THE FUTURE’S SO BRIGHT I GOTTA WEAR SHADES
ADARA BLOG

SD WAN | INDUSTRY | 2019
THE PAST, THE PRESENT, AND THE FUTURE WALK INTO A BAR...ONE WORD: TENSE

Recently, our Mobile SD WAN Platform for Personal Clouds entered Beta; you can read (or re-read) the details in one of several articles written that covered the announcement.

We thought it would be productive to start a series about the future of Internet of Things (IoT)/Internet of Everything (IoE) (we can almost hear you saying: what’s that?) and Mobility; a “future” that is actually the present. What do we mean by the future is actually the present? That is the question that gives rise to this post.

You likely do not realize this yet, but we have never experienced a transformation with the speed of what is occurring around us. The closest parallel would be the rise and spread of the Internet itself and the World Wide Web, but even those revolutions pale in comparison to what is occurring all around us, around you – right now, as you are reading these words. What is transpiring is much more than web browsing and e-commerce. What our world looks like, and how we will live is being transformed before our eyes. For example, E-commerce has created a huge company in Amazon with annual revenues of over $230 Billion; that is more than Microsoft and Google’s combined annual revenues; and it is only a fraction of the revenues that will be generated by companies in this next wave of transformation. That transformation is not just in Mobility, nor is it in the Internet of Things (IoT), it is in the Internet of Everything (IoE); and it is happening now. That is why we created our Mobile SD WAN Platform for Personal Clouds and IoT/IoE.

We will address a few aspects: reasons why we created this platform; the size, scale and scope of the market; the use cases and industries; the impact this technology can have on your life and how it is already changing out world as we know it.

It is no secret that we are attuned to the market, especially Public Cloud Providers, and particularly, AWS. We realized in our discussions that networking is the connecting fabric for everything that is powered by battery, wired connection, solar,
or wireless charging. We understand that everything will soon be connected. The implications are more massive than can be imagined.

I LOOK TO THE FUTURE BECAUSE THAT’S WHERE I AM GOING TO SPEND THE REST OF MY LIFE

Firstly, the size of the market is much larger than commonly discussed. In our announcement we used public, conservative numbers.

The number of connected mobile devices is generally comprised of mobile computing platforms: smartphones, tablets, laptops and some wearable technology devices like watches. With a global population of approximately 7.5 billion, the number of devices is estimated at nearly 50 billion; just under 7 devices per person.
However, that is just a small fraction of the market. Now think about **Home Automation** household connected devices and embedded systems, refrigerators and other appliances, electronic locking systems, security systems, child monitoring (even outside the home), lighting systems, networked thermostats in Heating, Ventilation and Air Conditioning (HVAC) systems, exercise equipment, home entertainment systems, and move beyond that to automobiles and transportation.

Embedded systems are used as wired or wireless networking to automate and control lights, security, audio/visual systems, sense climate change, monitoring for both home and industrial use.
Factor in sensors embedded in roads (for trucking and transportation), dams and levees, buildings and airports, and tags (for monitoring patients in hospitals or at home), warehouses (for managing inventory), and cashier-less checkout stores. Now count in portals that are distributed everywhere, screens that you can approach and be instantly recognized to securely order any product or service; even ones that are created upon your request. The number of connected things is not in the billions; it is in the **quadrillions** — *over a million times greater than a billion*.

Note the technology requirements for this: Mobility, Ultra-Fast Networks, ability to scale (Big Data), Location awareness. The kind of Networking ADARA provides is performance based and only ADARA can increase networking performance (with our new virtual cloud platform software) and scale the performance (by up to 1,000 times per ADARA instance). ADARA’s capacity and number of virtual cloud and mobile software instances is in the quadrillions. We deliver what’s required for this transformation.

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<tr>
<th>Bandwidth</th>
<th>Page Load Time via HTTP</th>
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<tbody>
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<td>10Mbps</td>
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What’s required from networking is beyond the types of connections currently in use. 5G has been thought of as the sole answer; it is defined by a few features such as self-organization and virtualization, but the real defining feature is more bandwidth. It is projected that latency will be lower – that is the same claim that was made of optical fiber (which has millions of times more bandwidth). As it has been proven over and over, bandwidth is not a solution for performance.

Additionally, because 5G is about virtualization, SDN, SD WAN, and NFV are required for 5G to deliver on its promises. IoT relies upon Cellular Radio such as 3G, 4G, LTE or 5G, WiFi, Bluetooth (low power radio), and on Satellites in orbits that are: more than twice the circumference of the Earth, more than 5 times its diameter and more than 10 times its radius.
These are all the most challenging types of networking because they are wireless, and operate over environments that are not as controlled as those of terrestrial (wired) environments such as fiber optics.

In fact, Service Providers have shared with us that most SD WAN companies avoid these kinds of connectivity situations, especially Satellite, because they highlight the fact that the primary offering of common SD WAN, more bandwidth, does nothing to solve the performance issues of networking.

99% of everything that will be connected is still waiting to be networked. When does that happen? It happens now, in 2019 and in 2020. The true term is not the Internet
of Things, it is Internet of Everything (IoE). IoE is the most revolutionary, innovative and universal technology advancement in the history of the planet. It is going to make networked connections more relevant and valuable than ever before. Turning information into action creates new services and capabilities, richer life experiences, and unprecedented economic opportunities for businesses, individuals and countries.

IoE refers to quadrillions of connected end points: sensors, devices, consumer products, all connected to an Internet that is an intelligently networked environment with expanded digital functionality and features.

The current Internet encompasses connections to only SmartPhones, Tablets, PCs and a handful of other devices but in IoE, everything is connected and automated with machines becoming more intelligent and interactive with more access to data and expanded network opportunities.

IoE is the intelligent connection of people, process, data, and things that will be transforming our world. This transformation will happen in such an impactful way, that billions of connected devices will have sensors to detect, measure and access
their statuses at all times. They will all be connected over public or private network built over standard protocols like *TCP/IP*.

As you can see, the Internet of Everything is very different from the Internet of Things; the difference is in the intelligence of the connections, performance based, performance aware, self-organization, with AI managing everything. IoT is primarily about physical devices and objects communicating with each other; IoE brings with it the network intelligence to bind all these endpoints together into a cohesive system. In IoE, everything is a network node.

**I’VE BEEN EVERYWHERE MAN**

A simple use case, but one with monumental implication is Transportation, especially [Freight Transportation](#). In the front of this Blog we wrote about a transformation that exceeded the Internet and the Web itself. Freight Transportation is one of those
revolutions that are running down the highway at a breakneck pace. A quick look at the numbers shows the US Freight Transportation Trucking Industry is just under a Trillion Dollars Annually, and you need look no further than the Venture Capital money flowing into transforming the Industry from analog to digital.

Startups as well as former startups (e.g. Google, Tesla, and Uber) are fighting for positions with new apps and support systems. New positions by investors from Amazon.com Inc. founder Jeff Bezos, Salesforce.com Inc. founder Marc Benioff, eBay Inc. founder Pierre Omidyar and Uber Technologies Inc. co-founder Garrett Camp, are rapidly evolving the space.

There are Smart Vehicles, the analog of SmartPhones, and as you have seen, BYOD (Bring Your Own Device) has become common in trucking. When the device is Corporate Owned, the fleets now incorporate the same Personal Mobile devices that consumers use, and experience the same performance issues at a greater degree due to the more challenging mobile austere connectivity environment.

Smart Vehicles assist drivers and revolutionize the way vehicles, road sensors and drivers communicate. Vehicle Area Networks (VANs) are internal and external. The benefits accrue to other industries. For example, a major goal is to use Telematics and IoT to provide an accident-free environment, and to fully implement the zero-accident-vehicle. This would be a major financial windfall for the Insurance Industry.

Intra (i.e. In-Vehicle) VANs connect data communication network of on-board-equipment (OBE). Functions such as assessing driver behavior or a vehicle’s performance will subsequently be sent off the vehicle. While there is a significant amount of intra-vehicle function, the data and inputs must first come from outside the vehicle (from the cloud, sensors, or other vehicles or infrastructure) or exit to outside the vehicle, (to the cloud, sensors, or other vehicles or infrastructure). This is why inter-vehicle is the most critical communication. The network, especially the Wide Area Network, is key to network nodes moving at incredible speeds all over the planet, and it is all TCP/IP.
Inter (i.e. Outside -Vehicle) VANs includes vehicle-to-vehicle (V2V), vehicle-to-broadband cloud communication (V2C) and vehicle-to-roadside-infrastructure communication (V2I) using road-side infrastructure.

An intelligent VAN is a network of vehicles that interact with one another and with infrastructure to transmit and receive data. Various interactions among participating elements may include lane-keeping signals, obstacle detection, adaptive cruise control, navigation data, driver status, facial and vehicle recognition, and much more. These provide automatic driver assistance, which is good for driver safety, and create a cooperative meshed environment where the correct information is provided at the correct instant to prevent accidents and increase crash survivability. Vehicles can exchange useful information such as real time weather, road, and traffic conditions as they travel the same or nearby roads.

Vehicle-to-Vehicle (V2V) Communication can provide data exchange by cooperative communication among vehicles through adaptive broadcast and information sharing. Wireless connectivity along with GSM, cell tower signal, GPS and other wireless LAN is the networking to be used. Location awareness through GPS coupled with wireless LAN means many access points can network vehicles entering a wireless LAN-available area. For fleets beacons can gather service set identifiers (SSID), MAC address (BSSID), and performance based networking such as ADARA’s can estimate
real bandwidth, latency and signal strength; this is important for verifying vehicle speed and direction.

Cellular radio and Wi-Fi (WiMax) will be used for both short and long range inter-vehicle communication if they meet power and bandwidth requirements, such as GPRS used in 3G, 4G used in long term evolution (LTE) mobile broadband, for connections between multiple vehicles and their devices.

In discussions with Public Cloud Providers, like AWS, we realized that companies such as FedEx and UPS, companies so large they are used to chart the economic health of the entire country, were the textbook examples of how IoE and our Mobile SD WAN Platform for Personal Clouds and IoT/IoE would be required. That’s when we re-engineered our platform to be fully cloud based, we intentionally built our Mobile SD WAN Platform for IoT/IoE with industries such as Freight Transportation Trucking in mind.

The Freight Transportation Trucking industry is highly fragmented; technology such as ADARA’s that delivers profits and allows consolidation in IoT Freigh Transportation, can allow companies to capture most of the Trillion dollars annually that is projected within the next few years. How fragmented is the industry? Since trucking was deregulated in the 1980s, some 18,000 freight brokerages have sprung up; the largest player, publicly traded C.H. Robinson, has less than 3% of the market. This is why we contend that any Freight Transportation Trucking that has plans on surviving the coming consolidation should equip itself with the required technologies and best products, such as ADARA; and the best Public Cloud Service Providers, such as AWS.
Unmet Requirements that need to be addressed.

- Because this will be a series of heterogeneous networks and network architectures, there will need to be an SDN overlay and virtual (software) infrastructure that can operate on any platform.
- Because there is massive interconnectivity and interoperability, there will need to be impenetrable security.
- Because vehicles operate at high speed, there will need to be Performance Based Networking due to the time limit (order of several fractions of a second to seconds at most) that vehicles are within access range of each other or infrastructure.
  - Throughput in those fractions of a second will mean everything as vehicles move in and out of range.
- Because there will be massive numbers, scale on demand will be required (multiple software instances spun up and down intelligently).
Vehicle-to-Cloud (V2C) Communication with vehicles communicating with a broadband cloud, such as AWS, where a monitoring data center in a vehicle-area-network, hosts many transportation applications is starting now. Vehicles will connect via wireless broadband mechanisms such as 3G/4G and SATCOM.

Applications for vehicle and driver tracking in network fleet management are already being deployed to the cloud. V2C includes outgoing data; vehicle-centric information such as speed, global positioning, routing, vehicle functionality and performance, and driver-centric information such as drowsiness, length of continuous driving, in vehicle video and audio for safety are all sent to the cloud for analysis and storage. That is in addition to in-coming data that include receiving data from a fleet management system in the cloud. Infotainment, Entertainment (i.e. multimedia streaming), Internet, connections to dealers and service centers, and location based systems will face the challenge of latency, prioritization of data, and what data to send and receive.

For example, vehicles traveling 90 miles an hour move 150 feet every 1,000 milliseconds. From vehicle-to sensor-to cloud and back, when location awareness data enters from the sensors (the unmanaged network) into the wired infrastructure with network devices (the managed network), which connects to cloud data centers for processing, location data will be delayed by other network data. It will not be
received nor processed, and the response will not be provided before the vehicle has moved down the road, potentially to a dangerous point in travel. This will happen without solving latency on and End-to-End basis. This renders the sensor and location data gathering useless. In short, real-time vehicle systems can only benefit if data is networked in real time, not when the vehicle has moved hundreds of feet from where delayed data causes the systems to think it is. Solving this requires Performance Based Networking such as ADARAs.

Vehicle-to-Roadside Infrastructure (V2I) communication for sensing and environmental monitoring is another critical function that highlights the need for performance because of the speeds at which the vehicle and infrastructure approach and recede form each other; by only fractions of a second, at most. These communication’s support automatic warning of hazardous road conditions, Anti-collision detection systems based on vehicles and obstacles, real-time weather updates, and traffic updates.
Challenges

The greatest challenges to creating real time networks such as these are not the applications. Those components are relatively simple.

The real technical challenges lie in the **networking issues** which occur at the speed vehicles move:

- **Network Prioritization** of what information to collect, filter, direct in-vehicle to process, and what to send/receive out of the vehicle to/from the cloud data center where there is almost unlimited computational power.
- **Uniform SD WAN Mobile Gateway** that accelerates all apps and has peers in the cloud and on other mobile platforms and network nodes
- **Near infinite Scalability**, addressed in virtual (i.e. software) form on any platform operating system
- **Impenetrable Security**; fully integrated systems over Internet require security that cannot be compromised.
An End of Latency; the most important challenge, unsolved by anyone except ADARA

The only company that has a proven answer for the End to Latency is ADARA

The only company that can End Latency over any type of connectivity including 4G, LTE, 5G, WiFi and Satellite, the most common connectivity methods for Transportation in IoT/IoE is ADARA

The only company that has Performance Based Networking to enable Real Time Networking at the speed of Vehicle’s and Freight Transportation is ADARA

Platforms

IoE has altered communications in transportation. The platforms used have changed from purpose (e.g. Garmin) built proprietary operating systems, (e.g. Windows CE) hard-wired fixed in-dash systems, to smartphones and tablets. Why? Because operations occur in many ways and many times outside the vehicle; signature captures, external vehicle or environment image captures providing evidence for claims in accidents/insurance are examples of this. Smartphones and tablets are less expensive, they are touch screen making fonts larger; they are network capable
making automation possible; they support Bring Your Own Device (BYOD), making them convenient with no learning curve. They incorporate the newest technology so they are not quickly obsolete, and can be replaced anywhere in the world at a moment’s notice. They are platforms that support any application if that app is approved on the two largest operating systems in production: Apple iOS and Android.

More consumer mobile devices run on Android than any other mobile operating system on a worldwide basis. Android, has a higher level of support from transportation technology vendors. Android is more open to app developers; Apple, a closed system, requires app developers to complete certification to have their apps approved to run on iOS. Apple iOS for iPhone and iPad requires a significantly higher investment cost in comparison to Android. In 2018, many reported an exact split in usage; 50% for both Android and iOS; in 2019, reports are approximately 60% Android to 40% Apple iOS. Android edges iOS for diversity and value.
Applications

Omnitracs is a major supplier of mobile communications systems for transportation; it has adopted Android. The flagship in-cab system is called the Intelligent Vehicle Gateway, or IVG.

The primary issues reported for this app are nearly identical to all apps that use Wide Area Networks: latency. Latency issues are magnified in these wireless fast-moving deployments. That’s why ADARA performance based networking is even more critical.

A quick look at cost and value is another key point.

<table>
<thead>
<tr>
<th>Omnitracs IVG.</th>
<th>Up Front Cost</th>
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<th>3-year Total Cost</th>
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<tbody>
<tr>
<td>$799</td>
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<td>$1,879</td>
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Source: BCG analysis.
A typical application like Omnitracs costs over a thousand dollars; $800 initial costs plus $360 per year in recurring costs, and as an application, it has no ability to reduce network latency because an application sits on the network not in the network. ADARA Mobile SD WAN Platform is $100 and solves performance issues for all of the millions of apps and quadrillions of network nodes that it networks.

“So we went to Atari and said, ‘Hey, we've got this amazing thing, even built with some of your parts, and what do you think about funding us? Or we'll give it to you. We just want to do it. Pay our salary, we'll come work for you.' And they said, 'No.'

So then we went to Hewlett-Packard, and they said, ‘Hey, we don't need you. You haven't got through college yet.’”

--- Steve Jobs
Founder Apple Computer Inc. on attempts to get Atari and HP (Hewlett Packard) interested in his and Steve Wozniak's Personal Computer

Sometimes the future is standing right in front of you. You just have to embrace it.

The bottom line is ADARA is the answer for IoE and for everyone.

Try ADARA and see the difference.

We are products of our past, but we don't have to be prisoners of it. With ADARA, the road ahead is open and the future is bright.

Shades anyone?