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Wireless and Mobile Networks

Subject 12

Evolution of 3G Standards

Mujdat Soyturk, Ph.D.
Associate Professor

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INTRODUCTION

Introduction

OVERVIEW OF 3GPP

The 3rd Generation Partnership Project

3rd Generation Partnership Project

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The 3rd Generation Partnership Project

Evolution of 3GPP

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Evolution of 3GPP

Release 8	2008 Q4	First LTE release. All-IP Network (SAE). New OFDMA, FDE and MIMO based radio interface, not backwards compatible with previous CDMA interfaces. Dual-Cell HSDPA.
Release 9	2009 Q4	SAES Enhancements, WiMAX and LTE/UMTS Interoperability. Dual-Cell HSDPA with MIMO, Dual-Cell HSUPA.
Release 10	2011 Q1	LTE Advanced fulfilling IMT Advanced 4G requirements. Backwards compatible with release 8 (LTE). Multi-Cell HSDPA (4 carriers).
Release 11	2012 Q3	Advanced IP Interconnection of Services. Service layer interconnection between national operators/carriers as well as third party application providers.
Release 12	2015 March	Enhanced Small Cells (higher order modulation, dual connectivity, cell discovery, self configuration), Carrier Aggregation (2 uplink carriers, 3 downlink carriers, FDD/TDD carrier aggregation), MIMO (3D channel modeling, elevation beamforming, massive MIMO), New and Enhanced Services (cost and range of MTC, D2D communication, eMBMS enhancements)
Release 13	2016 March	LTE in unlicensed, LTE enhancements for Machine-Type Communication. Elevation Beamforming / Full-Dimension MIMO, Indoor positioning
Release 14	Planned to 2017 June	V2X and IoT communications support. In frozen status

HSPA AND RELATED STANDARDS

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

HSPA family includes:

- High Speed Downlink Packet Access (HSDPA)
- High Speed Uplink Packet Access (HSUPA)
- HSPA+

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Packet Access

High Speed Downlink Packet Access

High Speed Downlink Packet Access

High Speed Downlink Packet Access

High Speed Downlink Packet Access

HSDPA Technology	Description
HARQ	
Adaptive modulation and coding	
Fast scheduling	
Shared downlink channel	

High Speed Downlink Packet Access

HSDPA Technology	Description
HARQ	In this technique, a sender adds redundant bits to its messages, an action that helps the receiver to detect and correct errors without spending unnecessary time in asking the sender for retransmission. Previous transmissions are combined with the latest transmission. Individual transmission of corrupted packet is thus avoided, which in turn reduces network traffic. This also reduces network latency, thus reducing the round trip time.
Adaptive modulation and coding	
Fast scheduling	
Shared downlink channel	

High Speed Downlink Packet Access

HSDPA Technology	Description
HARQ	In this technique, the modulation and coding formats are varied according to channel conditions. When the channel conditions are good, the bits bearing more information are transmitted and when the channel condition deteriorates, the bits bearing less information are transmitted. This is achieved by varying the modulation and coding schemes. This technique results in a higher system capacity. The channel condition is generally based on the feedback from the receiver.
Adaptive modulation and coding	
Fast scheduling	
Shared downlink channel	

High Speed Downlink Packet Access

HSDPA Technology	Description
HARQ	In this technique, data to be transmitted is placed in different queues and a scheduler determines the sequential order in which data needs to be transmitted. Scheduling the transmission of data packets over the wireless interface is performed in NodeB, instead of in the RNC, because NodeB is closer to the wireless interface, thus reducing delay. Scheduling is based on channel quality and QoS class of data packets. The UE senses the condition of the downlink channel. Data from the UE experiencing good channel conditions is given a higher priority.
Adaptive modulation and coding	
Fast scheduling	
Shared downlink channel	

High Speed Downlink Packet Access

HSDPA Technology	Description
HARQ	A separate channel known as the high-speed downlink shared channel has been introduced specifically for data transfer from the network to the mobile phone. This channel is shared between all users for downloading content from the network efficiently.
Adaptive modulation and coding	
Fast scheduling	
Shared downlink channel	

High Speed Uplink Packet Access

High Speed Uplink Packet Access

High Speed Uplink Packet Access

High Speed Uplink Packet Access

High Speed Uplink Packet Access

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

Evolved HSPA

LONG TERM EVOLUTION (LTE)

Long Term Evolution

Long Term Evolution

Long Term Evolution

Long Term Evolution

Long Term Evolution

LTE offers data rates 100 times faster than 3G networks

Long Term Evolution

Long Term Evolution

Long Term Evolution

Long Term Evolution

LTE offers very high spectral efficiency and latency of less than 10ms

Long Term Evolution

Long Term Evolution

The LTE System Architecture

The LTE System Architecture

The LTE System Architecture

System Architecture Evolution

The LTE System Architecture

Evolved Universal Terrestrial Radio Access Network

The LTE System Architecture

Evolved Packet Core

The LTE System Architecture

The LTE System Architecture

The LTE System Architecture

The LTE System Architecture

evolved Node B

The LTE System Architecture

Evolved Universal Terrestrial Radio Access Network

Evolved Universal Terrestrial Radio Access Network

Evolved Universal Terrestrial Radio Access Network

Evolved Universal Terrestrial Radio Access Network

Functions of the eNodeB:

- IP header compression and encryption
- Scheduling and transmission of paging messages
- Routing of user data towards EPC

Evolved Universal Terrestrial Radio Access Network

Evolved Universal Terrestrial Radio Access Network

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

Evolved Packet Core

LTE Advanced

LTE Advanced

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OVERVIEW OF 3GPP2

3GPP2

3GPP2

3GPP2

3GPP2 Structure

Technical Specification Groups

3GPP2 Structure

Organizational Partners

3GPP2 Structure

Market Representation Partners

3GPP2 Structure

MRPs offer advice based on market requirements falling within the 3GPP2 scope

3GPP2 Structure

3GPP2 Structure

3GPP2 Structure

3GPP2 Structure

3GPP2 Structure