5G is for tomorrow

Simon Forge
SCF Associates Ltd


Is 5G just the emperor's new clothes:-
Hype? – any real business models?
Tripe? – millimetric or UHF or what ??
Or is there something there?
… but is it ripe ?

What is the context? Who is setting the agenda? The drivers?

•**Supply industry** consolidation eg Nokia acquires Alcatel – Lucent and Siemens Networks while Motorola and Nortel sold off or bankrupt

•**Survivors** are seeking new revenue streams as revenues from 4G sales slow and layoffs are gathering speed while NFV/SDN hits sales–

- •eg Cisco (17Aug 2016 Reuters) 20% laid off; Ericsson several rounds – latest 4000 (Oct 2016) and expecting further 20%; Qualcomm 15% laid off (22July 2016, Fortune) and considering break up into patent royalties and chip design as income sinks 47% and revenues down 14%

•**OTT** is eating the **MNO**'s lunch as data priced fairly high (often necessary to protect the network from being swamped) so **Wi-Fi** plus fixed line broadband serves the majority of web-surfers by **offloading**

•**Telco operators** want new revenue streams from **CONTENT** and see need for better SVOD delivery channel than LTE as the way forward – ATT acquires Time Warner for US$ 85Bn, 22 Oct 2016 ; BT buys premium sports

There is a feeding frenzy over patents on the supply side

– taking rents from IPR has far higher margins than producing software and hardware, or integrating and servicing it - so NPEs highly active in 5G

5G Technology Area	Largest Patent Holders
RF front end and RAN	**Ericsson (64)** **Qualcomm (63)** **•InterDigital (58)** **Nokia (54)** **Blackberry(46)**
5G waveforms and modulation technologies	**Qualcomm (121)** **Nokia (73)** **•InterDigital (45)** **Intel (35)** **Fujitsu (34)**
5G core network engineering	**Nokia (39)** **Qualcomm (36)** **•Headwater Partners (34)** **Cisco (32)** **Intel (29)**

Source: Rana Pratap & Rahul Vijh, The Next Big Battleground, IP Watchdog 31 March 2016

The current state of data traffic makes 5G seem very attractive to MNOs…for cities

- Wi-Fi + backhaul dominates data traffic carried (UK and USA ~ 50% and for smartphone/tablet market, 60% estimated by 2019*)
- Wireline 2nd ~ 45%
- 3G and 4G more minor role ~ 5% ? As 3G/LTE cannot handle so offload
- Public /community Wi-Fi hotspots growing fast
- FTTH /FTTC is too expensive

5G offers Radio Broadband alternative for SVOD to MNOs

Sources: Ofcom workshop on 5G, London 2015
NTIA/FCC workshop on Federal spectrum release, NY 2015

*Juniper Research, 2015

5G promises for the short term are more incremental than revolutionary

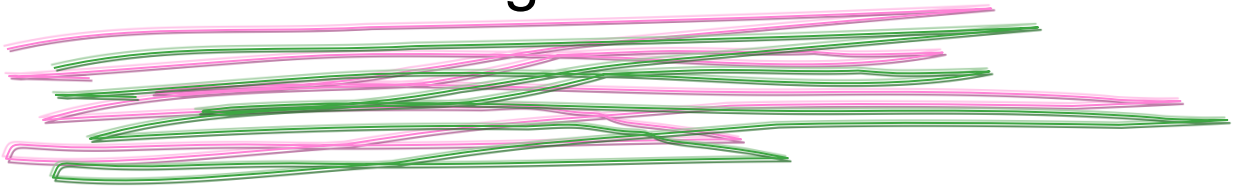
	Delivered	Conclusion
2G GSM – 2.5G, GPRS	**Successful; robust; Simple (for voice + SMS)**	**Few data promises and weak on delivery as not designed for data, and has weal add-on**
3G – WCDMA - 3.5G HSPA	**Strong promises of IP networking Weak on delivery**	**3G seen as failure in data speeds and QoS for broadband**
LTE 4G, 4.5G LTE-A, LTE NB etc	**4G has IP data but VoIP-VoLTE is a voice add-on**	**Squeeze more – aggregate carriers, more intelligent adaptive RAN but still slow expensive data**
5G - no standards yet, or common concepts	**The great white hope, or … the great white elephant? -Really for SVOD**	**To succeed this concept needs a rethink of the basics of cellular technology and radio propagation techniques developed since 1947**

Short term view

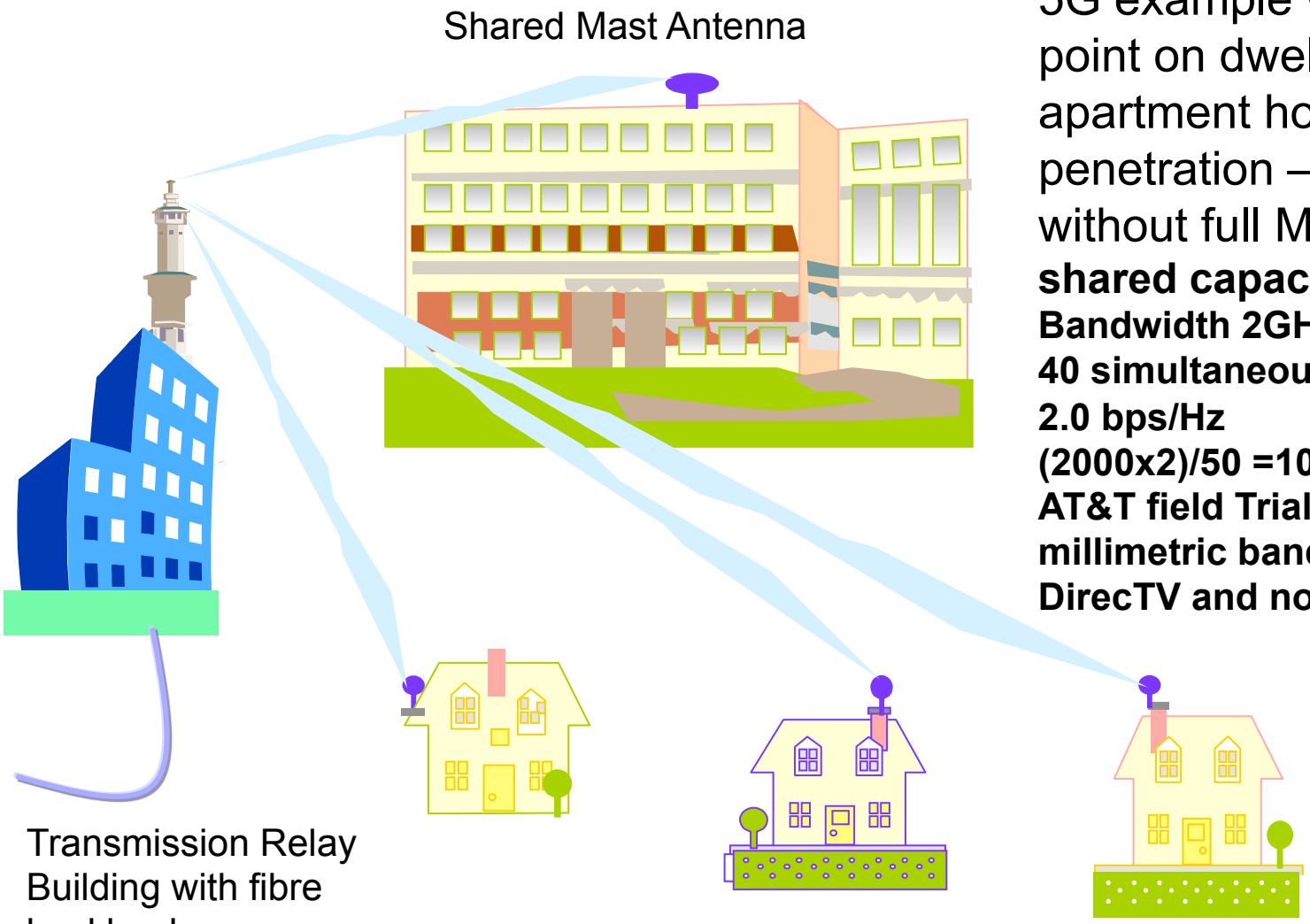
5G is a complement to other mobile and Wi-Fi for small cells in urban settings

Long term view

5G seeds technology foundations for tomorrow - and so deserves long term R&D investment



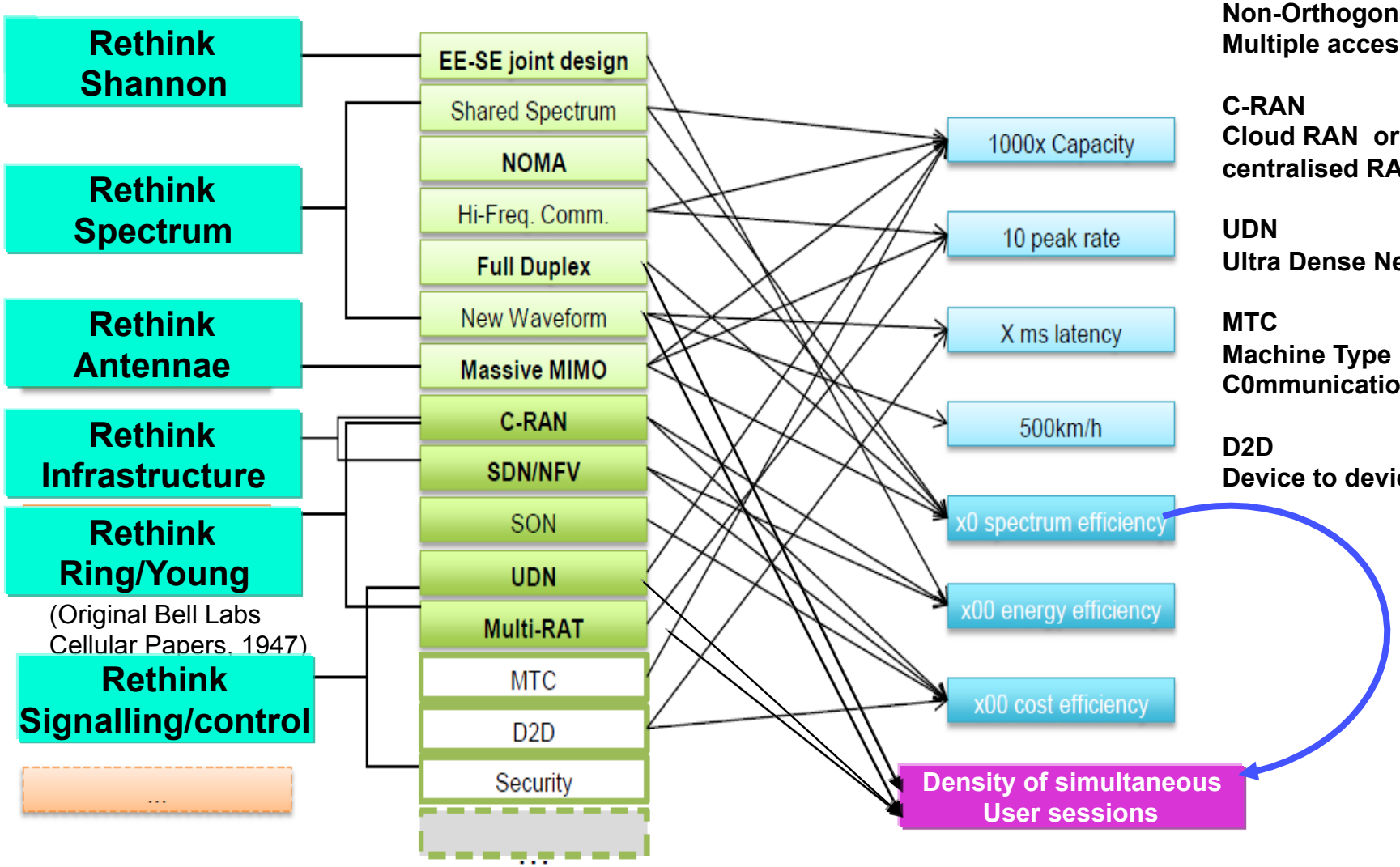
A real business case for the short term? '5G' for wireless broadband to buildings as ***Fixed Wireless Access*** (FWA) = Gigabit speeds to multiple users in the local loop (urban and suburban)



5G example with repeater point on dwelling or apartment houses for indoor penetration – early model without full MIMO, MSA so **shared capacity:-**

Bandwidth 2GHz
40 simultaneous users
2.0 bps/Hz
(2000x2)/50 =100 Mbps /user
AT&T field Trials H2, 2016 in millimetric band - has bought DirecTV and now Time Warner

China Mobile's "From Pearls to technologies"



EE-SE
Energy Efficiency-Spectrum Efficiency

NOMA
Non-Orthogonal Multiple access

C-RAN
Cloud RAN or centralised RAN

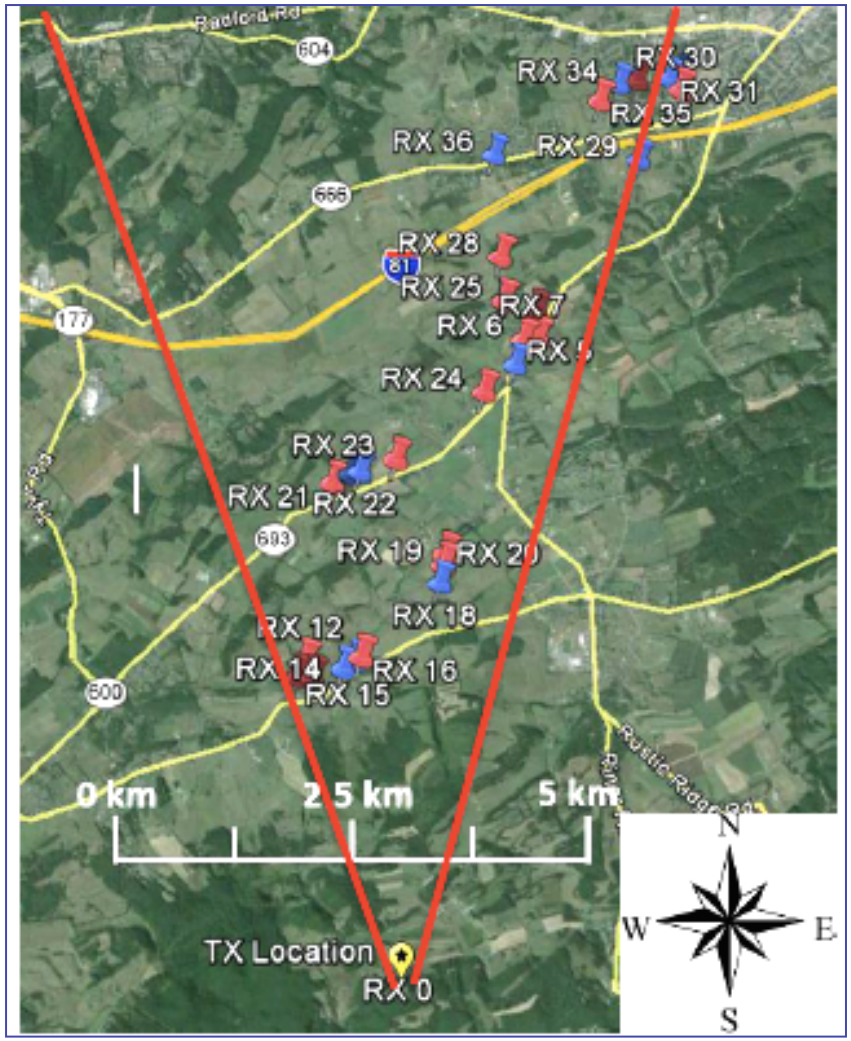
UDN
Ultra Dense Network

MTC
Machine Type C0mmunications

D2D
Device to device

Source: Chih-Lin I, China Mobile, SEP 2015

But is there hope ? – 07 October 2016: NYU Wireless field test results published : tests at 73GHz indicate longer range – up to 10 kms possible with LoS for specific designs

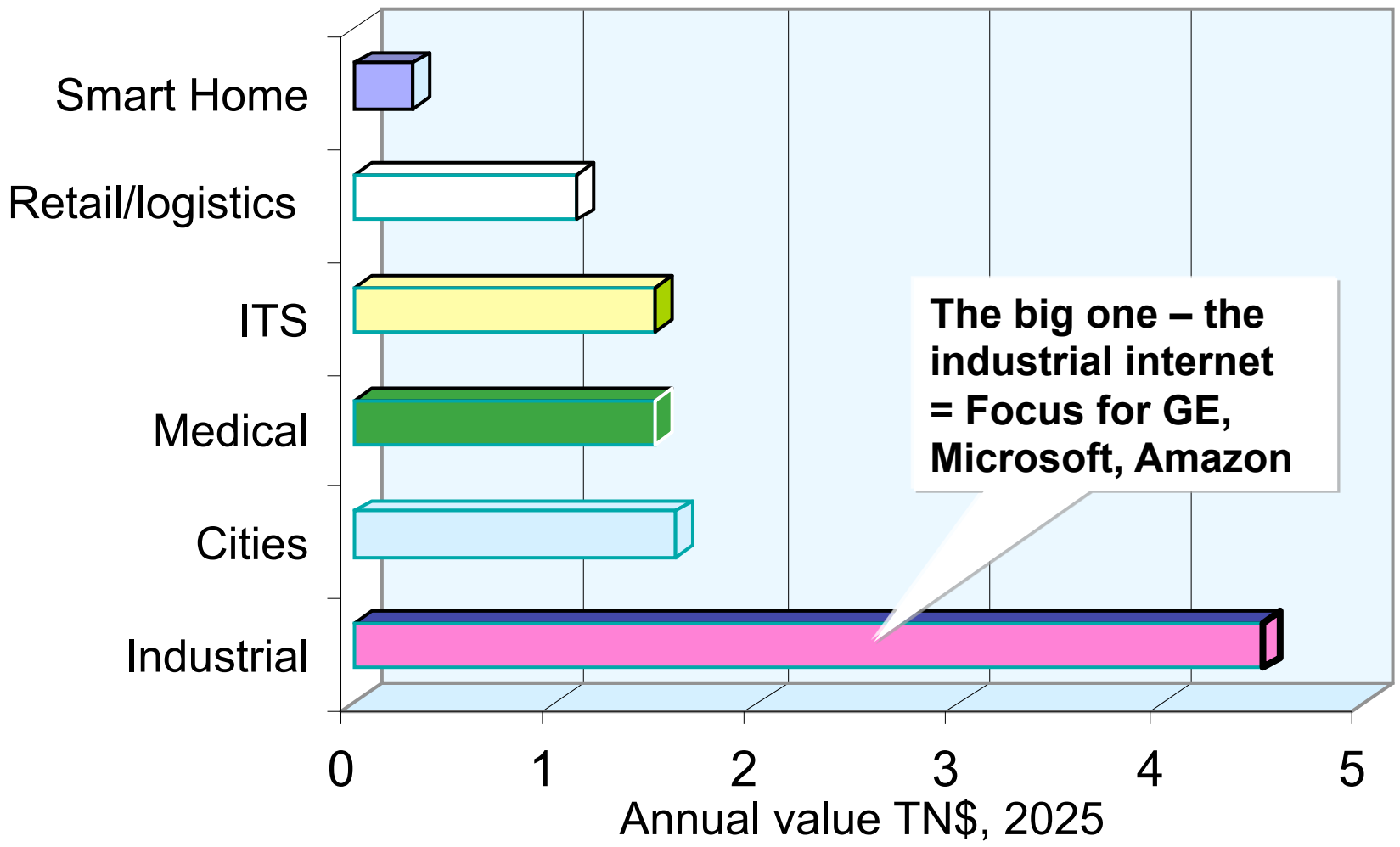


- 73.5GHZ tone
- 29mW power
- Tested for LoS and NLOS (tree blocking)

Source NYU Wireless,
G.R.MacCartney,S.Sun,andT.S.Rappaport,Y.Xing,H.Yan,J.Koka,R.Wang, And D.Yu,
"MillimeterWaveWirelessCommunications:NewResultsforRuralConnectivity,"
All Things Cellular'16:5thWorkshoponAllThingsCellularProceedings,
In conjunction with ACM MobiCom,Oct.7,2016.

Thank you

IoT Economic impact by sector: estimates for 2025



Source: Financial Times, 23/24April 2016, CB Insights

The industrial IoT needs distance and low cost simplicity

Possibly in-home entertainment centres, smart homes and some ITS could use 5G