Synergy at SpaceX, Tesla and Tesla Energy Is No Accident

Elon Musk's head aches because of X, formerly known as Twitter. But when it comes to broadband and energy distribution, his companies in many ways lead the way to the future.

By David Daugherty / *FyberCorp*

As current and potential broadband deployers enumerate possible revenue sources, it is time to look more closely at the need for internet-borne control of electric power distribution and aid for driverless vehicles. The interlocking, synergistic infrastructures and services of Elon Musk enterprises that *aren't* X, the social media platform formerly known as Twitter, offer a good glimpse at a future that has already begun rolling out – especially in rural areas.

The current generation of Starlink low-Earth-orbit (LEO) broadband communications satellites, for instance, reliably delivers between 100 and 200 Mbps of bandwidth in areas in which hundreds of users can "see" several satellites at once. SpaceX rockets routinely launch 60 at a time, and more powerful rockets will soon reduce the per-satellite cost.

Another synergy is between Tesla and Tesla Energy. The usability and environmental worth of electric cars is obvious only if one considers grid-scale storage systems such as the Megapack technology from Tesla Energy. Megapacks, launched in 2019, can each store up to 3.9 megawatt-hours of electricity. Megapack clusters can store and deliver gigawatt hours of electric power on demand.

Tesla is quietly working with regional power companies nationwide to launch a *virtual* electric power service independent of infrastructure. The service includes a residential solar array and a Tesla Powerwall to augment power provided through the local power grid. Individual residential solar power arrays become extensions of regional Megapack clusters and an important component of the virtual grid.

Ultimately, this should help resolve security and vulnerability problems with the national power grid. But it also helps convert the grid from a mix of large "baseload" plants supplemented by more expensive-to-run "peaking" powerplants that today are usually fossil-fueled turbines. The future will likely see the bulk of all electric power generated by variable wind and solar sources, backstopped by widespread sharing of electric power and battery storage.

Management of a geographically diverse, virtual power system depends on reliable, high-speed, low-latency fiber internet. As a result, deployment of fiber to the home will be an eventual byproduct of the affiliation between Tesla Energy and EMCs. Given the current lack of broadband infrastructure in underserved markets, the affiliation with Starlink will help get things started.

Thus, federally stimulated spending on terrestrial networks is also good news for Tesla Energy and its electric grid competitors, despite Wall Street seeing it as a "competitor" to Starlink. Access to $42.5 billion in Broadband Equity, Access, and Deployment (BEAD) Program funding from the National Telecommunications and Information Administration (NTIA) should drive the domestic deployment of virtual utilities. It is not apparent that the NTIA and regional broadband providers fully understand that BEAD funding can stimulate power and broadband.

Rural deployers will especially benefit. The 2020 World Population Data Sheet predicts a peak global population of almost 10 billion by 2050. The United Nations Food and Agriculture Organization (FAO) estimates that currently approximately 10 percent of the global land surface is used to feed the global population. FAO historical data indicates that global cropland area per capita decreased by 46 percent between 1961 and 2016. In summary, from 1960 to the present, the world population nearly *tripled* while the total available cropland decreased by *half*.

In 2019, the USDA estimated that automating manufacturing in agriculture would create upward of $47 to $65 billion in additional revenue. In other words, if broadband were available on farms at levels currently available in urban areas, the U.S. could increase annual output by nearly 18 percent.

TOP PRIORITY: FULLY AUTONOMOUS VEHICLES

In June, Tesla updated plans for its Dojo supercomputer. Dojo is the artificial intelligence (AI) system Tesla expects to use to train and manage autonomous vehicles. The four things needed to deliver vehicle autonomy at scale include extremely large, real-world data sets; neural net training; vehicle hardware and vehicle software. Tesla is developing each element in-house. Musk claims that Dojo will be capable of an exaflop, or 1 quintillion (1018) floating-point operations per second.

Thus, one of the first-order applications of ubiquitous LEO satellite and terrestrial broadband is the ability to deploy fully autonomous vehicles. This includes everything from delivery drones to the Tesla Model Y. Less obvious applications include agriculture, fully autonomous tractors and crop maintenance vehicles. This technology is the first step toward a vast, worldwide expansion of precision agriculture and improvements in the U.S.

Precision agriculture is based on measuring and responding to variability in water, nutrients, sunshine and other factors to improve agricultural production and sustainability. But it is only the first part of the tenfold agricultural production improvement required to feed 10 billion people in 2050.

AI will manage complex, rapidly changing, real-time, global data to deploy and manage autonomous farming and agricultural production – data ranging from geopolitical conflict (Ukraine) to global weather, market fluctuations, soil conditions and the cost and availability of regional labor. Most urban food consumers do not realize that farmers have been doing this since the 1970s on a large scale. Many rural officials do not realize how much more precise and actionable the data has been getting, decade after decade.

SPACEX, GOOGLE AND STARLINK CONVERGE

Starlink broadband services require a fully functional, next-generation Starship to deploy Version 2 satellites. In the meantime, SpaceX uses the Falcon 9 launch vehicle to deploy

THE LEVELS OF AUTONOMOUS VEHICLES

SAE International's standard J3016 defines six levels of automation for automakers, suppliers and policymakers.

Level Zero: No Automation
System responsibility: None.
Driver involvement: The human at the wheel steers, brakes, accelerates and negotiates traffic.

Level One: Driver Assistance
System responsibility: Under certain conditions, the car controls either the steering or the vehicle speed, but not both simultaneously.
Driver involvement: The driver performs all other driving aspects and is responsible for monitoring the road and taking over if the assistance system fails to act appropriately.

Level Two: Partial Automation
System responsibility: The car can steer, accelerate and brake in certain circumstances.
Driver involvement: Tactical maneuvers such as responding to traffic signals, changing lanes, or scanning for hazards largely fall to the driver. The driver may have to keep a hand on the wheel as a proxy for paying attention.

Level 3: Conditional Automation
System responsibility: In the right conditions, the car can manage most aspects of driving, including monitoring the environment. The system prompts the driver to intervene when encountering a scenario, it can't navigate.
Driver involvement: The driver must be available to take over at any time.

Level 4: High Automation
System responsibility: The car can operate without human input or oversight but only under select conditions defined by factors such as road type or geographic area.
Driver involvement: There may be none in a shared car restricted to a defined area. But in a privately owned Level 4 car, the driver might manage all driving duties on surface streets and become a passenger as the car enters a highway.

Level 5: Full Automation
System responsibility: The driverless car can operate on any road and in any conditions a human driver could negotiate.
Driver involvement: Entering a destination.

Megapack at Moss Landing in California. The largest Megapack installation in the U.S., it has a current capacity of 250 megawatts – about a quarter the size of a typical baseload plant – and can store 1.3 gigawatt-hours.

V2 Mini satellites that provide four times more per-satellite capacity than earlier versions.

V2 Minis include more-advanced phased array antennas and E-band backhaul to boost throughput. Version 1 provides an aggregate downlink capacity of 17 to 23 Gbps per satellite, but V2 throughput is just short of 100 Gbps per satellite.

In May 2021, SpaceX and Google announced that Google data centers would deploy Starlink ground stations. The combination of high-speed, low-latency broadband with data center infrastructure will be required to fully deploy 5G, next-generation services required for level 5 autonomous precision agriculture and T-Mobile satellite telephones.

Space-based data services that connect directly to terrestrial devices are the future of communication services. In August 2022, SpaceX and T-Mobile announced plans to develop satellite-to-cell service and "end mobile dead zones." A growing number of satellite companies are partnering with terrestrial mobile network operators and device makers to fill in coverage gaps across the planet.

To be safe, fully autonomous driving requires real-time data transmission. LTE cellular services are too slow to handle real-time data processing requirements for level 5 autonomous vehicles. 5G service provides higher data rates – up to 10 Gbps – with considerably lower latency, making it suitable for Level 5 autonomy safety applications.

David Daugherty is the founder and CEO of FyberCorp, a veteran-owned, Texas-based company specializing in broadband solutions for underserved communities. He can be reached at david@fybercorp.