

Why you need to accelerate the move to LTE

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IoT MODULES

IoT CONNECTIVITY IoT PLATFORMS

IoT KNOW-HOW

Agenda The Cellular world we live in LTE Evolution LTE for IoT (Cat-1, Cat-M1 & NB1) Advantages of LTE Why to adopt LTE Creating competitive advantages with LTE

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Cellular world we live in



- Sunset of 2G
 - Unique to USA/Australia vs ROW
- Limited lifespan on 3G
 - North America movement to LTE
 - EU move to sunset 3G first
- Common trend to align on 4G LTE as next generation technology
 - MNO requirements for use of 4G LTE



Our LTE World

104 LTE networks launched



Q3 - 2016 1.68 Billion connections

581 LTE Commercial Networks in 186 Countries

2010



183 LTE-Advanced

Commercial Networks in 87 Countries

118 VoLTE

Commercial Networks in 56 Countries



3GPP LTE Evolution and 5G

Pre-standards 5G 5G Commercialization

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	Rel. 13	Rel. 14	Rel. 15	Rel. 16	Rel. 17
	Q1	Q2	Q2		Q4
	LTE-Advanced Pro Focus on areas significantly expa capability and opportunities	nding LTE plạtform	5G		
BB	LAA/LWA/LWIP eLAA/LAA UL 32CC eLWA/LWIP D2D/eProSe LTE-V2X	eLAA/LAA UL	Breaking the g	gigabit barrier	
			Solving the 10	000x data challenge	
			Enabling new	spectrum paradigms	
	CatM1	Positioning/Multicast	Mobilizing mn	nWave spectrum bands	<u> </u>
	NB-IoT	Mobility enhancements Power enhancements [NB-IOT] Higher data rates / Vol TE	Bringing new	ways to connect	NR_
			E Optimizing for	the Internet of Things	
		support [eMTC]			

5G: Realistic Timelines





Subscriptions vs Technology

- Subscriptions ~ 454 M
- Population ~ 360 M (325 + 35)
- LTE growth \rightarrow 63M+
- Net growth \rightarrow 23M
- CDMA & GSM & HSPA declining
- Breakdown
 - 62% LTE (4G) 282M devices
 - 19% HSPA (3G) 84M devices
 - 18% CDMA (3G) 82M devices
 - 1% GSM (2G) 6M devices



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Reference: http://www.4gamericas.org

LTE Evolution





3GPP Technology Path

	• 2014 	2015 • 2016	• 2017				
Cat 3/4 – Rel 8	8 Commercial Deployment 3GPP Specification = Q4-2008 Commercial Deployment = Dec 2010						
Cat 1 – Rel 8	New Concept		on Commercial Deployment				
Cat M1 – Rel 13	M1 – Rel 13 _3GPP Work Item		Implementation	Commercial Deployment			
NB1– Rel 13	3GPP Work Item		Implementation	Commercial Depl.			
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LTE Cat-M1 Steps

3GPP Standard	Release 13 (Cat M1) Standard	Cat M1 Performance Requirements and Specifications	Industry Approval Bodies (ex. PTCRB / GCF)
Mobile Network Operators	Lab Testing, Field Trials, and Customer Pilots	Limited Market Deployments	Nationwide Deployments
Chipsets	Development to Release 13 specification	Chipset Lab Testing and Certifications	Chipset Commercial Availability
Modules	Module Design	Module Samples for customer development and Field Trials	Mass Production of Cat M1 modules



LTE-M / LPWA Deployment Plans



LTE for IoT Technology Selection

LTE Cat-1



LTE Cat-M1 / NB1











Extended Coverage





Technology Comparison

- Globally available
- 5Mb UL / 10Mb DL
- 2 Antennas (MIMO)
- Full Mobility
- Voice (VoLTE)
- Power Savings (PSM)
- NO Extended Coverage
- FOTA





• 2017-2018 Varies by MNO

- < <500 Kbps UL/DL (half duplex)
- 1 Antenna (SISO)
- Full Mobility (Mode A coverage)
- No Voice now (3gpp rel14 ~ 2018)
- Power Savings (PSM & eDRX)
- Extended Coverage up to 10 dB (Mode A)
- FOTA



- 2017-2018 Varies by MNO
- 20 Kbps UL (single tone) & 250 Kbps DL
- 1 Antenna (SISO)
- No Connected mode mobility
- No Voice
- Power Savings (PSM & eDRX)
- Extended Coverage up to 24 dB
- FOTA TBD



Power Save Mode (PSM) – Rel 12

- Ability to reduce idle/standby power
- T3324 Active Time Value (seconds to minutes)
- T3412 Power Save Mode (minutes to hours)
- Extended periods where device is not reachable (until MO or TAU)
- Designed for devices at use mobile originated communication



UE side: reduce power consumption of the module associated with frequent communication with the networkNW side: save network resources due to limited signaling and no need to re-attach when module wakes up





Extended DRX (eDRX) – Rel 13

Applicability○LTE Cat-1✓LTE Cat M1✓NB1

- Elegant version of PSM to allow incoming MT traffic
- Better synchronization with network
- Device sets duration of DRX period (seconds up to ~ 44minutes) in idle mode





Extended Coverage

Increase in RF link budget
Narrower BW, robust coding, and retransmissions

RF Link Budget

- LTE Cat 1-4 = ~140 dB
- Cat-M1 (Mode A) = 5-10 dB increase (150 dB)
- Cat-M1 (Mode B) = up to 16+ dB increase (156 dB)
- NB1 = up to 24 dB increase (164 dB)



Applicability

LTE Cat-1

NB1

LTE M1/NB1

<u>CAT 1-6</u>

LTE Cat M1

IoT Segments vs Technologies





LTE-M Opportunity

LTE crossing into new Markets

Same Benefits

- Cost Effective
- Low Power

Offering Advantages

- Security
- Coverage
- Mobility
- Reliability (SLAs)
- Scalability
- QoS





Why move to LTE

- Legacy technologies life span
- Ecosystem / Sustainability
- Advancements in size, cost, and power
- Game changing features (power saving modes / extended coverage)
- New market opportunities
- New innovation / IP opportunities



LTE Technologies Tradeoffs

- Coverage / Scalability (local vs national vs international)
- Timing / Availability (networks & devices)
- Mobility vs Fixed
- Voice Support
- Battery Powered
- Extended Coverage (in building, sky, in ground)
- Interoperability / consistent deployment models



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What is Telit doing to enable success

Global portfolio of LTE single-mode IoT modules, including North America's First LTE Cat M1 Modules

Four LTE Cat M1 modules for the U.S. and additional variants for M1&NB-IoT for EMEA and APAC





Place Holder: Survey Directions Slide





ENABLING END-TO-END OT SOLUTIONS Any Market. Any Industry. Anywhere.

Thank You!



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