

Smart Home in Smart Grids

(a solution waiting for the problemdefinition)

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Cosmote S.A. (OTE group of companies)



OTE Group key figures

OTE is the leading integrated telecommunications operator in southeast Europe, providing voice, mobile, TV and broadband services. OTE's strategy aims at further strengthening its market positions through successful leveraging of new technologies, active customer service and innovative marketing.

OTE Group – Key figures (FY 2016)

Revenues

€4bn

Employees

21,086

Adjusted EBITDA*

€1.3bn

Market Cap

>€4bn

Greece

Fixed Business

Total Access Lines 2.7mn

Broadband Subscribers 1.6mn

COSMOTE TV Subscribers 503k

Mobile Business

Mobile Subscribers 7.7mn

Romania

Fixed Business

Total Access Lines 2.2mn

Broadband Subscribers 1.2mn

TV Subscribers 1.5mn

Mobile Business

Mobile Subscribers 5.3mn

Albania

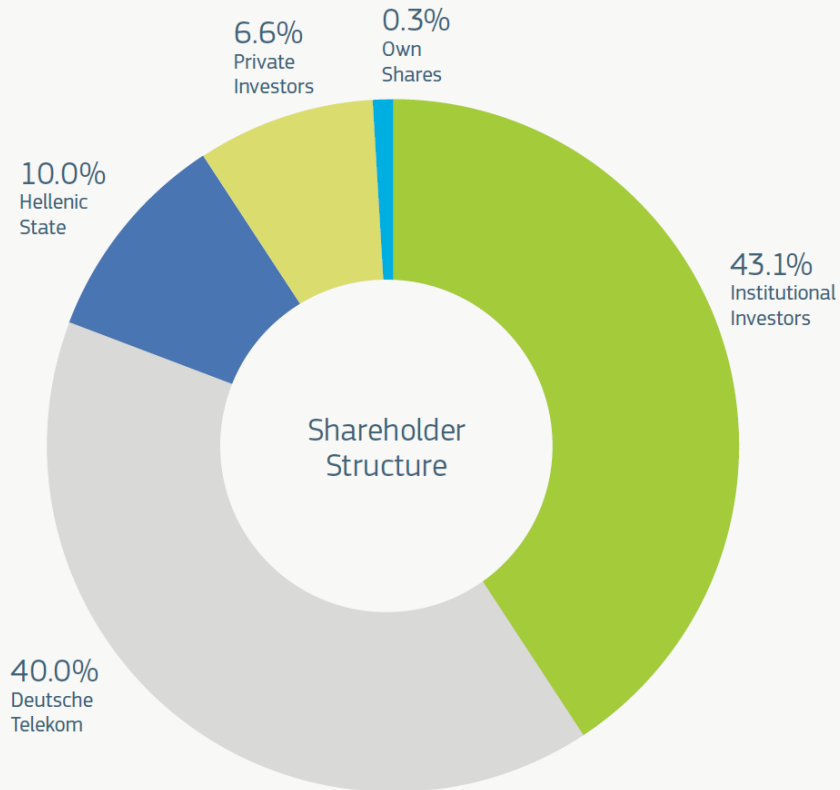
Mobile Business

Mobile Subscribers 1.8mn

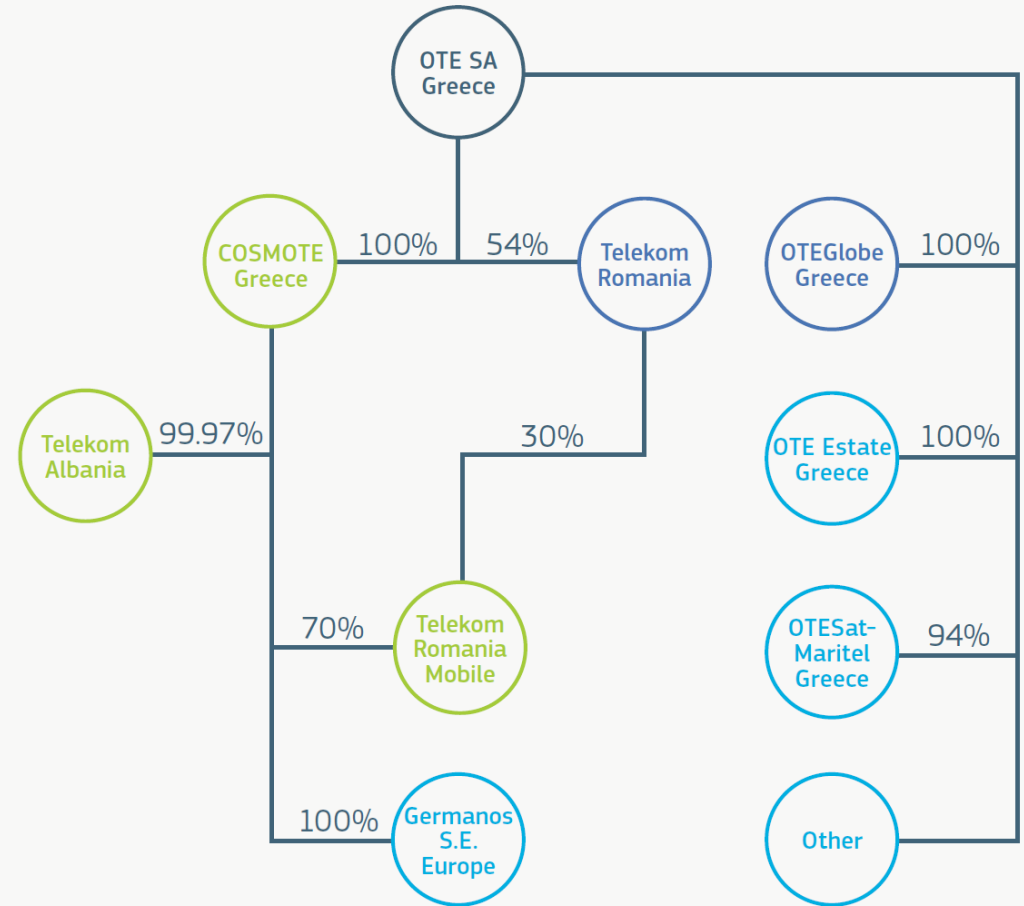
* The purpose and calculations of all 'Adjusted' data presented are detailed in the Alternative Performance Measures Section of the 2016 Annual Report of the Board of Directors:
(<https://www.cosmote.gr/fixed/documents/10280/188096377/REPORTENG.pdf/5db65e63-3109-422b-8c56-03ceaa705f2d>)

OTE group at a glance

Shareholder Structure (Dec' 31, 2016)



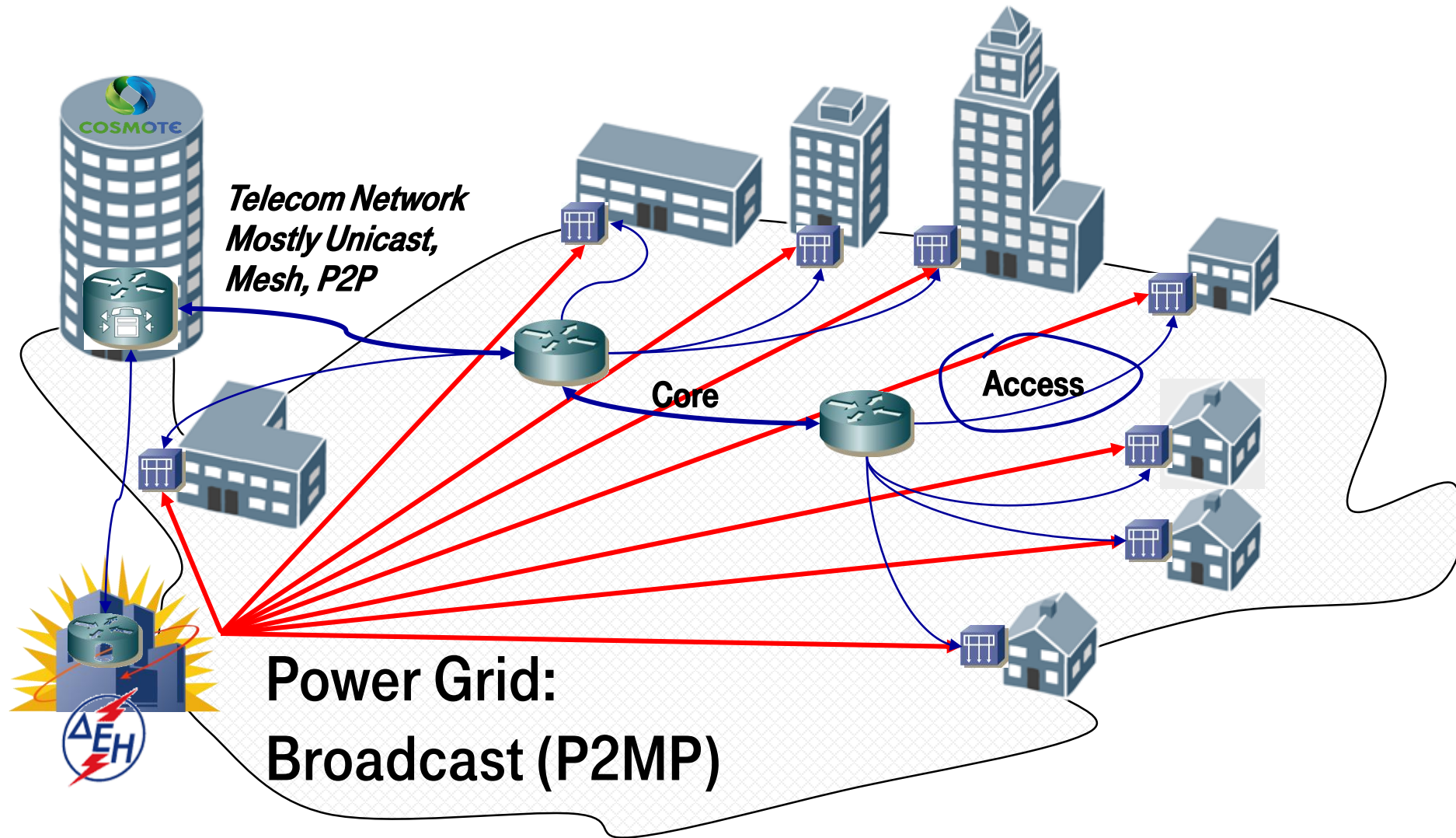
OTE Group Structure



*Including voting rights attached to 4% of shares owned by State Pension Fund and voting rights attached to 5% of shares owned by HRADF (Hellenic Republic Asset Development Fund)

● Fixed-line Telephony ● Mobile Telephony ● Other Operations

Energy Grid vs. Telecom Network (5-10 years ago)



Energy Networks vs. Telecom Network Evolution

Energy

- ❑ From P2MP to Peer 2 Peer (distributed production/storage like torrent networks – hopefully not ?)
- ❑ From (almost no storage) to Central Storage to Distributed storage (Tesla Wall)
- ❑ From Measurement to Management & Control (of load, faults, (re)distribution, demand, etc...)
- ❑ From Passive to Active (real-time reconfiguration)
- ❑ From stationary to mobile (e-vehicles.... etc.)

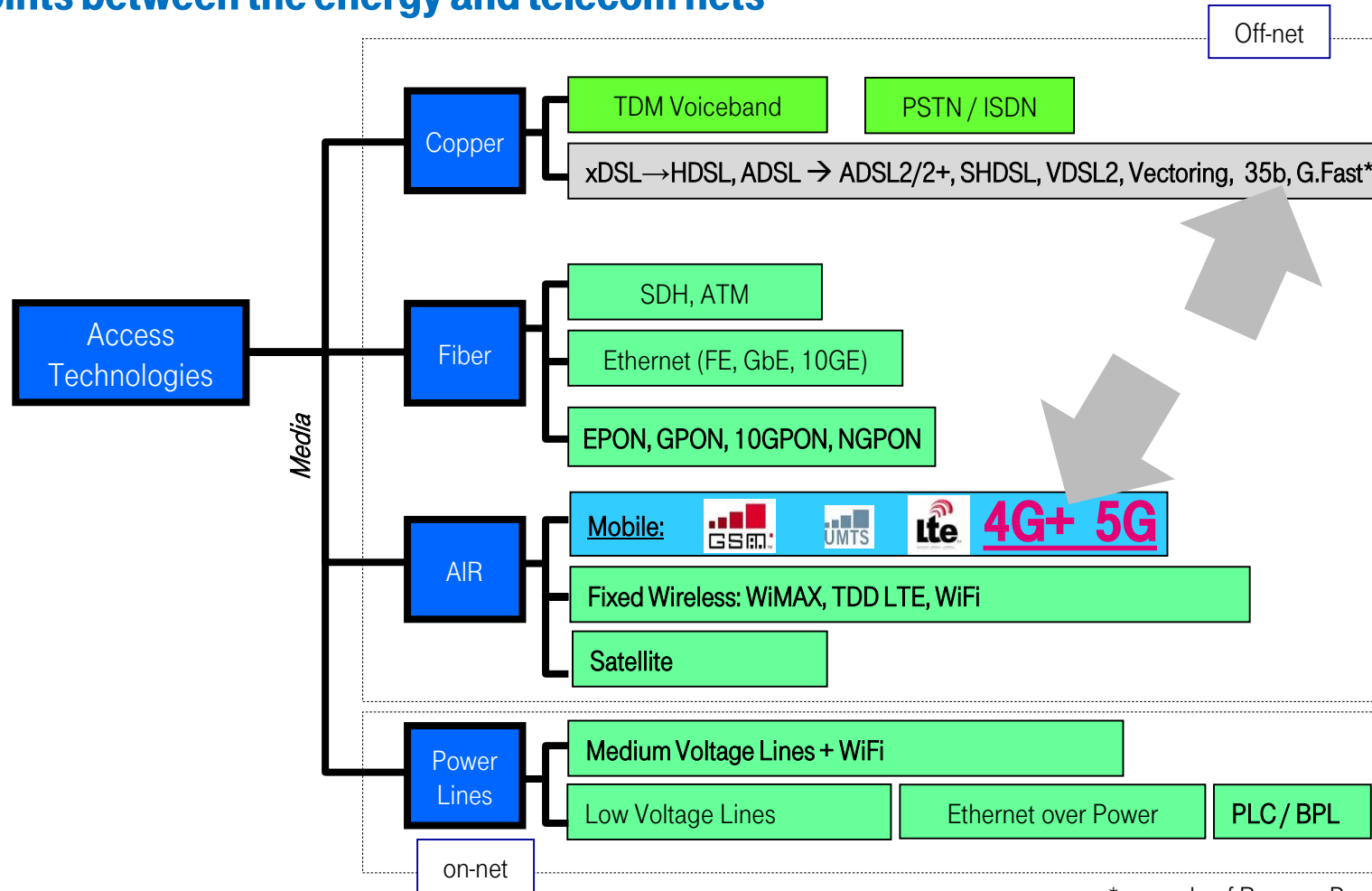
Telecom

- ❑ From Voice to Data (voice is just another service)
- ❑ From a network per service to an all-IP network for all services
- ❑ From dedicated nodes to Software Defined Network and Network Function & Service Virtualization (name me Cloud)
- ❑ From Kbps to Gbps... and beyond
- ❑ From sub-second latencies to sub-mili-second delays



Access Network Alternatives (now)

the common points between the energy and telecom nets



With 5G Communications become:

- ❑ Lightning Fast
- ❑ Ubiquitous
- ❑ Dense (i.e. for crowds)
- ❑ Super-Real-time/Reliable
- ❑ Follow the User

The network can provide :

- ❑ Guaranteed Latency (a few msec to sub-msec)
- ❑ Guaranteed Bandwidth end-2-end
- ❑ High Availability (4 to 5 9s → 99.99% or)
- ❑ High Reliability (alternative routes, multiple homing....)
- ❑ Quality of Service (QoS)



Cosmote's Communication as a Service proposal for “Smart Grid”

- ❑ Creation of an overlay communication network for the interconnection of the PowerGrid elements (off-net management).
- ❑ Utilization of different means of access depending on availability and traffic demand (Copper, Optical Fiber, Wireless Transmission etc.).
- ❑ Multiple Access Networks (including 4G+ & 5G) will be used for the interconnection of the end points.
- ❑ The IP protocol (IPv6) should be used as the least common denominator for communication.
- ❑ Create one or more VPNs (Virtual Private Networks) for communication between the “energy/utilities” grid elements.
- ❑ Agreement of particular SLA (Service Level Agreement) that will govern the performance and functional characteristics of the VPN(s)
- ❑ Use the same (hybrid) communication infrastructure but separate VPNs for the different Utilities (electric power, water, gas etc).
- ❑ Enable user/customer access to the measurements /billing via the Internet/Web.
- ❑ Ensure privacy and security of the data and “grid elements” using cryptography and Tunnel connections (i.e. IP Sec).
- ❑ Cloud infrastructure can be used upon request for hosting the Energy Players ICT needs (Management, OSS, BSS etc.)

5G and Energy Related Funded Research at OTE group

5G Related

- ❑ SESAME: Small Cells Coordination for Multi-tenancy and Edge services (OTE coordinator)
- ❑ COHERENT: Coordinated control and spectrum management for 5G heterogeneous radio access networks (OTE)
- ❑ 5G-XHaul : Dynamically Reconfigurable Optical-Wireless Backhaul/Fronthaul with Cognitive Control Plane for Small Cells and Cloud-RANs
- ❑ CHARISMA: Converged Heterogeneous Advanced 5G CloudRAN Architecture for Intelligent and Secure Media Access

Energy Related (Smart-Grid etc.)

- ❑ SmarterEMC2: Smarter Grid: Empowering SG Market Actors through Information and Communication Technologies (OTE)
- ❑ TESTBED: Testing and Evaluating Sophisticated information and communication Technologies for enabling a smartEr grid (OTE)

Not only Smart Grid but also Smart Home (micro GRID?)



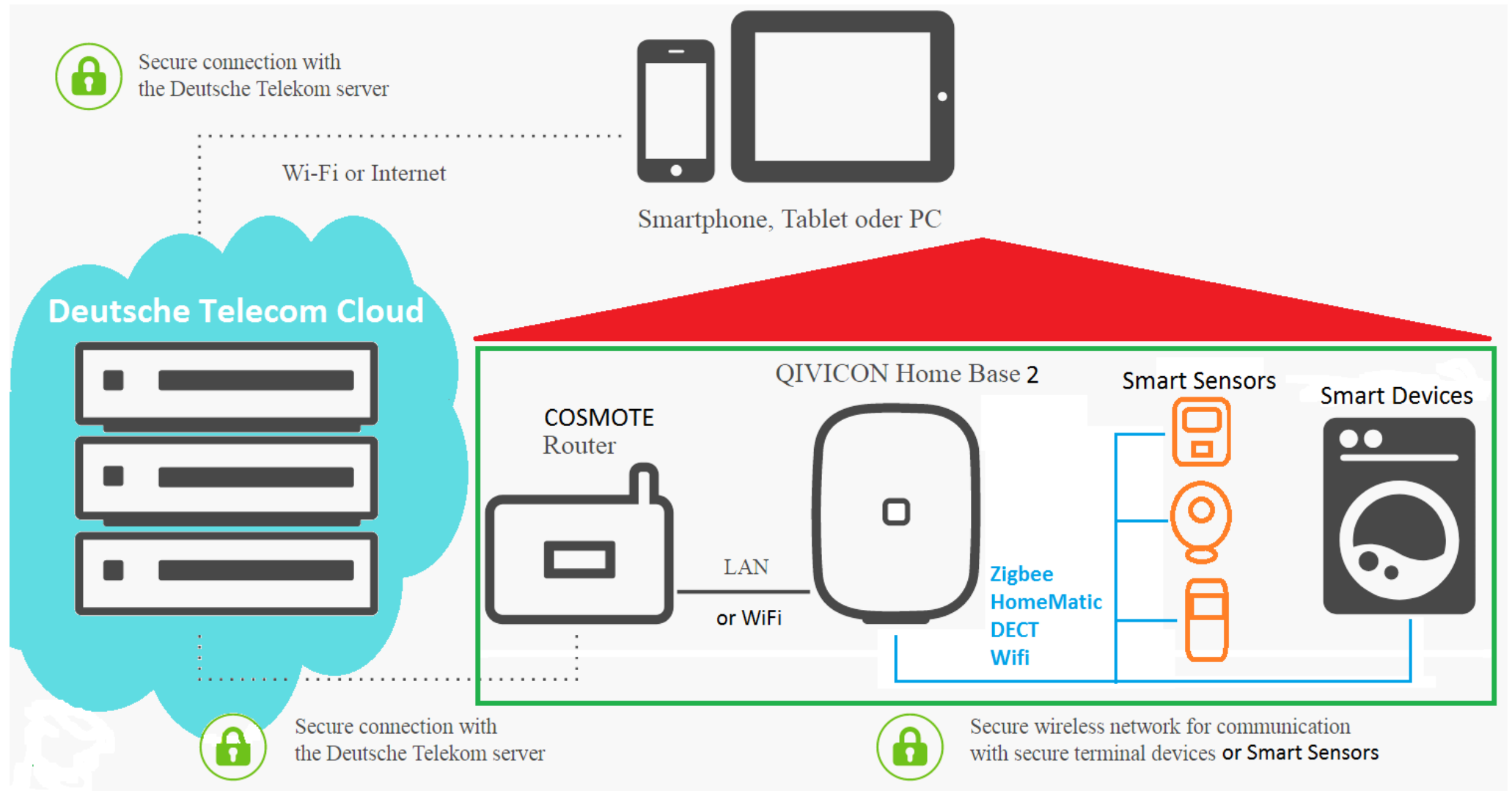
Smart home aspects



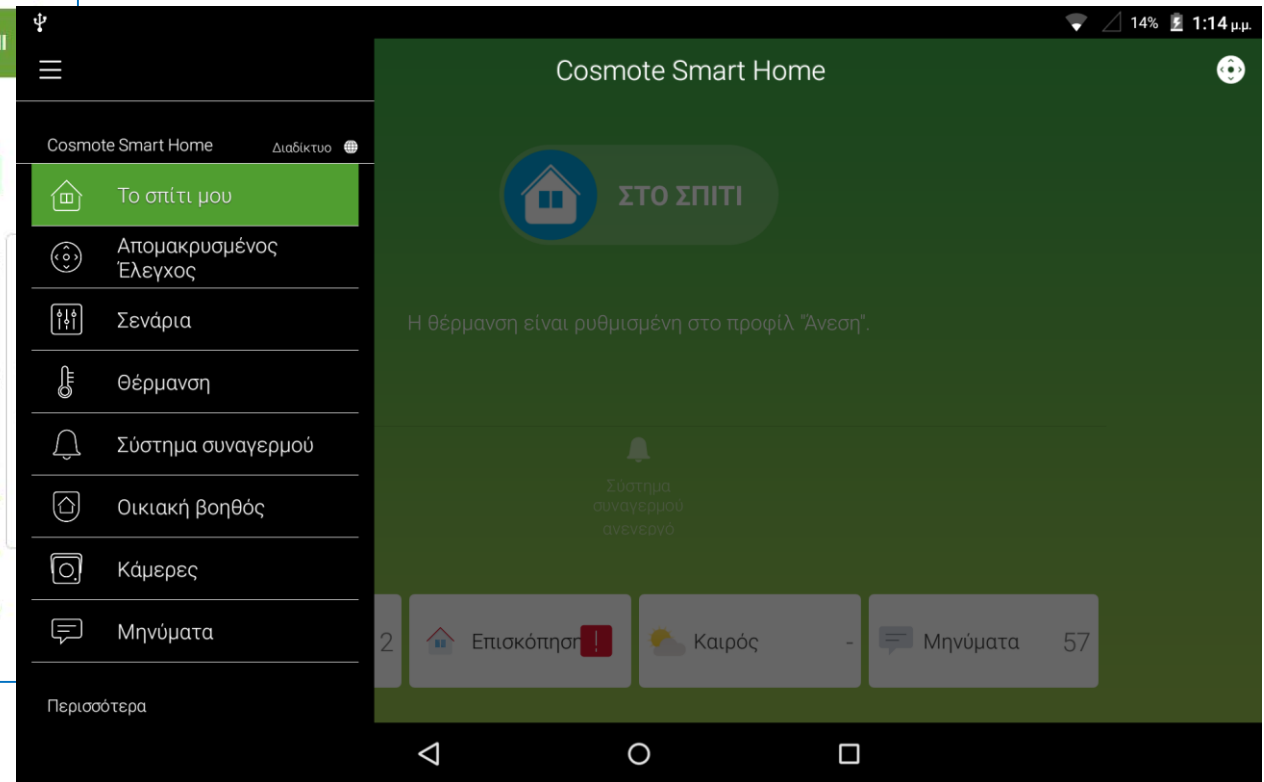
- ❑ Energy consumption monitoring and control
- ❑ Environmental monitor and control (Temp., Humidity, Light...)
- ❑ Home automation (Heating/Cooling, Lighting, Shades,)
- ❑ Surveillance and Security (Motion detection, Alarm, Video monitoring, Smoke detection, Water leakage,...)



Smart Home with Qivicon Home Base 2



Cosmote Smart Home App for iOS and Android



Home Automation with a few Clicks

