Wirless Networks And Mobile Applications

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Disclaimer

Hello guys!
These notes contain all the concepts and arguments which are explained during professor's lessons. However they are not intended in any sense as a replacement for professor's lessons, but as a help for studying and preparing the exam. Furthermore it's possible there are some errors and we don't take any responsibility of them. If you like to contribute for any correction, here is the link to the repository:

> **https://github.com/filippobrugnolaro/WNMA-notes**

You can create a new branch with all modifications and create a pull request. We'll be pleasured for any correction in order to improve the qualiity of the document.
Hope it could be useful.
Cheers :)

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1   Introduction

1.1   Wireless Development

Present
it is constantly growing due to higher use of laptops or devices which can connect
to internet. This implied an important growth of WiFi and n-G (3G, 4G, 5G)
technologies also thanks to the emerging of apps with both low and high data
demand. Smartphones open to new wireless scenarios such as AR, VR, MR,
tele-presence. . . Other topics are Tactile Internet (combination of low latency,
high availability, reliability and security) and Web Squared (integration of web
2.0 with technologies of sensing).

Future
it is based on ubiquitous communication among people and devices. So this
implies to take into account some requirements such as bandwidth, delay, energy
and connectivity.

Challenges

- Wireless channels are a difficult and capacity-limited broadcast communications medium (with respect to the wired counterpart);

- Traffic patterns, user locations, and network conditions are constantly changing;

- Applications are heterogeneous with hard constraints required by the network;

- Energy and delay constraints change design principles across all layers of the stack.

Multimedia requirements

	Voice	Data	Video	Game
Delay	low	irrelevant	low	low
Packet Loss	low	no	low	low
Bit Error Rate	10^{-3}	10^{-6}	10^{-6}	10^{-3}
Data Rate	8-32 Kbps	1-100 Mbps	1-20 Mbps	32-100 Kbps
Traffic	Continuous	Bursty	Continuous	Continuous

One-size-fits-all protocols and design

- are used by wired networks $\rightarrow$ poor results;

- do not work well $\rightarrow$ Crosslayer design.

Crosslayer Design

It's made of 5 layers:

Application
Network
Access
Link
Hardware

$\rightarrow$ Meet delay, rate and energy constraints

$\rightarrow$ Adapt across design layers

$\rightarrow$ Reduce uncertainty through scheduling

$\rightarrow$ Provide robustness via diversity

1.2   Wireless Systems

There are different types of current wireless systems:

- Cellular Systems;
- Wireless LANs;
- Satellite Systems;
- Bluetooth;
- Ad hoc Wireless Network;
- Mesh Network;
- Sensor Network;
- Distributed Control Network;
- MANET/VANET/FANET;
- Underwater Networks;
- RFID;
- Nano-networks;
- . . .