TELECOM INFRA PROJECT®

Neutral Host Infrastructure Sharing Framework

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1. Introduction

The rapid growth in mobile data traffic, driven by the proliferation of smartphones, Internet of Things (IoT) devices, and high-bandwidth applications, has placed unprecedented demands on mobile networks. According to the **Ericsson Mobility Report (2024)**, global mobile data traffic reached **145 exabytes per month** in 2024, a figure expected to triple by 2028 due to the increasing adoption of 5G. This surge is exacerbating existing challenges, such as the need for improved network coverage, capacity, and performance, particularly in dense urban areas, indoor environments, and rural locations.

At the same time, mobile telecom operators face significant financial pressures. The cost of deploying and maintaining traditional mobile network infrastructure has escalated, while revenue growth has slowed. Industry estimates indicate that deploying 5G in dense urban areas alone can cost mobile network operators (MNOs) more than 4G networks due to the need for extensive small cell deployments and fiber backhaul. Moreover, extending reliable coverage to underserved regions, such as rural or remote areas, often presents an unviable economic challenge for individual MNOs.

In parallel, end-user expectations continue to rise, with consumers and enterprises demanding seamless connectivity, low latency, and high reliability, especially in high-density environments such as stadiums, airports, and shopping centers. According to **GSMA Intelligence,** more than **80% of mobile data traffic** is generated indoors, yet many indoor environments experience poor coverage and inadequate capacity from traditional outdoor network infrastructure.

To address these challenges, the telecom industry is increasingly looking to innovative infrastructure models that emphasize cost efficiency, rapid deployment, and scalability. One such model is the **Neutral Host Network (NHN)**, which allows multiple operators to share network infrastructure, reducing the total amount of investments, cost of operations and environmental impact for all players across the ecosystem while delivering enhanced coverage and capacity. This paper explores the concept of Neutral Host Networks in detail focusing on their key aspects, benefits, and business models.

Mobile subscriptions by technology (billion)
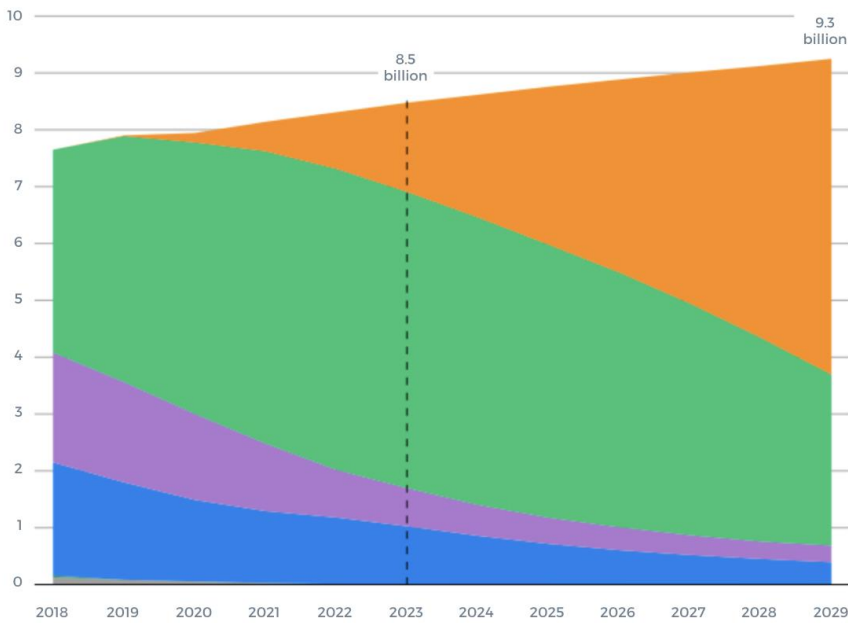
5G subscriptions are forecast to reach 5.6 billion by the end of 2029

5.6bn

Legend:
- 5G
- LTE/TD-LTE
- WCDMA/HSPA
- GSM
- TD-SCDMA
- CDMA

[1] A 5G subscription is counted as such when associate with a device that supports New Radio (NR), as specified in 3GPP Release 15, and is connected to a 5G-enabled network.
[2] GSA and Ericsson (May 2024)

Source: Ericsson Mobility Report June 2024

According to an Ericsson Mobility Report (June 2024), the next wave of data consumption will come from 5G networks, and this provides an opportunity for Neutral Host Networks to address the increasing costs by sharing resources.

2. What is a Neutral Host Network

Neutral Host Networks (NHNs) are telecom infrastructure systems designed to be shared by multiple mobile network operators (MNOs) and other service providers. These networks are typically owned and managed by a third-party entity (the "neutral host") rather than any one MNO. The primary goal of NHNs is to optimize the use of telecom infrastructure, reduce costs, and enhance service coverage, capacity and provide value added functionalities like Mobile Edge Computing and URLLC.
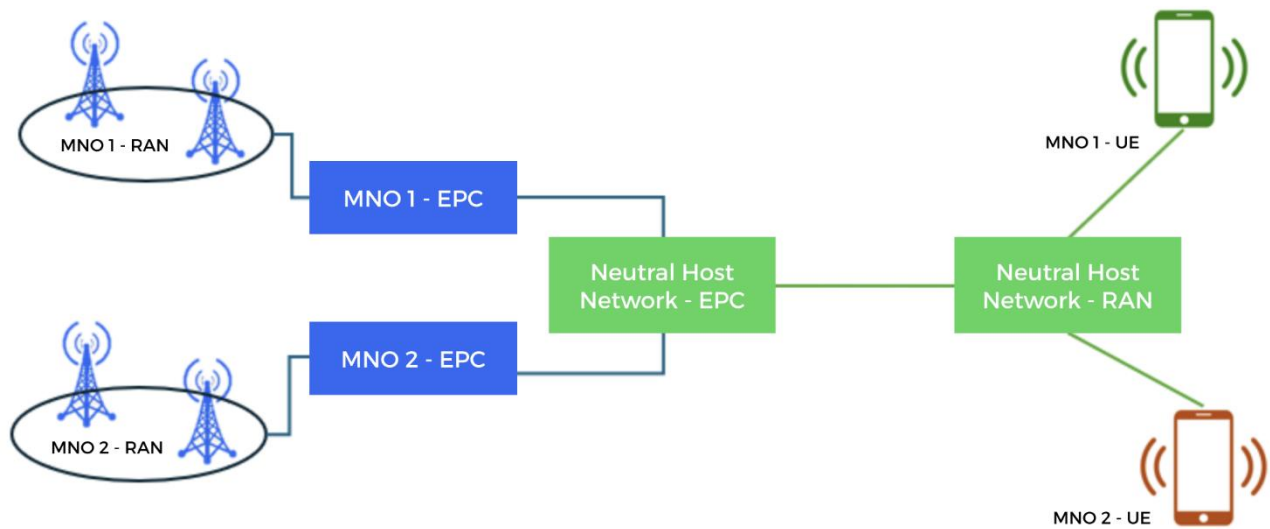
Neutral Host Network - Architecture

Key Aspects of Neutral Host Networks

When designing an efficient and adaptable NHN, seven key aspects play a crucial role. Here's a breakdown of these essential parameters that enable and aid to identify the neutrality of networks in diverse deployments.

1. Shared Infrastructure

Shared infrastructure is a strategic approach to resource utilization, allowing multiple entities to leverage the same physical and sometimes electronic assets. This approach drives efficiency, reduces costs, and promotes sustainability, making it an increasingly important concept in telecommunications.

There are 2 types of Infrastructure Sharing, Passive Infrastructure sharing and Active Infrastructure sharing.

Active Infrastructure Networks involve the sharing of both passive infrastructure and active electronic network components among multiple MNOs, for example Base Stations, Radios, Software and Network Management Systems, Fronthaul etc.

Comparison Summary

Feature	Passive Network Sharing	Active Network Sharing
Infrastructure Shared	Physical components only (towers, cabling, antennae)	Both physical and electronic components (towers, radios, base stations)
Active Electronics	Not shared	Shared
Management Complexity	Lower	Higher
Cost Savings	Moderate	Higher
Efficiency	Lower	Higher
Deployment Speed	Moderate	Faster
Control	Higher for MNOs	More reliance on neutral host
Regulatory Issues	Fewer	Potentially more

Infrastructure sharing is a strategic approach that allows multiple telecom operators to utilize the same physical infrastructure to deliver their services. By sharing cell towers, poles, power, civil structure operators can reduce costs, increase efficiency, and minimize environmental impact while maintaining or improving network coverage and capacity.

Passive Distributed Antenna System (Passive DAS) is a type of wireless solution that enhances cellular coverage by using a network of passive components such as coaxial cables, splitters, couplers, and antennas to distribute RF signals from a central source throughout a venue, building or facility. Passive DAS relies solely on the base station and distributes this signal passively through the building.

Active Distributed Antenna System (Active DAS) is an advanced in-building wireless solution designed to improve cellular coverage and capacity by using a combination of a network of fiber optic cables, remote radio units, and antennas paired with a passive DAS system. Active DAS actively amplifies and distributes signals, allowing it to cover large and more complex buildings with multiple floors, dense walls, and significant interference than what a passive DAS can accomplish.

MORAN (Multi-Operator Radio Access Network) is an effective network-sharing model that enables multiple mobile network operators to share RAN infrastructure while maintaining separate spectrum allocations and core networks. This approach provides cost savings, improves coverage and capacity, and accelerates the deployment of new technologies because active network elements are brought closer to the edge, all while allowing operators to maintain their independence and service differentiation. However, it requires careful management and coordination to address challenges such as interference and regulatory compliance.

MOCN (Multi-Operator Core Network) is a highly efficient network-sharing model that allows multiple mobile network operators to share both the radio access network and the spectrum while maintaining separate core networks. This model offers significant cost savings, improved spectrum utilization, and faster deployment of services, making it particularly valuable in areas with limited resources or high deployment costs. However, successful implementation requires careful coordination, regulatory

compliance, and robust management of shared spectrum resources to ensure high-quality service for all participating operators.

Core Network Sharing is a sharing model where along with either MORAN or MOCN the core resources (like HSS, IGW, MME) are also shared amongst multiple MNOs. This provides further cost savings over and above the MORAN or MOCN.

2. Multi-Access

In telecommunications, **multi-access** refers to the ability to handle multiple types of access technologies (e.g., 4G, 5G, Wi-Fi) simultaneously at the edge. This ensures that users can seamlessly connect through various networks, depending on the availability and requirements of the application. These systems are essential for supporting multiple connections in wireless and wired networks, ensuring that users can communicate without interference or degradation in service quality

3. Equal Opportunity (Level playing field)

Equal opportunity in the context of Neutral Host Networks refers to the principle that all mobile network operators (MNOs) and service providers sharing the infrastructure have fair and non-discriminatory access to the network resources and services offered by the Neutral Host. This ensures that no single operator has an unfair advantage over others in terms of network performance, quality of service, or cost, promoting healthy competition and better service for end-users.

Key parameters for equal opportunity in Neutral host networks:

Non-Discriminatory Access: All participating operators must be granted the same level of access to the shared infrastructure, including antennas, backhaul, and core network elements, without any preferential treatment.

Transparent Pricing and Costs: The costs for using the shared infrastructure must be transparent, with pricing models that apply equally to all operators, ensuring no hidden fees or unfair discounts.

Quality of Service (QoS) Parity: The Neutral Host must ensure that all operators receive the same quality of service, with no degradation or prioritization of one operator's traffic over another's.

Fair Resource Allocation: Network resources, such as bandwidth and spectrum, must be allocated fairly among all operators. This involves implementing mechanisms to manage congestion, capacity, and peak demand equitably.

4. Technology Agnostic

Technology agnostic refers to a strategy, approach, or solution that is independent of specific technologies, platforms, or vendors. Being technology agnostic means that a solution, system, or methodology can work with a variety of different technologies, without being tied to one. This allows for flexibility, adaptability, and interoperability across different environments and systems.

Parameters for defining a technology agnostic approach:

Flexibility: The approach can work with multiple technologies, making it adaptable to changing technological landscapes and evolving requirements.

Interoperability: It ensures that the solution can integrate and function with various systems, platforms, and devices, regardless of the underlying technology.

Vendor Independence: There is no reliance on a single vendor's products or services, which reduces the risk of vendor lock-in and increases the ability to switch or mix technologies as needed.

Scalability: The solution can be easily scaled or modified without being constrained by specific technologies, making it suitable for diverse environments.

Future Proofing: By not being tied to specific technologies, the solution remains relevant and adaptable as new technologies emerge.

5. Cost-Effective

Neutral Host Networks can deliver network services and infrastructure to the MNO or venue owner at a lower overall cost compared to traditional single-operator models. By sharing infrastructure among multiple mobile network operators (MNOs) and service providers, Neutral Host Networks can significantly reduce capital expenditures (CAPEX) and operational expenditures (OPEX), making it more economical to deploy and manage network services, especially in areas where individual deployments would be financially unfeasible.

Neutral Host Networks reduce the CAPEX, direct & the indirect OPEX:

- The CAPEX includes everything from site civil, infrastructure, passive material, active material, radio, antennae etc. The direct OPEX associated to Neutral Host Network deployment is Energy, Rent & AMC.
- The CAPEX includes everything from site civil, infrastructure, passive material, active material, radio, antennae etc.
- Indirect OPEX includes all the people and the management costs.

6. Third-Party Ownership

Third-party ownership refers to a model where the infrastructure required for telecommunications services (such as towers, antennas, backhaul, and other network elements) is owned, managed, and maintained by an independent entity (the third party), rather than by the mobile network operators (MNOs) themselves. This third party acts as a Neutral Host, providing shared access to the infrastructure for multiple MNOs and service providers. The third party is a neutral entity, independent of the MNOs that use the network. This ensures that no single operator has control over the infrastructure, promoting fairness and equal access.

7. Scalability

Scalability is the ability of the shared infrastructure to accommodate growth and adapt to increasing demands from multiple mobile network operators (MNOs) and service providers without compromising performance, quality, or cost-effectiveness. A scalable

Neutral Host Network can efficiently expand its capacity, coverage, and services as the needs of the network operators and their customers evolve

Capacity Expansion: The network can increase its capacity to handle more users, higher data traffic, or additional operators without requiring a complete overhaul of the existing infrastructure. This could involve adding more antennas, upgrading the backhaul, or increasing the number of base stations.

Geographic Coverage: Scalability also includes the ability to extend the network's geographic coverage to new areas or underserved regions. This can be achieved by deploying additional infrastructure in these areas while integrating it seamlessly with the existing network.

Flexible Resource Allocation: The infrastructure can dynamically allocate resources like spectrum, power, and bandwidth based on real-time demand from different operators, ensuring efficient use of shared assets as the network scales.

Operator Integration: The Neutral Host Network can scale by onboarding new operators or service providers with minimum changes, allowing them to use the shared infrastructure without negatively impacting the existing users.

3. Benefits of Neutral Host Networks

Economic Efficiency

- Lower infrastructure deployment and maintenance costs.
- Reduced capital expenditure for MNOs and Venues.

Enhanced User Experience

- Better network coverage and reliability.
- Increased capacity to handle high data traffic.

Environmental Impact

- Reduced physical footprint due to fewer redundant structures.
- Lower energy consumption and environmental impact.

Innovation and Flexibility

- Faster adoption of new technologies.
- Flexibility to support various services and applications.

4. Scoring of Neutral Host Deployments

Keeping in mind the different aspects of a Neutral Host, below is a reference scale across all the 7 parameters which can help us in visualizing the nature of the deployment.

The below tables are a representation of how a particular neutral host deployment would potentially score across the 7 key aspects. The scale for a few key aspects is additive while others are absolute scales.

The scoring mechanism is an evolving framework in its initial draft, whose purpose is to better understand how various deployments or options compare across the seven parameters. A higher score doesn't necessarily mean a better solution. Each deployment has to be evaluated against the specific customer or venue needs, which will vary depending on market requirements and different deployment scenarios.

Shared Infrastructure

No Infrastructure Sharing)	Infrastructure Sharing (Civil)	Passive & Active DAS	MORAN	MOCN	Core Network Sharing
0	20	20	20	40	20

* Additive scale, all scores must be added to derive the total score

Multi Access

Supports 1 technology (like 2G, 3G, 4G & 5G)	Supports multiple technology (like 2G, 3G, 4G & 5G)	Supports multiple technology (like 2G, 3G, 4G & 5G) + WiFi/CBRS
0	50	100

* Absolute scale

Equal Opportunity

MNO owned self-deployment	Non - Discriminatory Access	Transparent Pricing & Costs	Quality of Service	Fair Resource Allocation
0	25	25	25	25

* Additive scale, all scores must be added to derive the total score

Technology Agnostic

No Flexibility or upgradability	Flexibility	Interoperability	Vendor Independence	Scalability	Future Proofing
0	20	20	20	20	20

* Additive scale, all scores must be added to derive the total score

Cost Effective

Self-Deployed MNO Network or no savings in TCO	50% saving in TCO from self-deployment option
0	100

* Absolute scale. If the saving is less than 50% of the TCO, then the derived score calculated will be proportional. For e.g. If there is 25% saving, then the score will be 50 points

Third Party Ownership

| One/Multiple MNO Ownership	MNO Ownership: 50% to 100%	MNO Ownership: 25% to 50%	MNO Ownership: Less than 25%	No MNO Ownership
0	25	50	75	100

*Absolute scale

Scalability

Difficult to expand Network	Capacity Expansion	Geographic Coverage	Flexible Resource Allocation	Operator Integration
0	25	25	25	25

* Additive scale, all scores must be added to derive the total score

Below are two examples of actual deployments rated using the framework. CloudExtel's Shared RAN deployment at Mumbai Railway Stations for which TIP has published a case study and Proptivity's Solution deployed in Stockholm.

CloudExtel's Shared RAN
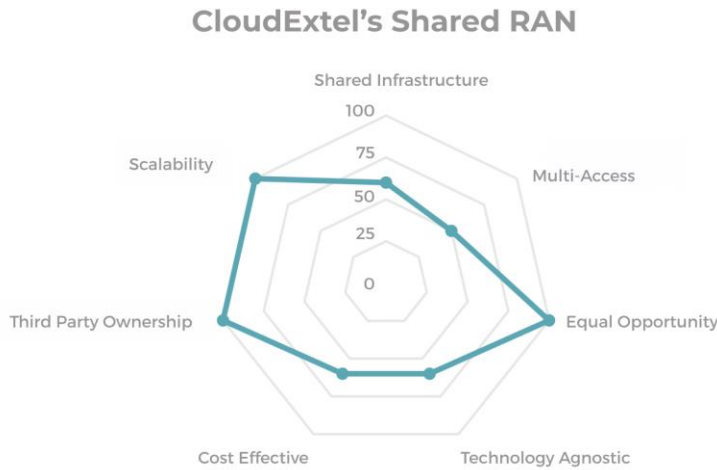
CloudExtel's Shared RAN deployment

Shared Infrastructure: CloudExtel has deployed a MORAN architecture. The civil infrastructure as well as the passive DAS is shared amongst the operators resulting in a score of 60.

Multi Access: CloudExtel supports 3G, 4G and 5G resulting in a score of 50.

Equal Opportunity: CloudExtel's solution provides non-discriminatory, transparent pricing, quality of service and fair resource allocation resulting in a score of 100.

Technology Agnostic: The solution is flexible, scalable and upgradable in the future resulting in a score of 60.

Cost Effective: Shared RAN solution by CloudExtel has benefited the TCO reduction by 30%. This results in a score of 60. (30/50*100)

Third Party Ownership: This deployment is completely owned by CloudExtel which is a neutral host and having no MNO ownership, resulting in a score of 100.

Scalability: CloudExtel's solution has the capability to expand capacity, improve geographic coverage, has flexibility for resource allocation and operator integration with multiple operators. Shared RAN score is 100.

Below is an example of Proptivity's Shared RAN deployment in Stockholm at a commercial office building called GT-30 spread across 10,000 sq. meters.

Proptivity's Shared RAN
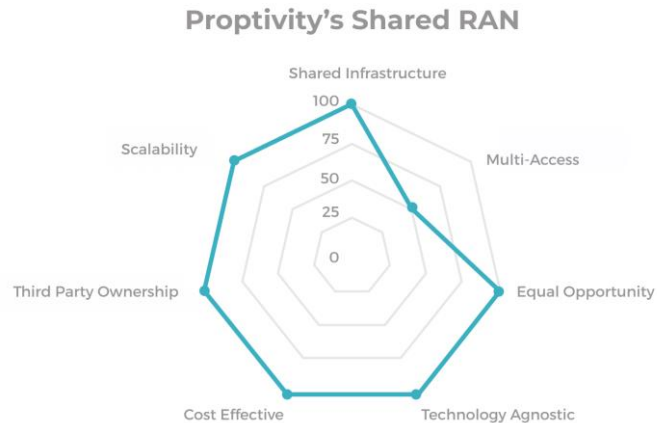
Proptivity's Shared RAN deployment

Shared Infrastructure: Proptivity solution enables sharing of multiple operators, allowing operators to choose from connecting with MORAN, MOCN or Active DAS - resulting in a score of 100.

Multi Access: Proptivity solution supports 4G and 5G resulting in a score of 50.

Equal Opportunity: Proptivity solution provides non-discriminatory, transparent pricing, quality of service and fair resource allocation resulting in a score of 100.

Technology Agnostic: Proptivity supports operators to connect regardless of vendor equipment, can use any radio supplier, existing networks can be easily upgraded for future proofness, solution can scale to any size building and can exist regardless of what outside radio is precent - resulting in a score of 100.

Cost Effective: Proptivity infrastructure can be fully shared by 4 operators in base deployment. If compared to single deployment, the savings would be linear to this - results in a score of 100

Third Party Ownership: Proptivity has no MNO ownership - resulting in a score of 100.

Scalability: Proptivity solution has no limits to expansion in any aspect - resulting in score of 100.

5. Business Models

Neutral Host Networks (NHNs) operate on a variety of business models that cater to different stakeholders, including mobile network operators (MNOs), enterprises, venue owners, and municipalities. The goal of these business models is to offer shared telecom infrastructure solutions that reduce costs, improve coverage, and optimize network performance for multiple service providers. Here's an overview of common business models around Neutral Hosts:

1. Infrastructure Leasing Model

Description: In this model, the Neutral Host builds and owns the shared telecom infrastructure (e.g., towers, small cells, Distributed Antenna Systems (DAS), fiber networks) and leases access to MNOs and other service providers.

Revenue Generation: Revenue is generated through leasing agreements, where MNOs pay a recurring fee (typically monthly or annually) to access the shared infrastructure.

Key Features:
- Passive infrastructure sharing (e.g., towers, fiber): Neutral Host provides physical assets like towers and backhaul.
- Long-term lease contracts are common, providing stable revenue streams.
- OPEX savings for MNOs, as they don't have to build or maintain the infrastructure themselves.

Example: Tower companies (e.g., American Tower, Crown Castle) often use this model, where they own and operate cell towers and lease space to multiple MNOs.

2. Managed Services Model

Description: The Neutral Host not only owns the infrastructure but also manages and operates it on behalf of the MNOs. This includes network maintenance, monitoring, and optimization.

Revenue Generation: Revenue comes from both infrastructure leasing and a service fee for network management and operational support.

Key Features:
- Comprehensive end-to-end service, including monitoring, maintenance, and troubleshooting.
- Active infrastructure sharing: In some cases, the Neutral Host may manage not only passive infrastructure (towers, fiber) but also active elements like base stations and radio equipment.
- MNOs can focus on their core business without worrying about day-to-day network operations.

Example: Some small cell and DAS providers operate on this model, particularly in environments like stadiums or large buildings where operators need to ensure high-performance coverage but lack the resources for direct management.

3. Pay-Per-Use or Pay-As-You-Go Model

Description: In this flexible model, MNOs or other service providers pay based on usage rather than fixed leasing contracts. This might include payment for specific capacity, data traffic, or active users on the network.

Revenue Generation: Revenue is directly linked to the volume of data traffic or user activity on the infrastructure.

Key Features:
- Flexible pricing allows MNOs to scale usage up or down as needed.

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- This model is often used in venues with fluctuating traffic, such as sports arenas, airports, or conference centers.
- Provides a cost-effective solution for operators looking to meet seasonal or event-driven demand without long-term commitments.

Example: A stadium's Neutral Host provider may charge MNOs based on the number of users accessing the network during a major event or the amount of data traffic generated.

4. Revenue-Sharing Model

Description: In a revenue-sharing model, the Neutral Host and the participating MNOs or service providers share the revenues generated from users connected through the shared infrastructure.

Revenue Generation: The Neutral Host receives a percentage of the revenue generated by the services delivered over the shared infrastructure (e.g., mobile data, voice, IoT applications).

Key Features:
- Often used in public-private partnerships where infrastructure is deployed in public venues, such as transportation hubs, smart cities, or public Wi-Fi networks.
- Shared risk and reward: Both the Neutral Host and the MNOs benefit from the success of the service.
- This model can encourage greater collaboration between stakeholders, as they have a shared interest in maximizing service uptake and quality.

Example: A Neutral Host provider may partner with a city government to deploy smart city infrastructure, with revenue shared between the host and the participating operators.

5. Build-Operate-Transfer (BOT) Model

Description: In the BOT model, the Neutral Host builds the infrastructure, operates it for a predetermined period, and eventually transfers ownership or control to the MNOs or venue owners.

Revenue Generation: Revenue comes from infrastructure operation during the transfer period, after which ownership may revert to the operator or venue owner.

Key Features:
- Often used in greenfield deployments where the host is responsible for the upfront capital investment and network rollout.
- MNOs benefit from a fully deployed and functional network, but eventually assume operational control or ownership once the infrastructure is established.
- Suitable for new markets or regions where there is limited existing telecom infrastructure.

Example: A Neutral Host could deploy 5G infrastructure in a remote area, operate it for a set number of years, and then transfer ownership to the MNOs who will continue providing service.

6. Enterprise or Venue-Paid Model

Description: In this model, the enterprise or venue (e.g., shopping malls, stadiums, hotels) pays for the deployment of the Neutral Host infrastructure, either directly or through a managed services contract.

Revenue Generation: The venue pays the Neutral Host a fixed fee for the infrastructure deployment, and the venue may also monetize the network by charging service providers for access.

Key Features:

- Typically used in enterprise environments, such as corporate campuses or large venues, where the venue owner wants to ensure high-quality coverage for all users and MNOs.
- The venue may offer free access to end-users or charge operators for enhanced services.
- Enhances the customer experience within the venue, often improving overall customer retention and satisfaction.

Example: A hotel chain could pay a Neutral Host provider to deploy a DAS or small cell network, ensuring that all guests, regardless of their mobile operator, receive strong signal coverage.

7. Public-Private Partnership (PPP) Model

Description: A collaboration between public entities (e.g., city governments, transportation authorities) and private Neutral Hosts to deploy shared infrastructure in public spaces such as smart cities, transportation networks, or public Wi-Fi systems.

Revenue Generation: The public sector may provide funding, assets, or regulatory support, while the Neutral Host invests capital and operates the network, with revenue shared between both parties.

Key Features:

- Enables deployment of Neutral Host infrastructure in areas where market economics alone might not justify the investment, such as rural regions or underserved urban areas.
- The public sector's involvement can reduce barriers to entry, such as site acquisition or permitting.
- Encourages wider societal benefits, such as digital inclusion, improved urban connectivity, or smart city applications.

Example: A city government may collaborate with a Neutral Host provider to deploy a smart city IoT network, with shared revenue from services like smart lighting, public safety applications, or public Wi-Fi.

8. Hybrid Model

Description: A combination of multiple business models, customized to the specific requirements of a region, venue, or group of stakeholders.

Revenue Generation: Revenue streams may include a mix of leasing, pay-per-use, revenue sharing, and managed services fees.

Key Features:
- Flexible and adaptive to various market conditions and stakeholder needs.
- Suitable for complex deployments where different regions or venues may require different business arrangements.
- Provides a high level of customization for MNOs, enterprises, and public sector organizations.

Example: A Neutral Host provider might use a leasing model in one region, a pay-per-use model in dense urban centers, and a revenue-sharing model for large public venues like airports.

6. Conclusion

With the ever-increasing network cost and deploying newer technologies like 5G and beyond, Neutral host networks (NHNs) have been gaining traction because they offer a shared infrastructure that can be leveraged by multiple mobile network operators (MNOs), private network operators, and service providers. By allowing various entities to utilize the same infrastructure, NHNs reduce redundant investments, improve coverage, and enable faster network deployments – especially important in urban areas with high user density and remote regions where building individual networks isn't cost-effective.

The model not only enhances operational efficiency but also aligns with the industry's push towards sustainability by minimizing environmental impact through shared resources. Additionally, NHNs can foster a more collaborative telecom ecosystem, where operators and venues benefit from collective resources, rather than competing for costly deployments, which often helps in delivering improved connectivity to underserved regions as well.

7. About TIP

About Telecom Infra Project (TIP)

The Telecom Infra Project is a global community of companies and organizations working together to accelerate the development and deployment of open, disaggregated, and standards-based technology solutions and open business models that deliver the high-quality connectivity the world needs now and in the decades to come.

About TIP's Neutral Host and Infra Sharing Project Group

The Neutral Host & Infra Sharing Project Group (PG) focuses on advancing neutral host business models for In-Building Solutions (IBS), Outdoor Densification, and Edge Solutions. By fostering collaboration among stakeholders, the PG accelerates the adoption of shared infrastructure, which reduces both capex and opex while enabling cost-effective connectivity deployments.

A neutral host operates a shared network infrastructure that service providers use through commercial agreements. This model promotes shared passive and active network components, driving competition and lowering costs in indoor and outdoor urban environments.

The group's vision is to be a global catalyst for neutral host deployment, bringing together neutral hosts, vendors, system integrators, MNOs, policymakers, and other stakeholders to eliminate barriers and promote innovative solutions.
With growing momentum from industry leaders, policymakers, and real estate stakeholders, now is the time to join the Neutral Host & Infra Sharing PG and shape the future of connectivity.

Contact Us	URL: https://telecominfraproject.com/neutral-host-infra-sharing/