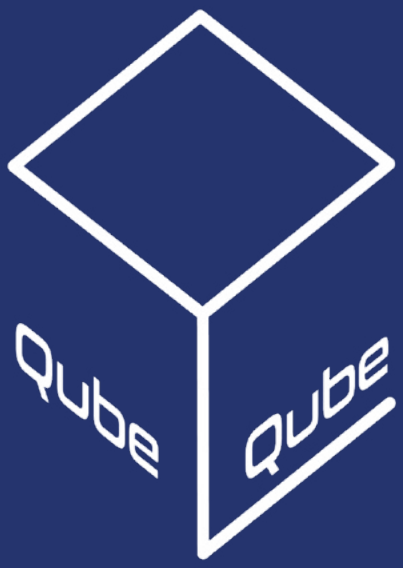
5G EDGE Computing



5G, the latest generation of cell phone technology, brings lots of advantages over previous iterations. The most advertised advantage is speed because it is the most noticeable to the user. References are usually given to the amount of time required to download a movie with 5G compared to 4G, and rightfully so - the peak data rate of 4G is 150 Mbps while that of a 5G connection is 10 Gbps!

Another critical advantage of 5G over 4G is the number of connections it supports. 4G could allow for up to 2,000 connected devices per square km compared to 5G's 100,000 per square km. This makes the much-hyped Internet of Things (IOT) closer to becoming a reality, in large part because the devices can be closer to each other - and can communicate with each other faster than ever. The dramatic increases in speed and connections allow for artificial intelligence (AI) applications never before possible.

The evolution of 5G New Radio (NR) has progressed dramatically since the NR standards were first released in 2018. The new standards enable features very important to IOT and V2X (especially autonomous driving). All require extremely low network latency. Mobile Edge Computing (MEC) places the compute power closer to the user reducing the distance the data travels thereby lowering latency. Qube-MRS offers infrastructure solutions which enable distributed multi-access edge computing by placing the processing at the absolute edge of the network, adjacent to the 5G radios.

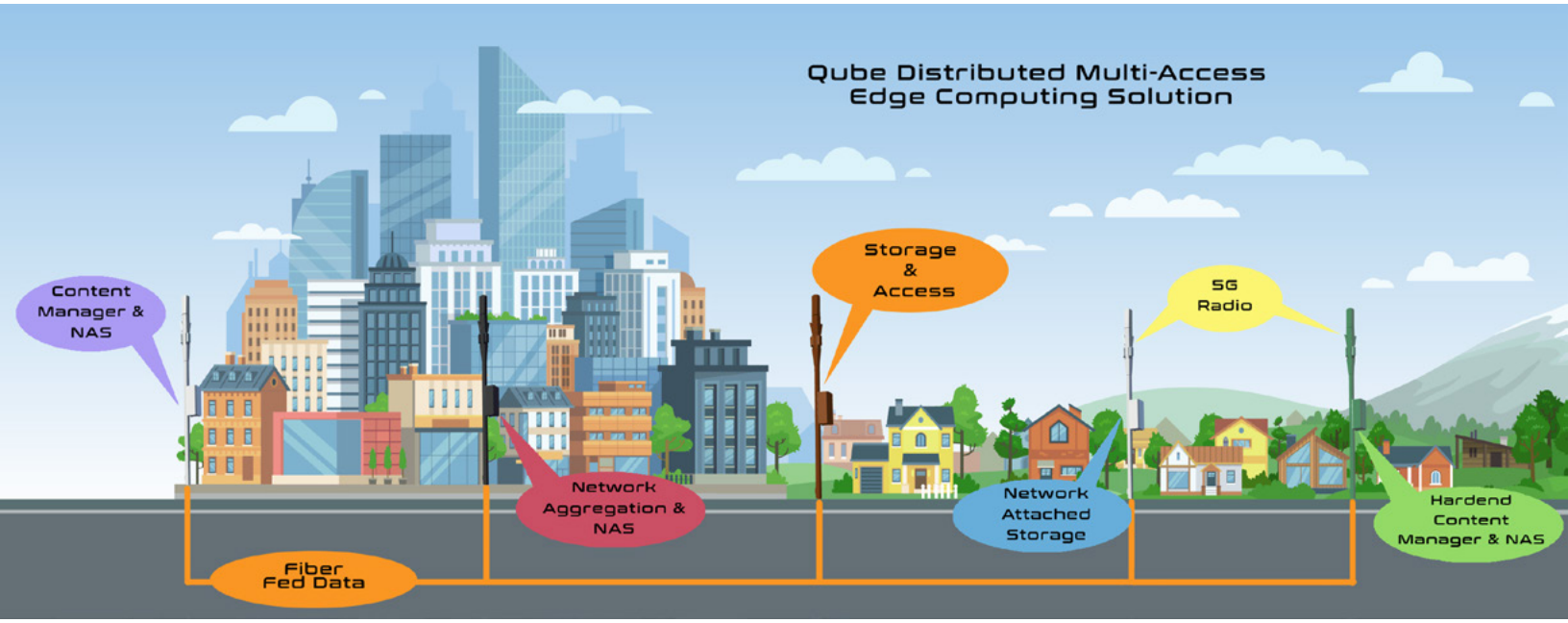
Speed Matters

The speed required to download a movie is important to the commercial 5G consumer but the round-trip speed of a data transaction is as important as download speed, in most applications, more so. In an IOT scenario, sensors gather data which is normally sent to the cloud where AI makes decisions and the results are returned to an IOT device for action. The transmission of the data takes time, and although it's measured in thousandths of a second, minimizing this lag time (latency) is critical to 5G IOT applications.

A decade ago, the primary reason the U.S. DOT mandated the use of LED brake lights in vehicles was their studies showed that an LED brake light could be illuminated 20 milliseconds faster than its incandescent predecessor - and that resulted in a 7% decrease in rear-end collisions! Human reaction time is approximately 200 ms so any reduction to reaction times saves lives. Autonomous driving, one of the biggest drivers of all IOT applications, requires ultra-fast decisions meaning the latency needs to be less than ten milliseconds to ensure safe machine reactions. Lower latency means faster reactions to stimuli and therefore safer autonomous vehicles.

Reducing the time required for round trip data transmissions enables more efficient IOT applications and one method of eliminating latency is by moving the computing process closer to the user – to the edge of the network. Edge computing is a distributed information technology architecture in which data is processed at the client side of the network, as close to the originating source as possible, which eliminates round-trip issues and enables actions to happen quicker.

In addition to taking time-sensitive data off of an already crowded global Internet, Edge computing puts storage and servers where the data is, often requiring little more than a partial rack of gear to operate on the remote LAN to collect and process the data locally. In many cases, the computing gear is deployed in shielded or hardened enclosures to protect the gear from extremes of temperature, moisture and other environmental conditions. Qube-MRS has developed a line of ruggedized 5G shrouds designed to provide the ideal environment to house the components required to make distributed Edge computing a reality.



EDGE Computing in support of 5G network functions

5G itself takes advantage of Edge computing by allowing for the disaggregation and virtualization of core functions of the radio access network (RAN). Rather than depend on physical network components, the 5G Core uses virtualized, software-based network functions that can therefore be replicated within Edge computing cloud infrastructures. Edge computing offloads user content to the edge for a faster user experience and more importantly frees up the aggregation points and major data centers from huge volumes of user traffic.

At each aggregation point, the number of high bandwidth users increases exponentially, so that by the time a packet reaches the major point of presence, the bandwidth required to support the potentially millions of user requests can overwhelm even a 100 Gb fiber feed, not to mention a high-end server.

If a computer/storage device is at the edge, it supports a few hundred users, if it is at the POP, it may support multiple millions of users.

Edge computing in support of 5G Fixed Wireless

The three major U.S. wireless carriers have begun trials offering fixed wireless access (FWA) for home Internet. All three had programs using their existing 4G LTE networks but the available bandwidth was limited. FWA across 5G can be a mixed bag depending on the spectrum used. 5G FWA on mid-band spectrum has - to date - not offered speeds much greater (sometimes less) than 4G offerings. Recent trials of 5G FWA on higher frequency mm wave spectrum however have been very promising and could provide the wireless carriers a way of delivering effective competition to cable operators without the expense of installing and maintaining the "drop" cable from the street into the home.

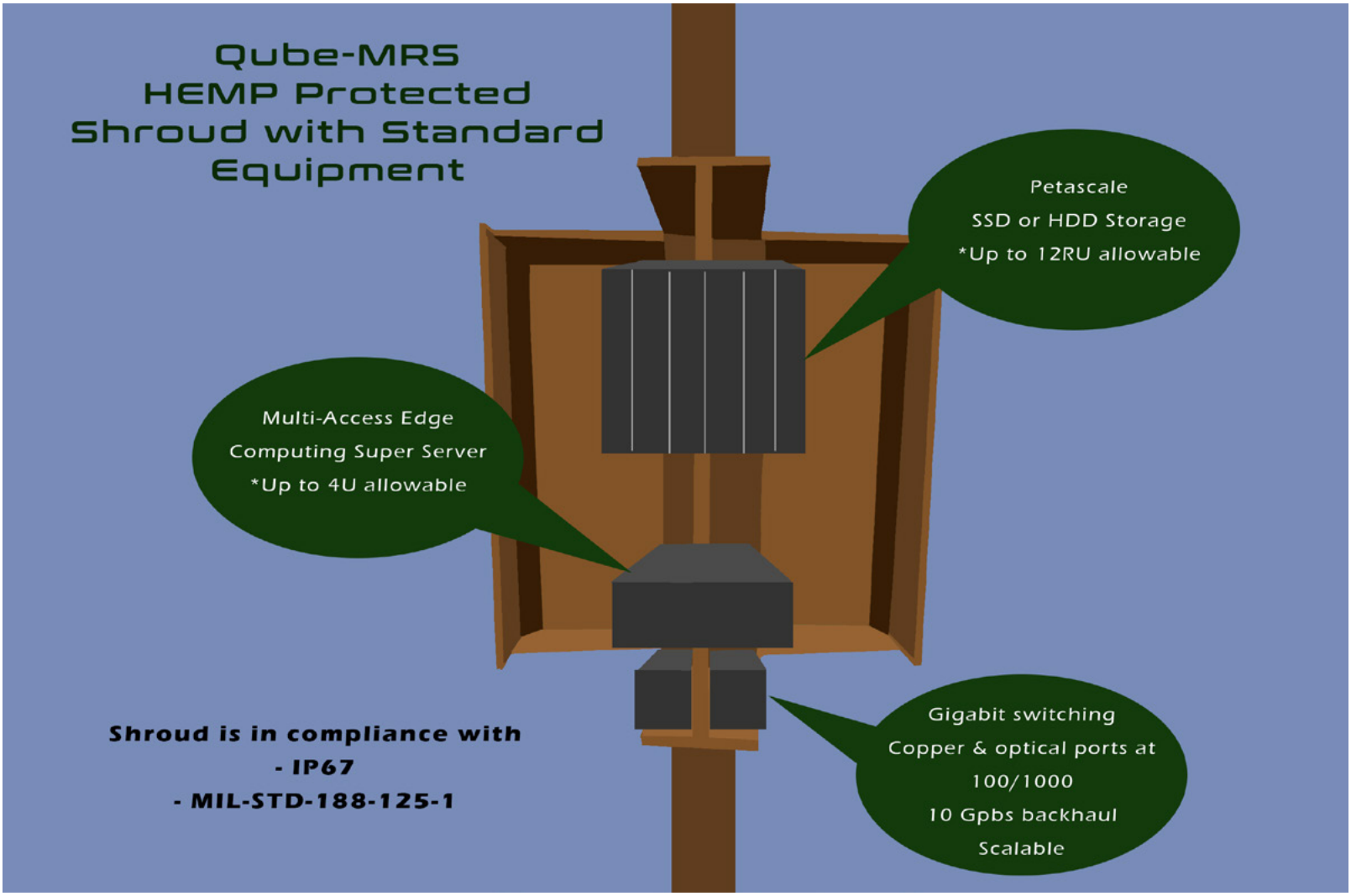
Fixed wireless access on 5G would intensify the need for distributed, Edge-based computing and storage. In addition to supporting 5G, Edge computing can also provide processing and content storage for other mediums like cable TV, Fiber-to-the-premise (FTTP) and other land line telemetries.

Qube is an ISO 9001-2015 certified company and is a member of Qualcomm's Smart City Accelerator program.

Qube-MRS

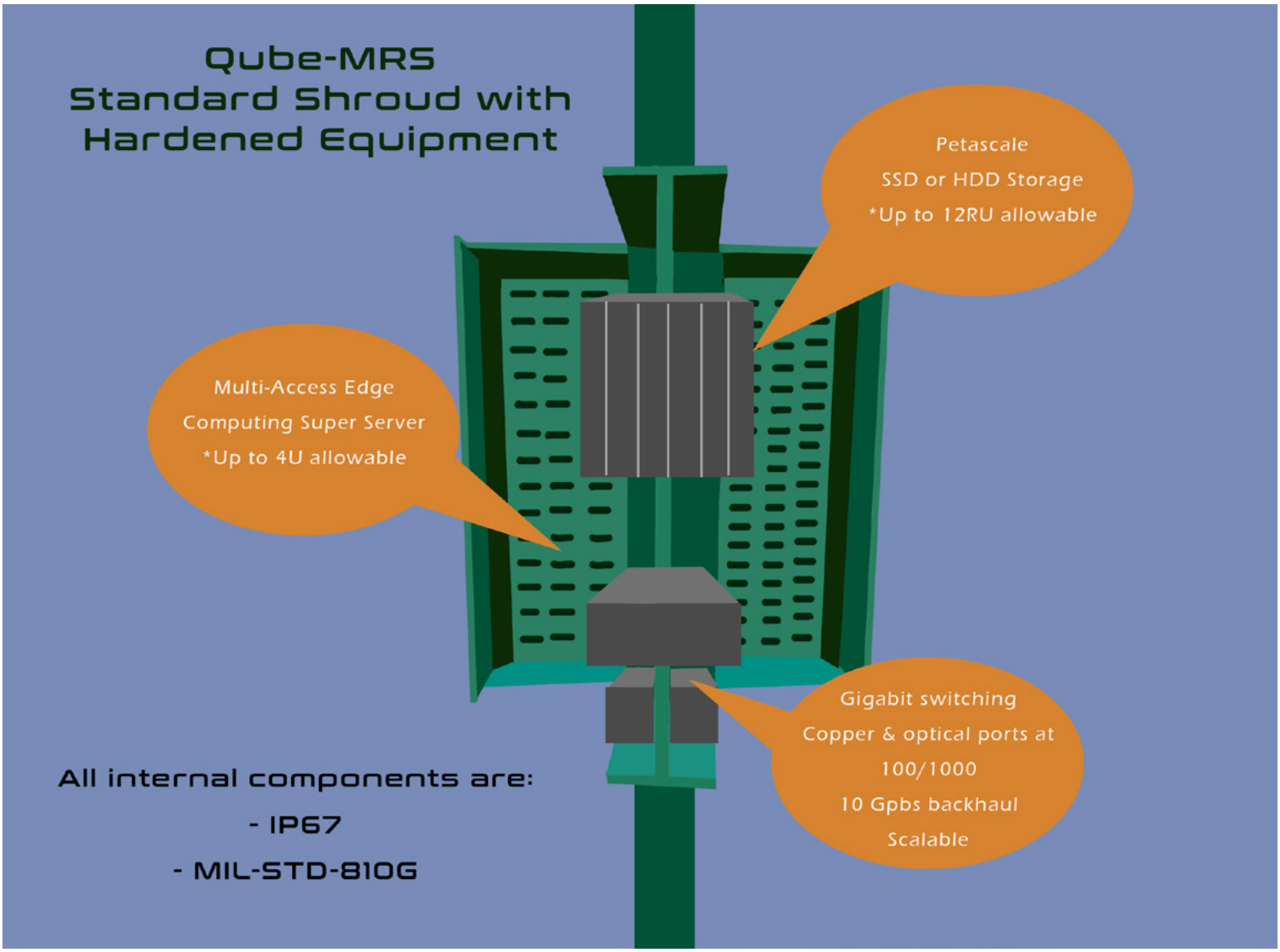
Qube-MRS offers a line of equipment shrouds developed specifically for 5G small cell networks that house and protect the 5G network and Edge computing components while placing them as close to the client as possible.

Developed to withstand extreme conditions in hostile environments for power utility and military customers, Qube ruggedized shrouds provide an ideal hosting environment for Multi-access, Edge Computing. With power and fiber connectivity available at each location, Qube small cell shrouds are an ideal mounting location for distributed Edge computing solutions.



Qube's patented mounting system allows for maximum flexibility and versatility and can accommodate most any array of Edge computing server, storage or processor configurations.
Qube-MRS manufactures an exhaustive selection of poles, small cell shrouds and related hardware in support of its customer base which consists primarily of telecommunications companies, neutral host providers and electric utilities. All Qube shrouds, poles and related hardware are manufactured in its custom-built fabrication facility in Gainesville, GA, just north of Atlanta.

In order for 5G to work as advertised, up to 800,000 small cells will be required to be installed across the U.S. In addition to being the ideal hosting point for Edge computing and storage, Qube poles were designed to be multi-function structures capable of hosting multiple wireless carriers while serving as traditional utility poles providing street and area lighting as well as a hosting point for smart city components.



We Don't Limit Our Challenges

We Challenge Our Limits.

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