

WIRELESS MEDIUM ACCESS CONTROL AND CDMA, 3G, WIMAX AND 4G COMMUNICATION

Lesson 13

HSPA/HSPA+ and HSOPA

HSPA (HIGH SPEED PACKET ACCESS)

- Introduced near about 2005
- Provides higher increased capacity and higher rate transfers
- Enables high speed packet access by mobile radio service networks

HSPA FEATURES

Property	Description
Frequency Bands	2.100GHz, 1.9GHz, 1.8 GHz, 900 MHz, 850 MHz.
Uplink Features	HSUPA 1 Mbps; one Carrier, 1 × 5 Mbps per user, each user channel shifted in the time space
Downlink Features	<ol style="list-style-type: none">1. HSDPA 3.8 Mbps; Device support 7.2 Mbps2. Dual carrier 2 × 5 Mbps per user Shifted in time space3. High speed enhancement of WCDMA/UMTS4. Short transmission time interval of nearly 2 ms5. Fast Scheduling and user diversity low and high data rates6. Higher order modulation7. Fast link adaptation8. Fast hybrid automatic repeat request for error control
Common Data transfer rates	Downlink 4 Mbps; Uplink 1 Mbps

HSPA FEATURES

Peak Data transfer rates	HSPA R6 Downlink 14 Mbps; Uplink 5.76 Mbps
Application :	<ol style="list-style-type: none">1. Mobile phone and Mobile TV2. Video Call3. Mobile Wireless Internet4. Mobile Data network
Mobile Phone Examples	Apple iPhone 3, iPhone 4, Nokia N8, Blackberry Bold 9700
Latency	Nearly 100 ms
Migration to VoIP	Smooth migration to VoIP

HSPA SYSTEM

- Context stored in the MS as well as in the SGSN
- Context has information of about the status of MS, data compression flag, identifiers for the cell and channel for the packet data and the routing area information

RSS

- The RSS consists of a number of mobile stations (MSs), base transceivers (BTSs), and base station controllers (BSCs) BSC1, BSC2, ..., BSC k .

NSS

- NSS consists of a number of serving Gateway support nodes (SGSNs) SGSN1, SGSN2, ..., SGSN/ and mobile services switching centres (MSCs) MSC1, MSC2, ..., MSCj.

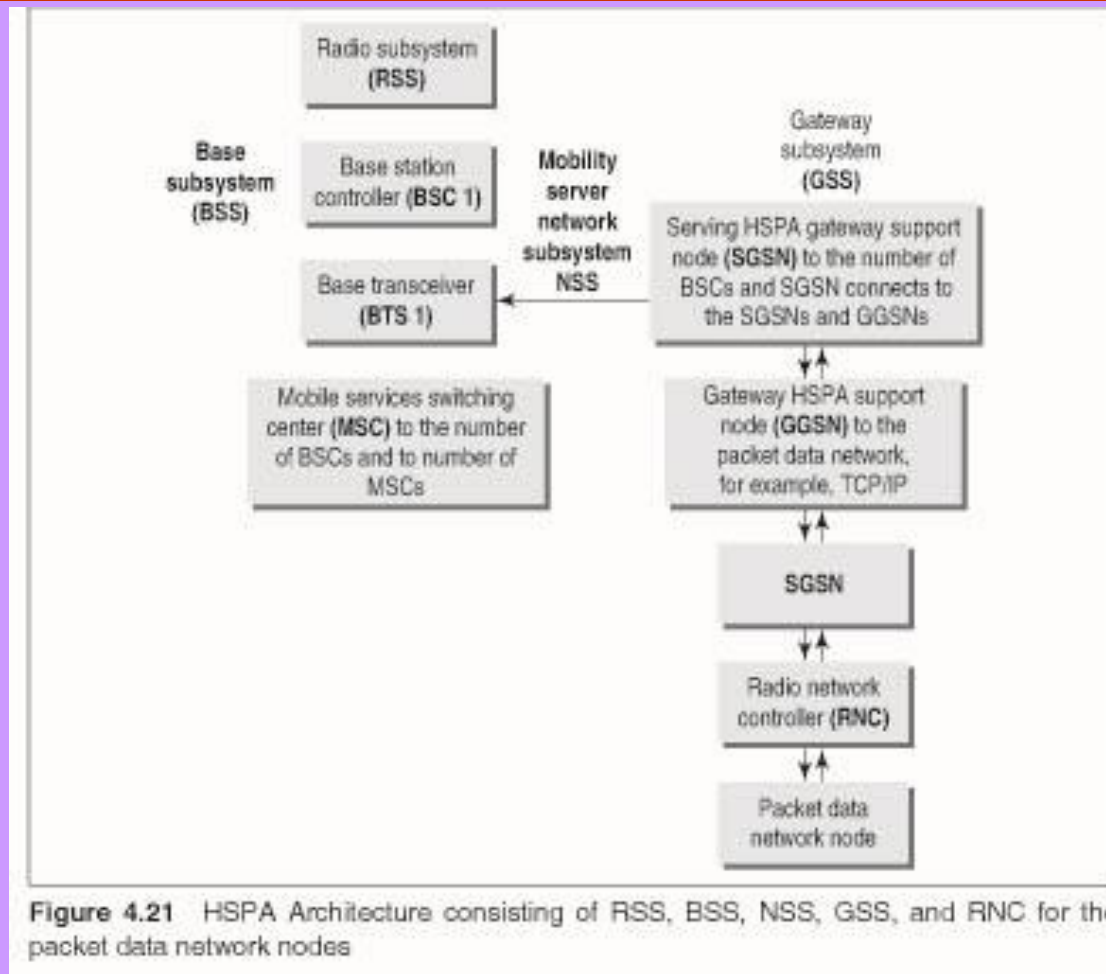
GSS

- GSS consisting of the SGSNs and GGSNs
- The GSS provides HSPA connections through a Radio Network Controller (RNC)
- RNC interfaces to with the packet data network node (Internet and other PDNs (public data networks))

SGSN AND MSC

- Each SGSN and each MSC in the NSS layer connect to a number of BSCs at RSS layer.

HSPA ARCHITECTURE



HSPA+ FEATURES

Property	Description
Frequency bands	2.100GHz, 1.9GHz, 1.8 GHz, 900 MHz, 850 MHz.
BTS and BSC transmitter	2 × 2 MIMO
Modulation	Downlink 64 QAM; uplink 16-QAM.
Peak data transfer rates for downlink	<ol style="list-style-type: none">1. Downlink 21 Mbps [3.9 Mbps with 15 codes provides 14 Mbps. 14 Mbps with 64 QAM provides 21 Mbps.]2. 14 Mbps with 2 × 2 MIMO provides 28 Mbps.3. 14 Mbps with 64 QAM and 2 × 2 MIMO provides 42 Mbps.4. Four Carriers of 42 Mbps can provide 168 Mbps in future

Contd.

HSPA+ FEATURES

Property	Description
Downlink and uplink data rates	<ol style="list-style-type: none">1. HSPA R7 (2007) Downlink 28 Mbps; Uplink 11.5 Mbps2. HSPA R8 (2008) Downlink 42 Mbps; Uplink 11.5 Mbps3. Expected HSPA R9 (2011) Downlink 84 Mbps; Uplink 23 Mbps in 10 MHz band4. Expected HSPA R9 (2012) Downlink 128 Mbps; Uplink 23 Mbps in 20/10 MHz band
Application	Base station direct interface to packet data network such as TCP/IP and broadband internet

HSPA+ ARCHITECTURE

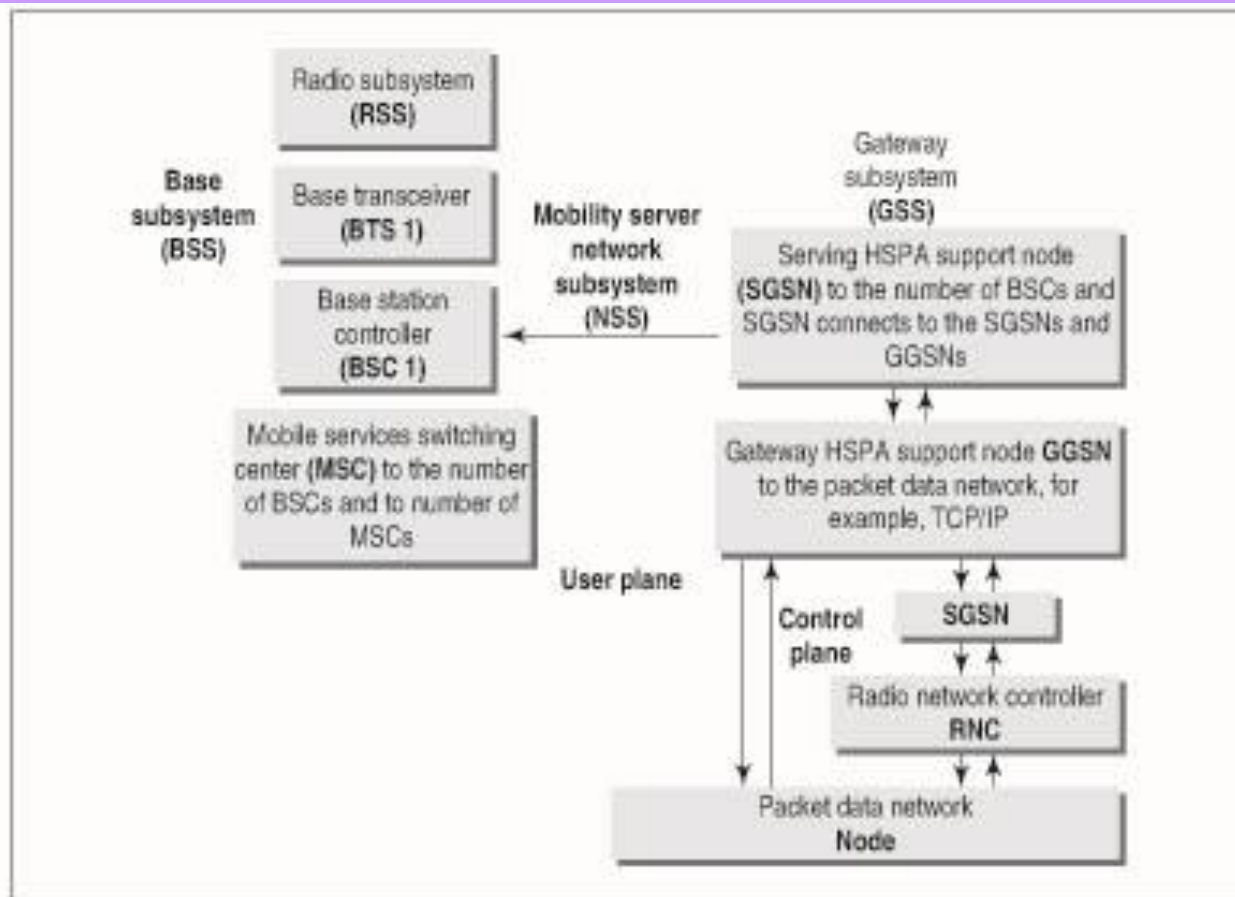


Figure 4.22 HSPA+ Architecture packet data network nodes without radio network controller connecting to RSS, BSS, NSS, and GSS

HIGH SPEED OFDM PACKET ACCESS (HSOPA SUPER 3G)

Property	Description
Feature	Increased data speeds, and spectral efficiency
Peak data Transfer rate	Downlink 100 Mbps; 50 Mbps uplink
Bandwidth	1.25 MHz to 20 MHz bandwidth
Downlink	OFDMA
Uplink	SC-FDMA
Latency	20ms
Applications	Voice, large data transfer, IP-TV , Mobile TV High-speed interactive applications

USE OF MIMO



Figure 4.23 Doubling of data transfer rate by a 2 x 2 MIMO

SUMMARY

- HSPA Architecture RSS (radio subsystem), BSS (base subsystem), NSS (network subsystem), and GSS (gateway subsystem)
- High speed packet access by the mobile radio service networks
- HSPA+ advanced version of HSPA
- Direct interface of user plane base stations with Gateway to the packet data network
- Use of MIMP double the data transfer rate

End of Lesson 13
HSPA/HSPA+ and HSOPA