Mobile and Wireless Networks

Assignments – Winter Semester 2024

6/11

Logistics

- Mandatory Individual Assignment (30% of the grade)
- 15-minute presentation in video format
- Topics from a provided list or your own choice
- The number and content of the slides is at your discretion (… as long as the presentation does not exceed 15 minutes)
- Free "direction" (e.g., slides only with student's voice, student in front of the screen, etc.)
- Use of Greek or English (both for slides and presentation)
- Submission on e-class ("Assignments") by January 19, 2025

Topics (1/2)

1. IEEE 802.11 Networks (Wi-Fi): An overview of Wi-Fi 6 (6th generation Wi-Fi) and Wi-Fi 7 (7th generation Wi-Fi)
2. Internet of Things (IoT) in unlicensed frequency bands: technologies and applications
3. Overview of Vehicle-to-Everything (V2X) communications
4. Challenges in implementing Unmanned Aerial Vehicle (UAV) communications over cellular networks
5. Challenges in implementing Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) applications over 5G networks
6. Cloud computing services in wireless networks
7. Wireless communications in Industry 4.0 and Beyond (Industry 5.0)
8. Digital Twins (DTs): What They Are, how they are implemented, and the role 5G and 6G networks in their realization

Topics (2/2)

9. Quantum Key Distribution (QKD): Description and Applications in 5G and 6G Networks
10. O-RAN: open-source software for implementing modern access networks (Architecture, Applications, Challenges)
11. Joint Communication and Sensing (JCAS): Description and enabling features to 6G Networks
12. Artificial Intelligence in 5G and 6G networks (Needs, Benefits, Challenges)
13. Overview of the UE attachment process in 5G networks
14. Overview of the UE handover process in 5G networks
15. Overview of the PDU session establishment process in 5G networks
16. Access Traffic Steering-Switching-Splitting (ATSSS): Description, Standardization, and enabling features to 5G and 6G Networks.

Topic 1

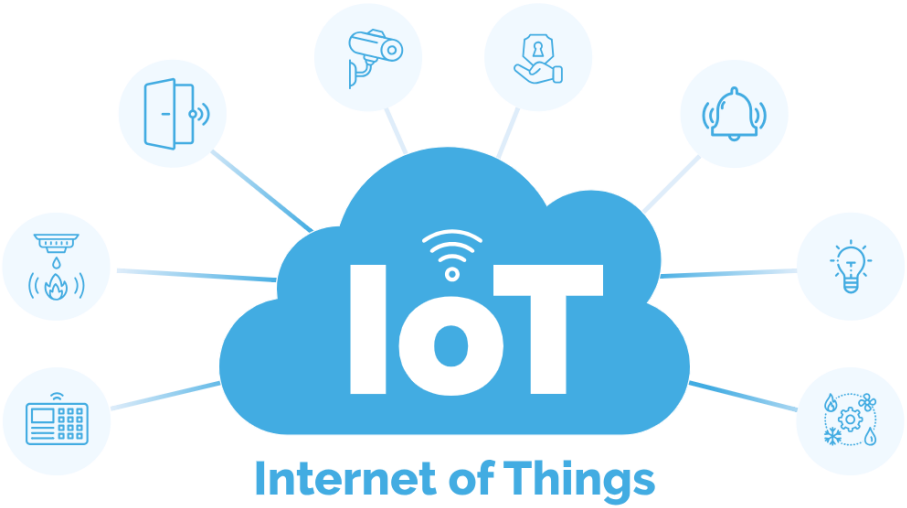
IEEE 802.11 Networks (Wi-Fi): An overview of Wi-Fi 6 (6th generation Wi-Fi) and Wi-Fi 7 (7th generation Wi-Fi)

- Characteristics
- Upgrades
- Advantages
- Challenges

Topic 2

Internet of Things (IoT) in unlicensed frequency bands: technologies and applications

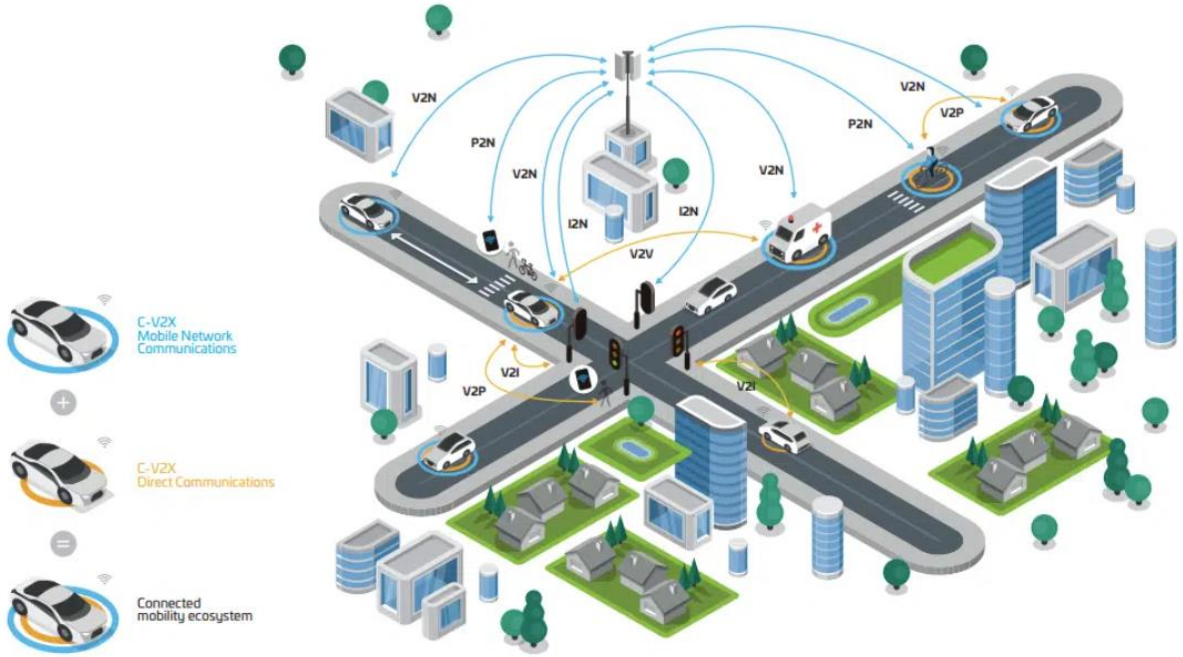
- Internet of Things (IoT)
- Description of protocols in unlicensed spectrum
- Applications



Topic 3

Overview of Vehicle-to-Everything (V2X) communications

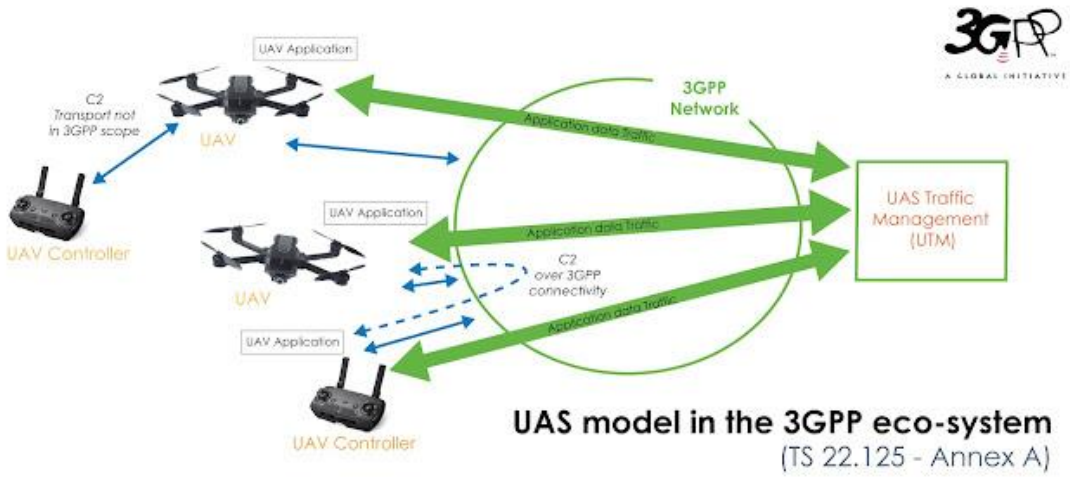
- Automotive environmental communication
- Types (V2V, V2I … κλπ)
- Protocols
- Advantages
- Challenges



Topic 4

Challenges in implementing Unmanned Aerial Vehicle (UAV) communications over cellular networks

- Description
- Integration with cellular networks (3GPP)
- Challenges and possible solutions

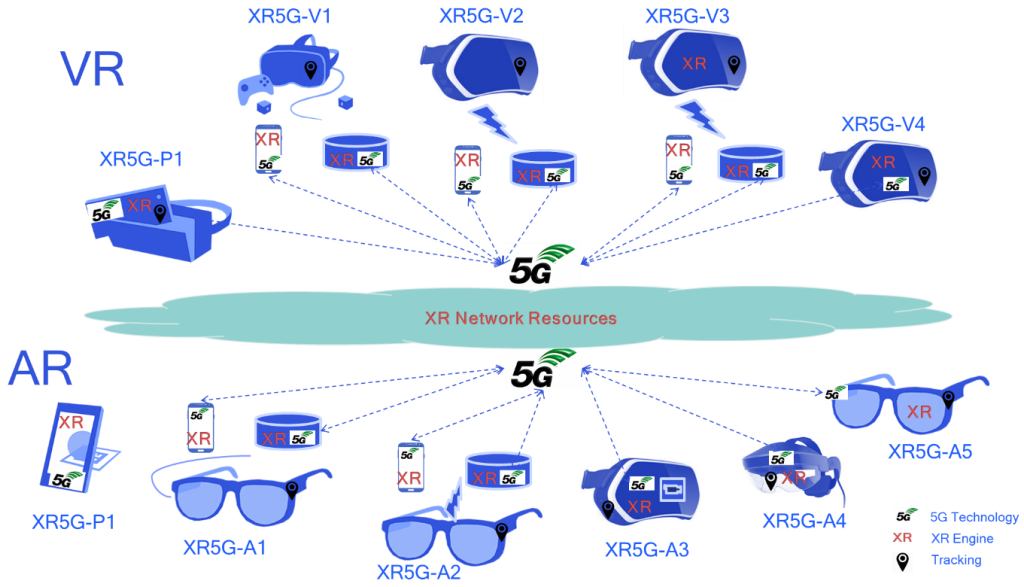


UAS model in the 3GPP eco-system
(TS 22.125 - Annex A)

Topic 5

Challenges in implementing Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) applications over 5G networks

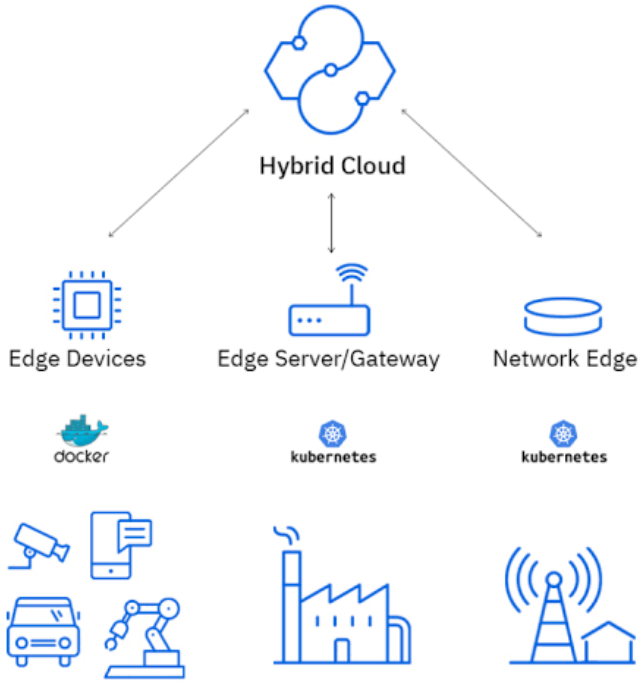
- Description of technologies
- What 5G offers
- Use cases
- Challenges and possible solutions



Topic 6

Cloud computing services in wireless networks

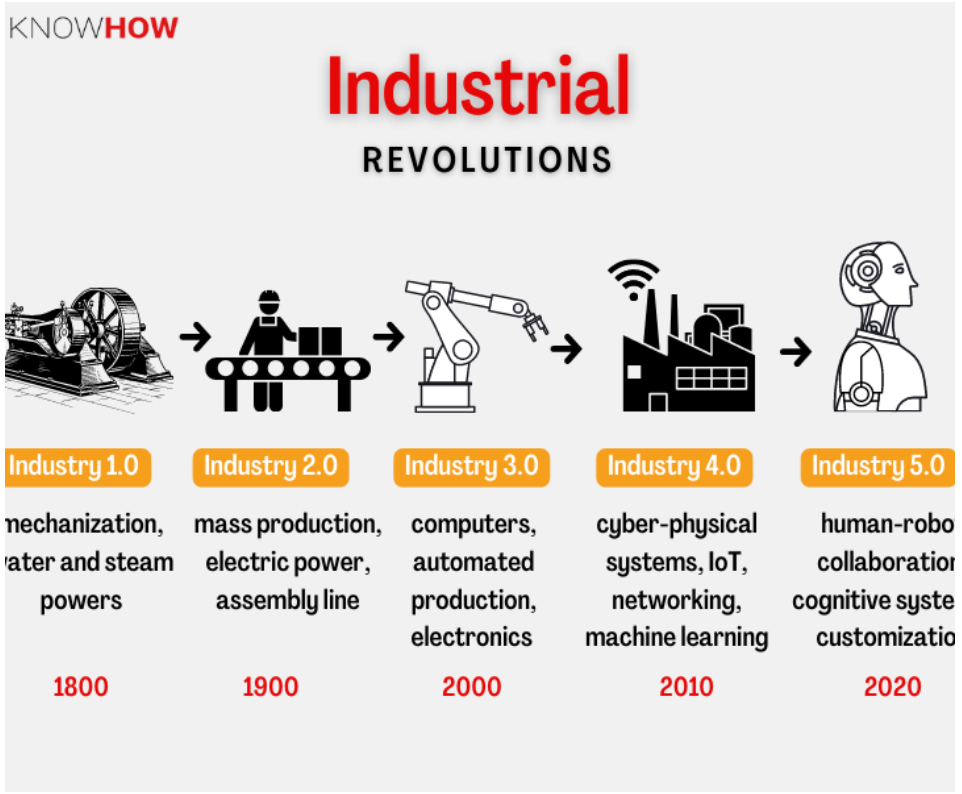
- Cloud Computing (XaaS)
- How cloud computing can support 5G
- Advantages - Challenges



Topic 7

Wireless communications in Industry 4.0 and Beyond (Industry 5.0)

- Description of concepts
- Requirements
- How 5G realizes the above concepts



Topic 8

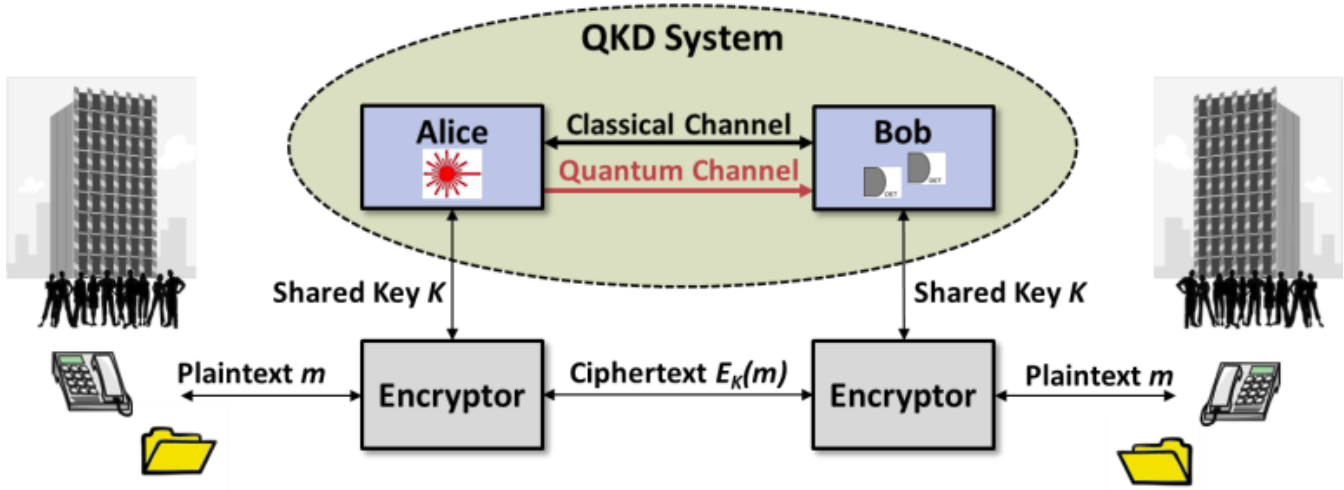
Digital Twins (DTs): What They Are, how they are implemented, and the role 5G and 6G networks in their realization

- Digital copies of systems or “objects”
- Creation, Deployment, Operation
- Types
- How 5G can support DT
- How 5G can use DT

Topic 9

Quantum Key Distribution (QKD): Description and Applications in 5G and 6G Networks

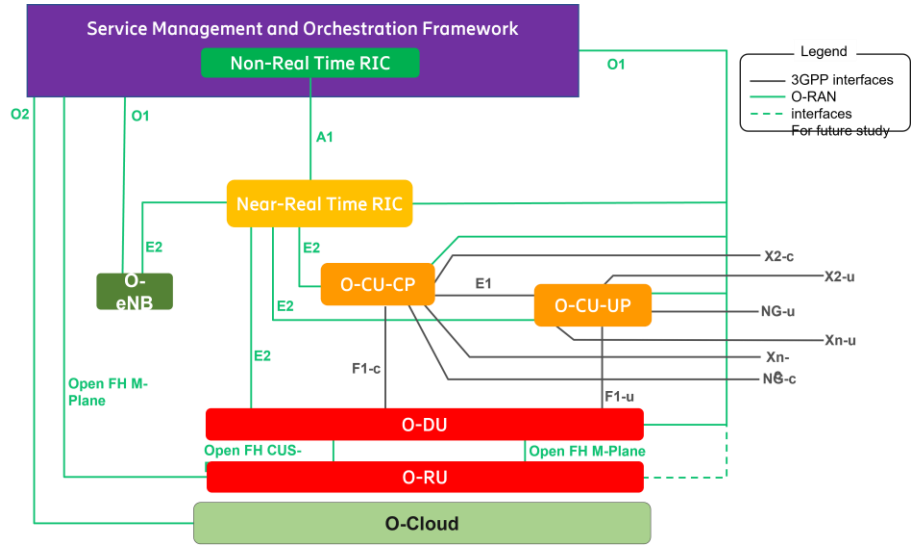
- Description
- Comparison with older security Key Distribution methods
- Integration with 5G/6G



Topic 10

O-RAN: open-source software for implementing modern access networks (Architecture, Applications, Challenges)

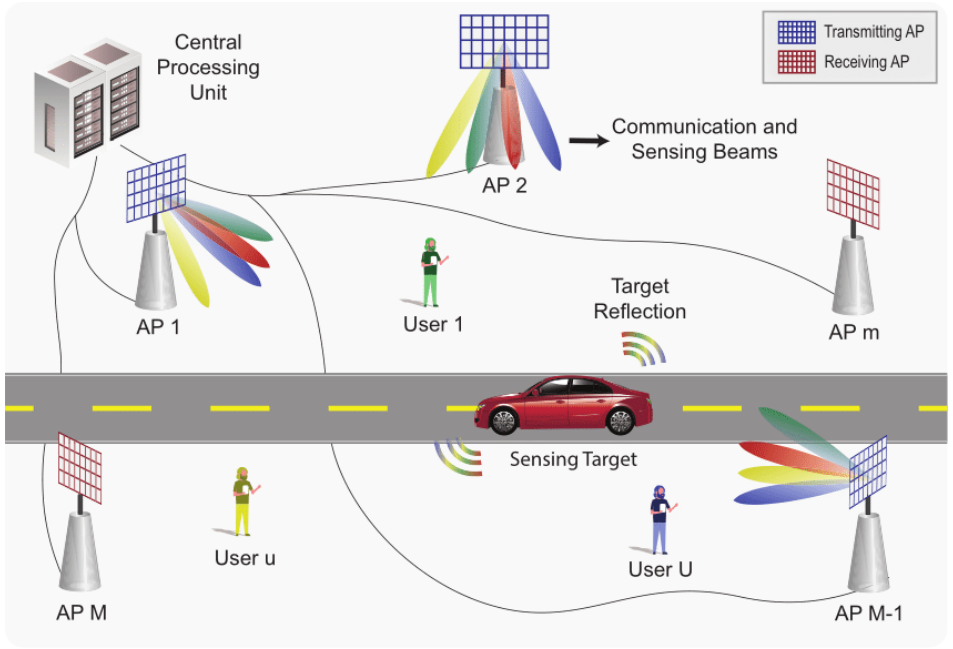
- O-RAN Alliance (Scope and Objectives)
- Architecture
- Challenges



Topic 11

Joint Communication and Sensing (JCAS): Description and enabling features to 6G Networks

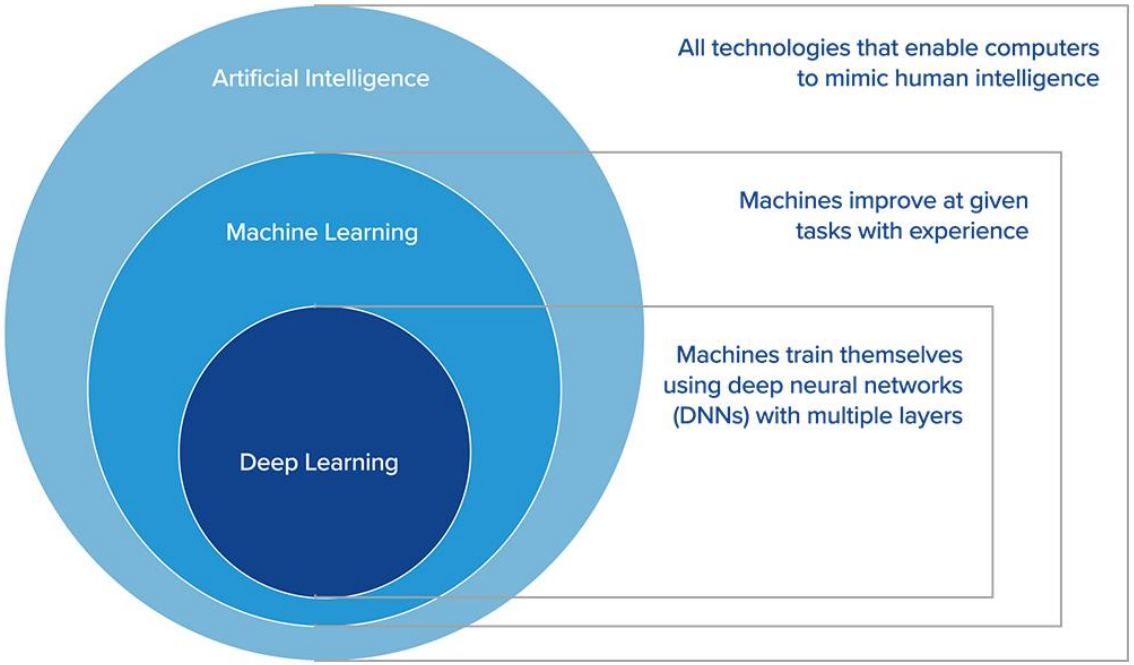
- Radar functionalities using RF signals (high-frequency)
- Use cases
- Advantages



Topic 12

Artificial Intelligence in 5G and 6G networks (Needs, Benefits, Challenges)

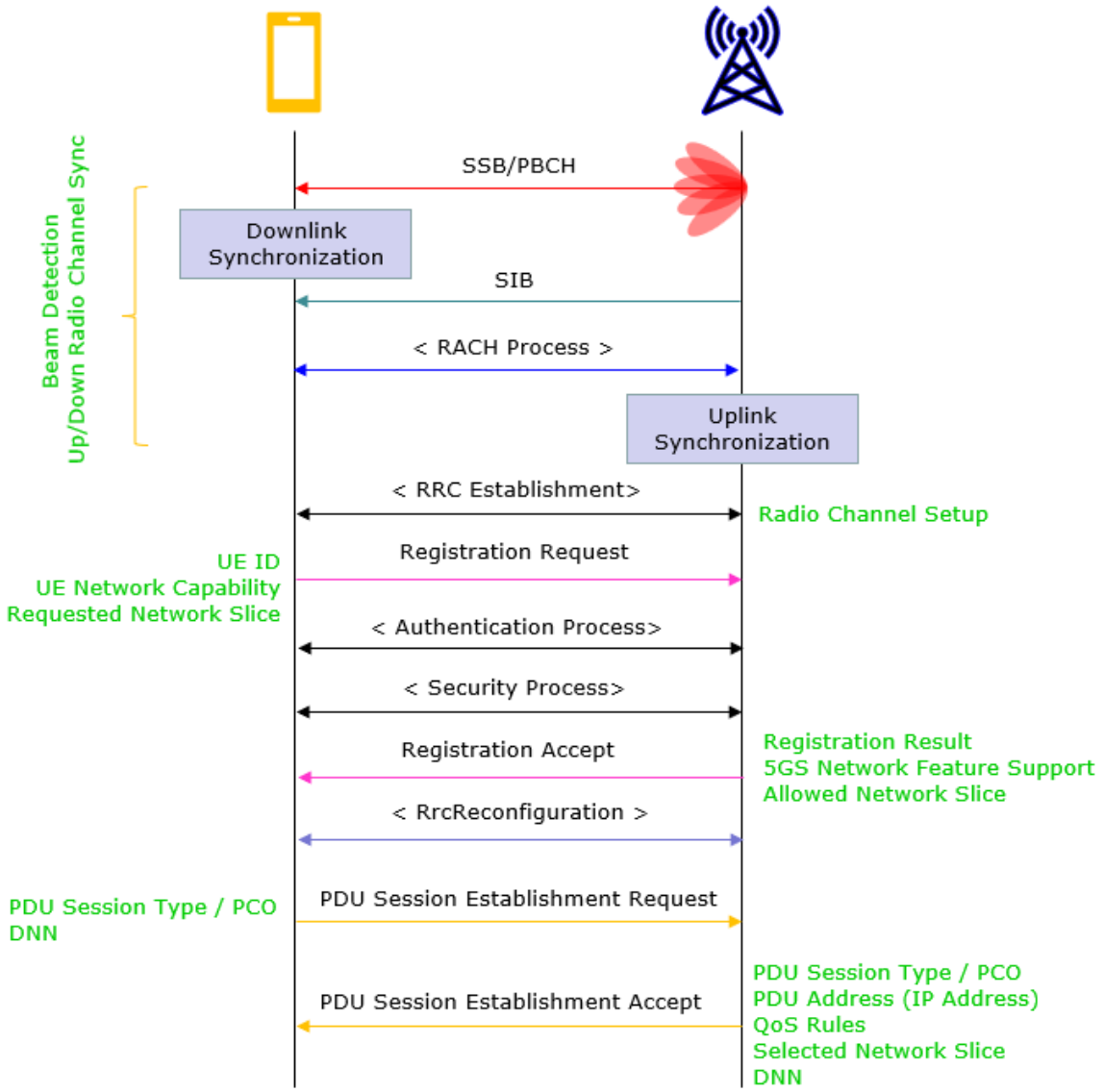
- AI Categorization
- Why AI
- Advantages
- Use cases
- Challenges



Topic 13

Overview of the UE attachment process in 5G networks

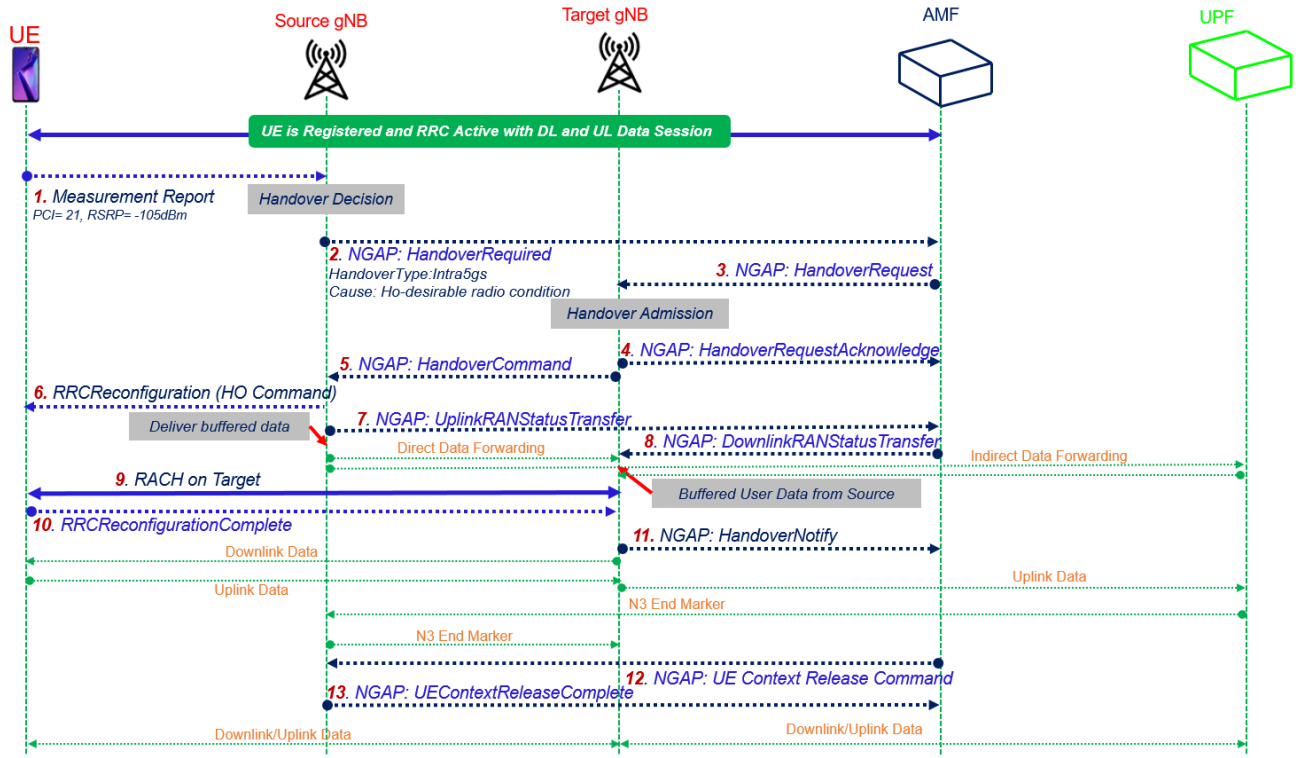
- Initial connection
- Detailed description



Topic 14

Overview of the UE handover process in 5G networks

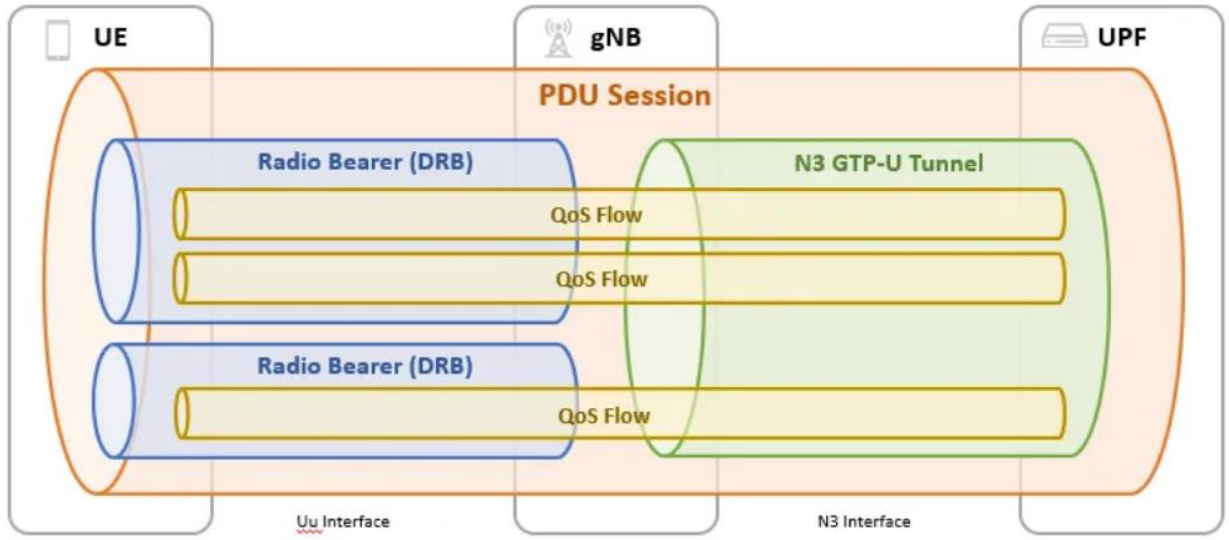
- How a UE changes serving base station
- Detailed description



Θέμα 15

Overview of the PDU session establishment process in 5G networks

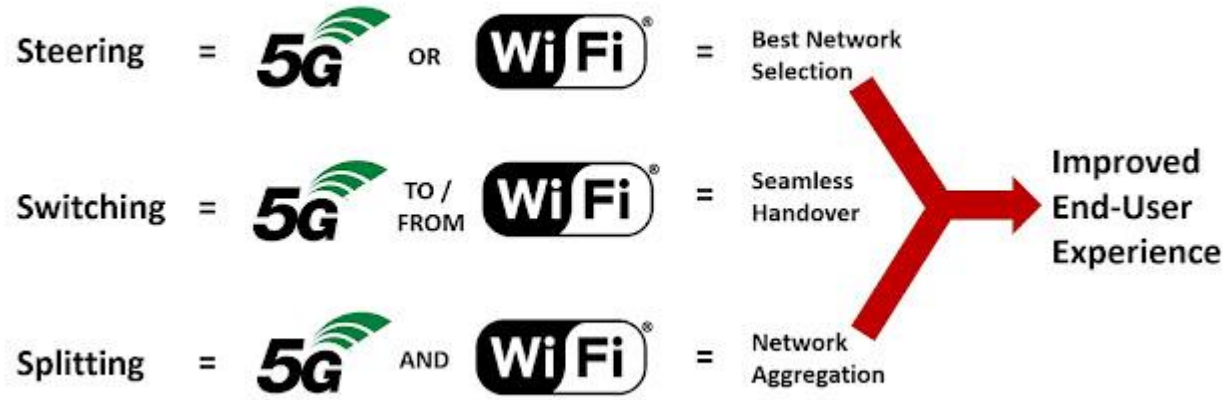
- How a UE can access network services and establish data flow
- Detailed description

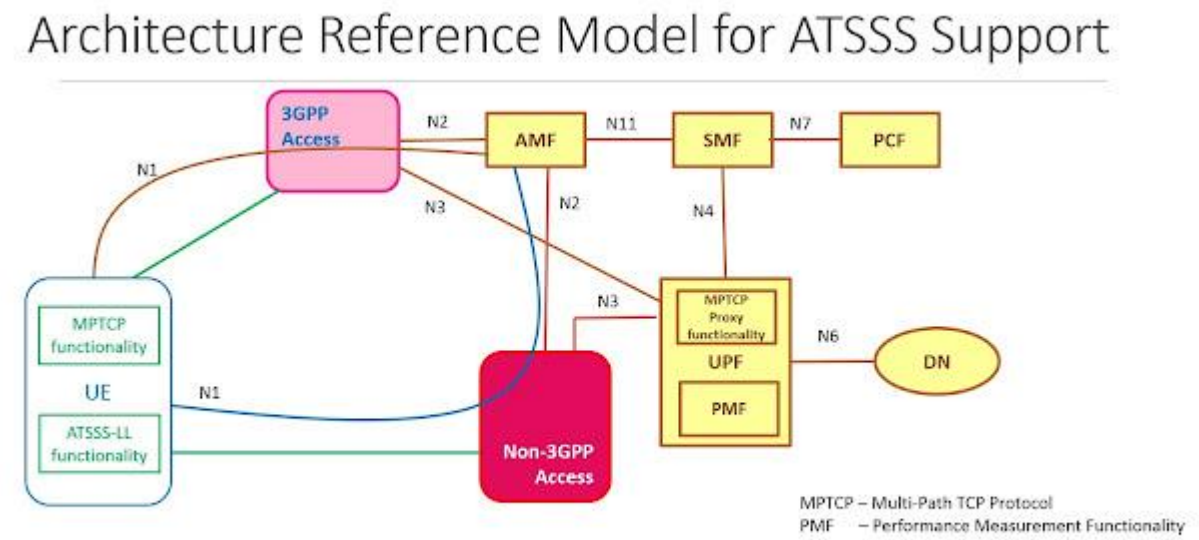


Θέμα 16

Access Traffic Steering-Switching-Splitting (ATSSS): Description, Standardization, and enabling features to 5G and 6G Networks.

- Data traffic can be served over one or more concurrent accesses through 5G core network
- Description
- Advantages
- Challenges





Based on 3GPP TS 23.501 4.2.10-1: Non-roaming and Roaming with Local Breakout architecture for ATSSS support

References

- Books
- White papers (3GPP, 5GPPP, SNS-JU, operators …)
- Review papers (IEEE Xplore – μέσω δικτύου της σχολής)
- Google Scholar
- Researchgate
- Google or ChatGPT it … Αλλά …
- At the end of the presentation, include a slide with all the references.

Tips …

- Limit text
- Use appropriate font (in size and design)
- Simple template (without too many bright colors)
- Use high-quality images, graphs, photos, etc.
- Use animation (but not too many, at appropriate points)
- Do not read from the slides
- Do a few rehearsals beforehand … ☺

Topic selection

- Each student must declare three topic choices in order of preference via email to **passas@di.uoa.gr**, so that the assignment can be made.
- There is no deadline for selecting preferences (the sooner your topic is assigned, the better for you...)

  For example:
  4. Algorithms for position detection in wireless mobile networks
  2. Multiple Access Methods in wireless networks, with an emphasis on 5th generation networks
  14. Overview of the process of connecting a terminal device to a 5G network.
- For any questions, please contact Mr. Passas.

Questions