Mobile Security

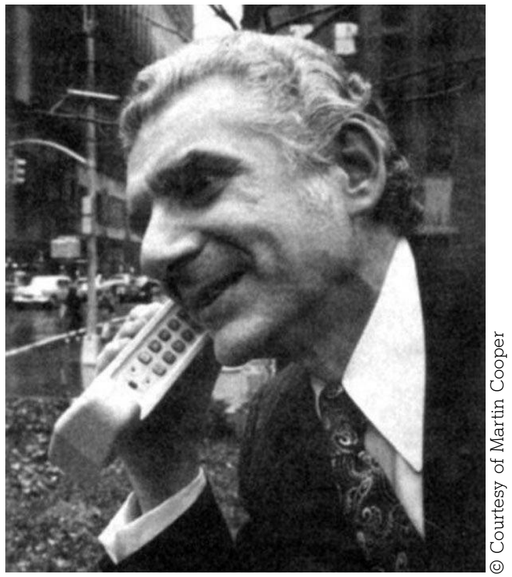
A1 | Georg Löffelmann

29 May 2026

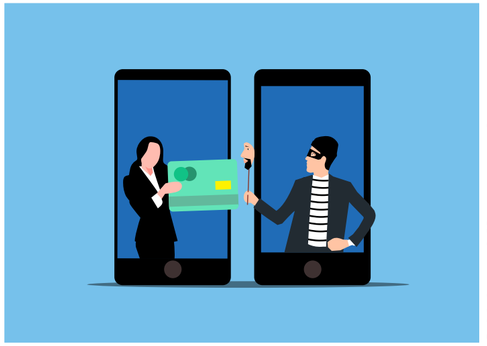
Quotes on Mobile and Security

"The biggest innovation of all is social networking, and **cellular technology is the facilitator for social networking**. People are mobile; social networking is people, and the only way people connect with each other is wirelessly."

Martin Cooper
(Inventor of the first handheld mobile phone)



"Amateurs hack **systems**, professionals hack **people**."



Look Who's Talking

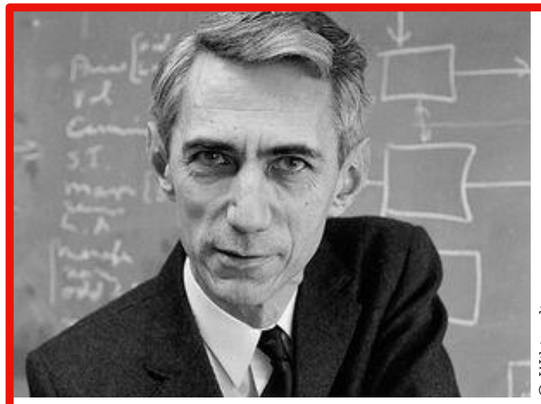
9125569 TECHNISCHE UNIVERSITÄT WIEN

Dipl.-Ing. Georg Löffelmann, Head of Department Mobile, A1 Telekom Austria AG

Siemens Munich	GHz
ABB, Thomcast CSF Baden	kHz
Kapsch	MHz
ÖBH	MHz
A1	MHz → GHz

https://www.linkedin.com/in/georgloeffelmann/

What I do: Mr. Shannon meets Net Present Value



© Wikipedia

$$C = B \log_2 \left(1 + \frac{S}{N} \right)$$

$$NPV = \sum_{t=0}^{N} \frac{CFt}{(1+\mathrm{i})^{\mathrm{t}}}$$

© pixabay.com

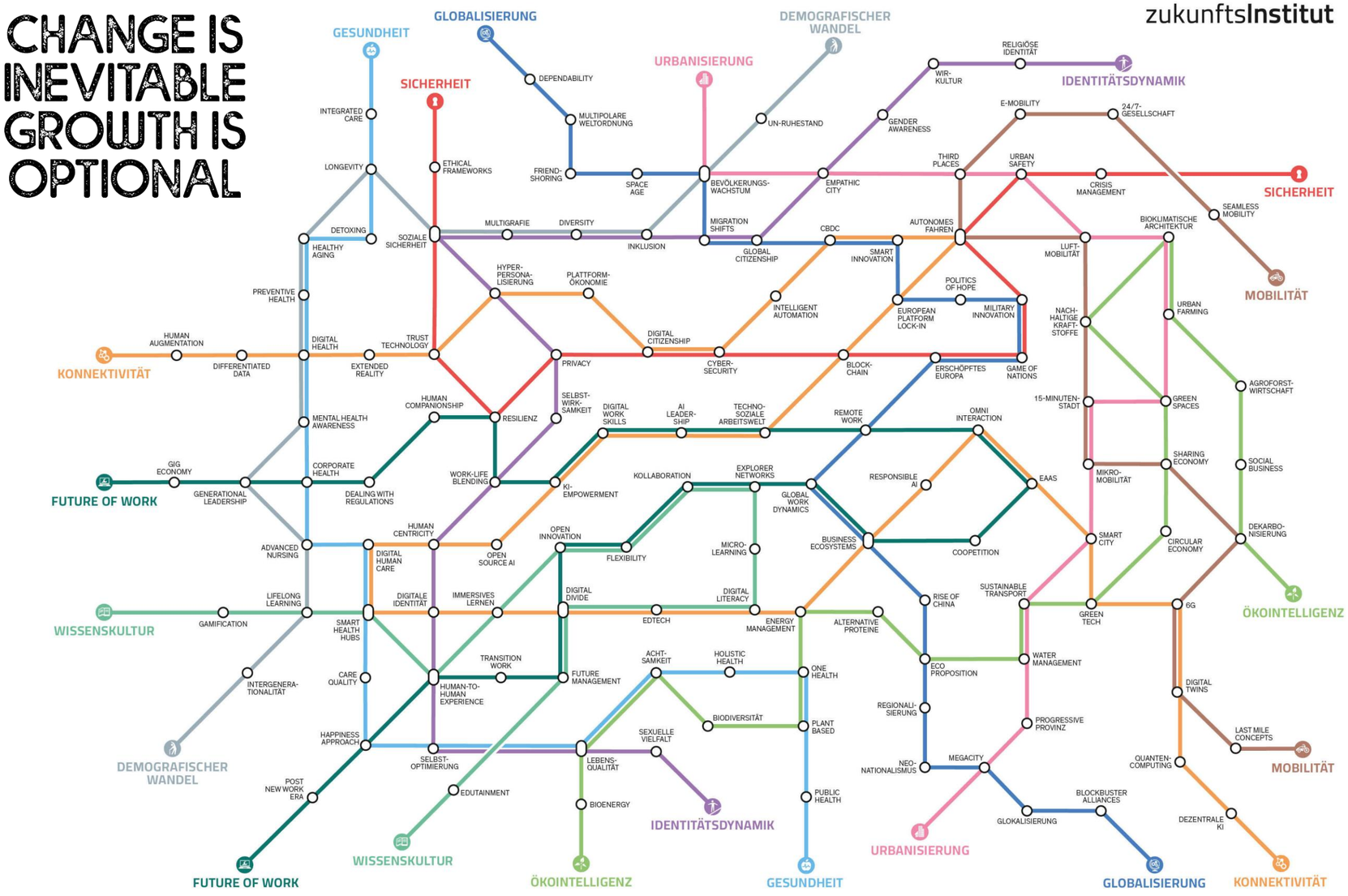
Agenda 29.05.2026

- Megatrends & The Times They Are A-Changin‘
- Telecommunications Primer
- Mobile Communications, Frequencies, Immissions, Standards
- Cellular Network Planning, Architecture
- Traffic Development
- Edge Computing
- MNO Spectrum in Austria
- Slow & Fast Fading, Massive MIMO
- 5G Slicing
- 5G Security
- 6G
- Latest News: SMS Blaster

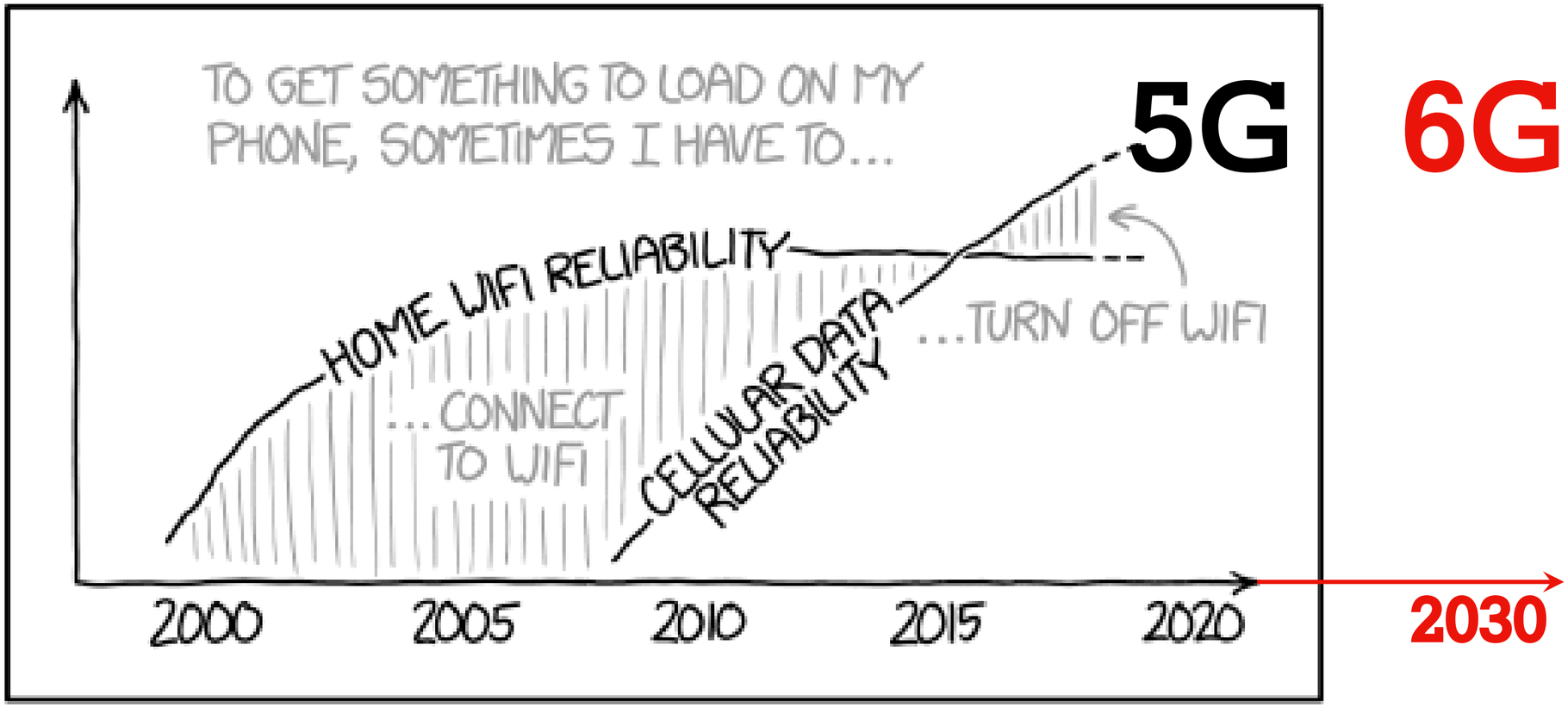
- AMA

... and who the hell are SUPI, SUCI and SEPP?

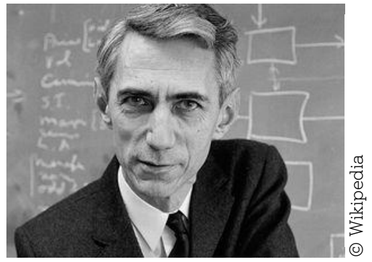
Mobility and Security are Megatrends



The Times They Are A-Changin‘

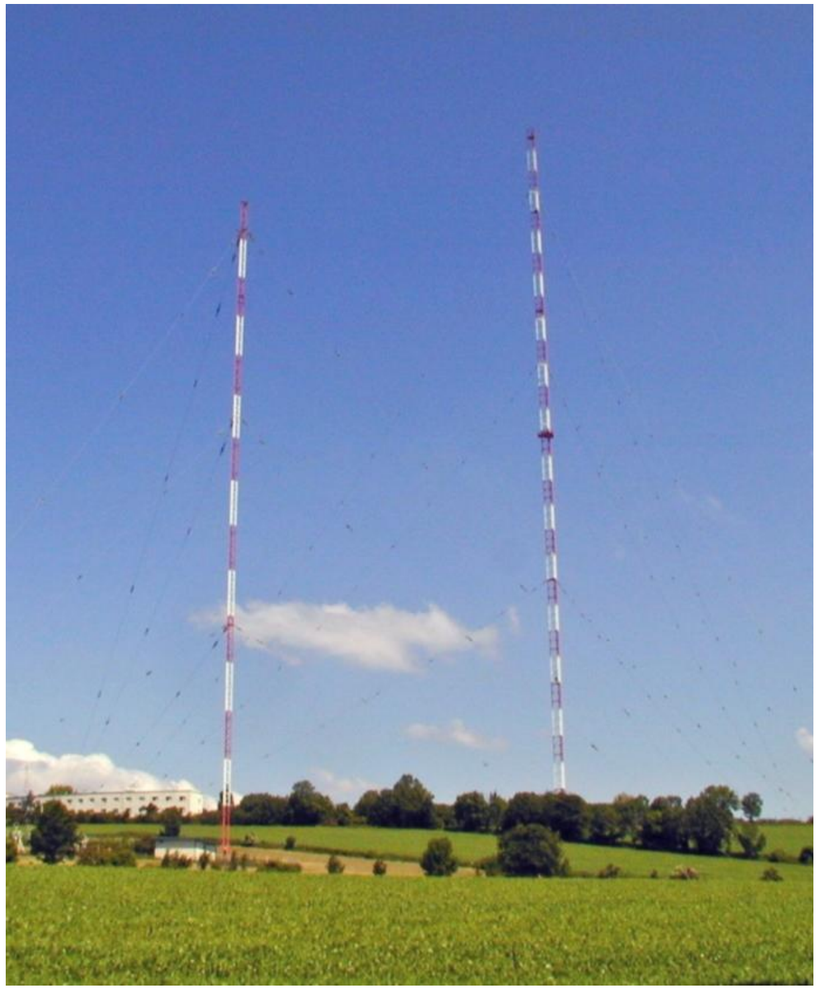


Telecommunications Primer - Signal-to-Noise Ratio


© Wikipedia

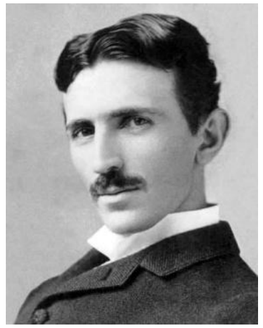
$$C = B \log_2 \left(1 + \frac{S}{N} \right)$$

- S ... Signal: e.g. Transmitter power
- N ... Noise: e.g. Interference („Crosstalk“)


© Wikipedia

Mobile Communications are brought to you by...

James Clerk Maxwell 1831 – 1879 (Classical EM Theory)
Nikola Tesla 1856 – 1943 (AC, Induction)
Heinrich Hertz 1857 – 1894 (proof of EM waves)
Guglielmo Marconi 1874 – 1934 (long distance radio)
Erwin Schrödinger 1887 – 1961 (Quantum Theory)
Hedy Lamarr 1913 – 2000 (Spread Spectrum)



Major Innovation Drivers: Military, Industry

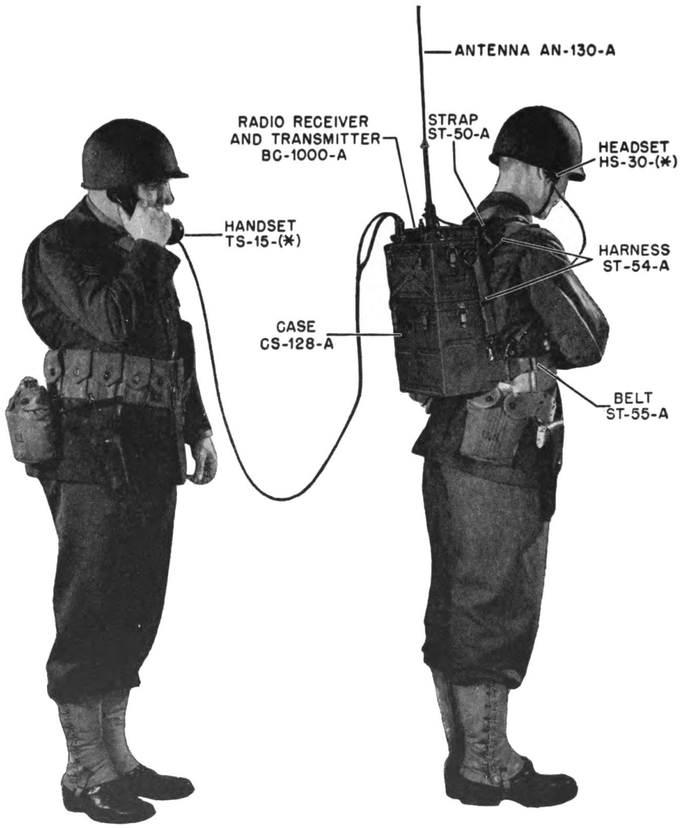


Figure 1. Radio Set SCR-300-A, In Use, Viewed From Right Side.

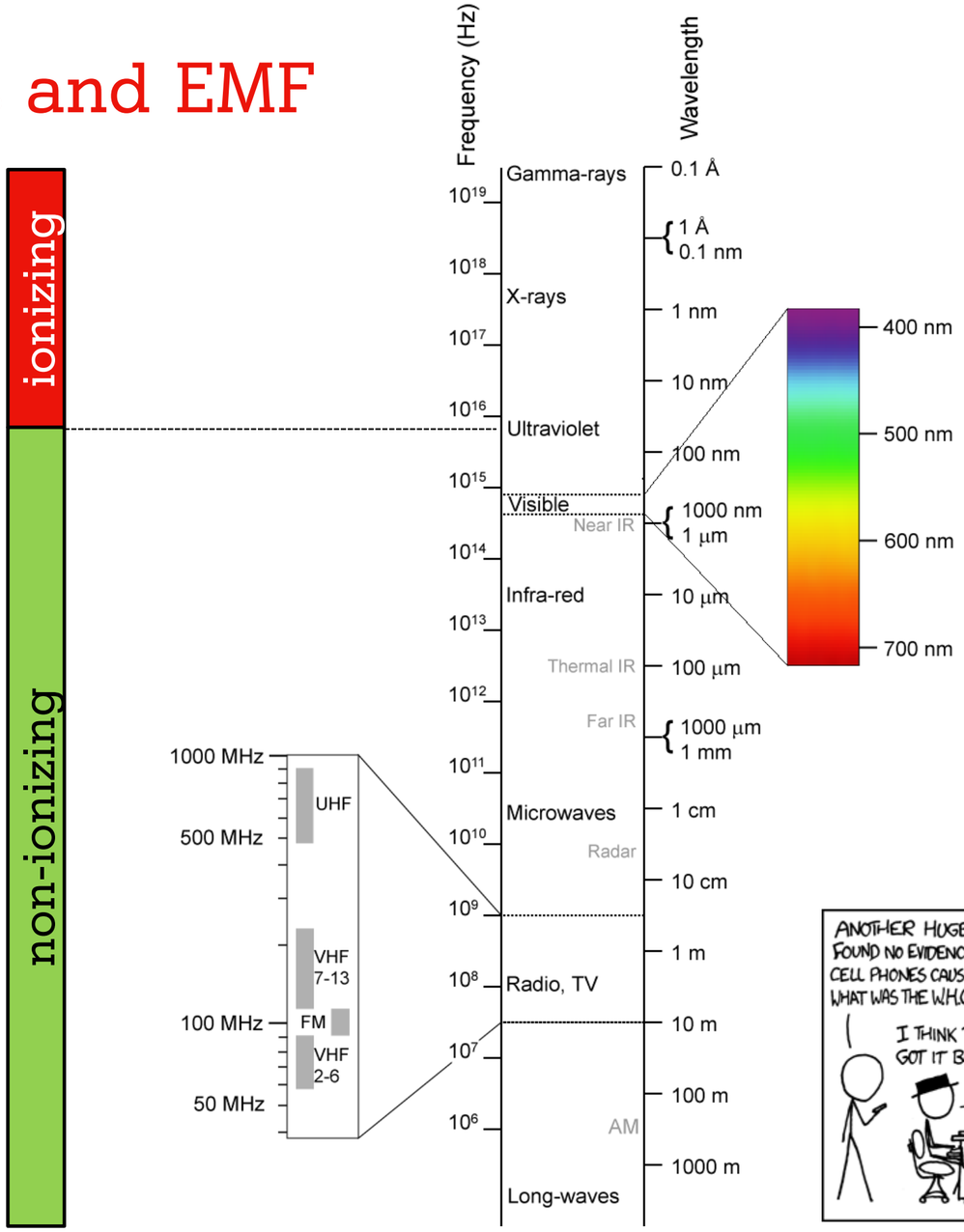
Woman with Walkie Talkie
Source: DLA/Special Collection

Walkie Talkie from 1939
Source: DLA/Special Collection

© Wikipedia

Frequencies and EMF

$$E = h \cdot f$$



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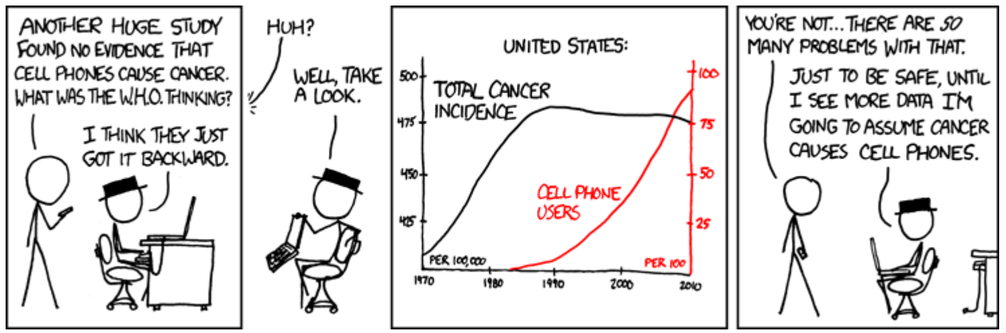
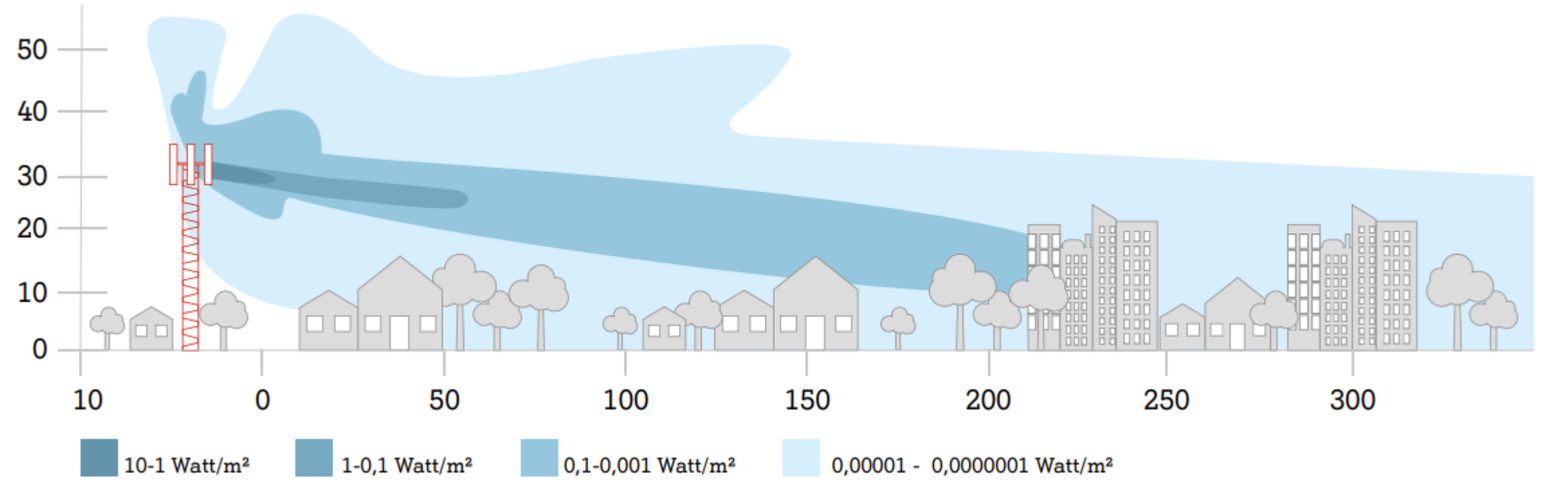


© xkcd, https://xkcd.com/925/

$h = 6.62607015e^{-34}$ J s

Immission


50
40
30
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10
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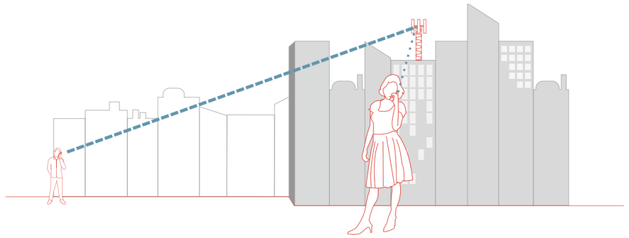
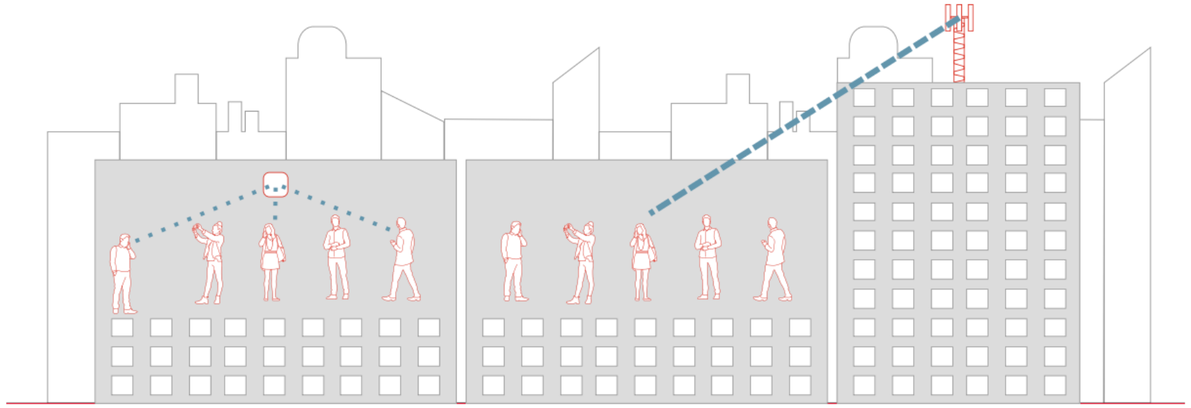
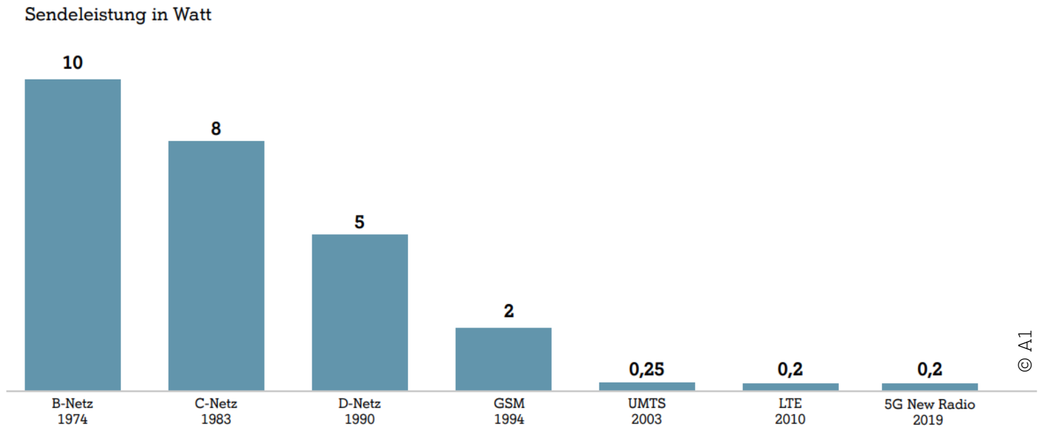
10-1 Watt/m²
1-0,1 Watt/m²
0,1-0,001 Watt/m²
0,00001 - 0,0000001 Watt/m²






Sendeleistung in Watt
10
8
5
2
0,25
0,2
0,2
B-Netz 1974
C-Netz 1983
D-Netz 1990
GSM 1994
UMTS 2003
LTE 2010
5G New Radio 2019
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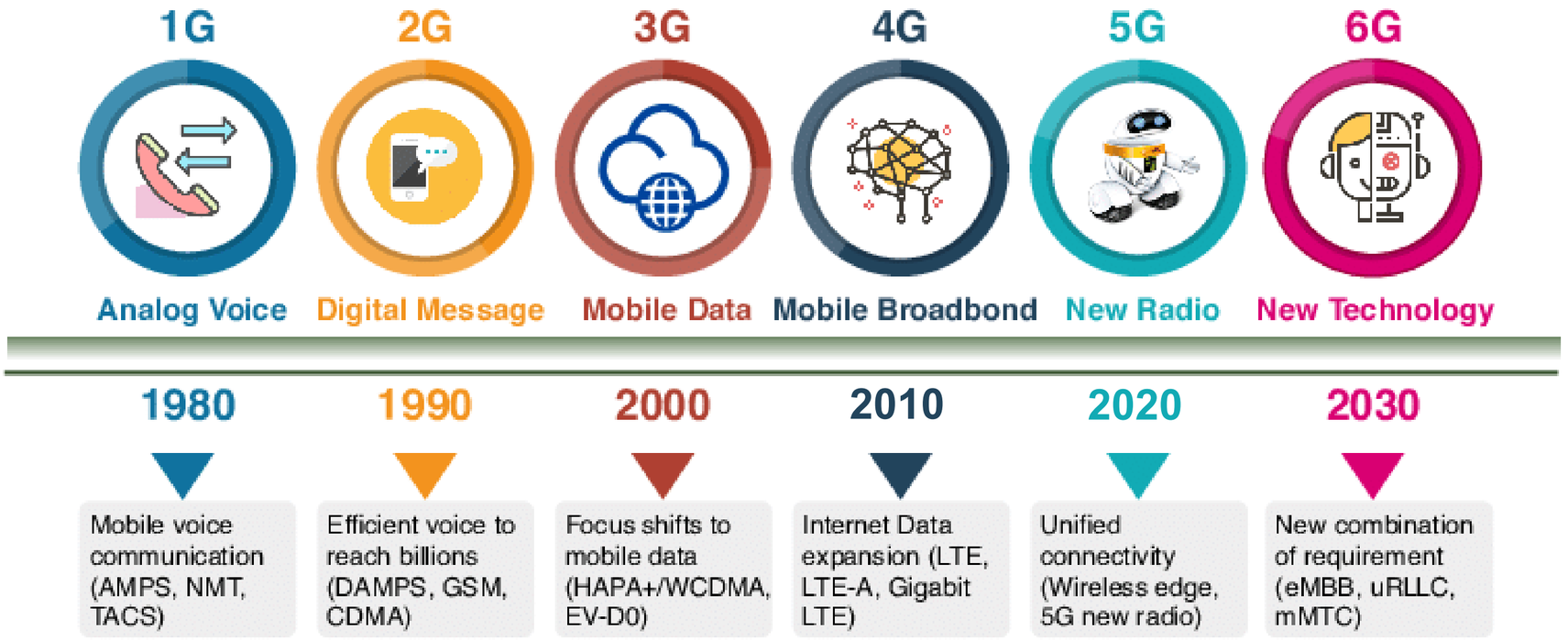
Technology Generations: Industry Standards guarantee interoperability

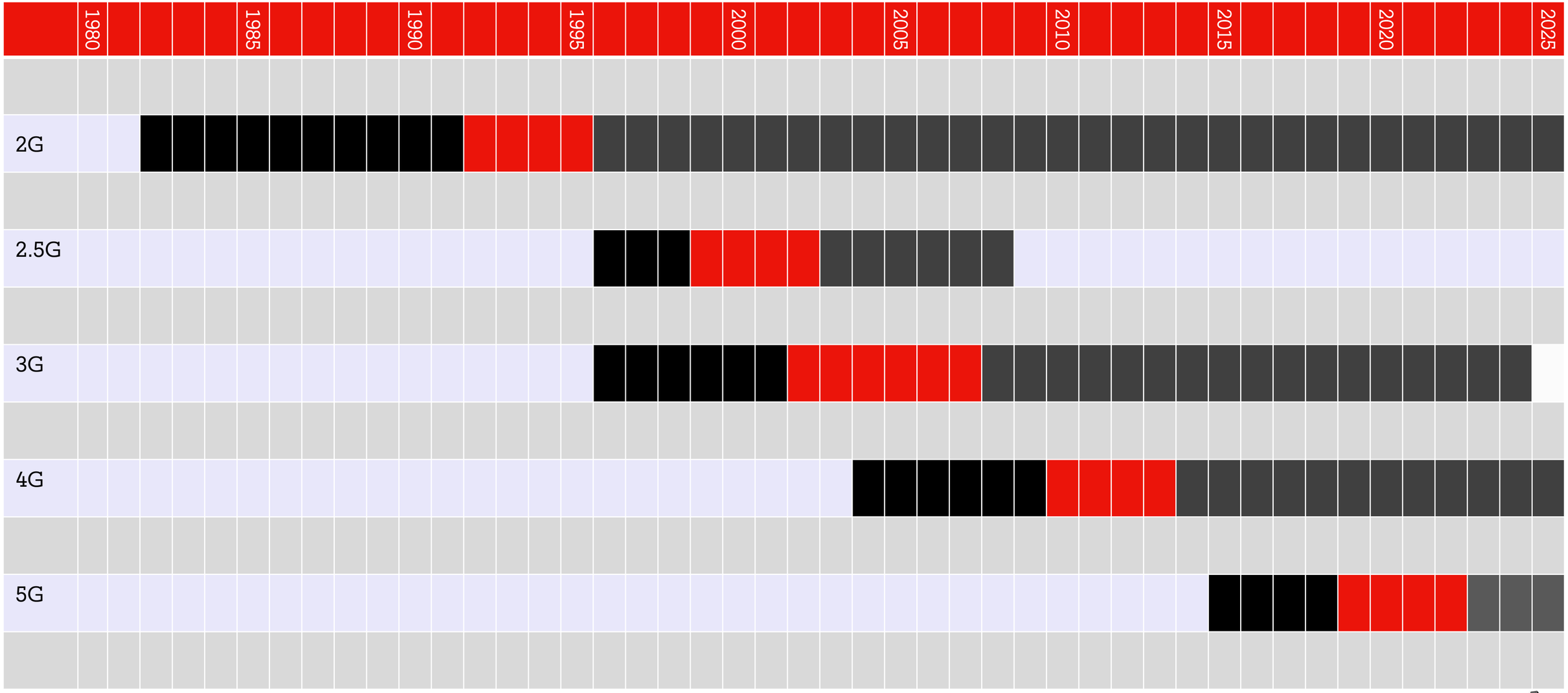
Spectrum, Technologies, Features



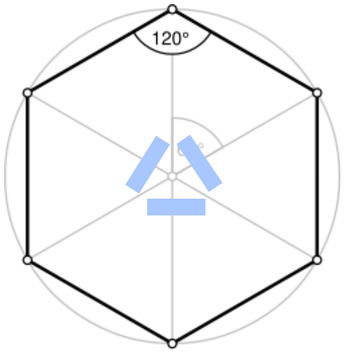
Time To Market

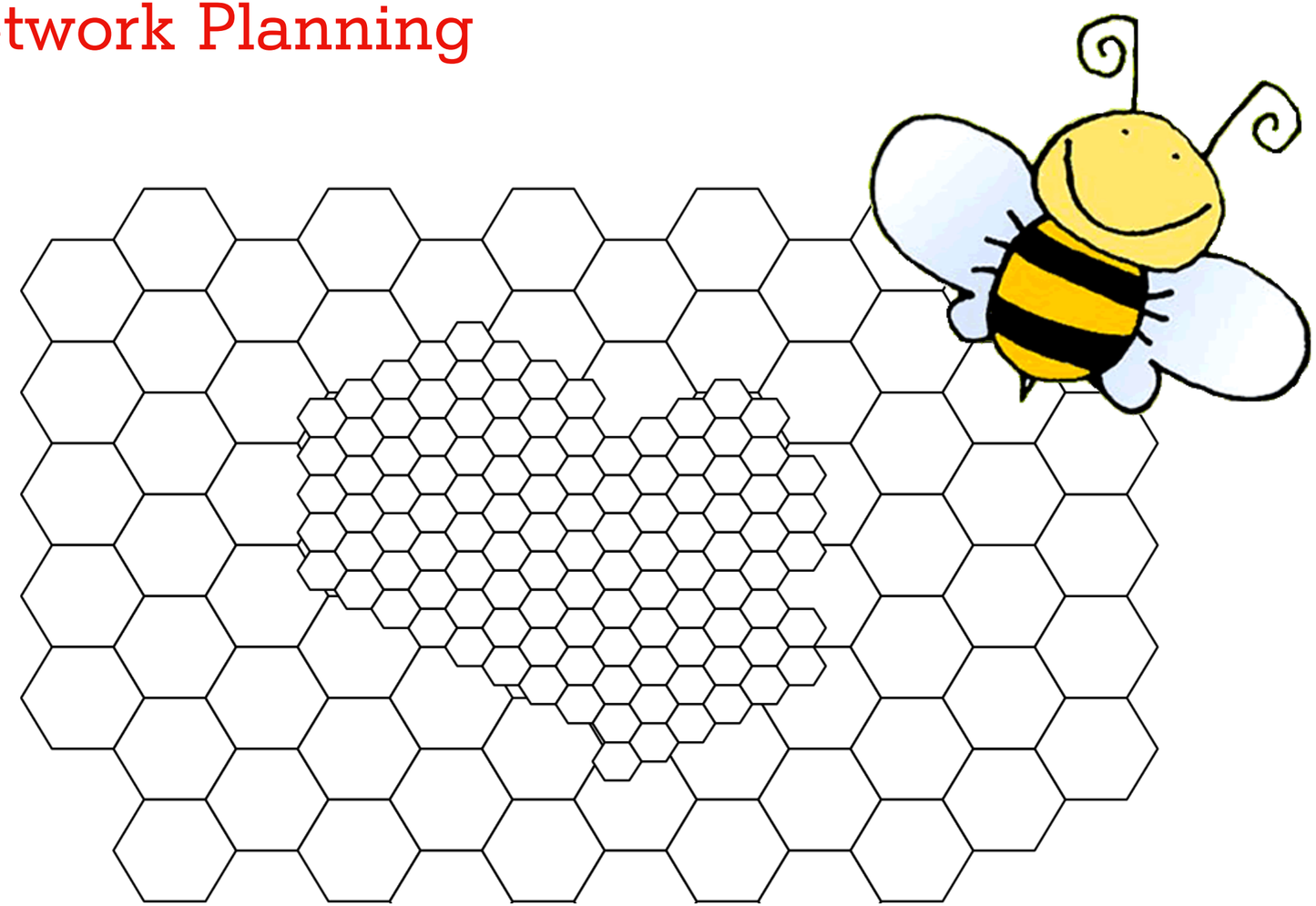
Development
Trials/Uptake
Success

A1 Austria

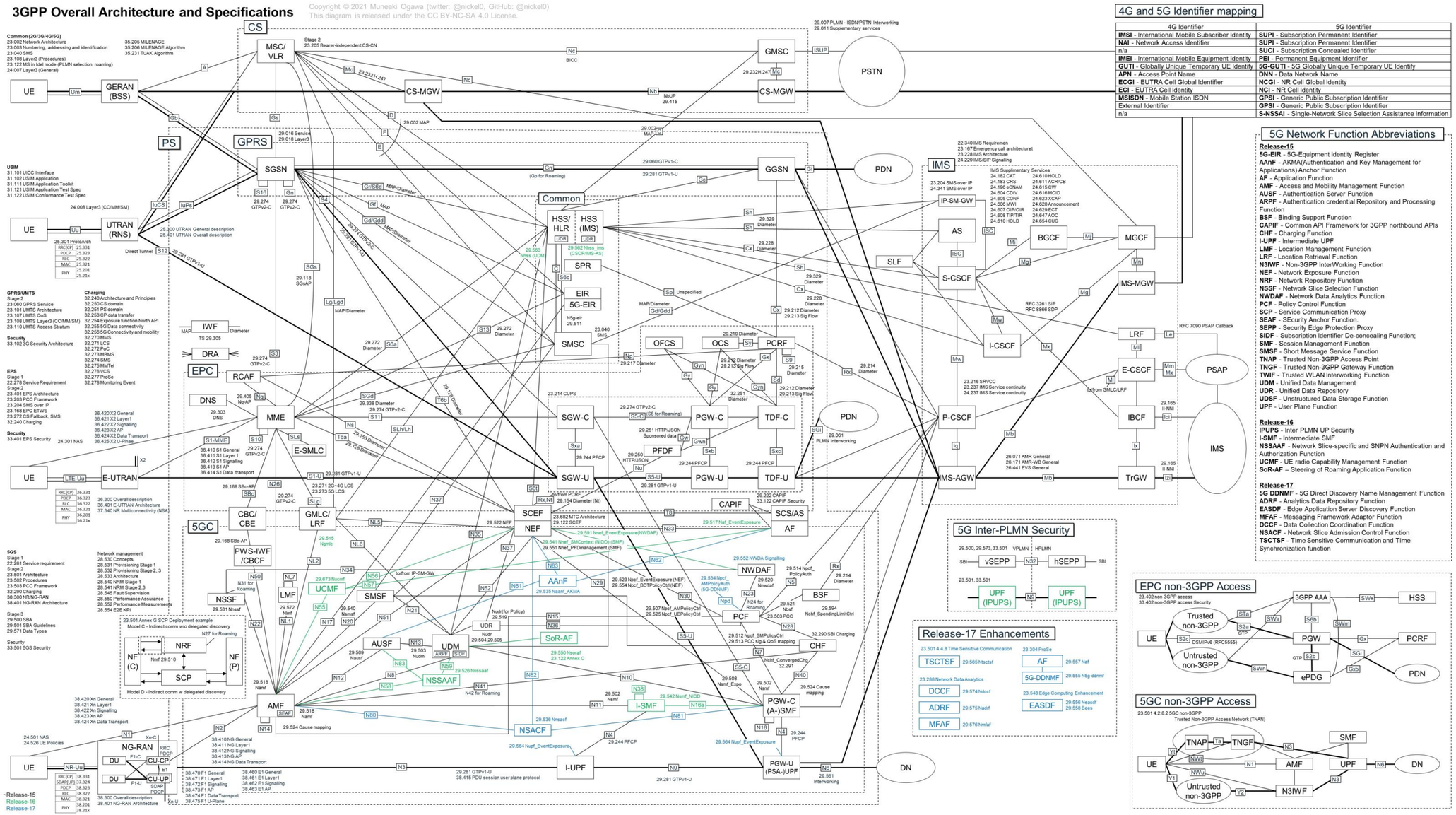


Cellular Network Planning

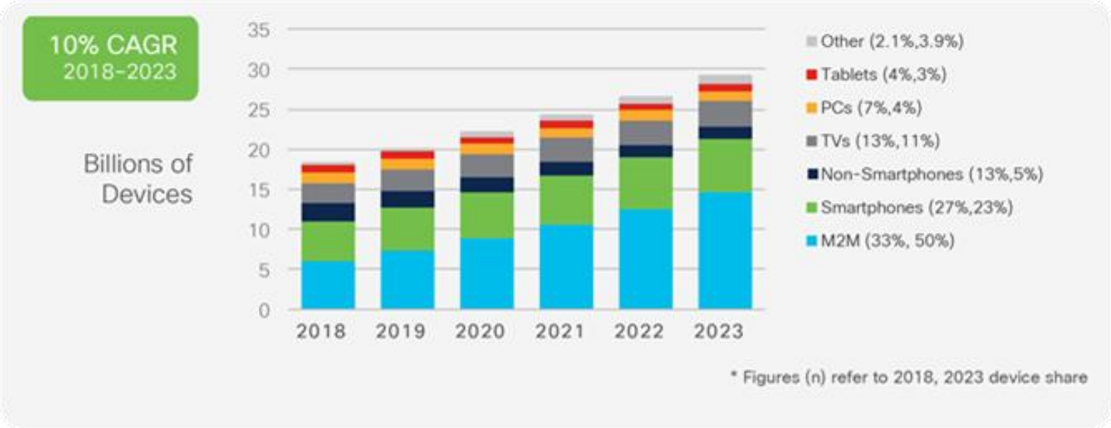


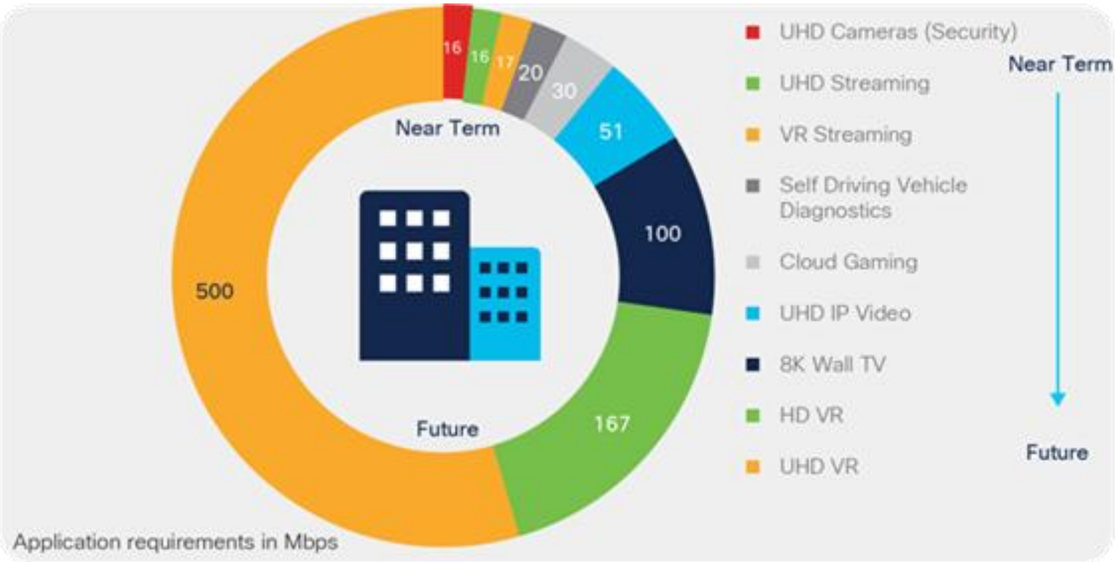


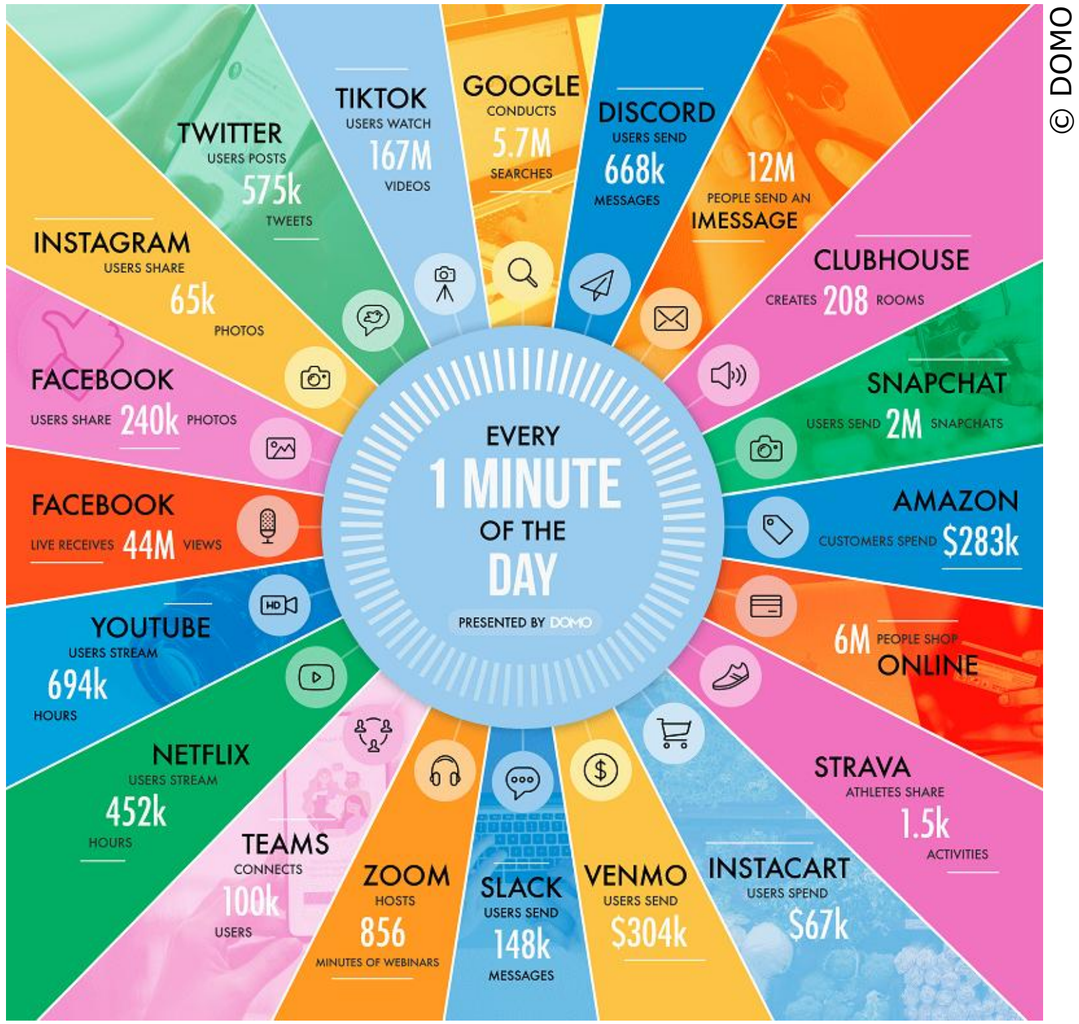
2G/3G/4G/5G RAN + Core Architecture



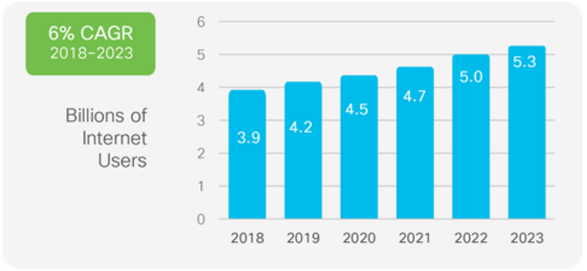
Cisco Annual Internet Report & Internetminute

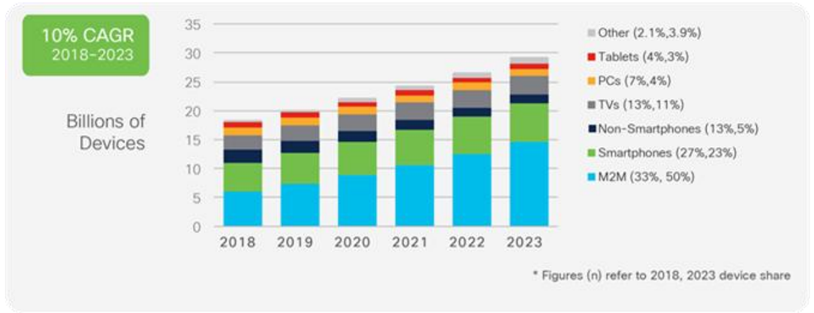


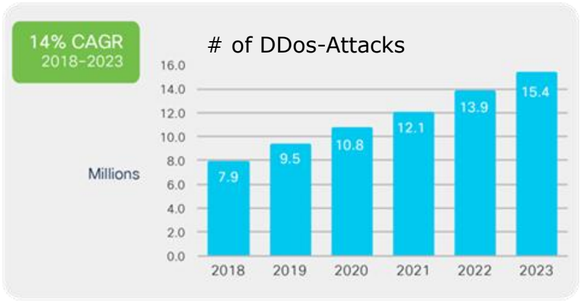




Traffic Development: The Sky is the Limit

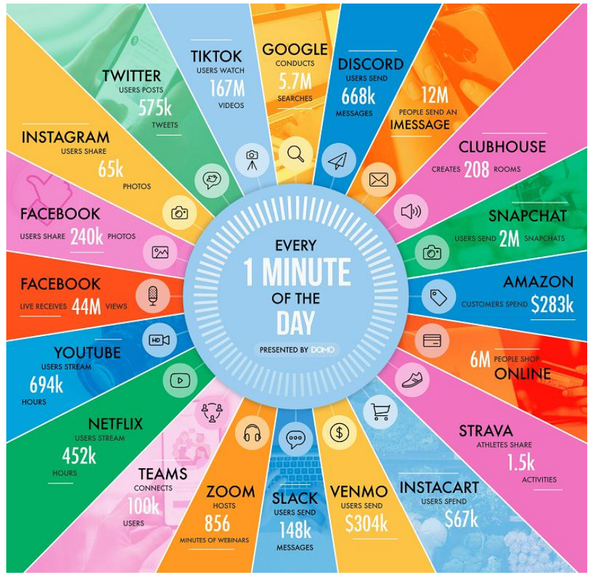






- **Busy-hour** traffic grows stronger than overall traffic
- Traffic shift wired → wireless
- Broadband Datarates double every 5 years

  → Backhaul demand rises



AHB 1959

Quelle: nzhistory.govt.nz

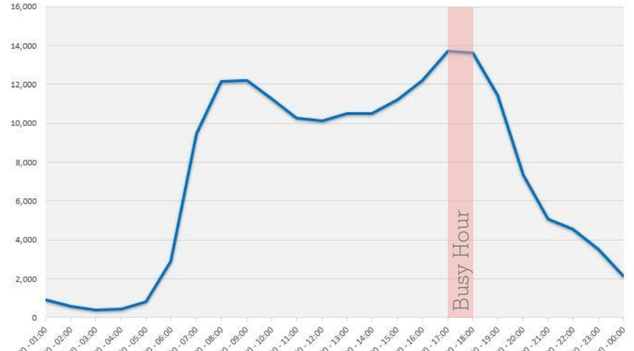
2+2

AHB 2009

Quelle: John Selkirk/stuff.co.nz

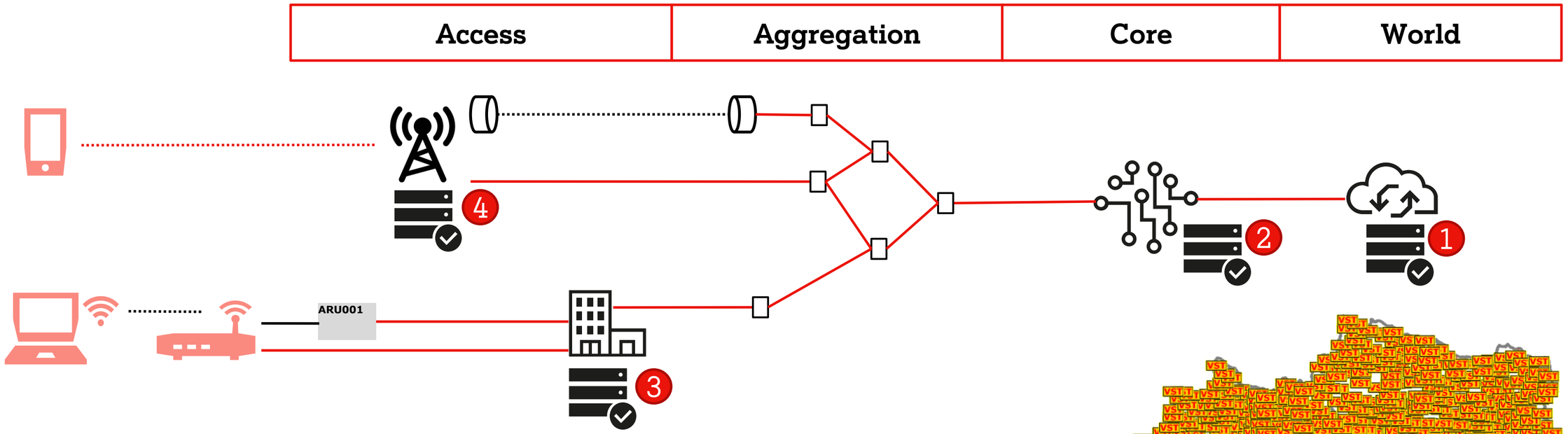
(2+2) + (2+2)

AHB Weekday Average Hourly Volumes

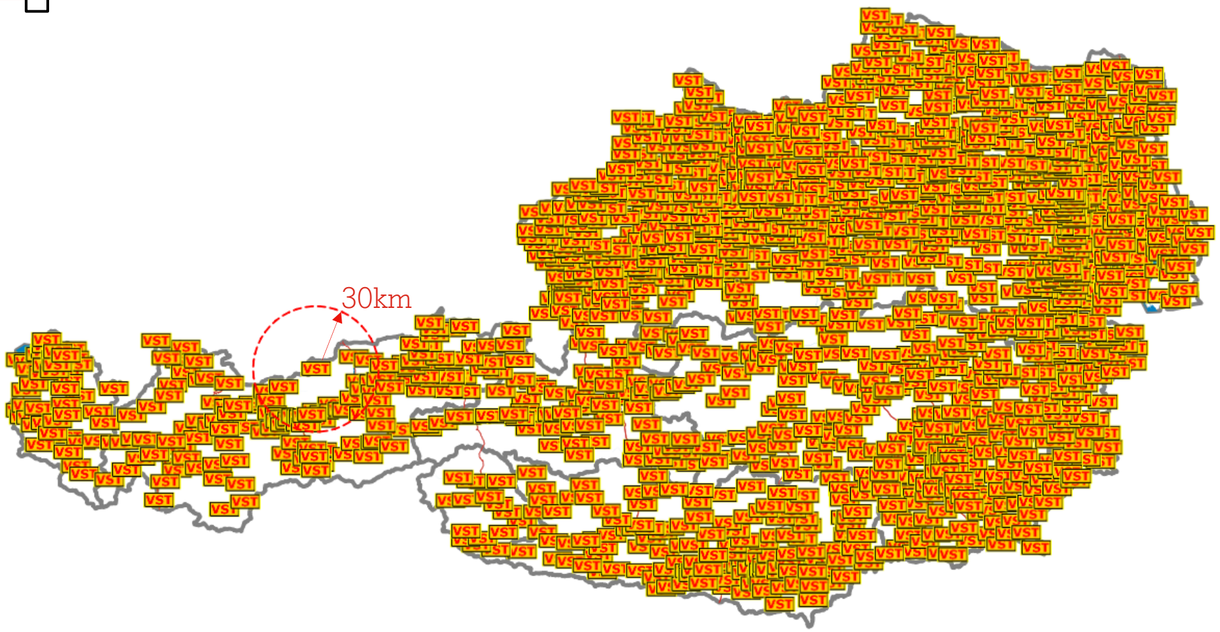


Quelle: Greater Auckland

Edge Computing



- **App-Servers** move to the edge of the radio access network (RAN) 1 → 4
- Fiber Cable: v ≈ 200m/µs → 100km distance:
  Latency ≈ 1ms + 2x 1ms optic/electric conversion
  → **30km distance: Latency ≈ 1ms**

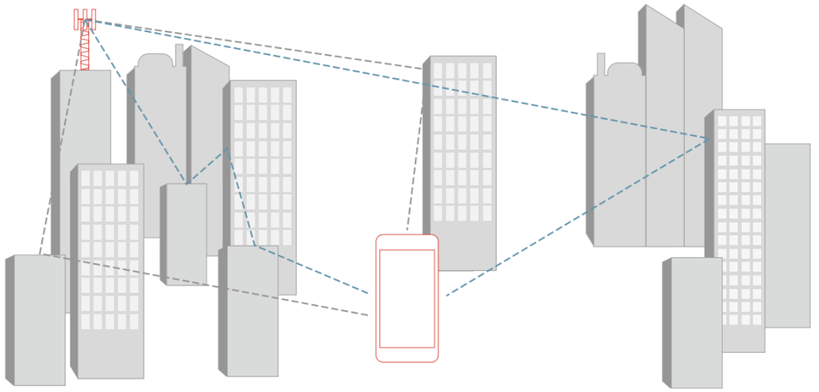


MNO Spectrum Assets in Austria

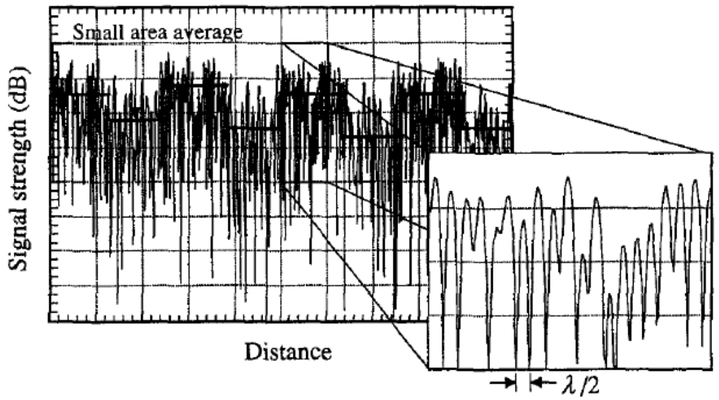
Spectrum (MHz)	Band Classification	Duplex	Coverage Layer	Performance Layer	Voice Layer	Data Layer	Fiber Like
700	Low	FDD	●	◔	◕	◔	○
800	Low	FDD	●	◔	●	◔	○
900	Low	FDD	●	◔	●	◔	○
1500	Mid	SDL	◑	◑	○	◑	○
1800	Mid	FDD	◕	◕	◑	◕	○
2100	Mid	FDD	◕	◑	◕	◑	○
2300	Mid	TDD	◑	◑	○	◕	○
2600	Mid	FDD	◑	◑	◔	◑	○
2600	Mid	TDD	◑	◑	○	◑	○
3500	Mid	TDD	◔	●	○	●	◕
26000	High	TDD	○	●	○	●	●

Fast Fading vs Slow Fading

- **Fast fading** is also called **multi-path fading**, as a result of multi-path propagation. When multi-path signals arriving at a UE, the constructive and destructive phases create a variation in signal strength.



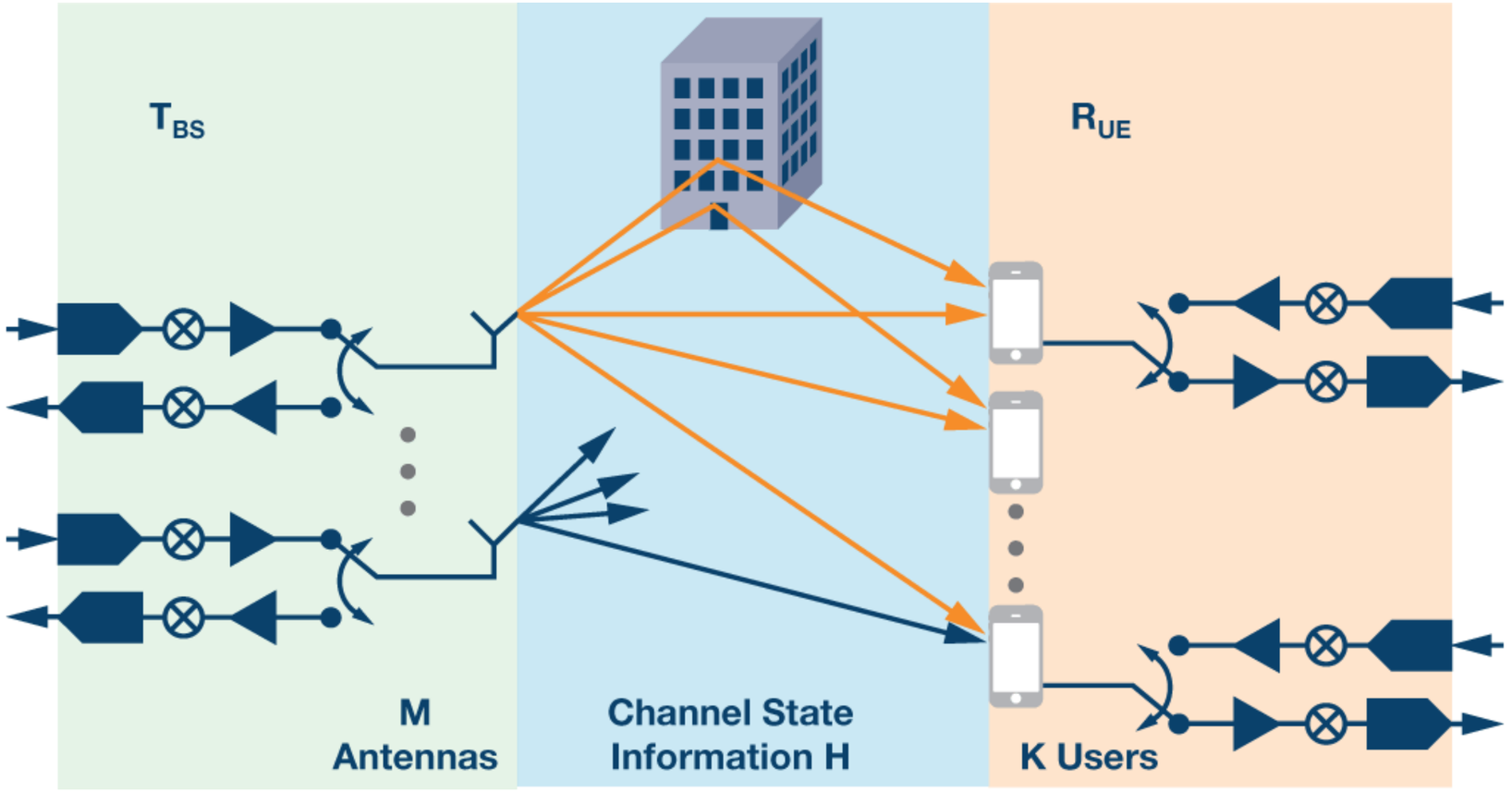
- **Slow fading** is also called **shadowing**. When a UE moves away from a cell the signal strength drops down slowly.



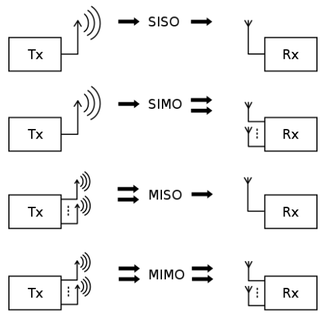
$$\lambda = \frac{c}{f}$$

Massive MIMO – Electronic Beamforming

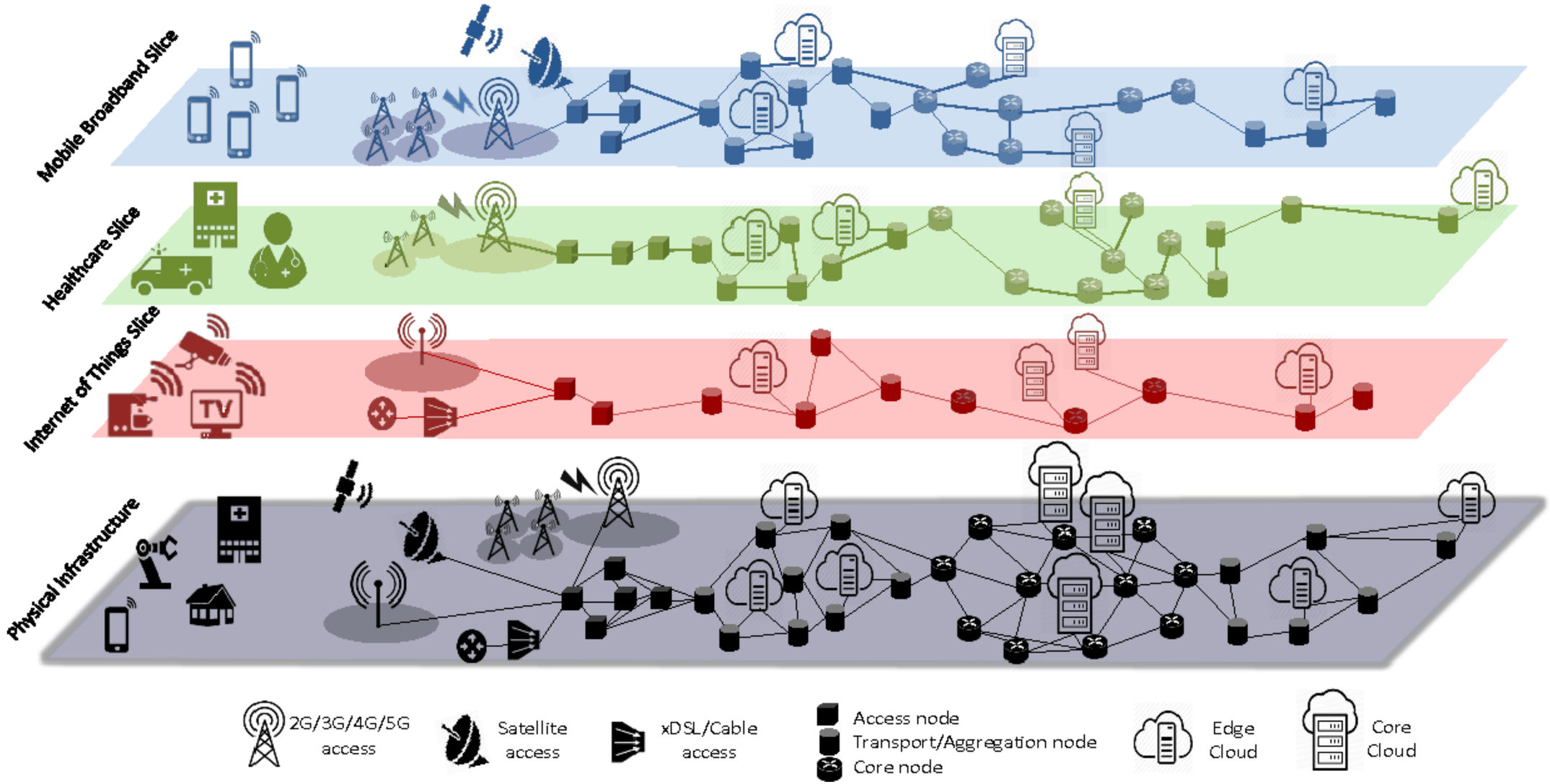
MIMO: Multiple Input Multiple Output



Quelle: mwrf.com



5G Network Slicing – Your own Virtual Network



5G Security – The Paradigm Shift

- **4G Network:** **Proprietary hardware** (bespoke SoC), security is **perimeter-based** with distinct physical boundaries between core and edge/radio nodes

- **5G Network:** **Software-defined and virtualized**. Relies on distributed cloud hosting and Network Function Virtualization (NFV), provides flexibility and scalability/speed.

→ **Paradigm Shift:** **De-coupling** core static **hardware perimeters** to **dynamic software-defined** ecosystem

SUPI & SUCI

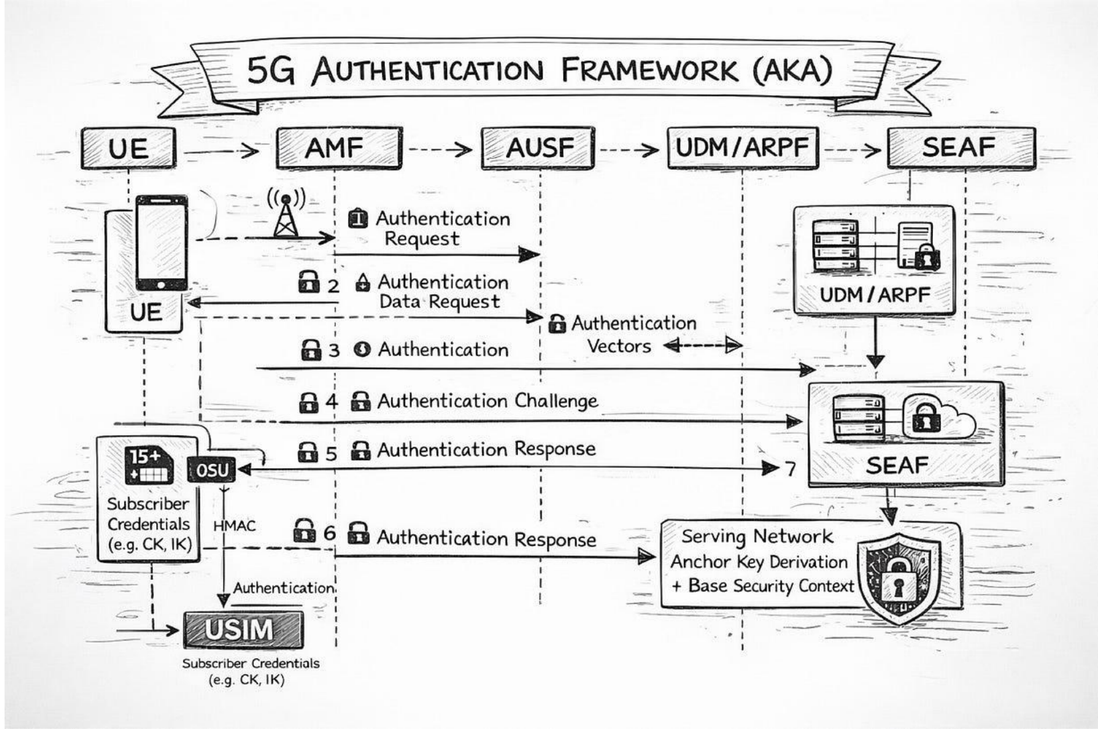
- **SUPI: Subscription Permanent Identifier:** never exposed over radio link

- **SUCI: Subscription Concealed Identifier**

→ Using Elliptic Curve Integrated Encryption Scheme (ECIES)-based public-key encryption under MNO control on the SIM/UE, identities are concealed before transmission.

→ Only the Home Public Land Mobile Network (HPLMN) contains the matching private key required to decrypt the SUCI

Authentication Framework



Primary Auth Options:

- Standardized options include 5G Authentication and Key Agreement (5G-AKA) and Extensible Authentication Protocol Method for UMTS Authentication and Key Agreement (EAP-AKA). The access layer is fully decoupled, enabling security integration also with Wi-Fi 6 or satellite links.

Home Control Anchor:

- Authentication terminates directly in the HPLMN on Authentication Server Function (AUSF)/ Unified Data Management (UDM). The serving network cannot fake validation. Security Anchor Function (SEAF) decouples mobility from root keys.

Secondary Auth:

- Enables out-of-band enterprise domain EAP authentication, isolating industrial slices from basic carrier access frameworks

5G Key Derivation Tree

HPLMN Root Key (K):

- Cryptographically unexposed master seed stored safely in SIM and Home Network UDM

Security Anchor Key (K_SEAF):

- Serving network-level root key, generated in AUSF and handled by SEAF. Tied to specific visited network domain ID

Core Signalling Keys (K_AMF, K_NAS):

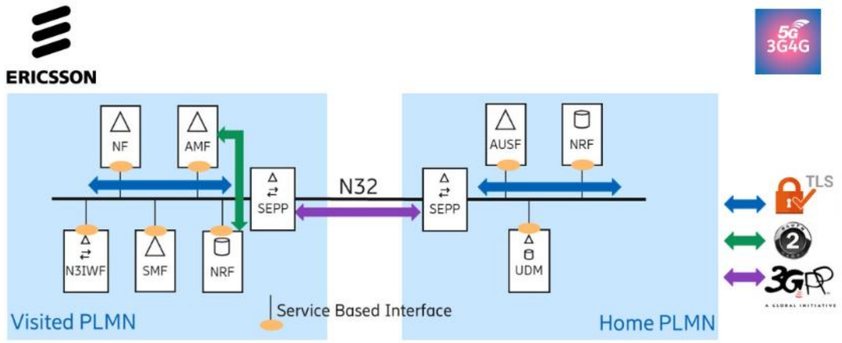
- Derived from K_SEAF to secure the Non-Access Stratum (NAS) control plane, splitting into unique identity (K_NASint) and ciphering (K_NASenc) variations.

Access Stratum Keys (K_gNB):

- Keys delivered down to base station. Ensures that a physical compromise of a cell tower HW cannot leak core infrastructure signalling keys

SEPP – Securing Roaming

N32 SEPP Proxy



- Traditional roaming exposed carriers to **malicious signaling over SS7/Diameter** backbones due to implicitly trusted models.
- 5G resolves this by standardizing the **Security Edge Protection Proxy** (SEPP). Operating at the edge of each PLMN boundary, SEPP handles **mutual authentication** and enforces **application-layer cryptography** protection (N32 PRINS protocol), signing and encrypting inter-operator traffic.

- N32-PRINS **approved cipher suites**:

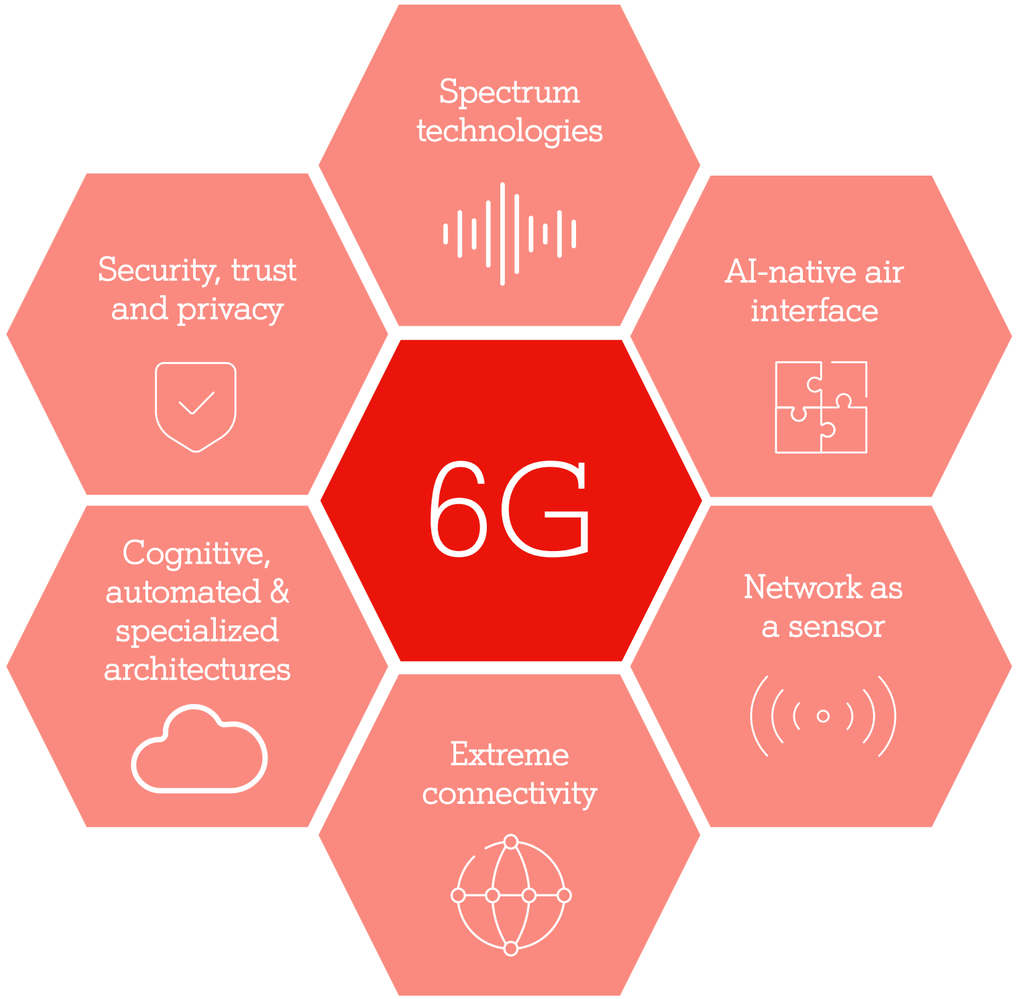
Suite Identifier	Encryption Algorithm	Integrity Method	Deployment Scenario
A128GCM	AES-GCM (128 bit)	AEAD GHASH	Default high-throughput roaming profiles
A256GCM	AES-GCM (256 bit)	AEAD GHASH	Military, government & financial slices
A128CBC-HS256	AES-CBC (128 bit)	HMAC-SHA256	Backward compatibility, IoT environments

6G - Bringing Future to Life

Six key technology areas for the 6G essential infrastructure

PQC Migration:

Post-Quantum Cryptography algorithms inside AUSF/UDM



6G: Networks that

- **Sense**
- **Think**
- **Act**

Key value drivers for 6G

Green by design

- 10X capacity increase with 50% power reduction, compared to 5G

Security and privacy

- Increasing security and privacy risks require higher levels of control

Digital inclusion

- Aims to address three key factors: accessibility, affordability and consumability

6G Introduction is planned in two steps

6G day-one focus

- Extreme MIMO on existing grid
- Smooth migration and core evolution
- Programmable networks and API native
- Framework for native AI
- Framework for energy efficiency


NextG mobile broadband


Fixed Wireless Access (FWA)


Immersive /Cloud gaming


Extended Reality


IoT/LPWA native support

6G to build on 5G success and do so in a more efficient, economical, scalable and sustainable way

6G evolution and beyond

Potential services that take us:

- From connectedness to **togetherness:** immersive holographic experience, connect the unconnected

- From information to **knowledge:** cognitive and complete context awareness, leveraging ambient IoT, digital twins, sensing

- From efficiency to **purpose:** mission & life-critical services supported by subnetworks

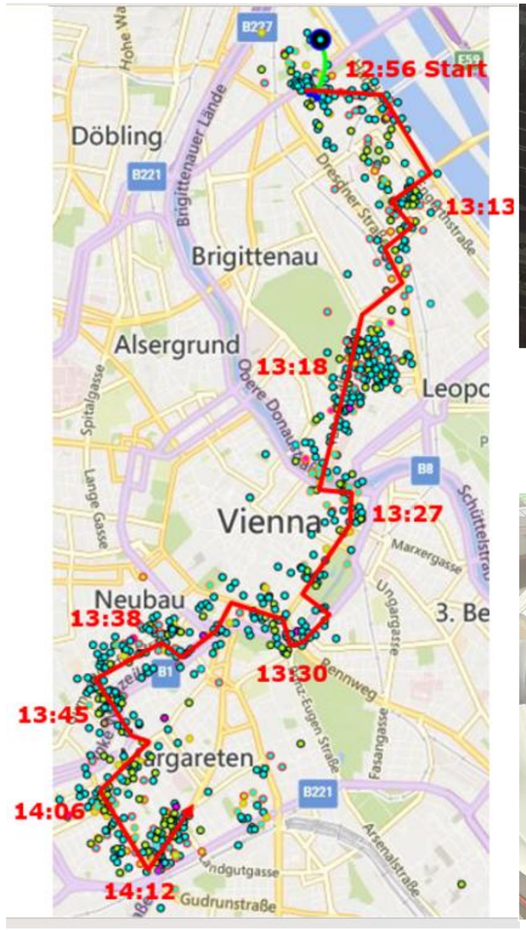
Augmenting humanity and the full realization of digital-physical fusion

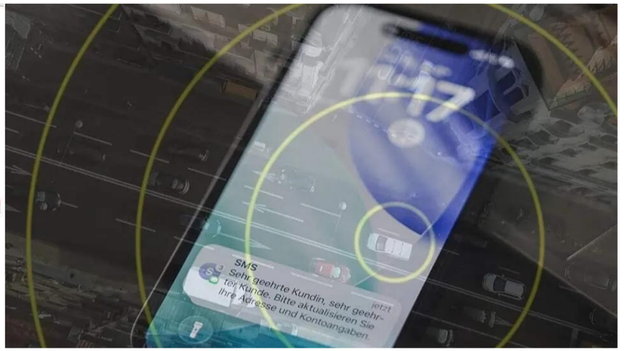
Latest News: SMS Blaster

- **Situation:** Weeks leading up to the Eurovision Song Contest (ESC) at Wiener Stadthalle

- **Action:** Increase in **fraudulent SMS messages**. **Unusual activity on the mobile network**. Criminals had been using a so-called **SMS blaster** to set up **a fake 2G network across Vienna for days** and were sending out fake text messages

- **Result:** Suspect caught, SMS Blaster off air





In the Media

DERSTANDARD

AUF GROSSVERANSTALTUNGEN

32-jähriger SMS-Betrüger in Wien festgenommen

Über "SMS Blaster" konnte der Verd
Mobiltelefone in seiner Umgebung s

19. Mai 2026, 15:45

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MIT SOHN AUF RÜCKBANK

So blockierte Chinese Notrufe um den Song Contest

Wien | 20.05.2026 05:30

Millionen Phishing-SMS in Wien versendet – Tatverdächtiger in Haft

19.05.2026 | 13:16

Redaktion Polizeiticker Österreich

Nächster >

hen beschlagnahmte Geräte im Fall großflächiger Phishing-SMS im Großraum Wien. (Bildquelle: LPD Wien)

Am Donnerstag, 14. Mai 2026, nahm die Polizei in Wien einen mutmaßlichen Betreiber sogenannter „SMS Blaster" fest. Der 32-Jährige soll Millionen betrügerische Phishing-SMS versendet haben.

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Phishing-Nachrichten

Mann mit speziellen Betrugs-SMS-Geräten im Auto geschnappt

19. Mai 2026, 13:56 Uhr

Redaktion
Antonio Šećerović
zu Favoriten

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Mit strahlendem Gerät und Baby im Auto

Chinese (32) verschickte Millionen Phishing-SMS

SMS blaster used in smishing scheme targeting Eurovision fans

Published: 21 May 2026

Niamh Ancell, Journalist

Image by Getty/Picture Alliance

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Hightech-Betrug in Wien

Mit "SMS Blaster": Millionen Fake-Nachrichten versendet

Ein 32-Jähriger soll in Wien mit SMS-Blastern Millionen Fake-Nachrichten verschickt haben. Jetzt sitzt er in Haft.


Thank you!

AMA

ASK ME ANYTHING


Stay secure!