Mass Transit Mobile WiFi & the Public Sector: Successful Implementation by the Santa Clara Valley Transportation Authority

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ABSTRACT

Prior to 2010, the Santa Clara Valley Transportation Authority (VTA) lacked WiFi access on its light rail and bus lines. Given the VTA's area of operation, Silicon Valley, it's not surprising that WiFi access was the most frequently requested feature among VTA passengers. The VTA's service area contains dozens of tech companies; many local workers craved complimentary transit WiFi, to check email, catch up on business news, and do other online work. VTA riders also wished for WiFi for entertainment and social media. As stated in a 2011 *San Francisco Chronicle* article, *"Santa Clara Valley Transportation Authority's customer surveys consistently find [WiFi is] the most requested feature and that ridership increases when it's implemented."*

Recognizing that adding WiFi would draw in new riders, the VTA pursued mobile WiFi solutions for their light rail cars and express buses, about 120 vehicles in total. WiFi installation was one element in a larger plan to woo new transit customers.

Santa Clara Valley Transportation Authority

The VTA worked with a consulting firm between 2010 and 2012 to outfit its light rail and express bus lines with fast, reliable WiFi, complimentary for passengers. This paper describes how the VTA overcame financial and technological obstacles to realize its WiFi goals, becoming the world's first transit system with 4G connectivity.

Having overcome said difficulties, VTA enjoyed increased ridership following WiFi installation. Light rail ridership has grown by 3.6% each fiscal year since all trains were outfitted with WiFi in July 2011. The transit authority's express bus ridership increased nearly 20% from 2011 to 2012 due to the addition of WiFi, new routes and new higher-amenity buses which have made trips more convenient, comfortable and enjoyable for VTA customers.

Understanding how VTA successfully implemented WiFi installation can help other transit agencies gracefully bridge the same transition. Our study concludes with an exploration of other, unanticipated advantages of installing light rail and bus WiFi systems, including improved vehicle security monitoring through on-board closed-circuit television, or CCTV, and improved compliance with federal funding programs such as MAP-21.

VTA Express Train

INTRODUCTION

To fully appreciate the hindrances that the transit agency overcame to achieve WiFi adaptation, it's helpful to consider background information on the VTA system as a whole.

The Santa Clara Valley Transportation Authority serves the San Jose area, and all of Santa Clara County. In addition to providing bus, light rail, and paratransit services for the Silicon Valley, VTA is a funding partner for other regional transportation services, including the Capitol Corridor, Caltrain, and the Altamont Corridor Express. Moreover, VTA acts as the county's congestion and transportation manager, which involves traffic management; the creation and construction of pedestrian, bicycle, and highway improvement projects; and providing support for transit-oriented development.

With an annual budget of almost $400 million, VTA employs about 2,100 workers. Under the public transportation branch of VTA's operation, the agency maintains a fleet of 425 buses and 100 light rail vehicles. For the 2012 fiscal year, VTA saw more than 42 million boardings on its combined light rail/bus system. About 135,000 passengers ride VTA each weekday.

The VTA's mission is to provide *"sustainable, accessible, community-focused transportation options that are innovative, environmentally responsible, and promote the vitality of [the] region."* In pursuit of that mission, VTA has set several strategic plan goals, including financial stability, increasing ridership, and putting customers first. Adding train and bus WiFi systems worked toward these goals.

The VTA prioritized its light rail line for the area's first WiFi transit system, so let's consider this portion of the system first. At 42.2 miles long, VTA's light rail is one of the longest light rail systems in the United States. Each year, about 10 million trips are taken on the VTA light rail network. Communities served by the light rail include San Jose, Santa Clara, Campbell, Milpitas, Mountain View, and Sunnyvale, California. There are 62 stops in the VTA light rail system, including Downtown San Jose, Lockheed Martin, Paramount's Great America theme park, and the San Jose Convention Center. VTA light rail trains run 365 days a year, with arrivals every 15, 30, or 60 minutes, depending on the time of day.

"Free onboard WiFi is rapidly becoming expected by passengers across the country"

After mobile WiFi had been successfully installed on VTA's light rail system, the agency added WiFi on some of its Express Bus lines. Altogether, VTA offers thirteen different Express Bus routes, serving longer commutes between San Jose and Palo Alto (line 102), to give an example. Of these thirteen Express Bus lines, seven have WiFi onboard.

In January 2012, VTA added 20 new hybrid diesel-electric buses to the VTA express system. Ridership on VTA's express buses had dropped from 4,000 riders per day in 2008 to about 2,700 daily riders in 2010. The VTA predicted that its newly improved buses would drive daily ridership up to more than 3,600 by 2015. As VTA's Board Chairman Ken Yeager explained at that time, *"Many people have told us that they are willing to take an express bus if there was WiFi and more comfortable seating. We're doing it now, and we're hoping this increases overall ridership levels."*

These hybrid buses, with a price tag of about $675,000 each, were funded mainly through federal stimulus and state bond measures. With plush features including comfortable high-back seats, footrests, reading lights, luggage racks, and free WiFi, VTA hoped these sleek cherry red and silver express buses would target *"the younger and tech-savvy market,"* as VTA General Manager Michael Burns put it.

With this general understanding of where WiFi was added in the VTA's structure, let's explore the problem of adding mobile WiFi in more depth.

THE PROBLEM

Like many transit groups, VTA recognizes that its long-term financial stability relies upon increased ridership. Indeed, improved ridership levels are partially responsible for VTA's recovery from a staggering $98 million dollar operating deficit in 2009. Sales tax provides the lion's share of VTA's operating budget, and a significant drop in sales tax revenues sent the agency's budget into the red. In response, the VTA adopted a two-year budget that cut some services, raised fares, decreased employee benefits, and redirected money away from new projects. In a remarkable turnaround, by 2011, the VTA was *"in better shape financially than just about any transit agency in the Bay Area,"* according to a *Mercury News* article from that time. To continue growing financial stability and ridership, VTA looked for ways to stay relevant with potential riders, such as through the addition of mobile WiFi.

Research shows that WiFi is an amenity that many customers desire, and that new riders can be wooed to public transportation if free WiFi is added to a transit system. As VTA General Manager Michael Burns said in a VTA press release from that time, *"Free onboard WiFi is rapidly becoming expected by passengers across the country and one amenity that has been most requested when it comes to making public transit a more appealing option to non-riders here in Silicon Valley."*

As Burns suggested, the trend toward mobile transit WiFi extends beyond California's borders.

Demographic studies have shown that 71% of passengers carry a mobile device or laptop that they wish they could connect to the Internet while commuting. That number is probably higher in VTA's operating district, given the area's technological industry. Similarly, a Devicescape survey has found that 91% of passengers expect WiFi while traveling.

What's more, adding WiFi is a long-term strategy for transit agencies, as upcoming generations are even more desirous of mobile transit WiFi than their older counterparts. In a sense, WiFi holds the future of public transportation ridership. Millennials (those under 34 years of age) made up 34% of mass transit riders in 2007, and that percentage will only grow going forward. Among these younger "Generation Y" commuters, 80% would rather ride a bus with WiFi for 50 minutes, over driving themselves for 25 minutes.

While adding mobile WiFi is clearly a wise move for transit agencies, there are several significant challenges to WiFi adoption. Indeed, other transportation groups in the San Francisco bay area have struggled to overcome financial and technical hurdles of adding WiFi.

Challenge #1: Cost to Install and Operate WiFi Systems

For an idea of how much investment is required to add mass transit mobile WiFi, consider that Caltrain, a commuter link between San Francisco and San Jose, rejected WiFi adoption on its commuter coaches because the requisite financial investment of $3 million was too high. With hour-long commutes, many Caltrain passengers would be happy to pay for WiFi access—and some do, to the tune of $90 per month for Internet cards. However, the financial hurdle for the Caltrain organization is just too high. As San Mateo County Transit District Executive Officer Mark Simon has explained, *"It's something we really want to do. But we need a business plan that shows that it's feasible and affordable."*

Another example comes to us from Capital Corridor, a 168-mile rail Amtrak service between Sacramento and San Francisco. For this passenger train transit agency, adding WiFi required 8 years and $3.75 million. Like mass transit leaders across the country, Capital Corridor executives understood that a 1-2% increase in ridership as a result of WiFi availability would offset capital and operating costs. As VTA Technology Manager Richard Bertalan has said, *"If you put somebody into a seat because of WiFi, it will pay for itself."* Still, transit agencies must raise significant capital to put new WiFi systems in place.

Challenge #2: Reliability of WiFi Connection

Another WiFi obstacle, technological reliability, has plagued a different Bay Area transportation service, BART. In 2007, third party group WiFi Rail installed WiFi devices on 44 of BART's 669 trains. Unfortunately, the BART WiFi service frustrated customers with spotty connections, including unreliable accessibility underground. The financial angle also rubbed customers the wrong way, as riders were required to pay for BART WiFi access.

Likewise, Amtrak was widely panned for unreliable connectivity after its initial rollout of WiFi on its Northeast Corridor service. The root problem? Amtrak's WiFi service was based on 3G cellular networks, which simply couldn't provide the bandwidth that contemporary web surfers demand for streaming videos, music, and so forth. Fortunately, modern transit WiFi packages can tap into the 4G network, which is 10 times faster, and based on LTE and WiMAX technology.

91% of passengers expect WiFi while traveling.

Even with a stronger network, technological challenges still lurk for providing WiFi on a moving vehicle:

The Handoff. As they pass through different areas, buses and trains' WiFi systems tap into nearby cell phone towers. When one tower's service area ends and another one begins, there is a "handoff" moment that provides a special challenge for WiFi device designers. Without exceptionally advanced mobile technology, this handoff moment can cause lagging service, or it may even kick users off the system altogether.

Network Tower Locations. Cell tower locations are intended to maximize residential and commercial usability; bus and light rail lines may or may not be in these same zones. Cellular providers are improving this situation incrementally, by installing towers along commute routes. For instance, Sprint Nextel has erected towers along some of the heaviest trafficked spots on BART.

Bandwidth requirements. If every passenger on a WiFi enabled train is watching streaming videos, chances are that the shared connection speed will be slow.

Underground areas and tunnels are notoriously difficult to reach with WiFi, as cell tower signals can't easily reach these subterranean levels. As services such as BART extend cell phone service into underground tunnels, this aspect of WiFi connectivity will improve.

After years of unreliable WiFi, BART has contracted with their original partner, WiFi Rail, to add 100 more onboard communication devices through a $2.5 million contract, funded partially through the US Department of Homeland Security. Caltrain still lacks WiFi.

Now that we've reviewed the financial and technological stumbling blocks that transit agencies face in adding mobile WiFi, let's see how the VTA overcame these challenges.

Phase #1: Pilot Program for VTA Commuter Express Program.

In 2010, the VTA launched a pilot WiFi service, with the intention to research operability for future expansion. Transit consulting firm Xentrans was selected to coordinate the pilot program, which launched in October 2010 and ran through January 2011. Signs reading "WiFi on Board" announced the free WiFi service on a new VTA Commuter Express service running between Santa Teresa and Baypointe light rail stations.

This pilot program allowed the VTA to test service quality via the Clearwire 4G network in the San Francisco Bay area, plus other provider networks (3G EV-DO, HSPA and 4G WiMAX) throughout the operating area. Additionally, the Xentrans program tested closed circuit television (CCTV) monitoring on VTA light rail cars. WiFi connectivity can also connect mobile CCTV feeds to transit agencies' operation hubs. Digital advertising, one approach for offsetting operation costs, was also tested through this program.

Each Commuter Express car was equipped with a cellular router with a split: one set of cables went forward, to facilitate CCTV functionality, while another went back to provide WiFi service for passengers.

Overall, the Commuter Express service was considered a success, with 16% of customers indicating they were new riders, attracted to public transit solely because of the new faster service with WiFi access. Next, the VTA moved onto adding WiFi across its light rail system.

Phase #2: VTA Adds WiFi in All Light Rail Trains.

In July of 2011, VTA extended WiFi service to all light rail cars, via SinglePoint's WiFi in Motion Moovbox M220 mobile solution. The WiFi In Motion Moovbox M220 system consists of two parts: A rugged antenna about the size of a hockey puck that is mounted on top of each vehicle, and a 3G/4G router that can also connect to CCTV.

The M220 MoovBox is SinglePoint's flagship product, sold in more than 20 countries around the world. It meets all regulatory standards, including those for Electromagnetic Compatibility (EMC), the Federal Communications Commission (FCC), and E-Mark, for those in European markets. For reliable WiFi delivery, each SinglePoint M220 MoovBox has:

- Dual modems.
- Dual SIMs, allowing failover and geo-fencing.
- 4G LTE compatibility.
- 2 Ethernet ports.
- Integrated GPS, allowing agencies to track location of each train or bus.

Additionally, the M220 MoovBox supports SinglePoint's MoovManage software, which provides sophisticated management of transit WiFi. MoovManage can track the location of each vehicle in real time through GPS coordinates. It also provides transit agencies with up-to-the-minute information on the status and use of WiFi on each car or train. Finally, MoovManage allows for remote management of software upgrades, ad campaigns, traffic shaping, content filtering, and even customer questionnaires.

WiFi In Motion Moovbox M220

Along with the technological experience from the Xentrans pilot service, SinglePoint's WiFi solution

proved advanced enough to offer consistent WiFi availability. Indeed, with this second phase of WiFi installation, the VTA light rail became the first transit service in the world to offer an all 4G WiFi connectivity solution. Compatibility with the lightening-speed 4G network was critical for allowing riders access to "content-rich, real time data," such as streaming videos.

The VTA overcame the financial difficulty of WiFi installation through local funding partnerships and a unique advertising program. Area technology and sales companies sponsored WiFi installation on VTA light rail vehicles; these firms had a vested interest in making employees' commute time more enjoyable and productive. SinglePoint's built-in advertising revenue program, SingleREV, also provided capital for installation and ongoing operations.

On a basic level, SingleREV is software that requires transit riders to watch advertisements in exchange for complimentary WiFi access. SinglePoint Communications works closely with each transportation group to design a revenue sharing program to offset WiFi operation costs. Knowing that they will enjoy more productive time with access to the Internet, riders are willing to "pay" with their own time spent watching advertisements. This willingness to watch ads isn't exclusive to the Silicon Valley; a recent survey found that 68% of commuters are willing to watch ads in exchange for free WiFi. SingleREV facilitates the installation of mobile WiFi by providing a consistent, reliable source of funding. For many transit agencies, SingleREV can completely offset the cost of adding transit WiFi.

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Having overcome financial and technological hurdles, the VTA light rail WiFi service was a success. To date there have been over 175,000 unique users who have logged approximately 2 million sessions. The average WiFi connection time was 26 minutes on the VTA's light rail fleet and 40 minutes on their express bus fleet.

In addition, VTA has installed the Moovbox solution in several of their light rail platforms, with plans to deploy more; which allows passengers WiFi access as they wait for trains. Since June of 2013 over 5,000 sessions have been logged. Soon VTA will announce the use of SingleTrak, which provides passengers with real-time vehicle locations so they know when their train or bus will arrive, thus enhancing the customer experience. The VTA has also incorporated the Moovbox solution in their fleet of operational vehicles used by their staff.

Phase #3: VTA Puts WiFi On Express Buses.

As explained earlier, 20 hybrid electric Express Buses were added to VTA's fleet in January of 2012. WiFi was one of several amenities intended to attract new riders. VTA General Manager Michael Burns explains that the agency was "targeting the younger and tech-savvy market" with the Express Bus service. The VTA was also hoping to "target workers who wouldn't normally consider public transit."

For advice on schedule timing and stops, the VTA reached out to Google, which runs a broad-reaching, WiFi-enhanced shuttle service for employees. Following this research, VTA added later express service times, for workers who show up at the office after 9 or 10 in the morning.

The addition of the Express Bus system sent VTA ridership soaring up about 20%. Express bus ridership increased an average of 19.6% in 2012 over 2011. Ridership on certain bus lines increased as much as 73.7%.

PROBLEM SOLVED & BENEFITS REALIZED

SinglePoint's WiFi in Motion Moovbox solution allowed VTA to successfully equip its light rail trains and a portion of buses with WiFi access. This mobile WiFi package overcame the technological difficulties of Internet for transit. By partnering with local companies, VTA was able to offset installation costs, while a built-in advertising mechanism, SinglePoint's SingleREV program, continues to fund ongoing operation.

VTA Technology Manager Richard Bertalan summed up the agency's WiFi experience this way:

"It's not easy to get Silicon Valley commuters out of their cars and onto public transit. One way we have found we can compete is to offer something that the car can't offer: time! Time to surf the net, respond to emails, catch up with friends. The most frustrating thing about being stuck in traffic is thinking about all the things

you'd rather be doing. Now, you can do those things while you commute, from the comfort of our trains, thanks to the new 4G WiFi service on board."

The proposed addition of WiFi to VTA public transit vehicles helped increase ridership, as we have seen. The inclusion of CCTV in VTA's mobile WiFi arrangement will help improve safety as well. Emergencies are more quickly relayed back to transit headquarters when CCTV is installed. Moreover, WiFi allows VTA to monitor the location of each vehicle, which is quite helpful for security.

An unanticipated benefit of WiFi installation has to do with MAP-21 readiness. MAP-21 stands for Moving Ahead for Progress in the 21st Century; this federal transportation funding legislation requires a "state of good repair" before funds can be awarded to transit agencies. With WiFi, agencies like the VTA can better monitor the performance of breaks, air conditioning, and other onboard systems on each train or bus, and thereby show that their system is in a state of good repair for MAP-21 funding.

CONCLUSION

Overall, the WiFi program has been quite successful for the Santa Clara Valley Transportation Authority. VTA experts are predicting an extra 10% increase in light rail ridership this year. New riders continue to switch to public transportation in the area, knowing that their commute will be more productive with WiFi on board.

Going forward, WiFi will continue to be a distinguishing feature on mass transportation vehicles. Agencies that install WiFi will be positioned for continued growth and financial stability. Private groups such as Bolt Bus, Mega Bus, and Greyhound have added WiFi for an improved customer experience, and it's safe to say that more public and private transit groups will seek WiFi installation in the future.

WiFi On Board

About SinglePoint Communications

At SinglePoint Communications, the goal is simple: Give people a way to connect, wherever they go. SinglePoint is North America's leading distributor of products designed to do just that. Our suite of award-winning WiFi In Motion products acts as a bridge between vehicles and high-speed cellular data networks, delivering wifi access and an Ethernet-based local area network (LAN) for connecting on-board systems.

We also sell wireless antennas, amplifiers, wireless data services and a suite of exclusive software solutions.