www.pipelinepub.com
Volume 17, Issue 1

The Critical Risk at the Edge

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The stunning growth of the Internet of Things (IoT) is resulting in a digital revolution across all industries. Expansion is accelerating. According to Gartner, there will be more than 5.8 billion endpoints deployed by the end of this year. Unsecured IoT devices continue to flood the market, increasing the attack surface of service provider networks. With the growing number of devices that are autonomously roaming across networks along with the rising volume of data breaches, the need for security by design is even more crucial.

We are at a critical decision point, but we do have choices. There's no magic answer to adapt to the massively changing conditions that we're all facing around the world. We can cling to old approaches and a fast path to extinction, or we can disrupt the norm and evolve as a global community to transform to next-generation strategies.

At the forefront of these strategies is 5G mobile network technology combined with highly distributed edge computing on cloud-native platforms. Everywhere around the globe, operators are aggressively testing and deploying innovative 5G and multi-access edge computing (MEC) technologies and solutions. As these solutions are rapidly being rolled out around the world, there is a compelling opportunity for them to have a sweeping impact on the entire economy.

Edge in the spotlight

All industries are under constant pressure today to improve product quality, boost factory efficiency, stay competitive, and enhance safety, security and sustainability while remaining profitable. Industry 4.0 is about the significant transformation taking place in the way goods are produced and delivered as we move toward greater industrial automation and the flexible factory. Latency and capacity restrictions and proprietary technologies have limited the ability to securely deliver near real-time industrial services. The implications of 5G will be felt across all

industries at the network edge, with factories and warehouses using the industrial Internet of things (IoT) and digitalization to become much more agile and efficient.

With remote work on the rise and businesses leveraging digital platforms and services more than ever before, edge computing combined with 5G has the potential to lead us toward faster and more reliable data processing where we need it. While industries have automated many factory processes, secure wireless connectivity makes industrial automation possible on a much larger scale. Huge gains await industries that embrace operational transformation with Industry 4.0 enabled by edge computing and 5G wireless connectivity.

In manufacturing, edge computing enables flexible production by allowing smart factories to rapidly change over production lines, increasing efficiency and shortening lead times while continuing to meet end customer commitments. Innovative approaches for oil and gas production are already using cameras and sensors to validate yield quality, safety conditions, and security—and they are optimizing the efficient use of limited resources.

We are also seeing the digital twin concept in complex product development across many industries that apply advanced visualization, IoT, and analytics to create virtual assets even before their physical counterparts are built, enabling increased production efficiency, employee safety, and higher-quality products.

Sometimes faster data processing is a luxury. Other times, it is a crucial aspect of decision-making, especially in times of crisis. Across healthcare, wearables (including portable EKG devices and sensors for monitoring vital signs) are increasingly important for collecting patient data. With the uptick in patient data in hospitals, experiencing even the smallest delay in processing can be a matter of life or death. Bringing analytics and secure data computing closer to the patient is already improving care and outcomes.

Consider that edge computing is already enabling virtual patient care to assist in the completion of medical training. There is also the use of secure multi-compute to share brain scans across multiple hospitals. 5G and edge computing can even help enable smart ambulances and the use of drones for first responders and fighting wildfires. These innovations coupled with human enhanced machine learning (AI/ML) are helping healthcare and public safety professionals to make potentially life-saving decisions faster.

Right now, our favorite sports are a remote-watching experience. Edge computing has recently been used at many world-class sporting events not only for an amazing digital experience but also to process mass quantities of data to track athlete conditions and provide real-time information to their coaches. Many of the sports stadiums and arenas have also been updated to share instant video replays, in-game metrics like ball velocity and trajectory, and player statistics for coaches and virtual fans.

Open source accelerating innovation

Industry edge applications blend the movement of workloads and near real-time data computation closer to customers or specialized devices—like robots, cameras, and sensors—with open cloud-native platforms using microservices. Open source is driving innovation in both hardware and software, enabling edge services that combine IT, network, operational technology (OT), and AI/ML workloads across a highly distributed architecture and optimizing for significantly smaller footprints, including ruggedized unmanned locations.

The software stack is quickly moving towards microservices in containers on bare metal to support the performance, latency and security needs for localized processing of the network, IoT, and AI/ML applications. In some cases, the edge nodes will be optimized for compute, network, and storage with a distributed high-performance bus aggregating telemetry and metadata transmitted to the larger data and applications platform sites.

Virtualized Radio Access Networks (VRAN) are a very specific mobile edge network workload with performance, latency and timing sensitive requirements. Red Hat has been working in the O-RAN community alongside our partners to enable multi-vendor deployments of 5G deployed in containers on bare metal. In many operator environments, vertical industry MEC workloads will be deployed alongside the 5G Core (5GC) user plane function (UPF) upstream from the VRAN access to simplify the networking, security, operational, and slicing requirements for deploying enterprise edge services.

The fact that many of these locations will be unmanned drives the need to have secure boot, zero touch automation of these edge nodes to simplify and assure the scalable delivery of edge services. The innovations are brutal automation of the nodes, the network apps, the enterprise applications, data management, and telemetry in a distributed edge compute environment that can span across on-premises, telco cloud, and multiple hyperscalers.

Distributed edge computing and 5G technologies are rapidly expanding across a hybrid collection of physical, virtual, and containerized cloud-native environments. These environments include open interoperable northbound APIs to abstract the clouds from their respective underlays, with common east-west provider APIs to select locations or environments to deploy them, and southbound APIs to select hardware used to deploy a given workload in that location. They are key to operationalizing edge services at scale. In addition to the open interoperable APIs abstracting the network and services that enable application of policy and security for the business systems, innovations are developing to automate lifecycle management across multiple cloud environments, including hardware selection, data acceleration for AI/ML and time-sensitive applications.

We are starting to work with our customers and partners to architect a multi-phase continuous integration/continuous delivery (CI/CD) approach for cloud-native infrastructure configurations that span the network and compute domains and are distributed at scale to the edges.

Future of the Edge

In the face of uncertain world dynamics, industry leaders are actively creating living strategic plans and approaches for edge computing and 5G to address a diverse set of challenges: scale,

complexity, growing services demands, data privacy protection, and location, as well as business process and organization structure.

Within these plans, many businesses focus on minimizing the attack surface with security by design across edge computing hardware, software, applications, data and networking technologies. They are also focusing their investments in open technologies and platforms that automate data management and governance at the edge to further reduce their potential business risks. While there is great promise from technology innovation, there is still an ongoing challenge of mindset and vision within organizations to think more like software application companies. This means they need to think about how they can focus on their core competencies and unique insights but also identify key areas where they must adapt and change.

The future of the edge is creating a new dynamic, one that encourages new types of edge services worldwide that securely combine data, 5G, and human-enhanced machine learning to achieve the ultimate effect of improving the quality of our lives around the world.