Living on the Edge?

The rise of Fog Edge Computing (FEC) in our low-touch, autonomous world

orange™ Business Services

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Fog Edge Computing (FEC) promises to revolutionize traditional cloud architectures by bringing part of the processing closer to the user and the network edge.

FEC works in tandem with the internet of things (IoT) to enable brand new services and applications while improving the overall end-user experience. Its benefits include reduced latency, improved security, cost savings, reliability, and scalability.

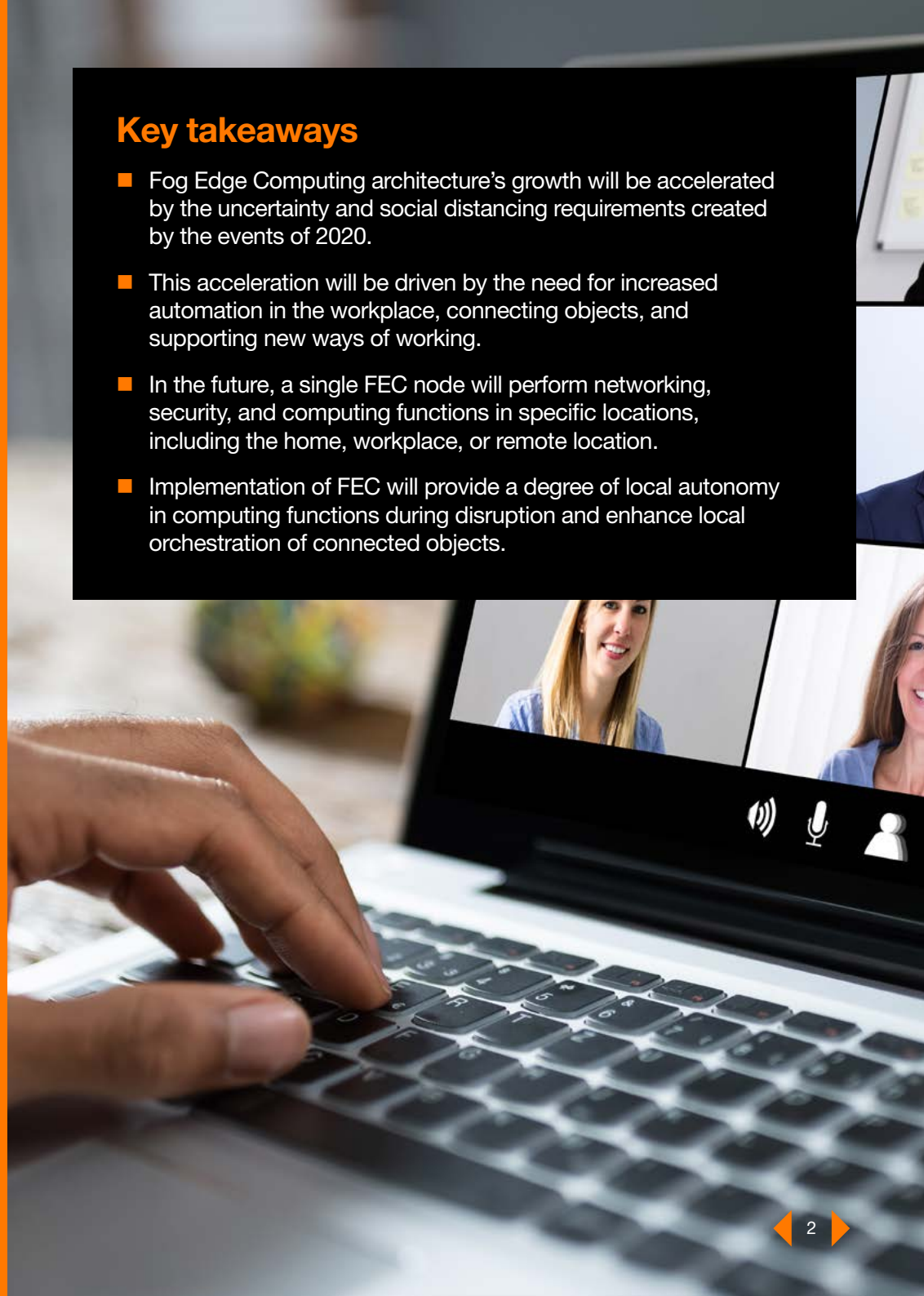
Any organization with an installed IoT base can make their first steps to deploying edge by leveraging their existing infrastructure. Already many organizations are starting to make their transition in reaction to the uncertainties caused by COVID-19. In fact, according to analyst IDC, 80% of edge investments are being driven by changed workforce and operations requirements during the pandemic.

In this paper, we look at how FEC can help the transition to a low-touch, autonomous world and its application in the office, home working environment, and Industry 4.0.

Contents

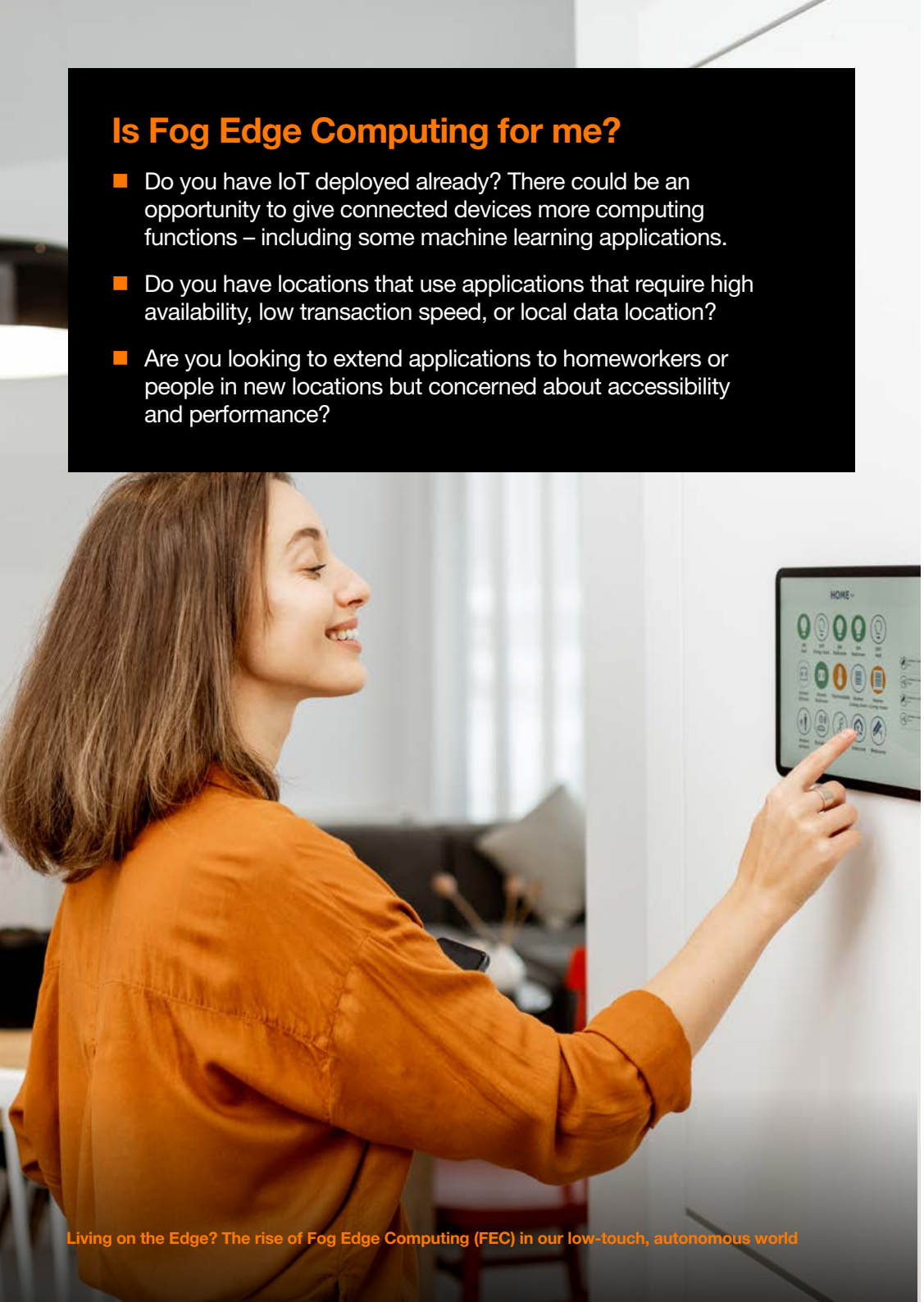
Key takeaways

- Fog Edge Computing architecture's growth will be accelerated by the uncertainty and social distancing requirements created by the events of 2020.
- This acceleration will be driven by the need for increased automation in the workplace, connecting objects, and supporting new ways of working.
- In the future, a single FEC node will perform networking, security, and computing functions in specific locations, including the home, workplace, or remote location.
- Implementation of FEC will provide a degree of local autonomy in computing functions during disruption and enhance local orchestration of connected objects.



Is Fog Edge Computing for me?

- Do you have IoT deployed already? There could be an opportunity to give connected devices more computing functions – including some machine learning applications.
- Do you have locations that use applications that require high availability, low transaction speed, or local data location?
- Are you looking to extend applications to homeworkers or people in new locations but concerned about accessibility and performance?



What is Fog Edge Computing?

Fog Edge Computing can improve the end-user experience and enable new applications by bringing processing power closer to the user.

Fog Edge Computing (FEC) means that devices at the edge of the network, such as those in the internet of things (IoT), perform some computing functions instead of sending all data straight to the cloud to be processed. The wide acceptance of IoT is a key driver for FEC because it has created a new ecosystem of devices, all of which feature onboard processing and network capabilities.

FEC typically works as part of a broader cloud architecture and can draw on cloud-native development to create truly distributed applications. For example, the edge device could carry out low-complexity data sorting, such as classification or filtering, while sending data to the cloud for further analysis, management, and storage. Google's Nest Smart Home products use this architecture for its range of home thermostat and security products.

Fog computing

A variation of edge computing is fog computing. In edge computing processing takes place on the remote device itself, while in a fog environment, further computing is carried out in the same subnet (local network community) as the IoT device.

Fog computing requires data, compute, storage, and application resources to sit between the IoT device and the cloud data center. It can take the form of a dedicated edge device or router, for example. Fog computing provides for some autonomy and local control, while reducing application latency and increasing transaction speed.

Most fog computing deployments are currently in settings where access to cloud data centers is unreliable, such as for remote locations. Several hardware manufacturers provide "ruggedized"

fog computing nodes for use in shipping, mining, oil and gas, and disaster relief settings. This allows for computing functions to continue without a reliable connection to data center cloud services.

In addition, a fog approach to edge computing can help enterprises enjoy its benefits in scenarios where the installed IoT devices don't have enough processing power to handle the compute functions themselves.

"Low touch, high care" economy

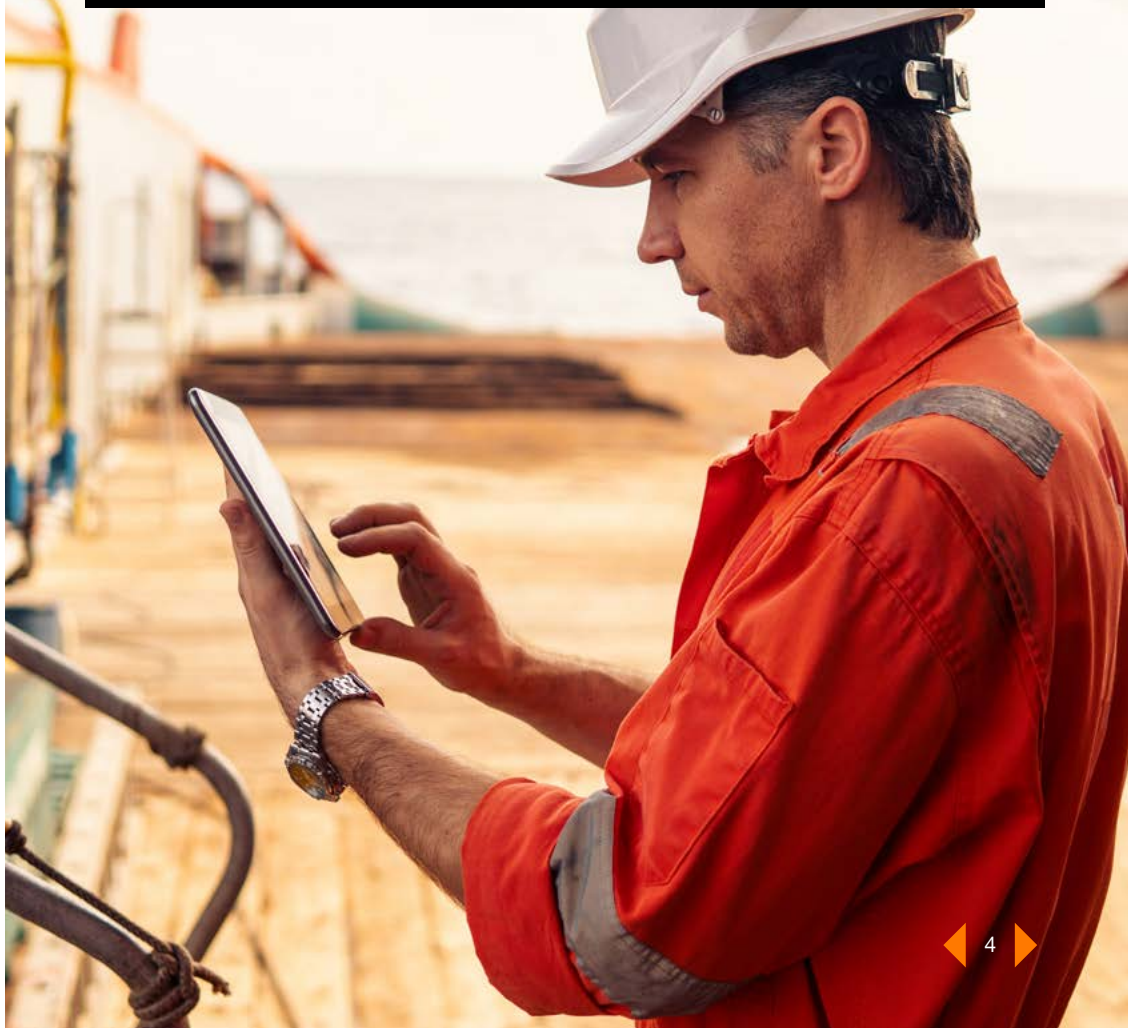
FEC can also support the shift into a "low touch, high care" economy. This means that although interactions between people are carried out remotely or are automated, the level of attention, customization, and support that employees, customers, and suppliers anticipate will be much higher. FEC supports this requirement by providing computing power closer to the end user, thereby enabling applications that provide localized data storage, privacy, and control.

For instance, users will be able to benefit from the power of machine learning algorithms without them needing to run in the cloud. This processing carried out near the user will deliver a faster and more effective service. Another example is that FEC allows organizations to create ecosystems of devices, like the Nest system mentioned earlier. With edge, devices can work together autonomously to provide richer services to end-users.

Employees, customers and suppliers expect much higher levels of attention, customization and support.

Key points

- Fog Edge Computing is a variation of a pure cloud-based architecture that leverages IoT.
- FEC brings processing closer to the user for faster response times and a better end-user experience.
- Fog computing adds a layer of local compute power between the edge device and the cloud.
- FEC can help realize the "low touch, high care" economy.



Fog and edge in the workplace

The workplace has seen significant changes over the last year. FEC promises to help enterprises make the transition into the new ways of working for the office.

Although predicting the future is always fraught with uncertainty, workplaces have made some significant changes to cope with social distancing requirements. And they look set to continue for some time yet.

For example, workplaces will have fewer facilities staff on-site and will rely on more automation and remote monitoring of objects. Areas that will be automated include general services, such as reception and guest management, environmental controls, and infrastructure. Others are IT-focused, such as printers, scanners, and audio visual (AV) equipment, and operational technology (OT), which encompasses automated production lines and robotic manufacturing.

Health and wellbeing

It is also likely that some organizations will install infrastructure to monitor and manage employee health and wellbeing. This may include employee temperature monitoring, location tracking – and as the technology evolves, airborne pathogen detectors. The security and "healthiness" of specific locations can then be used to attract and retain key employees. Furthermore, it is possible that social distancing could be managed by sensors deployed in workplace locations.

These technologies will be made possible by an FEC architecture. The ability for multiple sensors and objects to provide real-time monitoring and alerts will require a degree of autonomy and response time that is simply not possible through current cloud architectures. FEC will also help reduce the pressure on both network and cloud infrastructure for the many routine processing requirements that smart offices require.

Infrastructure requirements

The infrastructure bar for rolling out FEC in offices is set low as IoT devices can utilize existing Wi-Fi networks or short-range wireless technologies such as Bluetooth. This is because network requirements for IoT edge devices are modest. For those offices which don't yet have smart building infrastructure, it is also quite a simple step to add smart functionality and control to that equipment.

Integration using application programming interfaces (API) between the different object networks will be the most critical part of any deployment. They will also need middleware and a management layer for operations and analytics, typically hosted in the cloud. This will give facilities managers and other stakeholders an organization-wide view of the estate, in addition to a per-site view.

Autonomous buildings

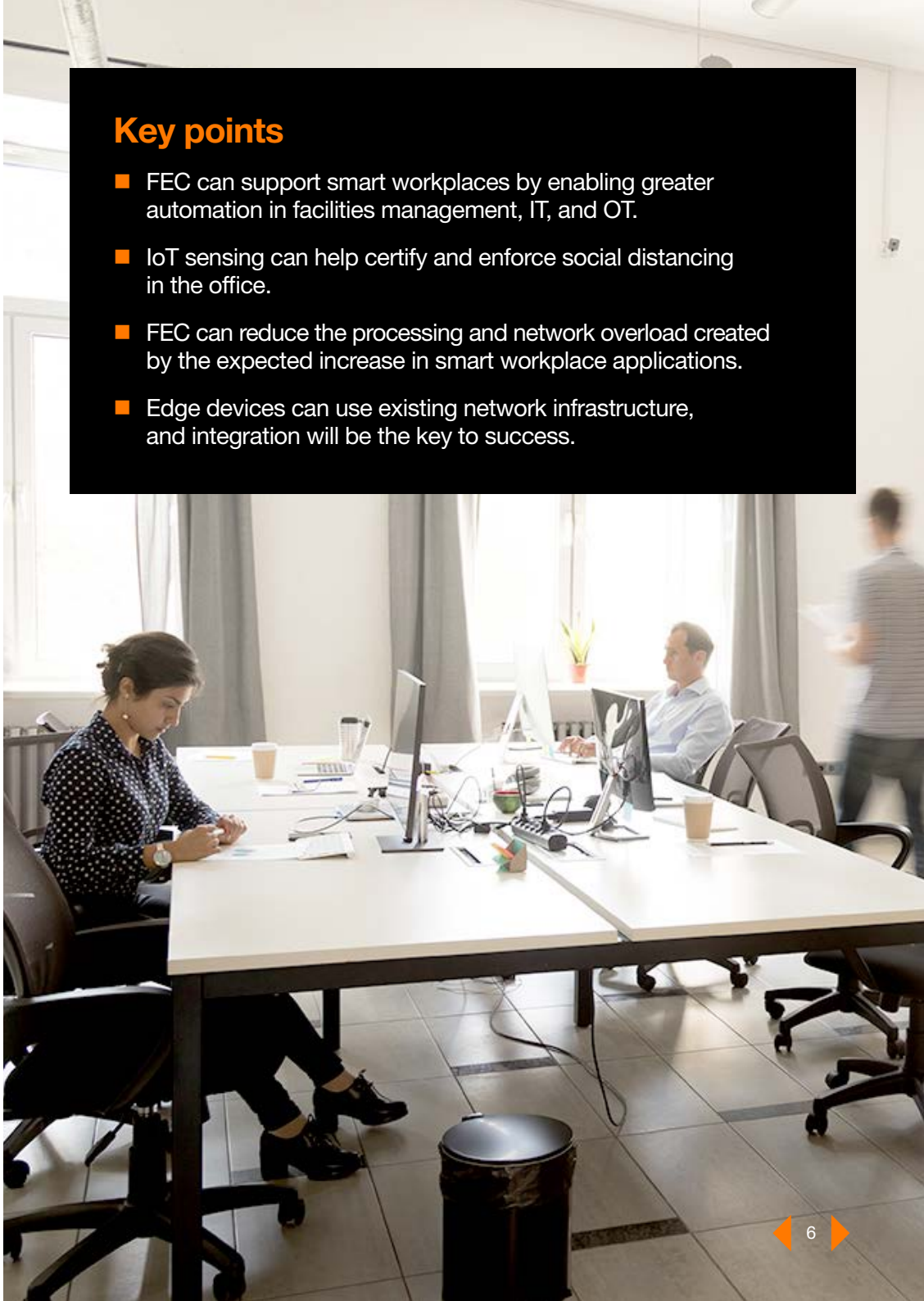
With the application of machine learning, buildings could become autonomous and fully automated. This will create smart offices that protect, monitor, and manage all the interactions between objects and people that take place within them.

As with many technological advances, employees will need to accept a higher degree of monitoring and less privacy when being protected as part of the autonomous office. This may lead to some concerns regarding privacy. What will happen to that "private meeting"? What happens if an employee is found to be carrying an infectious disease?

While FEC can't necessarily answer all of these questions, it can help ensure that personal data is processed on-site rather than in the cloud. This can help meet some of the data protection requirements that enterprises must comply with.

Key points

- FEC can support smart workplaces by enabling greater automation in facilities management, IT, and OT.
- IoT sensing can help certify and enforce social distancing in the office.
- FEC can reduce the processing and network overload created by the expected increase in smart workplace applications.
- Edge devices can use existing network infrastructure, and integration will be the key to success.



The impact of fog and edge on home working

Homeworking continues to be at the forefront of corporate strategy. Can fog and edge computing help more roles work remotely effectively?

Working from home is a priority at most organizations now. Analyst Forrester predicts that remote work will rise to 300% of pre-COVID-19 levels. FEC has the potential to enable home working for professions and activities that have previously required individuals to be in specific locations.

Already organizations are taking a greater interest in the IT and network infrastructure of home users. Extending the managed plan for software-defined networking to include combined FEC, security and network devices in the home could be the next step.

This additional computing power, lower application transaction speed, and reduced dependency on connections to cloud data center services could enable a range of different applications. Examples include complex diagnostic scans for medical imaging, trading platforms, and computer-aided design software for engineering or life sciences.

Performing neurosurgery from home

Even something as involved as surgery could be enabled by greater processing power. Already there is a level of automation in surgical practice. To take it to the next level, high-definition scans of bodies could be uploaded to robotic surgeons that can make tiny insertions at sub-millimeter accuracy. This automation is particularly suited to more ‘static’ parts of the body – especially the skull.

In the future, it will be possible to imagine FEC enabling remote surgery. This will be particularly useful in countries where there is a lack of specialists. Surgeons could perform surgery from their home office with the support of the team in the same location as the patient. This could involve a range of different technologies, such as virtual reality (VR), to allow the surgeon to interact remotely with a virtual model of the patient.

Local processing

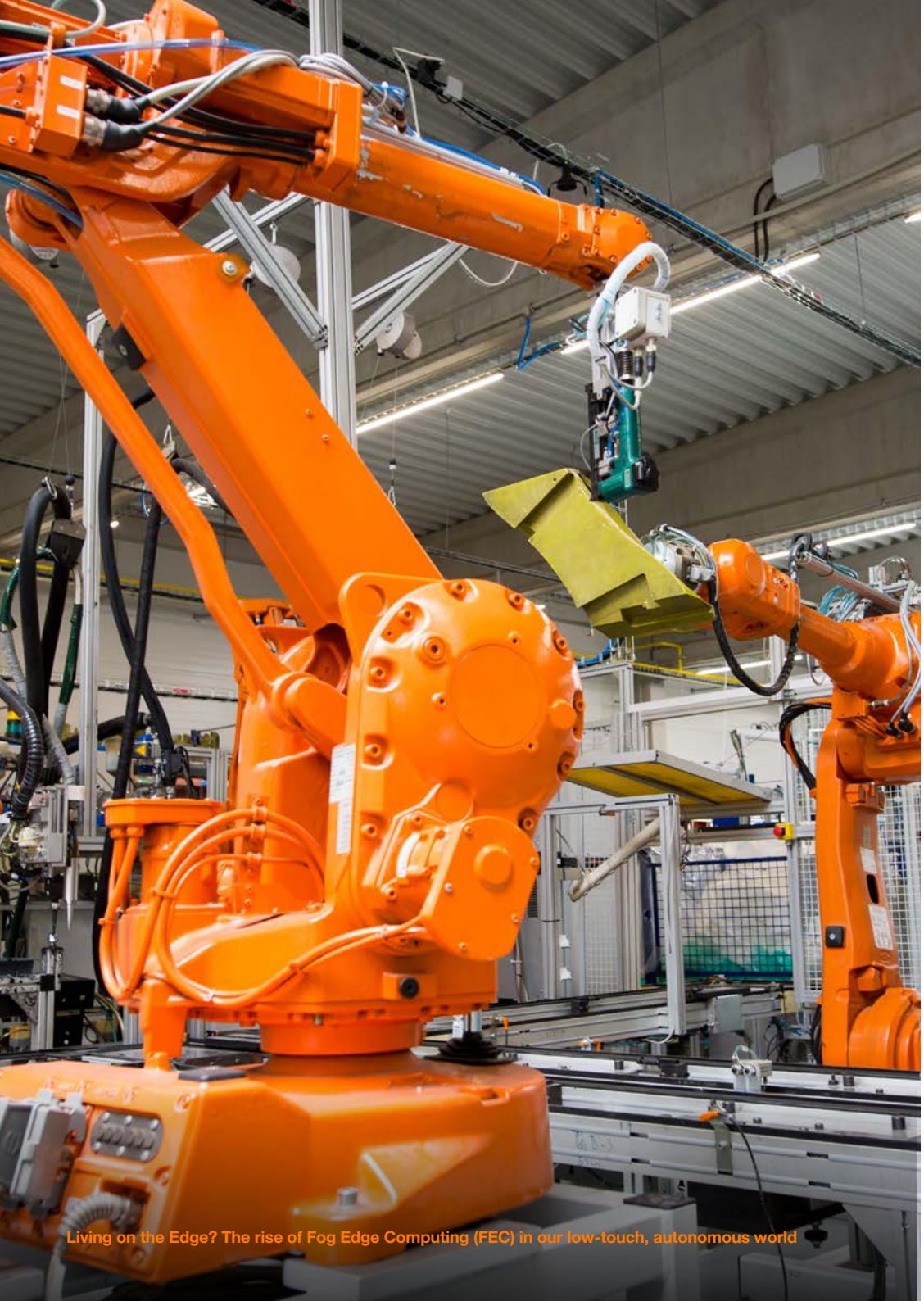
The key to enabling these new home working use cases is the local processing of key applications by the edge infrastructure. It will take the pressure off a sometimes-overloaded home network while reducing the latency inherent in sending data to the cloud. This is particularly apparent if large files need to be processed locally.

Deploying edge computing for home workers can be done in tandem with SD-WAN, by using an application that is both an edge and a network device. This will allow users to have a consistent experience as in the office, with matched security and network policies. In addition, there is even the opportunity to use unused processing capabilities in the office to act as an edge hub for home workers.

Edge computing takes the pressure off the home network and reduces the latency inherent in sending data to the cloud.

Key points

- FEC can enable new roles to work from home by providing the processing power they require, such as engineering, finance, or medicine.
- Local processing of data takes the strain off the home network and compute power.
- Can be deployed in tandem with SD-WAN home appliances to improve compute and network performance, along with strengthened security.



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Industry 4.0 meets fog and edge computing

With increasing use of digital technologies and IoT in industry 4.0, it is set to reap significant benefits from fog and edge computing.

Industry 4.0 is the perfect match for fog and edge computing. The digitalization of manufacturing processes requires IoT to collect and transport data for analysis at cloud data centers. Consequently, the uses cases for IoT in industry 4.0 are well developed. They range from sensing when machinery may need to be repaired, to health and safety monitoring for employees working in dangerous locations.

In most cases, the IoT devices that power Industry 4.0 will connect to cloud applications that analyze, predict and report on many key performance improvements. With the introduction of edge computing, the power of analysis, control, and machine learning capability can move to the production location.

To the next level with edge computing

Edge computing can deliver significant benefits for Industry 4.0. For example, high-frequency sensor data can be processed in real-time. In the event of a critical incident involving an employee or a production line, timely action can be taken.

Also, as Industry 4.0 develops, the number of sensors and IoT devices in every location will increase significantly. Managing large increases in the amount of data could be problematic, particularly in locations with patchy network services. Having processing capability on-site will allow organizations to manage this pressure more effectively.

Setting local standards

A specific issue in industrial locations is what constitutes “normal” conditions for this location? Industrial locations can be large and are not uniform in environmental, usage, and security. Introducing FEC can enable the system to understand the normal condition of an individual device.

This use case is very relevant for the application of machine learning. Individual sensors can learn what is normal for that location through machine learning, developing individual parameters and thresholds for each sensor. In other words, the system can understand whether the data it is seeing is a typical variation in data or whether it is worthy of raising the alarm.

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Key points

- With the increase in sensor deployments in industrial environments, FEC can manage the explosion in processing requirements.
- FEC allows manufacturers to react quickly to changing situations on the factory floor, which is key in delivering safety for workers.
- Machine learning can benefit from local processing to establish normal operating environments for sensors to prevent erroneous alarms.

If you are considering deploying Fog Edge Computing in your organization and need some advice on how best to proceed, please get in touch with the author at tom.gavin@orange.com

Sources:

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2. Forrester Predictions 2021: Digitally Advanced Firms Will Have A Sustained Advantage Over Their Competitors https://go.forrester.com/press-newsroom/forrester-predictions-2021-digitally-advanced-firms-will-have-a-sustained-advantage-over-their-competitors/

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