

## Index

## Table of Contents

Table of Contents.....	i
List of Figures.....	vi
Executive summary.....	1
1 Wide area networks for the Internet of Things.....	3
1.1 3GPP family of cellular technologies.....	3
1.1.1 3GPP Release 13 – Introducing LTE-M and NB-IoT .....	4
1.1.2 3GPP Release 14 – IoT enhancements and V2X.....	5
1.1.3 3GPP Release 15 – The first 5G specifications .....	6
1.1.4 Network footprint.....	6
1.2 LPWA and satellite technologies .....	11
1.2.1 LoRa .....	11
1.2.2 Sigfox.....	14
1.2.3 Satellite networks .....	16
1.3 IoT networking platforms.....	17
1.3.1 IoT connectivity management platforms.....	17
1.3.2 SIM solutions and embedded UICC .....	20
1.4 International coverage and alliances.....	22
1.4.1 Roaming and international coverage .....	22
1.4.2 Mobile operator alliances .....	23
2 Europe .....	27
2.1 Regional market trends .....	27
2.1.1 Western Europe.....	29
2.1.2 Regional market trends in Western Europe .....	32
2.1.3 Central Eastern Europe.....	39
2.1.4 Russia & CIS.....	39
2.2 Mobile operators.....	40
2.2.1 Vodafone .....	41
2.2.2 Deutsche Telekom .....	44

2.2.3	Telefónica .....	47
2.2.4	Orange.....	50
2.2.5	Telenor .....	52
2.2.6	3 Group Europe.....	54
2.2.7	A1 Telekom Austria .....	55
2.2.8	Bouygues Telecom .....	57
2.2.9	BT Group .....	58
2.2.10	JT Group.....	59
2.2.11	KPN .....	59
2.2.12	Megafon .....	60
2.2.13	MTS .....	61
2.2.14	POST Luxembourg.....	62
2.2.15	Proximus.....	62
2.2.16	SFR.....	63
2.2.17	Telecom Italia .....	64
2.2.18	Telia Company .....	65
2.2.19	Tele2.....	66
2.2.20	UtilityConnect .....	67
2.3	IoT managed service providers .....	67
2.3.1	Arkessa.....	68
2.3.2	Com4.....	68
2.3.3	Cubic Telecom .....	68
2.3.4	EMnify.....	69
2.3.5	Eseye.....	70
2.3.6	Sierra Wireless.....	71
2.3.7	Stream Technologies .....	72
2.3.8	Telit.....	73
2.3.9	Wireless Logic .....	74
2.3.10	Others.....	75
2.4	LPWA networks.....	76
2.4.1	LoRa networks.....	76
2.4.2	Sigfox and network partners .....	77

3 The Americas ..... 79

3.1 Regional market trends ..... 79

3.1.1 United States and Canada ..... 81

3.1.2 Brazil ..... 83

3.1.3 Rest of Latin America ..... 85

3.2 Mobile operators ..... 85

3.2.1 AT&T ..... 85

3.2.2 Verizon ..... 88

3.2.3 Sprint ..... 89

3.2.4 T-Mobile USA ..... 90

3.2.5 Rogers Communications ..... 91

3.2.6 Bell Canada ..... 92

3.2.7 América Móvil ..... 92

3.2.8 Vivo and Telefónica Latin America ..... 93

3.2.9 Other mobile operators in Latin America ..... 94

3.3 IoT managed service providers ..... 96

3.3.1 Aeris Communications ..... 96

3.3.2 KORE Wireless ..... 97

3.3.3 Numerex ..... 99

3.4 Satellite networks ..... 99

3.4.1 Orbcomm ..... 100

3.4.2 Inmarsat ..... 101

3.4.3 Iridium ..... 103

3.4.4 Globalstar ..... 103

3.5 LPWA networks ..... 104

3.5.1 LoRa networks ..... 105

3.5.2 Sigfox and network partners ..... 105

4 Asia-Pacific ..... 107

4.1 Regional market trends ..... 107

4.1.1 China ..... 109

4.1.2 Japan and South Korea ..... 112

4.1.3 Australia and New Zealand ..... 113

4.1.4	Southeast Asia .....	114
4.1.5	India and South Asia .....	115
4.2	Mobile operators.....	116
4.2.1	China Mobile .....	116
4.2.2	China Unicom.....	118
4.2.3	China Telecom .....	119
4.2.4	Softbank .....	120
4.2.5	NTT Docomo .....	121
4.2.6	KDDI .....	122
4.2.7	SK Telecom .....	123
4.2.8	KT .....	124
4.2.9	Singtel.....	124
4.2.10	Telstra.....	126
4.3	IoT managed service providers .....	127
4.3.1	Soracom .....	127
4.3.2	Unlimit.....	127
4.4	LPWA networks.....	128
5	Middle East & Africa.....	131
5.1	Regional market trends .....	131
5.1.1	Middle East.....	132
5.1.2	Africa.....	133
5.2	Mobile operators.....	134
5.2.1	Etisalat .....	134
5.2.2	FastNet .....	135
5.2.3	Ooredoo .....	136
5.2.4	MTN .....	137
5.2.5	Turkcell.....	137
5.2.6	Vodacom .....	138
5.2.7	Zain.....	138
5.3	LPWA networks.....	139
6	Market forecasts and trends .....	141
6.1	Geographic markets.....	141

- 6.1.1 Global market summary ..... 144
- 6.1.2 Europe ..... 147
- 6.1.3 North America ..... 149
- 6.1.4 Latin America ..... 151
- 6.1.5 Asia-Pacific ..... 153
- 6.1.6 Middle East & Africa ..... 155
- 6.2 Vertical markets ..... 157
  - 6.2.1 Connected cars reach an inflection point ..... 159
  - 6.2.2 Steady growth in the fleet management industry ..... 160
  - 6.2.3 Governments and utilities leverage IoT to address critical challenges..... 162
  - 6.2.4 Industry 4.0 gains momentum ..... 163
  - 6.2.5 Redefining consumer experiences through connectivity..... 164
- 6.3 Technology trends..... 165
  - 6.3.1 China’s economic planning will make 2G obsolete by 2020..... 165
  - 6.3.2 Global sunset for 2G/3G networks ahead..... 166
  - 6.3.3 Network virtualisation decouples cellular IoT from physical infrastructure..... 167
- 6.4 Industry trends..... 167
  - 6.4.1 China Mobile first to reach 100 million cellular IoT subscribers ..... 168
  - 6.4.2 IoT accounts for less than 1 percent of mobile operator revenues ..... 169
  - 6.4.3 IoT managed service providers focus on high-end segments and platforms .. 170
- Glossary ..... 173

## Index

## List of Figures

Figure 1.1: Comparison of LTE MTC enhancements in 3GPP Release 13 .....	5
Figure 1.2: LTE-M network deployment plans (Q3-2017) .....	9
Figure 1.3: NB-IoT network availability by country (Q3-2017) .....	10
Figure 1.4: Examples of network operators deploying LoRaWAN .....	13
Figure 1.5: Sigfox network operators by country .....	15
Figure 1.6: MSS operator data services and coverage .....	17
Figure 1.7: MNO IoT connectivity management platform, by vendor (Q2-2017) .....	18
Figure 1.8: Mobile operator M2M/IoT alliances (Q2-2017) .....	23
Figure 2.1: Europe cellular IoT connectivity market data (Q2-2017) .....	28
Figure 2.2: Western Europe cellular IoT connectivity market data (Q4-2016) .....	31
Figure 2.3: Italy cellular IoT connectivity market data (2016–2017) .....	33
Figure 2.4: France cellular IoT connectivity market data (2013–2017) .....	34
Figure 2.5: Germany cellular IoT connectivity market data (2014–2017) .....	34
Figure 2.6: UK cellular IoT connectivity market data (2013–2016) .....	35
Figure 2.7: Spain & Portugal cellular IoT connectivity market data (2014–2017) .....	36
Figure 2.8: Benelux cellular M2M market connectivity data (2014–2017) .....	37
Figure 2.9: Nordics cellular M2M market connectivity data (2013–2016) .....	37
Figure 2.10: Central Eastern Europe cellular IoT connectivity market data (Q4-2016) .....	38
Figure 2.11: Russia & CIS cellular IoT market connectivity data (2013–2017) .....	39
Figure 2.12: Telefónica M2M subscribers by country (2016–2017) .....	49
Figure 2.13: Orange M2M subscribers by country (2015–2017) .....	52
Figure 2.14: Financial data for Telenor Connexion (2011–2017) .....	53
Figure 2.15: A1 Telekom Austria M2M subscribers by country (2016–2017) .....	56
Figure 2.16: LoRa network operators Europe (Q4-2016) .....	77
Figure 2.17: Sigfox network partners in Europe (Q2-2017) .....	78
Figure 3.1: The Americas cellular IoT connectivity market data (Q2-2017) .....	80
Figure 3.2: US cellular IoT connectivity market data (2013–2017) .....	81
Figure 3.3: Brazil cellular M2M market connectivity data (2014–2017) .....	83

Figure 3.4: Estimated number of M2M subscribers in Latin America ex. Brazil (H1-2017) .....	84
Figure 3.5: Telefónica M2M subscribers in Latin America by country (2014–2017) .....	94
Figure 3.6: Satellite network operators by IoT subscriber base (Q3-2017).....	100
Figure 3.7: LPWA network operators in the Americas (November 2017).....	106
Figure 4.1: Asia-Pacific cellular IoT connectivity market data (Q2-2017) .....	108
Figure 4.2: Japan cellular IoT connectivity market data (2013–2017) .....	112
Figure 4.3: Cellular IoT subscribers by application category (South Korea, August 2017) ...	113
Figure 4.4: Planned LPWA network rollouts in Asia-Pacific (November 2017) .....	129
Figure 5.1: Middle East & Africa cellular IoT connectivity market data (Q2-2017) .....	131
Figure 5.2: Turkey cellular M2M market connectivity data (2014–2017) .....	132
Figure 5.3: Planned LPWA network rollouts in Middle East & Africa (November 2017) .....	140
Figure 6.1: Key regional markets for cellular IoT (Q2-2017).....	142
Figure 6.2: Monthly ARPU data for cellular IoT by country (2016) .....	143
Figure 6.3: Cellular IoT subscriber forecast, by region (World 2016–2022).....	145
Figure 6.4: Cellular IoT network revenue forecast, by region (World 2016–2022) .....	146
Figure 6.5: Cellular IoT communication market forecast (Europe 2016–2022).....	148
Figure 6.6: Cellular IoT communication market forecast (North America 2016–2022) .....	150
Figure 6.7: Cellular IoT communication market forecast (Latin America 2016–2022) .....	152
Figure 6.8: Cellular IoT communication market forecast (Asia-Pacific 2016–2022) .....	154
Figure 6.9: Cellular IoT communication market forecast (MEA 2016–2022).....	156
Figure 6.10: Cellular IoT communication market forecast, by vertical (2016–2022) .....	158
Figure 6.11: OEM telematics attach rates in new vehicles, by region (2016/2021) .....	159
Figure 6.12: Top 25 international providers of fleet management solutions (Q4-2016).....	161
Figure 6.13: Projected smart meter penetration in key markets (2023) .....	162
Figure 6.14: NB-IoT device shipments and installed base forecast (China 2017–2020) .....	166
Figure 6.15: Top 10 mobile operators by cellular IoT subscriber base (World Q2-2017).....	168
Figure 6.16: Annualised IoT revenues for mobile operator groups (2016/2017) .....	169
Figure 6.17: Major IoT managed service providers by subscriber base (H2-2017) .....	171





## Index

## Table of Contents

Table of Contents.....	i
List of Figures.....	v
Executive summary.....	1
1 Wide area networks for the Internet of Things.....	3
1.1 Which things will be connected to wide area networks? .....	3
1.1.1 Utility meters.....	4
1.1.2 Motor vehicles .....	4
1.1.3 Buildings.....	5
1.1.4 Low value assets – Industry 4.0 and consumer products .....	6
1.1.5 Future opportunities in smart cities and agriculture .....	7
1.2 What are the technology options? .....	8
1.2.1 Network architectures .....	8
1.2.2 Unlicensed and licensed frequency bands.....	10
1.3 Which are the leading technology ecosystems?.....	11
2 3GPP ecosystem .....	13
2.1 Technology characteristics.....	13
2.1.1 3GPP Release 13 – Introducing LTE-M and NB-IoT .....	14
2.1.2 3GPP Release 14 – IoT enhancements and V2X.....	15
2.1.3 3GPP Releases 15 and 16 – 5G phase 1 and 2.....	16
2.1.4 Network footprint.....	16
2.1.5 2G mobile networks .....	17
2.1.6 3G/4G mobile networks .....	18
2.1.7 4G-MTC mobile networks (eMTC/LTE-M and NB-IoT) .....	19
2.1.8 5G networks .....	20
2.2 Chipset vendors.....	22
2.2.1 Qualcomm.....	22
2.2.2 Mediatek.....	23
2.2.3 Unigroup Spreadtrum & RDA.....	24

2.2.4	Intel .....	24
2.2.5	HiSilicon .....	25
2.2.6	Sanechips Technology.....	26
2.2.7	Altair Semiconductors .....	26
2.2.8	Sequans Communications .....	27
2.2.9	Nordic Semiconductor .....	28
2.3	Module vendors.....	29
2.3.1	Sierra Wireless.....	30
2.3.2	Gemalto M2M.....	34
2.3.3	Telit.....	39
2.3.4	Quectel .....	42
2.3.5	Sunsea Telecommunications (SIMCom/Longsung) .....	45
2.3.6	u-blox.....	47
2.3.7	Huawei.....	50
2.3.8	ZTE WeLink (Gosuncn) .....	51
2.3.9	Neoway.....	53
2.3.10	Fibcocom .....	54
2.3.11	Other cellular module vendors.....	56
3	LoRa ecosystem .....	59
3.1	Technology characteristics.....	59
3.2	Network footprint .....	60
3.2.1	Europe .....	61
3.2.2	Asia-Pacific .....	62
3.2.3	The Americas and Middle East & Africa.....	63
3.3	Chipset and module vendors .....	64
3.3.1	Semtech .....	64
3.3.2	LoRa module vendors .....	65
4	Sigfox ecosystem.....	69
4.1	Technology characteristics.....	69
4.2	Network footprint .....	71
4.2.1	Europe .....	71
4.2.2	The Americas.....	72

4.2.3	Asia-Pacific .....	73
4.2.4	Middle East & Africa .....	75
4.3	Chipset and module vendors .....	75
4.3.1	Chipset vendors .....	76
4.3.2	Sigfox module vendors .....	76
5	802.15.4 WAN ecosystem.....	81
5.1	Technology characteristics.....	81
5.1.1	IPv6 connectivity stacks based on 802.15.4.....	82
5.1.2	Wi-SUN .....	82
5.1.3	ZigBee .....	83
5.2	Network footprint .....	84
5.3	Chipsets and modules.....	85
6	Vertical market segments .....	87
6.1	Motor vehicles .....	87
6.1.1	OEM connected car applications.....	87
6.1.2	Aftermarket connected car applications .....	89
6.2	Energy & Infrastructure.....	90
6.2.1	Smart electricity metering .....	90
6.2.2	Smart gas and water metering.....	92
6.2.3	Smart cities.....	93
6.3	Industry & Transport.....	94
6.4	Other .....	95
6.4.1	Buildings & security.....	96
6.4.2	Consumer products .....	96
6.4.3	Payments.....	97
7	Market forecasts and trends .....	99
7.1	Market summary .....	99
7.2	3GPP family .....	101
7.2.1	Cellular IoT device market forecast.....	102
7.2.2	Europe.....	104
7.2.3	Americas.....	105
7.2.4	Asia-Pacific.....	106

7.2.5 Middle East & Africa ..... 109

7.3 LoRa..... 110

7.4 Sigfox..... 111

7.5 802.15.4 WAN ..... 112

Glossary ..... 115

## Index

## List of Figures

Figure 1.1: Top wide area IoT target segments (2018) .....	4
Figure 1.2: Building stock by category (EU/US 2015).....	5
Figure 1.3: Unlicensed and reserved radio frequencies available for wireless IoT .....	10
Figure 2.1: Comparison of LTE MTC enhancements in 3GPP Release 13 .....	15
Figure 2.2: 3GPP cellular network connections by generation (World Q3-2017) .....	17
Figure 2.3: LTE-M network deployment plans (Q1-2018) .....	19
Figure 2.4: NB-IoT network availability by country (Q1-2018).....	21
Figure 2.5: Top cellular module vendors, by revenues and shipments (World 2017) .....	29
Figure 2.6: Sierra Wireless embedded modules and terminals (Q1-2018) .....	31
Figure 2.7: Gemalto M2M embedded modules (Q1-2018) .....	35
Figure 2.8: Telit M2M embedded wireless modules (Q1-2018) .....	41
Figure 2.9: Quectel embedded wireless modules (Q1-2018) .....	43
Figure 2.10: SIMCom and Longsung embedded wireless modules (Q1-2018).....	46
Figure 2.11: u-blox embedded wireless modules (Q1-2018) .....	48
Figure 2.12: Huawei embedded wireless modules (Q1-2018) .....	51
Figure 2.13: ZTE WeLink embedded wireless modules (Q1-2018).....	52
Figure 2.14: Neoway embedded wireless modules (Q1-2018) .....	54
Figure 2.15: Fibocom embedded wireless modules (Q1-2018).....	55
Figure 3.1: LoRa wide area network architecture .....	60
Figure 3.2: LoRa network operators in Europe (Q4-2017) .....	61
Figure 3.3: LoRa network operators in Asia-Pacific (Q4-2017) .....	62
Figure 3.4: List of certified LoRa modules by vendor (Q1-2018).....	66
Figure 4.1: Sigfox network architecture .....	70
Figure 4.2: Sigfox network partners in Europe (Q1-2018).....	72
Figure 4.3: Sigfox networks in the Americas (Q1-2018) .....	73
Figure 4.4: Sigfox networks in Asia-Pacific and MEA (Q1-2018).....	74
Figure 4.5: List of Sigfox module vendors by supported regions (Q1-2018) .....	77
Figure 5.1: Major 802.15.4 networking platforms for smart metering (2017) .....	84

Figure 6.1: OEM telematics attach rates in new vehicles, by region (2016/2021) .....	88
Figure 6.2: Projected smart meter penetration in key markets (2023) .....	91
Figure 7.1: Cellular/LPWA IoT device shipment forecast, by region (World 2017–2023) .....	99
Figure 7.2: Cellular/LPWA IoT device shipment forecast, by technology (2017–2023) .....	100
Figure 7.3: Cellular IoT device shipment forecast (World 2017–2023).....	102
Figure 7.4: Cellular IoT device shipments, by network technology (World 2017–2023) .....	103
Figure 7.5: Cellular IoT device shipment forecast (Europe 2017–2023) .....	104
Figure 7.6: Cellular IoT device shipment forecast (Americas 2017–2023) .....	106
Figure 7.7: Cellular IoT device shipment forecast (Asia-Pacific 2017–2023) .....	107
Figure 7.8: Cellular IoT device shipment forecast (Middle East & Africa 2017–2023).....	109
Figure 7.9: LoRa device shipments forecast (World 2017–2023).....	111
Figure 7.10: Sigfox device shipments forecast (World 2017–2023) .....	112
Figure 7.11: 802.15.4 WAN device shipments forecast (World 2017–2023) .....	113