



Evolution to 5G

A convergent operator perspective

IEEE 5G Lisbon Summit, IT/ISCTE-IUL



NOS

Telecom & Entertainment

TV leader: **1.5M**

Mobile subs: **4M subs**

600k convergente subs

8.9M cinema tickets

Growth

TV subs: **+ 4.5%**

Mobile: **+13.2%**

RGUs Enterprise: **+18.7%**

Cinema: **+21.6%**

Networks

FTTH: **3.6M** Households

90% Pop 4G

2015 Results (highlights)

Revenue: **1 444 M€**

EBITDA: **36.9%**

Net Profit: **82.7 M€**

CAPEX: **408.3 M€**

Great Place to Work



Brand trust



TV + Net + Fixo + Móvel
Bilhetes de Cinema

Why 5G? By 2020 we will be pushing 4G to its limits...

Traffic @ BH

5...8x

% Video

70%

Site density (Hetnets)

>2.5x

Smartphone's penetration

>90%

IoT (# devices)

>10M

Spectrum efficiency

**Carrier Agg. +
4x4 MIMO**

4.5G/5G Use Cases (Massive IoT)

Smart metering

Digital meters, smartgrids



WIRELESS

Nos tests smart meter over new NB-IoT network

Wednesday 16 November 2016 | 11:21 CET | News

Huawei, Janz build first NB-IoT smart meter in partnership with NOS

16 NOVEMBER 2016

Smart cities

Municipalities & E-government

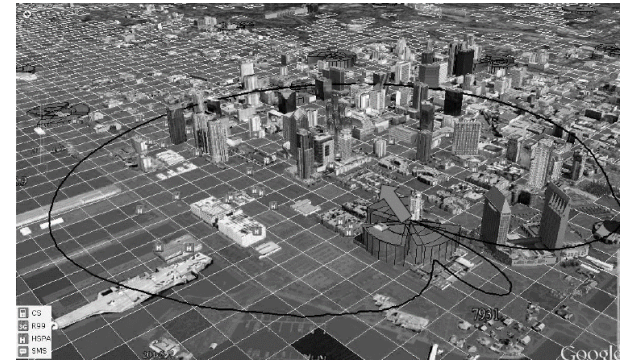


NOS, Oeiras e Nova assinam protocolo para Smart Cities

Depois de Oeiras, é a vez da Câmara de Lagoa passar a usar uma plataforma de gestão de equipamentos e sensores urbanos fornecida pela Nos.

Mobility & Assets Mgmt

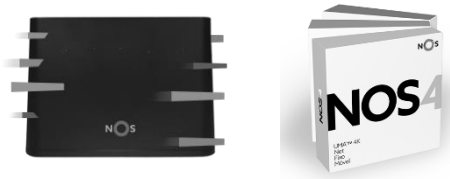
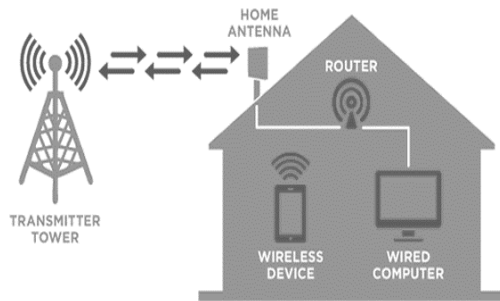
Location based information



5G Use Cases (Enhanced Mobile Broadband)

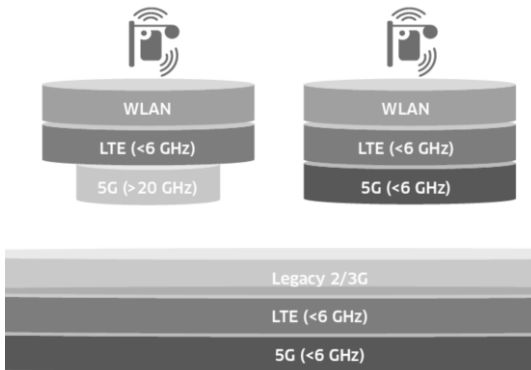
Fixed Wireless

Extending fixed services with wireless last mile



Hotspots

Solving capacity & QoE at events, public hotspots, etc.

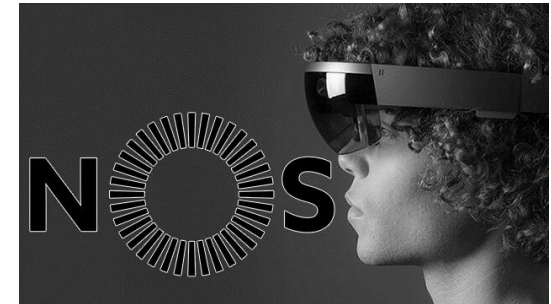


Smallcells 5G:

3.5 GHz – macro layer
 24-29 GHz – smallcells / indoor

VR/AR - Entertainment

VR – content extension, education
 AR – advertising, gaming, etc.

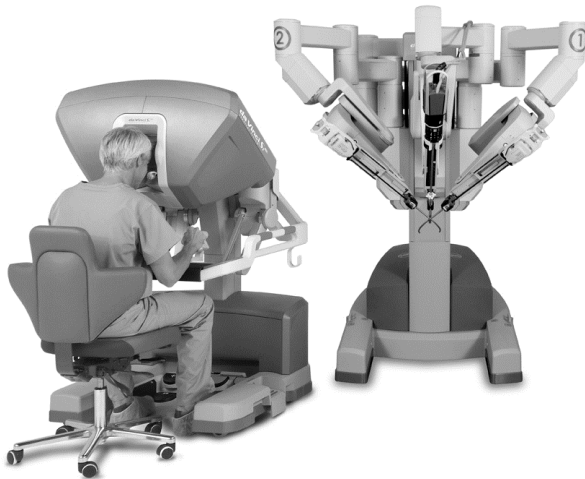


Portugal's NOS operator release
 HoloLens NOS TV app
[IDC2016, Oct 2016](#)

5G Use Cases (Ultra Reliable Low Latency)

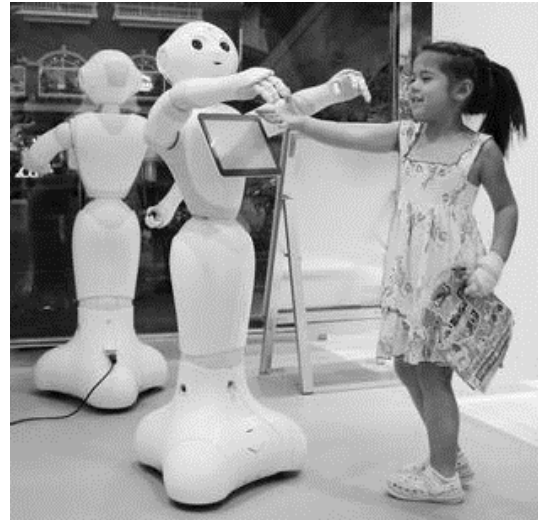
Remote Control

Machinery control, healthcare



Traffic control / safety

Vehicles & robots



Industry 4.0

Cyber-physical systems



5G architecture will fasten 4G NFV and C-RAN



Services

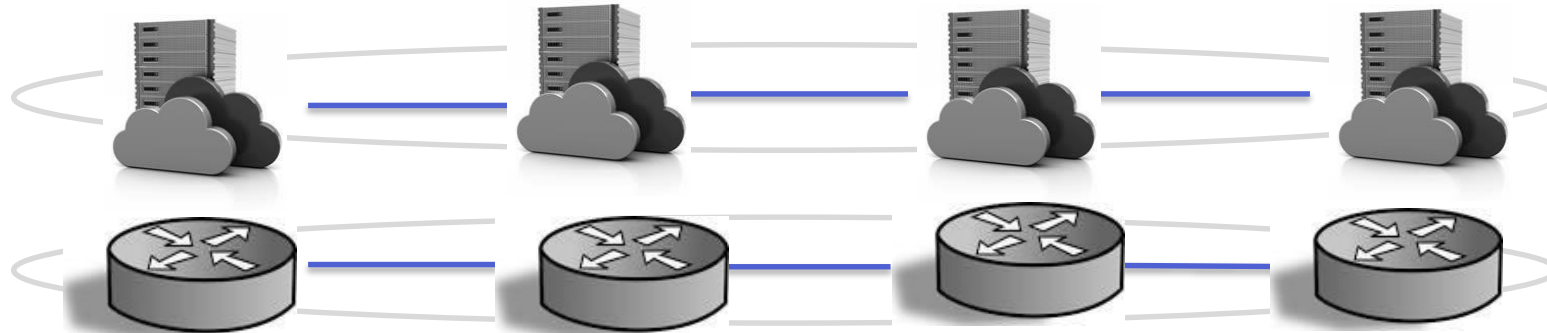
eMBB

Massive IoT

Human Interaction

Mission Critical

Slicing



NFV
CDN, EPC, DNS...

SDN
WDM, IP,...

abg WiFi na

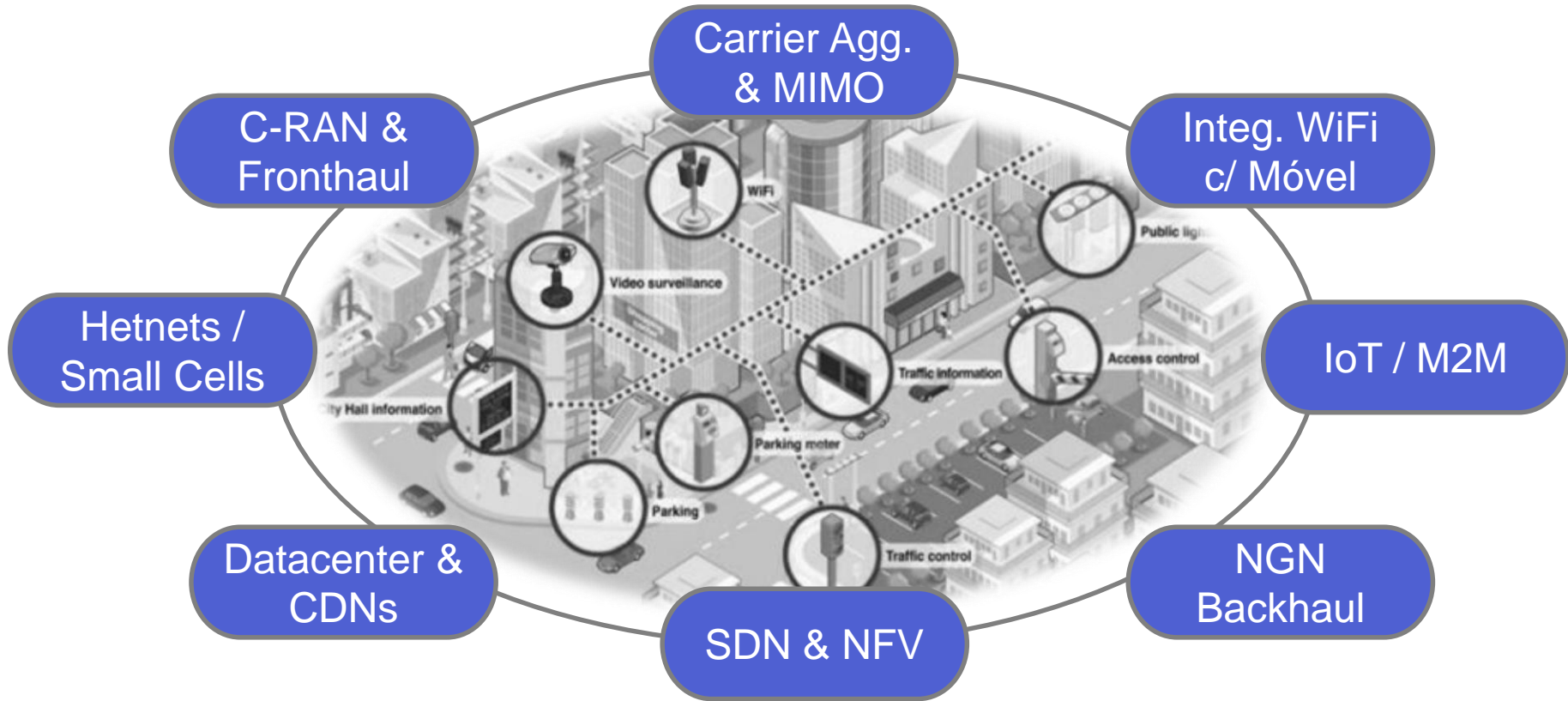
3GPP

Lte 4ADVANCED

5G

Multi-RAT

5G preparation is already happening...



Wrap-up

1

Growth over 4G seems challenging beyond 2020; even evolutions as high order MIMO will be limited by cost and implementation. A new radio (5G) is required to allow 10x more capacity

2

5G drivers are clearly growth and sustainability; new revenue streams are expected from resilient use cases and lower cost per bit will provide long term benefits

3

NOS is starting use case's prioritisation and developing respective business cases. Spectrum is key to such assessment. Current spectrum cost model strongly affects 5G attractiveness

4

5G approach is likely to be evolutive; while 4G will play a role as macro national coverage, 5G is likely to be confined to urban areas/ hotspots with specific use cases

5

5G has already started; several technologies, key to 5G are being developed and explored. NFV, SDN and RAN virtualisation are baseline for 5G architecture



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