PERASO | WIRELESS UNLEASHED™

Transportation

Contents

Introduction

Transportation networks are evolving to provide higher capacities, faster speeds and advanced automation to the degree that humans will soon be out-of-the-loop, and free to focus on other activities. The autonomous operation of vehicles and the use of human time for productive or entertainment activities will require networks exchanging continuous, reliable streams of data with the vehicles and their passengers.

Rail Transportation

Rail transportation networks ranging from high-speed bullet trains to subway and municipal rail systems, need data connectivity to support operation and provide internet

service to passengers. Three primary connections are needed: Train-to-Station, Carriage-to-Carriage, and Track-to-Train. Each of these can be supported by mmWave wireless connectivity with clear advantages over other wireless or wired solutions.

Train-to-Station

Modern rail vehicles contain telemetry and security monitoring systems, such as video cameras, which continuously collect large amounts of data. Offload of accumulated data at each station stop can be done conveniently with a wireless connection.

With Peraso's 60 GHz products, a train can make connection with a station at up to 1 km distance and maintain a steady stream of data transfer while it is at the platform. With data transfer rates up to 3 Gbps, it will have time to dump large amounts of data in the few minutes during its stop.

The use of the 60 GHz band ensures that the signal will not be interfered with by Wi-Fi or any other common consumer wireless communication frequencies. Furthermore, the narrow beam pattern of the phased array antenna, and robust encryption, reduces the chance of unwanted snooping.

Carriage-to-Carriage

With Wi-Fi hotspots located in each carriage for the use of riders, a network backbone spanning the length of the train is needed. Since carriages are constantly in motion and may be periodically added or removed according to rider demand, a great strain can be placed on any mechanical connection between carriages. Carriage-to-carriage wireless bridges can be created with Peraso modules which will support a multi-gigabit backbone with very low latency. The Peraso modules are compact and can be located in small housings at each end of the carriage. As the train carriages move relative to each other the dynamic beamforming will maintain constant connection. Furthermore, the backbone can be automatically expanded or reduced as the number of carriages is changed.

Track-to-Train

Providing reliable high speed internet connection to vehicles moving up to 300 kph, over hundreds of kilometers of track, through varied terrain, and even in tunnels is a formidable technical challenge. Mobile network providers strive to provide a level of connectivity, but have not achieved the reliability, responsiveness and performance rail passengers would like to see. Rail operators are motivated to install private networks to address anticipated demand expansion, allow direct management and maintenance and improve overall rider experience.

The benefits of mmWave radio systems are again being demonstrated in this application. Operating in the 60 GHz band, there is ample spectrum bandwidth available for multi-gigabit data connections without special licensing or dependance on mobile operator spectrum allocations.

Furthermore, Peraso has developed a High Velocity Roaming (HVR) operating mode for its 60 GHz modules. HVR ensures that data terminals located along the rail side are able to track the fast-moving train and that the train's terminals are able to seamless switch between connection points in a make-before-break sequence.

HVR also provides system scalability. Each channel provides up to 3 Gbps traffic bandwidth and multiple channels can be aggregated for scalability. Peraso's HVR can provide riders with faster, more reliable data which will meet foreseeable future demands.

Automotive

A transition to a world of autonomous vehicles will lead to safter, faster and more reliable road transportation of passengers and freight. This transformation will allow all passengers the freedom to be productive or engage in entertaining activities while travelling. To support

autonomous operation and services for the passenger, a wireless infrastructure is needed which can support thousands of fast-moving vehicles with high rate, low latency data.

Traffic management and safety systems will consist of a complex network of video and telemetry systems such as LIDAR. This infrastructure will communicate with core traffic management processing which will in turn need to communicate directly with vehicles and traffic control infrastructure. mmWave radio systems, including the 60 GHz band, are ideal for these applications. Offering not only high bandwidth and extremely low latency throughput, the narrow-angle beamforming possible with mmWave allows direct communication between the vehicle and data distribution point, minimizing overall interference. Efficient management of the RF spectrum resource is essential to servicing many vehicles in a congested environment.

Autonomous driving passenger vehicles will free passengers to focus on other activities. Whether participating in a VR conference call, catching up on social media, or chatting with friends, reliable, interruption free, data service will be mandatory. This quickly approaching future vision will again be ideal for mmWave wireless connectivity. Next generation mmWave will support the massive scale and complexity of vehicular traffic with connected riders and only mmWave will offer the available spectrum needed to support all the foreseeable services.

Air Transport

Within many passenger aircraft, miles of heavy cabling are used to connect each passenger seat with the central entertainment system. As a cost savings measure, some aircraft use Wi-Fi to distribute content to passenger owned phones, tablets and laptops. Neither configuration is ideal for cost or user experience and neither is ready for upgrade to the level of service needed to provide the immersive passenger experiences anticipated in future travel platforms.

In the dense user environment of an airplane, the high throughput and directionality of mmWave system is a huge benefit. Furthermore, with compact antenna sizes, the size, weight and power consumption of the infrastructure Access Points can be kept to a minimum.

Conclusion

Communication systems supporting future transportation networks will be called upon to be fast, reliable and cost effective. Furthermore, they will need to be able to operate as independent, stand-alone networks without dependency on external network operators. mmWave systems, including those operating in unlicensed bands, offer the capacity and flexibility which these applications demand.

About Peraso

Peraso Inc. (NASDAQ: PRSO) is a pioneer in high-performance 60 GHz unlicensed wireless technology, offering chipsets, antenna modules, software and IP. Peraso supports a variety of applications, including tactical communications, fixed wireless access, immersive video and factory automation. For additional information, please visit www.perasoinc.com.