

Redefine Connectivity by Building a Network to Support the Internet of Things

How billions of connected devices will change the shape of networks

The impact of connected devices

Connected devices will generate a massive amount of data in the next few years, but the Internet of Things (IoT) covers a broad range of applications. It covers everything from cars and industrial machinery to weather monitoring stations, street lights, and even connected cows.¹ Connected cars can generate gigabytes of data that need to be uploaded. At the other end of the scale, equipment sensors might need to connect more frequently but only send small amounts of data at a given time.

If you're planning to use IoT devices or the data they generate, you need to consider several key questions:

- What data will the devices generate and how does the data get from the device to the aggregation point?
- From the aggregation point, what happens to it and where?
- How many different parties are involved at each stage of this journey? And can they all guarantee data security?

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A market on the move

The IoT marketplace is changing rapidly. Consider these recent facts and statistics. According to Gartner, by 2023 the average CIO will be responsible for more than three times the endpoints they manage in 2018.² The GSMA predicts that there will be 25 billion IoT connections by 2025.³ Gartner also expects that there will be more than 600,000 autonomous vehicles on the roads worldwide by 2025.⁴ Netscribes claims the UK is set to have around 2 million 5G SIM machine-to-machine (M2M) mobile connections by 2022.⁵

The impact of these new connections will be felt around the world, and dealing with them will require a significant change in how businesses manage data. It also will affect the networks that transport the data and the businesses involved at each stage. Even if businesses aren't planning to deploy IoT devices today, the odds are that it will affect their customers, suppliers and partners.

The backbone of these networks will be the fiber that links data centers, public clouds, core networks, and mobile access points across towns and cities. However, coping with IoT devices will require a network that is different in shape and scope.

Getting data from the devices

Just as there is no one size fits all approach to the data IoT devices generate, the same is true for how they connect to networks. Some devices will use cellular connections (3G, 4G, and 5G), others will use Wi-Fi, and others will use open or proprietary mesh networking standards. All of the devices will generate data that needs to be transferred, processed, and stored.

A key difference will be in how this data is stored and managed. Cisco's Global Cloud Index estimates that nearly 850 Zettabytes (ZB) will be generated by all people, machines, and things by 2021. This number is up from 220 ZB generated in 2016.⁶ Yet only around 10 percent is classed as useful data. In fact, there will be 10 times more useful data being created (85 ZB, 10 percent of the 850 total) than will be stored or used (7.2 ZB) in 2021. Useful data is also predicted to exceed data center traffic (21 ZB per year) by a factor of four.

Unlike much of the data generated by consumer devices or business applications, IoT data can be treated differently because most of it won't need to be stored. The value will come from analysis of the big data pools generated. For example, the data from a single piece of industrial machinery may not be useful unless it flags readings outside of safe limits. But when this data is matched with data from hundreds of others it's possible to predict future faults and plan maintenance. This big data analysis will drive significant value, and how this data is transferred and processed will be key to its success.

The challenges will be in managing this traffic and ensuring that processing is done in the most efficient location, rather than relying on the same approaches that worked with legacy networks.

Where does the data go?

Rather than sending everything back to a core network, edge computing enables common processing tasks to be carried out closer to the devices themselves. This configuration minimizes the amount of data that needs to be transferred long distances and reducing latency for users.

According to analyst group Analysys Mason, the edge is defined as a set of network-connected cloud locations for content delivery and application processing that is deployed close to users (with a less than 20 millisecond latency). Although there are differing interpretations of the edge of the network, from an IoT perspective,

it means collecting and processing more data at data centers that are closer to users and devices rather than sending it back to a core network or customer site.

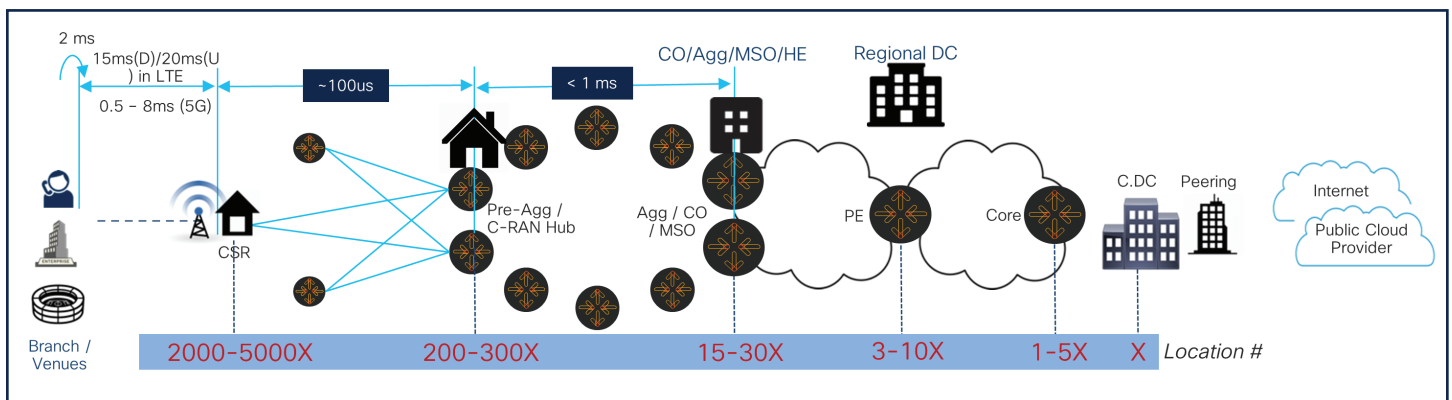
Processing at the edge also changes the business case for companies that are offloading workloads to the public cloud. The cost of running applications at the edge of networks is likely to be higher compared with public cloud. However, the costs can be offset by reducing the need to backhaul large volumes of data.

Enterprises with a presence across multiple geographies, such as large industrials like transport, manufacturing, and healthcare are moving to edge computing. These enterprises have high data processing requirements, large numbers of mobile assets or customers and will probably already be working with software defined networking (SDN) and the multi-cloud environment.

In many ways, the networks powering edge computing will look the same. Businesses still need reliable, high-speed connectivity and secure links to public and private clouds. The difference is that companies will require a network that offers not just deep fiber density in metropolitan locations, but one that has connections into key central and edge data centers.

According to Equinix, Global Interconnection Bandwidth capacity is projected to grow 10 times larger than IP traffic by 2021.⁷ Planning efficient ways to process and collect data from IoT devices will become even more important. The partnerships between cloud and data center providers and the networks will also be essential.

Figure 1. Processing at the edge reduces latency, with 10-20 ms from user to app considered the sweet spot.



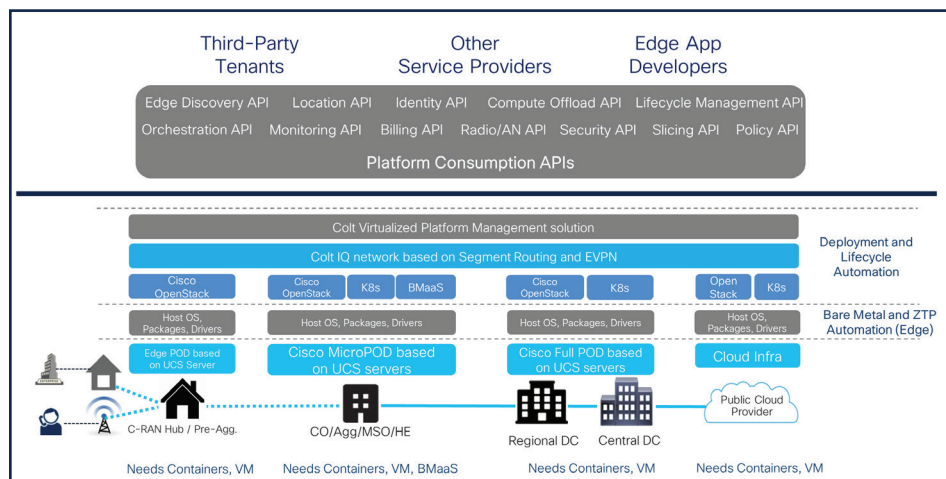
5G and the edge

Although 5G is still developing, it will have a big role to play in the edge computing and IoT market. Many of the promised applications for 5G rely on ultra-low latency, which will require edge computing. As 5G services roll out and more resources are deployed at the network edge, it will drive economies of scale for companies that want to take advantage of the IoT. Whether that's using 5G to connect remote nodes or sensors or just using the edge compute centers, as 5G gains traction it will drive the IoT market.

Colt, Cisco, and the IOT

Colt and Cisco are working together on a virtual services platform, which provides compute, storage, and network services from an enterprise data center (DC) to the public cloud and to the network edge using a single pane of glass system. As part of this project, Cisco is providing virtualization infrastructure to deploy IoT applications closer to the edge of the Colt IQ Network. It is using the programmability, automation, and visibility provided by Colt to meet service level agreements for IoT deployments.

Figure 2. The Colt and Cisco Virtual services platform.



Do you know where your data is going?

The IoT ecosystem will be unlike any other in the sheer number of companies involved at every stage. A single IoT deployment could involve more than a dozen different players that cover multiple ecosystems. With 25 billion IoT connections on the way, the impact will be felt far and wide.

The ecosystems supporting the IoT need to be well tested and secure because adding more parties to data management and transfer will increase the number of potential vulnerabilities in the network. A KPMG survey of 750 tech leaders identified the IoT as the trend driving the greatest business transformation in the next three years.⁸ It also predicted that IoT will lead to the next indispensable consumer technology. It also has the greatest potential to drive the greatest benefits to life, society, and the environment.

This growth in ecosystem partners has a significant impact on data security. Worldwide IoT security spending is to increase by 300 percent to \$6 billion by 2023 according to a study by Juniper Research. The report says that this increase will be among product and service providers in consumer markets and customers in industrial and public services.⁹

Keeping control of data security at every step in its journey will be critical. Businesses should ensure that they know exactly who has access and where. In particular, they need to know whether data is traveling over a single network or multiple providers. Although much of the focus is on the users and applications, protecting in-flight data across the network is a critical component of a holistic IoT security strategy.

When it comes to making the most of these new IoT ecosystems, the companies who derive the greatest benefit will be the companies that have the strongest partnerships and who take the time to build relationships.

The IoT in action: transportation use case



Transportation is an example of how the IoT will change ecosystems and business models. It's also an area with considerable potential. The connected car market alone is expected to be worth \$225.16 billion by 2025, according to a report by Allied Market Research.¹⁰

Transportation includes connected vehicles, smart cities, and public transport. Consider how the answers to the questions posed earlier apply to this use case.

What data will the devices generate and how does the data get from the device to the aggregation point?

In transportation, some data will need to be sent instantly, such as reporting a crash, major faults, or real-time location data. However, sending performance data or planning for scheduled maintenance can take place at set times.

5G is often touted as a solution to uploading data on the move, and many cars already have 3G or 4G SIM cards. For street furniture such as traffic lights, benches, and bus stops, easy access to fiber networks will be essential for applications generating large amounts of data. Alternatively, wireless mesh networks can be used for applications such as street lighting. The challenge will be for new applications that rely on near real-time upload and response, which is where the low latency offered by 5G will come into play.

Low latency also applies to data going in the other direction. Sizeable updates can be downloaded in garages or during scheduled maintenance, but on-demand content can be streamed over cellular when users demand it.

From the aggregation point, what happens to it and where?

The new transport ecosystem is complex and different manufacturers and vendors are taking different approaches. Given the wide variety of ways in which data will be transmitted, it must be brought together at central aggregation points, whether the point is managed by the wireless or wired network operator or the device owners.

Learn more

To learn more about the changes you need to make to your network to take advantage of new opportunities related to the IoT, visit:

www.cisco.com/go/5g-transport

To find out more about the network that connects the digital society, visit

www.colt.net/digitalsociety

From there, critical data that requires a rapid response can be processed in an edge location, requests for other content can be directed to the content owner, and maintenance data can be sent back to manufacturers. As consumers demand more content and instant responses, having content and intelligence at the edge of networks will be an efficient way to manage the increase in traffic.

How many different parties are involved at each stage of this journey? And can they all guarantee data security?

The ecosystem will vary by manufacture and country, but partners will include cellular connectivity providers, wireless and wired network operators, neutral host network partners for coverage in dense urban areas, fiber backhaul to an edge datacenter, and potentially a different provider to connect back to the core network and then from there to the manufacturer.

Organizations such as the 5G Automotive Association (5GAA) have been established to bridge the gap between the automotive, technology, and the telecoms industry and help enable the next generation of connected cars. Other groups are performing a similar function in other application areas.

How to prepare for the IoT

The IoT is already here, and its impact will only continue to grow as new devices come online and as 5G services are rolled out. Connectivity, particularly into aggregation points and edge data centers, needs to be at the top of planning discussions.

Regardless of how the IoT might impact a business, or how the data is gathered and transmitted for the devices being used, preparing high-speed, secure fiber networks today will enable businesses to quickly take advantage of the IoT, regardless of the form it takes.

1 Financial Times. "Meet the connected cow." <https://www.ft.com/content/2db7e742-7204-11e7-93ff-99f383b09ff9>

2 Gartner, *Top Strategic IoT Trends and Technologies Through 2023*. Nick Jones. Published 21 September 2018

3 <https://www.gsma.com/newsroom/press-release/new-gsma-study-operators-must-look-beyond-connectivity-to-increase-share/>

4 <https://www.bbc.co.uk/news/business-45048264>

5 <https://5g.co.uk/news/24-million-5g-sim-connections-in-uk/4270/>

6 Cisco GCI <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/global-cloud-index-gci/white-paper-c11-738085.html>

7 <https://equinix.app.box.com/embed/s/2pbdy7neghvk8yrgwdyxm9eayq4vzh>

8 KPMG, *The Changing Landscape of Disruptive Technologies*, 2018

9 *The Internet of Things for Security Providers: Opportunities, Strategies & Forecasts 2018-2023*.

10 <https://www.verdict.co.uk/connected-car-market-225bn-2025/>