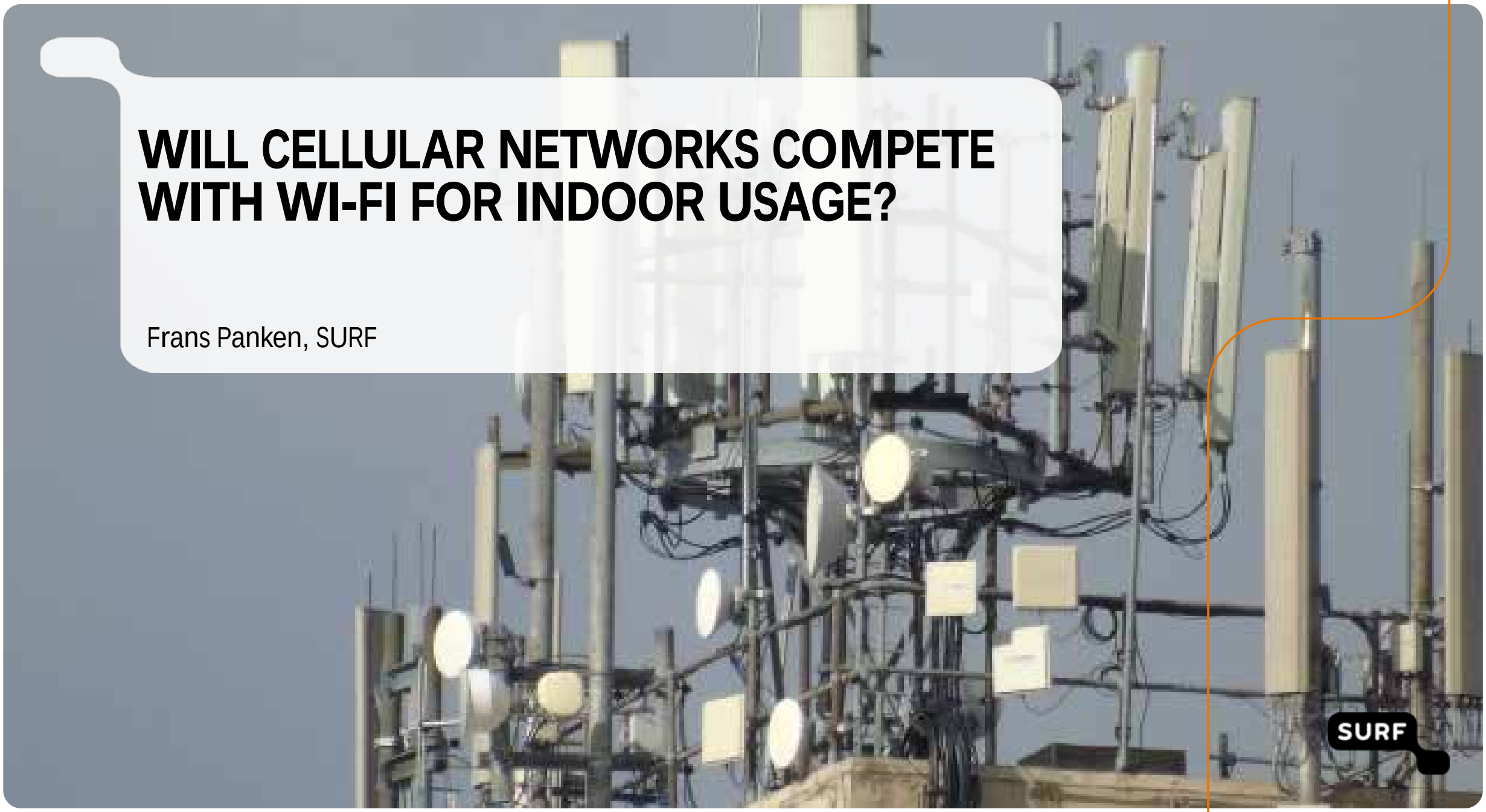
WILL CELLULAR NETWORKS COMPETE WITH WI-FI FOR INDOOR USAGE?

Frans Panken, SURF



What will be addressed in this presentation?

- Indoor wireless data network: Wi-Fi
  - Residential use
  - Enterprises
- Outdoor wireless networks: cellular networks (= 2G/3G/4G/5G)
- Outdoor carrier-grade Wi-Fi networks
- (Indoor + outdoor) cellular private networks
- Cellular private networks competing for indoor usage at Enterprises?
  - Cellular private networks a niche? Some trends/announcements
  - …
  - …

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5G BUILDINGS CARRIERS CONNECTIVITY INFRASTRUCTURE INTERNET OF THINGS (IOT) LTE NEWS SMART FACTORY

Telenor signs up to resell Ericsson's private LTE and 5G factory bundle

James Blackman • February 13, 2020 • Share 0

'The pricing is highly attractive' – Siemens applies for private 5G spectrum licences

James Blackman • December 2, 2019 • Share 0

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Zoek naar nieuws

Brussels Airport bouwt eigen 3,5GHz-netwerk

Door **Olaf van Miltenb**
Nieuwscoördinator
Feedback

23-12-2019 • 15:40

31

Submitter: ByteMeTwice

Het Belgische vliegveld Brussels Airport gaat samen met Nokia en Citymesh zijn eigen mobiele netwerk opzetten dat gebruikmaakt van de 3,5GHz-frequentieband. Het vliegveld gaat het netwerk onder andere voor track & trace en beveiligingssystemen inzetten.

Volgens Brussels Airport is zo'n eigen netwerk efficiënter, betrouwbaarder en sneller dan wifi of publieke 4g. Naast track & trace en mobiele beveiligingssystemen moet het netwerk gebruikt worden voor geautomatiseerde voertuigen en internet-of-things-toepassingen.

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Nokia 5G private wireless networking moves from trial to permanent deployment for Lufthansa Technik

Press Release 21 June 2021

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Aug 9, 2021, 08:30am EDT | 2.777 views

Private 5G Networks Ar… The Rise, Fueling The Industry 4.0 Drive

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5G paired with private network capability key for smart buildings: JMA

APRIL 28, 2020 BY JUAN PEDRO TOMÁS

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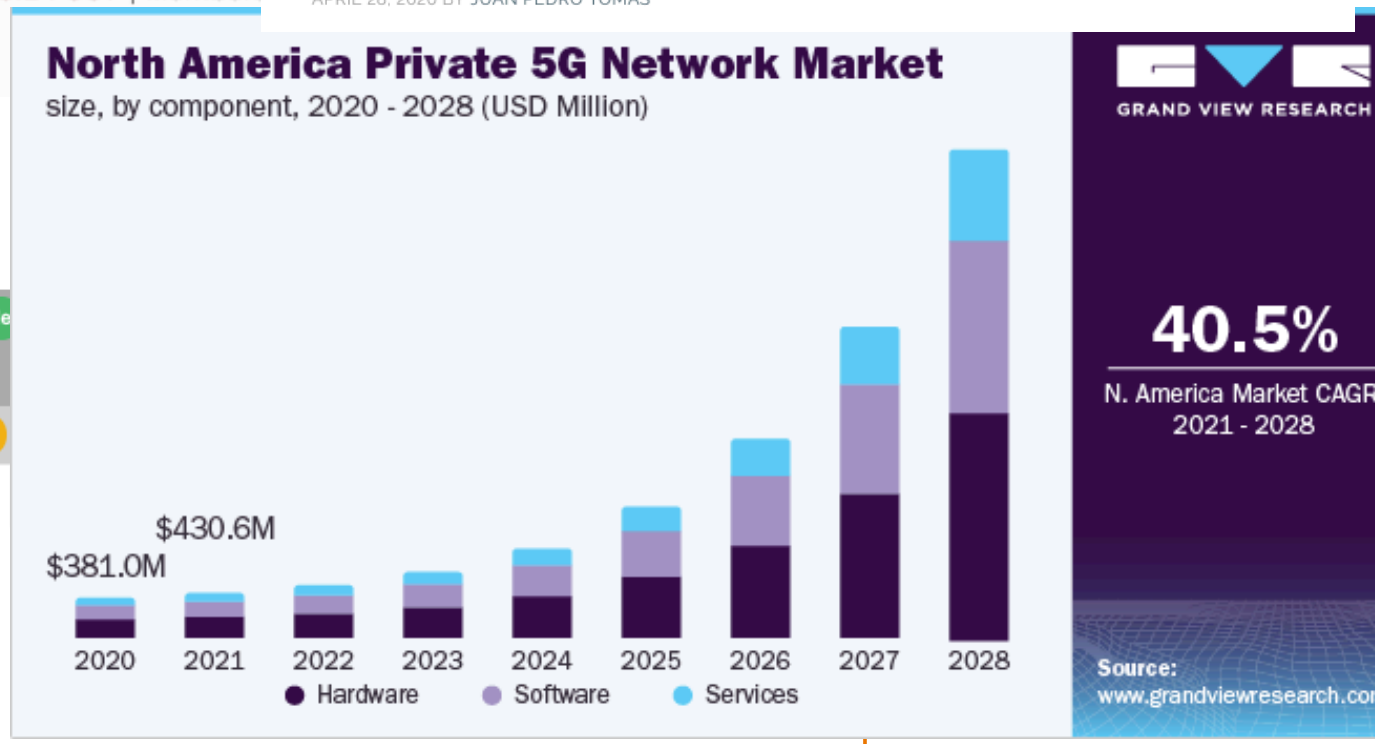
Boom year for private 5G? Telcos restructure to take enterprise bull by network horns

James Blackman • July 29, 2021 • Share | 0



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IDC > Products & Services > Research > Enterprise Requirements for Private Cellular...

TECH SUPPLIER Feb 2021 - IDC Survey Spotlight - Doc # US47444021

Enterprise Requirements for Private Cellular Networks from Their Services Firms

By: Leslie Rosenberg

$1,000.00

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IDC > Products & Services > Research > 5G and Mobile Private Networks

TECH SUPPLIER Feb 2021 - Market Perspective - Doc # EUR147334120

5G and Mobile Private Networks

By: John Delaney

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5G - Private mobile Networks December 2020: Global Update

Private mobile Networks December 2020: Global Update

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#5GDevices - The number of announced #5G #devices continues to rise and has now passed the 1000 mark for the first

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TELECOMMUNICATIONS

MEC and Private Wireless – CSPs Enabling Enterprise Transformation

Communications service providers are in the pole position to enable enterprise transformation through private wireless and multi-access edge computing (MEC).

By David Paterson | September 10, 2021

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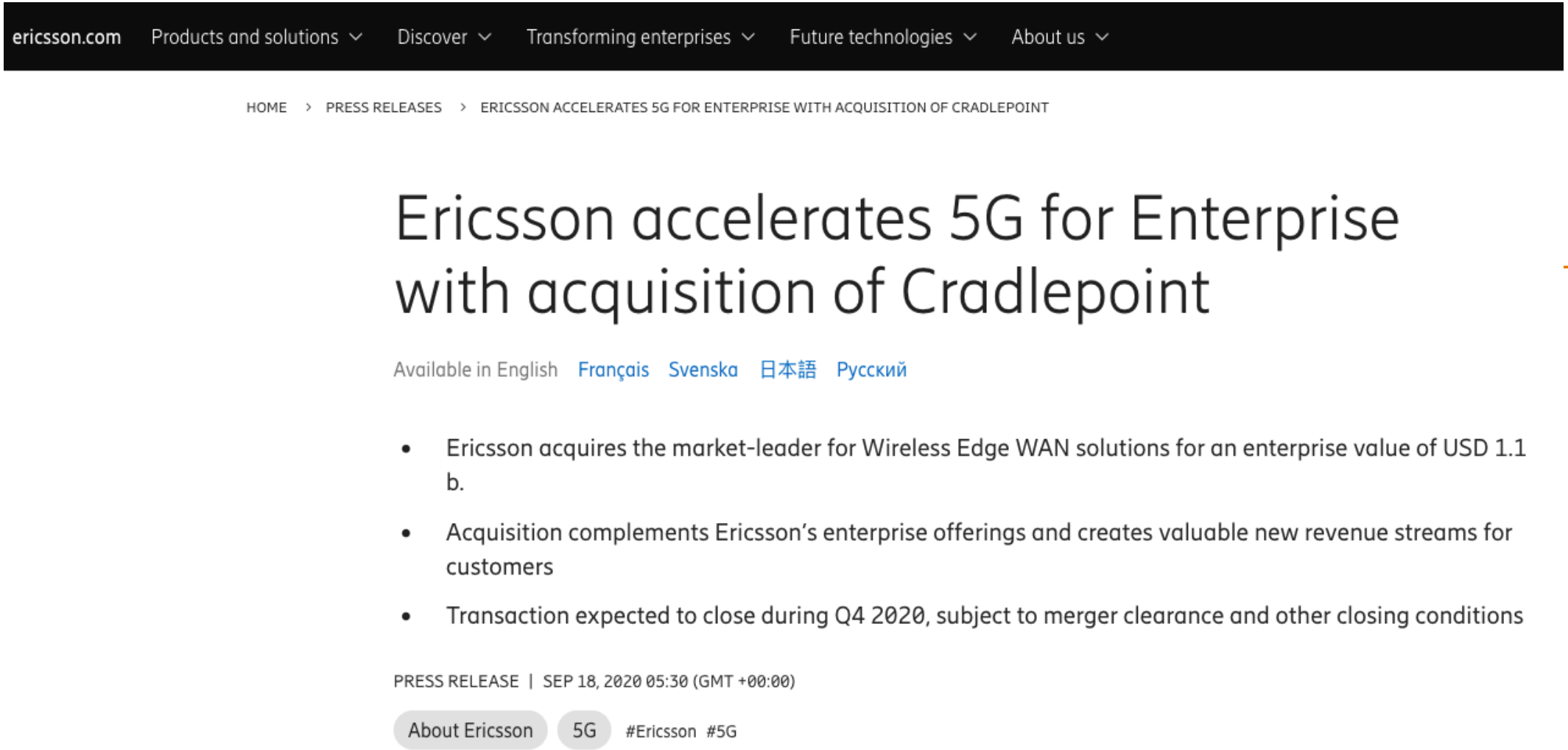
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Ericsson accelerates 5G for Enterprise with acquisition of Cradlepoint
Available in English Français Svenska 日本語 Русский
• Ericsson acquires the market-leader for Wireless Edge WAN solutions for an enterprise value of USD 1.1 b.
• Acquisition complements Ericsson's enterprise offerings and creates valuable new revenue streams for customers
• Transaction expected to close during Q4 2020, subject to merger clearance and other closing conditions
PRESS RELEASE | SEP 18, 2020 05:30 (GMT +00:00)
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Qualcomm and Capgemini to launch end-to-end 5G private networks

The two firms are collaborating on non-public, high bandwidth, ultra-low latency networks for industrial IoT settings

by: Keumars Afifi-Sabet 2 Jul 2021

AWS Partner Network (APN) Blog

Scalable Mobile Private 4G and 5G Network Services on AWS from Deloitte

by Sigit Priyanggoro, Awaiz Ahmad Khan, Rahul Bajpai, and Arpan Tiwari | on 01 SEP 2021 | in AWS Partner Network, Customer Solutions, Intermediate (200), Internet Of Things, Thought Leadership | Permalink | Comments | Share

SURF

Will 5G restrict to mainly outdoor usage?

Many buildings cope with poor indoor cellular services (2G/3G/4G)

This problem increases when 5G uses higher frequencies (3,5GHz + 26GHz)

Trends

FierceWireless

WIRELESS TECH 5G IOT

Wireless

Verizon anticipates indoor 5G without Wi-Fi

by Monica Alleven | Jan 7, 2020 4:24pm

In Verizon's view, there will be substantial environments in which public Wi-Fi will be eliminated in favor of millimeter wave because of the security, reliability and service capabilities. (FierceWireless)

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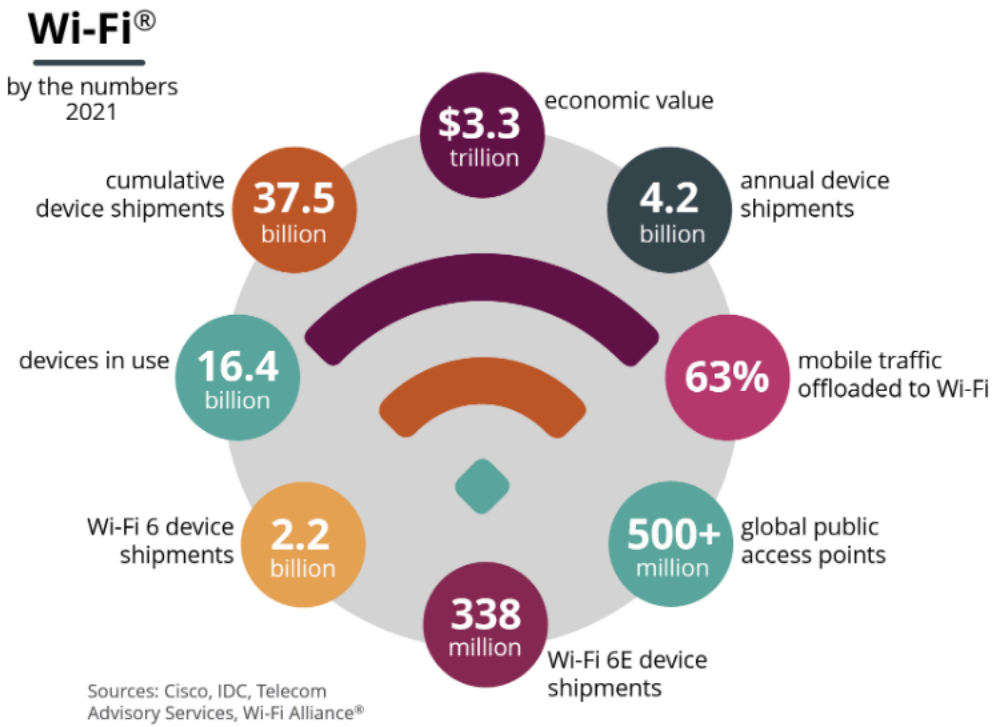
- Cellular solutions competing for indoor usage at Enterprises?
  - Cellular private networks a niche? Some trends/announcements
  - Are cellular solutions a serious competitor for Wi-Fi at Enterprises?
  - What is needed (what are the side conditions) for cellular solutions to compete with Wi-Fi for indoor network solutions?

Wi-Fi facts

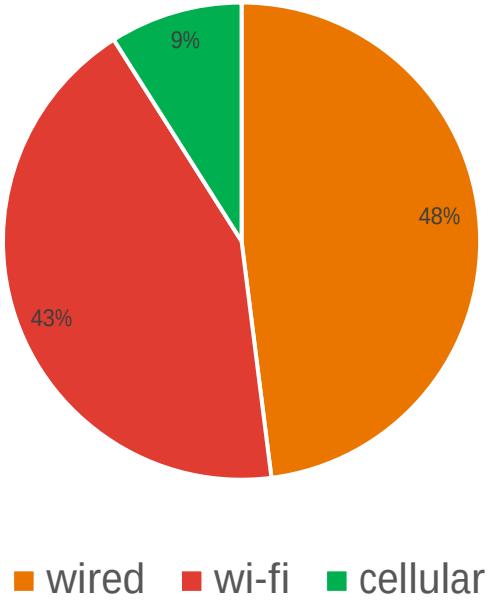
- World-wide Wi-Fi revenues (IDC 8 sep 2021):
  - Enterprise market: YoY growth 2Q21: +22.4% to $1.7 billion
  - Consumer market: YoY growth 2Q21: -5.7% to $2.3 billion
  - year-over-year wifi growth 2Q21: +4.6% in 2Q21



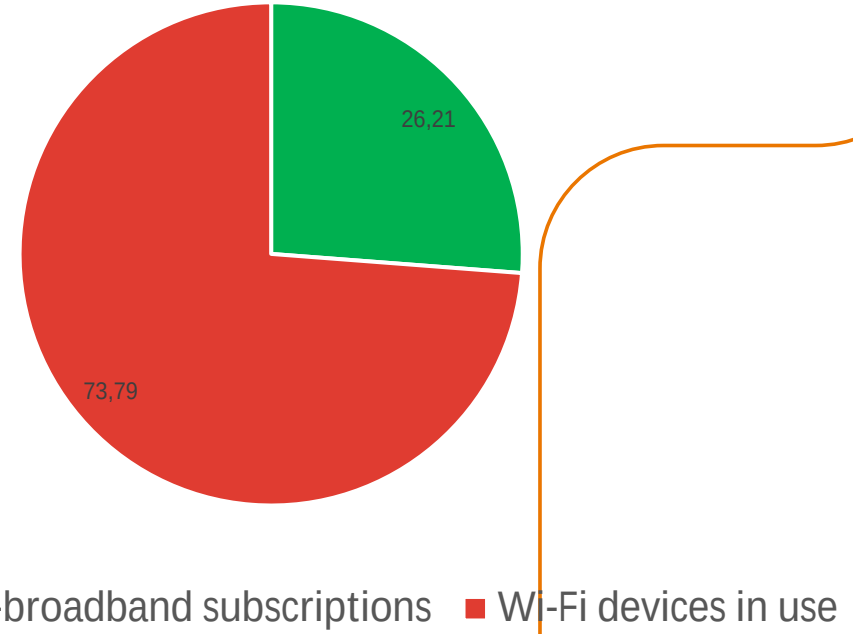
Source: wi-fi alliance: 'Global Economic Value of Wi-Fi', September 2021

Wi-Fi vs cellular in traffic and devices

Global IP traffic 2017 (source: Cisco VNI)



Global Wi-Fi devices in use vs cellular subscriptions
(source: Wi-Fi alliance 2021 & ITU key ICT aggregates 2020)

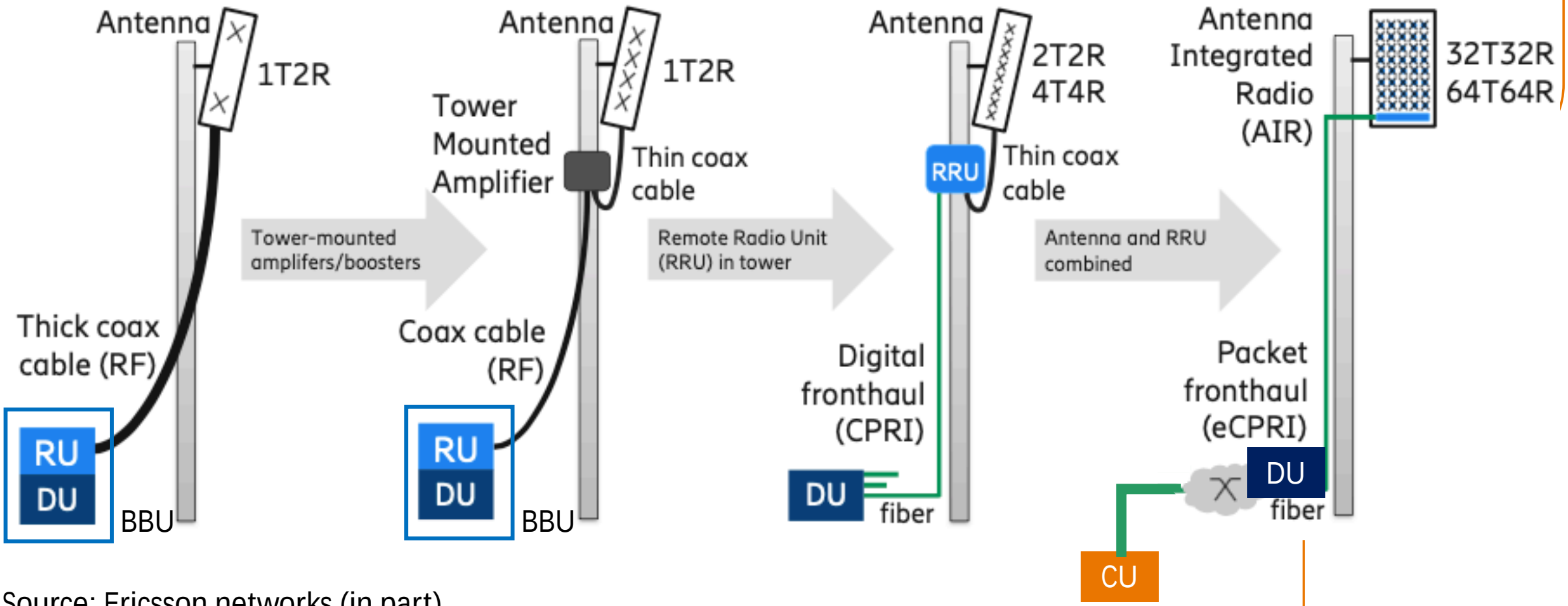


My conclusion for the coming 3 years: Wi-Fi is here to stay

9 hurdles / requirements for private 4G/5G to compete with Wi-Fi

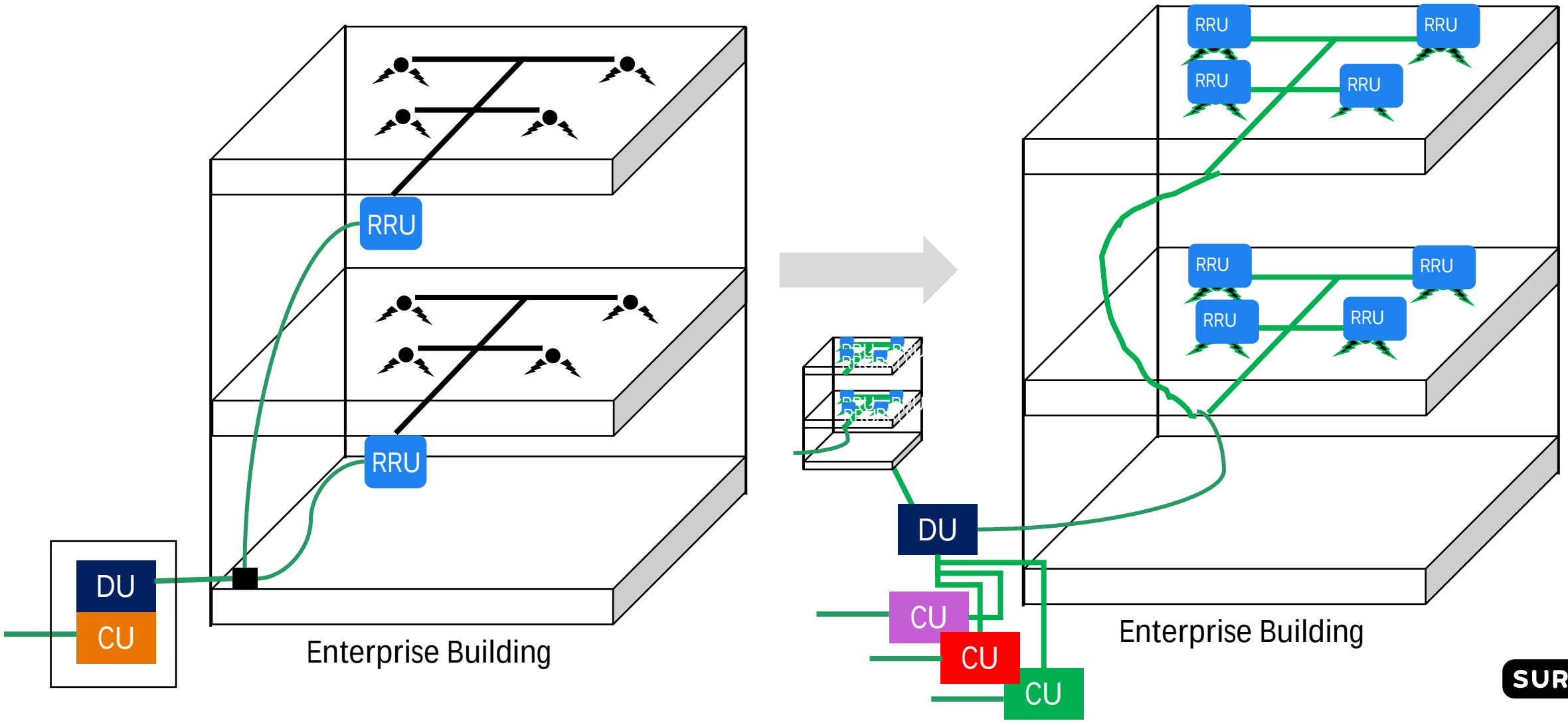
1. Multi-operator, ownership & reduction of equipment
2. Mobile operators to use networks of third party's
3. Private & unlicensed frequencies
4. Modular 5G (+ Wi-Fi) cells using UTP cables, without loosing availability
5. Integration of private 5G indoor networks with public cellular operators
6. Improved match & interaction with working procedures
7. Availability of laptops with 5G radio
8. Handsets fully operational on private networks
9. Costs & performance

1: multi-operator, ownership & reduction of equipment evolution of fronthaul

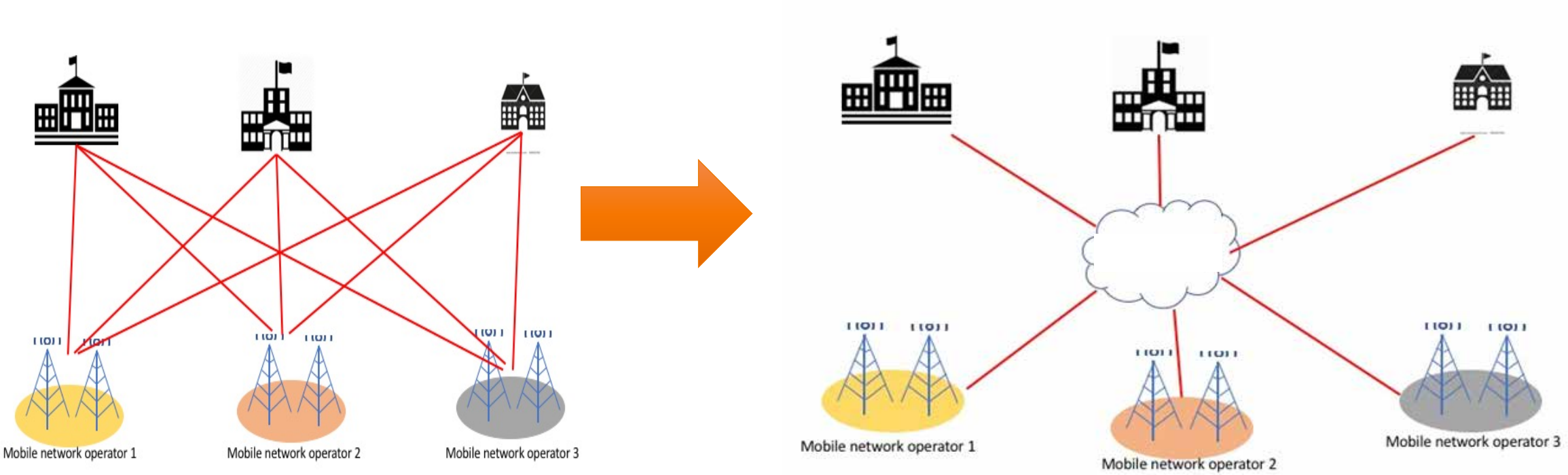


Source: Ericsson networks (in part)

1: multi-operator, ownership & reduction of equipment : evolution of fronthaul



2: Mobile operators to use networks of third party's



3: Private & unlicensed frequencies for 4G and 5G

4G/5G spectrum for private usage in various countries

Country	Spectrum	Availability
NL	1800 MHz 2 x 5 MHz 'DECT guard band' (2x50 MHz in 3.5GHz)	Available since many years (Planed in 2026)
Germany	3.7 – 3.8 GHz (+ 26 GHz)	Since Q3 of 2019 (2020)
UK	1.7817-1.785/1.8767-1.880 GHz, 2.39-2.4 GHz, 3.8 - 4.2 GHz	Since Q4 2019
France	2.575–2.615 GHz	Since 2019
Sweden	3.720 – 3.800 GHz	Since March 2020
USA	CBRS, 3550 – 3700 MHz	Since Q2 2019
Japan	Local 5G, 2.575–2.595 GHz, 4.6–4.9 GHz	Since Feb 2020
China	Shared spectrum for indoor usage, 3.3 – 3.4 GHz	Since Feb 2020
Brazil	2.390–2.400 GHz, 3.7 – 3.8 GHz	Since 2021
Chile	3.750-3800 GHz	Since 2019

3: Private & unlicensed frequencies for 4G and 5G
Efforts to use ISM bands for cellular networks

- LTE in unlicensed frequency bands (LAA, LTE-U, LWA, LWIP, MulteFire)
  - Started with downstream
  - Since 3GPP R14: no anchor in license specrrum needed
  - According to GSA (March 2020): 42 operators around the world invested in LTE in ISM
  - Study on Wi-Fi / LAA interworking ICC 2021: goodput of Wi-Fi users decreased up to 97%, LAA users decrease 35%

- 5G NR-U (aka: feLAA):
  - Various scenario's using 5G NR in unlicensed and shared spectrum
  - Includes the 6GHz band for Wi-Fi6E

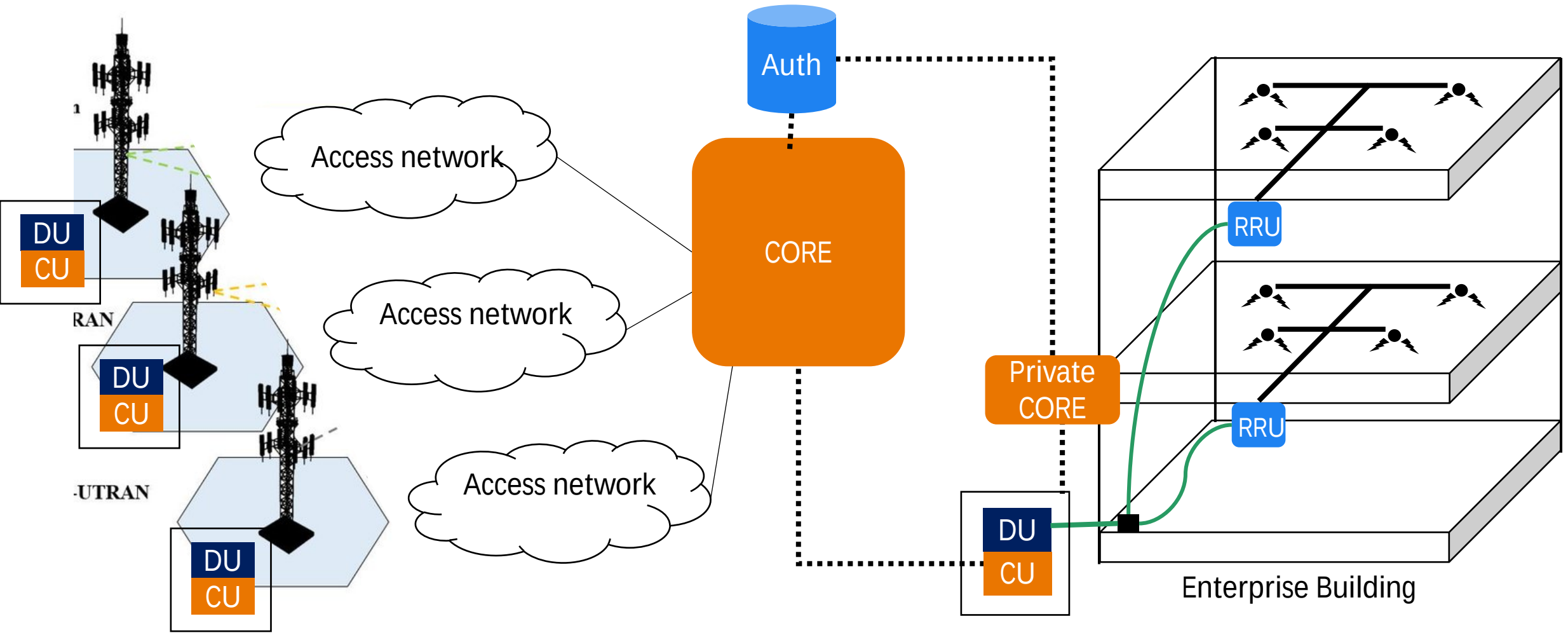
4: Modular 5G (+ Wi-Fi) cells using UTP cables, without loosing availability

Ruckus Q410

LTE BAND 48

Stand-alone or integrated in a Wi-FI access point

5: Integration of private 5G indoor networks with public cellular operators



6: improved match & interaction with working procedures

- Do-it-yourself

- Buy it as-a-service

7: Laptops equipped with 4G / 5G modem

Lenovo
Miix 310

Yoga 5G
X1 (Thinkpad / Fold),
Flex 5G 2-in-1

Acer Chromebook 314 C933LT-P3G5 4G LTE
Acer Spin 7

Google Chromebook Pixel (4G LTE)

Microsoft Surface 3, Pro 5, Pro 7, Go 2, Pro X

Dell Latitude E5470
,7420, 7490 (7000 series)

Dell Latitude 9510

HP EliteBook 1040
HP Elite Dragonfly G2

Xiaomi Mi Notebook Air 4G

Samsung
Chromebook Plus, LTE
Galaxy (Book) Flex2

ASUS Chromebook C300

8: Handsets fully operational on private networks

- Restricted availability of the built-in ‘green button’ eperience
- Emergency (112) not available
- Challenges on certification of private LTE networks for critical communication

9: Costs & performance

- The costs of a Wi-Fi network are much

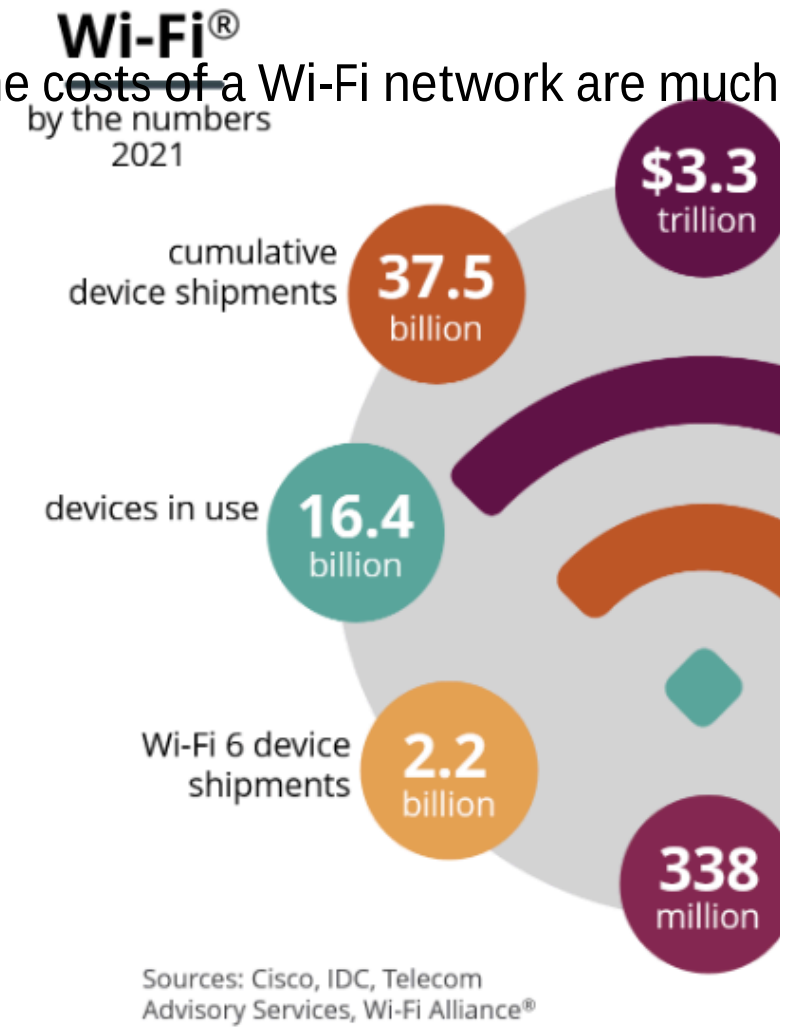
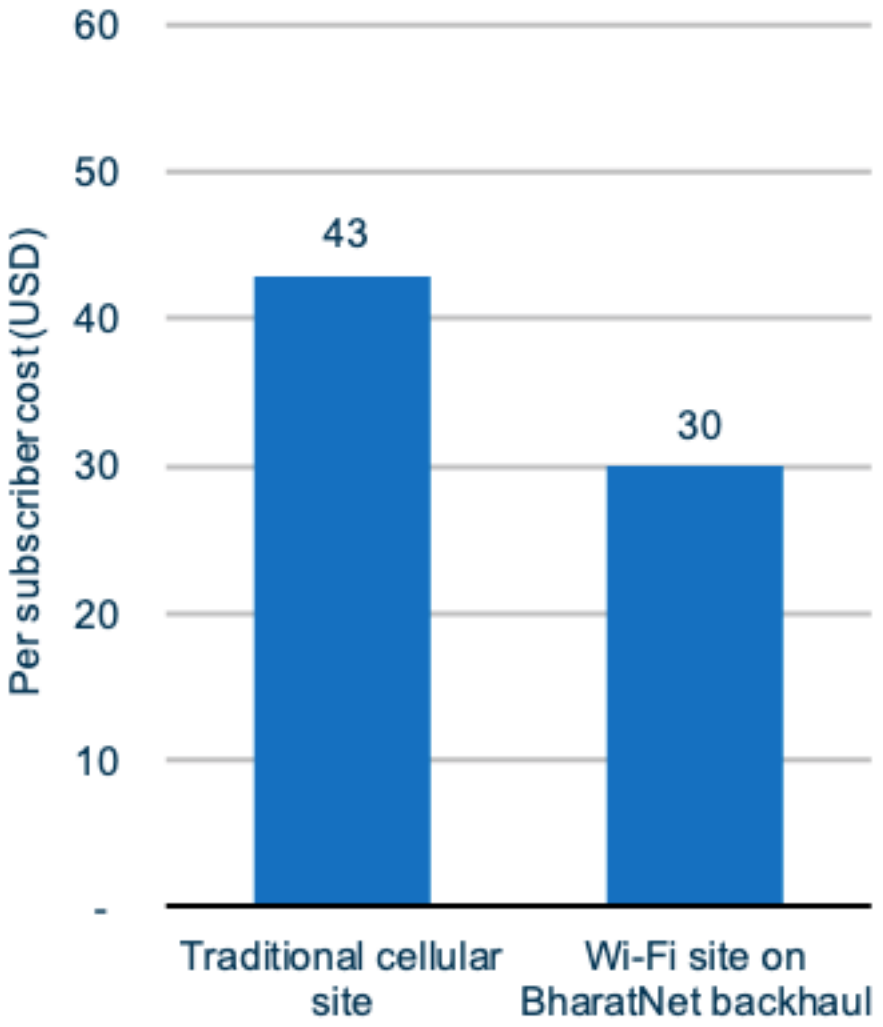


Figure 3.16: Per-subscriber cost of various deployment models [Source: Analysys Mason, 2018]



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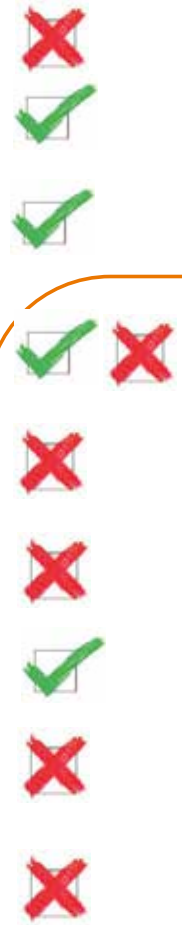

WILL CELLULAR NETWORKS COMPETE WITH WI-FI FOR INDOOR USAGE?

MY CONCLUSION: A LONG WAY TO GO

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