

THE CASE FOR

PURPOSE-BUILT HARDWARE

White Paper



HARDWARE IS HARD.

Why some transit technology providers use purpose-built hardware to drive their solutions and others do not.

Throughout our history, we have occasionally been asked why we remain committed to designing, manufacturing, and servicing our proprietary, purpose-built fixed-route on-board hardware as part of our overall solution. Each time our answer was simple – Our commitments to our clients are best achieved by designing solutions that meet the unique needs of the public transit market.

Generally, our clients accept this answer. In fact, over time, they get to witness firsthand how purpose-built hardware is indeed in their best interest in terms of reliability, serviceability, expandability, and cost.



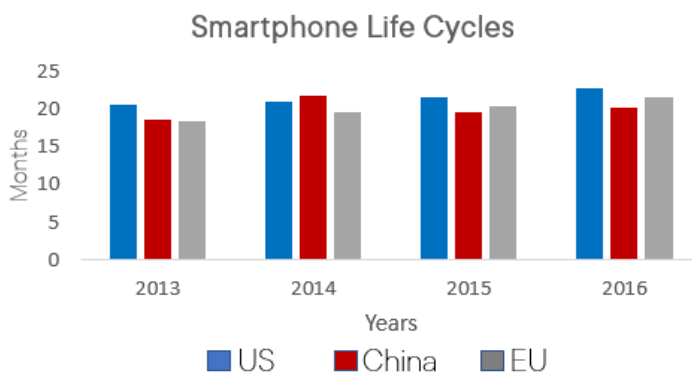
Over the past decade, we are getting asked this question more and more. We believe there are three key reasons for this.

- The most obvious reason is our general familiarity with mobile devices in our personal lives. On the surface, tablet PCs indeed appear to be a perfectly viable alternative to purpose-built on-board hardware.
- Another unfortunate reason is the fear of proprietary hardware and obsolescence. We hear many stories of clients who have been taken advantage of by their previous supplier, who also happened to use proprietary hardware. In such cases, clients often felt like their supplier did not continue to advance the technology, provided limited expansion capability, or forced them to upgrade their entire fleet when parts became obsolete (something we have **NEVER** done).
- Lastly, tablet PCs have performed reasonably well in similar applications, like ride-sharing (i.e., Uber, Lyft) and demand response (i.e., paratransit) services. While this is true, such projects require significantly less integration than a fixed-route vehicle and still come with trade-offs and compromises, many of which are not felt or realized until many years down the road.

With over 30 years in public transportation, serving over 250 customers and powering over 30,000 vehicles, our experience has taught us that commercial off-the-shelf (COTS) hardware is the right choice for a variety of solutions, but powering your core fixed-route ITS infrastructure **should not be one of them.**

SOLUTIONS DESIGNED TO LAST

Think about it; the original iPhone was released 13 years ago, in 2007. It had a 320 x 840 3.5" screen, a 2-megapixel camera for still pictures only, no video and no GPS; it used 2G cellular networks for voice and data communications. It didn't even support basic functions like copy and paste! There have been 13 generations of iPhone in the 13 years since its initial release. Studies show that the average life of today's smartphones is less than two years. In contrast, a fixed-route bus you purchased in 2007 is running in service right now and will likely be running for a few more years before you replace it!



At Clever Devices, we design our system to match the cadence of your business, not those of Silicon Valley. **Our systems are designed with a minimum 12-year life in mind.** In some cases, our systems have reliably operated in revenue service for over 20 years! This kind of longevity is simply impossible unless you manufacture your own equipment.

With an off-the-shelf solution, we have no control over its life expectancy. The third-party manufacturer does not think about public transit when they choose to end of life a product, nor do they care what impact their decision will have on your ITS infrastructure. This would undoubtedly force us to force you to swap out hardware once, or even two times during your vehicle's lifetime at a cost neither company can plan for. These costs can be avoided with a purpose-built solution designed to meet your needs throughout the life of our partnership.

In striking contrast to these situations is our purpose-built Intelligent Vehicle Network (IVN®) system. As a supplier of purpose-built transit hardware, we design our platform to fit transit's unique needs, all of which are reflected throughout our product lifecycle. For example, when an electronic sub-component within the IVN goes end of life, it is incumbent upon us to find a suitable replacement. This happens from time to time, and when it does, the difference is that the number one priority of our team is to make sure that the replacement we choose doesn't impact your system performance in any way whatsoever. This is not something you, as our client, should have to be concerned about.

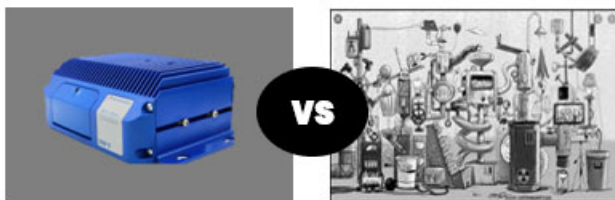


A SOLUTION YOU WON'T OUTGROW

We build our IVN specifically for transit vehicles.

It is designed to expand with you as your needs change and grow. While we can select an off-the-shelf solution that will meet most of your current needs, it likely won't have the necessary capacity to support all your current and future needs without requiring additional "black boxes" and cabling to integrate with 3rd-party systems.

The combined effect creates a practical problem of space on-board the vehicle (with more units needed on-board, more harnessing and likely more antenna holes on the roof) and increased acquisition and maintenance costs. In contrast, our IVN system is designed with enough integration points and capacity (i.e. Ethernet, Serial, CAN, Audio, Video, Discrete, etc.) to serve as the foundation of your ITS platform for years to come.



We are always concerned that COTS hardware will not meet our high expectations for performance.

At Clever Devices, our team of hardware engineers and product experts work in parallel with our software teams to ensure that the hardware we build works seamlessly with our backend solutions. Because our IVN platform is made specifically for transit, we are confident that it will support your complex needs without fail. Third-party solutions built for generic use often do not meet our exacting performance standards or the rigorous requirements of transit.

When we enter a partnership that will likely last over a decade, we are committed to maximizing your hardware investment. This means making sure that the investment you make today will be backward compatible with the hardware we install on your bus builds five years from now. With off the shelf hardware, we cannot make this promise.

We do not force our clients to install older versions of our IVN on new bus builds just to match their current fleet.

Although Clever Devices launched IVN5 in 2019, thousands of vehicles in North America are still running on IVN2s, IVN3s, and IVN4s, with no issues whatsoever.

Even more impressive – many of our customers are running up to three generations of hardware in their fleet, concurrently.



TOTAL COST OF OWNERSHIP

While there are a handful of generic, third-party vendors who do make high-quality products, those devices can be very expensive and typically offer no cost-saving vs. our purpose-built solution.

Other, more affordable options often compromise quality to get to their attractive price points or require additional peripherals to provide comparable functionality.

With IVN, we spare no expense on quality; it is built into the foundation of everything we do. We source our electronic components from trusted vendors with whom we have established long-term relationships and who genuinely care about our business. This allows us to deliver a robust, reliable platform for the best value.



**“THE BITTERNESS OF
POOR QUALITY
REMAINS LONG AFTER
THE SWEETNESS OF
LOW PRICE
IS FORGOTTEN.”**

Benjamin Franklin

This best value approach continues throughout the 12+ years of operation you expect from our system. The IVN system is renowned in our industry for its reliability and longevity. Multiple customers like [Washington, D.C.](#), [Chicago](#), [Pittsburgh](#), and others have successfully operated our equipment for up to 20 years, in some cases.

Others, like [New York City](#), have measured the Mean Distance Between Failure (MDBF) of the IVN system to be more than 1,000,000 miles! These customers have saved countless dollars through lower system maintenance costs and by avoiding premature hardware replacement. Because we know what goes into building our IVN solution, we can stand by it with confidence, assured that it will stand the test of time because we’ve designed it to meet your needs today and in the future, without question.

Because of these factors and others, we do not recommend commercial off-the-shelf hardware for fixed-route buses. Your needs as a transit agency are far too complex and demanding for a generic solution that is not purpose-built to meet your needs.

As the saying goes, “hardware is hard,” and the real reason some do not manufacture their own hardware is because they simply do not know how. Using off the shelf hardware is easier for them in the short term, [not what is best for you in the long term.](#)



For more information about Clever Devices Public Transportation Solutions, visit us at www.cleverdevices.com