

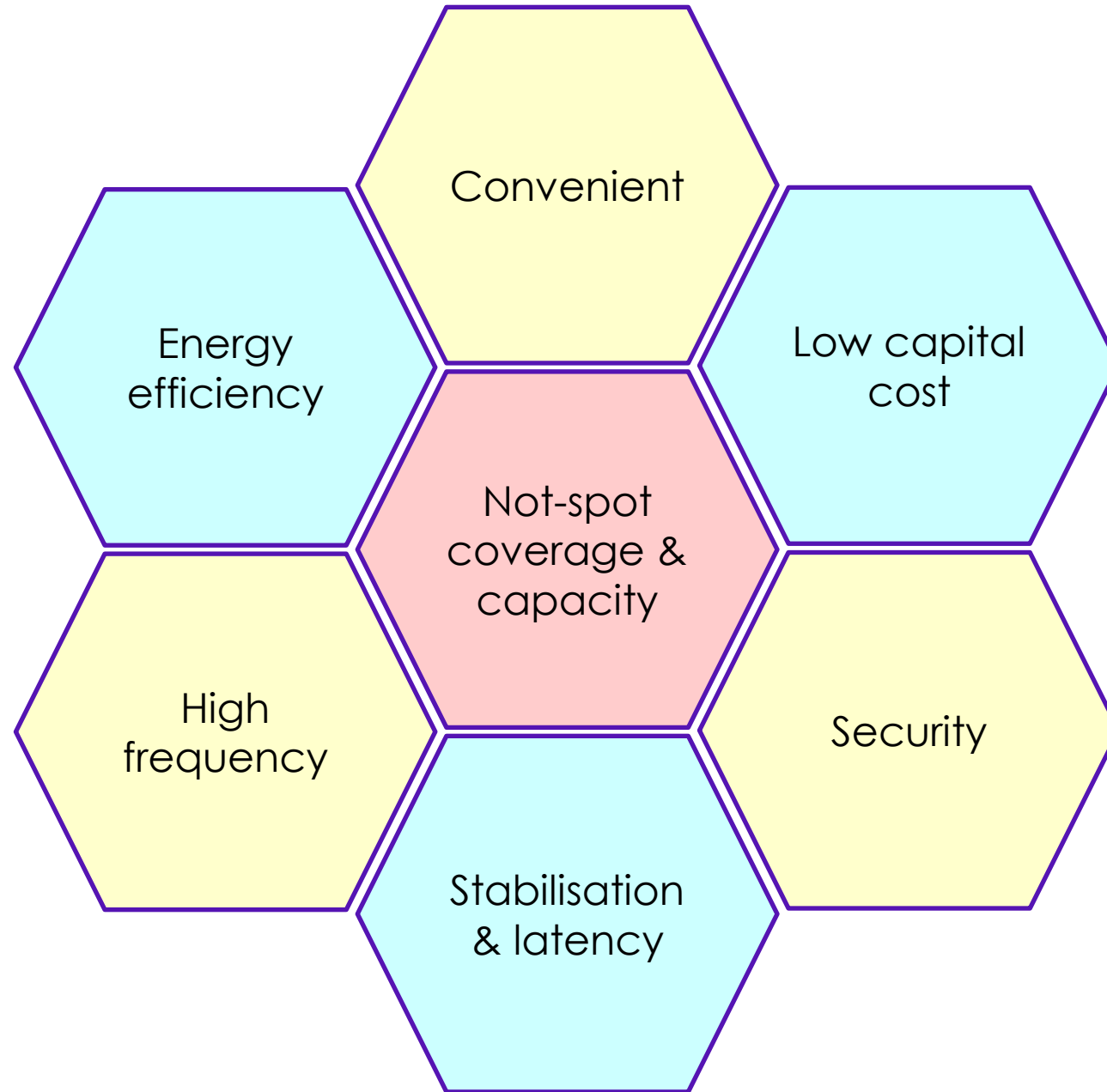
A Network Operator's hopes and requirements for RIS

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Hopes for RIS



For a network operator to use RIS:

We need this to be true

“RIS can be an additional/ replacement network component which in some use-cases can be integrated with the current/ future network to provide an increase in coverage/ capacity/ resilience/ flexibility which as an end-to-end solution would be impossible/ less convenient/ more costly to do any other way”

- Low hardware costs, low energy consumption and easy power supply, straightforward flexible deployment, simple robust control, low latency
- Offering enhanced coverage for 5G, IoT, V2V in various geographies/settings

Ideally this would be for the simplest definition of RIS used in a well-known 5G use-case addressing a current challenge e.g. phase-change-only reflective surface array serving 5G not-spots in a congested dense urban environment instead of deploying more base-stations

We can allow ourselves to expand the definition of RIS and consider new or niche use-cases but we always need to consider how the RIS is operated as part of the overall network

Passive Reflectors

Wireless coverage – hot-spots vs not-spots

Current Solutions:

- New cell sites – expensive

Capability to direct signals into not-spots,
much more cost effective

Start-ups (e.g. Metawave) producing passive metasurfaces, along with universities, and at least one telco trial (NTT Docomo)

Can also operate in transmission in windows



RIS trade-offs

	Passive reflector		Semi-passive RIS		Relay or cell site	
Power reqt	None		Small but requires battery, cable, wireless power or ambient harvesting		Significant	
Control reqt	None		Significant – fixed wired or wireless connectivity		Significant	
Latency	None		Some - depends on processing location		Significant	
Sensing	None		Usually none but possible		Yes	
Active beamforming	Impossible		Possible		Yes	

Active control with low weight, low latency and low power reqt

Snowballing multi-disciplinary research

- industry take-up is slower

- Low energy networks
- Comms theory
- ML control for multiple RIS
- CSI, sensing & stabilisation
- Fabrication
- Metasurfaces
- Regulation & economics

