Mobile Infrastructure Sharing: Economics, Competition and Case Study

Dr. Zoltán Pápai

"Fifth Generation (5G) Implementation: Practices and Case Studies"

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Roadmap

- Mobile network sharing agreements (NSAs): a brief introduction
- Sharing options on the value chain
- Main dimensions of sharing
- The rationale for sharing
- Competition issues and the assessment framework
- Does 5G makes a difference?
- European case study

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An introduction to network sharing agreements

Mobile network sharing is a type of cooperation between competing mobile network operators to jointly use, manage and/or develop some of the network inputs required for their operations. It is an infrastructure sharing agreement.

A central distinction is made based on whether a sharing agreement includes only passive or at least some active elements of the network:

- **Passive sharing** involves the common use of sites and masts, energy supply, and sometimes antennas.
  - Passive sharing is extremely widespread worldwide, and is often even incentivised by regulators, due to its obvious benefits: lower costs for rents and equipment due to an absence of needless duplication, as well as less visual clutter for consumers.
- **Active sharing** implies the common use of some of the active elements of operators' networks, including the Radio Access Network (RAN).
  - Active elements are the electrical parts of the network (which are able to generate, process, amplify and control signals).
  - Active network sharing has become widespread over the past 20 years.
- **Roaming** can be considered a type of active sharing. We do not discuss it here because it is an asymmetric one-way access agreement, not a voluntary cooperation of more or less equals.

NSAs come in a variety of forms: variations on active sharing

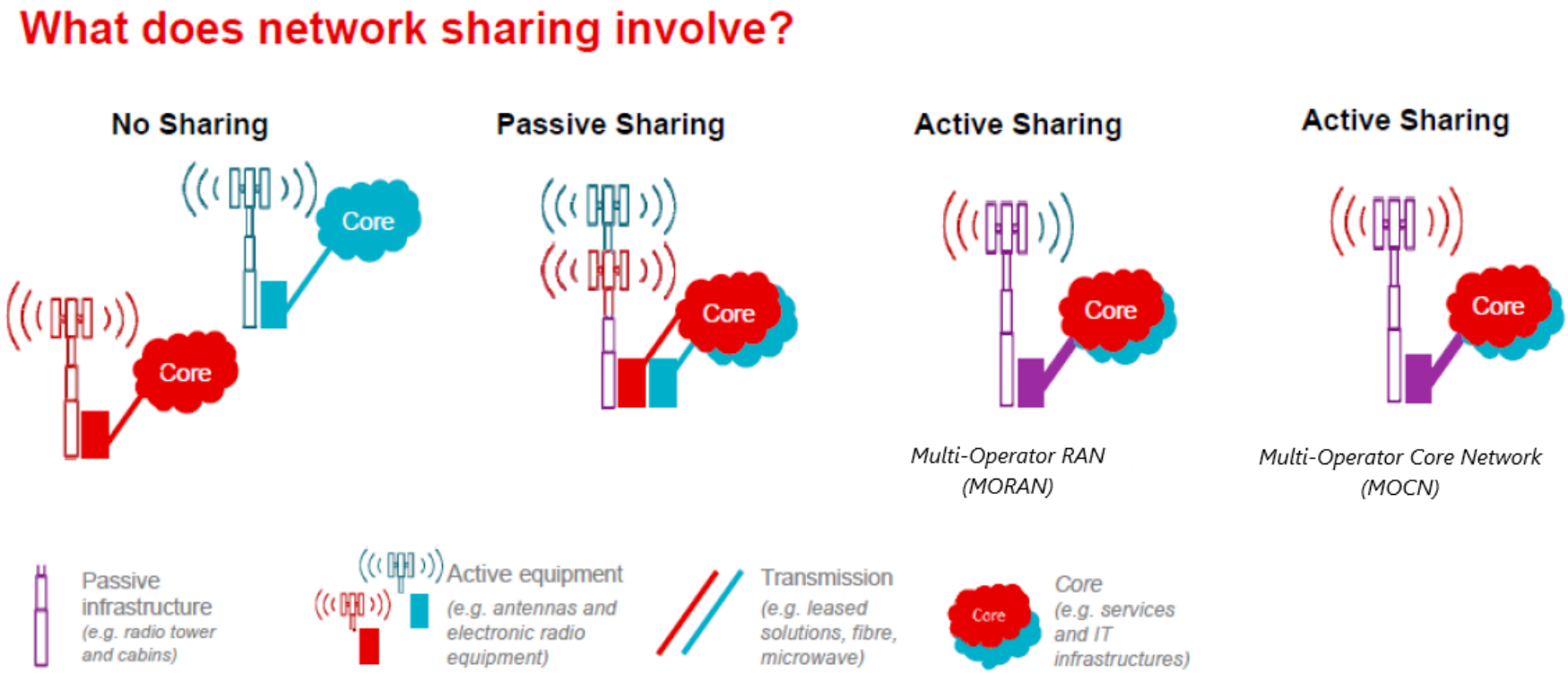
Depending on which elements of the active network are shared, the main types of the agreements can be identified. These various types imply different depths of technical and business cooperation.

- **MORAN** (Multi-Operator Radio Access Network) is the case where each operator uses **common RAN** equipment, but its own spectrum.
- **MOCN** (Multi-Operator Core Network) denotes the case when, beside the common RAN, **spectrum** is also pooled and used jointly.
- **Partial core sharing**: beside the RAN and spectrum, parts of the core network are also shared. This is currently largely a theoretical possibility.

The **core network is the key to managing and differentiating services**. It is therefore important to stress that in the case of both MORAN and MOCN, **the core network remains completely separate.**

In all cases it is assumed that the parties continue to compete as entirely separate entities on the retail market.

An illustration of various types of network sharing



Source: Vodafone, Infrapont

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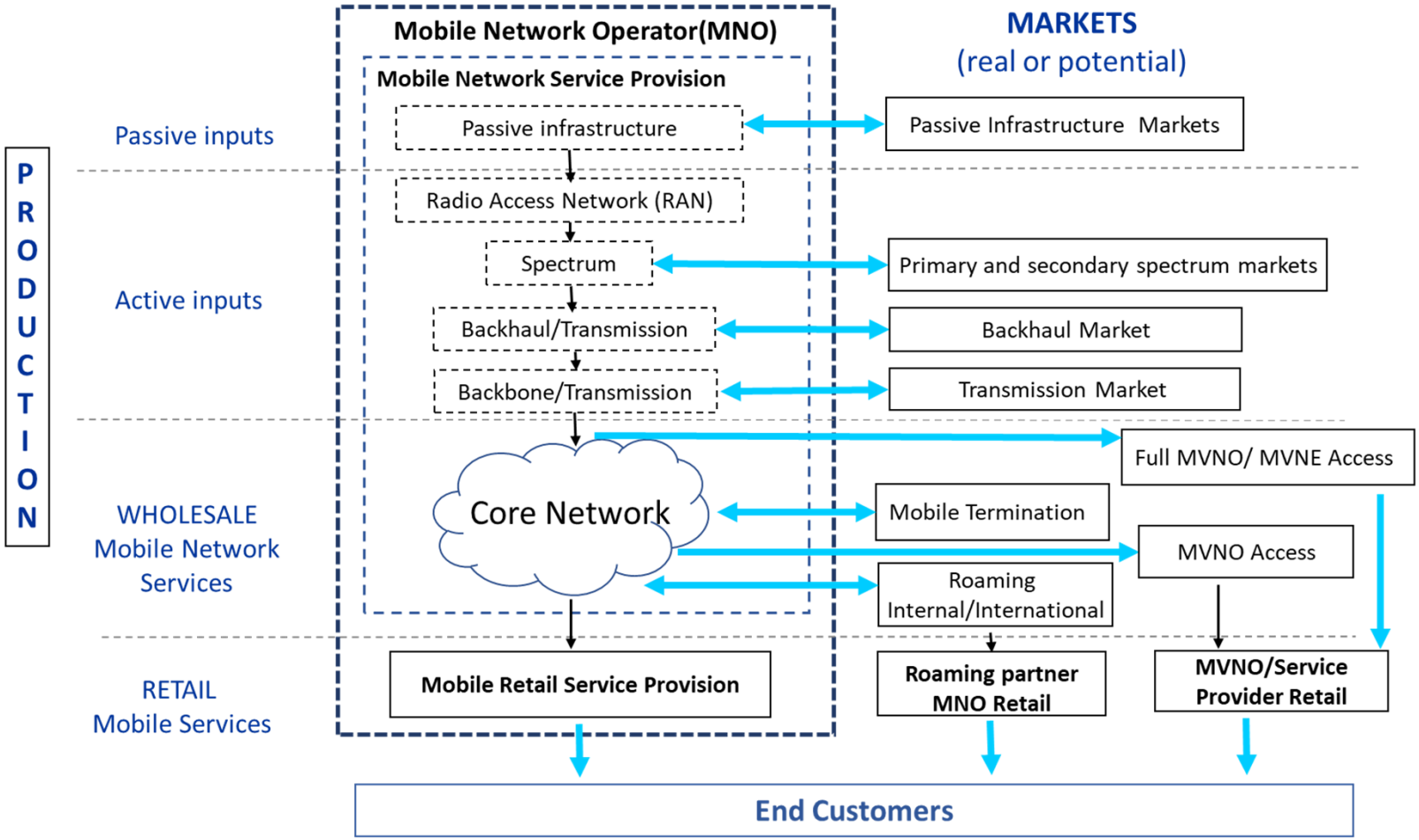
Mobile service production: vertical chain and related markets



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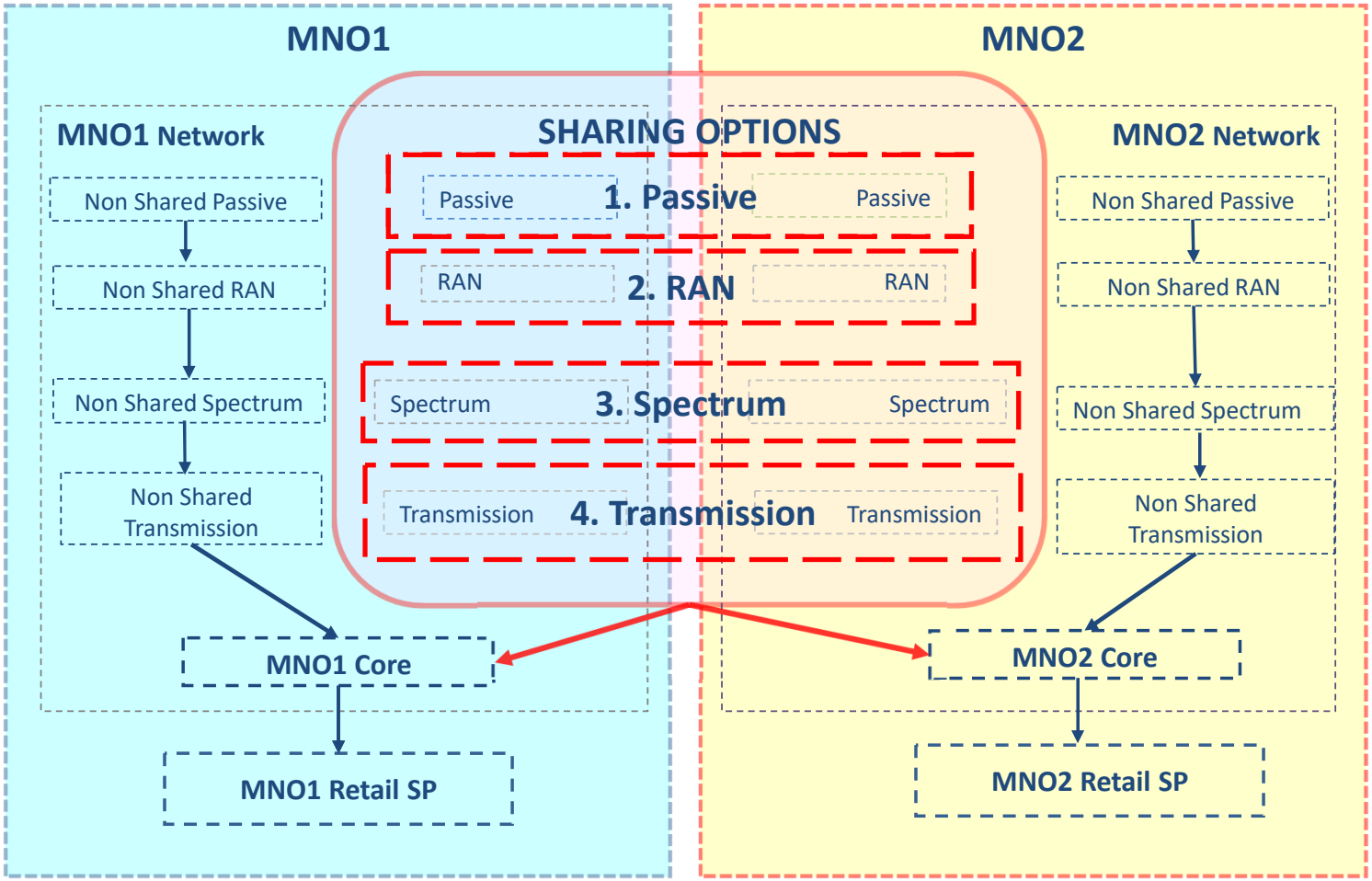
General view of network sharing options - without core sharing



Sharing can be:

- passive and/or active
- partial to full – both in spectrum and in the technology dimension
- local, regional or national

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The rationale for sharing

An NSA between well-matched parties can:

- reduce capital expenditure (CAPEX) and operating expenditure (OPEX) for the parties – this **cost saving** and ROCE improvement is the main motivation
  - it is true for new and legacy networks, however the level of cost saving may differ
- help a **more efficient and faster rollout and operation** of the new generation network,
- achieve **better network quality** than the parties would have achieved separately,
- help to **cover „grey" and „white spots"** (remote, high-cost and/or low-profitability locations),
- lead to the **more efficient use of the spectrum** - under MOCN,
- create **economies based on the complementarities** between the parties
- help to **reduce the environmental and visual impact** of mobile networks on the built and natural environment.

Main dimensions of network sharing

Network Sharing Agreements may take on a **wide variety of forms, scope and depth**. These dimensions are useful for categorisation

Network elements involved	passive / RAN / spectrum / backhaul / core
Technology generations	2G / 3G / 4G / 5G
Spectrum bands	which specific bands
Geographic scope	local /regional / national
Network densification	macro / micro / pico cells
Organisation and governance	mutual lease / Joint Venture (asset light OPCO or asset heavy NETCO) / 3rd party provider

Cost savings 1

- **Cost savings highly depend on the extent and depth of sharing**
- There are only ballpark figures in the public domain
- GSMA (2019) refers to
  - Ericsson (2012): asset savings from infrastructure sharing can reach up to 40% and cash-flow improvement up to 31% depending on the type of sharing
  - Booz & Company (2012): infrastructure sharing can enable operators to save as much as 30 to 40 percent of the network costs.
  - Coleago (2010): calculated savings in roll-out CAPEX and savings in network operations and maintenance OPEX can reach up to 65% each
  - Analysys Mason:
    - passive sharing may result in 35~40% reduction of TCO (Total Cost of Ownership) for CAPEX
    - for OPEX, passive sharing also can significantly reduce the cost.

Cost savings 2

Body of European Regulators (BEREC, 2018) cost savings estimates, based on figures provided by European NRAs:

	CAPEX	OPEX
passive sharing	16%-35%	16%-35%
active sharing (excl. spectrum)	33%-35%	25%-33%
active sharing (incl. spectrum)	33%-45%	30%-33%
core network sharing	according to Swiss authority, core network sharing cost savings are limited	

* upper limit for both the total CAPEX and OPEX seems to be exaggerated in the case of passive sharing

There is a trade-off between cost savings and strategic control of the network, though its magnitude is heavily dependent on the technical and legal details of the agreement

From the consumers' point of view:

+ Potential benefits to consumers: Operators can economise on the network costs – savings may be passed on to consumers in various forms

- like cheaper offers, better quality, larger coverage, …

– Potential harm to consumers: Operators are direct competitors – these agreements could potentially lead to a restriction of competition

- higher prices, decreasing choice, slower innovation, delayed development

Because of the potential restriction of competition, **competition assessment is needed**

- Usually done by competition authorities, but competition issues on the telecom markets may be in the regulatory domain in some countries
- case by case assessment or conditional exemption?

Key elements of the competition assessment framework

While the concrete legal framework depends on the national competition laws, these elements are key to good competition economic assessment

- Focus on the effects on end costumers
- Identification of the affected markets
- Setting and testing consistent Theories of Harm
  - Theory of Harm: a convincing, testable theory of how an expected change of structure or behaviour may harm the customers
- Counterfactual
- Burden of proof on the competition authority

If anticompetitive effects are substantiated – possibility of efficiency defence

- Are there efficiency gains that outweigh the harm?
- Burden of proof on the parties.

Potential competition concerns

Horizontal unilateral effects	**Decrease in ability and incentives to compete due to the decreased differentiation of services between parties**
	Decrease in incentives to compete due to fixed costs becoming variable
	Decrease in the ability or incentive to innovate
Horizontal coordinative effects	**Increased commonality of costs**
	Information exchange
Vertical effects	Access to MNOs to passive infrastructure
	Wholesale access to MVNOs to the operators' network
Unfair competitive advantage	Potential exclusion of operators not party to the NSA
	Excessive concentration of spectrum

This framework was originally developed and applied to NSAs till 4G

Pápai – Csorba – Nagy – McLean (2020): *Competition policy issues in mobile network sharing: a European perspective*, Journal of European Competition Law and Practice: https://doi.org/10.1093/jeclap/lpaa018

Horizontal unilateral effects: differentiation

- The argument:
  - Certain aspects of the **operators' services will become more similar** to each other.
  - Their technical and strategic autonomy will decrease.
  - The ability and/or incentive to differentiate will also decrease.
  - **The loss of differentiation implies a loss of competition.**
- The concern is **more serious for deeper agreements**:
  - *The more of the network is shared, the larger the geographic scope, the more technologies are involved, the more of the operators' spectrum bands are included*
- There are strong counter-arguments:
  1. **Technical and commercial differentiation differ.** Many of the most important aspects of product differentiation are plainly commercial (pricing, bundling, marketing), and obviously unaffected. But even technical differentiation mainly takes place in the core.
  2. If an NSA leaves **the core separate** the autonomy for differentiation does not decrease substantially
  3. If an agreement allows **unilateral network expansion**, strategic autonomy is not constrained substantially
  4. **More similarity may mean better results for everyone** – e.g. increased, but identical coverage, better service quality.
- Overall, it is **hard to substantiate**. But if it is, there is **no easy fix**.

Horizontal unilateral effects

Fixed costs becoming variable

- The argument:
  - Some fixed network costs become shared.
  - These need to be split between parties.
  - One approach is to split them according to usage – but then they become variable costs.
  - Variable costs affect pricing, and therefore, competition.
  - Specifically, parties' incentives to compete for more usage decreases.
- Mitigation: **fixed costs must remain fixed** – this can be solved in the design of the NSA.

Decrease in the ability or incentive to innovate

- The argument:
  - The ability and/incentive to deploy new features and innovate decreases and/or the party with lower willingness to develop holds back the other
  - There will be lower dynamic competition (technological development, innovation)
- Counter-argument:
  - Core related technical and commercial innovations are rarely constrained
  - Network related technical innovations and new features are mostly coming from the vendors, and their deployment do not always involve significant costs
- Mitigation: this could be solved at least partly in the design of the NSA.

Horizontal coordinative effects

Increased cost commonality

- The argument:
  - The **proportion of costs** that the parties **share will increase**.
  - It **may** reach a level which enables them to **collude**.
- The theory refers to **variable costs** only, but fixed costs may also be taken into account.
- The concern is more serious if the NSA is deeper.
- **No safe harbour** – but even when the full network is shared, we expect less than half of costs to be shared.
- Mitigation: no easy fix. **Difficult to substantiate** harm, but **difficult to remedy** if substantiated.

Information exchange

- The argument:
  - Parties must share some **sensitive information** with each other: they must maintain the shared network, and settle accounts with each other.
  - Sharing information **facilitates collusion** or makes it more stable, especially through increasing market transparency.
- The concern is more serious if the NSA is deeper.
- Mitigation: The **amount and scope** of information exchange should be **as small as possible**. This concern can be significantly diminished by the design of the NSA.

Vertical effects

Access to passive infrastructure

- The argument:
  - NSA parties will consolidate their networks and abandon facilities their competitors also use.
  - This may (temporarily) adversely affect competitors' consumers.
- The effect is mostly small, if any. Easy fix: parties can commit to offering access or similar.

Wholesale access

- Three concerns may arise:
  - Parties may limit or overprice MVNOs access to wholesale services.
  - MVNOs will have fewer distinct networks to choose from.
  - NSA parties may optimise their networks in a way that there remains less free capacity for MVNOs.
- Mitigation: if concerns are substantiated, they can be remedied by commitments to offer access.

Unfair competitive advantage

Exclusion of competitors

- The argument: the parties may gain a non-replicable cost advantage that created such a large competitive advantage that a competitor is forced to leave the market.
- Unrealistic, but may be raised by competitors.

Concentration of spectrum (when spectrum is shared at all: MOCN)

- The argument:
  - The amount of available spectrum affects network capacity and speed.
  - If the **parties** to the NSA have a significantly **larger amount of spectrum at their disposal than their competitors**, the competitors may be unable to offer services of comparable quality.
- A **faulty argument** in many respects, since pooled spectrum serves two MNOs customers, and there is no foreclosing effect
- Mitigation: requirement of bidding **jointly at future spectrum auctions and calculate spectrum caps for the parties jointly** – but this creates further problems.

Efficiencies: the potential benefits to consumers

Two main types of efficiencies may arise in NSAs:

- **Cost efficiencies**:
  - Cost savings resulting from the agreement which translate into lower prices (or similar benefits) to consumers.
  - These **can and should be quantified**.
    - Usually parties can easily quantify their own cost savings.
    - They also need to show how much are passed on to consumers.
- **Qualitative efficiencies**:
  - The quality of services (such as coverage, speed, reliability) improve for some or all consumers.
  - Certain improvements (such as new technologies and thereby, services) may reach consumers sooner than they would have absent the agreement.
  - **Often not quantifiable, or their quantitative assessment is not trivial.**
  - **Taken together may be larger and more important than those passed through in the form of price decreases.**

On balance

There is a solid business rationale for active network sharing

Many effects are not anticompetitive.

- Competition authorities must keep this in mind when assessing NSAs.

Many potential concerns can be easily addressed.

- Parties must keep this in mind when designing NSAs.

Some important issues remain, the arguments must be allowed to play out in case by case assessment: the „hard to substantiate, hard to mitigate"-type.

- Further precedents can help establish safe harbours (see cost commonality).
- Some consensus should emerge regarding the assessment of certain concerns (for example, differentiation).

The challenge of 5G

Business case challenge for 5G

- Huge investment is needed to build the network
- No significant increase in revenues on the horizon

Does 5G technology change the game of the competition assessment of an NSA?

- In the short term, surely no
- In the longer term …
- It may be worth making a distinction between
  - early 5G – the current reality
  - mature 5G – the promise

Early versus mature 5G

	Early 5G	Mature 5G
Deployment scenario	Non-standalone	Standalone
Time frame	From 2019 -	Expected after 2023
Relationship between 5G and 4G	5G piggybacks on 4G core	Independent
Spectrum used	Mostly sub-6 GHz	Sub-6 GHz and mmWave
Densification	Moderate / Gradual	Widespread

Mature 5G … the expectations

Mature 5G promises certain features that could affect NSAs and their competition assessment, for example:

- Service-Based Architecture, Virtualisation
  - differentiation occurs in the software layer
  - increasing flexibility in introducing new services
  - services become RAN-agnostic
  - Network slicing: the possibility to define special-purpose networks that can open up new dimensions in differentiation
- RAN changes
  - Multi-standard RAN: technology-agnostic RAN
  - Open RAN:
    - less differentiation ability on the cell side, more in the cloud
    - can blur the line between passive and active sharing
- Core – Edge relationship
  - Mobile Edge Computing: bringing the core closer to the end-user: possible partial core sharing

Competition assessment for 5G

Early 5G closely resembles 4G in its network and service capabilities; overall, it is closer to 4G than mature 5G and NSAs can be assessed as before

… and the expectation

- For the significantly different mature 5G, some concerns may even be less grave than under 4G.
  - Differentiation: the role of the core will increase and the role of the RAN will decrease – non-core NSAs result in smaller similarity
    - If partial core sharing could emerge, possibly exacerbating the concern
  - Vertical issues: the usual access concerns may arise, but remain hard to substantiate and easy to fix with commitments;
    - But new markets may need more careful assessment

European case study

There is a unified European Competition Law Framework defined by the Treaty on the Functioning of the European Union

- with some national differences in the institutions and slight differences in flavour in the implementation and application of the rules

Article 101 deals with the agreements between undertakings:

(1) all agreements between undertakings, decisions by associations of undertakings and concerted practices which may affect trade between Member States and which have as their object or effect the prevention, restriction or distortion of competition within the internal market are prohibited

(3) but they are allowed if they contribute to improving the production or distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit, and

(a) do not impose on the undertakings concerned restrictions which are not indispensable to the attainment of these objectives;

(b) do not afford such undertakings the possibility of eliminating competition in respect of a substantial part of the products in question.

European case study: many commercial NSAs

	NSA for earlier technologies only (2G/3G/4G)	NSA including 5G
Number of countries	5 (3 MORAN, 2 MOCN)	10 (5 MORAN, 5 MOCN)
Covered population	~ 133 million	~ 216 million

* 27 European Union Countries + UK
** EU27 + UK population is ~ 520 million
*** only national or regional NSAs are counted

European case study: Denmark

Context:

- small country (area: ~ 43 thousand km2, pop: 5.8 million)
- high living standard: HDI(2019): 0.94, 10th in the world
- 4-player market with vigorous competition

- NSA in 2012 between the 2nd and 3rd player (Telia & Telenor)
  - All technology (2G/3G) and the (then) future 4G
  - MOCN (spectrum pooling)
  - national
  - TT-Network Joint Venture – practically a network merger
- The Danish Competition Authority (DCC) prepared a thorough competition assessment

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European case study: Denmark

The DCC raised the following anti-competitive concerns:

1. The agreement reduces competition on significant parameters such as coverage and the development and spread of new technology (LTE, LTE-Advanced), because these parameters are solely defined in the Radio Access Network. If the parties' respective RANs are integrated, their mobile coverage and supply of mobile technologies will thus become identical.
2. The tariff structure initially proposed to recover the joint venture's costs from the parties may change the underlying cost structure of the RAN compared to the situation before the agreement in a way that converts fixed costs into variable costs which can reduce the parties' incentives to compete and attract new customers.
3. The agreement increases the risk of exchange of commercially strategic information.
4. The agreement may increase the risk of a collusive outcome on the wholesale market.
5. The parties will reduce the number of antennas and masts in their common RAN, which may create coverage problems for competitors that rent antenna positions on the parties' masts.
6. The parties may obtain a joint amount of frequency resources that in the long term significantly exceeds that of the competing operators.

The parties submitted **commitments which solved concerns 2 - 6**

Regarding the **differentiation concern**, since the parties have provided sufficient proof of high-enough transaction-specific efficiencies, there were no grounds for action on this point.

European case study: Denmark

- TT Network, the 50/50 owned, joint venture NETCO of Telia and Telenor was established in 2012. It operates the largest mobile network in Denmark, with more than 4 thousand antenna positions. It also offers mast space rental to 3rd parties
- Telia and Telenor jointly bid and won 2*10 MHz in the 800 MHz band (for LTE) in 2012
- Telia and Telenor announced a full merger at the end of 2014, but after 9 months of investigation they withdrew it, as they realized that the European Commission would not approve the merger due to a concern for the serious weakening of competition.
- Telia and Telenor joint venture acquired 2*5 MHz in the 700 MHz spectrum in 2019

European case study: Denmark

„This network sharing agreement between Telia and Telenor has led to a substantial cost saving and a common network with a better coverage and capacity than the two previously independent networks."

Morten Bæk,

Director General, Danish Energy Agency (the regulator)

2018

In 2020 Telia and Telenor started to roll-out the common 5G network which supports MOCN capabilities for 2G, 3G, 4G and 5G simultaneously

European case study: Vodafone

International player with strong European position

Operations (mobile and fixed):

European Union	Other Europe	Outside Europe
Germany, Italy, Spain, Netherlands, Portugal, Greece, Czechia, Hungary, Romania, Ireland	United Kingdom, Albania	10 countries (including India, Turkey and South Africa)

The total population of Vodafone covered European countries is more than 330 million

European case study: Vodafone

Active network sharing agreements:

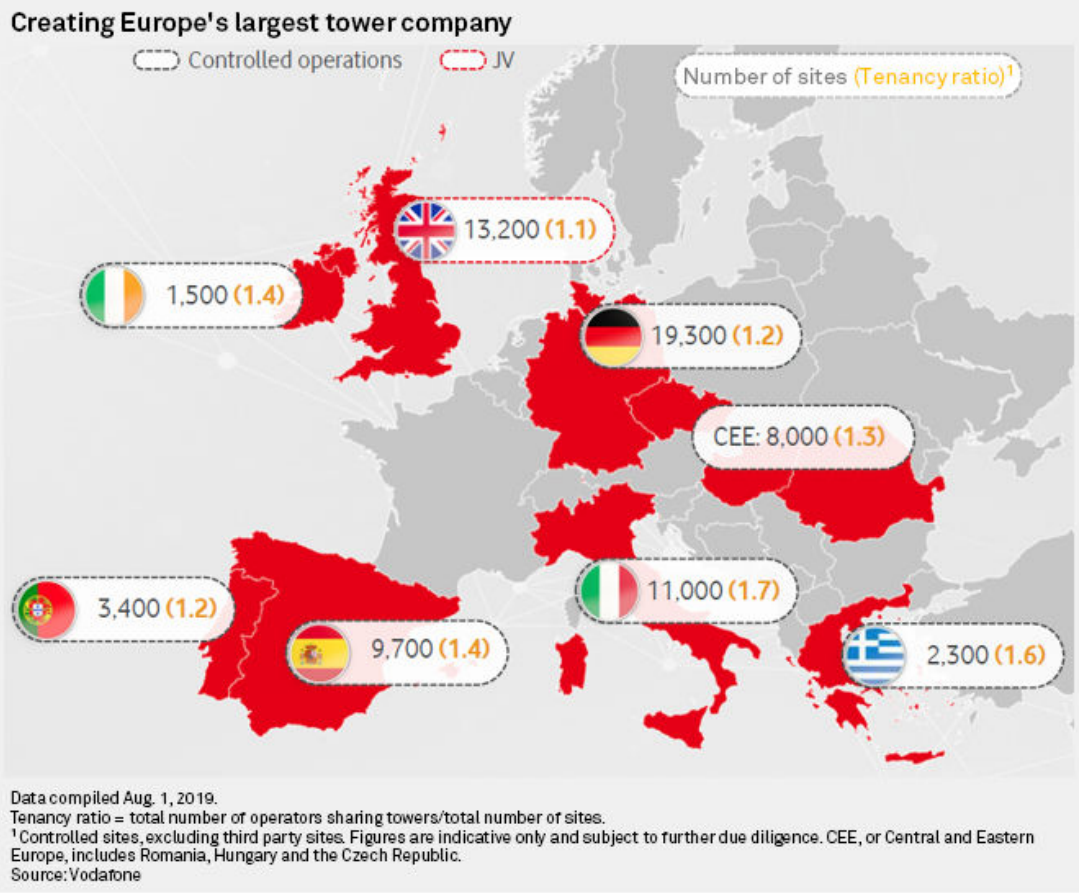
- UK, Italy, Spain, Portugal, Greece - and in Germany for grey and white spots only
- all agreements are MORAN
- all are regional (dense urban regions excluded)
- different organisational forms

Sharing approach (rather special):

- prioritises **sharing outside urban areas and some marginal coverage areas**
- **keeps networks in urban areas independent** in order to remain in full control of plans to roll-out the latest technologies and services, without being unnecessarily hindered or constrained by partners
- supports the idea for 2G networks (which will be more difficult to switch off than 3G) not just to share, but to collapse competing 2G networks together, creating a single shared legacy network and freeing up valuable spectrum

Vodafone - Vantage Towers

- In 2019 Vodafone created Vantage Towers from its infrastructure assets
  - more than 82 thousand towers in 10 countries
  - acquire, build, operate
  - services to 3rd parties
- IPO in 2021



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Thank you for the attention