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Tackle Robotic Service Requirements in 6G Mobile Networks

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WE INVENT THE TECHNOLOGIES THAT MAKE LIFE BOUNDLESS

InterDigital

- R&I-driven licencing company
- Innovation on wireless and video
- Standardisation of technologies in key SDOs such as 3GPP and MPEG
- Established in 1972
- Global presence

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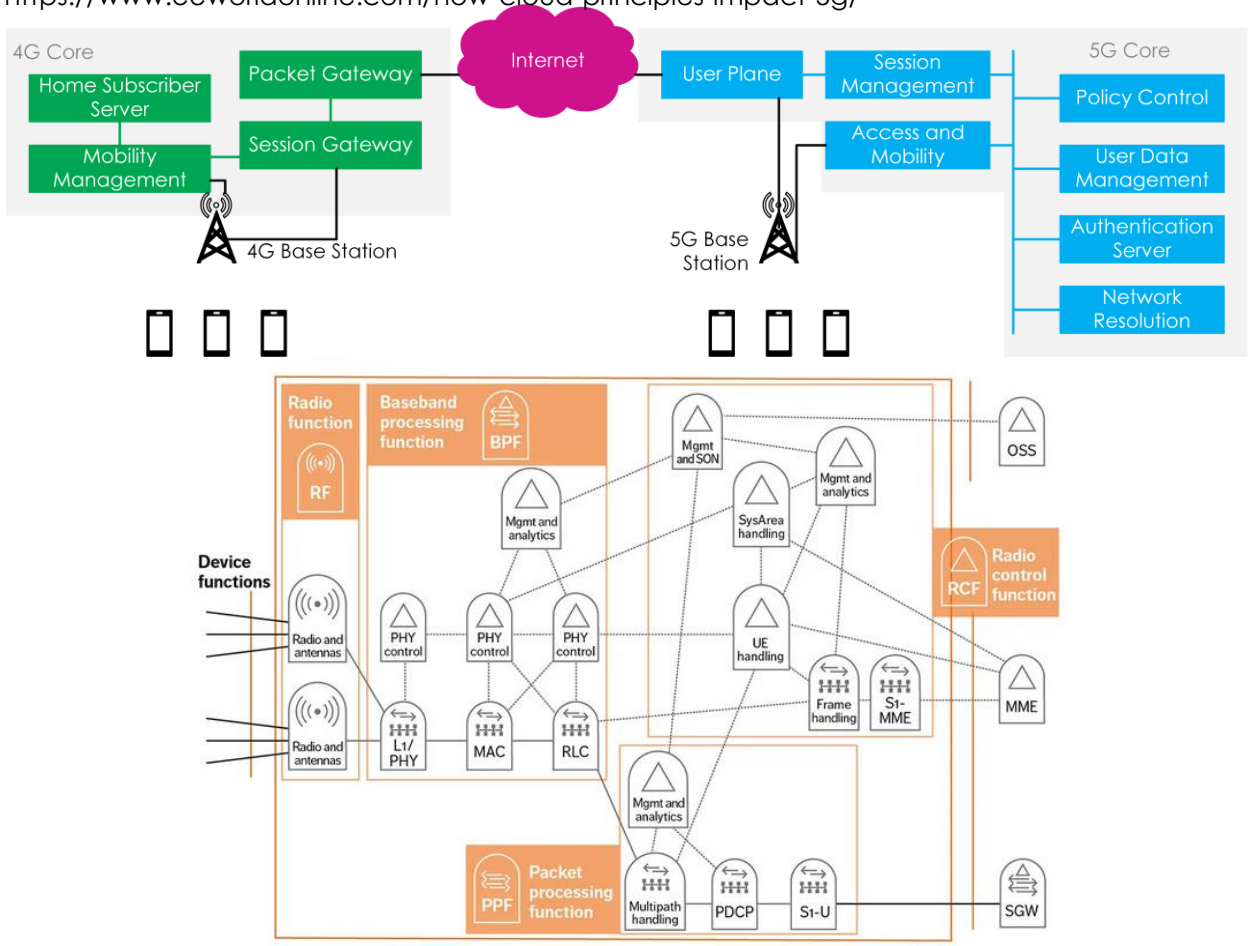
State of Affairs in Mobile Networks

What 5G Can Achieve

State of Affairs of Mobile Networks

- Starting with Release 15, 5G saw the adoption of Service-Based Architecture (SBA) in the CN and disintegration effort in the RAN
  - Multi-vendor deployment
  - Increased flexibility for network owner
- 5G aims at verticals
  - Dedicated Core Network APIs
  - Various deployment options

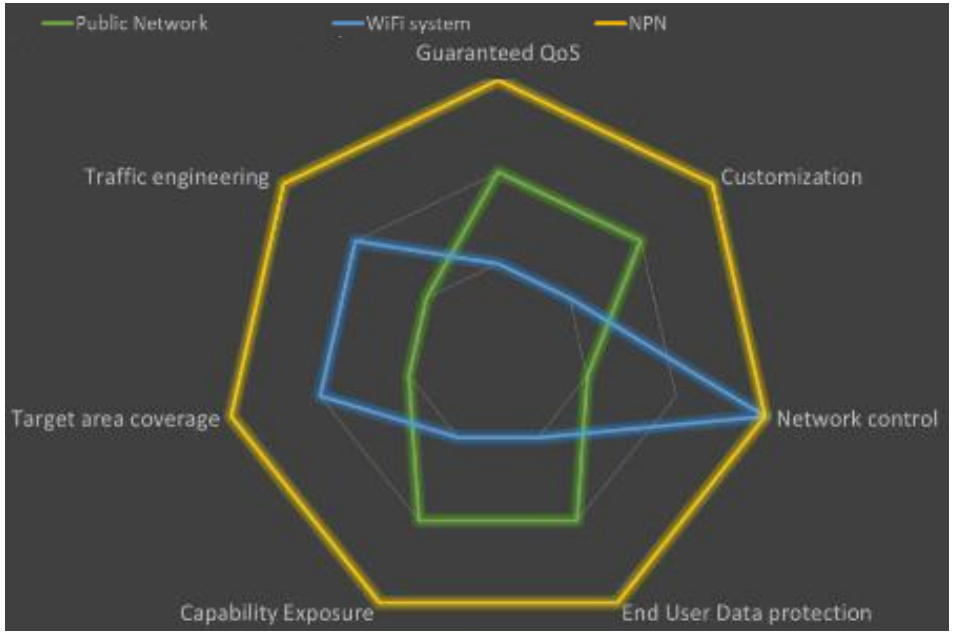
https://www.eeworldonline.com/how-cloud-principles-impact-5g/



https://www.ericsson.com/en/reports-and-papers/ericsson-technology-review/articles/4g5g-ran-architecture-how-a-split-can-make-the-difference

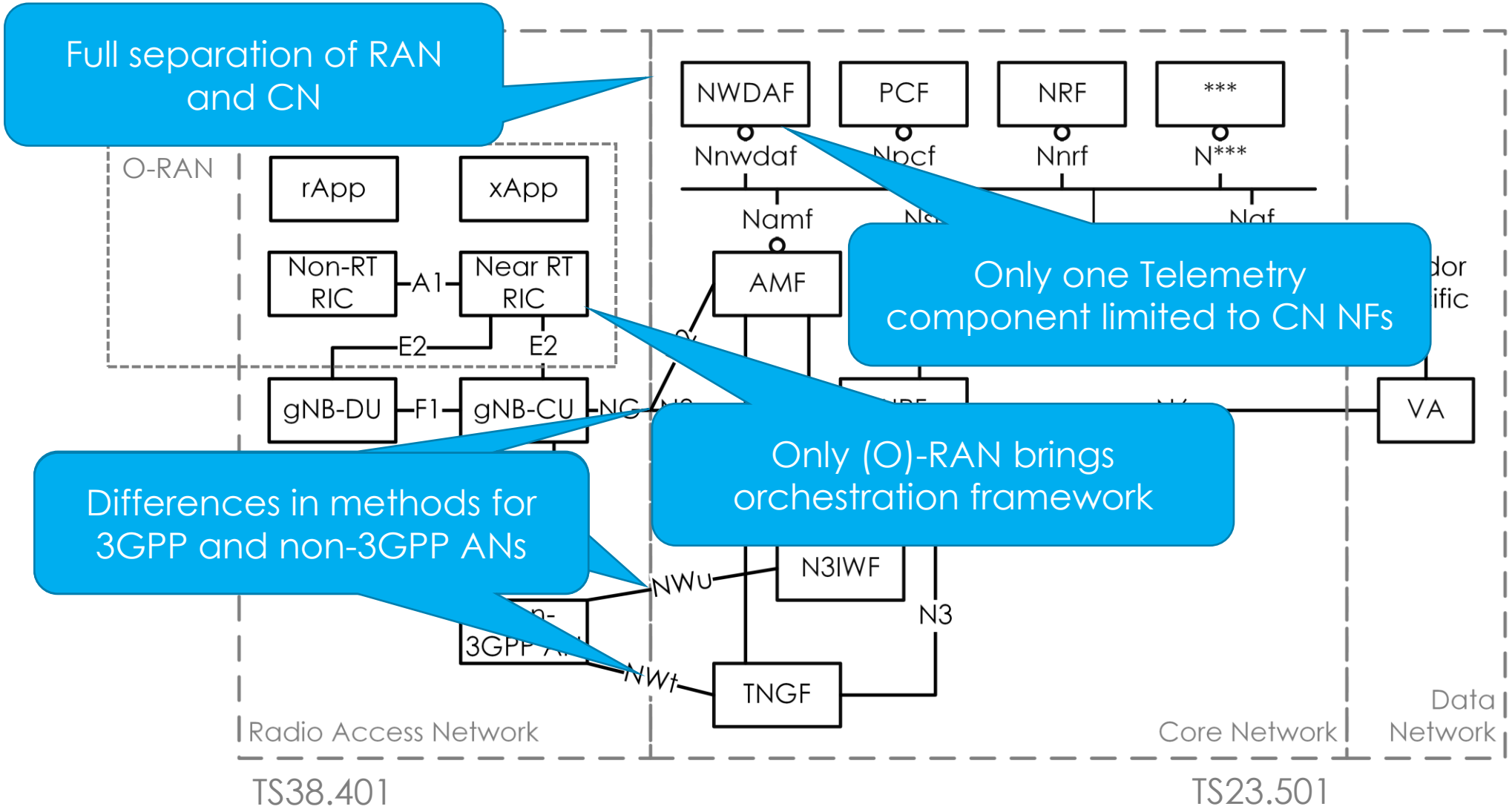
Current State of Affairs

- 5G != 5G
  - PN vs NPN
  - Release 15 vs Release 19
- 5G Non-Public Networks are intrinsically different from Public Networks
  - NPNs can be tweaked to significantly outperform public networks
- 6G must work on assessing KPIs against capabilities in 5G → where 5G cannot deliver on an KPI is B5G/6G



5G-PPP Whitepaper on NPNs

Current State of Affairs



Roadmap towards 5G-Advanced and 6G

https://www.ericsson.com/en/reports-and-papers/ericsson-technology-review/articles/5g-evolution-toward-5g-advanced

Requirements for Robotic Communications

Reliable

Availability of resources across layers and understanding their dynamics among each other

Predictable

High level of confidence that the network delivers packets within requested boundaries

Time Sensitive

Request for bounded latency and jitter across all OSI layers (network as well as application)

Key Performance Indicators for Human Content Consumption

KPI	Haptics	Video	Audio
Jitter [ms]	≤ 2	≤ 30	≤ 30
Delay/Latency [ms]	≤ 50	≤ 100 (lip sync limit) ≤ 150 (preferred) ≤ 400 (limit)	≤ 150
Packet loss [%]	≤ 10	≤ 1	≤ 1
Update rate [Hz]	≥ 1000	≥ 30	≥ 50
Packet size [bytes]	64-128	≤ MTU	160-320
Throughput [kbit/s]	512-1024	2500 - 40000	64-128
Reliability	99.999999	99.9	99.99999

3GPP, "Technical Report 23.856: Feasibility Study on Localized Mobile Metaverse Services (Release 19)", Nov 2022.

Key Performance Indicators for Human Content Consumption

Jitter Boundaries for inter-application service flows

	Haptic second	Video second	Audio second
Haptic first		20ms	25ms
Video first	30ms		20ms
Audio first	12ms	20ms	

3GPP, "Technical Report 23.856: Feasibility Study on Localized Mobile Metaverse Services (Release 19)", Nov 2022.

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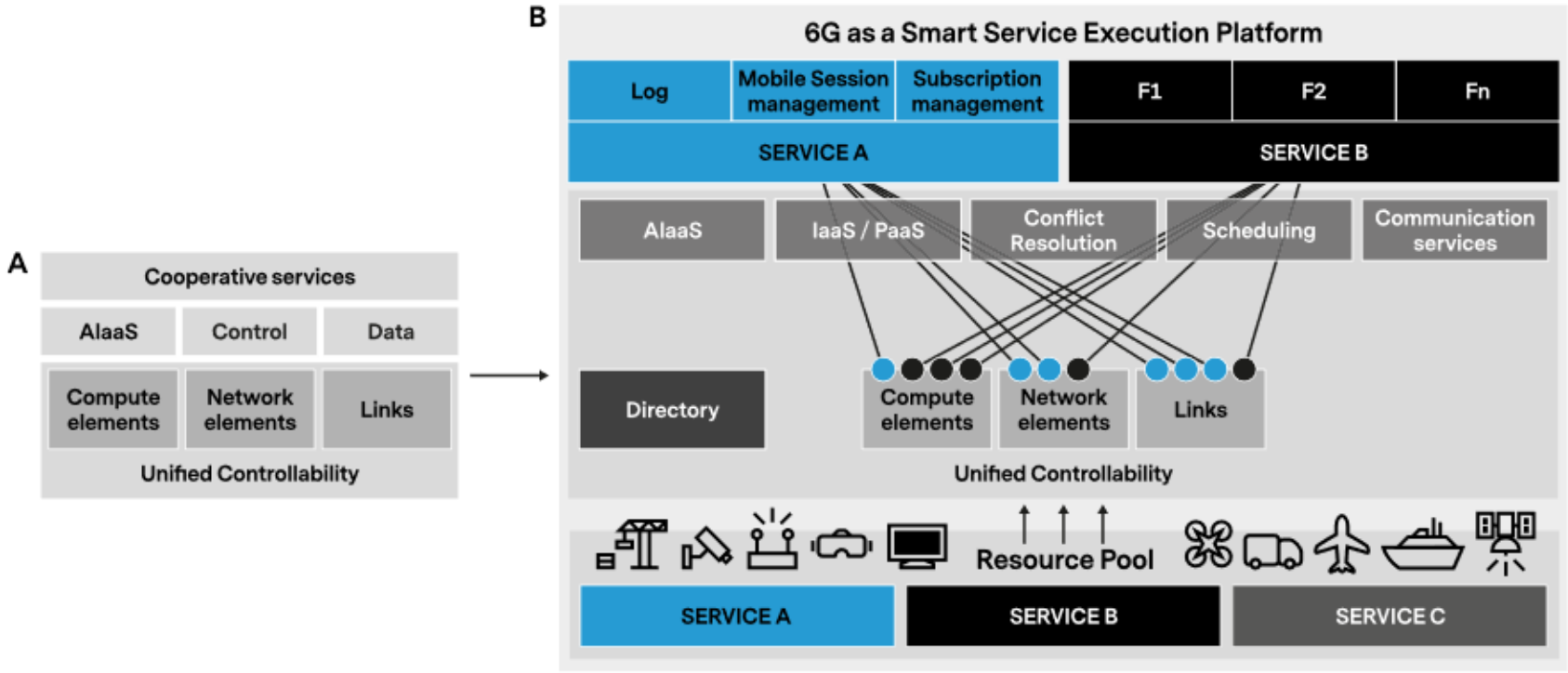
The Time Is Ripe

The Next G Is Around the Corner

The Next G Is Around the Corner

- Multi-domain
- Multi-service
- Programmable
- Open APIs
- Tenant-enabled
- Resource sharing
- Secure

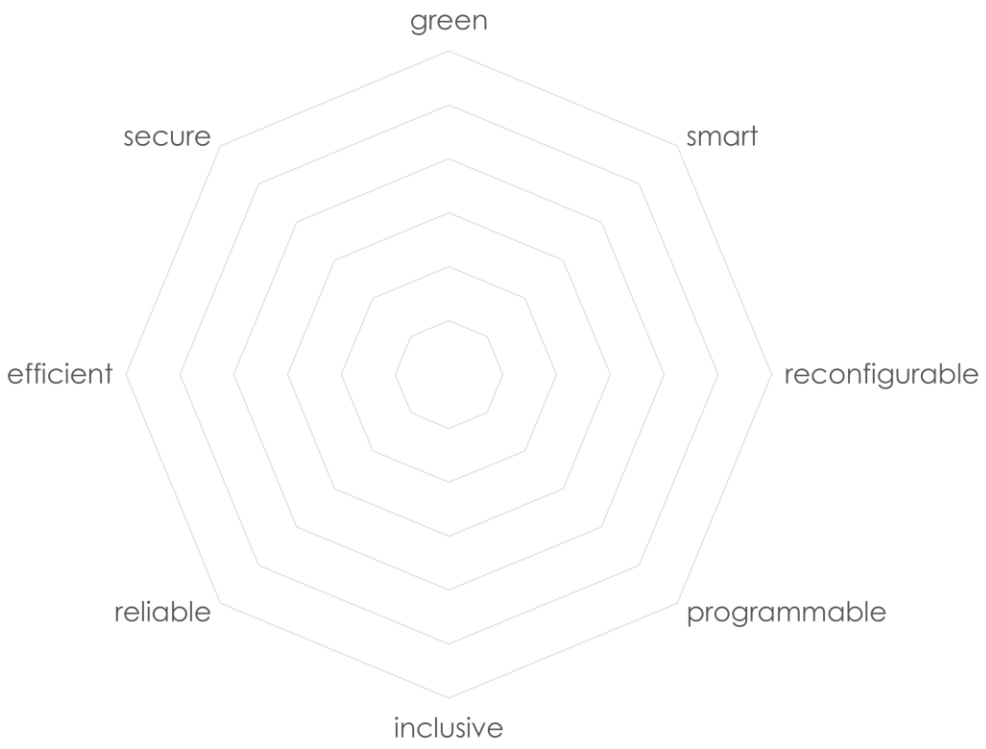


Strategic Research and Innovation Agenda 2022
https://bscw.5g-ppp.eu/pub/bscw.cgi/d516608/SRIA-2022-WP-Published.pdf

Key Value Indicators

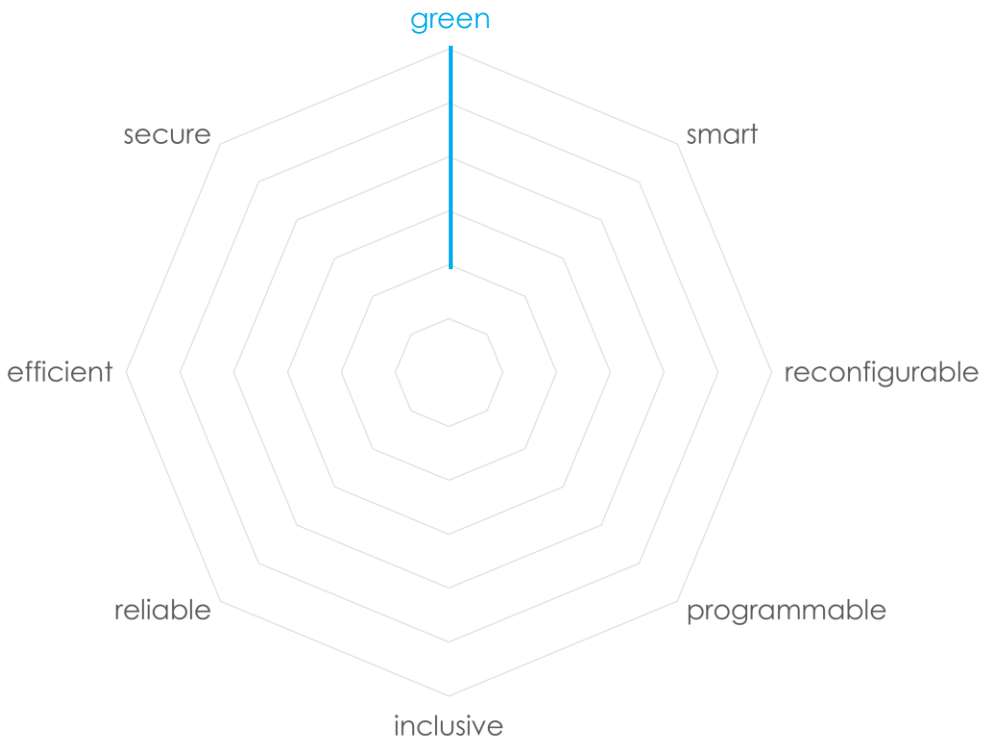
- Value-oriented and future looking indicators
- KVIs more than societal and environmental indicators

Key Value Indicators for the Next G



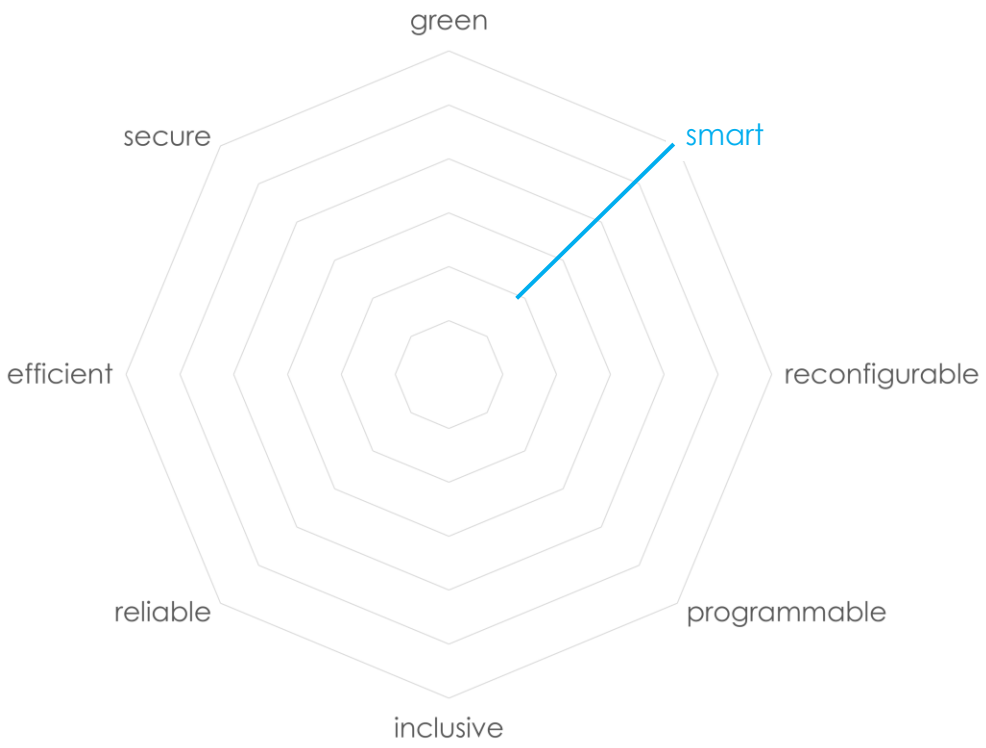
In the name of **FLEXIBILITY**.

Key Value Indicators for the Next G



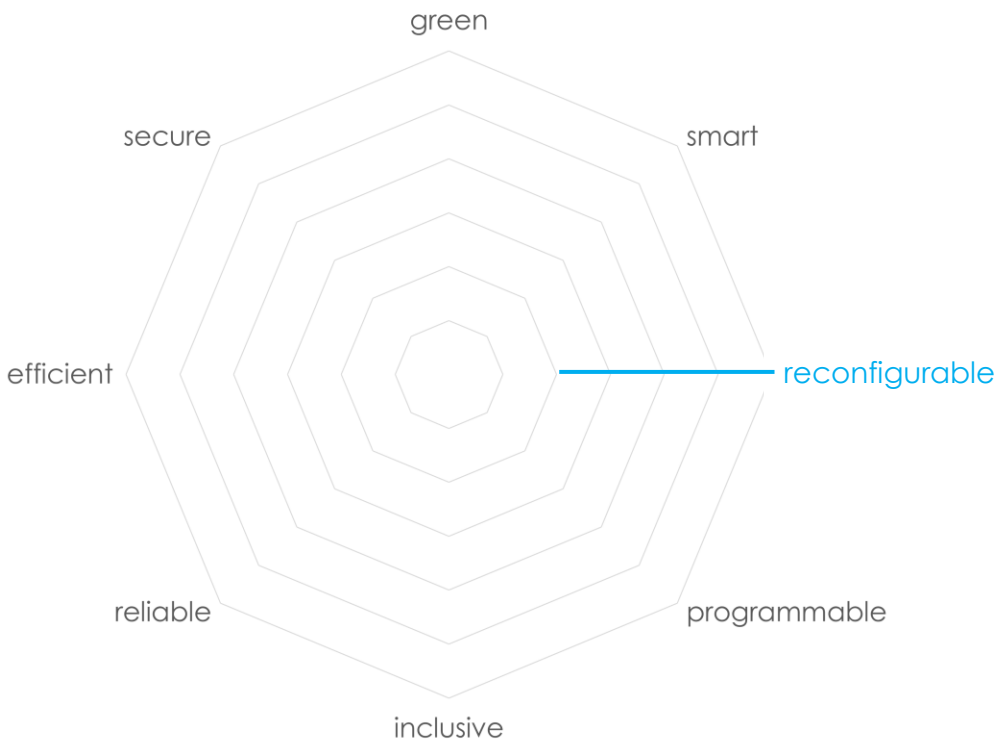
- Put “Green” systems are the foreground of any system behaviour
- Contribute to the United Nation’s climate call for actions
- Environmental-friendly operations of the telco domain

Key Value Indicators for the Next G



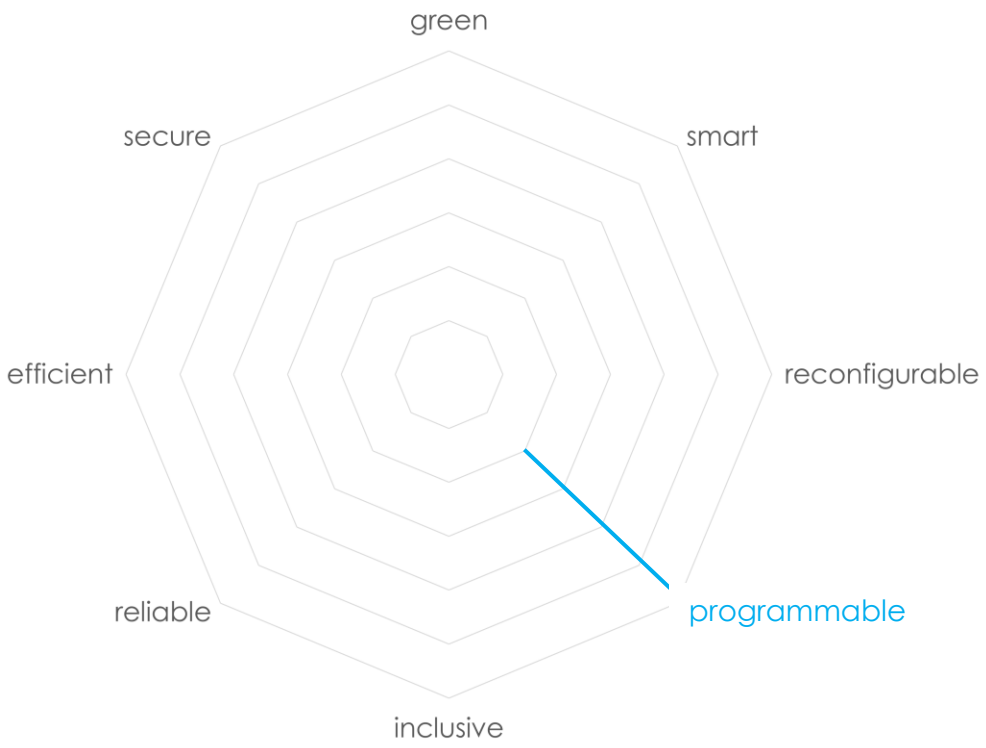
- It has been acknowledged that future systems will become more complex
- To cope with this increase of complexity → systems must be come more intelligent
- Using advanced AI/ML-driven algorithms

Key Value Indicators for the Next G



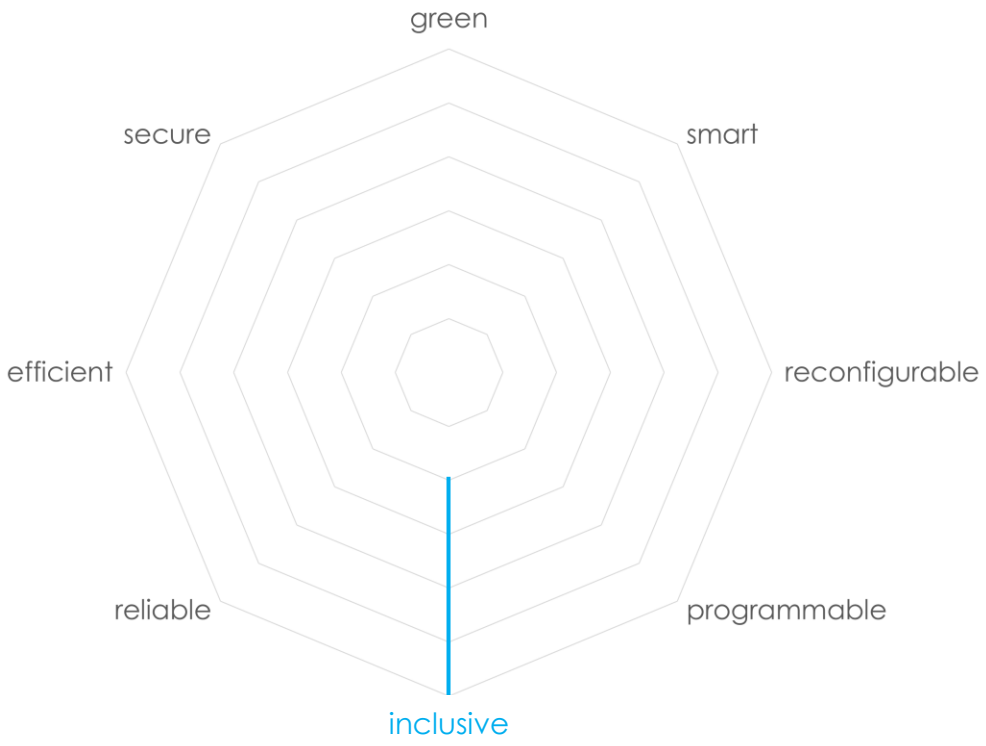
- SDN and NFV principles widely acknowledged in telco domain
- Allows to reconfigure resources after their instantiation

Key Value Indicators for the Next G



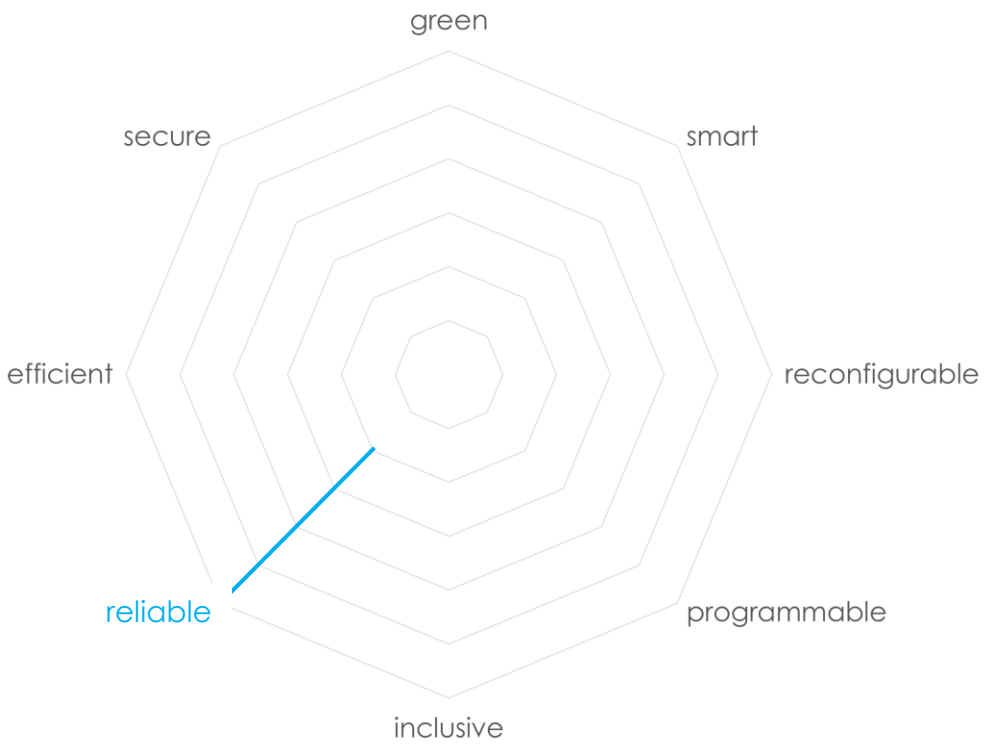
- Ability to programmatically create/change/delete state
- The adoption of SBA in 5G demonstrates the importance of programmable interfaces

Key Value Indicators for the Next G



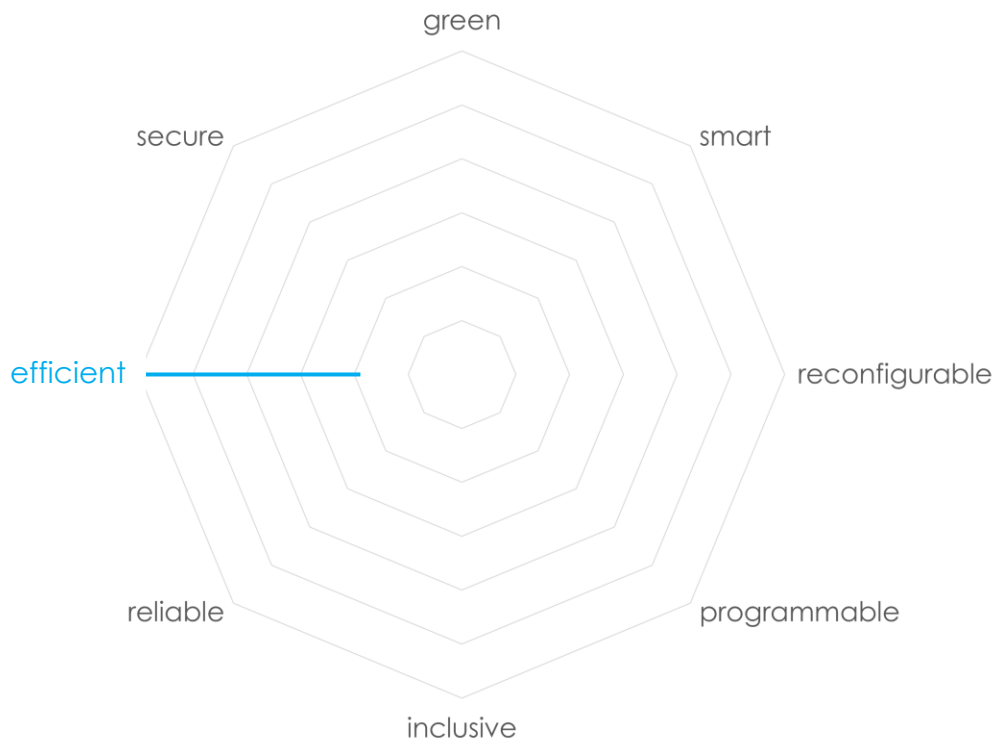
- More inclusiveness leads to wide adoption of mobile telco standards
- Trend in 5G to bring vertical stakeholder has been hugely successful

Key Value Indicators for the Next G



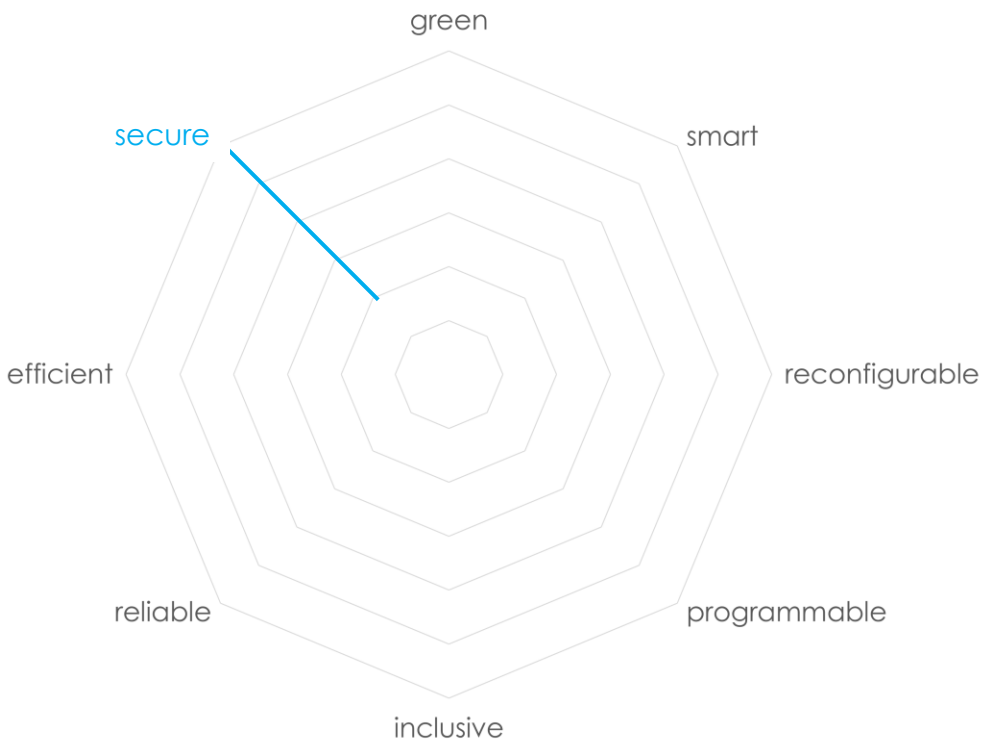
- SLAs required in mobile telecommunication network have many more 9s compared to cloud solutions
- This created trust and adoption to use 3/4/5G as the daily communication technology
- Any 6G requirement shall be assessed regarding its impact on a reliable system

Key Value Indicators for the Next G



- Ever-growing traffic demands
- Becomes inevitably important to design 6G to be more efficient

Key Value Indicators for the Next G



- Mobile telco networks are one of the most secure
- System design changes must ensure secure nature of mobile telecommunication networks

Final Thoughts

If 6G is the answer, what is the question?!

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