



Reti Wireless

Introduzione

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Programma del corso

- Elementi di trasmissione numerica
- Elementi di teoria dell'informazione
 - Codifica di canale e codici
- Trasmissione numerica sul canale wireless
- Trasmissione a banda stretta
- Trasmissione a banda larga
- Multiplazione – diversità
- Sistemi cellulari: da 1G a 5G
- Lo standard 802
 - WiFi
 - Bluetooth
 - Zigbee
- Internet of Things



Libri di testo

- J.G. Proakis, M. Salehi, *Fundamentals of communication systems*, Prentice Hall International, 2013.
- G. L. Stüber, *Principles of Mobile Communication*, Springer, 2011.
- C. Smith, *Wireless networks*, Mcgraw-Hill, 2014.
- Martin Sauter, *3G, 4G and Beyond: Bringing Networks, Devices and the Web Together, 2nd Edition*, John Wiley, 2013.
- R. Stewart, K. W. Barlee, D. S. W. Atkinson, *Software Defined Radio Using Matlab & Simulink and the Rtl-Sdr*,
<http://www.desktopsdr.com/download-files>.



Materiale del corso

- Tutto il materiale del corso è accessibile sul sito moodle2.units.it
- Chiave di accesso: RW2020
- Matlab.

Nel corso si farà ampio uso del programma Matlab.

Per scaricarlo e installarlo sul proprio computer seguire le istruzioni riportate al link: <https://dia.units.it/it/dipartimento/node/32619>

- Orario lezioni

Lunedì 14.15-15.45

Martedì 8.30 – 11.00 (con pausa intermedia).

Venerdì 8.30 – 11.00 (con pausa intermedia).



Enti di normativa

- **International Telecommunication Union (ITU)**
- **3rd Generation Partnership Project (3GPP)**

Accordo fra gli enti che gestiscono le telecomunicazioni nei vari stati, stipulato con l'obiettivo di definire uno standard comune per il 3G a partire dal GSM, e in accordo con i requisiti e le specifiche *International Mobile Telecommunications 2000* dell'ITU.

Oggi gestisce l'evoluzione degli standard cellulari.

- **Institute of Electrical and Electronic Engineers (IEEE)**
 - **IEEE 802 LAN/MAN Standards Committee (LMSC)**
 - **IEEE 802.11 Wireless LAN (WiFi)**
 - **IEEE 802.15 Wireless Personal Area Networks**
 - **IEEE 802.16 Broadband Wireless Access (WiMAX)**



3GPP Standard

Versione	Data	Informazioni
Phase 1	1992	GSM Features
Phase 2	1995	GSM Features, EFR Codec,
Release 96	1997 Q1	GSM Features, 14.4 kbit/s User Data Rate,
Release 97	1998 Q1	GSM Features, GPRS
Release 98	1999 Q1	GSM Features, AMR, EDGE, GPRS for PCS1900
Release 99	2000 Q1	Specified the first UMTS 3G networks, incorporating a CDMA air interface
Release 4	2001 Q2	Originally called the Release 2000 - added features including an all-IP Core Network
Release 5	2002 Q1	Introduced IMS and HSDPA
Release 6	2004 Q4	Integrated operation with Wireless LAN networks and adds HSUPA.



3GPP Standard

Release 7	2007 Q4	Focuses on decreasing latency, improvements to QoS and real-time applications such as VoIP. This specification also focus on HSPS (High Speed Packet Access Evolution), EDGE Evolution.
Release 8	2008 Q4	First LTE release. All-IP Network (SAE). New OFDMA, and MIMO based radio interface, not backwards compatible with previous CDMA interfaces.
Release 9	2009 Q4	LTE/UMTS Interoperability.
Release 10	2011 Q1	LTE Advanced fulfilling IMT Advanced 4G requirements. Backwards compatible with release 8 (LTE). Multi-Cell HSDPA (4 carriers).



3GPP Standard

Release 11 2012 Q3

Advanced IP Interconnection of Services. Service layer interconnection between national operators/carriers as well as third party application providers. Heterogeneous networks (HetNet) improvements, Coordinated Multi-Point operation (CoMP). In-device Co-existence (IDC).

Release 12 2015 Q1

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 March 2016

LTE in unlicensed, LTE enhancements for Machine-Type Communication. Elevation Beamforming / Full-Dimension MIMO, Indoor positioning.



3GPP Standard

Release 14 Sept. 2017

5G requirements, Multimedia Broadcast Supplement for Public Warning System, Location services, Mission Critical Video over LTE, Enhancement for TV Video service, Latency reduction techniques for LTE, Channel model above 6 GHz, Robust Call Setup for VoLTE subscriber in LTE, Requirements for Next Generation Access Technologies, Multi-Carrier Enhancements for UMTS.

Release 15	Sept. 2018	5G: Phase 1. First set of 5G standards - including new work as well as the maturing of the LTE-Advanced Pro specifications.
Release 16		5G: Phase 2.



3GPP Standard

