

INDUSTRY GUIDELINE FOR NETWORK INFRASTRUCTURE SHARING

Enabling Network Infrastructure Sharing For Sustainable Connectivity



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Malaysia Mobile Network Operators

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1.0 Committee

This Industry Guideline has been developed by Mobile Network Operators (MNOs) in Malaysia and consists of representatives from the following organisations.



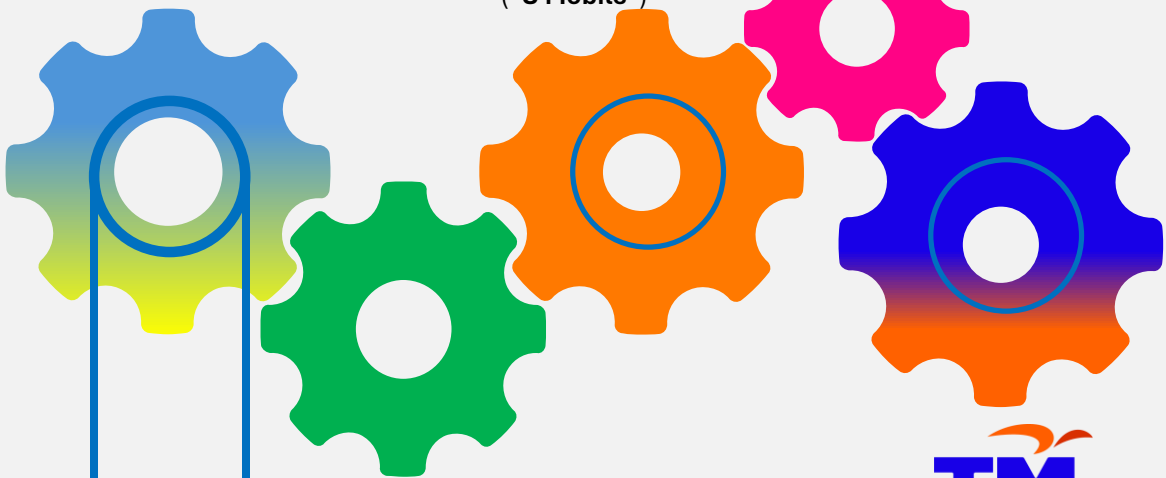
Celcom Networks Sdn. Bhd.
("Celcom") and Digi
Telecommunications Sdn. Bhd.
("Digi") (collectively "CelcomDigi")



U Mobile Sdn Bhd
("U Mobile")



YTL Communications
Sdn Bhd ("YTL")



Maxis Broadband Sdn Bhd
("Maxis")



TM Technology Services
Sdn Bhd ("TM")

2.0 Definitions

For the purpose of this Industry Guideline, the following terms shall have the meanings set forth in their respective definitions, unless a different meaning is required for in the context of another provision in this Industry Guideline:

“Act”	means the Communications and Multimedia Act 1998, as amended from time to time;
“Active Infrastructure Sharing”	means the active sharing of electronic and signal-processing of network components as set out in Section 6.2 of this Industry Guideline;
“Equipment”	means the telecommunications equipment and its components which include but is not limited to outdoor/indoor radio and transmission equipment with shelter; cabin or outdoor/indoor units, antenna systems and its related mechanical, electronic and electrical system installed and/or to be installed for the purpose of the Network Infrastructure Sharing;
“Industry Guideline”	means this Industry Guideline for Network Infrastructure Sharing including any modifications, amendments or additions as may be mutually agreed in writing between the MNOs from time to time;
“MCMC or SKMM”	means the Malaysian Communications and Multimedia Commission or Suruhanjaya Komunikasi dan Multimedia Malaysia;
“Minister”	means the Minister of Communications Malaysia or, if different, the Minister administering the Act;
“MNOs”	means the operators listed in Section 1 (Committee) of this Industry Guideline;
“MOCN”	means Multi-Operator Core Network, a functionality that allows a network operator to provide access to other network operators, where radio access networks and spectrum are shared, and traffic for each party are routed to the respective core network;
“Network Infrastructure”	means the telecommunications infrastructure that forms part of the Network Infrastructure Sharing;
“Network Infrastructure Sharing”	means either the Passive Infrastructure Sharing or Active Infrastructure Sharing, as the case may be;
“Passive Infrastructure Sharing”	means the sharing of non-electronic, physical components of network as further set out in Section 6.1 of this Industry Guideline;
“RAN Sharing”	means the 4G Radio Access Network (RAN) Sharing System using Multiple Operators Core Network (MOCN) technology system comprising of eNode B, Point of Interconnect (POI), Power Source and the associated Element Management System (EMS) with backhaul/transmission from eNode B to the POI and/or other backhauling via microwave, leased line or fibre;
“Selected Sites”	means the telecommunication sites including the outdoor sites and/or in-building system (IBS) sites, on which the Network Infrastructure, including Equipment, is constructed and/or installed for the purpose of Network Infrastructure Sharing as mutually agreed upon in writing amongst the MNOs;

3.0 Objective and Key Drivers



The MNOs' commitment to supporting the Malaysian Government's digital agenda reflects the MNOs dedication to fostering innovation, inclusivity, and enhanced connectivity across the nation.

MNOs are supportive and fully aligned with the Government's aspiration

The MNOs strongly align with the Government's aspiration to strengthen Malaysia's telecommunications infrastructure, focusing on expanding 4G coverage and addressing the digital divide across states. By collaborating with other stakeholders, the MNOs ensure that all communities, particularly those in rural and remote areas, will have access to enhanced telecommunications services. The MNOs' initiatives reflect the Government's vision for creating a connected and inclusive Malaysia with quality services for the benefit of every citizen.

MNOs share a common ambition with the Government to establish an excellent telecommunication networks and service quality

The MNOs embrace innovative solutions that empower individuals, businesses, and communities to thrive in an interconnected world. By championing initiatives like this Industry Guideline, the MNOs are driving cost-effective and efficient network-sharing strategies that enhance coverage and service quality. This approach ensures that Malaysia remains competitive whilst enabling seamless connectivity for both urban hubs and rural villages. Through this shared ambition, the MNOs are laying the foundation for a future-ready telecommunications ecosystem.

MNOs are enabling infrastructure sharing for sustainable connectivity

Infrastructure sharing is a cornerstone of the MNOs strategy for enhanced network deployment efficiency, reduction of operational costs, and minimization environmental impact. This Industry Guideline provides the framework for effective collaboration between the MNOs, ensuring that assets and resources are shared or pooled to achieve optimal outcomes. This collaborative approach accelerates service rollouts in underserved regions, bringing the benefits of connectivity by all MNOs to more communities while fostering sustainability in the telecommunications sector. By leveraging shared infrastructure, the MNOs support Malaysia's transition towards a more resilient and future-ready telecommunication landscape.

MNO's collaboration to enhance connectivity in seven priority areas

By prioritising the seven priority areas identified by MCMC, the MNOs are addressing connectivity gaps and delivering high-quality services in identified areas. The MNOs' efforts are guided by this Industry Guideline, which facilitates collaboration among the MNOs to deploy shared networks effectively. This targeted approach aims to ensure that all Malaysians, regardless of their locations, can access reliable telecommunications services. These efforts are more than just about expanding connectivity—they are about empowering communities, driving economic growth, and enhancing the quality of life for residents.



4.0 Background



- 4.1 On May 9, 2024, the Minister of Communications, YB Fahmi Fadzil witnessed a defining moment in Malaysia’s telecommunications landscape: the signing of a Trial Agreement amongst five MNOs — CelcomDigi, Maxis, U Mobile, TM, and YTL. This Trial Agreement marks the beginning of an ambitious journey towards a Network Infrastructure Sharing collaboration. Through this initiative, the MNOs aim to foster a more efficient, equitable and sustainable Network Infrastructure Sharing that enhances connectivity and empowers communities across Malaysia.
- 4.2 At the heart of this collaboration is the identification of five strategically selected trial sites. These sites serve as testbeds for evaluating technical, operational, and financial feasibility for a 6-way Active Infrastructure Sharing. By pooling resources and expertise under this Industry Guideline, the MNOs seek to unlock new opportunities for network efficiency, improve service delivery, and create a robust Network Infrastructure Sharing to address connectivity challenges, particularly in underserved areas.

Strategic Alignment with National Sustainability Goals

This initiative is deeply aligned with Malaysia's national agenda for sustainable development and equitable growth. Network Infrastructure Sharing addresses critical issues such as:

- 1. Resource Optimisation:** By reducing redundant infrastructure deployment, the MNOs minimise environmental impact and lower carbon footprints associated with telecommunications expansion.
- 2. Bridging the Internet Connectivity:** This initiative will ensure that no community is left behind in accessing excellent broadband services.
- 3. Economic Resilience:** A shared network model fosters a competitive yet collaborative market environment, driving innovation while ensuring affordability for end users.
- 4. Promote quality services and coverage:** MNOs will have the opportunity to share each other's infrastructure consistent with this Industry Guideline for quality services and coverage.

A Roadmap for Shared Success

To guide this transformative journey, the MNOs have developed this Industry Guideline that establishes high-level principles and strategies to ensure alignment with national objectives, priorities and stakeholder expectations.

Key Features of this Industry Guideline:

1. Purpose-Driven Collaboration

This Industry Guideline envisions Network Infrastructure Sharing to balance commercial interests with social responsibility. It establishes decision-making principles to promote transparency, equity, and fairness, thereby reinforcing trust among MNOs and stakeholders.

2. Focus on 7 Priority Areas

Recognising the critical need to address connectivity gaps, the initiative prioritises several areas. Special emphasis is placed on addressing the seven priority areas as identified by the Ministry of Communications and MCMC, which represent communities in immediate need of improved connectivity.

3. Consumer-Centric Outcomes

The initiative is designed to deliver measurable benefits to end users. By rapidly resolving coverage complaints and improving service availability, the initiative directly enhances the broadband experiences of individuals and businesses alike.

4. Adaptability Across Regions

While the primary focus is on 7 priority areas, the framework allows for scalability. Subject to further commercial discussions, this Industry Guideline can be extended to other areas, creating a consistent and unified approach to network Infrastructure sharing nationwide.

Challenges and Opportunities

Implementation may require close engagement with MCMC and state governments to address regulatory, technical, and operational complexities. Additionally, achieving collaboration among MNOs on shared infrastructure models and investment strategies remains a critical focus area.

Looking Ahead

- 4.3 This initiative represents more than just a technical solution; it is an effort to build a sustainable and high-quality connectivity for Malaysia. By aligning industry practices and approaches with sustainability goals, the MNOs aim to create a telecommunications ecosystem that delivers value to stakeholders, fosters innovation and ensures equitable and high-quality connectivity for all.
- 4.4 Through shared efforts and visionary leadership, the MNOs are confident in the ability to drive meaningful change and set a benchmark for sustainable telecommunications nationwide.



5.0 Overview of This Industry Guideline

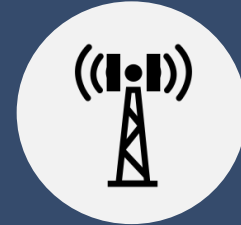
5.1 In alignment with the Malaysian Government's strategic directive to enhance 4G network coverage as outlined above, this Industry Guideline establishes principles, processes, and guidelines for Network Infrastructure Sharing among MNOs in Malaysia. It aims to provide a clear and structured approach that fosters collaboration, optimises resources and improves connectivity, particularly in underserved and unserved areas

5.2 This Industry Guideline focuses on two key sharing methodologies:



Passive Infrastructure Sharing:

Sharing of non-electronic, physical components of the network. These components do not directly process or transmit signals.



Active Infrastructure Sharing:

Sharing of electronic and signal-processing network components.

Further details of the sharing methodologies are set out in **Section 6 (Sharing Methodology)** of this Industry Guideline.

5.3 The MNOs anticipate that several challenges may exist in adopting or executing the sharing methodologies despite the associated varying benefits. There is no “one-size-fits-all” solution, as each MNO will face unique engineering or financial limitations in meeting parity terms. To address these challenges, the Industry Guideline proposes two types of collaboration arrangements:

Parity Collaboration	Non-Parity Collaboration
Collaboration is satisfied through equivalence of contributions between the host and access seeking operators subject to agreement(s) between the hosting MNO and the seeking MNO.	Where equivalence of contributions cannot be achieved, the collaboration will be satisfied through commercial arrangements subject to written agreement(s) between the hosting MNO and the seeking MNO(s).

Further details of the collaboration arrangements are set out in **Section 10 (Collaboration Arrangements)** of this Industry Guideline.



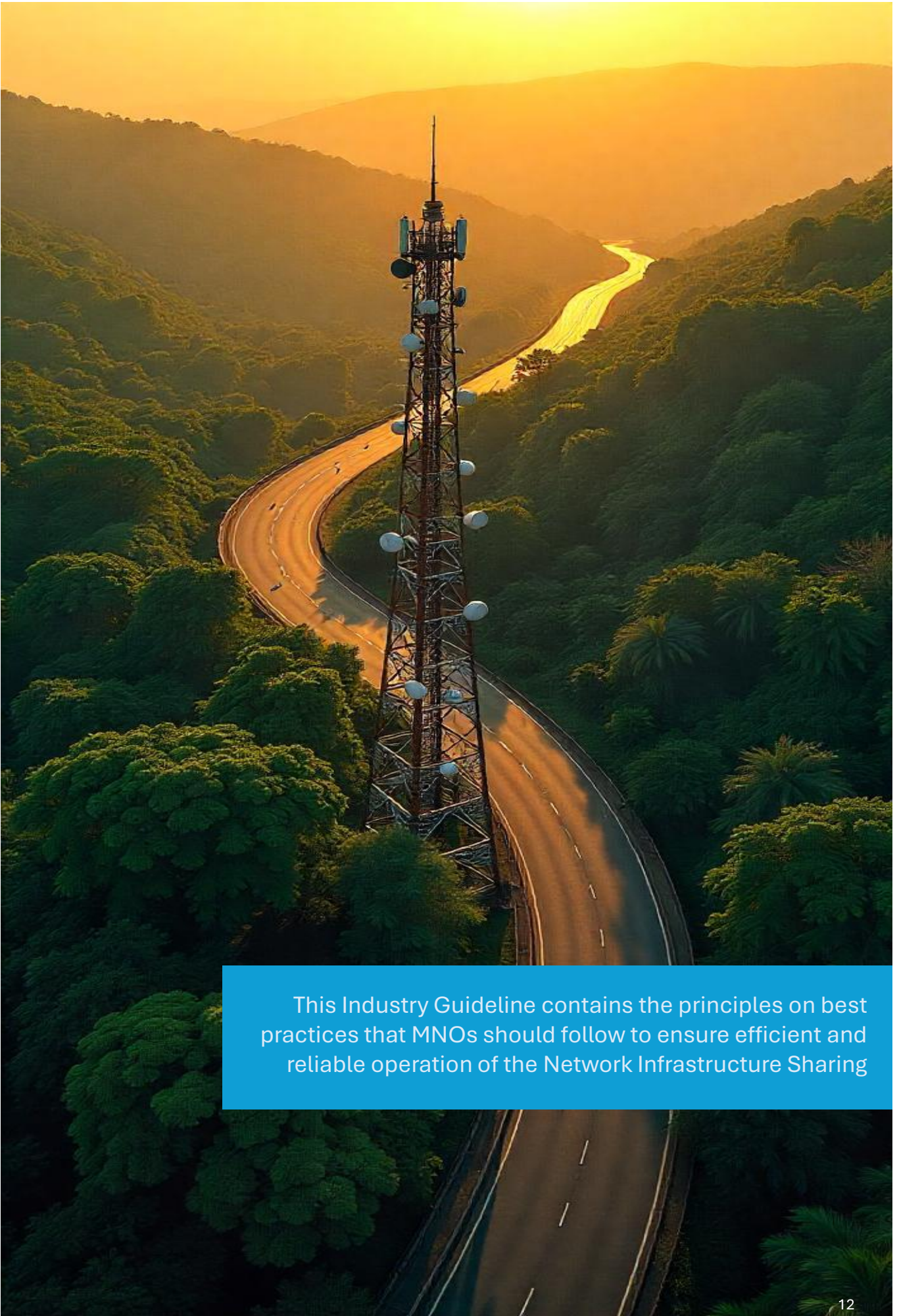
5.4 Further to the above, one of the key elements of this Industry Guideline is the effective management of Technical and Implementation (**T&I**) and Operation and Maintenance (**O&M**) activities. It establishes the fundamental principles and procedures on the best practices that MNOs should follow to ensure the efficient and reliable operation of shared Network Infrastructure. It serves as a reference document for the MNOs to address the unique challenges of shared Network Infrastructure, such as ensuring compatibility between different MNOs' systems, efficient network operation and the long-term sustainability of shared Network Infrastructure.

5.5 This Industry Guideline also aligns with MCMC's directive to explore sustainable and cooperative approaches for expanding digital connectivity. By addressing coverage gaps and promoting equitable access to reliable voice and data services, it ensures effective collaboration among MNOs while preserving their individual business strategies and competitive priorities.

5.6 As such, this Industry Guideline focuses on Network Infrastructure Sharing **within seven priority areas** identified by MCMC and other locations that may be mutually agreed upon by the MNOs. By adhering to its principles, MNOs can achieve cost optimisation, enhance coverage, and improve resource utilisation. This approach ensures that all communities benefit from reliable connectivity while safeguarding the strategic and competitive interests of each MNO.

5.7 In addition to outlining the principles, processes, and guidelines for successful Network Infrastructure Sharing among the MNOs as stated above, this Industry Guideline also addresses challenges such as site acquisition, bureaucratic obstacles and lessons learnt drawing from past experiences. By identifying and addressing these challenges, this Industry Guideline aims to highlight practical solutions and support to ensure that the MNOs can maximise the benefits of Network Infrastructure Sharing, ultimately benefiting the public as a whole.

5.8 Through its integrated approach, this Industry Guideline aspires to enhance operational efficiency among the MNOs while aligning with national objectives. Its successful implementation will significantly contribute to the transformation of Malaysia's telecommunications landscape, enabling the MNOs to deliver high-quality 4G services effectively and expeditiously. Ultimately, the fostering of synergies among the MNOs will play a crucial role in achieving the Government's vision for a digitally inclusive Malaysia, ensuring improved connectivity and service quality for all citizens.



This Industry Guideline contains the principles on best practices that MNOs should follow to ensure efficient and reliable operation of the Network Infrastructure Sharing

6.0 Sharing Methodology

While individual infrastructure offers full independence and control, as MNOs build and manage their networks, but these come with considerable resources and investment. Consequently, MNOs continuously explore options of Network Infrastructure Sharing either via **Passive Infrastructure Sharing** or **Active Infrastructure Sharing**.

Passive Infrastructure Sharing, such as sharing towers and physical infrastructure, reduces costs while allowing MNOs to retain control over their RAN and spectrum. On the other hand, to Active Infrastructure Sharing, where MNOs share critical elements like RAN or even spectrum, significantly enhances cost-efficiency and resource utilisation but increases complexity and reduces operational independence. As more network elements are shared, MNOs benefit from economies of scale but must navigate challenges in coordination, reduced control and fairness. This progression reflects the trade-offs between efficiency and autonomy.

The MNOs explore these categories of Network Infrastructure Sharing, their differences, and their respective subcategories in detail as set out below.

6.1 PASSIVE NETWORK SHARING

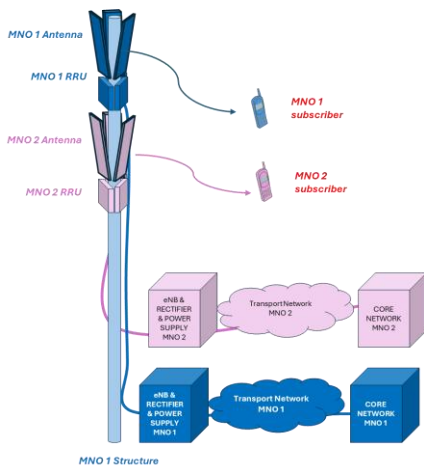


Diagram 1 – Passive Network Sharing

6.2 ACTIVE NETWORK SHARING

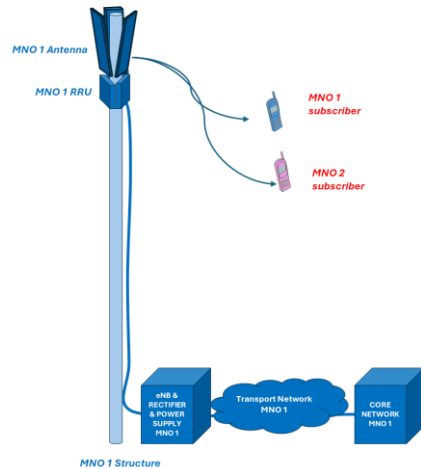


Diagram 2 – Active Network Sharing

6.1.1 Passive Infrastructure Sharing involves the sharing of non-electronic, physical components of the network. These components do not directly process or transmit signals but are essential to support the active components of the network. The primary objective of passive sharing is to reduce Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) by utilising shared physical assets.

6.1.2 Examples of Passive Infrastructure Sharing include the shared use of civil infrastructure, towers, poles, masts, ducts, trays, shelters, equipment rooms, power systems (including battery backup), generator sets (genset), Heating, Ventilation, and Air Conditioning (HVAC), security, Distributed Antenna System (DAS), etc.

6.2.1 Active Infrastructure Sharing involves the sharing of electronic and signal-processing network components. This type of sharing has a more significant impact on network performance and operational control. It often requires close cooperation amongst operators and adherence to regulatory requirements.

6.2.2 Examples of Active Infrastructure Sharing include the shared use of the Radio Access Network (RAN) inclusive of antenna, spectrum, radio equipment, transport network, etc.

6.2.3 For the purpose of this Industry Guideline, Active Infrastructure Sharing is limited to 4G MOCN (Multiple Operators Core Network) only.

Aspect	Passive Infrastructure Sharing	Active Infrastructure Sharing
Components Shared	Physical infrastructure (e.g., towers)	Electronic equipment (e.g., RAN, spectrum)
Technical Complexity (e.g, Capacity, Spectrum)	Low	High
Complexity of Network Optimisation	Minimal	Extensive effort and coordination between hosting and seeking MNO

Diagram 3 – Comparison between Passive Infrastructure Sharing and Active Infrastructure Sharing

Individual Infrastructure vs Passive Infrastructure Sharing vs Active Infrastructure Sharing

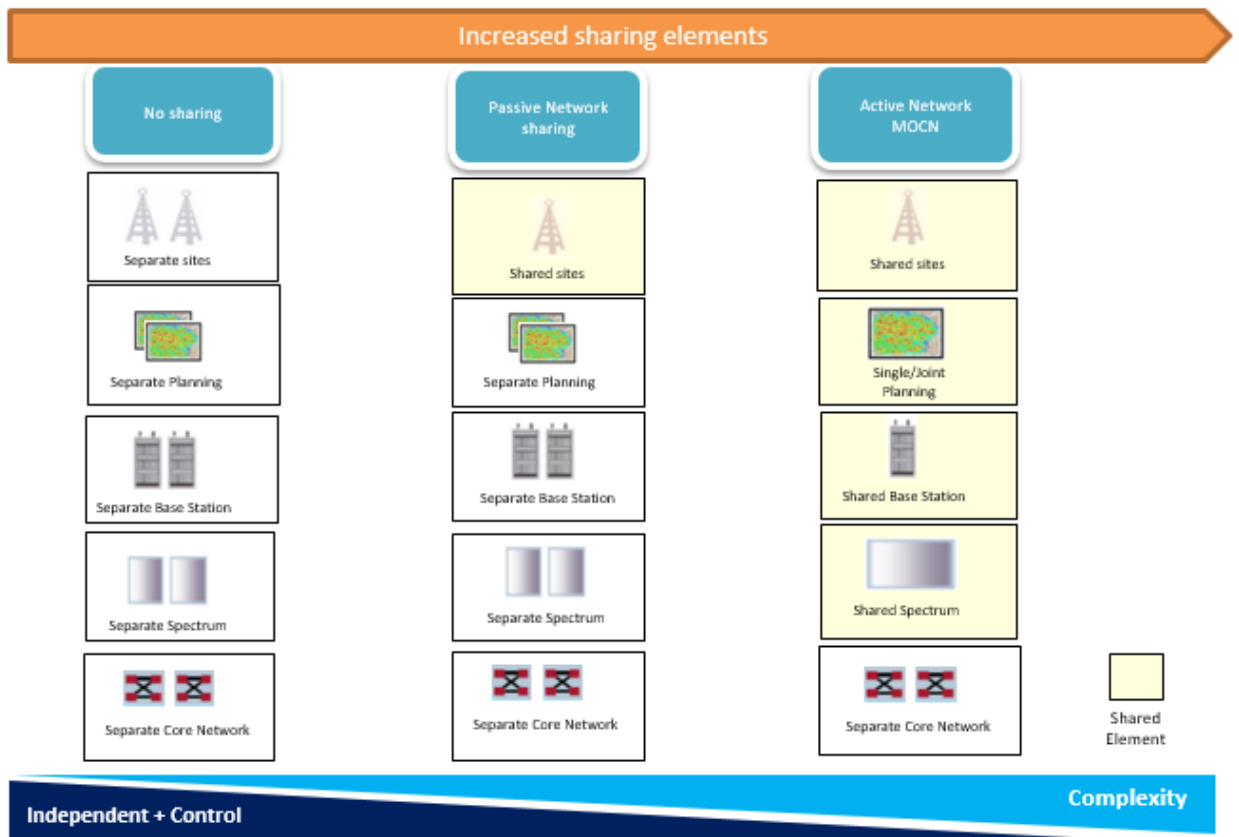


Diagram 4 – Individual Infrastructure vs Passive Infrastructure Sharing vs Active Infrastructure Sharing

7.0 Key Priority Areas

7.1 As mentioned above, the Network Infrastructure Sharing initiative among MNOs as principally governed in this Industry Guideline aims to enhance mobile network coverage and quality in the following **seven priority areas** identified by MCMC:



7.2 These areas are identified based on the presence of at least one MNO, with the other MNOs given the option to engage in Network Infrastructure Sharing with the hosting MNO. This approach ensures better service quality for end users while fostering collaboration among the MNOs. Places within the seven priority areas are subject to review and agreement from time to time.

7.3 To support this initiative, a formula is being developed in response to the idea proposed by YB Fahmi Fadzil, the Minister of Communications in May 2024 under the initiative, “*Di Mana Ada Jalan, Di Situ Ada Internet*”. This initiative reflect the Government’s commitment to equitable access to information and communication technologies. This initiative aims to support long-term national development and social progress.



Coverage improvement for populated area.



Ongoing collaborations with MCMC to address user complaints and improve service delivery.

- 7.5 In parallel, each MNO is implementing commercial plans to support consistent progress toward achieving comprehensive national coverage. This approach of Network Infrastructure Sharing benefits various user groups, including commuters, students, patients, tourists, event attendees, and military personnel, by ensuring reliable network access especially in underserved areas.
- 7.6 This Industry Guideline aligns the telecommunications industry with Malaysia’s broader national strategies, such as Jalinan Digital Negara (JENDELA) and MyDIGITAL blueprint. The initiatives aim to transform Malaysia into a fully connected and digitally empowered economy.
- 7.7 In addition to the seven priority areas as identified above, MNOs can also commit to written agreement to extend their collaboration to other areas, beyond the identified priority zones, for bilateral or multilateral Network Infrastructure Sharing arrangements. By entering into such agreements, MNOs can further optimise resource utilisation, enhance network performance, and ensure more widespread coverage.
- 7.8 Before fully transitioning to a RAN sharing implementation, the MNOs have conducted a trial involving five sites, with each MNO contributing one site on a swap basis. This trial phase involves a live network rollout and testing to validate the performance of the MOCN solution, as hosted by each MNO at each of the sites. The aim is to successfully enable all MNO services to be in compliance with MCMC's Mandatory Standards on Quality of Service (MSQoS).

Sites progress for the 6-way trial sites



					
Site Name	Prima Gambang	Kem Pengakap, Bukit Putus	WCE Banting	Ikon Tengkolok, Bukit Putus	Tanjung Asam
Location	Kuantan, Pahang.	Kuala Pilah, Negeri Sembilan	Banting, Selangor	Kuala Pilah, Negeri Sembilan	Jln Gertak Sanggul, Pulau Pinang
Status	6-way MOCN On Air 7 Nov 2024	6-way MOCN On Air 15 Nov 2024	6-way MOCN On Air 29 Nov 2024	6-way MOCN On Air 3 Dec 2024	6-way MOCN On Air 31 Dec 2024
Benefit	Provide continuous coverage to more than 2000 population at nearby village and 1000 commuters daily at main trunk road	Provide continuous coverage to more than 3000 commuters daily at main trunk road and tourist attraction area	Provide continuous coverage to more than 3000 commuters daily at the new highway and Kampung Orang Asli (KOA)	Provide continuous coverage to more than 3000 commuters daily for main trunk road and tourist attraction area (Replica Tengkolok, waterfall)	Provide continuous coverage to more than 350 daily commuters at the main trunk road and population of 500 at nearby village
Structure					

Diagram 5 – Sites progress for the 6-way Trial Sites

- 7.9 Upon the successful completion of this phase, the MNOs will advance toward a detailed implementation plan that aligns with their respective commercial objectives.

8.0 Sites Selection and Sharing Solution

8.1 This Industry Guideline distinguishes four primary geographic areas, namely (a) urban area, (b) sub-urban area, (c) rural area and (d) remote area, as illustrated in the subsequent Diagram below where the MNOs can choose to implement the Network Infrastructure Sharing.

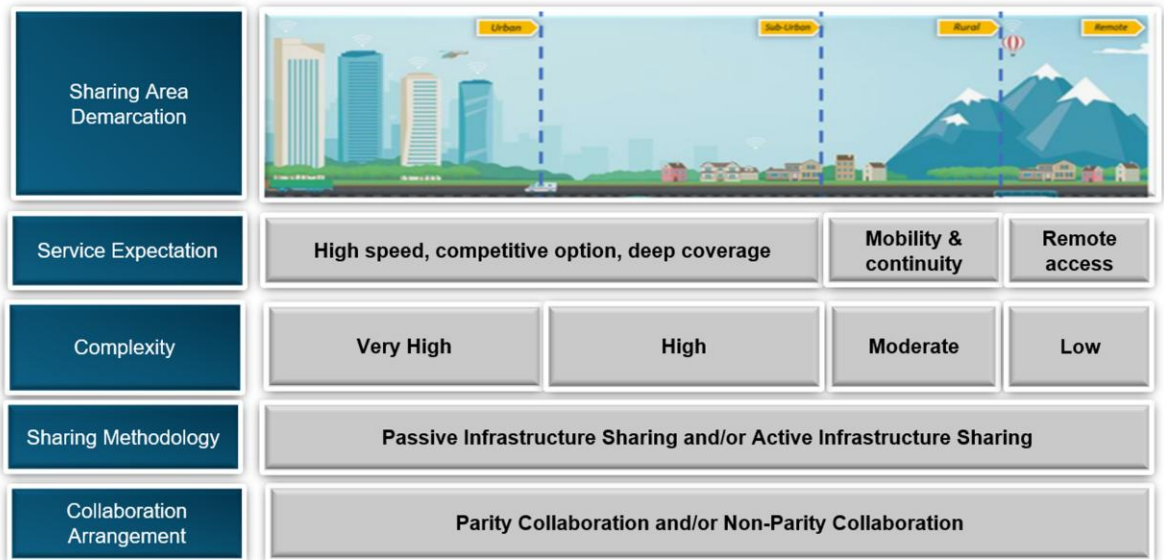


Diagram 6 – Area demarcation and Network Infrastructure Sharing Solutions

- 8.2 Demarcation of areas enables MNOs to tailor a suitable, sustainable, and cost-effective Network Infrastructure Sharing solution to meet different needs of 4G services, such as urban areas’ expectation on high speed and indoor enhancement, to rural areas’ service expectation on mobility and continuity, and to remote areas for service availability and accessibility.
- 8.3 The selected sites among the MNOs are evaluated on a per site basis for Network Infrastructure Sharing, taking into consideration factors such as business strategies, deployment viability, and operational factors. During such Network Infrastructure Sharing evaluation, hosting MNOs may exercise its discretion for the most feasible solution and collaboration arrangement (i.e. parity collaboration or non-parity collaboration).
- 8.4 The outlined population thresholds and area classifications below serve as flexible reference points, rather than a definitive directive, with the understanding that the Network Infrastructure Sharing arrangements will be evaluated on a case-by-case basis subject to the respective MNOs’ management approval, recognising that each MNO’s participation decision may be influenced by their unique circumstances, operational considerations and business strategies.
- 8.5 The choice of the selected or proposed sites by the MNOs for the Network Infrastructure Sharing in these areas and the Network Infrastructure Sharing Methodology are at the respective hosting MNOs’ discretion, based on what the hosting MNOs deem feasible, and subject to mutual written agreement of the relevant parties.

Areas	Description of Area	Sharing Methodology
Urban area Sub-urban area	<ul style="list-style-type: none"> • Areas with dense populations • Has high demand for high-speed, superior and extensive coverage and low-latency networks • Complex infrastructure that requires substantial capital investment for macro, IBS, small cells and dense network layers 	<p>Passive Infrastructure Sharing</p> <p>MNOs optimise costs through Passive Infrastructure Sharing by deploying equipment on shared structures without duplicating, and lowering capital expenditure (CAPEX) on physical structures while accelerating deployment timelines.</p> <p>Passive Infrastructure Sharing allows MNOs to compete more effectively in the open market, ensuring they deliver the best possible service and quality to end users.</p> <p>Active Infrastructure Sharing</p> <p>MNOs may also consider adopting active 4G MOCN RAN sharing particularly in areas with low site utilisation and low-capacity areas.</p>
Rural area	<ul style="list-style-type: none"> • Areas with a population ranging from 400 to 1000 people within the site coverage footprint • Limited commercial activities • Require substantial investment and cost in Network Infrastructure due to the need for broad coverage and mobility 	<p>Active Infrastructure Sharing</p> <p>4G MOCN RAN Sharing is particularly effective where MNOs can extend coverage more efficiently while ensuring adequate service provision in regions with limited commercial activities.</p> <p>Passive Infrastructure Sharing</p> <p>MNOs may also consider implementing Passive Infrastructure Sharing as mutually agreed in writing.</p>

Areas	Description of Area	Sharing Methodology
Remote area	<ul style="list-style-type: none"> • Areas with a population less than 400 people within the site coverage footprint • Infrastructure may need to be built from scratch, costs can be high 	<p>Active Infrastructure Sharing</p> <p>Prioritization for 4G MOCN RAN Sharing is in low-site-utilization, low traffic and low-capacity areas. It is especially beneficial for MNOs to expand coverage efficiently, ensuring sufficient service in areas with minimal and/or no commercial activities.</p> <p>Passive Infrastructure Sharing</p> <p>MNOs may also consider implementing Passive Infrastructure Sharing as mutually agreed upon in writing.</p>

9.0 Technical and Implementation, Operation and Maintenance

The Technical and Implementation (**T&I**) and Operation and Maintenance (**O&M**) of **Network Infrastructure Sharing** are fundamental to delivering cost-effective, efficient, and high-quality telecommunications services.

To maximize these benefits, the MNOs have deliberately aligned with the strategies and initiatives, ensuring that the implementation of Network Infrastructure Sharing not only meets operational efficiency but also enhances service quality and user experience.

9.1 PASSIVE INFRASTRUCTURE SHARING

General Guidelines for T&I and O&M

9.1.1 This serves as a high-level T&I and O&M for the **seeking MNO and hosting MNO** on the arrangements for implementation and operation maintenance for Passive Infrastructure Sharing.

9.1.2 The guidelines for the implementation and operation maintenance for Passive Infrastructure Sharing are as below:

- General terms and conditions that delineate the rights to occupy shared sites and outline essential access procedures, including notice requirements and the presence of hosting MNO's representatives during site visits.
- The importance of establishing security protocols to ensure the safety and integrity of shared facilities.
- Responsibilities of the seeking MNO are specifically defined within the guideline, emphasizing the necessity for them to maintain their own equipments and secure the requisite permits for operational activities.
- Addressing billing disputes, outlines clear mechanisms to ensure involved parties fulfil their obligations, thus promoting accountability and transparency in financial engagements.
- Key obligations of the involved parties particularly concerning the confidentiality of shared information and the necessity for appropriate insurance coverage.

9.1.3 For reference, the physical connectivity design of a typical Passive Infrastructure Sharing amongst the MNOs is as follows:

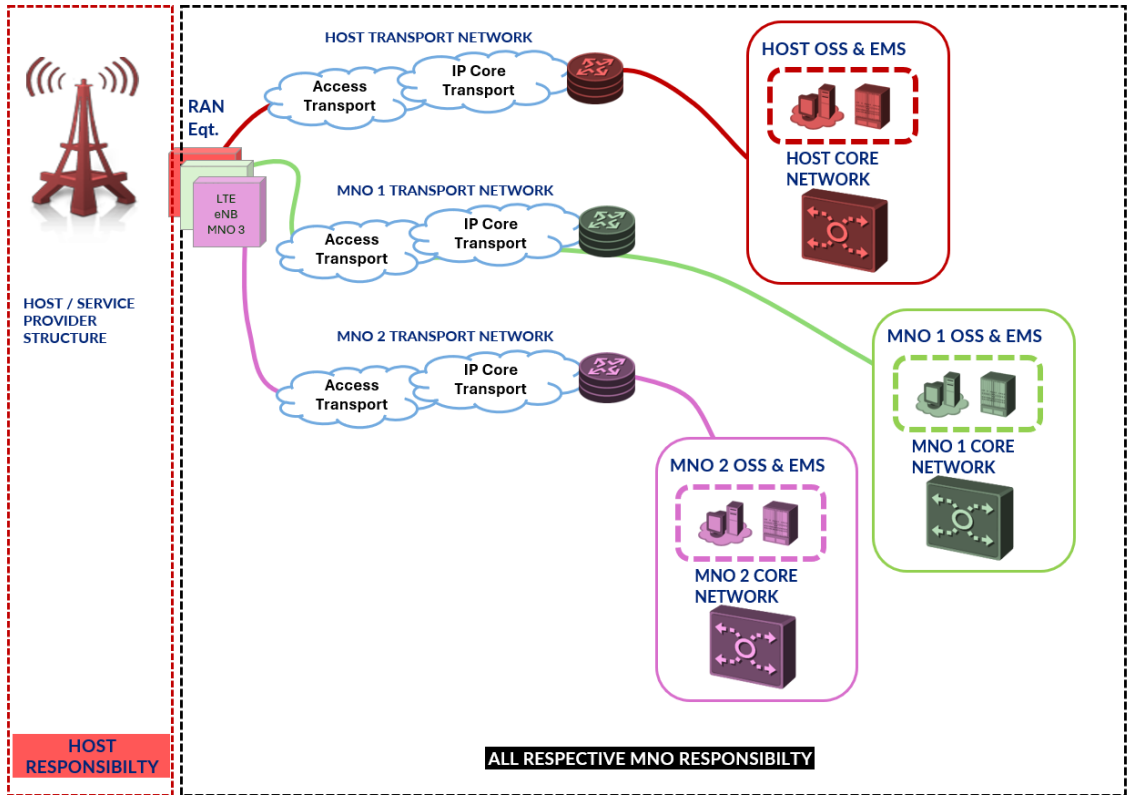


Diagram 7 – Physical connectivity design of a typical Passive Infrastructure Sharing

9.1.4 Overall, T&I and O&M for Passive Infrastructure Sharing document aims to facilitate a collaborative environment for telecommunications partnerships while ensuring compliance with relevant regulatory standards and fostering effective dispute resolution mechanisms.

9.2 ACTIVE INFRASTRUCTURE SHARING

General Guidelines for T&I

9.2.1 This serves as a high-level T&I guideline for the hosting MNOs and the seeking MNOs on the arrangements for the implementation and deployment via shared resources under the MOCN RAN Sharing model.

9.2.2 The manual for the T&I should outline the necessary key elements to support multiple MNOs on the same RAN infrastructure to enable MOCN host networks to facilitate seamless connections for users from different hosting MNOs to ensure seamless service delivery, efficient network deployment, and the long-term sustainability of shared infrastructure. These key elements include:

- Fundamental key principles of sharing at the targeted areas, e.g. underserved and/or rural areas;
- High-level network architecture, mobile site design & radio resource allocation among the hosting MNOs and seeking MNOs;
- Coordination of key network parameters (e.g. Public Land Mobile Network (PLMN) and mobility strategy among the hosting MNOs and the seeking MNOs to ensure mutual and non-conflicting co-existence;
- Technology-involved and offered services, i.e. Voice over Long Term Evolution (VoLTE) and general data services; and
- Defined Key Performance Indicators (KPIs) to maintain Quality of Service (QoS) and Service Level Agreements (SLAs), ensuring the ability to offer optimal end user experience

9.2.3 For reference, the physical connectivity design of a typical MOCN RAN sharing amongst MNOs is as follows:

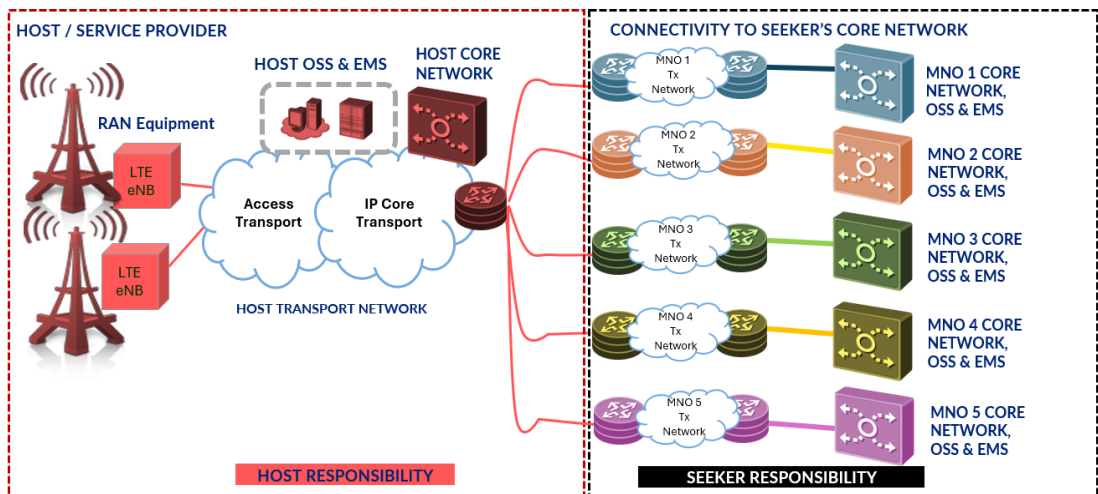


Diagram 8 – Physical connectivity design of a typical MOCN RAN sharing

General Guidelines for O&M

9.2.4 The O&M Manual serves as a high-level O&M guideline for the MNOs involved in the MOCN RAN Sharing model.

9.2.5 The O&M Manual should:

- (a) define the operational protocols, maintenance activities, and management procedures necessary for the provision of cellular services under the Network Infrastructure Sharing arrangement;
- (b) establish the fundamental principles and procedures for the operations and maintenance of services within the MOCN RAN Sharing environment.
- (c) serve as a reference document for the hosting MNOs, outlining the necessary steps to ensure seamless service delivery, efficient network operation, and the long-term sustainability of shared Network Infrastructure; and
- (d) ensure that all parties involved in the MOCN RAN Sharing maintain clear operational standards, promoting efficient service delivery and collaborative network management.

9.2.6 The criteria, processes and activities for the successful O&M of services under the MOCN RAN Sharing include, but are not limited to, the following O&M activities:



Fault Management, Emergency Maintenance, and Repairs

Outlines the reference for MNOs to classify the severity of a fault, restoration timeline, notification & escalation procedures along with requests to carry out emergency maintenance and repairs.



Planned Maintenance and Change Management

The hosting MNOs are responsible for executing planned maintenance activities while coordinating changes to the Network Infrastructure. This includes scheduling preventive maintenance, software upgrades, and infrastructure changes to ensure minimal disruption to services.



Customer Fault Handling

A robust process for handling customer-reported faults is critical. The O&M Manual should detail the escalation paths, timelines for resolution, and communication protocols between the hosting MNOs, seeking MNOs and end-users to ensure prompt and effective customer support.



O&M Performance Verification

The hosting MNOs and seeking MNOs are responsible for continuous monitoring and verification of O&M performance. This ensures compliance with agreed performance benchmarks and allows for ongoing optimisation of shared network resources.

10.0 Collaboration Arrangements

10.1 OVERVIEW OF SHARING ARRANGEMENTS

This Industry Guideline outlines the MNO industry's collaborative approach to Network Infrastructure Sharing. Two solutions have been identified: (a) **Parity Collaboration** and (b) **Non-Parity Collaboration**, as illustrated in the Diagram below.

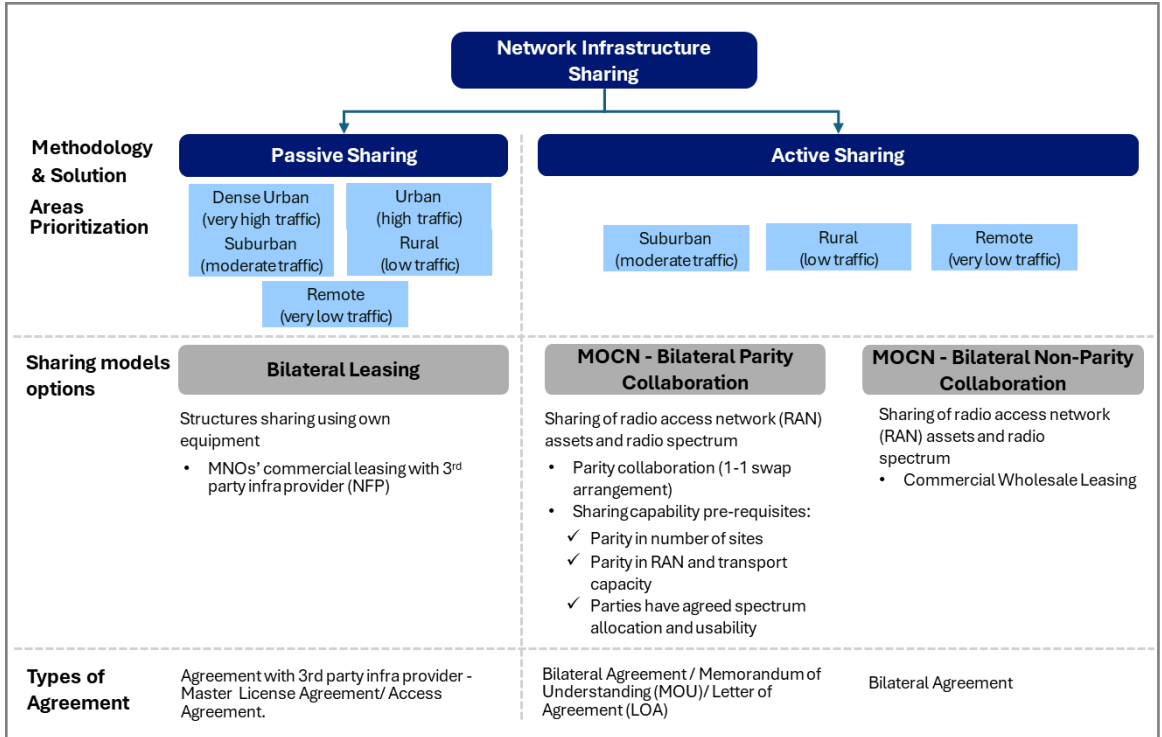


Diagram 9 – Network Infrastructure Sharing parity and non-parity collaborations

10.1.1 In Network Infrastructure Sharing, MNOs will attempt to achieve parity. This includes reconciling differences in resources, spectrum, technologies, site attributes and other factors. Given that not every location or configuration can feasibly be addressed through parity arrangements or swaps, MNOs are encouraged to negotiate mutually agreed commercial terms for both Passive Infrastructure Sharing and Active Infrastructure Sharing. Negotiation will also allow reasons for non-parity to be identified and addressed.

10.1.2 Commercial arrangements address non-parities and serve as an alternative approach that allows for flexibility. In commercial negotiations, MNOs will co-operate together to facilitate the Government's initiative for the telecommunications industry to share network infrastructure

10.2 PARITY COLLABORATION

10.2.1 Parity Collaboration for Passive Infrastructure Sharing

This section outlines a guideline for non-commercial passive parity collaboration amongst MNOs through site-swapping-based infrastructure sharing. Implementing passive parity sharing for telecommunication sites requires clear and comprehensive terms to ensure fairness, efficiency, and collaboration among MNOs. Below are key terms that need to be considered:

(a) Equal Contribution and Benefits

For the purpose of this Industry Guideline, all MNOs contribute equally to the shared infrastructure. This model ensures that all parties contribute equally, maintaining balance in terms of network coverage, capacity, and operational responsibilities.

(b) Area Parity

The principle of area parity ensures that infrastructure sharing benefits urban and rural areas alike, promoting constant network improvement. Sites may also be shared equitably across all areas, ensuring balance in network coverage for all MNOs.

(c) Transparency and Accountability

Parity collaborations are typically governed by stringent agreements, emphasizing transparency, accountability, and a strictly non-commercial nature. This approach is designed for long-term sustainability, fostering trust and equal opportunities for all MNOs to expand their networks collaboratively and equitably.

10.2.2 Parity Collaboration for Active Infrastructure Sharing

This section outlines a guideline for non-commercial active parity collaboration amongst MNOs through site-swapping-based infrastructure sharing. By adhering to key principles of parity, this collaboration seeks to enhance network coverage, capacity, and quality across diverse geographies.

(a) Mutual Agreement on Site Selection

MNOs to mutually identify and document the sites to be shared, establishing a written agreement to ensure clarity and accountability. Priority will be given to sites that meet the operational and strategic needs of all parties involved.

(b) Parity in Site Swapping

MNOs to ensure parity in the number and value of sites for swapping including for outdoor and IBS sites. Sites must be swapped within the same category (e.g. an outdoor site may only be swapped for another outdoor site, and an IBS site may only be swapped for another IBS Site).

- (i) For outdoor sites, calculated on a per physical site basis. Sites must offer comparable value in terms of structure (e.g., broadly similar structure such as swapping between 4 legged-towers, 3 legged-towers, monopoles) and geographic relevance (urban, suburban & rural).
- (ii) For IBS Sites: calculated on a per antenna basis. Parity is ensured through equivalence in equipment (antennas, Distributed Antenna Systems), site valuation, and building characteristics (size, complexity).

(c) Parity in RAN

MNOs to ensure parity in RAN capacity for swapping on as-is basis (any upgrade to be considered and agreed by the hosting MNO). The shared infrastructure will allow the necessary equivalent capabilities considering the frequency bands, technology use, and traffic handling capacity.

(d) Transmission/Transport Capacity

MNOs to ensure sufficient transmission/transport capacity to cater RAN capacity for the sites involved (any upgrade to be considered and agreed by the hosting MNO). Any transmission enhancements (e.g., fiber backhaul, microwave links) must be agreed by the hosting MNO and to be equitably implemented, ensuring costs and operational balance amongst the hosting MNO and seeking MNOs.

(e) Spectrum Allocation and Pooling

MNOs to mutually agree in writing on spectrum allocation/pooling and usability. A clear guideline needs to be defined on spectrum allocation or pooling to optimize efficiency and minimize interference to ensure consistent and continuous good network quality.

Where spectrum disparities exist, such as differences in bandwidth sizes or the use of Frequency Division Duplex (FDD) versus Time Division Duplex (TDD), MNOs must establish mutually agreed written conditions / mechanism acceptable to the relevant sharing parties. This conditions / mechanism should ensure that the disparity remains manageable and allows the objective of achieving coverage in the intended area.

(f) Public Land Mobile Network (PLMN) IDs

MNOs to mutually agree in writing on the list of PLMN ID to be opened at the agreed selected sites.

(g) Physical Resource Block (PRB) Allocation

MNOs to mutually agree in writing on PRB allocation within shared spectrum bands, ensuring fair bandwidth distribution and preventing performance degradation.

10.3 NON-PARITY COLLABORATION

(for Both Passive and Active Infrastructure Sharing)

10.3.1 When parity in Network Infrastructure Sharing cannot be achieved due to disparities, MNOs may opt for a non-parity collaboration model. This model introduces a bilateral commercial arrangement to address imbalances and ensure fairness amongst the MNOs.

(a) Non-parity collaboration typically arises when:

- (i) **Unequal site value:** One MNO's site has higher financial, operational, or strategic value.
- (ii) **Unequal infrastructure features:** Differences in technology, capacity (e.g., RAN equipment, backhaul capability), or geographic importance.
- (iii) **Unbalanced resource contribution:** One MNO contributes significantly more resources (e.g. spectrum, tower structures, land).

(b) Mutual Agreement on Commercial Charges

In a non-parity scenario, the MNOs can negotiate and establish bilateral or multilateral commercial terms. Such commercial terms are to be negotiated and mutually agreed in writing amongst the relevant MNOs.

10.4 COLLABORATION INTEGRITY

10.4.1 The collaboration arrangement shall be governed by a binding bilateral agreement that stipulates all the terms and conditions to be negotiated and mutually agreed in writing between the seeking MNO(s) and the hosting MNO(s).

10.4.2 Pursuant to Section 10.4.1, the seeking MNO(s) to inform and discuss with the hosting MNO on any new network collaboration arrangement with a third party and share the relevant information in connection with the said new network collaboration, prior to entering into any agreement with the said third party.

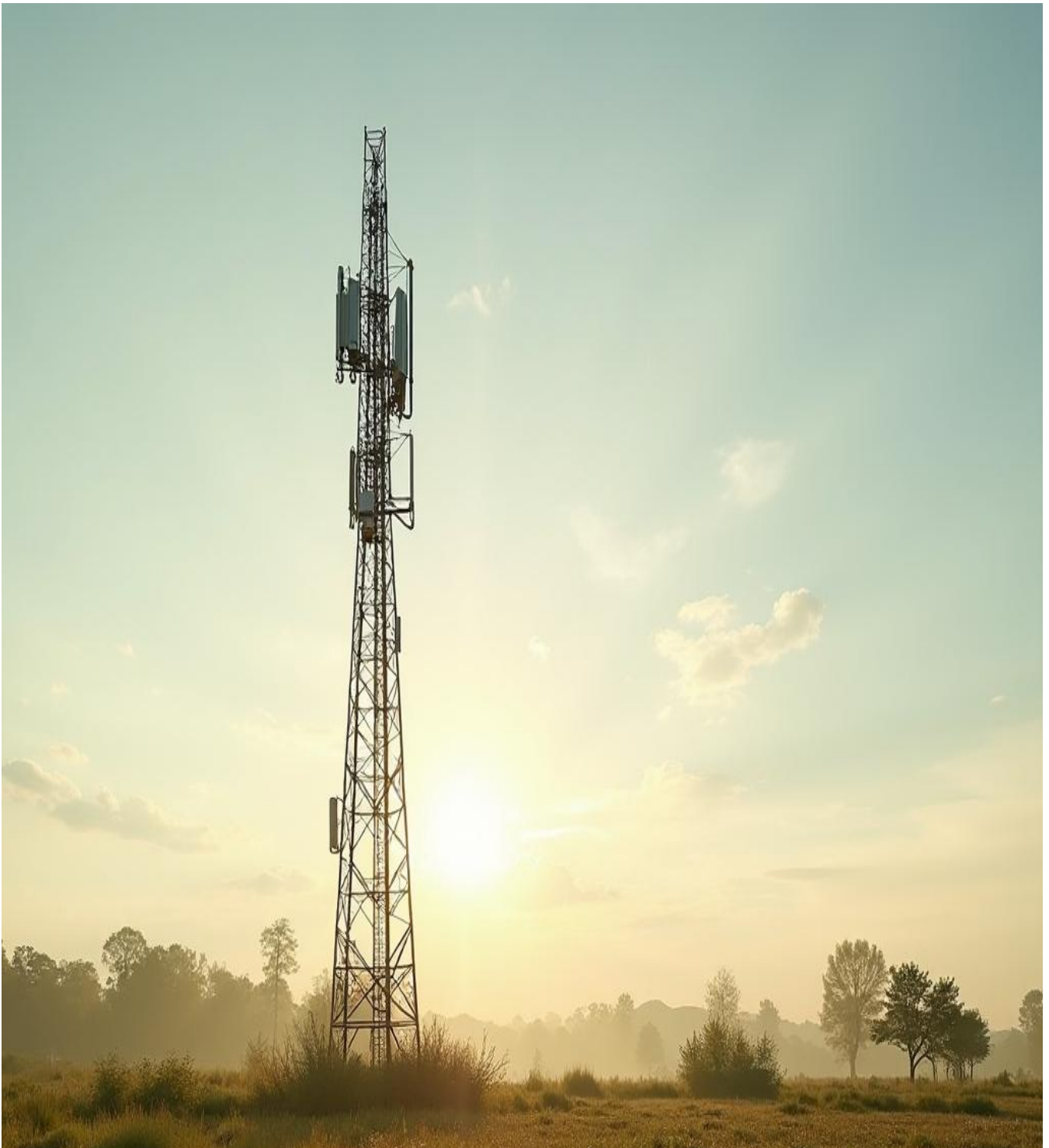
10.4.3 Pursuant to Section 10.4.1, the seeking MNO(s) to inform the hosting MNO on any existing network collaboration arrangement with a third party. Any disclosure of the existing collaboration arrangement to hosting MNO shall be subjected to the confidentiality agreement between the seeking MNO(s) and the third party.

10.4.4 Section 10.4.2 and Section 10.4.3 serve to prepare the hosting MNO for their network planning and readiness, as well as to manage the sites owner (where applicable) and any issue arising from the network collaboration arrangement between the seeking MNO(s) and third party.

10.4.5 This sharing principle serves to maintain the collaboration integrity and equity of the Network Infrastructure Sharing arrangements.

10.5 FOSTERING MNOs COOPERATION

- 10.5.1 The outlined sharing arrangements provide a high-level framework for collaboration amongst MNOs, fostering improved network coverage, capacity, and efficiency through both parity and non-parity models.
- 10.5.2 Parity Collaboration, whether passive or active, emphasizes equity, transparency, and non-commercial principles, ensuring mutual benefits and long-term sustainability. Conversely, Non-Parity Collaboration offers a flexible approach to address disparities through commercial terms, accommodating differences in site value, infrastructure features, or resource contributions.
- 10.5.3 Both approaches, governed by robust agreements and clear restrictions, aim to maintain collaboration integrity while enabling the MNO industry to adapt to diverse operational and strategic needs. By adhering to these guidelines, MNOs can achieve optimised network performance, equitable resource utilisation, and enhanced service quality for their customers.



Network Infrastructure Sharing initiative may require several iterations before it is well established

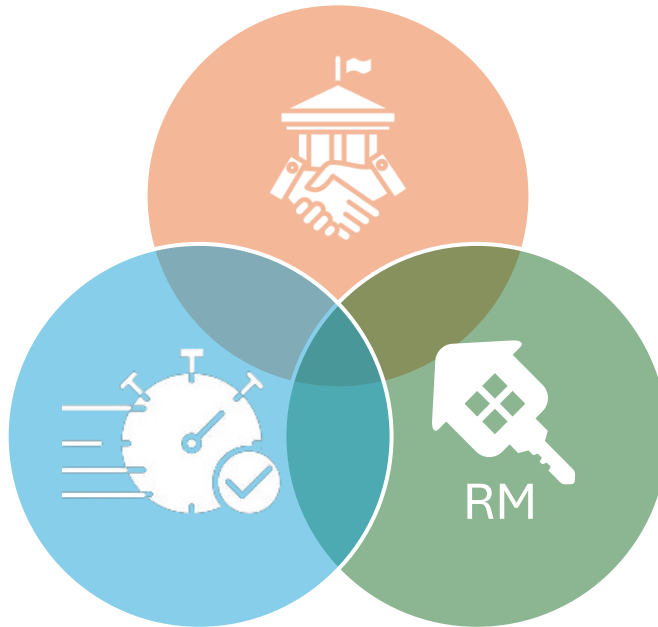
This Industry Guideline is designed to attend to the market, deployment, construction pace, and operational quality of services for each MNO's needs. This approach can be spearheaded with a pilot and will be continuously enhanced based on lessons learnt and requirements.

11.0 Support from Stakeholders

This Industry Guideline also identifies key focus areas where stakeholder cooperation is crucial to overcome existing challenges and drive the successful execution of national initiatives.

(a) Support from Government and Local Authorities

This Industry Guideline highlights the essential role of state government and local authorities (local councils, Ministry of Communications, MCMC, Ministry of Housing and local governments) in reducing exclusivity and embracing GPP-I specifications to ensure uniform, scalable network solutions nationwide by limiting regulatory barriers and adopting standardized infrastructure guidelines to avoid delays and ensure the uniformity of development.



(b) Expedited Process & Timeline for Approval

This Industry Guideline observes the need to standardise the approval processes involving key stakeholders such as the Ministry of Higher Education (MoHE), Ministry of Health (MOH), State-Back Company (SBC), Network Facilities Provider (NFP), Ministry of Defence (MINDEF), Malaysia Highway Authority (LLM), Malaysian Public Works Department (JKR), and major utility providers such as Tenaga Nasional Berhad (TNB), Sarawak Energy Bhd (SEB) and Sabah Electricity Sdn Bhd (SESB) to accelerate Network Infrastructure deployment and enable efficient resource allocation.

(c) Reasonable Land & Infrastructure Leasing Rates

This Industry Guideline advocates for fair and reasonable leasing rates for land and infrastructure, incorporating the *Garis Panduan Perancangan Infrastruktur Komunikasi (GPP-I) 2022* specifications for third-party utilities, which will foster a more conducive environment for infrastructure development. Key stakeholders including the landowners, building managers, State-backed network facility providers, network facility providers, State one-stop agencies (OSA), and *Koridor Utiliti* are crucial in establishing balanced pricing models that promote network expansion without financial burdens to the MNOs.

12.0 Process

The process to streamline the industry collaboration for Network Infrastructure Sharing on the priority areas with coverage gap are as follows:

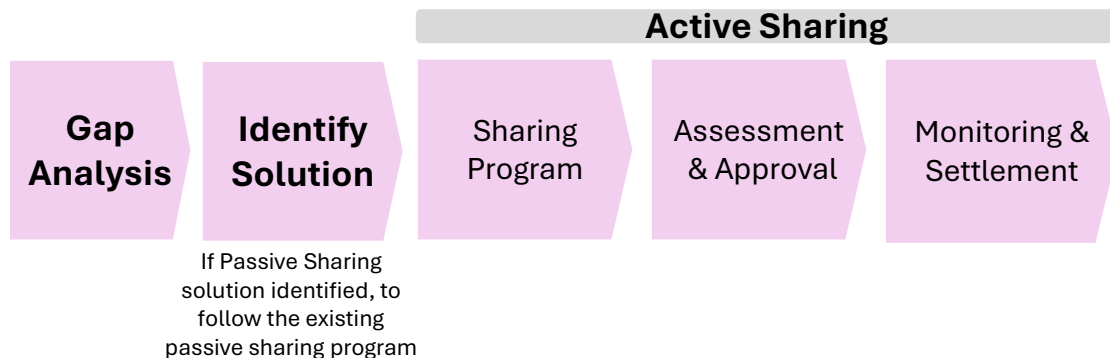


Diagram 10 – Process to streamline the industry collaboration

12.1 Gap analysis

A coverage gap refers to an area with no network coverage or weak/limited network coverage where none or only one MNO has coverage of the area. All MNOs are to perform such analysis on its own and identify the interested site(s) to share. Seeking MNO(s) would then approach the identified hosting MNO for the interested sites.

12.2 Identify Solution

Hosting MNO and seeking MNO(s) to exchange technical data and requirement to facilitate the detail solutioning. Solution outcome from the analysis by the hosting MNO could be either:

- (a) Passive Infrastructure Sharing; or
- (b) Active Infrastructure Sharing.

12.3 Active Infrastructure Sharing

(a) Sharing Program

Relevant MNOs to agree on the sharing program, including the parity through site sharing and/or swapping, considering the sites configuration, capacity and/or spectrum deployed, where applicable. If parity could not be achieved, the relevant MNOs to engage in such collaboration through commercial agreements.

(b) Assessment & Approval

Relevant MNOs shall conduct detailed analyses and submit their requests in accordance with established protocols, ensuring compliance with governance and approval processes.

(c) Monitoring and Settlement

Once the selected site(s) is/are agreed and approved for Infrastructure Sharing, monitoring of the collaboration arrangement (parity collaboration or non-parity collaboration) is needed, and the relevant MNOs are to establish such tracking and monitoring.

13.0 Governance

13.1 In the MNOs' commitment to uphold the highest standard of corporate governance, MNOs have established this Industry Guideline to guide our decision-making process and ensure the protection of the stakeholders' interest.



1

To enhance effective collaboration and ensure smooth implementation, MNOs should attempt to address any operational issues, disagreements, or disputes through direct engagement at the working level. In the event where matters remained unresolved within the working level, such matters may be escalated to senior management or C-Level executives of the respective MNOs for final resolution.

2

The MNOs shall deal with one another in good faith to ensure that the implementation of this Industry Guideline is carried out in a coordinated, cost effective and professional manner for mutual benefits. The MNOs acknowledge that it is impracticable to make provisions for every contingency which may arise in the course of implementation of this Industry Guideline and that this Industry Guideline shall operate between the MNOs with fairness and without detriment to the interest of any MNO.

14.0 Challenges

Network Infrastructure Sharing will help MNOs cover the gaps on their coverage by leveraging the Network Infrastructure of other MNOs that have coverage through Passive Infrastructure Sharing and/or Active Infrastructure Sharing. The implementation of this Industry Guideline can be complex and subject to potential challenges and limitations. In the event these challenges and limitations cannot be overcome, MNOs may need to resort to deploying individual infrastructure.



14.1 Technical Complexity

14.1.1 Technical Complexity of Active Infrastructure Sharing (MOCN)

RAN Sharing without spectrum parity could require detailed and extended commercial negotiations on pricing. Different MNOs may have varying pricing and cost structures, which could make commercial negotiations lengthy and complex.

In commercial scenarios on RAN Sharing generally means sharing capacity and may only be suitable in low traffic utilization areas. MNOs must be cautious with RAN sharing to avoid bandwidth overuse, which can lead to quality issues. Capacity constraints will be a limiting factor for RAN sharing.

14.1.2 Technical Complexity of Passive Infrastructure Sharing

Passive Infrastructure Sharing has been a norm as it is part of standard access obligations and represents the earliest case of Network Infrastructure Sharing. However, Passive Infrastructure Sharing is subject to availability of space, height and relative strength of the structure as well as its position in regard to the targeted coverage area. There could be situations where additional costs on tower strengthening may be involved.

14.2 Network Optimisation Complexity

Optimizing shared Network Infrastructure, especially for MOCN, requires careful planning and coordination. For example, seeking MNO does not have control on the hosting MNO's site parameters. This can impact network performance.

14.3 Permitting and/or Licensing

Permitting and/or licensing challenges relate to situations where local authorities may impose additional charges for Network Infrastructure Sharing even though there is no addition of equipment to the structure on the towers. This will increase costs and reduce the benefits that accrue.

14.4 Finding Suitable Locations

It is not always possible to find locations that are suitable with respect to the desired coverage. For example, for highways, an elevated location is preferred as it will maximise coverage. However, this has to be reconciled with the availability of backhaul fibre along the road or the need for line-of-sight for microwave. In some cases, the ideal location may have ownership issues/dispute. Ownership of land is prerequisite for permit applications.

14.5 Right-of-Way (ROW)

Another constrain faced is securing the right location involving:

- Right of way over land, both private and government.
- Land acquisition / leasing issues.

14.6 Significant Investments

The Network Infrastructure Sharing under this Industry Guideline involves significant investments in 4G networks. However, with the presence of 5G site at the Network Infrastructure Sharing area at the later stage, traffic will naturally shift from 4G to 5G, challenges may arise, potentially of losses/sunken cost on the previous 4G investments. It may be beneficial to avoid area that will be deployed with 5G and focus to low 5G penetration areas.

14.7 Mitigating Challenges and Maximizing Benefits

Although Network Infrastructure Sharing is mutually beneficial to both hosting MNOs and seeking MNOs, it is still subject to commercial negotiations. The setting up of an industry mechanism/joint committee, that incorporates technical, regulatory and financial aspects, to facilitate negotiation will be useful.

14.8 Continued support from MCMC

This Industry Guideline is driven by MCMC and the Government to address gaps in coverage for the benefit of end users. Its success can be attributed to the continued support and guidance from MCMC and the Ministry. This platform will continue to be required especially in dealing with local authorities, Government agencies and as well as ironing differences between access seekers and access providers.



15.0 Lesson Learnt from Trial Site

The deployment of TM's 6-Way MOCN at one of the five selected trial sites, West Coast Expressway (WCE) Banting, has provided significant insights into the complexities of implementing shared Network Infrastructure. This innovative initiative, aimed at enhancing coverage and connectivity along critical highway routes, unveiled various challenges and opportunities spanning technical, operational, and regulatory aspects. By addressing these factors, the project not only identified key areas for improvement but also laid the groundwork for future multi-operator collaborations in Malaysia.

15.1 The deployment of the 6-Way MOCN at WCE Banting, with TM as the host, highlighted several challenges in achieving optimal performance across dimensions such as coverage, capacity, and Right of Way (ROW).

(a) Coverage: Shared infrastructure significantly improves coverage efficiency, enabling MNOs to serve more areas with fewer sites. However, achieving uniform and balanced hybrid coverage for all participating MNOs remains challenging, particularly along highways where neighbouring MNO sites may vary in proximity.

(b) Capacity: Shared networks face challenges in meeting the capacity demands of all operators, especially during peak usage periods. Effective spectrum allocation, load balancing between FDD and TDD technologies, and physical network optimization are essential to maintaining service quality.

(c) Right of Way (ROW): Securing permissions to deploy infrastructure across highways, public spaces, or private properties is a time-intensive and complex process. Collaboration between NFPs and authorities such as LLM and WCE is crucial to streamlining approval processes and expediting deployment.

15.2 This trial site is one of the 6-Way MOCN deployment that incorporates hybrid technology (FDD + TDD) and supports 3CC Carrier Aggregation. This approach combines three carrier frequencies into a single, larger data pipeline, facilitating higher bandwidth and faster data speeds to enhance user experience.

15.3 Optimizing neighbouring cells is critical to ensure that User Equipment (UE) in idle or connected modes can seamlessly reselect or transfer to optimal serving cells. Continuous coverage can be achieved by addressing issues like non-logical handovers through adjustments in coverage, neighbor frequency addition, and refined handover parameter settings.

15.4 In summary, the implementation of the 6-Way MOCN in Malaysia has demonstrated its potential to enhance coverage efficiency, particularly in greenfield areas. By focusing on key priority areas like highways, the initiative ensures seamless connectivity and addresses the needs of surrounding communities. These insights will serve as a valuable reference for future efforts in building robust, collaborative network infrastructures.

16.0 Changes to This Industry Guideline

This Industry Guideline may be amended through industry discussions as and when the need arises and based on mutually agreed proposals by the MNOs.

17.0 Conclusion

17.1 In conclusion, this Industry Guideline is a transformative initiative that aligns with Malaysia’s broader digital inclusion goals. By fostering collaboration among the MNOs, this Industry Guideline seeks to optimise Network Infrastructure Sharing among the MNOs, reduce the costs associated with network deployment and enable more efficient service delivery. This approach is particularly critical for expanding 4G coverage to underserved areas, such as rural and remote regions, where it may not be commercially viable for MNOs to build individual infrastructure.

17.2 This Industry Guideline's core principle of Network Infrastructure Sharing, comprising both Passive Infrastructure Sharing and Active Infrastructure Sharing, addresses the country's pressing need for greater connectivity. In urban and suburban areas, MNOs may implement Passive Infrastructure Sharing, where towers and base stations are shared without compromising service quality. For less populated rural and remote regions, Active Infrastructure Sharing,

such as the MOCN model, allows MNOs to share spectrum and radio access equipment, extending coverage in areas where building individual infrastructure would be prohibitively expensive. This shared approach also addresses coverage gaps, ensuring that key areas such as hospitals, highways and educational institutions are well covered, contributing to national growth and equitable access.

17.3 However, challenges such as potential network congestion, increased interference, and the complexity of managing a shared system arise, particularly when multiple MNOs utilise the shared Network Infrastructure. Effective coordination, advanced network management, and continuous collaboration among the MNOs are essential to maintain service quality and mitigate these risks. Furthermore, regulatory compliance becomes more complex when balancing different MNOs' needs but overcoming these hurdles will result in a more robust, inclusive telecommunications network.

17.4 Ultimately, this Industry Guideline supports Malaysia’s long-term digital objectives, such as JENDELA, and the MyDIGITAL blueprint. By expanding network coverage and improving service quality, this Industry Guideline will help bridge the digital divide, ensuring all Malaysians, regardless of locations, gain access to reliable, high-speed connectivity, fostering economic development and enhancing the nation’s global competitiveness.



Industry Guideline Revision Log and Contact Information

Industry Guideline Revision Log

Version	Date	Author/ Owner	Changes / Comments
1.0	27 January 2025	CelcomDigi Maxis U Mobile TM YTL	Initial release

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Notes:

1. Ensure all updates to this Industry Guideline are recorded in the Revision Log.
2. Always maintain the latest approved version and archive outdated versions securely.
3. Include a brief explanation for any updates in the 'Reason for Revision' column for clarity.

