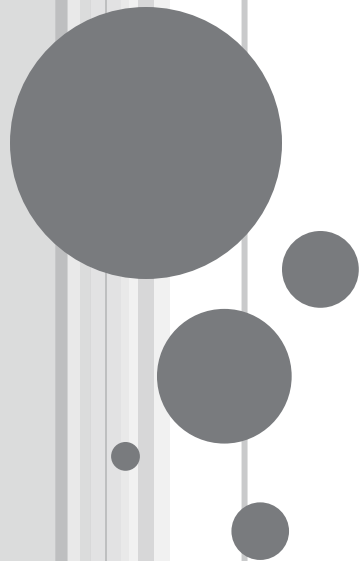


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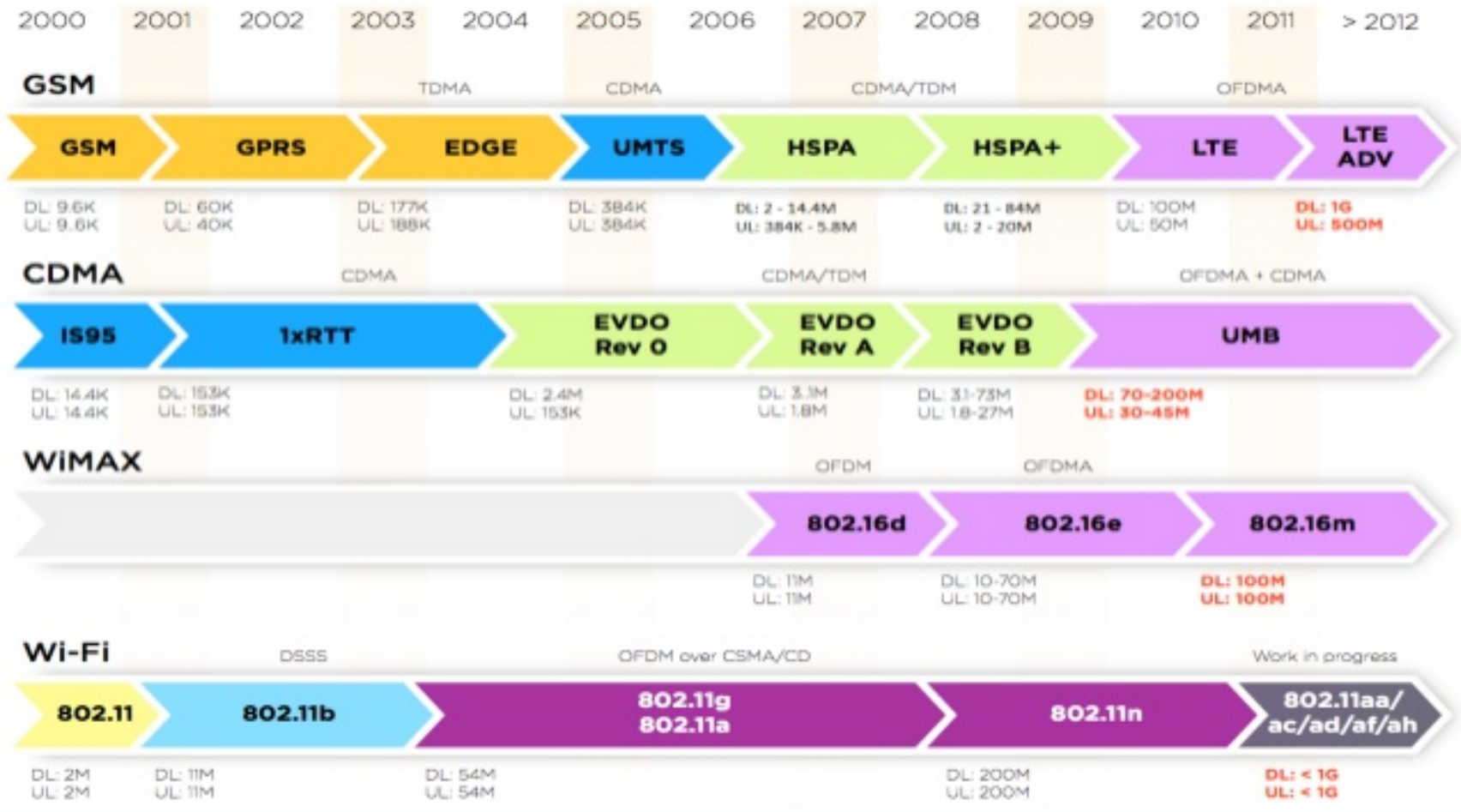


**THE 5G WIRELESS NETWORK
ARCHITECTURE: CONCEPTS AND
CHALLENGES**

Angelos Michalas



Generations of Mobile Networks



2.5G GPRS / 3G UMTS / 4G WiMax - LTE

5G Future

Integration
of access technologies
into one seamless experience



Existing technologies in 2017

3G

4G

Wifi

5G CHALLENGES

Avalanche of Traffic Volume

Further expansion of mobile broadband

Additional traffic due to communicating machines



“1000x in ten years”

Massive growth in Connected Devices “Communicating machines”



“50 billion devices in 2020”

Large diversity of Use cases & Requirements

Device-to-Device Communications

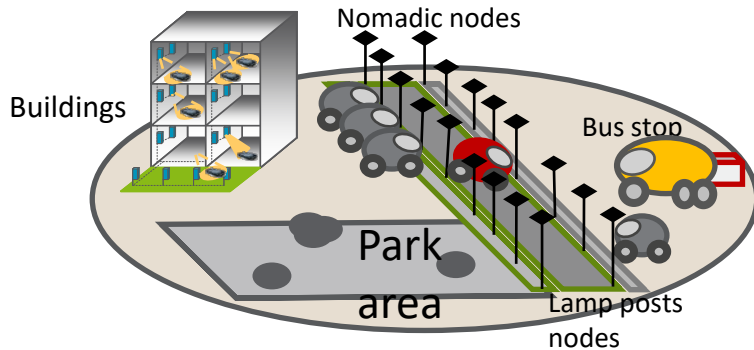
Car-to-Car Comm.

New requirements and characteristics due to communicating machines

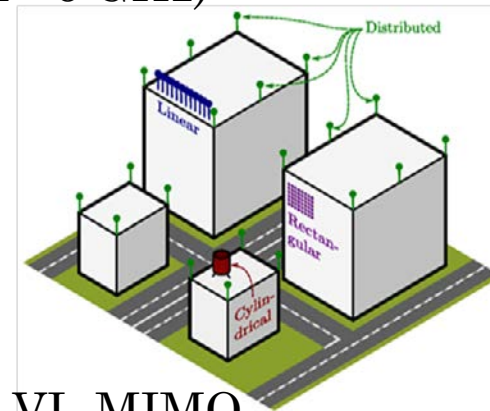
5G COMPONENTS



New spectrum bands and access methods
(primary spectrum bands between 1 GHz - 6 GHz)



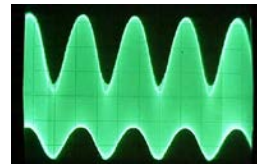
Dense and moving networks
Multi-hop wireless backhaul



VL-MIMO
Massive multi-antenna systems



Context-aware
interference and
mobility
management



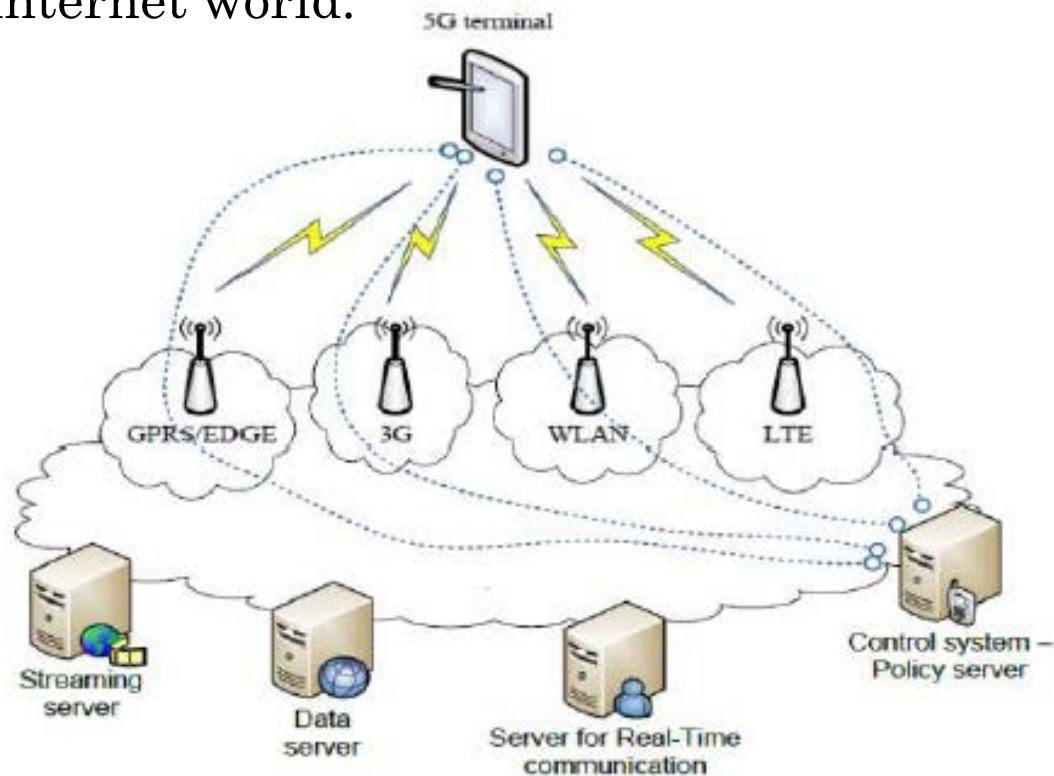
Air interfaces for
new applications
and reduced
signaling



Mobile
Device-to-device

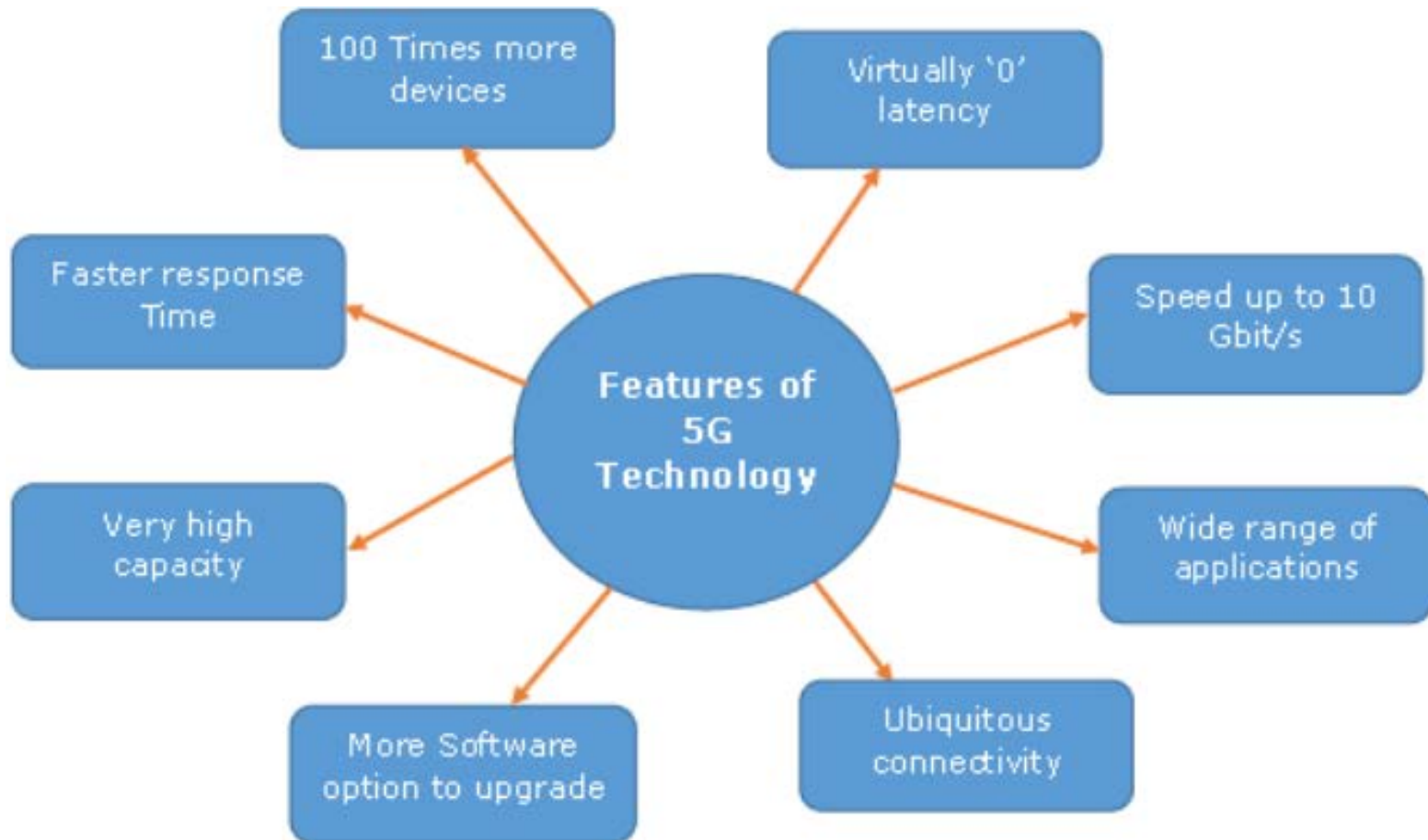
ARCHITECTURE OF 5G

- Entirely IP based.
- Heterogeneous network access environment.
- Each of the radio technologies is considered as the IP link for the outside internet world.

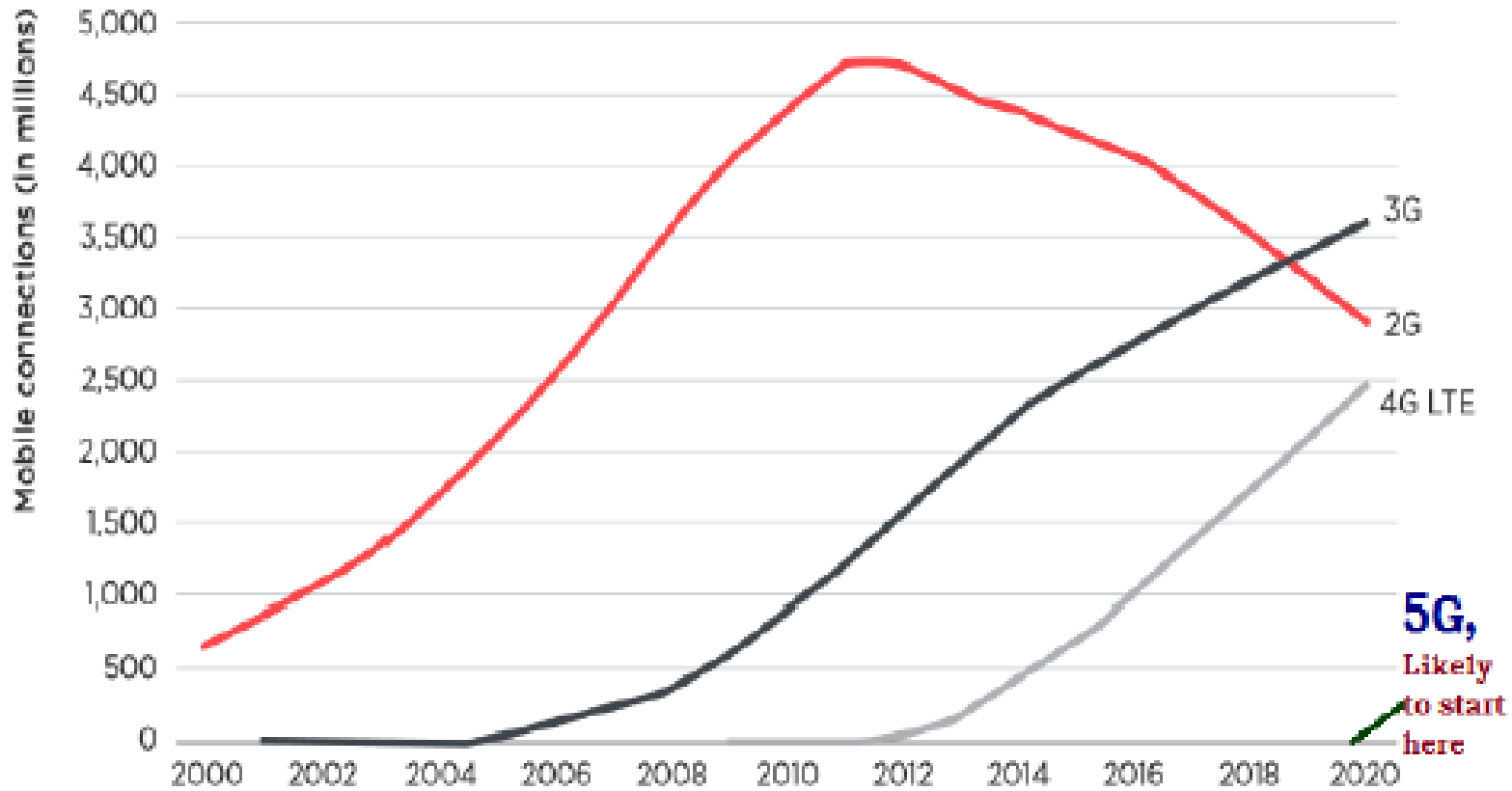


5G FEATURES

- 5G is the forthcoming revolution of mobile technology.



THE TIMELINE OF 5G



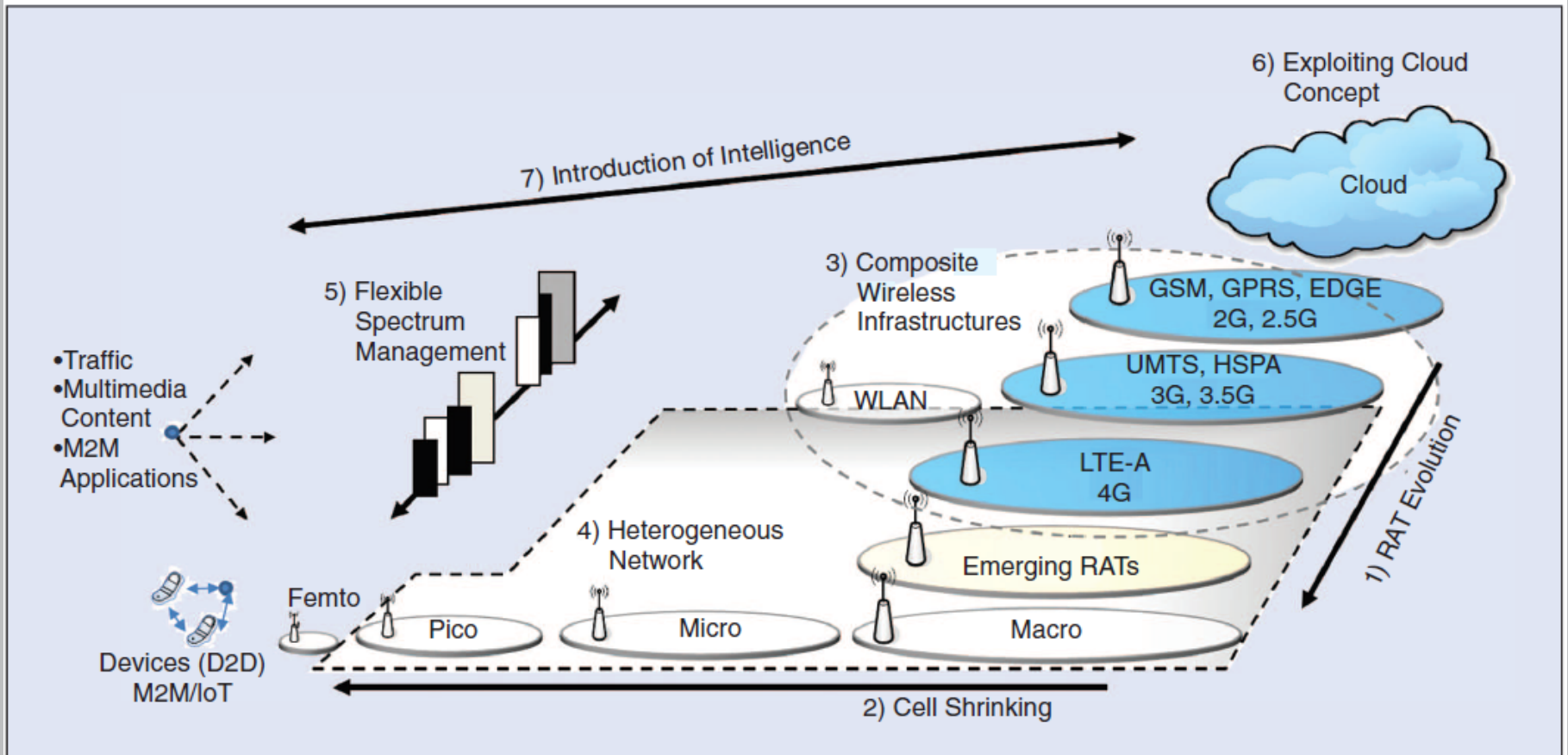
5G TECHNOLOGY ADVANTAGES

- High increased peak bit rate (Throughput).
- Larger data volume per unit area.
 - i.e. high system spectral efficiency.
- High capacity to allow more devices connectivity concurrently.
- Lower battery consumption.
- Better connectivity irrespective of the geographic region, in which you are.
- Larger number of supporting devices.
- Lower cost of infrastructural development.
- Higher reliability of the communications.



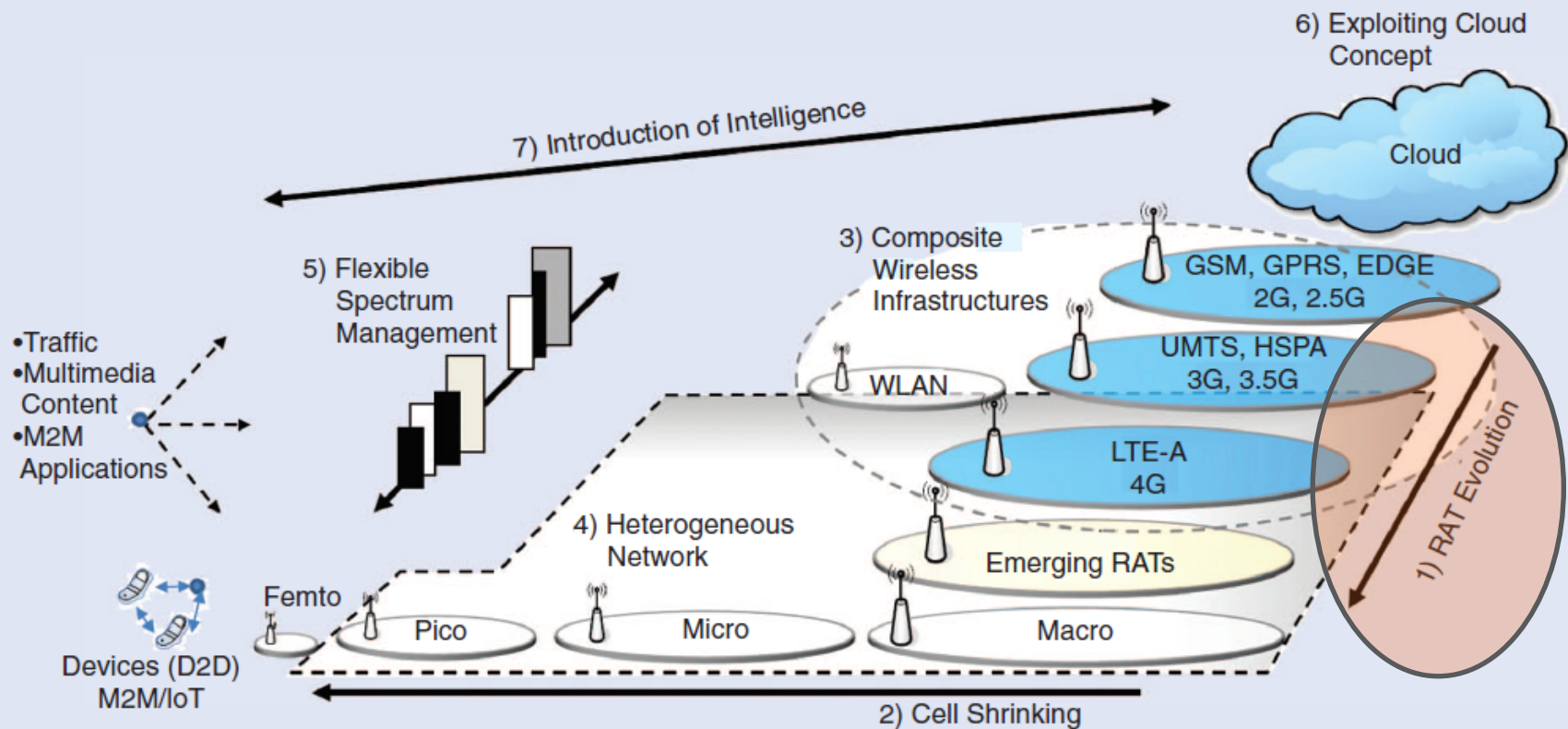
5G TECHNICAL DIRECTIONS

o 7 Technical Directions



5G TECHNICAL DIRECTIONS

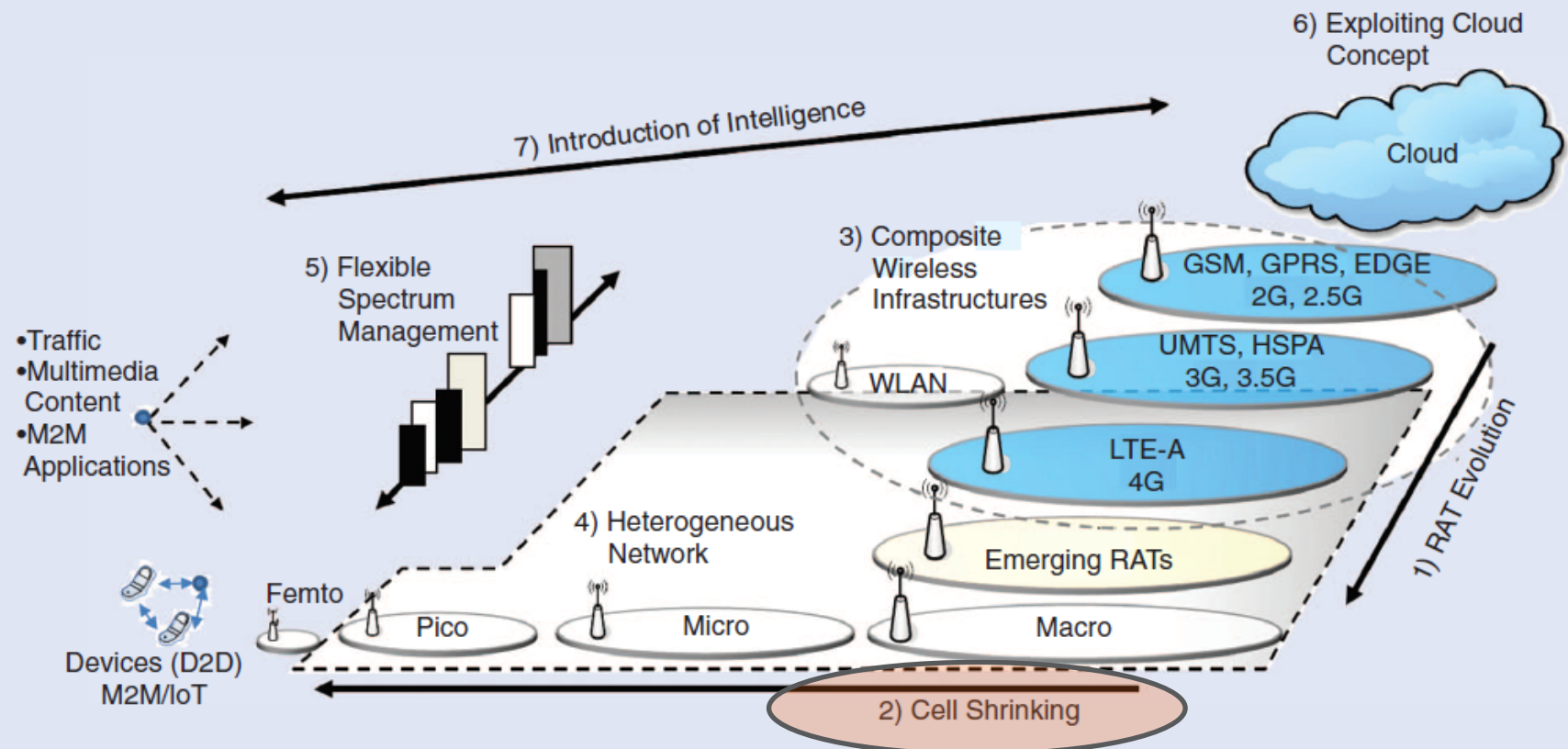
- Direction 1: Development of advanced radio-access technologies (RATs)
 - FDMA/TDMA & WCDMA => OFDMA



5G TECHNICAL DIRECTIONS

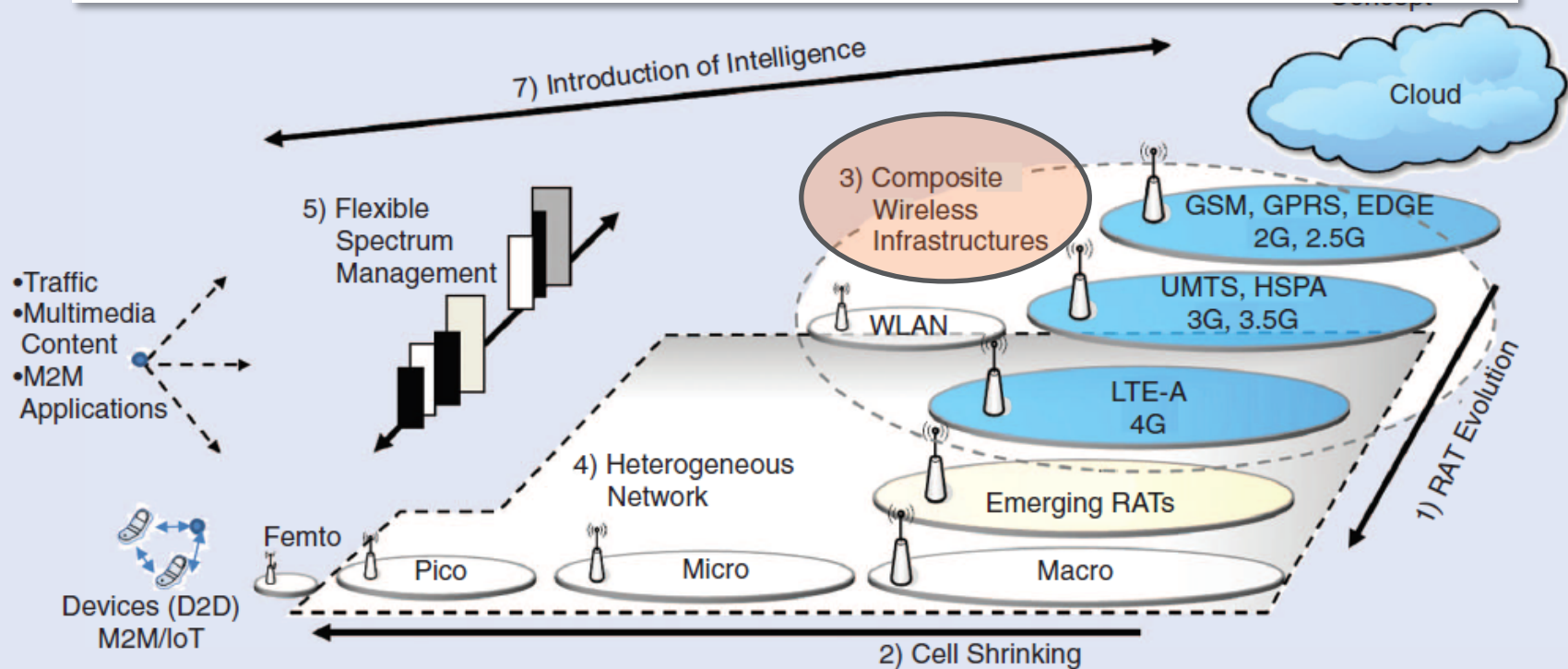
○ Direction 2: Cell Shrinking

- Decrease in the sizes of the cells that are being deployed.
 - Improving the capacity and cost of the resources that are deployed as well as resource (e.g., spectrum) use.



5G TECHNICAL DIRECTIONS

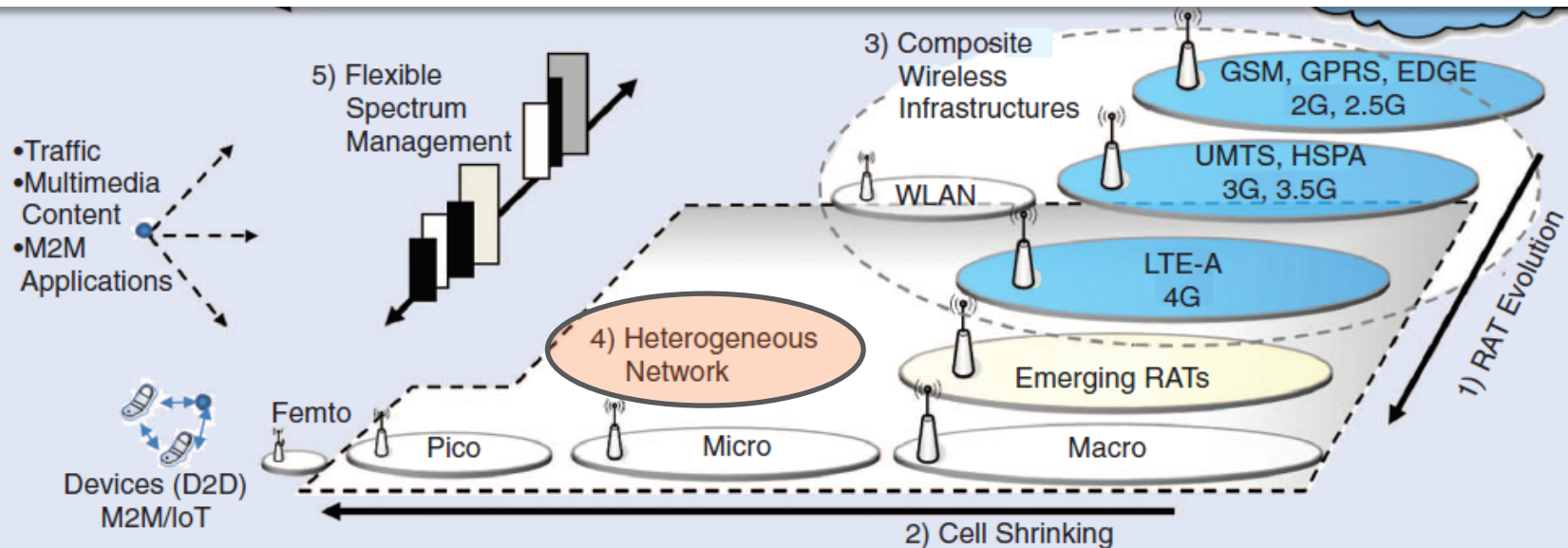
- Direction 3: Composite Wireless Infrastructures
 - Interworking of cellular systems with wireless local area networks (WLANs).
 - Improvement of application provisioning (e.g., applications that can be offered through the most appropriate wireless network).



5G TECHNICAL DIRECTIONS

○ Direction 4: Heterogeneous Network

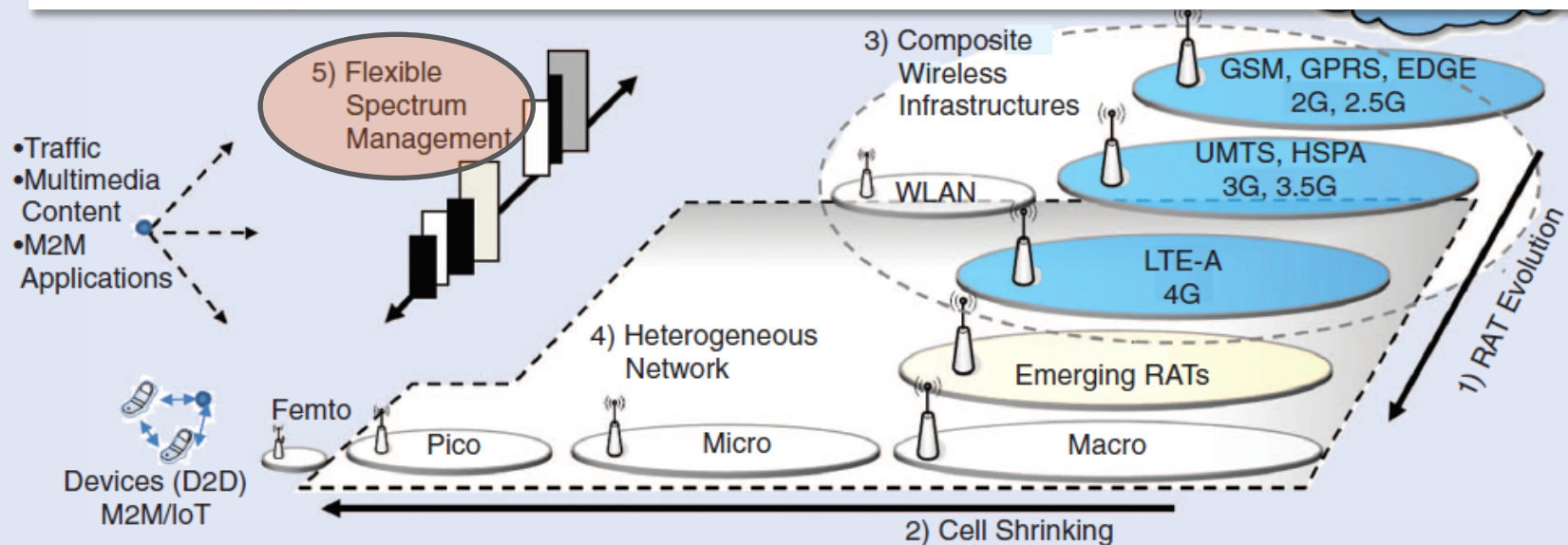
- Unlike the composite wireless paradigm (direction 3), which comprises diverse RATs:
 - A heterogeneous network is based on one cellular standard (i.e. 4G/LTE-Advanced).
 - According to the 3GPP organization:
 - A heterogeneous network may consist of different types of infrastructure elements (Base Stations - BSs).
 - Such as macro-, micro-, pico-, and femto-BSs.



5G TECHNICAL DIRECTIONS

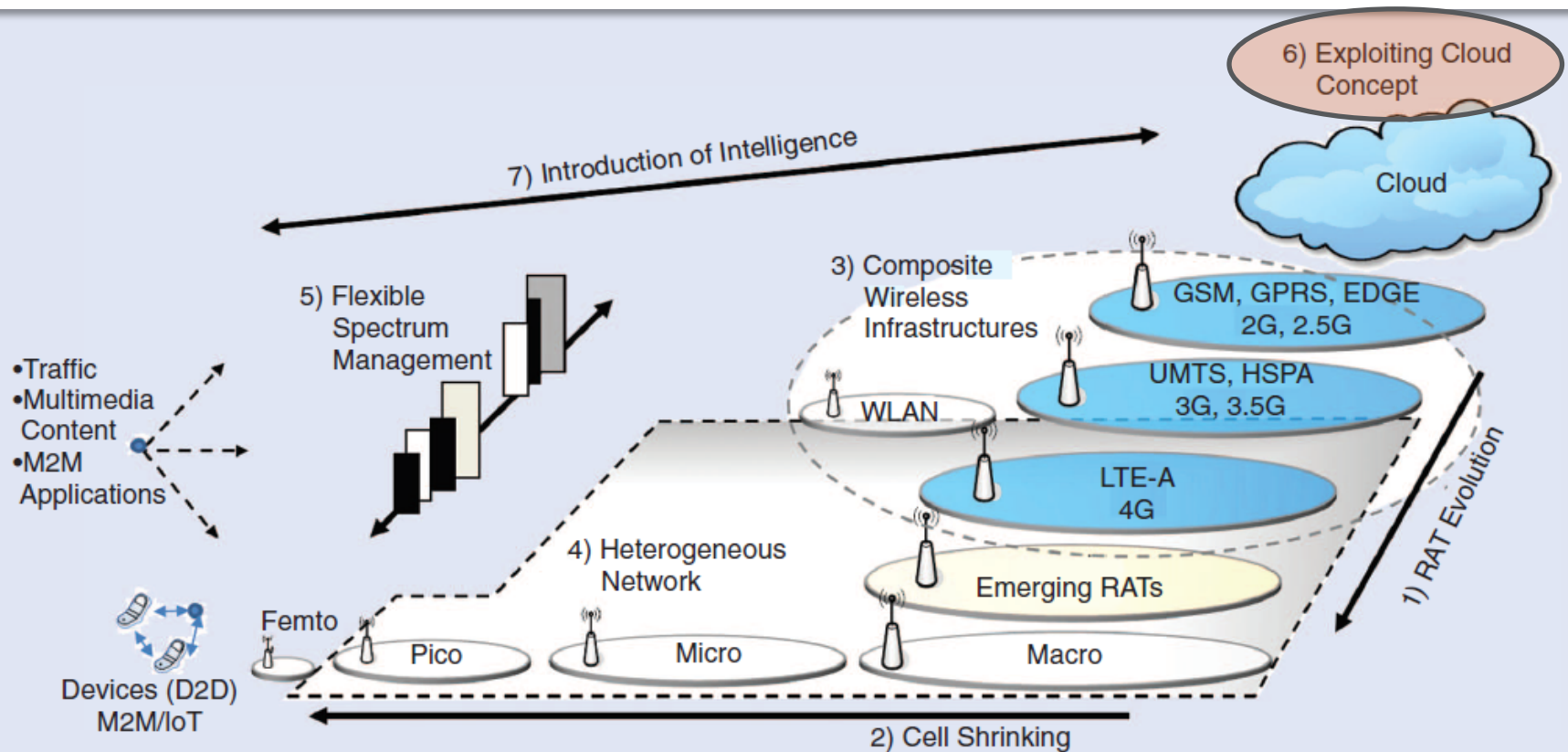
○ Direction 5: Flexible Spectrum Management

- Cognitive Radio Networking.
 - Opportunistic spectrum access
 - “Secondary users” are allowed to independently identify unused spectrum bands
 - and use them while not generating harmful interference to “primary” license holders.



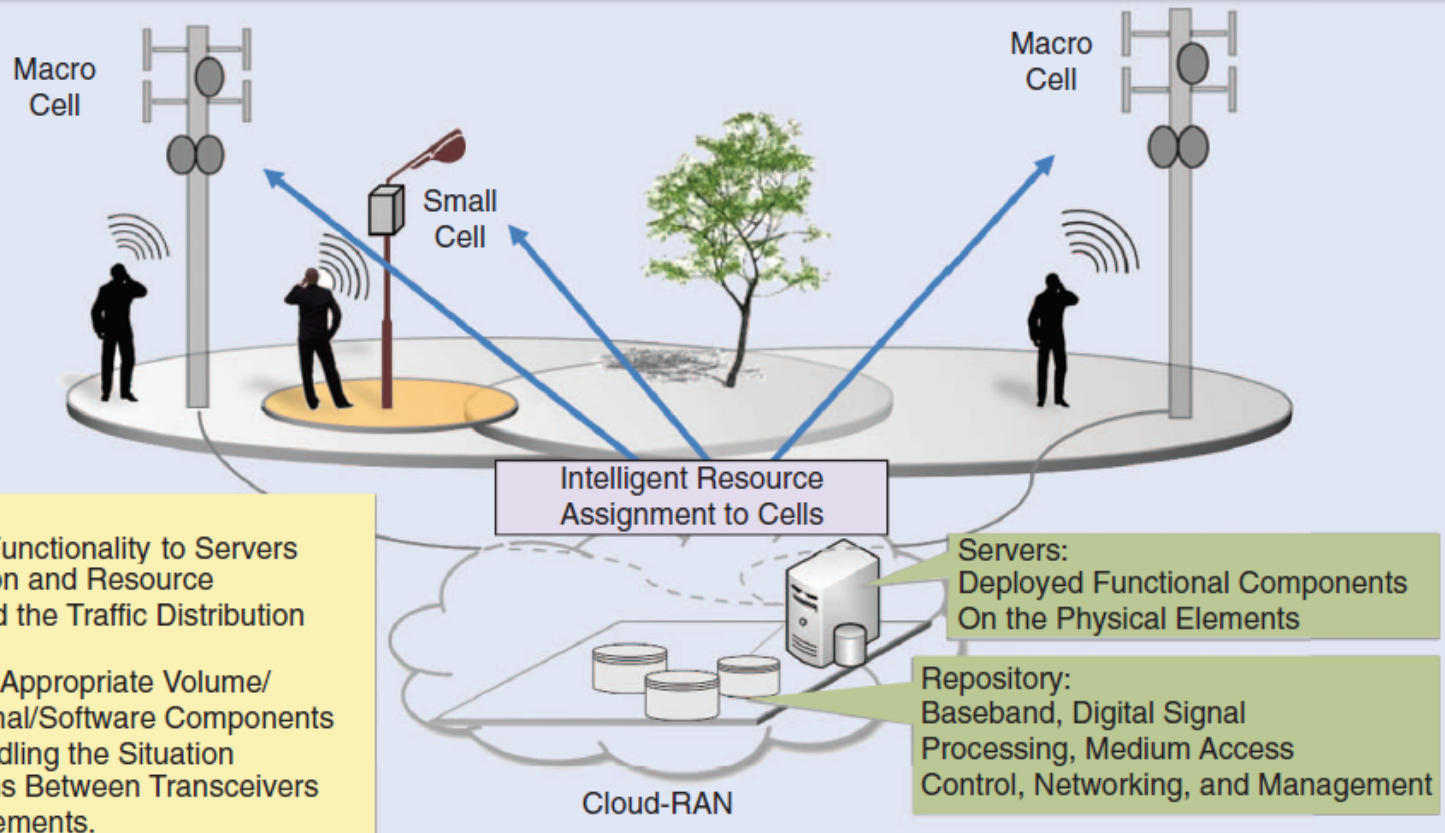
5G TECHNICAL DIRECTIONS

- Direction 6: Exploiting Cloud Concept
 - Common cloud repositories for networking functionality will be used to avoid multiple deployment of the same component.



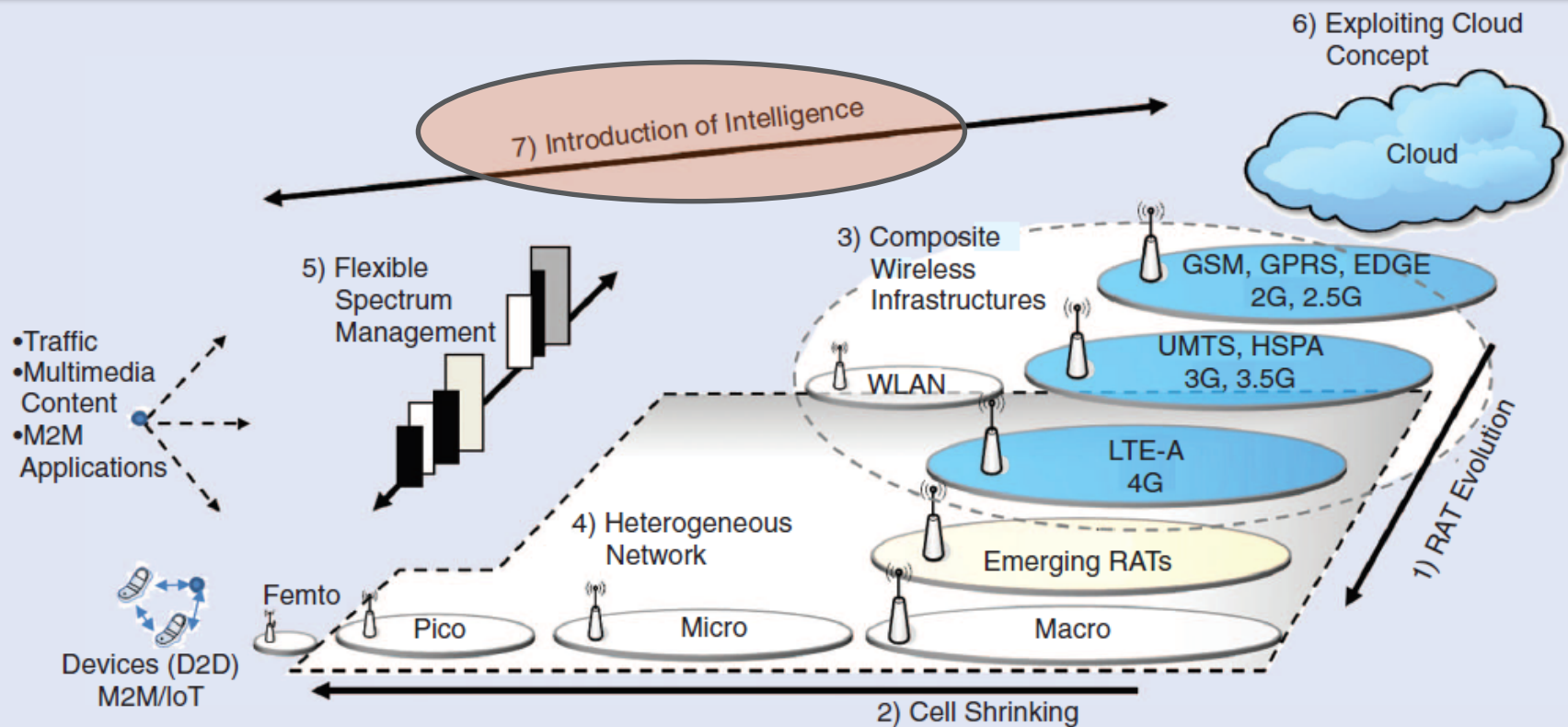
5G TECHNICAL DIRECTIONS

- Direction 6: Exploiting Cloud Concept (*An example*)
 - Macrocells and small cells (e.g., attached to lamp posts) can use shared resources by exploiting the cloud-RAN concept



5G TECHNICAL DIRECTIONS

- Direction 7: Introduction of 5G Intelligence
 - Make decisions on
 - Transceivers involved in handling the situation
 - Spectrum band assigned to transceivers
 - Transmission power per transceiver
 - Distribution of traffic to the cells involved in handling the situation



Thanks for your Attendance!
Comments, Questions?