Deutsche Bank

All roads lead to LTE

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Passion to Perform

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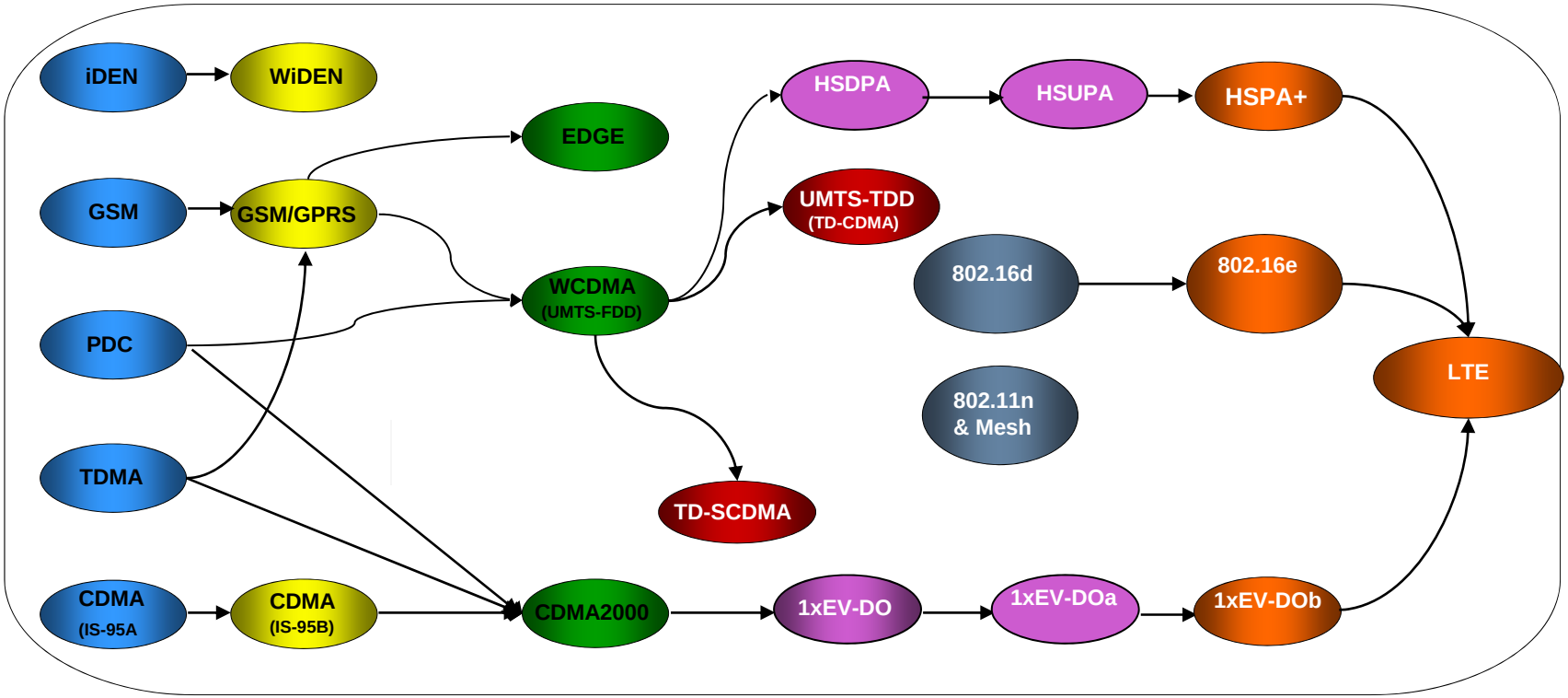
Client logo positioning

All roads lead to LTE



Challenges still remain…

Despite commercial rollouts across the globe, there are still challenges:

- Peak to average ratios and inter-cell interference – are we heading back to frequency planning?
- Spectrum: LTE is being proposed in over 40 frequency bands
    - No regional harmonization
    - Expect roaming to be limited for some time
- Power: 4x4 MIMO leads to handset design challenges
- Security: Securing all-IP devices, networks and interface
- Voice and SMS: Voice-over-LTE, Circuit-switched-fallback (CS fallback)?
- Backhaul: Realizing full mesh backhaul between eNodeBs; added capacity
- Handsets: the first transition in which these are not a bottleneck

Traffic Growth – the Data Tsunami…

Traffic is growing faster than carrier revenue and Capex is growing

- Mobile data usage is growing faster than anyone had expected
  - The average smartphone user consumes about 5 GB/month
- What is the average consumption for a user under 25?
  - 15GB-30GB/month
- Video is an important component of that growth and will likely be the dominant component in a few years
  - There is no busy hour anymore
- SD to HD transition is just starting to be felt in mobile
  - 10% of mobile video requests are HD requests, but that 10% of HD traffic is greater than all the rest of the SD traffic combined
- Bandwidth (in GB/S) is only one metric
  - We also need to look at signaling, control plane and intra app communications

Frequency Proliferation

- Carriers are now proposing 40 bands for LTE, and counting
- Range – from 700 MHz to 2.6 GHz presents challenges
  - And more bands are being added to this list
- Bands straddle connectivity components such as Wi-Fi, NFC, GPS
  - Unintended complication
- Global 4G roaming is some way off
- Focus of attention shifts to power amplifiers and front-end modules

Selected bands proposed for LTE

Band	UL	DL	Duplex
1	1920-1980	2110-2170	FDD
2	1850-1910	1930-1990	FDD
3	1710-1785	1805-1880	FDD
4	1710-1755	2110-2155	FDD
5	824-849	869-894	FDD
6	830-840	875-885	FDD
7	2500-2570	2620-2690	FDD
8	880-915	925-960	FDD
9	1750-1780	1840-1880	FDD
10	1710-1770	2110-2170	FDD
11	1425-1450	1480-1500	FDD
13	777-787	2110-2170	FDD
14	788-798	1480-1500	FDD
33	1900-1920	1900-1920	TDD
34	2010-2025	2010-2025	TDD
35	1850-1910	1850-1910	TDD
36	1930-1990	1930-1990	TDD
37	1910-1930	1910-1930	TDD
38	2570-2620	2570-2620	TDD
39	1880-1920	1880-1920	TDD
40	2300-2400	2300-2400	TDD

Network Topology

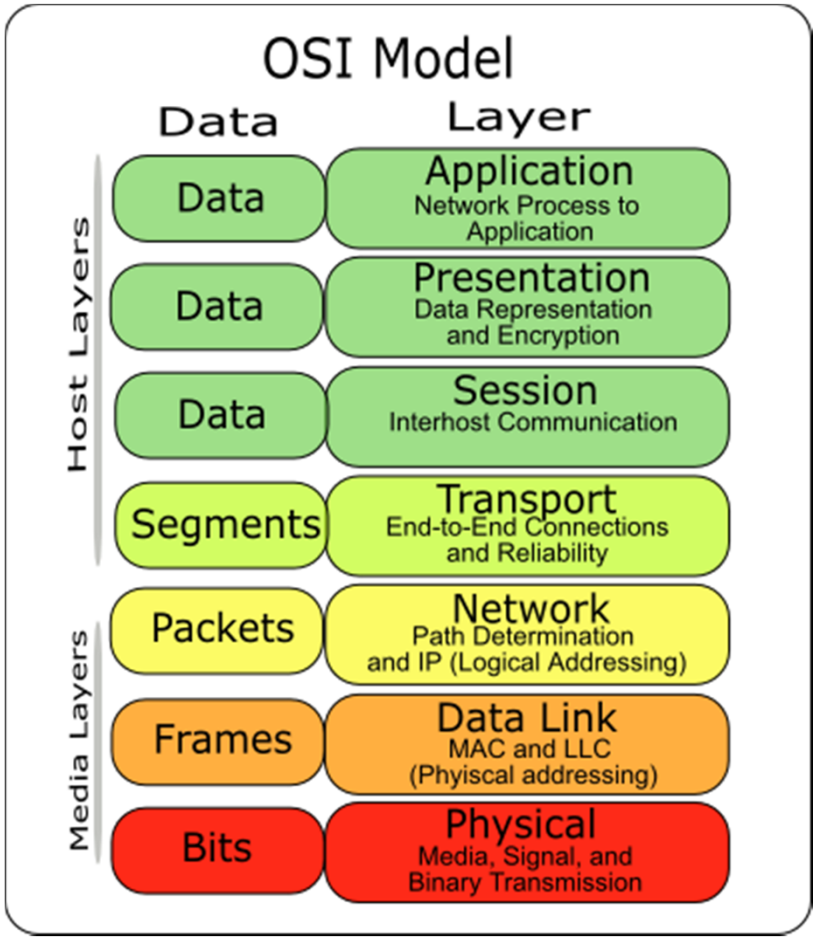
- No one is talking about 5G
- Next performance gains will have to come from denser networks
  - Small cells – micro-, pico-, and femtocells
  - Bring the network closer to the user to increase realized speeds
  - Added access points have implications for the aggregation layer
  - RF Planning - C:I issues and tones
  - LTE X2 handover – allows localized switching
  - Software becomes much more important in managing a network
  - Wi-Fi offload

Base station (eNodeB) challenges

- New architecture creates new challenges
  - Moving intelligence closer to the Edge
  - Offload traffic at the Edge and avoid the Core (e.g. LTE X2)
    - Will require new routers/fiber to be deployed at the Edge
  - Added access points have implications for aggregation at the Edge
- Interoperability amongst eNodeB's - operators need to mix and match equipment
- Continued support for 2G and 3G networks is necessary
  - Spectrum re-farming - certain countries have strict regulations, including nationwide requirements

What we prefer

- Wireless investment challenges
  - Physical layer challenges – business models
  - New access technologies – long incubation periods: WiFi; WiMAX
  - Semiconductor – there is a place for value added specialists
  - Optical – lots of pain, not much gain
  - Layer 4-7 - Similar to the 1990's transition to Layer 3 technologies, Layer 4-7 vendors have the potential to disrupt the market
  - We favor companies with significant software content in their offerings including F5, Acme Packet



Source: Deutsche Bank

Handset Model

By Region (in thousands)	2004	2005	2006	2007	2008	2009	2010	2011E	2012E	2013E	2014E	2015E
Handset Unit Shipments												
Western Europe	130,722	205,001	205,057	234,010	230,569	166,798	165,760	166,045	170,922	172,811	175,955	176,426
Eastern Europe	81,594	99,511	118,750	124,146	104,777	98,644	115,785	117,467	128,721	131,696	156,142	145,944
Asia	247,343	322,071	419,569	487,662	576,549	613,587	717,287	796,674	860,013	941,956	1,005,415	1,073,293
Developed Asia	*71,959*	*76,961*	*86,283*	*97,762*	*111,904*	*87,769*	*84,472*	*81,941*	*91,496*	*100,818*	*100,985*	*106,858*
China	*107,201*	*132,197*	*165,931*	*186,243*	*205,110*	*239,157*	*273,976*	*295,324*	*312,716*	*357,636*	*385,731*	*397,703*
India	*20,128*	*31,533*	*53,728*	*51,551*	*80,626*	*121,786*	*154,528*	*187,924*	*204,311*	*218,195*	*248,868*	*280,694*
Indonesia	*12,105*	*19,270*	*28,762*	*41,642*	*57,795*	*43,258*	*53,226*	*61,475*	*69,968*	*69,854*	*70,468*	*72,035*
Developing Asia	*35,950*	*62,111*	*84,866*	*110,465*	*121,114*	*121,616*	*151,085*	*170,010*	*181,521*	*195,453*	*199,363*	*216,003*
North America	124,733	128,347	141,992	154,214	162,469	133,057	146,329	158,668	162,812	165,751	167,002	168,365
Latin America (Ex. Brazil)	31,283	73,909	77,728	90,961	87,055	81,612	98,848	114,820	111,686	113,854	113,829	117,404
Brazil	20,540	38,610	36,265	48,547	62,733	64,106	71,295	77,752	79,337	76,735	72,729	72,180
Africa/Middle East	40,947	78,320	101,647	155,779	204,116	178,078	224,976	251,713	285,659	287,398	301,951	331,896
Total Unit Shipments	**677,163**	**945,768**	**1,101,008**	**1,295,317**	**1,428,268**	**1,335,882**	**1,540,281**	**1,683,139**	**1,799,150**	**1,890,201**	**1,993,024**	**2,085,509**
y/y growth	**19.5%**	**39.7%**	**16.4%**	**17.6%**	**10.3%**	**-6.5%**	**15.3%**	**9.3%**	**6.9%**	**5.1%**	**5.4%**	**4.6%**

By Technology (in thousands)	2004	2005	2006	2007	2008	2009	2010	2011E	2012E	2013E	2014E	2015E
Handset Unit Shipments												
GSM	474,552	677,204	774,412	894,209	936,020	816,068	881,876	874,409	747,785	647,426	521,508	376,711
# GSM	*202,847*	*143,823*	*34,895*	-	-	-	-	-	-	-	-	-
# GPRS	*252,893*	*406,371*	*510,267*	*468,919*	*380,984*	*233,211*	*182,692*	*124,955*	*114,906*	*100,564*	*85,639*	*69,258*
# EDGE	*18,812*	*127,010*	*229,251*	*425,290*	*555,036*	*582,857*	*699,185*	*749,454*	*632,879*	*546,862*	*435,869*	*307,453*
WCDMA	18,029	60,891	98,134	175,435	265,954	299,050	399,417	528,821	742,303	895,238	1,069,748	1,226,666
#WCDMA	*18,029*	*60,890*	*92,288*	*138,941*	*147,143*	*115,802*	*139,776*	*91,214*	*135,857*	*175,487*	*216,735*	*262,046*
#HSDPA	-	*1*	*5,846*	*36,494*	*118,811*	*183,248*	*259,642*	*437,607*	*606,446*	*719,750*	*853,013*	*964,620*
CDMA	151,212	177,709	210,253	214,375	220,013	213,097	239,136	246,490	259,050	262,084	274,947	299,088
# CDMA	*3,698*	*0*	-	-	-	*3,629*	*8,968*	*10,624*	-	-	-	-
# CDMA2000 1xRTT	*136,491*	*153,915*	*162,402*	*137,374*	*107,160*	*91,624*	*90,650*	*39,383*	*48,627*	*44,046*	*44,898*	*46,016*
# CDMA450	-	-	-	-	-	-	-	*50*	*50*	*49*	*48*	*47*
# CDMA2000 1xEV-DO	*11,023*	*23,794*	*47,851*	*77,001*	*112,853*	*117,845*	*139,518*	*196,433*	*210,373*	*217,989*	*230,001*	*253,025*
LTE	-	-	-	-	-	-	-	5,932	14,632	37,470	66,609	109,804
TD-SCDMA	-	-	-	-	-	3,952	15,760	19,995	25,811	36,027	45,874	55,793
WiMax	-	-	-	-	-	904	894	5,097	7,220	10,128	12,993	16,094
TDMA	12,125	13,868	6,648	2,230	-	-	-	-	-	-	-	-
iDEN	6,626	6,710	6,238	6,156	4,488	2,251	1,829	1,316	1,277	733	239	233
AMPS/Other	14,620	9,386	5,323	2,913	1,793	560	1,368	1,080	1,071	1,094	1,105	1,120
Total Unit Shipments	**677,163**	**945,768**	**1,101,008**	**1,295,317**	**1,428,268**	**1,335,882**	**1,540,281**	**1,683,139**	**1,799,150**	**1,890,201**	**1,993,024**	**2,085,509**
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**Data is company historicals and DB estimates*

Risks and Valuation

Valuation

- We use a discounted cash flow analysis to value the stocks in our universe.
- We determine a discount rate using the weighted average cost of capital
- Risk free rates determined based on market appropriate rates
- Beta calculated using stock price data
- Equity risk premium determined using comparable companies analysis

Risks

- Upside risks to our price targets center largely on consumer end-demand trends. We expect a modest recovery in spending, and should spending re-accelerate faster than anticipated we could see better than expected earnings.
- Downside risks center on consumer demand, the inverse of the above. In addition, consumer electronics is a highly competitive industry with intense pricing pressure. New market entrants or aggressive price tactics by one company can have a serious impact on earnings trends.

Analyst Certification

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst about the subject issuers and the securities of those issuers. In addition, the undersigned lead analyst has not and will not receive any compensation for providing a specific recommendation or view in this report. – Brian Modoff