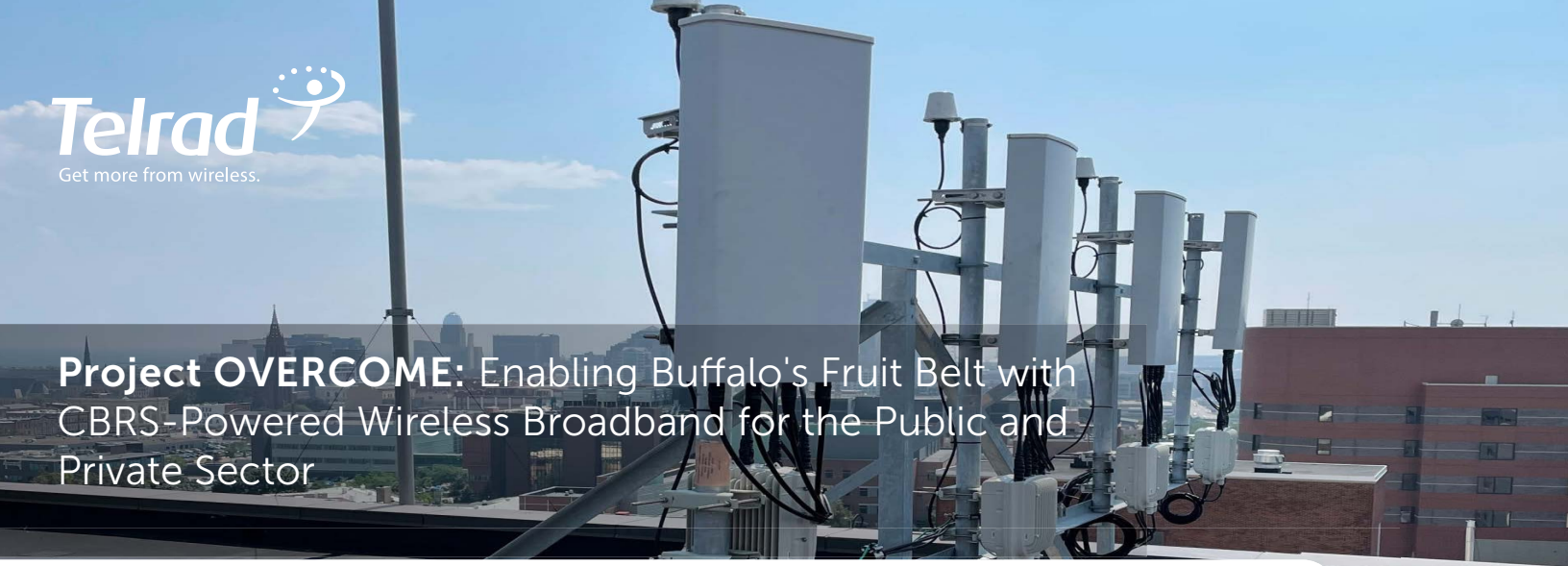


Project OVERCOME: Enabling Buffalo's Fruit Belt with CBRS-Powered Wireless Broadband for the Public and Private Sector

- **Location:** Fruit Belt - Buffalo, NY
- **Frequency:** 3.55-3.70GHz (CBRS)
- **Challenge:** Dense foliage & historic buildings

Introduction:

Founded in 1839, the Fruit Belt is a vibrant and historic neighborhood in Buffalo's East Side rich in both vegetation and culture. Residents share a strong sense of community and self-sufficiency, with families averaging over 50 years in their homes. However, despite its historical and cultural significance, the community struggles to get access to reliable and affordable high-speed internet, putting Fruit Belt residents on the wrong side of the digital divide.

While many in Buffalo rely on the Internet for healthcare, work, banking, education and leisure, connectivity in the Fruit Belt has been limited by a lack of infrastructure and affordable telecom solutions. The historic nature of many of the houses and buildings and thick seasonal foliage has also restricted the kinds of deployable wired and wireless technologies.

With financial support from the National Science Foundation (NSF Award #CNS – 2044448) and Schmidt Futures, US Ignite created Project OVERCOME to better understand the strengths and weaknesses of novel broadband solutions available to communities wanting to expand Internet access to underserved and unserved populations. A working group at the University at Buffalo sought to develop a small-scale, cost-effective infrastructure deployment that would bring wireless broadband connectivity to Fruit Belt residents. As a proof of concept for a community-based Internet model, this limited rollout would leverage "middle mile" infrastructure to create a last-mile solution for un- and underserved households. Telrad equipment was key to this deployment because of its performance, versatility, affordability, and support for the unlicensed Citizens Broadband Radio Service (CBRS) spectrum.

Application

The guiding principle for the community-driven wireless broadband project was digital equity first and foremost. The Fruit Belt neighborhood includes a large number of households and community buildings with limited or no Internet access, so the team's priority was to ensure uniform and reliable coverage among the participating users.

Nicholas Mastronarde, an associate professor in the University at Buffalo's Department of Electrical Engineering, served as one of the project's principal investigators and technology leads.

"This was all happening in the middle of the pandemic, when broadband connectivity was more essential than ever for accessing basic services, such as education and medical care," he says.

CHALLENGE:

Limited site locations for Infrastructure installation

Dense, tall foliage and historic building materials contributed to signal loss

Lack of a reliable propagation study in the CBRS range

Community needs sustainable and affordable connectivity solutions

"There was a research component to this, which is why we were interested in doing something with a novel technology," Mastronarde explains. "For reasons of cost and performance, we were very interested in CBRS networks and how they work."

The project involved thirty-five residences and one historic church. The recently allocated CBRS spectrum by the Federal Communications Commission (FCC) was identified as a suitable option for providing wireless services.

The team also implemented data rate caps of 25 megabits per second (Mbps) up, 3 Mbps down to eliminate perceived unfairness among participants and maintain consistent service regardless of the time of day and their use cases.

Deployment

The project design phase began in December 2021. Several factors determined the positioning of the fixed wireless infrastructure. Antennas needed sufficient height, which made the low-lying buildings of the Fruit Belt unsuitable. This meant the team had to find tall structures adjacent to the neighborhood.

"We installed all four antennas on the Buffalo General Medical Center, which lies to the west of the community. It's a high, multi-floor building. There we were also able to tap into a 1 gigabyte (Gb) backhaul circuit that was provided pro bono," Mastronarde says.

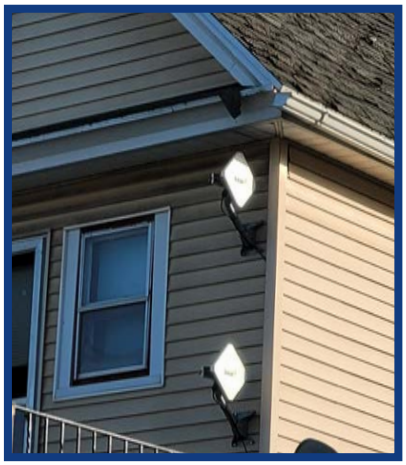
Initially, the team tried to use indoor CPEs mounted inside windows facing the tower, but these proved inadequate for the real-world conditions.

SOLUTION:

BreezeCOMPACT 1000

BreezeWAY 2020

CPE12000



"We quickly found that, in this neighborhood, things were not ideal for indoor models," Mastronarde continues. "The parking garage close to the hospital blocked some of the signal. The Fruit Belt also has quite a lot of foliage, and all the trees above the rooflines caused signal loss. The materials in these historic buildings also caused the indoor customer premises equipment (CPE) signal to degrade as it entered the home. We simply weren't able to use it for connectivity."

The team quickly pivoted to Telrad's high-performance outdoor CPE12000. The ruggedized IP67-rated device would install easily and withstand the elements while also providing excellent performance, thanks to its CBRS support and Quality of Service (QoS) features.

> ***"With those problems related to foliage, the parking garage, and other factors, we found that our original propagation study had been too optimistic. But once we dialed things in, CBRS allowed us to connect a large area with lower costs," says Filippo Malandra, an assistant professor in the Department of Electrical Engineering of the University at Buffalo. He also served as one of the principal investigators and technology leads on the project.***

Results

The goals of this small-scale project were twofold. One was to bring usable wireless broadband connectivity to a limited number of un- and underserved households in the Fruit Belt neighborhood. The other was to study the performance of the system so that it could be refined and applied in similar environments as standardized community-driven wireless broadband model.

"At launch, we were worried by the reliability of CBRS, but that ended up being the easiest part of this deployment," says Mastronarde. "We didn't have major problems, disruptions or disconnections, and its robustness was an advantage during storms."

Today, nearly three dozen households in the Fruit Belt have access to wireless broadband connectivity from this network. Many of them had no service previously.

RESULTS:

Versatile equipment allows for ease and flexibility of installation

High performance and robust signal under real-world conditions

Cost-effective CBRS solution and template for similar deployments

> ***"This deployment is allowing us to conduct active research on CBRS technology and is aiding in the development of new propagation models, which are critical in the design stage. We are working to better characterize the potential and performance of CBRS in an urban environment," says Malandra, "and we are developing new cost-effective tools to foster the adoption of CBRS technology in other areas."***

"At the start of each of projects, efforts focus on providing access to connect the unconnected. When the community sees reliable access, trust is built with the academic, municipal and private sector partners and efforts shift to increasing Internet adoption," says Lee Davenport, Director of Community Development at US Ignite.

"Many historic buildings in the neighborhood wouldn't have supported a wired network without considerable expense seen as out of residents' reach. In the Fruit Belt, CBRS could go where a neighborhood-wide Wi-Fi 6 network couldn't. Without CBRS and the Telrad equipment that supports it, the project wouldn't have been able to deliver on the intended outcomes." says Davenport.