Make Room For The Autonomous Edge In Your IoT Strategy

Understand The Different Types Of Edge And How They'll Shape Your IoT Initiatives

by Paul Miller

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Why Read This Report

"The edge" is important in internet of things (IoT) deployments, but different domains (and vendors) offer contradictory explanations for what it is and why it demands your attention. This report steps back from discussing specific technologies and products to help infrastructure and operations (I&O) professionals understand how four key edge usage patterns should fit within their IoT strategy.

Key Takeaways

The Edge Is Nebulous

Everyone's talking about the edge, or edge computing, but there's little shared understanding about what these terms mean. For IoT use cases, it's more useful to plan for four flavors of edge: sensing edge, actuating edge, stateful edge, and autonomous edge.

The Edge Is A Place And A Way Of Working

Being explicit about the use cases that edge is tackling within your IoT strategy makes it easier to address challenges as they arise and simpler to identify the value that it contributes.

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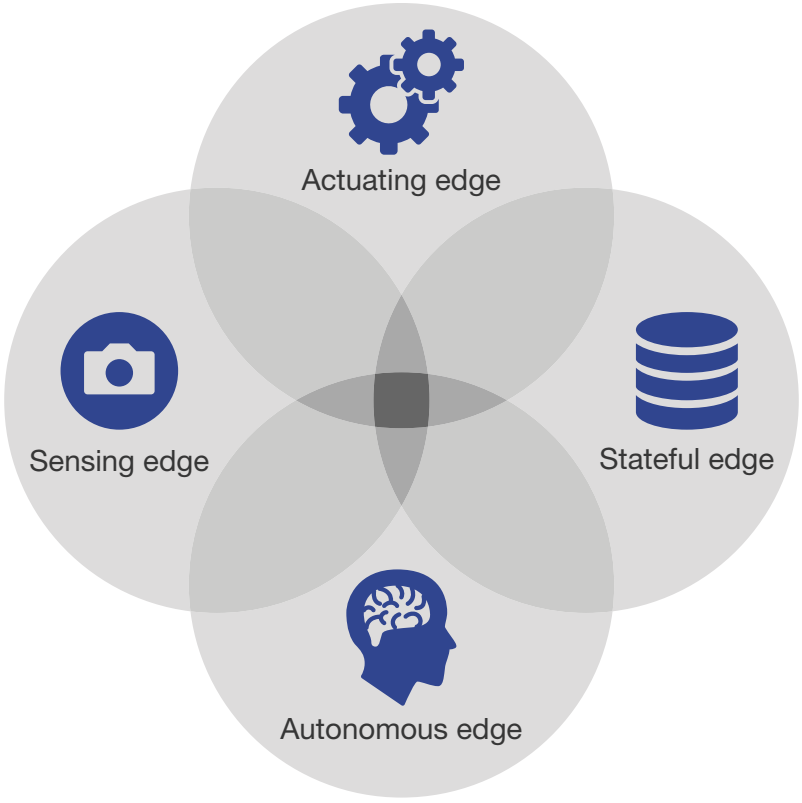
There's More Than One IoT "Edge," Defined By Context And Need

Look out from the windows of a telco's network control room, and the edge of that world is easy to understand: The cell towers at the extremities of the network's map mark it. Beyond that, in the uncontrolled mess of customers' cell phones and connected cars? There lie dragons. But, increasingly, the edge matters to more than just telecom providers. IoT direct spend will exceed $400 billion by 2023, and I&O professionals must understand the significance and complexity of this world beyond their data centers — the edge — if they're to translate spend into results.[1] Use cases are diverse and include connected production lines inside factories on the other side of the world, connected cars on the roads of China, remotely controlled wind farms off the wild north coast of Norway, or predictively maintained trains speeding across the UK.[2] In the context of IoT, we define four broad categories of edge (see Figure 1).

- **Sensing: gathers data to create context.** The simple use cases we refer to as the sensing edge will initially drive much of the predicted growth in IoT. Small, cheap, low-power sensors propagate through the environment to measure everything from light, temperature, wind, or vibration to the opening of doors. This class of edge sensor lacks the ability to interpret or act upon the data it collects and must rely on intelligence elsewhere to transform the stream of ones and zeroes into actionable insight. Sensors in the bedroom or kitchen, for example, simply transmit the temperatures they observe to a more capable smart thermostat or boiler elsewhere in the home; that more-intelligent device must interpret the data, compare it with homeowner preferences and external weather data, and decide when to produce more heat.
- **Actuating: extends control into the field.** Certain use cases require action, and the actuating edge consists of an increasingly diverse set of connected actuators and related devices that can affect their physical environment. This class of edge device lacks the ability to sense much more than its own state and must rely on intelligence elsewhere to formulate and deliver instructions. Day after day, small, cheap, low-power devices on the actuating edge close valves, activate pumps, angle turbines into the wind, switch trains from one track to another, or lock doors, all under the control of some remote intelligence, either human or virtual.
- **Stateful: addresses erratic connectivity.** IoT sensors and actuators must often perform in locations a world away from the order and ubiquitous connectivity of the enterprise data center. Extreme operating conditions and intermittent communications with far-off data centers mean that IoT-enabled solutions must be designed to cope with the unexpected. These devices may require local storage or computational ability to preserve data that cannot transmit immediately or to make decisions when the remote control room is unable to send instructions. For example, both isolated wind farms and deep-sea research vessels use expensive cellular or satellite connections to transmit critical messages. But the mass of background data about a changing climate or the manner in which components wear is stored locally for collection during a scheduled visit by maintenance engineers or for offloading during a stay in port.[3]

› **Autonomous: has the intelligence to make decisions locally.** Increasingly, IoT use cases expect or require an element of local decision making. Autonomous edge is comparable to the concept of edge computing. On the autonomous edge, cameras watch station platforms or industrial processes, and locally deployed algorithms make the call to redirect passengers, alert the police, or flag a set of products for quality control.[4] While both sensing edge and actuating edge see cheap devices controlled remotely, the picture is more complex on the autonomous edge. Devices are more capable and more expensive, but they remain unlikely to operate entirely in isolation. Advanced machine learning models may run on the autonomous edge, but those models were almost certainly built — and will be regularly refined — in the cloud.

FIGURE 1 Four Overlapping Categories Of Edge Matter In IoT Use Cases



New Use Cases Increase The Need For The Autonomous Edge

There's value in each of the four edge types and in use cases that combine two or more. But for I&O professionals, the autonomous edge is the most similar to the computers, networks, and applications in their data centers, making this a natural focus for their attention. Forrester defines the autonomous edge, or edge computing, as:

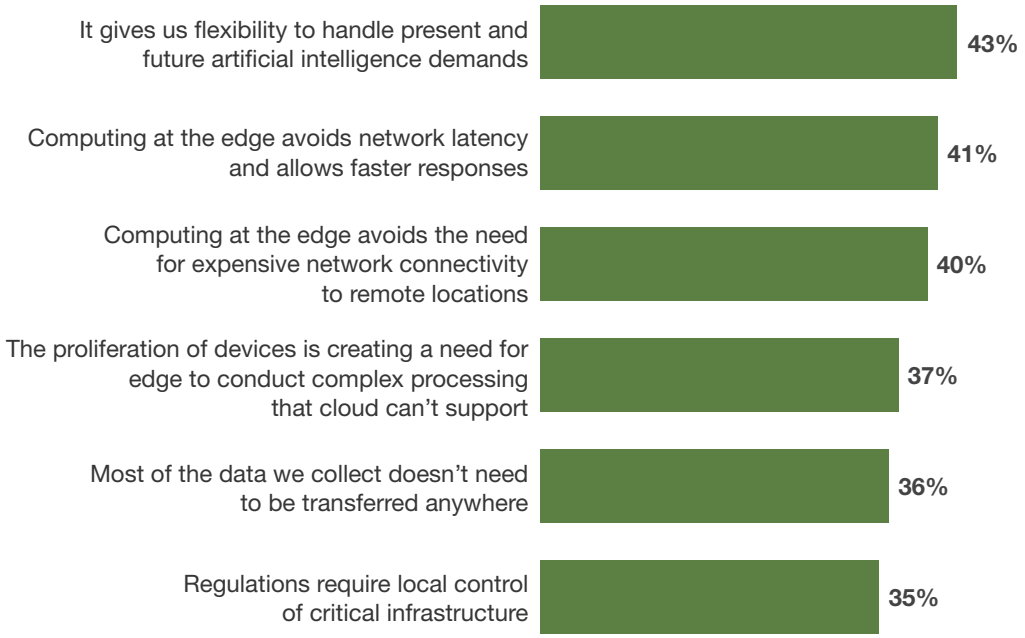
> *A family of technologies that distributes application data and services where they can best optimize outcomes in a growing set of connected assets. It includes edge infrastructure and edge analytics software.*

Organizations recognize the value of the autonomous edge because it (see Figure 2):

- **Unlocks new data-driven businesses.** Autonomous vehicles generate a terabyte of data every day and must interpret and act on at least some of that in real time.[5] Without the autonomous edge, self-driving cars wouldn't be joining our roads. Similar use cases lead 43% of global telecom decision makers to highlight the importance of the autonomous edge's ability to handle present and future artificial intelligence demands. And 37% recognize its role in conducting the complex onsite processing that the cloud can't easily support, as 13.8 billion connected devices will insert themselves into every aspect of our lives by 2023.[6]
- **Simplifies the (very) wide-area network.** The lack of affordable global high-speed connectivity hinders adoption of data-intensive applications in the field. In offshore oil and gas production, a drilling rig might generate 1 to 2 terabytes of data per day but be tenuously connected to shore by an expensive satellite connection capable of transmitting 2 Mbps at best; if any significant portion of the data needs prompt analysis, it can only be done on the rig.[7] Forty-one percent of global telecom decision makers recognize that increasing local computing capacity reduces the problem of network latency, and 40% see it as a way to avoid paying a premium to provide expensive connections to remote locations.
- **Eases unnecessary data transport and retention.** Thirty-six percent of global telecom decision makers believe that most of the data collected at the edge isn't needed anywhere else in their organization. Similarly, 35% highlight regulations that may require control systems for critical infrastructure to be capable of acting locally. On the autonomous edge, locally collected data can be processed locally, used locally, and then discarded or archived once no longer needed, avoiding unnecessary reliance on expensive and perhaps intermittent network connectivity.

FIGURE 2 Global Telecom Decision Makers Highlight The Benefits Of Edge Computing

"Which of the following do you believe are the biggest benefits to your organization's using edge computing?"



Base: 1,960 global telecommunications decision makers whose firms are planning, implementing, or expanding edge computing
Source: Forrester Analytics Global Business Technographics® Mobility Survey, 2018

Address Security And Complexity Early

The challenge of securing systems and infrastructure grows dramatically when those systems are situated in public places, possibly thousands of miles from the nearest responsible security professional. Network firewalls, physical walls, padlocks, key cards, and watchful people simply don't cut it out in the big bad world.[8] Security is the most commonly cited barrier to autonomous edge ambitions: 31% of global telecom decision makers listed it as among the biggest barriers (see Figure 3). Almost half (49%) of global technology security decision makers plan to increase IoT security spending by 5% or more in 2019.[9] Even once security is under control, I&O teams must:

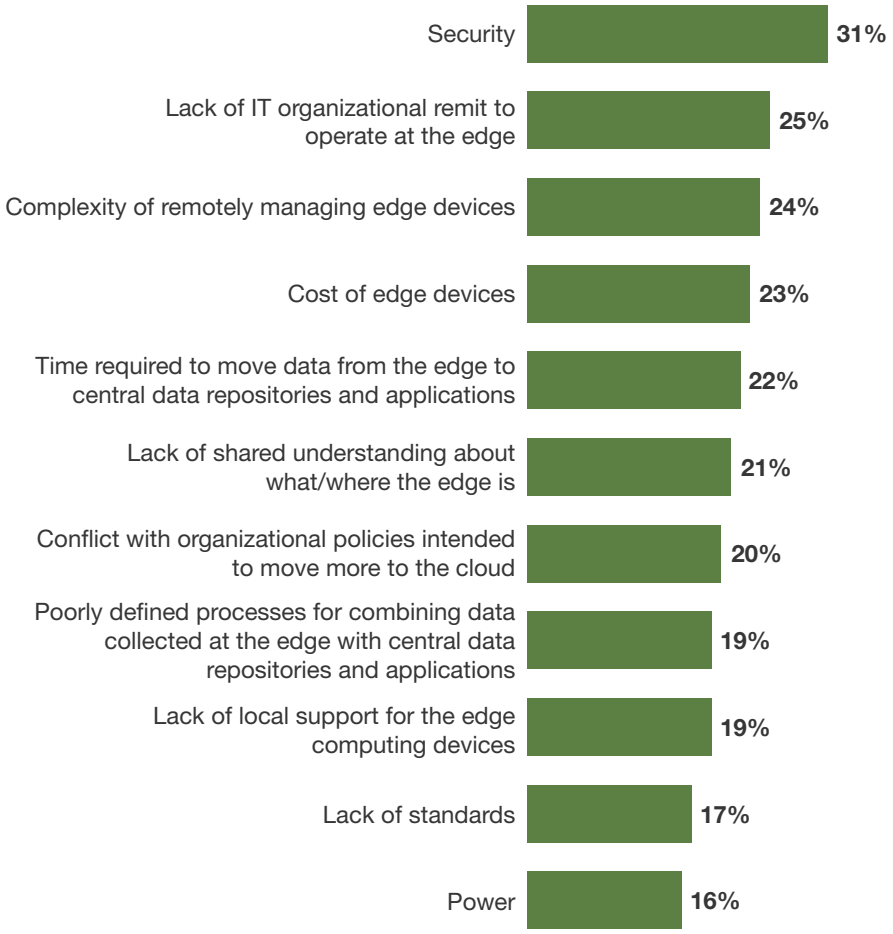
› **Build consensus and new ways of internal collaboration.** IoT use cases are already complicated by turf wars, confusion, miscommunication, and a lack of shared goals between the IT and operational technology (OT) groups within most industrial firms. Out on the edge, things are worse: 21% of global telecom decision makers admit to a lack of shared understanding about what —

or where — the edge is, and 25% note the lack of a clear remit for the IT organization to operate at the edge. Also, 20% say that autonomous edge use cases appear to conflict with cloud-first policies inside their business.

- **Create edge device management strategies.** It's still early days in the commoditization of augmented edge devices. Costs are falling for sensing edge and actuating edge components, but more complex requirements on the augmented edge lead global telecom decision makers to highlight device costs (23%), the complexity of managing devices (24%), and the lack of local support for them within existing teams (19%). And 17% point to a lack of standards, although community projects such as EdgeX and StarlingX are finally making some progress in this area.[10]
- **Design networks to support data transfer.** Even on the autonomous edge, with its ability to process and act upon data in situ, there's a recognition that at least a subset of data will need to be transferred elsewhere: 22% of global telecom decision makers see network latency as a concern. Nineteen percent of global telecom decision makers see the complexity of deciding which data to send and how to amalgamate it with data from elsewhere as a barrier. Any requirement to alter models and processes centrally before transmitting some subset of data back to the autonomous edge adds further complexity.

FIGURE 3 Security, Complexity, Cost, And Organizational Silos Slow Adoption Of The Autonomous Edge

"Which of the following do you believe are the biggest barriers to your organization's using edge computing?"



Base: 1,960 global telecommunications decision makers whose firms are planning, implementing, or expanding edge computing

Source: Forrester Analytics Global Business Technographics® Mobility Survey, 2018

Recommendations

Understand Which Edges You Need, Then Focus Plans And Budgets

The edge is key to many current and future IoT initiatives, but it encompasses physical environments that are often alien to I&O professionals and their IT colleagues and requires modes of collaboration that challenge all concerned. To move past the hype and get beyond the current obsession with proofs of concept and relatively small localized deployments, I&O professionals must:

- **Focus on customer value and not let edge hype lead them astray.** Don't lose sight of the overarching drive to win, serve, and retain customers. Obscure connectivity protocols, extreme physical environments, and the challenge of delivering applications on constrained hardware make IoT at the edge a fun problem to work on. But understand the value to the customer, and don't get lost down the rabbit hole of tinkering, optimizing, and making possible a set of intriguing technical capabilities that no one needs or can afford.
- **Consider all forms of edge opportunity.** While the greatest potential may lie at the autonomous edge, it's also the most problematic. Today, large-scale applications on the sensing edge or the actuating edge are addressing real customer requirements. Deployments here are cheaper, simpler, and — probably — more robust. Don't discount them in your rush to deploy mind- and budget-stretching applications of artificial intelligence to the autonomous edge.
- **Bring IT and OT teams together around shared goals.** IoT use cases at the edge challenge the skills and capabilities of all concerned. Domain experts can't do it alone. Nor can I&O professionals or their colleagues in application development and delivery, analytics, networking, or security. To succeed, you need to harness a broad range of talents and be willing to push all of them beyond their comfort zone. A wind turbine operating north of the Arctic Circle operates in extreme physical conditions; the situation is equally extreme for the IoT hardware, software, and processes that make the whole endeavor viable. Focus on the end goal — a successful customer outcome — and align internal objectives to that end.

Supplemental Material

Survey Methodology

The Forrester Analytics Global Business Technographics® Mobility Survey, 2018, was fielded from April to June 2018. This online survey included 3,334 respondents in Australia, Canada, China, France, Germany, the UK, and the US.

Forrester Analytics' Business Technographics ensures that the final survey population contains only those with significant involvement in the planning, funding, and purchasing of business and technology products and services. Research Now fielded this survey on behalf of Forrester. Survey respondent incentives include points redeemable for gift certificates.

Please note that the brand questions included in this survey should not be used to measure market share. The purpose of Forrester Analytics' Business Technographics brand questions is to show usage of a brand by a specific target audience at one point in time.

Endnotes

[1] See the Forrester report "Edge Computing Will Radically Alter Your Infrastructure Strategy" and see the Forrester report "Forrester Analytics: Internet-Of-Things Spending Forecast, 2017 To 2023 (Global)."

[2] See the Forrester report "Autonomous Vehicles Will Reshape The Global Economy," see the Forrester report "IoT Transforms A 200-Year-Old Industry," and see the Forrester report "IoT Brings Firms With Remote Assets Closer To Their Customers."

[3] Source: Macy Bayern, "How edge computing transformed marine biology research at Oregon State University," ZDNet, October 1, 2018 (https://www.zdnet.com/article/how-edge-computing-transformed-marine-biology-research-at-oregon-state-university/).

[4] Source: "How automation and the Internet of Things will transform commuting and slash train delays," Wired UK, August 21, 2018 (https://www.wired.co.uk/article/internet-of-things-uk-train-delays) and Jim Camillo, "Integrated Cameras Detect Defects in Semiconductor Material," Assembly Magazine, September 15, 2018 (https://www.assemblymag.com/articles/94485-integrated-cameras-detect-defects-in-semiconductor-material).

[5] Source: Leslie Hook, "Driverless cars: mapping the trouble ahead," Financial Times, February 21, 2018 (https://www.ft.com/content/2a8941a4-1625-11e8-9e9c-25c814761640). For a broader discussion of how autonomous vehicles will reshape the global economy, see the Forrester report "Autonomous Vehicles Will Reshape The Global Economy."

[6] See the Forrester report "Forrester Analytics: Internet-Of-Things Spending Forecast, 2017 To 2023 (Global)."

[7] Source: Aaron Hand, "Oil and Gas at the Edge," Automation World, September 3, 2017 (https://www.automationworld.com/oil-and-gas-edge).

[8] See the Forrester report "The State Of IoT Security 2018" and see the Forrester report "The Top Five Emerging Technologies Security Leaders Need To Prepare For."

[9] Source: Forrester Analytics Global Business Technographics Security Survey, 2018.

[10] Source: EdgeX Foundry (https://www.edgexfoundry.org/) and StarlingX (https://www.starlingx.io).

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