
 Marmara University, 2021

Wireless and Mobile Networks


Subject 10
Wireless Data Access Networks

Mujdat Soyuturk, Ph.D.
Associate Professor


 Contents

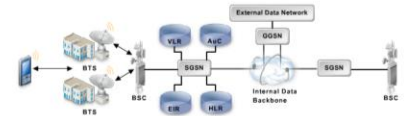
- General Packet Radio Service (GPRS)
- EDGE
- CDMA2000 1xEV-DV

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 INTRODUCTION


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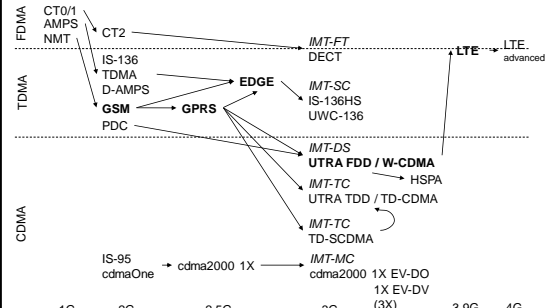
 Introduction



The diagram illustrates a mobile network architecture. On the left, a mobile phone is connected to a Base Transceiver Station (BTS). The BTS is connected to a Base Station Controller (BSC). The BSC is connected to a Radio Network Controller (RNC). The RNC is connected to a Serving GPRS Support Node (SGSN). The SGSN is connected to a Gateway GPRS Support Node (GGSN). The GGSN is connected to an External Data Network. The BSC is also connected to a Core Network (CN) which includes a Home Location Register (HLR) and a Visitor Location Register (VLR). The RNC is connected to a Core Network (CN) which includes a Home Location Register (HLR) and a Visitor Location Register (VLR). The SGSN is connected to a Core Network (CN) which includes a Home Location Register (HLR) and a Visitor Location Register (VLR). The GGSN is connected to a Core Network (CN) which includes a Home Location Register (HLR) and a Visitor Location Register (VLR).


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 Evolution of Mobile Networks



The diagram shows the evolution of mobile networks across different generations (1G, 2G, 2.5G, 3G, 3.9G, 4G). The vertical axis represents different network technologies: FDMA, TDMA, and CDMA. The horizontal axis represents the generations. The evolution path is as follows: 1G (CT0/1, AMPS, NMT) leads to 2G (GSM, D-AMPS, IS-136, IS-95, cdmaOne). 2G leads to 2.5G (EDGE, GPRS). 2.5G leads to 3G (IMT-SC, IS-136HS, UWC-136, IMT-DS, UTRA FDD / W-CDMA, IMT-TC, UTRA TDD / TD-CDMA, IMT-TC, TD-SCDMA, IMT-MC, cdma2000 1X, 1X EV-DO, 1X EV-DV (3X)). 3G leads to 3.9G (LTE, LTE advanced). 3.9G leads to 4G.

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 GENERAL PACKET RADIO SERVICE (GPRS)

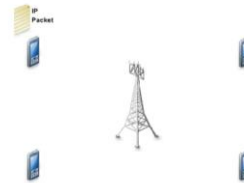
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General Packet Radio Service (GPRS)



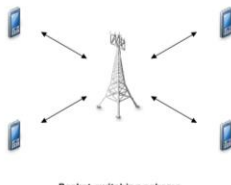
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General Packet Radio Service (GPRS)



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General Packet Radio Service (GPRS)



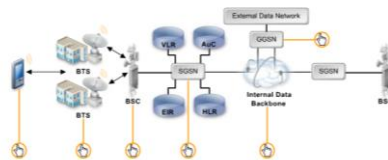
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General Packet Radio Service (GPRS)



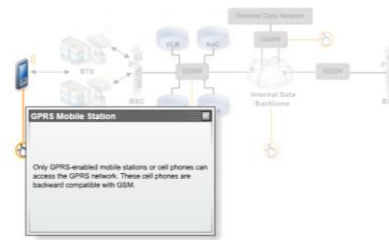
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GPRS Architecture



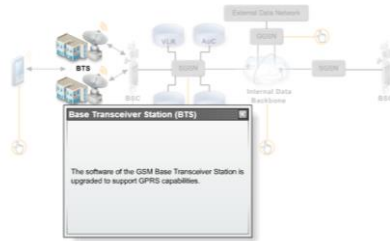
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GPRS Architecture



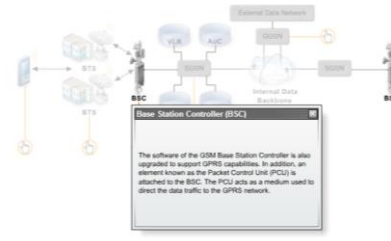
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GPRS Architecture



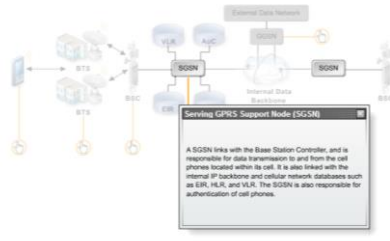
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GPRS Architecture



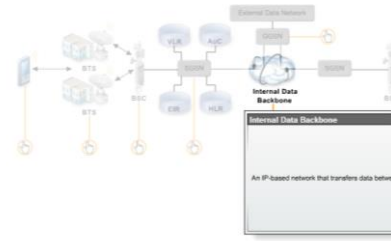
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GPRS Architecture



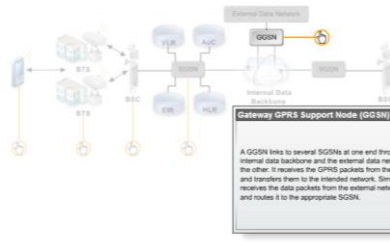
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GPRS Architecture



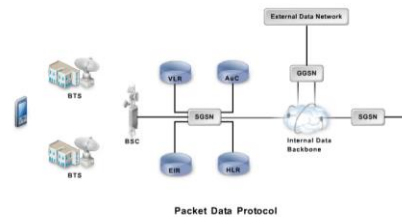
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GPRS Architecture



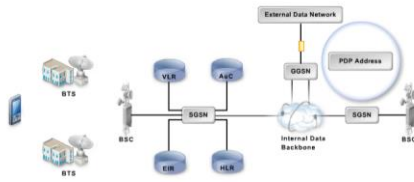
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Packet Data Protocol (PDP) Address



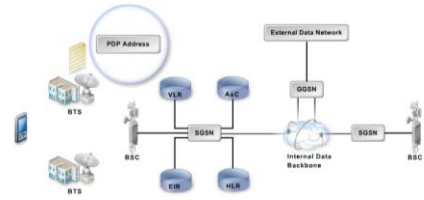
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Packet Data Protocol (PDP) Address



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Packet Data Protocol (PDP) Address

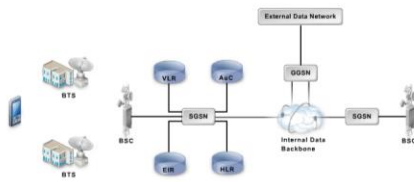


subscriber attaches and a PDP context is activated

- Subscriber's IP address
- Subscriber's IMSI
- Subscriber's
 - Tunnel Endpoint ID (TEID) at the GGSN
 - Tunnel Endpoint ID (TEID) at the SGSN

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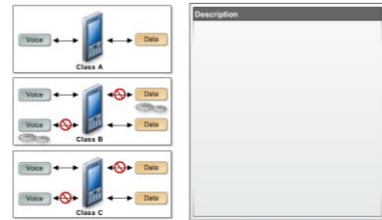
Packet Data Protocol (PDP) Address



Static or dynamic PDP
address assignment

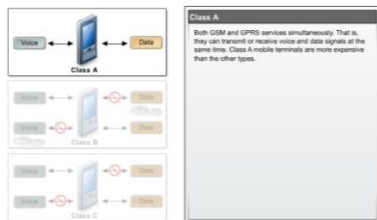
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GPRS Mobile Terminal Types



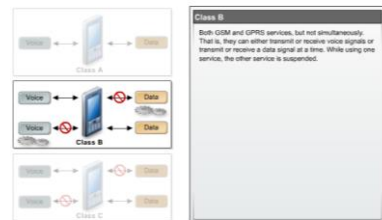
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GPRS Mobile Terminal Types



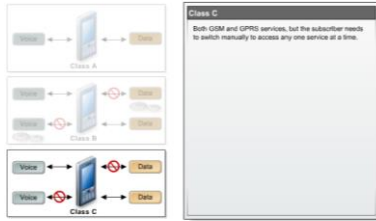
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GPRS Mobile Terminal Types



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GPRS Mobile Terminal Types



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GPRS Channels

GPRS channels are classified as

- common control channels,
 - used for initial call setup
- dedicated control channels
 - used to manage data transfer once the link is established

Traffic channel is another GPRS channel.

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GPRS Channels

common control channels

GPRS Channel	Description
Packet Broadcast Control Channel (PBCCH)	
Packet Paging Channel (PPCH)	
Packet Access Grant Channel (PAGCH)	
Packet Notification Channel (PNCH)	

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GPRS Channels

GPRS Channel	Description
Packet Broadcast Control Channel (PBCCH)	A common control channel used for downlink transmission. The base station broadcasts general information such as access methods and network parameters on this channel for the cell phones to set up calls.
Packet Paging Channel (PPCH)	It is very similar in operation to the BCCH used for GSM. In fact the BCCH is still required in the initial to provide a time slot number for the PPCH. In operation the PBCCH broadcasts general information such as power control parameters, access methods and operational modes, network parameters, etc. required to set up calls.
Packet Access Grant Channel (PAGCH)	
Packet Notification Channel (PNCH)	

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GPRS Channels

GPRS Channel	Description
Packet Broadcast Control Channel (PBCCH)	A common control channel used for downlink transmission. This channel is used by the base station to alert the cell phone of an incoming data signal.
Packet Paging Channel (PPCH)	It is used for control signaling prior to the call set up. Once the call is in progress a dedicated channel referred to as the PAGCH takes over.
Packet Access Grant Channel (PAGCH)	
Packet Notification Channel (PNCH)	

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GPRS Channels

GPRS Channel	Description
Packet Broadcast Control Channel (PBCCH)	A common control channel used for downlink transmission. This channel is used by the base station to assign a traffic channel for the cell phone.
Packet Paging Channel (PPCH)	It occurs after the PPCH has informed the mobile that there is an incoming call.
Packet Access Grant Channel (PAGCH)	
Packet Notification Channel (PNCH)	

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GPRS Channels



GPRS Channel	Description
Packet Broadcast Control Channel (PBCCH)	A common control channel used for downlink transmission. This channel is used by the base station to alert the cell phone of a broadcast message intended for a large number of cell phones. It is typically used in what is termed point-to-point multicasting.
Packet Paging Channel (PPCH)	
Packet Access Grant Channel (PAGCH)	
Packet Notification Channel (PNCCH)	

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GPRS Channels



GPRS Channel	Description
Packet Random Access Channel (PRACH)	
Packet Associated Control Channel (PACCH)	
Packet Timing Advance Common Control Channel (PTCCH)	
Packet Data Traffic Channel (PDTCH)	

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GPRS Channels



GPRS Channel	Description
Packet Random Access Channel (PRACH)	A common control channel used for uplink transmission. Once the cell phone is turned on, it uses this channel to get registered with the network.
Packet Associated Control Channel (PACCH)	
Packet Timing Advance Common Control Channel (PTCCH)	
Packet Data Traffic Channel (PDTCH)	

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GPRS Channels



GPRS Channel	Description
Packet Random Access Channel (PRACH)	A dedicated control channel used for both uplink and downlink transmissions. This channel is used once a call is set up and it carries channel assignment and acknowledgment messages of received data. It is used for control signaling while a call is in progress. It takes over from the PBCCH once the call is set up and it carries information such as channel assignments, power control messages and acknowledgements of received data.
Packet Associated Control Channel (PACCH)	
Packet Timing Advance Common Control Channel (PTCCH)	
Packet Data Traffic Channel (PDTCH)	

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GPRS Channels



GPRS Channel	Description
Packet Random Access Channel (PRACH)	A dedicated control channel used for both uplink and downlink transmissions. It is used to synchronize the timing sequence of the base station and cell phone. Synchronizing the timing is critical to ensure that messages arrive at the base station at the correct time regardless of the distance between the cell phone and base station.
Packet Associated Control Channel (PACCH)	
Packet Timing Advance Common Control Channel (PTCCH)	
Packet Data Traffic Channel (PDTCH)	

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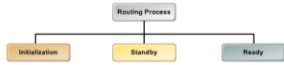
GPRS Channels



GPRS Channel	Description
Packet Random Access Channel (PRACH)	A dedicated traffic channel used for both uplink and downlink transmissions. Up to eight PDTCH channels can be allocated to a cell phone to transmit or receive data.
Packet Associated Control Channel (PACCH)	
Packet Timing Advance Common Control Channel (PTCCH)	
Packet Data Traffic Channel (PDTCH)	

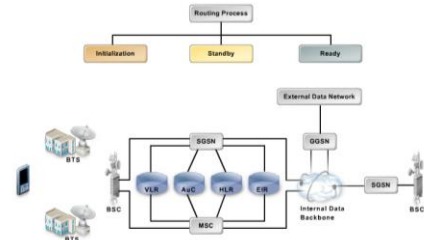
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Data Routing Process in a GPRS Network



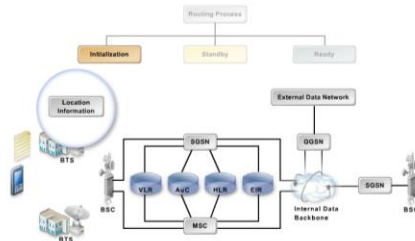
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Data Routing Process in a GPRS Network



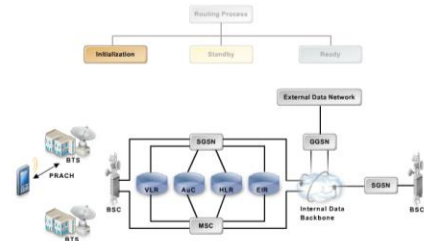
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Data Routing Process in a GPRS Network



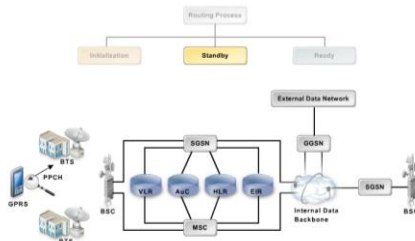
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Data Routing Process in a GPRS Network



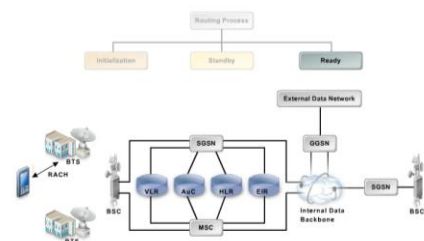
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Data Routing Process in a GPRS Network



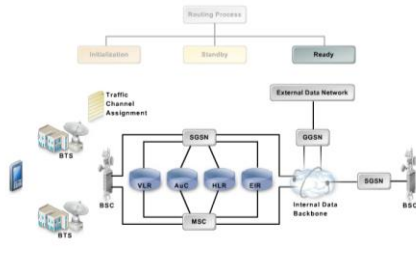
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Data Routing Process in a GPRS Network



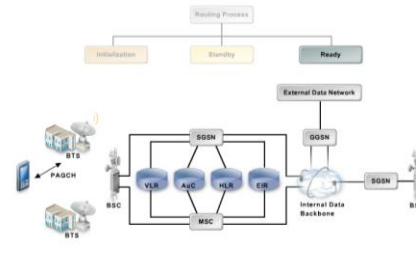
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Data Routing Process in a GPRS Network



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Data Routing Process in a GPRS Network

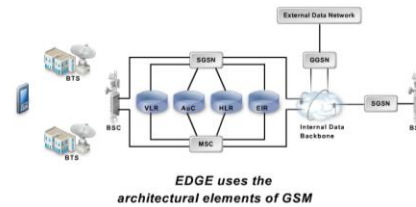


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EDGE

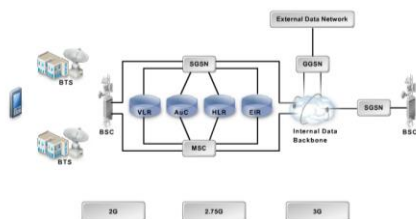
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The EDGE Technology



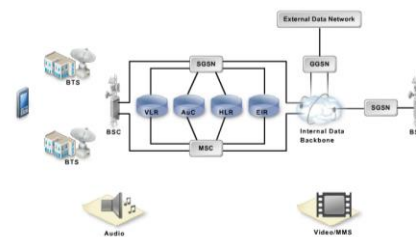
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The EDGE Technology



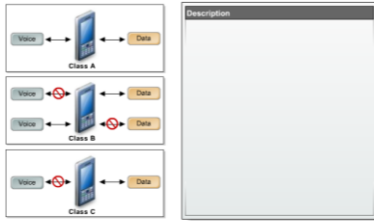
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The EDGE Technology



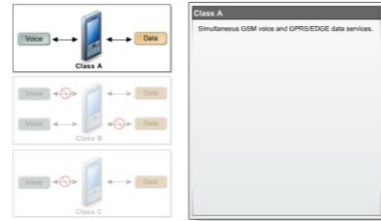
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Types of EDGE Mobile Terminals



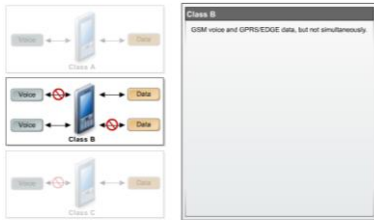
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Types of EDGE Mobile Terminals



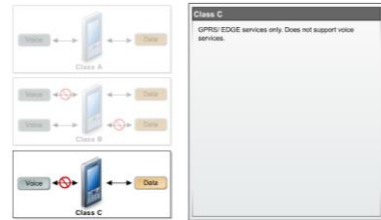
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Types of EDGE Mobile Terminals



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Types of EDGE Mobile Terminals



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EDGE vs. GPRS Technology



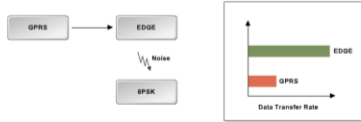
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EDGE vs. GPRS Technology



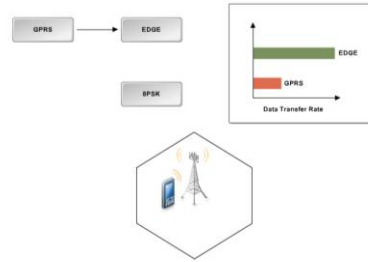
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EDGE vs. GPRS Technology



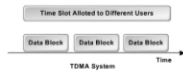
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EDGE vs. GPRS Technology



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EDGE Operation



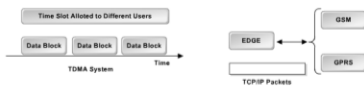
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EDGE Operation



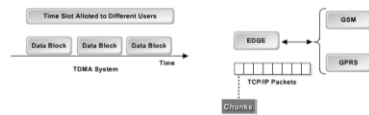
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EDGE Operation



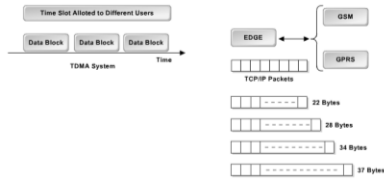
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EDGE Operation



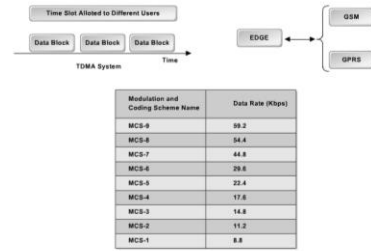
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EDGE Operation



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EDGE Operation



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CDMA2000 1xEV-DV

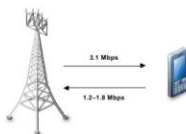
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The CDMA2000 1xEVolution-DataVoice (CDMA2000 1xEV-DV) Standard



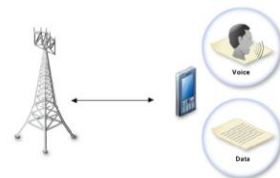
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The CDMA2000 1xEVolution-DataVoice (CDMA2000 1xEV-DV) Standard



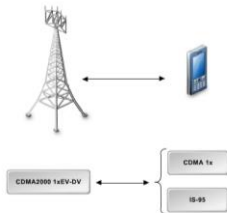
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The CDMA2000 1xEVolution-DataVoice (CDMA2000 1xEV-DV) Standard



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The CDMA2000 1xEVolution-DataVoice (CDMA2000 1xEV-DV) Standard



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CDMA2000 1xEV-DV Channels



One new traffic channel and three control channels are added.

CDMA2000 1xEV-DV	Description
Forward Packet Data Channel (F-PDCH)	
Forward Packet Data Control Channel (F-PDCH)	
Reverse Channel Quality Indicator Channel (R-CQICH)	
Reverse Acknowledgement Channel (R-ACKCH)	

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CDMA2000 1xEV-DV Channels



CDMA2000 1xEV-DV	Description
Forward Packet Data Channel (F-PDCH)	A traffic channel used for data transmission. Data is transmitted using both code-division and time-division access techniques.
Forward Packet Data Control Channel (F-PDCH)	
Reverse Channel Quality Indicator Channel (R-CQICH)	
Reverse Acknowledgement Channel (R-ACKCH)	

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CDMA2000 1xEV-DV Channels



CDMA2000 1xEV-DV	Description
Forward Packet Data Channel (F-PDCH)	A control channel used to send the MAC-ID, F-PDCH packet size, and the last Walsh code index. The information provided in this channel is used by the cell phone to identify the data intended for it using the MAC-ID and the size of the packet being sent. It uses the Walsh code information for multiplexing data using the code-division access technique.
Forward Packet Data Control Channel (F-PDCH)	
Reverse Channel Quality Indicator Channel (R-CQICH)	
Reverse Acknowledgement Channel (R-ACKCH)	

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CDMA2000 1xEV-DV Channels



CDMA2000 1xEV-DV	Description
Forward Packet Data Channel (F-PDCH)	The cell phone uses this control channel to report the measurements of channel quality to the base station.
Forward Packet Data Control Channel (F-PDCH)	
Reverse Channel Quality Indicator Channel (R-CQICH)	
Reverse Acknowledgement Channel (R-ACKCH)	

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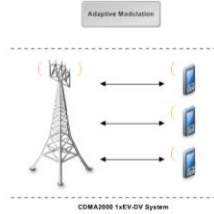
CDMA2000 1xEV-DV Channels



CDMA2000 1xEV-DV	Description
Forward Packet Data Channel (F-PDCH)	The cell phone acknowledges the transmission of a data packet using this control channel.
Forward Packet Data Control Channel (F-PDCH)	
Reverse Channel Quality Indicator Channel (R-CQICH)	
Reverse Acknowledgement Channel (R-ACKCH)	

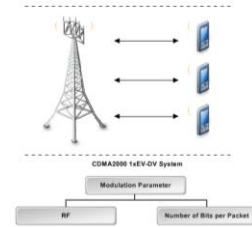
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Adaptive Modulation



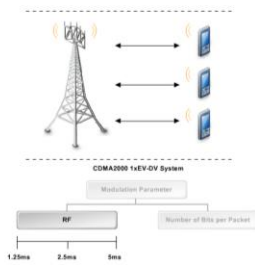
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Adaptive Modulation



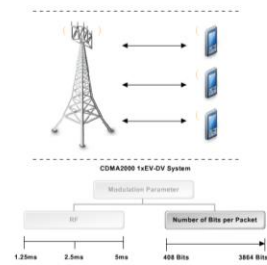
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Adaptive Modulation



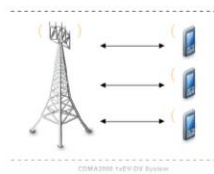
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Adaptive Modulation



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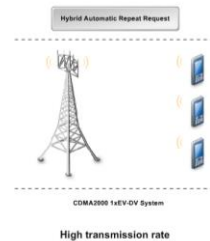
Adaptive Modulation



*Varying modulation parameters
optimizes carrier utilization*

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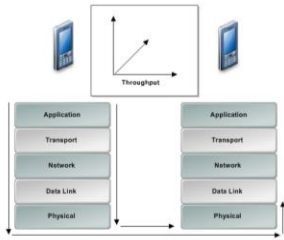
Hybrid Automatic Repeat Request



High transmission rate

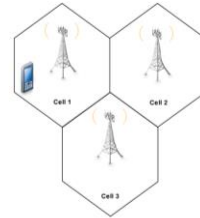
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Hybrid Automatic Repeat Request



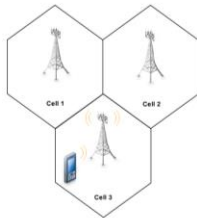
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Cell Selection



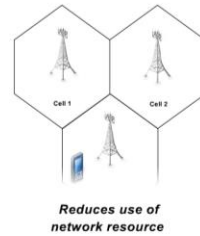
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Cell Selection



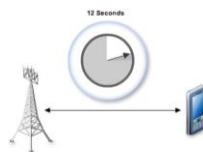
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Cell Selection



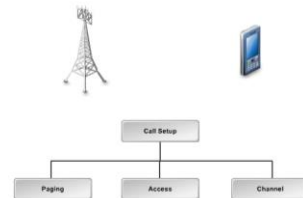
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Call Setup



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Call Setup



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