

# An Economic Approach to Neutral Host Network Deployments

## ABSTRACT

With demand for more capacity and connectivity necessitating wireless network densification, the required indoor and outdoor network buildouts can be capital intensive. At commercial real estate settings like Multi-Dwelling Units (MDUs), office buildings, mass transit stations, shopping malls, campuses, and convention centers, provisioning service for more than one mobile network operator (MNO) is essential. In addition, new licensed, unlicensed, and shared spectrum is being made available to bring a range of new services for end-user applications, exacerbating the site infrastructure ROI challenge for venue owners and third-party owners (3PO) of multi-operator networks. This white paper will first describe Neutral Host Networks (NHNs) for the scope of this paper, along with a brief comparison between NHN ownership models. It will then list the benefits and challenges that affect the Total Cost of Ownership (TCO) for NHNs. Finally, it explains opportunities for NHN owners to lower the TCO by minimizing the deployment complexity while providing an economical path to leverage future spectrum allocations to improve capacity per user or monetize new use cases.

## INTRODUCTION TO NEUTRAL HOST NETWORKS

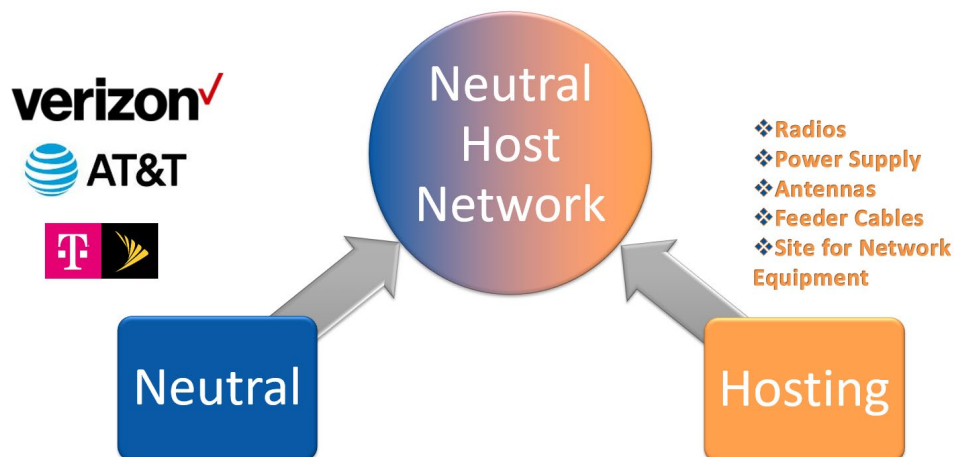
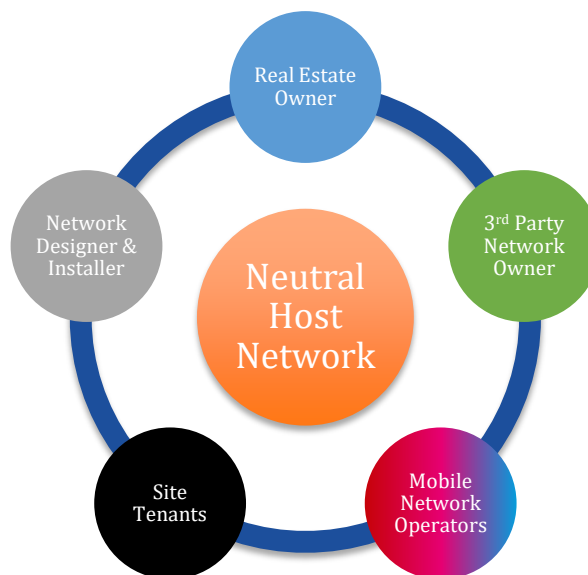


Figure 1 Neutral Host Definition

The term 'Neutral host' comprises of two words, "Neutral" and "hosting." First, neutrality refers to supporting all major MNOs, and second, it is a spectrum where a particular block can be shared between multiple MNOs for extending their respective service. It can constitute hosting of access, the backhaul, site assets, RAN hardware, and the core network. The significantly broad number of 5G use cases has revealed new addressable markets with new services/products and new, challenging requirements. To stay ahead of the growing demand for new use cases,

dramatically higher data rates, and lower latency, the need for network densification requirements has increased. In addition, with increased utilization of mid-band spectrum and LEED-certified building construction, outdoor tower signal penetration inside the building is severely limited.

The success of next-generation wireless technology is predicated on improvement to two key factors—coverage and capacity. NHNs make a compelling case to extend coverage and capacity into a broad range of venues, including commercial real estate like MDUs, office buildings, mass transit stations, shopping malls, campuses, and convention centers. These venues are high-density wireless environments, with several devices located in each area, and nearby macro-towers are insufficient to support the demand. These locations can thrive with increased visitors, new leases, retention of tenants, value-added experiences, and increased productivity with NHNs enabling the deployment of next-generation wireless networks. When considering NHNs for the in-building verticals, it is necessary to be aware of current requirements, determined by a venue's density of user equipment and overall capacity demand. For instance, a convention center with a high density of users using high-bandwidth applications like AR/VR and UHD videos would require the highest capacity. In contrast, campuses would require a significantly lower capacity due to the lower density of user equipment.



**Figure 2 NHN Stakeholders**

Figure 2 shows the key stakeholders required to be taken into consideration for an NHN. With multiple stakeholders, there are multiple ownership models, each with a unique value proposition. With MNO-owned NHNs, the venue owner can quickly get MNO-grade coverage but has the least room for customization to add network services, which increases the complexity of provisioning multi-operator service. In contrast, a real estate owned NHN provides the building owner with absolute freedom to customize with a broader scope of additional services that venue owners can monetize. A new 3PO model is gaining adoption momentum. The 3PO can come to the building or venue owner to subsidize some of the network infrastructure cost and then potentially share it with the multiple MNOs. This model is an excellent fit for all stakeholders. 3PO companies typically take the Capex cost and turn it into an Opex-driven model. The savings for the stakeholders depends on the depth of the sharing agreement. The key benefit is sharing the various costs of deploying and maintaining a network and the resulting net commercial benefit to the MNOs and building owners from improved service to their customers.

The difference between large venue cellular sites facilitated by the MNOs and hundreds of thousands of smaller venues is stark. There is a growing need for NHNs to bridge the gap between huge venues with MNO-owned networks and commercial real estate venues that do not make a strong business case for any single MNOs to

consider. This gap in serving the growing needs of the indoor venues necessitates NHNs to simplify business models associated with the multi-operator support.

## BENEFITS AND CHALLENGES OF NHN

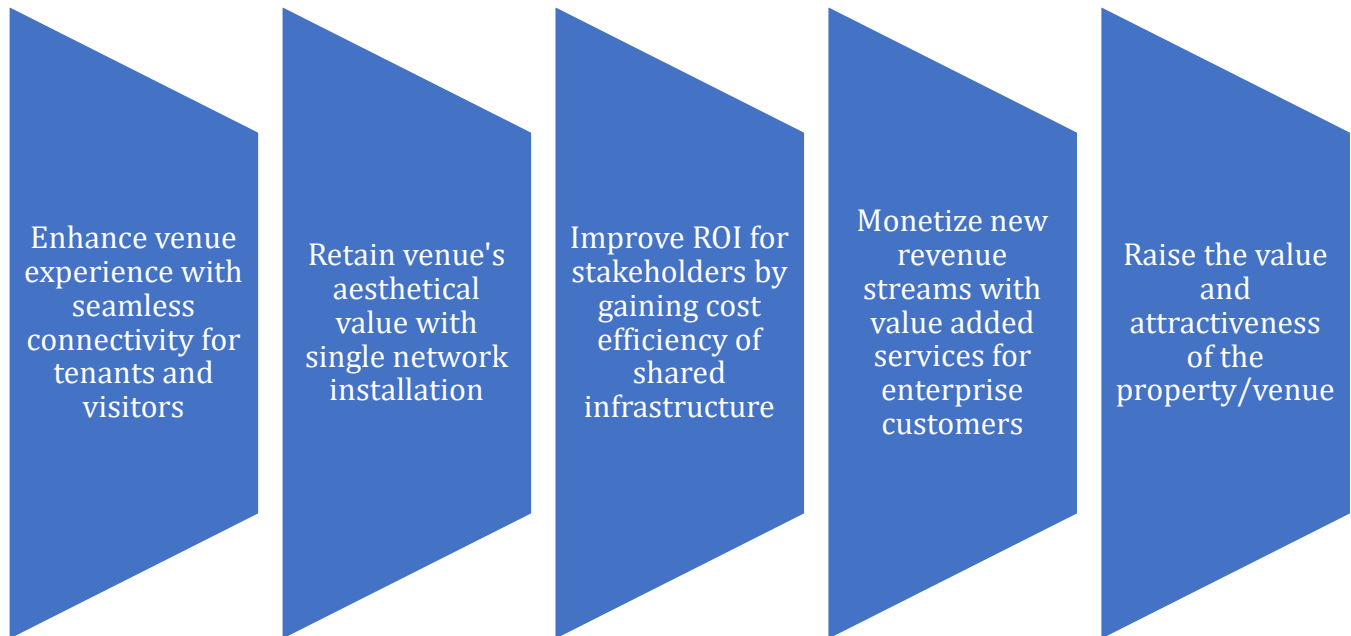


Figure 3 NHN Benefits

Figure 3 shares the benefits of NHNs, but they are not without their challenges. Many of these NHN deployments rely on facilitating MNOs signing up as tenants to join the network, with a second or third tenant justifying the business case. As the MNO tenant contracts are not all in place before the network is commissioned, deploying a fixed (non-upgradeable) solution increases the TCO for the building owner. The ability to add a new MNO after deploying a network can be challenging and expensive, requiring a complex, labor-intensive rip-and-replace of components and re-design of the network. Additionally, the intricacy of injecting new service bands after commissioning a site can make the resulting site Capex and Opex spending management onerous for the building owner/occupant.

NHN challenges include:

- Minimizing the operational complexity of the MNO upgrade or addition.
- Network upgrades for new licensed and shared frequency bands being allocated for wireless applications.
- Isolation amongst MNO licensed bands to avoid desensitization of MNO base stations.
- Passive intermodulation (PIM) in the network, which can cause significant capacity issues in NHN.
- Meeting capacity requirements not just of today but also of tomorrow.
- Maintaining network neutrality between multiple MNOs for coverage.
- Supporting close coordination between multiple stakeholders.

## ECONOMIC CONSIDERATIONS FOR NHN OWNERS

The shared infrastructure in an NHN constitutes a Point of Interface (POI) and the signal distribution network to the antenna. The POI is aptly named for the interface point where multiple operator signal sources like small cells and remote radio heads (RRHs) are interfaced with the signal distribution network in an NHN.

Cost efficiency opportunities with POI:

- Deploy modular and scalable POI to allow for the future addition of MNOs in the network in NHN deployments.
- Future proof for capacity expansion to minimize the scope of rip-and-replace.
- A single plug-and-play solution minimizes installation time while making the configuration repeatable for multiple properties.
- Deploy what is necessary today while ensuring straightforward upgrades in the future.

Cost efficiency opportunities with signal distribution network:

- Ensure the signal distribution network supports FR1 bands provisioning future capacity expansion.
- Add as much capacity for cables in conduits and power distribution as possible.
- Utilize better performing RF components in the network to improve coverage and capacity.
- For MNO-grade wireless coverage, utilize products relied upon by MNOs.
- Don't ignore PIM. Failure to consider PIM can be expensive!

PIM must be considered to deploy cost-effective NHN since a 5G network's higher utilization of available spectrum and modulation schemes like CP-OFDM with higher peak power make them more susceptible to PIM issues. Suppose high levels of PIM are allowed into the receiver path. In that case, it results in system performance degradation since it reduces receiver sensitivity and could also inhibit communication completely. System-level PIM can be minimized by selecting components with attention to mechanical design, material selection, and manufacturing process. Also, network designers need to consider harsh outdoor environments like coastal regions and tunnels where higher humidity, wide temperature range, and salt can cause rust in the network components over time, which again generates PIM.

## **Microlab MCC Platform for NHN Stakeholders**

The Microlab POI Modular Carrier Combiner (MCC) platform is a leading, cost-effective NHN solution providing unique value to the NHN stakeholders. NHN stakeholders can capitalize on the advantages of better coverage of MNO service today and in the future with new use cases. Microlab MCC platform empowers in-building network stakeholders to realize the benefits of seamless wireless coverage quickly and cost-efficiently.

Microlab MCC platform provides NHN Stakeholders with:

- Single field-upgradable solution with the flexibility to scale for multiple NHN configurations as desired by the MNO requirements.
- Ability to commission the network with just the lead MNO on day one with the seamless addition of remaining MNOs in the future when required contracts are in place.
- Streamlined future injection of new spectrum service bands in deployed infrastructure for capacity improvement in the future.
- Reduced TCO with a diminished scope of rip-and-replace of network infrastructure.
- Relied upon and approved by MNOs and major NHN providers, ensuring MNO-grade performance and quicker commissioning of networks.

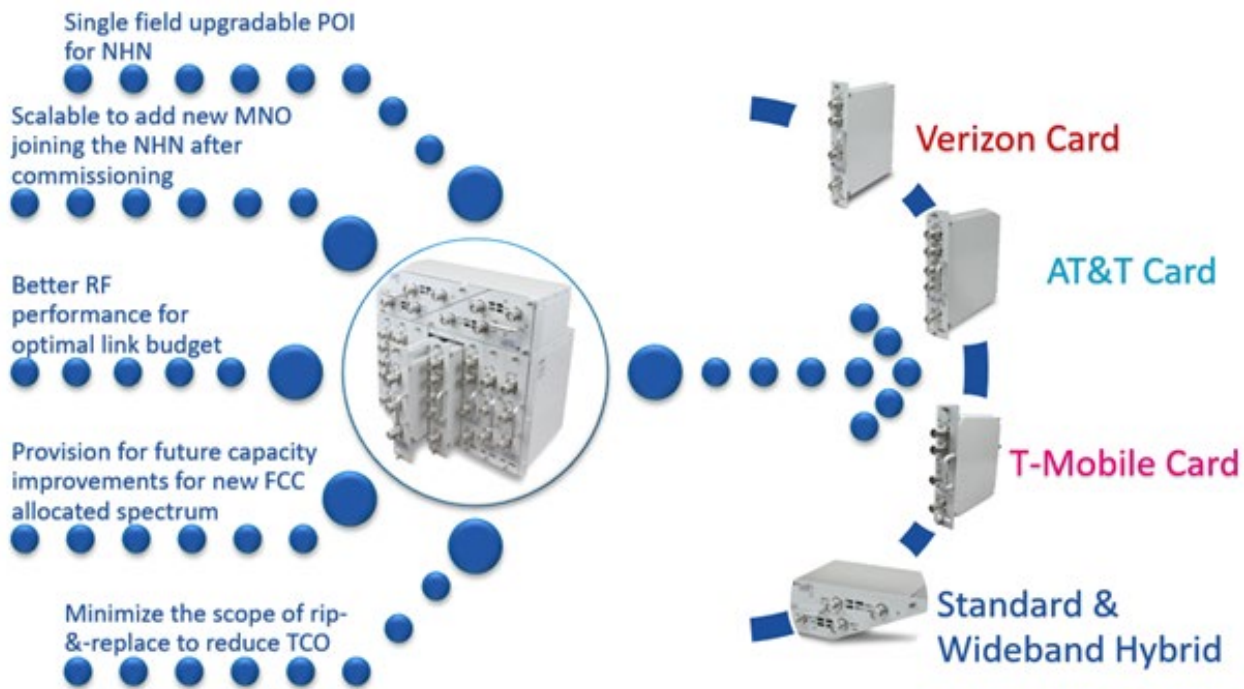


Figure 4 Microlab Modular Carrier Combiner (MCC) platform

## CONCLUSION

In conclusion, an NHN bridges the gap between large venues and commercial real estate by enabling seamless connectivity for the improved building occupant and visitor experience. Venues already equipped with NHNs add to their appeal, enabling owners to charge tenants higher rates for them. However, the current complexities of deploying an NHN make it prohibitively expensive for the NHN stakeholders. This white paper reviews considerations for NHN stakeholders to improve the ROI of NHNs with an upgradable network design capable of future upgrades either for new spectrum or new tenant. With the Microlab MCC platform, NHN stakeholders significantly minimize the complexity and operational costs with a plug-and-play design that can be rapidly installed and commissioned in a desired flexible configuration. By commissioning the POI with just the facilitating MNO, the Microlab MCC platform provides seamless modular addition for remaining MNOs in the future when required contracts are finalized.