I D C V E N D O R S P O T L I G H T

Wireless SD-WAN: A Critical Element of Industrial Internet of Things

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SD-WAN: What Is It and Why Now?

Over the next decade, the Internet of Things (IoT) is expected to add an exponentially higher number of distributed endpoints and connections to the enterprise network. An increasing percentage of the global workforce is now mobile or remote and is dependent on accessing applications in the cloud via mobile devices, as Enterprise applications continue their steady migration to the cloud. Increasingly, applications are being delivered from the Internet – Software-as-a-service (SaaS), Infrastructure-as-a-service (IaaS) and Platform-as-a-service (PaaS). A highly distributed enterprise connecting humans and machines to cloud-based applications with a never-ending appetite for bandwidth characterizes the enterprise network of the future.

As enterprise apps continue to rapidly move to the cloud, as enterprise users become increasingly mobile, and as IoT adds an ever-increasing number of connections to the network, it is apparent that the wide area network (WAN) needs to evolve to support the new paradigm. Irrespective of how they are connected, users and mobile/IoT sensors expect applications delivered with a consistent level of performance, security, reliability, and availability. Enterprise network traffic growth continues unabated as more business processes are digitized and more apps are accessed remotely. The challenge for enterprises and their service provider partners is to deliver the higher quantum of network traffic, while satisfying policy and user experience expectations for these new cloud/mobile/IoT applications without substantially increasing the cost of the network infrastructure. A hybrid WAN that incorporates all possible WAN connectivity options is not a luxury, but a necessity, and creates an opportunity for optimizing application performance and improving efficiencies.

SD-WAN enables an enterprise to deliver an automated, application-optimized and integrated hybrid WAN. It is a solution to the rapid shift in application and WAN traffic characteristics, and an opportunity to rationalize network costs in the face of rapidly growing data traffic. It incorporates both automated software intelligence and a hybrid WAN. Per IDC's definition, a hybrid WAN includes at least two WAN connections and leverages two or more different networks (MPLS, broadband internet, 3G/4G, etc.).

- SD-WAN leverages hybrid WAN in an active/active configuration, and it also includes
  - a centralized, application-based policy controller;
  - analytics for application and network visibility;
  - a secure software overlay that abstracts underlying networks; and
  - an SD-WAN forwarder (routing capability).

- Technically speaking, the SD-WAN solution provides dynamic application policy and traffic management through leveraging a central controller. This enables it to deliver:
  - Application-defined intelligent path selection across WAN links (MPLS, broadband internet, LTE, etc.) based on policies defined on the SD-WAN controller; and
  - Flexible and agile policy definition across all dimensions (security, performance, Class of Service (COS), reliability, availability) for all apps.

What is Industrial IoT?

IDC defines the Internet of Things as "a network of networks of uniquely identifiable endpoints (or 'things') that communicate bidirectionally using IP connectivity, typically without human interaction, using some form of automated connectivity, whether locally or globally." With IoT, firms can connect the mechanisms they use to conduct their business, analyze the data that they generate, and utilize the insight to gain greater operational efficiency, accelerate new product introduction, develop new customer engagement models, and enhance customer experience. The use cases for IoT are wide-ranging, spanning multiple industries such as transportation logistics, healthcare, hospitality, insurance, manufacturing, and retail.

Industrial IoT is the Internet of Things applied to industrial/enterprise use cases in key verticals such as manufacturing and operational resources, retail distribution, public sector, healthcare and energy and mineral industries, including oil, gas, and mining.

IDC expects the worldwide IoT market to grow to $1.3 trillion in 2020. According to IDC's Global IoT Decision Maker Survey (see Figure 1), the top factors influencing the decision to invest in an IoT strategy is dominated by factors most likely influenced by Industrial IoT use cases.

Figure 1

Top Factors Influencing Decision to Invest in IoT Strategy

Q. What is the top factor that influenced/will influence your organization's decision to create a strategy or investment in a connected sensor, system, or product solution?

	CIO Level	COO Level	CEO Level	CMO Level
Increase productivity	14.8	12.9	13.1	12.5
Improve customer service/data because of tracking behaviors or purchases	7.9	5.7	10.0	1.7
Reduce costs (i.e., fuel savings and head count reduction)	9.4	11.2	10.5	13.1
Competitive differentiation (i.e., viewed as a technology/innovation leader in the industry)	7.2	7.0	6.5	2.7
Faster/better decision making	9.6	9.4	11.6	3.9
Improve the quality your organization's product or service time to market	13.1	9.4	7.2	12.2
Create new revenue streams based on services as a result of the data generated	5.4	5.0	4.4	7.5
Process automation	10.6	11.1	6.5	6.9
Reduce maintenance costs	5.1	7.2	5.1	5.6
Improve energy efficiency	7.4	10.2	8.2	23.2
Improve customer experience	5.7	6.2	12.2	5.1
Reach new customer target segments/move into adjacent industries	3.5	3.0	3.0	5.6
Don't know	0.4	1.7	1.7	-
n =	1,310	351	235	75

Base = respondents who have already deployed or plan to launch a solution to connect sensors, systems, or products in the next 12 months or 12–24 months
Source: IDC's *Global IoT Decision Maker Survey*, August 2015

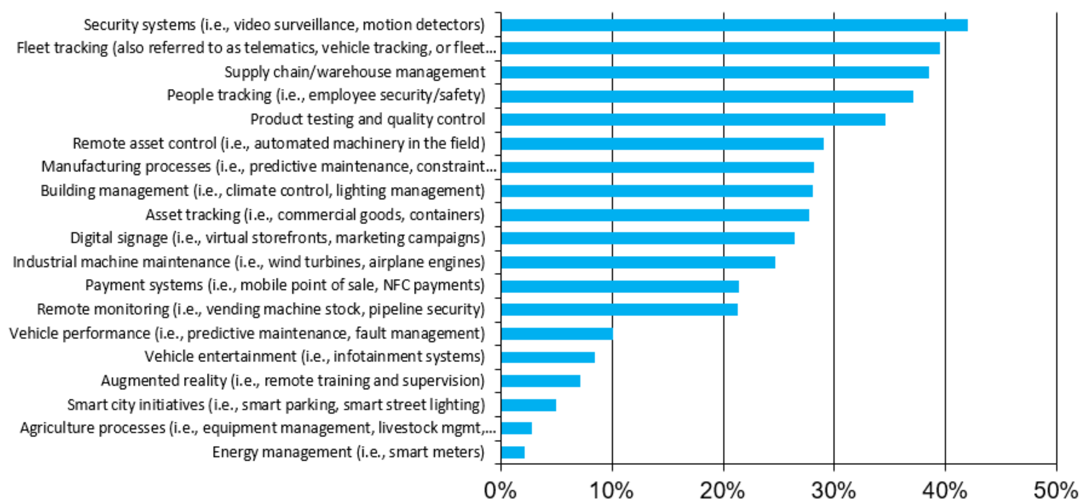
Source: IDC's Global IoT Decision Maker Survey, August 2015

Not surprisingly, the top IoT use cases that enterprises are planning to deploy are dominated by industrial use cases (Figure 2 below).

Figure 2

Top IoT Use Cases

Q. For which of the following use cases has your organization deployed or is planning to deploy connected sensors or devices?



Source: IDC's Global IoT Decision Maker Survey, August 2016 (n = 202, Western European sample)

This underpins IDC's Asia/Pacific Industrial IoT Install Base Forecast below.

Figure 3

Asia/Pacific excl Japan IoT Cellular Wireless Connections in 000s and Spending in US$ M, 2016-2021

	2016	2017	2018	2019	2020	2021	CAGR 17-21
Animals	8,063.8	10,086.4	12,607.0	14,423.7	15,580.9	16,854.0	15.9%
Buildings	15,473.7	21,345.8	29,379.5	40,308.5	55,091.8	75,169.1	37.2%
Enterprises/ Industrials	27,085.5	33,021.8	40,313.2	49,725.9	61,767.2	70,469.8	21.1%
Home	24,429.9	31,653.9	40,923.3	52,088.6	65,979.7	88,738.4	29.4%
Public Structures	2,219.1	2,550.9	2,955.5	3,456.4	4,079.8	4,833.6	16.8%
Telecom Infrastructur e	362.5	414.0	471.3	536.7	613.1	680.7	13.4%
People	1,833.4	4,746.0	11,588.2	22,651.3	37,276.6	65,857.7	104.7%
Total	79,467.9	103,818.7	138,237.9	183,191.0	240,389.1	322,603.3	32.3%
Growth %		30.6%	33.2%	32.5%	31.2%	34.2%	

Source: IDC, 2017

What is Wireless SD-WAN?

Wireless SD-WAN is a special case of SD-WAN designed to address the needs of non-consumer, industrial operations, and manufacturing companies. Most initial deployments of SD-WAN in an industrial/manufacturing context utilize multiple wireless, and in some cases fixed, links – all disparate networks integrated to form a hybrid WAN. Wireless links that could be utilized include cellular networks (4G/LTE) of different service providers, satellite networks, or networks based on unlicensed spectrum such as Wi-Fi, Bluetooth, LoRa, or SigFox.

As is the case with a typical SD-WAN deployment, Wireless SD-WAN includes all four components described in the previous section with two key differences:

- The presence of an SD-WAN forwarder with wireless routing capability; and
- An IoT aggregation/concentrator gateway function that aggregates data streams from multiple sensors.

In most Wireless SD-WAN deployments (similar to SD-WAN deployments) the policy/orchestration controller is a virtual network function (VNF) hosted on a server in a centralized cloud datacentre. Application policies are defined on the central controller. Based on these policy definitions and, the visibility gleaned across connections on the network, the controller implements dynamic routing of application traffic across connection types thus driving appropriate application policy outcomes in terms of performance, reliability, security, and availability.

How does Industrial/Wireless SD-WAN enable Industrial IoT?

Industrial IoT use cases are typically mission-critical for industrial enterprises. For instance, a typical machine used in a manufacturing context could potentially have thousands of sensors/IoT devices monitoring all key processes on the machine. Each of these processes is vital to the business and the use case is dependent on a reliable, highly available and low latency connection. It is impractical to provide wired connectivity to this multitude of sensors, hence IoT devices in an industrial context are typically accessed over wireless networks.

As some of these use cases increase in importance to the success of the business, the applications consuming the IoT sensor data become more sophisticated and key drivers of competitive advantage for the enterprise, the need for always-on ubiquitous connectivity, performance in terms of bandwidth and latency, and security are increasing in importance. Moreover, it is prudent to provide each sensor with more than one wireless connection in order to ensure a reliable, always-on connection. This, in essence, is the genesis of a hybrid IoT WAN. Depending on the use case, the hybrid IoT WAN can be made up of cellular connections from two different service providers or could be a combination of a cellular and an unlicensed spectrum alternative such as Wi-Fi or a satellite network connection. Ensuring seamless, sub-second failover, uninterrupted sessions, and backup across the network connections that make up the hybrid WAN is a key requirement of Wireless SD-WAN.

The bottom-line is that a Wireless SD-WAN enables an enterprise to provide secure, always-on, policy-driven, high-performance connectivity for IoT apps to their respective sensors across a hybrid wireless IoT WAN. IDC believes this functionality is emerging as a key element of enabling successful IoT use cases, particularly in the industrial context. The common theme across all use cases (discussed in the next section) of Wireless SD-WAN is the need for redundant, always-on, reliable wireless connectivity to monitor and track highly valuable assets or situations. While we believe Wireless SD-WAN can be applicable in a variety of verticals, we briefly outline a few in the section below.

Key Use Cases for Wireless SD-WAN

- **Logistics & Transportation, including Maritime**: Tracking and monitoring of valuable cargo and transportation assets is a popular use case of Industrial IoT. Providing effective wireless (Wi-Fi) connections to passengers in public transport by effectively aggregating several Wireless Connectivity options is another growing use case. These use cases assume an added degree of effectiveness with the use of Wireless SD-WAN.
- **Public Safety Infrastructure Management**: Live video streaming of important public assets and situations is an increasingly important use case. Besides video streaming, another important public safety use case growing in importance is Automatic Number Plate Recognition (ANPR). The importance of redundant, high-bandwidth connectivity enabled by Wireless SD-WAN is critical in ensuring public safety goals are effectively addressed across the globe.
- **First responders**: This use case is related to public safety and includes police body cameras, police automobile front and back cameras, as well as drones and body cameras for firefighters.
- **Healthcare**: Emergency healthcare can be greatly enhanced if vital biodata of the patient can be transmitted in real time by live video feeds. Remote monitoring of seniors is also a critical healthcare use case that is gaining in importance and has the potential to benefit significantly from the use of Wireless SD-WAN.
- **Manufacturing**: As discussed in the previous section, manufacturing with the increasing use of automated machines and robots lends itself to the use of Wireless IoT to improve efficiencies on the shop floor and improve yields. Wireless IoT enabled by Wireless SD-WAN across Wi-Fi and cellular connection on the manufacturing floor is a very promising use of Wireless SD-WAN.
- **Retail POS:** Wireless POS terminals can be deployed in retail stores, temporary retail environments, and ad-hoc environments such as a flea market or farmers' market. The ability to provide redundancy with VPN security makes for an ideal use case for Wireless SD-WAN.
- **Construction**: Construction typically involves the use of expensive equipment, often times in remote areas where the only form of communication available is satellite. In these situations, where monitoring equipment via video over unreliable connections is an important requirement, wireless SD-WAN can enable more reliable communication.
- **Utilities and resources**: This use case includes the use of wireless SD-WAN in a distribution grid and high-value/critical asset monitoring, autonomous mining vehicles, precision agriculture drones, and maintenance services.
- **Telecommunications enablement (microwave, LPWAN, satellite):** A key emerging use case for wireless SD-WAN is the telecom enablement of non-traditional connectivity options such as microwave, LPWAN, and satellite by connecting them in a redundant fashion to multiple cell towers.

Critical Technology Enablers of Wireless SD-WAN

- **Cloud-based centralized control**: A key element of Wireless SD-WAN is the centralized controller that implements policy across all IoT connections based on global visibility across the network.
- **Network and operator link path redundancy**: A key function of wireless SD-WAN is the ability to provide network and operator link path redundancy for every wireless connection between the IoT device and the edge node to ensure always-on, reliable, and highly-available connectivity. The SD-WAN forwarder performs dynamic routing across the available connections to fulfil this need.

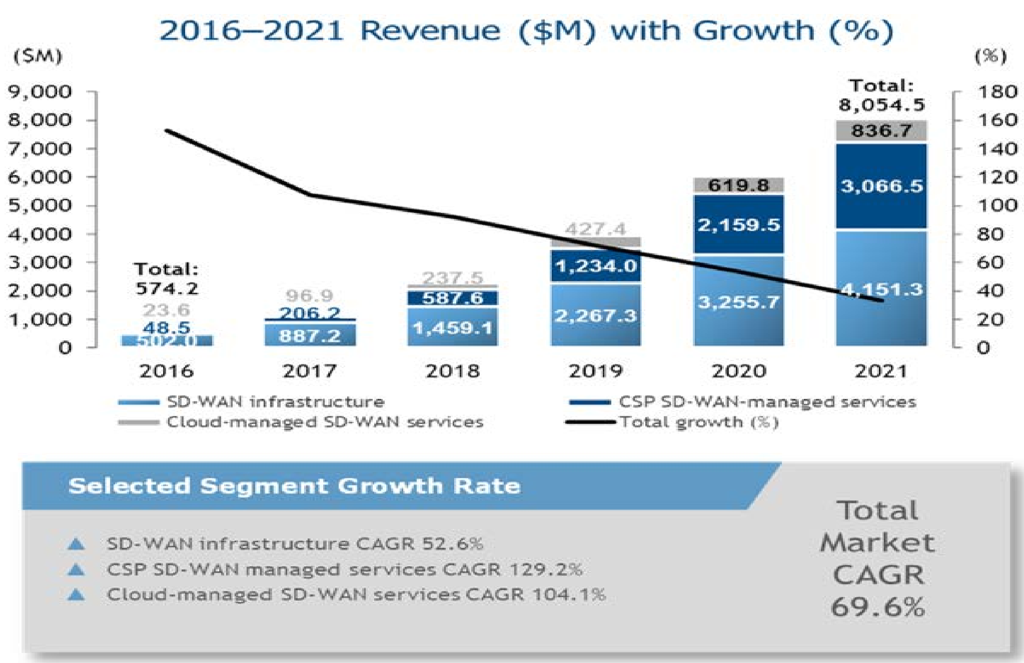
- **VPN Bonding**: In wireless SD-WAN, point-to-point connections have redundancy built-in. VPN security via tunneling should failover the redundant connections. With VPN bonding, it is possible to create a single, logical VPN connection across multiple WAN connections and allow for packet level failover for a single user session.
- **WAN Bonding/Mobile Bandwidth aggregation**: WAN bonding performs bandwidth aggregation, allowing all links to be used almost all of the time (even by a single IP session), and performs real-time traffic engineering, with sub-second reactions to WAN link failure and congestion.
- **Seamless network failover and backup**: In the enterprise/industrial setting, seamless sub-second failover, uninterrupted sessions, and backup are mission critical for many (if not most) use cases. For example, in the highly volatile environments of oil and gas exploration and production, oil and gas companies go to great lengths to ensure that VSAT backup and failover are put in place in remote locations.
- **WAN smoothing**: WAN smoothing is a feature in which the network router/appliance can smooth out traffic flows across multiple VPN-WAN links to mitigate IP packet loss that might occur in VoIP and video conferencing/video streaming.

IDC's Assessment of Market Potential/Forecast

Given the early days of the SD-WAN market, and the fact that it is addressing pressing enterprise needs, the SD-WAN global market is seeing remarkable growth rates. For the 2017–2021 forecast period, IDC foresees growth well above the rate of the greater network infrastructure market. By 2021, IDC believes the global SD-WAN market will reach $8.05 billion, representing a five-year Compounded Annual Growth Rate (CAGR) of 69.6%.

Figure 4

Worldwide SD-WAN Market Forecast 2016-2021



Source: IDC, 2017

As indicated above, the SD-WAN infrastructure segment is expected to grow from $502M in 2016 to $4.15B in 2021 at a CAGR of 52.6%. IDC estimates, by 2021, the Wireless SD-WAN infrastructure market segment will be 15-20% of the overall global SD-WAN infrastructure market.

Overview of Peplink's Wireless SD-WAN Solution for Industrial IoT

Peplink has designed its SD-WAN solution from the ground-up to serve the needs of the Industrial IoT market. While the solution has the capability to serve the needs of the typical branch-headquarters enterprise use case, given its design point, we see it delivering unique benefits for the Wireless SD-WAN market. IDC sees two software components – the InControl 2 SD-WAN Controller and the SpeedFusion VPN Bonding engine – as key sources of competitive advantage for Peplink in the Industrial IoT market.

Central to Peplink's Wireless SD-WAN solution is the InControl 2 Cloud-based SD-WAN controller. As a fully featured SD-WAN controller, InControl 2 provides device administrators and managed services providers with all the remote support and monitoring capability required to manage hundreds and thousands of devices deployed in the field. The included remote web admin functionality provides secure direct to device management interface access - even when deployed devices are behind customer firewalls and routers. The combination of enhanced remote monitoring, management, and reporting features included in InControl 2 reduces both initial configuration and ongoing support overheads, while allowing managed service providers to efficiently and effectively provide unbreakable connectivity to their service users.

Another key differentiating technology which IDC believes makes Peplink’s Wireless SD-WAN solution compelling for the Industrial IoT use case is the SpeedFusion VPN Bonding engine. With VPN bonding, it is possible to create a single, logical VPN connection across multiple WAN connections and allow for packet level distribution of a single user session. This allows for session persistent failover during individual WAN outages. Considering the need to have always-on redundant connections in mission-critical Industrial IoT use cases, VPN security enabled by SpeedFusion tunneling is able to fail-over multiple connections at the packet level. A related feature in Peplink’s solution is the capability to perform WAN Bonding – the aggregation of mobile bandwidth across all links – and to use all of them in an active-active fashion by spreading single session packets across connections.

Peplink also provides a family of Wireless Routers customized to individual use cases. Considering the wide diversity of Industrial IoT use cases, IDC views the purpose-built family of routers as prudent to addressing the specific requirements of each use case. These routers perform dynamic routing and path optimization across multiple wireless links in response to policy driven by the InControl 2 Controller. They also perform WAN smoothing to smooth out traffic flows across multiple VPN-WAN links to mitigate IP packet loss, which is a significant requirement when VPN bonding is used over multiple wireless connections.

IDC sees the unique, software-driven capabilities of Peplink's SD-WAN solution as particularly compelling for the Industrial IoT use case of Wireless SD-WAN. Considering most of the advantage is in software and the solution features the requisite separation of the data and control plane, IDC believes the solution can scale efficiently to meet the requirements of large, mission-critical Industrial IoT networks of the future. IDC notes that Peplink's EPX Wireless SD-WAN router can support 18 cellular connections and over 5000 users/devices.

However, we caution that potentially larger rivals could enter this space as operational technology companies/conglomerates start to look to enhance their communications architecture for connected assets and take advantage of SD-WAN. Thus, Peplink will need to invest its resources wisely to build the requisite alliances and partnerships to reach the potentially huge and high-growth industrial IoT market in the future.

A B O U T   T H I S   P U B L I C A T I O N

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