverage Planning
- Introduction to GSM Optimization
- Enhanced Data Rates for Global Evolution (EDGE)
- GPRS System Overview
- GPRS Air Interface





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The Global System for Mobile communications (GSM) is a well-established technology providing a near global standard for second-generation (2G) cellular telecommunication systems. A working GSM network contains many functional elements and interfaces, each supporting several different protocols.

This Wray Castle course provides a detailed description of all the key functional elements and interfaces found in a typical GSM network. The delegate will learn how standard and widely adopted protocols have been

blended with GSM-specific protocols to make a flexible and efficient communication system. Protocol stacks and signalling procedures are covered for all the major aspects of system operation. Importantly, this course is structured such that the delegate builds a global picture of the interactions between different parts of the network for aspects such as connection management, service delivery and security. The course also includes interworking between networks in mobile-to-mobile contexts and mobile-to-fixed contexts.

Who Should Attend

This course is primarily designed for engineers working for network operators and for equipment manufacturers who are involved in network planning, commissioning, network optimization, strategy determination, deployment, equipment design or manufacturing of GSM network equipment. Some will find that this course will satisfy their complete requirements, while for others it will provide one element in a wider study based on primary material and other related Wray Castle courses.

This course is also very useful for engineers and scientists working in areas related to GSM operation. This includes those working within service delivery, service developers, billing, Government security or forensic work, technical support staff and those in technical management roles.

Learning Objectives

On completion of this course the delegate will be able to:

- describe the functionality of the GSM network elements and relate them to GSM interfaces
- identify and discuss the use of the numbering plans used within a GSM environment
- outline the procedures for gaining access to the network for the General Packet Radio Service (GPRS) mode
- discuss the use of GSM logical channels from a signalling perspective
- describe layer 2 and layer 3 air interface protocols, frame structures and messages
- describe the protocol structure on the GSM Base Station System (BSS) interfaces
- differentiate global and dedicated signalling procedures on the A interface and relate these to Direct Transfer Application Part (DTAP) and BSS Management Application Part (BSSMAP) messages
- State the functions of Link Access Protocol on the Dm channel (LAPDm) and describe the frame structures used in logical channels
- describe layer 3 signalling flows for call control and mobility management
- describe system behaviour relating to a mobile in dedicated mode for location updates, handovers, supplementary service procedures and Short Message Service (SMS) point-to-point procedures

Benefits

In addition to gaining a good understanding of the GSM architecture and protocols used, attending this course will enable the delegate to deliver operational improvements and generate cost savings or reduce project timelines by:

- improving network design, planning, operations and maintenance
- avoiding the laborious search through specifications, standards and white papers, while benefiting from a practical analysis and interpretation of such documentation by experienced engineers
- knowing better where to look to accelerate research and fact finding and facilitate earlier project completion
- improving the equipment procurement process by better analysis and challenge of technical specifications and supplier responses, thus giving greater certainty to on-target performance and value-for-money purchasing
- shortening the learning curve and speeding productive inputs from new team members and freeing more experienced employees' time
- evaluating better a system's capabilities through improved knowledge, leading to superior operations and maintenance performance
- providing greater confidence in the sale of equipment by anticipating customers' technical requirements and being able to promote relevant superior equipment performance

and, after the course, Wray Castle's unrivalled post-course support comes into effect.



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Course Content

Section 1 – 2 hours

Architecture Overview

- GSM network architecture
- Mobile Station (MS)
- Subscriber Identity Module (SIM)
- GSM numbering

Section 2 – 2 hours

Air Interface Protocols

- GSM frequency spectrum
- GSM spectrum
- GSM channels
- Signalling on the air interface
- Physical layer
- Link layer and link layer frame formats
- Frame types
- Link layer procedures
- Layer 3 signalling protocols and messages
- Message format
- Air interface procedures

Section 3 – 3.5 hours

Base Station Controller (BSC) Interfaces

- BSC interfaces
- The A-interface
- Base Station System Application Part (BSSAP)
- BSSAP message format
- Dedicated and global procedures
- Base Station System Management Application Part (BSSMAP) procedures
- Use of SS7 on the A-interface
- MTP functions
- SCCP routing and connectionless service
- BSSAP messages
- Direct Transfer Application Part (DTAP) messages
- Example of A-interface procedures
- The A-bis interface
- A-bis layer 1, layer 2 and layer 3
- Layer 3 traffic management
- DTAP messages across the A-bis interface
- Example A-bis interface procedure

Section 4 – 2 hours

Mobile-services Switching Centre (MSC)

- MSC area
- MSC interfaces
- The ISDN User Part (ISUP)
- ISUP messages and parameters
- ISDN-UP call set-up

Section 5 – 2.5 hours

Transaction Capabilities and Mobile Application Part (TCAP)

- Transaction capabilities
- Use of transaction capabilities

- Transaction Capabilities Application Part (TCAP) structure and functions
- TCAP structure and procedures
- Component Sub Layer (CSL) procedures
- Transaction Sub Layer (TSL) procedures
- Dialogue Portion (DP)
- Application Context (AC) procedures
- Mobile Application Part (MAP)
- MAP procedures, protocol stack and interfaces
- SCCP routing functions supporting MAP procedures
- Communications scenarios
- Location update procedures

Section 6 – 2 hours

Signalling Sequences

- MO call handling procedures
- MT call handling procedures
- Mobile-terminated data call
- Handovers
- Support of Optimal Routing (SOR)

Section 7 – 2 hours

Supplementary Services

- Supplementary Services (SS)
- SS actions
- SS control procedures
- Message categories
- Message types
- Example of SS procedure (call-related)
- Call-independent SS procedures information transfer
- A-interface to D-interface mapping
- Example mobile-initiated SS procedure
- Call offering supplementary services
- Forwarded-to numbers
- Call Forwarding Unconditional (CFU)
- Operative and quiescent conditioning
- Call forwarding procedures
- Unstructured Supplementary Service Data (USSD)

Section 8 – 2 hours

The Short Message Service (SMS)

- Point-to-point SMS
- The Short Message Service Centre (SMSC)
- SMS layers overview
- SMS protocols
- Mobile-terminated SMS
- SMS delivery failures
- Message Waiting Data (MWD)
- SMS alert procedure
- SMS air interface procedures
- Transfer protocol procedures for SMS
- Transfer protocol messages

PRACTICAL EXERCISES: Includes computer-based practical exercises.



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Prerequisites

In order to achieve the maximum benefit from attending this course, it is recommended that delegates are familiar with the architecture and general operation of a GSM network and have a good working knowledge of SS7. This is best obtained through attendance on our **GSM System Overview** and **SS7 Engineering** courses. Familiarity with the OSI model is also beneficial.

Technical Level 3

This course has been developed for engineering staff requiring detailed knowledge of a specialist area of technology. It assumes some underlying knowledge in broader, related topic areas on which the detailed content is built. It also assumes general engineering skills and knowledge appropriate to the course topic.

Learning Methodology

In this time-critical, fast-moving industry, it is vitally important to maximize the effectiveness of training. Wray Castle recognizes that every hour of training needs to be relevant and effective. That's why it has developed a range of delivery options. Instructor-led and virtual classroom training are best for more complex content, while multimedia-based training is appropriate for less technical content.

All Wray Castle courses are carefully researched and structured to provide a comprehensive review of relevant content and delivered in a way that provides an interactive and engaging learning experience. Each course is interspersed with checkpoints to ensure that learning is truly taking place. Trainers explain complicated detail in succinct and clear ways, encourage questions, welcome interaction and promote discussion. A variety of visual aids, demonstrations and exercises are utilized to maximize the learning experience.

Post-Course Support

Following attendance on any Wray Castle course the delegate will automatically become eligible for free post-course support. If a delegate has any questions relating to the course content, this service puts the delegate in direct e-mail contact with a Wray Castle expert.

Delivery Options

This course is designed for **instructor-led** training.

The practical and/or complex nature of the course is best delivered in a class where the Wray Castle expert trainer can demonstrate and explain the content using a variety of specialist delivery techniques.

Need More Information?

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Searchable, Full-Colour Notes on CD

Along with a paper copy of comprehensive course notes the delegate will receive an electronic version on CD. This provides delegates with an easily transportable and fully searchable reference tool, including all the colour detail of the course presentation.

Follow-on Training

Those involved with core network development would benefit from our **GPRS Air Interface**, **UMTS System Overview**, **UMTS Core Network**, **Softswitching and VoIP** and **IMS and SIP** courses. Those involved with the radio network will find our **GSM Air Interface**, **UMTS Air Interface** and **LTE Radio Access Network** courses beneficial. This combination can lead into **Cell Planning for GSM Networks**, **Introduction to Optimization** or **2G/3G Indoor Coverage Planning**.

Areas of Expertise

This course forms an integral part of the Wray Castle portfolio. Areas of expertise include:

- IP Networks and Protocols
- Service Enablers
- WiMAX
- UMTS
- LTE
- GSM and GPRS
- Radio Principles and Planning
- TETRA
- CDMA
- Wireless Access
- Transport and Signalling
- Generic Technology
- Market Appreciation

Training Services

Wray Castle offers a comprehensive range of training services including:

- Training needs analysis
- Delegate evaluation
- Instructor-led, virtual classroom and multimedia-based training
- Customization
- Global delivery
- Training on client's or a Wray Castle site
- Client course development
- Managed training services