

# Vodafone 4G Webinar

27 March 2014



# Disclaimer

Information in the following communication relating to the price at which relevant investments have been bought or sold in the past, or the yield on such investments, cannot be relied upon as a guide to the future performance of such investments. This communication does not constitute an offering of securities or otherwise constitute an invitation or inducement to any person to underwrite, subscribe for or otherwise acquire or dispose of securities in any company within the Group.

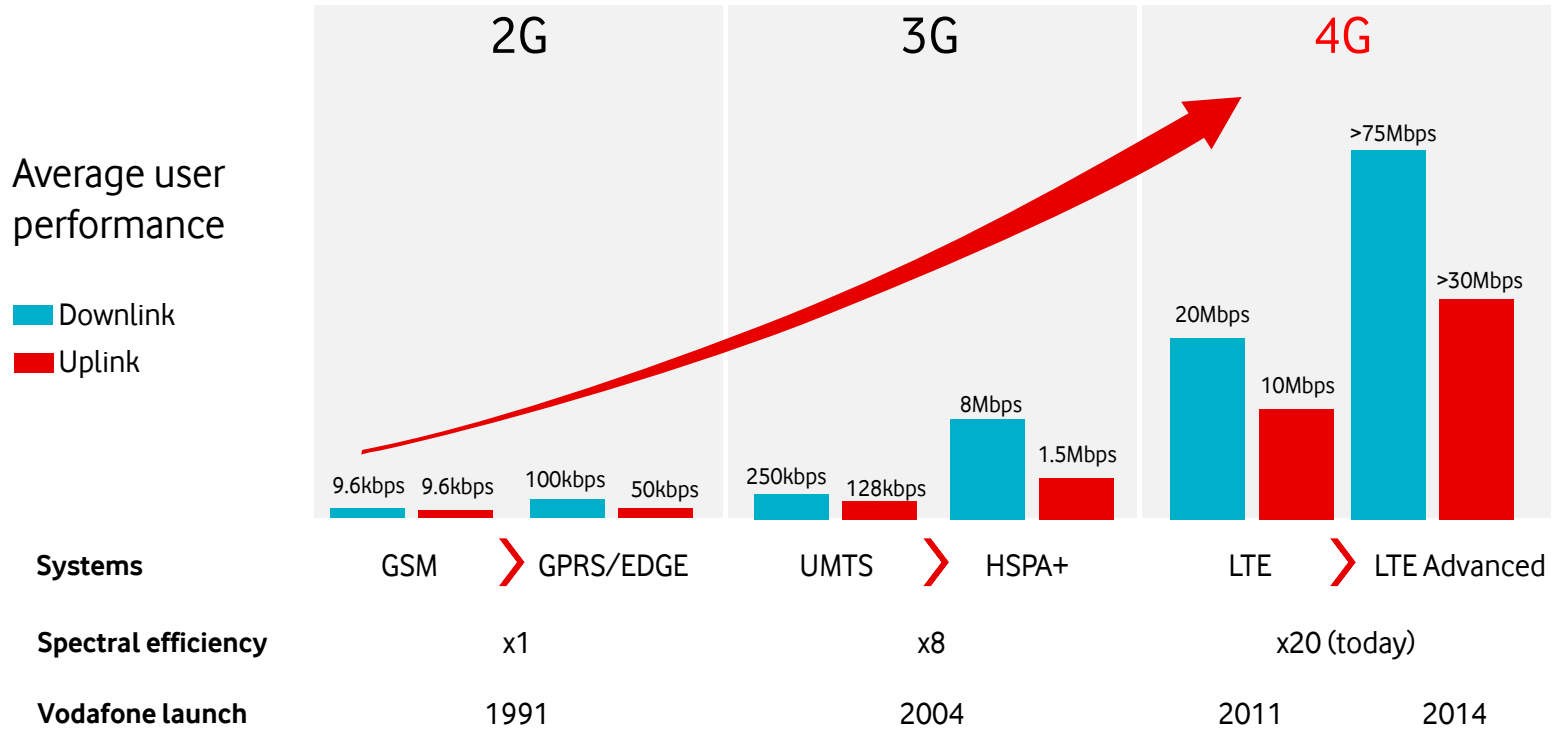
The presentation contains forward-looking statements within the meaning of the US Private Securities Litigation Reform Act of 1995 which are subject to risks and uncertainties because they relate to future events. These forward-looking statements include, without limitation, statements in relation to the Group's financial outlook and future performance. Some of the factors which may cause actual results to differ from these forward-looking statements can be found by referring to the information contained under the headings "Other information – Forward-looking statements" in our half-year financial report for the six months ended 30 September 2013 and "Principal risk factors and uncertainties" in our annual report for the year ended 31 March 2013, both of which can be found on the Group's website ([www.vodafone.com/investor](http://www.vodafone.com/investor)).

The presentation also contains non-GAAP financial information which the Group's management believes is valuable in understanding the performance of the Group or the Group's businesses. However, non-GAAP information is not uniformly defined by all companies and therefore it may not be comparable with similarly titled measures disclosed by other companies, including those in the Group's industry. Although these measures are important in the assessment and management of the business, they should not be viewed in isolation or as replacements for, but rather as complementary to, the comparable GAAP measures.

Vodafone and the Vodafone Speech Mark are trademarks of Vodafone Group Plc. Other product and company names mentioned herein may be the trademarks of their respective owners.



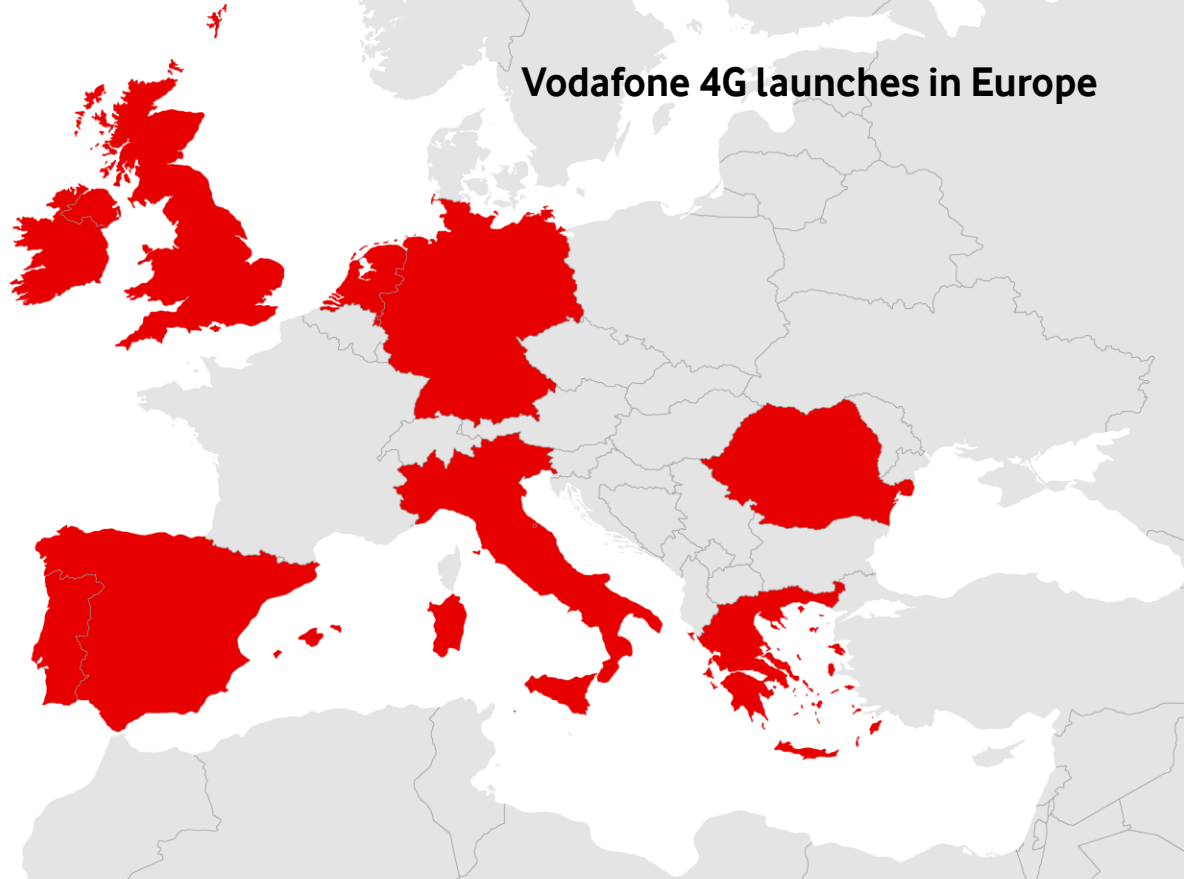
# Each generation of mobile technology has improved performance



# Vodafone has commercially launched 4G in 13 markets

<b>Year</b>	<b>Market Launches</b>
2010	Germany
	Portugal
	Italy
2012	South Africa
	Romania
	Greece
	New Zealand
	Spain
	Australia
2013	UK
	Netherlands
	Ireland
	Malta

Vodafone 4G launches in Europe



# 4G is driving strong demand for data

**11%**  
↑  
of smartphones in Europe on 4G

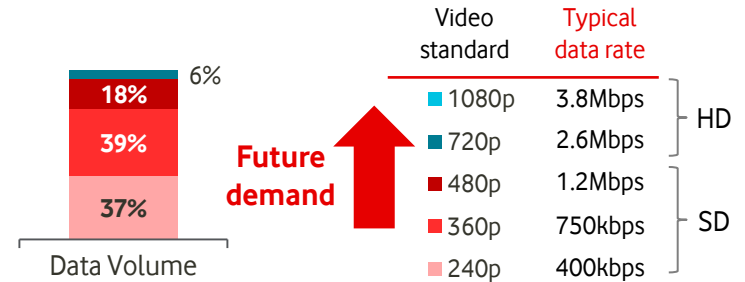
**130% more**  
↑  
data per customer on 4G vs. 3G

**17%**  
↑  
of data traffic in Europe on 4G

**81%**  
↑  
of data sessions >3Mbps today



## Video usage and resolution (%)



## 4G deployment underpinned by Project Spring

91% outdoor population coverage in Europe by March 2016



# We have the assets to build the best performing 4G network

## 4G capable spectrum holdings

4G Markets	800 (2xMHz)	900 (2xMHz)	1,800 (2xMHz)	2,100 (2xMHz)	2,600 (2xMHz)	2,600 TDD (1xMHz)
<b>Germany</b>	<b>10</b>	<i>12.4</i>	<i>5.4</i>	<i>15</i>	<b>20</b>	<i>25</i>
<b>Italy</b>	<b>10</b>	<i>10</i>	<b>20</b>	<i>15</i>	<b>15</b>	-
<b>Spain</b>	<i>10</i>	<i>11</i>	<b>20</b>	<i>15</i>	<b>20</b>	<b>20</b>
<b>UK</b>	<b>10</b>	<i>17.4</i>	<i>5.8</i>	<i>15</i>	<b>20</b>	<b>25</b>
<b>Ireland</b>	<b>10</b>	<i>10</i>	<i>25</i>	<i>15</i>	-	-
<b>Netherlands</b>	<b>10</b>	<i>10</i>	<b>20</b>	<i>20</i>	<b>10</b>	-
<b>Portugal</b>	<b>10</b>	<i>13</i>	<b>20</b>	<i>20</i>	<b>20</b>	<i>25</i>
<b>Romania</b>	<i>10</i>	<i>10</i>	<b>30</b>	<i>15</i>	-	<i>15</i>
<b>New Zealand</b>	<i>15(700MHz)</i>	<i>15</i>	<b>25</b>	<i>25</i>	<i>15</i>	<i>5</i>
<b>Australia</b>	<i>10+(850MHz)</i>	<i>5-10</i>	<b>30</b> (Metro)	<i>20 to 25</i>	-	-
<b>South Africa</b>	Awaiting auction	<i>11</i>	<b>12</b>	<i>15</i>	-	-
<b>Greece</b>	Awaiting auction	<i>15</i>	<b>25</b>	<i>20</i>	-	-
<b>Malta</b>	Awaiting auction	<i>15</i>	<b>25</b>	<i>20</i>	-	-

*Italics – band not yet in use for 4G*

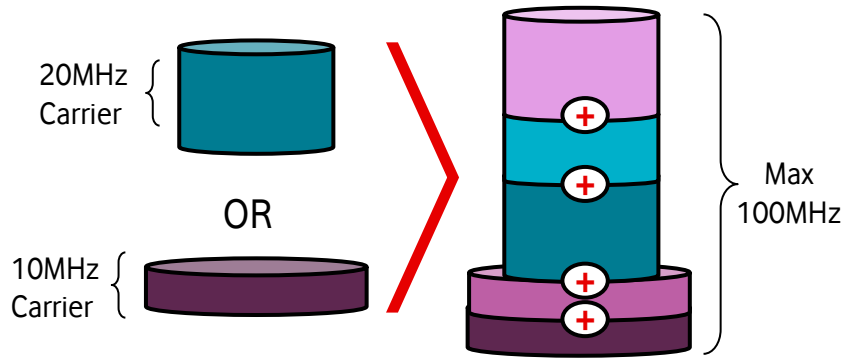
- <1GHz FDD for nationwide deployments and deepest indoor coverage
- 1800/2600 FDD for urban deployments and nationwide capacity/performance
- 2600 TDD to complement our FDD assets
- Potential to re-farm 1st 2100MHz carriers to 4G within next 3 years



# Carrier Aggregation is the first major evolution of 4G

**Today:** Single Carriers in 800, 1800 or 2600 FDD

**Future:** up to 5 carriers, FDD and TDD



- “Bonding” together multiple carriers to deliver large bandwidths to users
- 1st commercial devices available in H2 2014 enabling up to 300Mbps
- >50% improvement in average performance over most of the coverage area
- **Initial deployments in Germany, Spain, Italy and Portugal to date**
- **Speeds up to 300Mbps achieved**

**Consistency in customer experience and increased peak throughput**

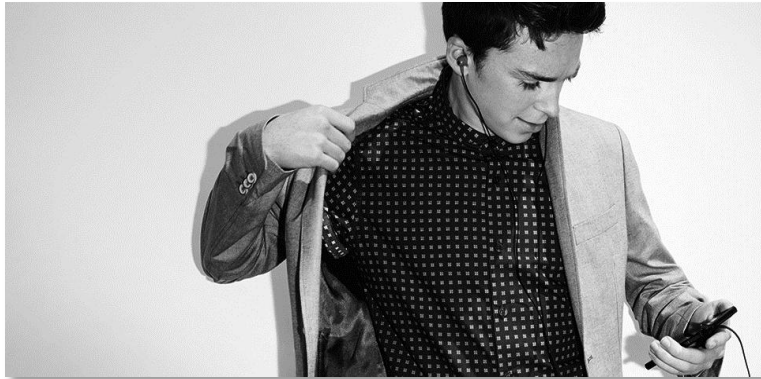


# VoLTE: enhancing 4G voice and enable new voice based services

**Today:** Voice carried on legacy 2G/3G



**Future:** Voice carried on LTE with new rich services



- VoLTE is the native high quality voice solution for 4G with devices expected from 2014
- Full packet solutions enable new “rich communication” services
- **VoLTE has been successfully tested in our test centre in Germany**
- **We will begin enabling VoLTE in Europe from H1 2014 and deployed in many markets in next 12 months**

Enriching the voice experience





# 4G small cells to enhance capacity and customer experience

## Heterogeneous networks



- Outdoor small cells are low power, small size base stations for deployment on street level assets such as lamp posts
- 4G small cells are available today (with integrated Wi-Fi options)
- Small cells bring new capabilities to enterprises with dedicated in-building systems
- Several solutions already in major premises
- **Deployments have begun and will accelerate as part of Project Spring**

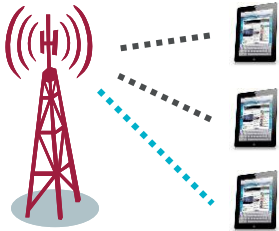
**Significant capacity & user experience increase**



# eMBMS - enabling the broadcast of video and content over 4G

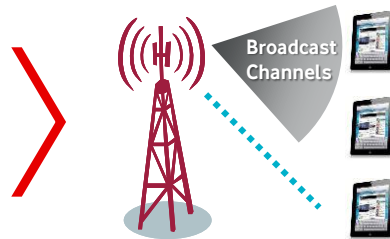
## Today:

Unicast only



## Future:

Unicast + Broadcast



- Standardised 4G broadcast mechanism
- Dynamic reservation of cell bandwidth for broadcast channels
- Can be deployed wide area or special locations such as sports stadiums
- **1st live eMBMS trials in Europe: Germany at Borussia Mönchengladbach's stadium**

Enables broadcast of mobile video and other content



# Convergence of TDD with FDD technology is another key evolution

- Single specification for FDD and TDD with aligned infrastructure products and roadmaps
- Single, worldwide technology – maximum flexibility in deployment
- Global roaming experience can be maximised



- **Own 110MHz of 2600 TDD spectrum for 4G across 5 European markets**
- **Already have live small cells backhauled with TDD today**
- **Combined FDD and TDD deployments (single antenna)**
- **Trialled FDD + TDD carrier aggregation**



# And there are many more evolutions of 4G to come...

- Network Function Virtualisation** > Migration of processing capabilities from dedicated network hardware to the Cloud
- Self-Organising Networks** > Automatic optimisation of radio networks, improving voice & data performance
- Machine to Machine** > 4G optimised for mass M2M deployment
- Emergency Services** > 4G enhancements to enable alternatives to tetra based networks
- Higher Order MIMO** > Higher performance with multiple transmit and receive paths
- LTE bonding** > Ability to bond together e.g. 4G+DSL to enhance performance
- Spectrum re-farming** > Further re-farming of spectrum used for GSM and 3G today for 4G



# Summary

- 1** 4G is a key component of our future technology portfolio – including 2G, 3G, fibre and cable
- 2** We have the assets to build the best 4G network in Europe
- 3** Project Spring will enable Vodafone to accelerate 4G deployment and deliver a clearly differentiated network
- 4** We are driving many new evolutions to greatly enhance the performance and capability of 4G in the future





# Q&A

# Glossary

- **eMBMS** - evolved Multimedia Broadcast Multicast Service, an efficient broadcast mechanism to deliver common content to a large number of users.
- **FDD** - Frequency Division Duplex is a 2-way transmission technique where one block of spectrum is allocated for uplink (from mobile device to base station) and a different spectrum block allocated to downlink (from base station to mobile device).
- **HSPA** – High Speed Packet Access is a 3G mobile cellular system supporting theoretical downlink data rates up to 14.4Mbps. An enhanced version called HSPA+ is the fastest 3G protocol, supporting downlink data rates such as 43.2Mbps.
- **LTE** – Long Term Evolution is the standard used in 4G mobile cellular systems. An enhanced version called LTE-Advanced supports higher data throughput rates using techniques such as carrier aggregation.
- **MiMo** – Multiple-input Multiple-output is a technique using multiple radio antennas at both the transmitter and receiver to improve communication performance.
- **Spectrum re-farming** – the process where spectrum bands are typically reallocated for different purposes (e.g. changing 900 spectrum from serving 2G customers to serve 3G customers instead)
- **TDD** - Time Division Duplex is a 2-way transmission technique where uplink is separated from downlink by the allocation of different time slots in the same spectrum frequency band.
- **TETRA** – Terrestrial Trunked Radio is a digital trunked mobile radio standard developed to meet the needs of Professional Mobile Radio (PMR) user organisations such as emergency services and government authorities
- **UMTS** - Universal Mobile Telecommunications System is the standard used in 3G mobile cellular systems.
- **VoLTE** – Voice over LTE is high quality ‘carrier-grade’ IP voice services running on a 4G data network

