Course ID
EGPRS
Course Duration
2 days

Course Title
EGPRS Engineering: Designing and Optimizing a GPRS/EGPRS Network

Related Courses

- UMTS-FDD: Network Architecture, Operation, and Design (UMTSFDD, 3 days)
- UMTS-TDD: Network Architecture, Operation, and Design (UMTSTDD, 2 days)
- HSDPA: Network Architecture, Operation, and Design (HSDPA, 2 days)
- HSDPA: An Advanced Tutorial (HSDPA-ADV, 2 days)
- HSUPA: Network Architecture, Operation, and Design (HSUPA, 2 days)
- Traffic Engineering Models for Network Design (TRAFFIC, 2 days)
- Traffic Engineering Models for 3G Network Design (TRAFFIC3G, 2 days)

Aimed At

Engineers with prior exposure to GPRS/EDGE who wish to explore some of the advanced EGPRS engineering issues in depth.

Group Size

5-25

Prerequisites

- GSM: Network Architecture, Operation, and Design (GSM-I, 5 days)
- GPRS: Network Architecture, Operation, and Design (GPRS, 3 days)
- EDGE: Network Architecture, Operation, and Design (EDGE, 2 days)

You should have at least two years experience in the design and optimization of a GSM network along with some exposure to GPRS and EDGE. You should also be familiar with packet switching networks. While the standard presentation of this course assumes an Electrical Engineering background, the course can be adapted to other audiences.

Course in a Nutshell

Wireless operators have, in recent years, pushed to provide data services to subscribers to help broaden their revenue base as well as the subscribers' mobile experience. Wireless and cellular/PCS technologies have traditionally been designed for circuit switched, voice oriented traffic. So with the introduction of data comes the challenge of designing a network which provides superior quality of service for both voice and data users across the same, contended air interface.

If you have a working knowledge of the air interface and operation of GPRS/EDGE systems, through prior experience or training, and are ready to focus on the advanced engineering issues, this course can help you achieve an enhanced quality of experience for your data services subscribers.

Customize It!

We can customize this course, usually at little to no added cost, to the backgrounds and needs of such diverse groups as RF and transport engineers, researchers, equipment and application developer, business strategists, planners and policy makers, and personnel in IT, marketing/sales, and operations/support.

Course Outline

- Reviewing GPRS/EGPRS
- Understanding voice versus data
  - Deterministic and random
  - Data services and mix of data
  - Voice versus data for system performance
- Standards overview
  - GPRS/EGPRS nodal and interface definitions
    - SGSN
    - GGSN
    - Gb
    - Gn
    - Ga
    - Gr
    - Gd
    - Gs
    - Gi
    - Ge
    - Gx
    - Gy
    - Gz
- GPRS bearer and signaling: Definitions, groups, and mapping of:
  - RLC/MAC layer
  - PRACH
  - PAGCH
  - PCCCH
  - PDTCH
  - PDCH
  - PACCH
  - Random access requests and packet queuing notifications
  - USF
- GPRS message sequence
  - Attached request
  - PDP context activation
  - Primary/secondary PDP context
  - GTP-U

- GTP-C
- GTP'
- GPRS homing
- Location areas and updates
- Routing areas and updates

■ Systems Engineering Considerations

- Exercises
  - Mapping bearer traffic to total traffic: Class will walk through several real world scenarios showing the impact of signaling overhead to various coding schemas
  - Simple estimations of throughput with various time slot configurations: Class will be asked to predict and collectively model in simplistic terms throughput for various timeslot allocation with the effect of IP packet error rate to arrive at a simple, estimated throughput calculation

■ More on GPRS

- Coding schema
- Temporary block flow – TBF
- Channel assignment: Hopping versus non-hopping
- BLER
- Throughput versus delay
- C/I ratio
- SR-ARQ
- Automatic retransmission request
- BEC
- FEC

■ GPRS Problem Areas

- Air Interface
  - Coverage
  - Interference
  - TBF usage
  - Congestion
  - Coding schema non-optimal
  - Transmission time wasted
- Core network
  - Contention at SGSN
  - Packet loss
  - Processing delays at SGSN/GGSN
  - Buffer/overflow

■ Problems, Causes, and Troubleshooting

- No IP address

- No PDP context
- No GPRS attach
- RAU failure
- No uplink data
- No downlink data
- No GPRS indicator

■ Final Exercises

- Create a test scenario to simulate parallel GSM and GPRS traffic load on a limited number of theoretical cells
  - Determine the impact of GPRS load on GSM quality
  - When and how to prioritize GPRS over GSM
  - When and how to prioritize GSM over GPRS
- Create a test scenario whereby GPRS traffic demand during the busy hour reaches 25% of total traffic
  - What is the impact on the air interface? BLER, CS, FEC/BEC, SR-ARQ?
  - What is happening at RA and LA?
  - What about MIP? How does high versus low mobility provide additional impact?
  - How should this be optimized and where does one begin?
  - How do the eight available coding and modulation schemes available in EGPRS impact throughput? What are the underlying causes of EGPRS using higher versus lower coding schemes?

■ Course Recap and Conclusion

How You Will Learn

- You will learn in interactive lecture format from an instructor who's also a GPRS/EDGE subject matter expert.
- Along with lecture, we will use exercises, case studies, and interactive activities to bring practicality and depth to the class.
- If you already something about GPRS/EDGE, we will build on that so we can put you farther ahead with this technology.
- If your background is less technical, we will rely on appropriate examples and analogies to ease the complexity of the subject matter.
- You will receive a copy of the instructor presentation to which you can add insights gained in real time to turn it into a long-term reference.

Revised *April 11, 2007*