BUILDING THE EDGE INFRASTRUCTURE

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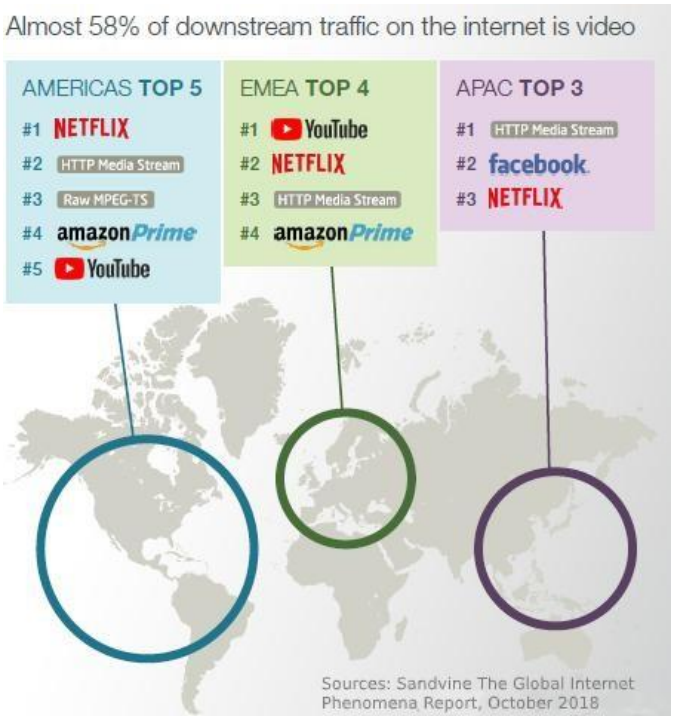
SURFING THE EDGE

With more consumers streaming online video, teleconferencing, and using mobile devices, Internet usage and bandwidth utilization is on the rise. Web traffic is increasing 10% to 20% each year and video streaming by 30% to 40% each year. Service providers are experiencing exponential increases in their network backbone, leading them toward a breaking point. This utilization has increased by more than 25%, in addition to the exponential growth due to the Covid-19 pandemic. With this increase in Internet usage and bandwidth utilization, the need for edge computing is greater than ever.

As more demand is placed on data centers for these services, that data takes longer to reach its destination. The further the distance from the data center, the longer it takes to deliver those digital-

-services, which in turn increases overall cost. To meet customers' growing demands, service providers and operators must accept the heavier bandwidth on the backbone.

Video Streaming is by far the largest bandwidth consumer of the Internet, followed by web browsing, gaming, and social media. The 2018 Global Internet Phenomena Report by Sandvine ranked video streaming as the top consumer of bandwidth utilization, with 57.69% of total Internet usage. The demand for online video streaming continues to grow. This is followed by Web traffic, online gaming, and social media.



PANDEMIC IN THE SPOTLIGHT

The unforeseen Pandemic has created a huge challenge for service providers and operators with unpredictable trends of traffic, sudden peaks in utilization, network uptime for consumers, and maintaining a network capable of meeting customer quality expectations. Networks are being pushed to the limit and people are experiencing the inconveniences of dropouts, reductions in streaming quality, and restrictions on the number of network connections. This is present in both professional and personal settings. Stay-at-Home and social distancing has shifted the reliance and importance of networks and communication.

The cumulative increase in utilization and traffic seems consistent throughout the day. Daytime traffic is primarily consumed by stay-at-home professionals for video conferencing and students' online classes. Daytime and evening traffic are utilized by video streaming, online gaming, video calls, social media, livestreams, and uploads.

This situation also highlights the importance of having remote orchestration capabilities for critical systems, especially outside of traditional IT environments. Many traditional office workers and IT admins have transitioned to remote working situations with the use of online collaboration tools. This includes a wide range of businesses, such as restaurants, bars, theaters, gyms, hospitals, factories, refineries, warehouses, waste systems, and transportation systems.

According to the Covid-19 Internet Phenomena Report by Sandvine, there is a 40% increase in network volume. This shift in customers' device utilization from highly distributed locations give us a glimpse into longer-term utilization patterns. It serves to highlight how edge computing will be required over time to supplement the cloud by reducing network bandwidth needs and decreasing latency, while maintaining autonomy and security. This is especially true considering there will be an order of magnitude, as the number of online devices increase in the future.

Sources: Sandvine The Global Internet Phenomena Report Covid-19 Spotlight May 2020

Traffic Growth	1 Feb – 1 Mar Growth	1 Mar – 1 Apr Growth	1 Apr – 19 Apr Growth	Total 1 Feb – 19 Apr
Upstream	+2.07%	+123.18%	-2.95%	+121%
Downstream	-2.39%	+11.72%	+13.67%	+23%
Total	-1.74%	+28.69%	+9.28%	+38%

BUILDING THE EDGE

Technology trends including Internet of Things (IoT) and content delivery networks (CDN) are driving the need to reduce bandwidth cost and telecommunications latency. Growing web-traffic bottlenecks, increased latency and transport cost encourages service providers to move their content closer to the customers. This gives birth to the term EDGE Computing, closer to the edge (consumer) and EDGE Data Centers (EDCs). The 'edge' is the physical location where devices and people connect with the networked digital world, and infrastructure will increasingly reach out to the edge. Edge computing is a part of a distributed computing topology where information processing is located close to the edge, which is where devices and people produce or consume that information. Edge computing architectures expand the reach of a typical cloud network by pushing key processing functions to the edge of the network, closer to where the data is gathered.

Service providers or cable operators will continue to move their storage and processing infrastructures closer to the edge, with respect to demand. It is important to understand that not all edge data centers will be in locations owned by the telecom operator. Edge data centers will also be needed for placement at the very edge of the network, perhaps supporting a few cells or network computing points. These locations can be remote, with no access to enterprise data centers. Deployment may be on the side of the road, in a commercial building, or in middle of nowhere.

The EDGE Infrastructure not only provides consumer benefits, it also benefits service providers and operators. Below are top EDGE Infrastructure benefits,

1. **Speed and Latency:** Every millisecond matters in digital communications. Excessive latency creates traffic jams that prevent data from utilizing the network to full capacity and avoiding network congestions.
2. **Security:** Since most of the data is analyzed locally, it reduces the amount of at-risk data at one time.
3. **Cost Saving:** Edge infrastructure allows service providers and operators to process critical data locally, while transmitting other data to a centralized data center. This reduces the bandwidth cost and data transportation between consumer and data center. Edge Infrastructure does not eliminate the need for cloud computing but optimizes the data flow which minimizes the operating cost.
4. **Reliability:** When EDGE infrastructure is geographically distributed, it provides increased reliability through redundancy. This also reduces the operating cost of the building infrastructure, due to the small footprint required.
5. **Scalability:** A scalable architecture provides opportunity for lower capital expenditure, when and where you need it. Micro Data Center solutions provide not only scalable architecture, but also fast deployment. Scalability becomes more manageable, compared to traditional data centers.

EDGE DATA CENTER FUNDAMENTALS

To establish an EDGE data center infrastructure, it is key to identify the product and solutions that not only meet the data processing requirements, storage, and communications, but also the physical infrastructure. Physical infrastructure readiness is vital for the successful operations of any EDGE infrastructure deployment. The nature of deployment in remote locations offers unique challenges such as availability of operational resources, utility services, physical security, and environmental conditions. Monitoring and reporting are also key elements in EDGE data center operations, where the infrastructure should be equipped to monitor all parameters that may lead to disruptive operations.

There are various cost-effective EDGE data center solutions available that offer quick deployment, scalable architecture, and environmental protection. Below are some of the solutions to provide the physical infrastructure requirements.

1. **Micro Data Centers (MDCs):** A Micro Data Center is a small-scale modular data center which can range from 1 to multiple MDCs in a single location. Micro Data Centers are a self-contained infrastructure with all the requirements for power, cooling, and monitoring built in a single cabinet. MDCs are designed to be installed in an indoor environment as well as for outdoor enclosures. MDCs reduce the requirement for building a traditional brick and mortar data center with all the necessary ingredients for operation. This provides not only the benefit of avoiding significant construction costs, but also requires less space for deployment.
2. **Containerized Data Centers:** Portable Modular Container data centers have been around for some time and were being utilized for temporary IT infrastructure requirements and for mobility. Data centers in shipping containers are a viable solution for scalable infrastructure with requirements of continuous outdoor operation with fewer racks. Shipping containers can be modified to resist harsh environmental conditions. Containerized infrastructures can also provide the advantage of centralized management and resource sharing (power and cooling). Deployment for prefabricated containerized data centers can be done quicker than traditional data centers.
3. **Rented Facilities:** It is not necessary that all EDGE deployments are outdoors or in remote locations. The requirements may also be fulfilled using a smaller, rented facility. This could be an existing warehouse, office space, or small store. A smaller rented facility can also be used for EDGE Infrastructure which can be provided with Micro Data Centers as a standalone infrastructure.

EDGE DATA CENTER CHALLENGES

A local EDGE site could be in an existing empty office space, warehouse, or empty store. Both indoor and outdoor deployments have their own unique challenges. Regardless of the deployment, all face the challenge of available technical resources and site accessibility for problem resolution to support continuous operations. Below are key challenges that EDGE infrastructures should consider while planning a site.

1. **Location:** No matter how redundant and robust infrastructure is installed; troubleshooting time of any problem is a key success factor. Service Providers and operators must plan for the availability of local resources. These local technical resources need to reach the site within the required time to identify, assess, and rectify a large variety of issues in the physical infrastructure, information technology, and communication. Resources also include the availability of spare parts and fuel requirements for emergency power systems.
2. **Environment:** The environmental conditions for MDCs located outdoors should be assessed carefully. MDCs or containerized data centers should be capable of withstanding extreme outdoor conditions, in addition to the propensity for flooding, lightning strikes, and seismic activities based on location.
3. **Monitoring:** Physical Infrastructure should be capable of monitoring and alerting for environmental parameters, water leakages, electrical power, physical security, and air-conditioning systems. Monitoring, alerting, and reporting are key elements in successful Edge Data Center operations. The use of intelligent equipment and components will provide timely resolution of a possible failure.
4. **Physical Security:** Physical security is a vital operational element for any indoor or outdoor locations. Indoor locations may have lower security threats due to physical barriers and being out of direct sight, while outdoor installations will have a greater risk of vandalism. Perimeter monitoring, access control, and video surveillance would play a key role in securing and identifying any incident. Outdoor enclosures should be strong enough to mitigate the risk of vandalism. There should also be consideration for proximity to automobile traffic, tall trees or poles that may damage the infrastructure in cases of accident or natural disasters.
5. **Resources:** For both indoor and outdoor EDGE Data Centers, availability of utility resources for continuous operation is critical. Those resources should also be accompanied by redundancy of critical physical infrastructure components and a continuous supply of utility power and water for cooling.

EDGE DATA CENTER STANDARDS

There are various companies and organizations establishing the guidelines and standards for EDGE Data Centers, such as the Uptime Institute, BICSI, and the Telecommunication Industry Association (TIA). All are playing a key role in addressing these guidelines. TIA is preparing an extension to its existing ANSI/TIA-942 standard for EDGE Data Centers. This standards document will provide guidelines for establishing an infrastructure which will solely focus on standalone EDGE Data Centers. Uptime Institute has prepared a whitepaper which provide report and information for edge computing capabilities and drivers. BICSI has released a data center standard which provides guidelines for enterprise data center to edge infrastructure.

VERICOM SOLUTIONS FOR EDGE

Vericom Global Solutions is a leading provider of network infrastructure, connectivity solutions, Micro Data Centers, and Prefabricated Data Centers for enterprise, government, and operator markets. With global headquarters in Knoxville, TN (USA), we provide best-in-class solutions to more than 30 countries worldwide.

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