



Delivering 5G

Investor Briefing
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Vodafone Group Plc

What is driving 5G?

New Business Capabilities

- Enabled by ultra low latency, and
- Ultra high reliability/resilience

Delivering Better Mobile Broadband

- Highly consistent, ubiquitous data rate and capacity

Service Flexibility

- Rapid service launch, support, operation and maintenance
- Scalability for billions of devices

Cost, Operation and Energy Efficiency

- Lower energy in infrastructure
- Operational efficiency, high level of automation



Consumer behaviour will change

2005



2013



Saint Peter's Basilica (election of Pope)

Source: Spiegel Online

<http://www.spiegel.de/panorama/bild-889031-473242.html>



Example applications

From
Communications to
Control



“Tactile” Internet



Ultra
Reliable



Real Time Image
Processing



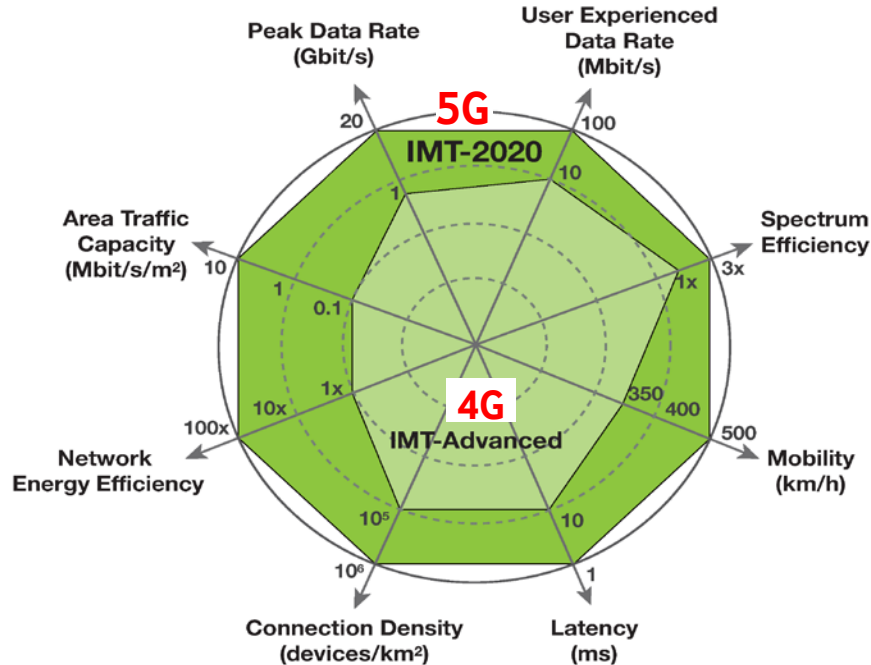
- Vehicles will become better connected offering infotainment and car-to-car services for safety purposes
- Objects can be controlled from a distance using responsive feedback
- Services will be provisioned according to individual Service Level Agreements (SLA)
- Applications will be hosted in the Cloud supporting intensive compute requirements

Illustrative Examples



International Telecommunication Union (ITU)

Vision: Framework and overall objectives of the future development of IMT for 2020 and beyond



- Significant improvements expected on:
 - Latency
 - User experience data rate
 - Capacity
 - Spectrum efficiency
 - Energy efficiency
 - ...

Enhancement of key capabilities from IMT-Advanced (4G) to IMT-2020 (5G)



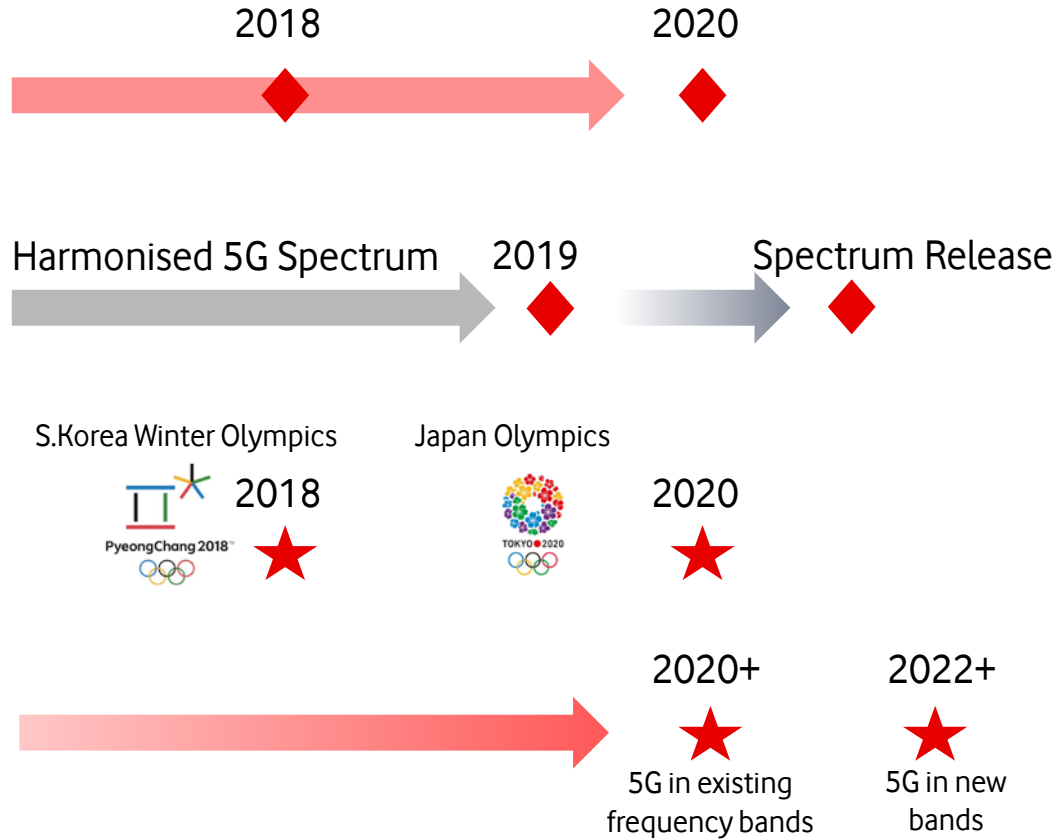
5G Roadmap

3GPP Standardisation

World Radio Conference (WRC)

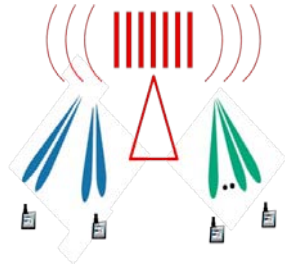
Localised Deployments

Possible 5G Deployment



5G Building Blocks

Advanced Radio



New radio waveforms

Higher speed/capacity, Lower Latency

Maximizing Spectrum Opportunities

Current Mobile Technologies
700MHz ← → 3500MHz

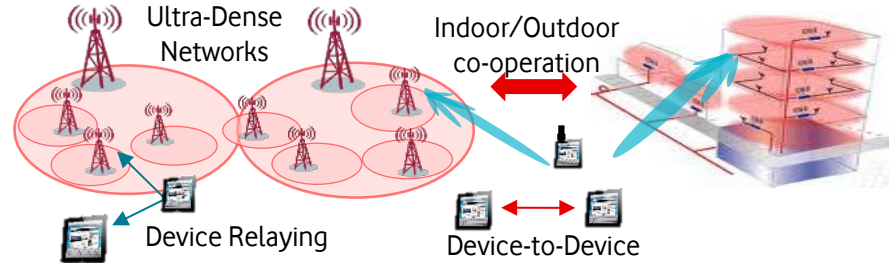


Below 1 GHz Coverage

28-70 GHz Ultra High Capacity

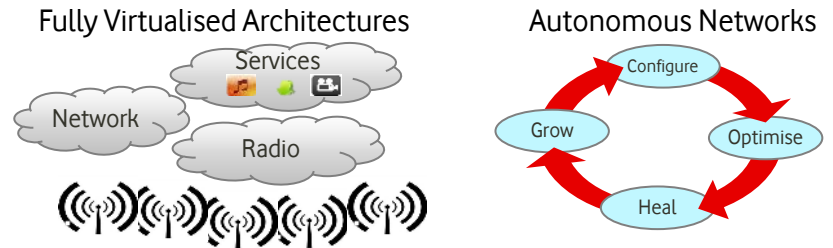
Leverage all spectrum licenced/unlicensed

Small/Large Cell Interworking



Fully flexible connectivity & coverage

Software Defined Architecture



Reducing costs & time to market

Illustrative Examples



The journey towards 5G

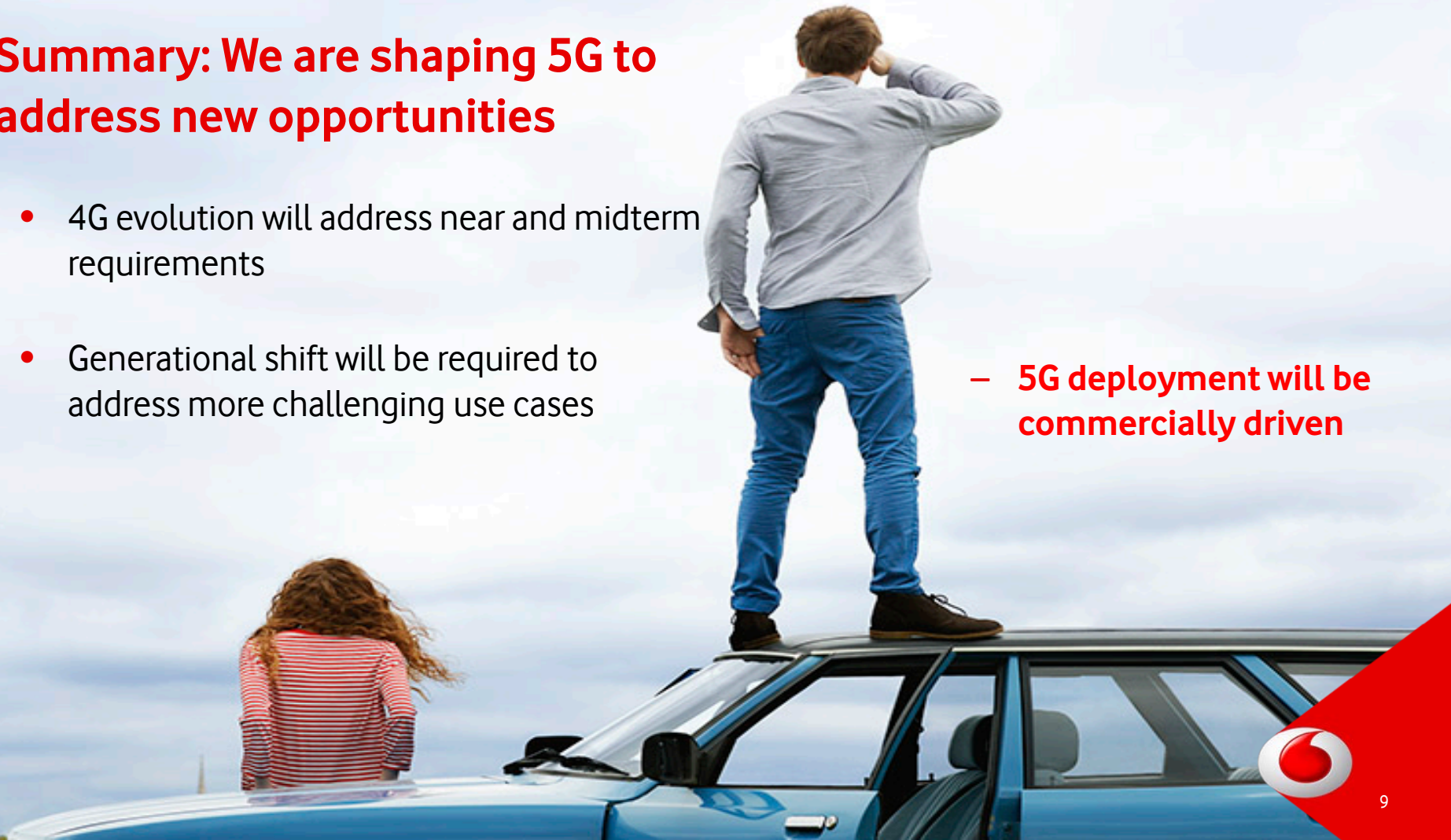
4G Radio Enhancements	Core Network Enhancements Radio Technology Agnostic
<ul style="list-style-type: none">• Vehicle-to-Vehicle communications (V2V)• License-Assisted Access (LAA)• Low-Power-Wide-Area (LPWA) M2M services• Up to 1Gbps with 100MHz spectrum• Enhanced multi-antenna systems (MIMO)• Higher order modulations (bits per second)	<ul style="list-style-type: none">• Software-Defined Networks (SDN)• Network Function Virtualisation (NFV)• Mobile-Edge Computing (MEC)



Summary: We are shaping 5G to address new opportunities

- 4G evolution will address near and midterm requirements
- Generational shift will be required to address more challenging use cases

– **5G deployment will be commercially driven**





Thank you