



# The Critical Role of Multi-Network IoT Connectivity in POS Systems

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# Introduction

The point of sales (POS) industry is undergoing a significant transformation driven by the increasing reliance on non-cash payments and the expanding opportunities they present. As the payments landscape evolves, POS providers face mounting pressure to ensure uninterrupted services, product reliability and customer satisfaction. Adopting a multi-network connectivity approach has become a critical strategy to address these challenges, as it offers a robust solution to the prevalent issues associated with a traditional cellular single-network or non-cellular-based approach.

This white paper explores the imperative for POS providers to embrace multi-network IoT connectivity. This approach will be examined for its potential to not only mitigate connectivity issues but also facilitate seamless market expansion, reduce operational complexities, and unlock new revenue opportunities.

## State of the market

Reliable connectivity is paramount for smooth POS operations as payment terminals must always be online to accept payments. Connection failures carry significant consequences, with the most immediate impact being lost sales. Beyond the financial toll, network downtime can also lead to damaged customer relationships and lost productivity. Although POS providers and merchants increasingly reevaluate their existing network setups, they still mainly rely on Wi-Fi, fixed and cellular single-network connectivity to support their operations. Overall, the adoption of cellular solutions is growing, as retailers embrace cellular failover routers and cellular POS solutions for enhanced reliability and flexibility.

## How connectivity failures impact POS and merchant operations

Today's retail world depends heavily on stable networks. While Wi-Fi networks are essential to home and business networking, their reliability and availability cannot be guaranteed since Wi-Fi operates on unlicensed spectrum. The dependency on Wi-Fi leaves merchants exposed to the risks of connection failures, particularly in high-traffic environments such as shopping malls, sports events and festivals. When thousands of devices compete for bandwidth, Wi-Fi networks can become congested, leading to intermittent connectivity or complete outages. Disruptions may also occur due to fixed network connection issues caused by construction mishaps, weather events or other failures in network operations.

Cellular connectivity solutions relying on a single network can also result in inconsistent service. For instance, at a festival where 100,000 customers share the same network as the POS devices, the quality of service can become severely impacted and lead to lower speeds, dropped

connections and higher latency. With the option of just one network rather than the failover that a multi-network offers, POS performance could suffer or even fail completely. Additionally, a network that performs well in one location may struggle in another, leaving merchants with slow or unreliable POS functionality across their footprints.

Connectivity issues create substantial operational challenges. When a payment terminal goes offline, transactions stop, directly affecting sales and customer satisfaction. The complexity of POS setups exacerbates the problem, as troubleshooting connectivity often requires specialised mobile operator support. Consequently, merchants face long waits to diagnose device issues, and operational costs increase as customer service teams spend more time addressing connectivity problems.



### **The cost of network failures in POS systems extends beyond monetary losses**

Connectivity problems have a direct and measurable impact on the financial performance of merchants. One significant metric affected is the Gross Process Volume (GPV), which represents the total value of transactions processed through a POS system. When connectivity is unreliable, merchants miss out on potential sales, as customers are unable to complete transactions. This is particularly problematic in high-volume transaction settings, where even brief periods of downtime can result in significant revenue losses. The world's largest coffeehouse chain, Starbucks, for example, experienced an outage in 2015 which shut down POS systems at thousands of its stores in the US and Canada. The cost of the failure is estimated to have been in the range of several millions of dollars.

**Figure 1: The impact of network downtime for retailers**

It is estimated that about 81 percent of retailers experience downtime at least once a year. Beyond the loss of sales revenue, the indirect costs of downtime can be considerable. Studies have shown that one in three consumers would walk away from a brand after just one bad experience, even if that same brand is held in high regard. In the era of social media, negative experiences can also have especially long-lasting effects on brands and businesses. Connectivity failures may also impact social well-being negatively as they place staff under increased pressure to deal with impatient and frustrated consumers at the point of sale.

#### **Multi-network solutions drive uptake of cellular POS terminals**

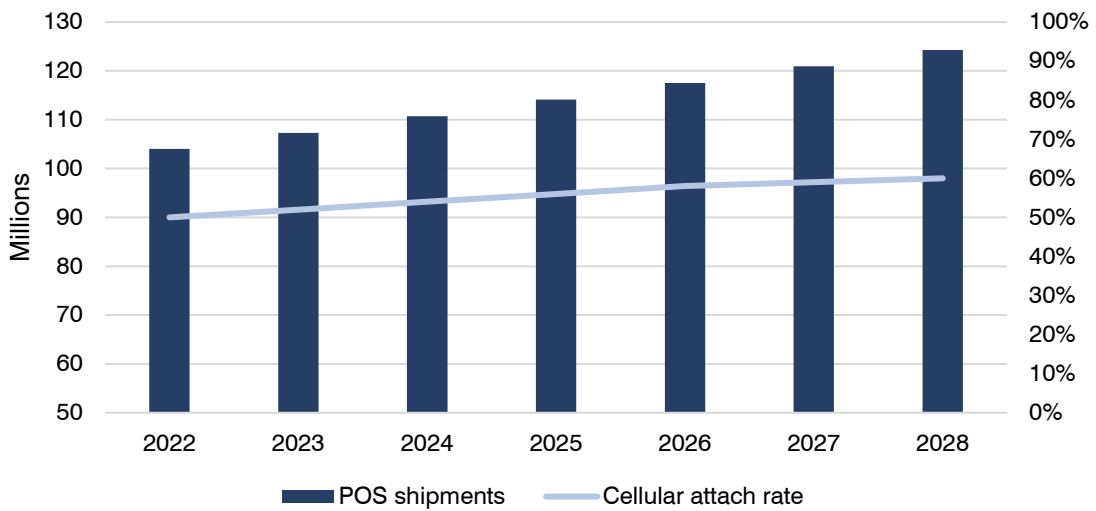
Despite these challenges, the POS market is poised for significant growth, driven by advancements in connectivity technology. POS terminals today use a variety of different communications technologies. Mobile terminals generally rely on short-range wireless connectivity technologies such as Bluetooth and Wi-Fi, or wide area networks such as 2G/3G/4G/5G. Stationary terminals meanwhile often rely on fixed networks such as DSL, PSTN, TCP/IP or X.25, although wireless connectivity is common also for stationary terminals.

The introduction of cellular connectivity has allowed many new groups of users to adopt POS terminals and accept electronic payments. Typical examples are home delivery services, taxi and limousine services, outdoor restaurants, and various services provided by professionals such as electricians and repairmen. Overall, the convenience and flexibility of not needing a fixed line connection have made cellular connectivity a highly popular option. The number of terminals connected to cellular networks reached 138 million units globally at the end of 2023, which corresponds to about 50 percent of the global installed base.

By 2028, it is expected that 60 percent of all POS terminals shipped will feature cellular connectivity. Multi-network solutions are projected to see a particular rise in demand as merchants and POS providers seek more reliable and versatile connectivity options. Multi-

network IoT connectivity is particularly attractive because it offers easy switching between different network providers, ensuring consistent performance even in areas with patchy network coverage.

**Figure 2: POS terminal shipments and cellular attach rate (World 2022–2028)**



*Note: Figures exclude mPOS terminals*

As multi-network POS solutions become more widely used, merchants will experience fewer connectivity-related disruptions, leading to more stable and efficient operations. This improvement in reliability and performance is expected to drive higher GPV and improve the overall customer experience. Another potential game changer in the market for POS terminals is related to marketplaces and new types of apps that can be installed on POS terminals.

Traditionally, POS terminals have been relatively closed with only a limited number of payment applications allowed to run on the device. The application environment on POS terminals has however started to open up, allowing merchants to download and install business-specific apps on their terminals. This can for instance enable merchants to accept coupons or vouchers in new ways, conduct their business more efficiently and improve the customer experience. A direct consequence is that merchants will start to consider the platform’s strength when they choose POS terminals. The POS terminal vendor with the broadest application base is likely to stand at an advantage vis-à-vis smaller competitors that have more limited platform support.

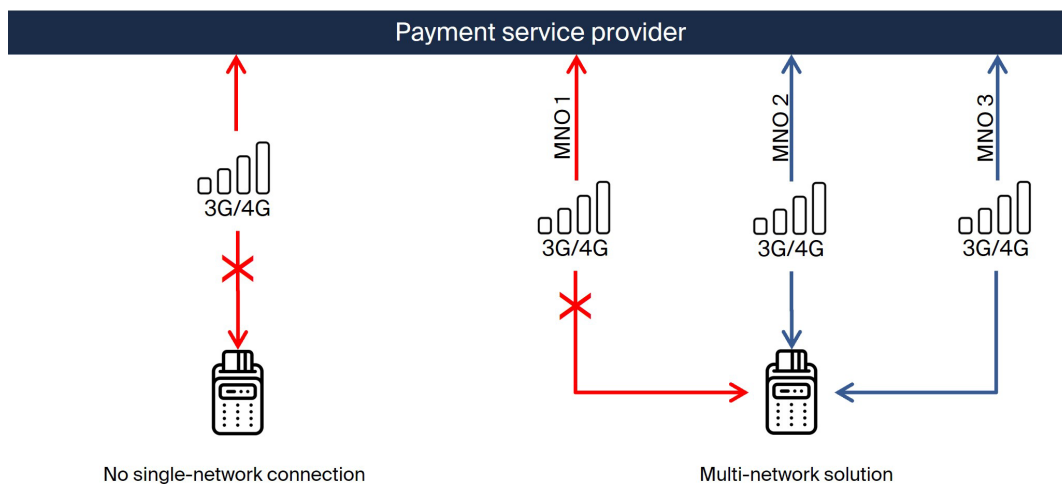
## Technology innovations shaping the future of POS operations

Innovations in POS operations are transforming the retail landscape, driven by advances in technology and changing consumer expectations. Cloud-based POS systems are leading the charge, offering real-time data access, enhanced security, and seamless integration with various business applications. Mobile POS solutions are also gaining traction, enabling sales transactions to be conducted anywhere within a store or even remotely, improving customer service and operational flexibility.

### Ensuring continuous service with multi-network POS solutions

Unlike traditional single-network solutions, a multi-network approach enables devices to connect to multiple networks and ensure resilient connectivity even if one network experiences issues. This capability is especially advantageous in diverse and dynamic environments such as shopping centres, sporting events and music festivals where network performance can vary significantly.

**Figure 3: Network connection failure scenarios for single- and multi-network solutions**



For POS providers, there are multiple benefits of multi-network connectivity. A single SIM that can access multiple networks in each location eliminates the need to test different SIMs and individual networks at each merchant deployment site. Instead, providers can deploy the same SIM in any device, knowing it will automatically connect to the best available network no matter where it goes in the world. This approach eliminates the need for multiple site visits, troubleshooting, and lengthy customer support calls for a POS to be deployed successfully.

Multi-network connectivity guarantees optimal performance by seamlessly switching to the best network based on location and traffic conditions. This automatic transition prevents downtime and allows merchants to maintain continuous service during peak times or in areas with

unreliable coverage of a single network. The result is a reliable POS system that enhances customer experience by minimizing transaction failures and delays. Additionally, this approach reduces the need for manual interventions, freeing up resources for other critical business functions.

### **Enabling operational scale through centralised control**

Managing a fleet of POS devices across various locations and different single-network operators can be daunting, particularly if network issues arise. The model becomes increasingly complex when scaling to a growing number of countries due to the management and integration of multiple connectivity management platforms and troubleshooting across multiple systems. Multi-network solutions simplify this challenge by offering remote management capabilities and network redundancy. A unified platform for managing connectivity across multiple networks centralizes control of devices and services, making it easier to monitor, manage and troubleshoot the network, and provides one point of integration. This contrasts starkly with the approach of using multiple single-network operators as any bulk changes need to be executed on disparate platforms which adds unnecessary complexity.

Through automatic network switching, POS systems can resolve connectivity problems before they impact operations. For instance, if a network outage occurs, the system can instantly switch to an alternative network, ensuring uninterrupted service. By having multiple failover networks available, POS devices are less likely to experience total connectivity failures. This redundancy is critical for maintaining consistent service, especially in locations with varying network quality. Moreover, POS providers can blacklist unreliable networks and prioritize those with better performance, tailoring connectivity to specific environments and ensuring the best possible service for their customers.

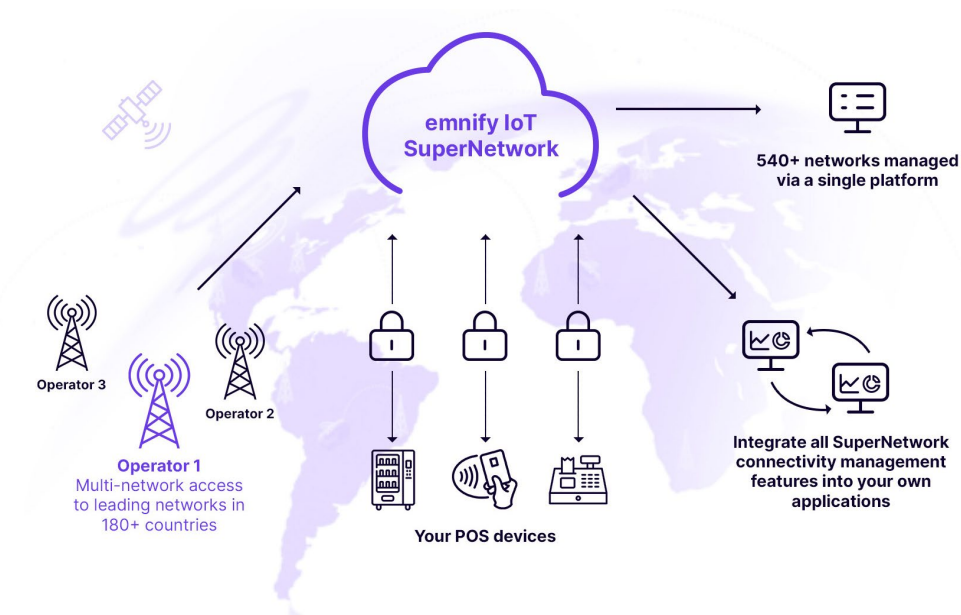
### **How emnify's SuperNetwork simplifies global expansion**

When looking to expand their operations regionally or globally, POS providers face numerous challenges related to network connectivity. Traditionally, entering new markets required sourcing of SIMs from local mobile operators and integrating their services, a process that is both time-consuming and costly. Multi-network solutions offer a more streamlined approach. With a single SIM multi-network solution, POS providers can ensure that their devices connect to the best available network in any given region or country without the need to negotiate new contracts or handle multiple vendors. This simplifies the deployment process, reducing operational costs and expediting market entry.

The emnify IoT SuperNetwork is a single, distributed service that provides access to multiple local networks in over 180 countries for uninterrupted connectivity around the globe. emnify's cloud-native platform uses AWS to facilitate regional Internet breakouts and dynamically selects

the closest breakout region based on the device location, enabling reduced latency and roaming costs while ensuring compliance with permanent roaming regulations. Using AWS Transit Gateway, emnify Cloud Connect establishes an intra-cloud connection between IoT devices and applications and services running on 25+ AWS regions globally, allowing two-way device communication to take place without being exposed to the public Internet.

**Figure 4: The emnify IoT SuperNetwork**



In addition to offering access to leading local networks in hundreds of countries from a single SIM, the SuperNetwork platform provides the tools to perform connectivity management, cost management and troubleshooting for all networks via a single unified platform or API. This eliminates the complexities associated with using multiple single-network operators that arise from managing multiple platforms, contracts and integrations.

**Alberici partners with emnify to deliver a superior user experience**

Alberici, a leader in the design and manufacture of automatic payment systems for the self-service industry, has developed a remote control system that lets customers monitor and manage their cash-handling assets in real time. Known as Argo, the solution collects numerous technical and usage data of unattended machines that allow customers to track payment transactions, receive machine-status alerts and make more informed decisions on replenishment, collection and maintenance procedures. As not every customer has a reliable Wi-Fi service or may not be adept with network technology, Alberici decided to use emnify’s IoT SuperNetwork solution to ensure that its products can be easily installed and used in any location.



With emnify IoT SIM cards installed in Alberici's machines, the SuperNetwork's multi-network coverage ensures stable data communications to the cloud while providing access to a range of tools to manage SIMs, proactively switch networks or reset connectivity to resolve unwanted issues. With the help of emnify, Alberici has also been able to enhance user experience through a simple setup process facilitated via APIs on the emnify platform. As a result, customers can get their payment systems up and running fast, without any technical expertise required.

"With the help of the emnify API, the provisioning process is reduced to a few button clicks, which makes the whole experience very user friendly. Plus, having an automated and standardized procedure helps us remove errors from manual data entry."

– Andrea Pagano, System Engineer, Alberici

### **POS systems in unattended environments**

While commonly associated with traditional retail environments such as stores and restaurants, POS terminals are increasingly finding innovative applications across diverse sectors. Beyond traditional retail, POS systems are pivotal in environments where cashless transactions and seamless payment experiences are essential. These include unattended applications such as EV charging stations, vending machines, micro markets, laundromats and gaming machines. POS terminals also play an important role in collecting fares on buses, trains and subways, and in providing secure payments for medical services in healthcare settings.

### **Why POS systems are a critical part of EV charging infrastructure**

As the electrification of vehicle fleets continues, the roll-out of EV charging stations proceeds at pace. The number of public charging points in North America and Europe alone is expected to grow from about 1.1 million in Q2-2024 to over 3.3 million in 2028. These will be placed throughout a variety of public spaces, such as transportation hubs, tourist destinations and commercial areas. At the same time, charging point operators need to collect payments and data from the charging stations.

Today, the most common ways of initiating payments for EV charging sessions are to use a mobile application or a radio-frequency identification (RFID) tag. An alternative to RFID tags and mobile payments is card payments using a POS terminal. The use of a dedicated payment terminal can help EV-charging operators comply with the non-discriminatory ruling in Directive

2014/94/EU, as it allows all EV drivers with a credit or debit card to charge and pay. In addition, the Alternative Fuels Infrastructure Regulation (AFIR) came into force in April 2024 which stipulates that public charging infrastructure in the EU with power outputs of 50kW and above must include the option to pay with a credit card, either contactless or via swipe, chip or dip. In the US, federally funded charging points similarly need to offer users the ability to pay using a credit card.



Besides helping operators adhere to regulations, the use of POS terminals at EV charging points enables drivers to avoid installing various mobile apps or carrying RFID cards from different operators. POS terminals also ensure that drivers are not restricted by unreliable network connections at EV charging stations which could otherwise impede their ability to download and install mobile applications.

#### **POS systems allow vending and micro market operators to streamline operations**

There are currently around 15 million vending machines in the world that dispense goods such as hot and cold beverages, foods, refreshments and other physical products to consumers on the go. Vending machines operate around the clock and can thereby offer products at any time, which is especially beneficial in areas with limited or no retail options. Coin mechanisms have historically been the most widely used payment system for vending machines. Today however, cashless payments are generally seen as low-hanging fruit for the vending industry, as adding acceptance of credit and debit card payments via POS terminals does not require changes in

the operating model. Sales data from cashless transactions can for example be integrated into existing financial reporting systems, while inventory management, replenishment and maintenance continue as before with the added benefit of more efficient operations. The Covid-19 pandemic further led to a surge in the popularity of cashless and contactless payments as users began to seek versatility, convenience and safety to a larger extent than before.

According to Automatic Merchandiser, more than 90 percent of US vending operators now use cashless payment devices. While adoption in other regions of the world remains more modest, cashless payments act as the single most powerful driver for adding connectivity to vending machines. Consequently, cellular POS terminals are expected to be the main source of connectivity for the vast majority of the world's 12 million connected vending machines by 2027. Its use is meanwhile not limited to offering users a convenient way to pay, but product suppliers and operators also leverage the connectivity from payment terminals to gain more efficient control of cash, sales, stock, route planning, operations and marketing data.

Closely related to vending machines is the concept of micro markets. These are stores in which consumers can access items such as pre-packaged food and pay for their selection at unattended kiosks, generally using cashless payments via a POS terminal. In North America, micro markets have experienced significant growth in recent years with the number of locations having increased from 13,000 in 2015 to over 42,000 in 2023. The concept has also started to spread to markets including Canada, Europe and Latin America. As an example, the leading European vending operator Selecta now operates close to 2,000 micro markets – up from just 200 four years ago. As micro markets can offer significantly more product variety and broad assortment ranges, it is expected that the roll-out of micro markets will continue to see significant growth in the years to come as an alternative to both vending machines and traditional retail stores.

## Conclusions

Several parallel market and technology shifts are currently reshaping the POS industry, potentially establishing new market dynamics for retail operations in the long term. Below, we highlight key trends emphasizing the crucial importance of multi-network connectivity.

- The uptake of cellular IoT connectivity in the POS market has been driven by vertical markets where mobility is central and where fixed-line telecommunications infrastructure is less developed. Future growth will be driven by multi-network solutions that ensure consistent performance in areas where reliable connectivity is not possible through Wi-Fi or cellular single-network connectivity.

- Connectivity failures have a direct and significant impact on the financial performance of merchants, but the costs extend beyond mere monetary losses to encompass operational disruptions, customer dissatisfaction, and potential damage to brand reputation. To mitigate this risk and to reduce costs related to on-site visits and lengthy customer support calls, POS providers will adopt multi-network solutions for enhanced reliability and flexibility.
- The growing use of payment terminals in unattended environments such as EV charging infrastructure is expanding the market for POS systems, which is likely to open up more use cases for cellular connectivity in general and multi-network connectivity in particular.
- Consumers today are increasingly opting for convenience, speed and ease of use when conducting transactions. As a result, the POS industry is undergoing a significant transformation driven by the increasing reliance on cashless payments and the expanding opportunities they present. To enhance the customer experience, it is therefore vital for POS providers and merchants to ensure uninterrupted services and product reliability.



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emnify is the leading IoT connectivity partner to the innovators building our connected world. Founded in 2014, emnify developed the industry's first cloud-native, global connectivity – the SuperNetwork. Our unique approach to IoT connectivity, coupled with our comprehensive connectivity management platform and services, ensures seamless data exchange between devices, cloud environments, and IoT applications.

Headquartered in Berlin, with offices in the US, Brazil and the Philippines, emnify is the global provider of IoT connectivity for thousands of enterprises worldwide. Our solution connects millions of devices across all industries including fleet management, consumer electronics, logistics, agriculture, environmental monitoring, smart buildings, retail, and beyond. Working with our customers, we connect the physical world with the digital world in a way that has real impact on how we work and live.

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