Solution Brief

Education

Improving Classroom Experience with Display Panels Based on Intel's Open Pluggable Specification (OPS)

Intel's Open Pluggable Specification (OPS) provides an industry standard for modular computing units that plug into an OPS slot on enabled interactive flat panel displays. This architecture eliminates cables and streamlines usability for educators as it improves security, manageability and maintenance for IT departments.

The digitization of modern classrooms enables teachers to actively engage students in collaborative environments with presentations, demonstrations and rich media content. Lessons in mainstream schools are now powered by interactive flat panel displays: large touchscreens that let both teachers and students interact with educational content in real-time, even remotely. Interactive flat panel displays are rapidly replacing older interactive whiteboards based on projectors and sensing technology.

Seeking greater value from the resources available to them, educators generally connect an external computer to the interactive flat panel display, often using a teacher laptop or a dedicated mini-PC. Cabling and connectivity for display and interactivity can introduce usability issues that interfere with lessons, as well as complicating manageability and maintenance, potentially raising TCO.

Intel's Open Pluggable Standard (OPS) resolves the problems of predecessor technology with a modular PC form factor that plugs into a dedicated internal slot on the interactive flat panel display, as shown in Figure 1. Specifying the physical interface and signaling for cable-free connectivity, OPS improves reliability and usability for teachers and streamlines deployment and maintenance for IT.

Figure 1. Open Pluggable Specification compute modules for interactive flat panel displays.

Addressing limitations and challenges for in-classroom computing

Schools have the option of using interactive flat panel displays on their own or with an attached computer, as summarized in Table 1. These options differ from each other in terms of factors that include usability, manageability and maintenance costs/TCO.

Table 1. Advantages and disadvantages of various computing solutions for interactive flat panel displays.

Description	BASIC: Stand-Alone Display	GOOD: Teacher Laptop	BETTER: Dedicated PC	BEST: OPS Module
Usability/Ecosystem	Low	High	High	High
Operating System	Android	Windows/Linux/ Chrome	Windows/Linux/ Chrome	Android/Windows/Linux/ Chrome
Potential Theft	Low	Moderate	High	Low
Remote Manageability	Complex	Moderate	Robust	Robust
TCO/Maintenance Costs	High	High	Low	Low
Cybersecurity	Low	Low	High	High
Ease of Install/ Upgrade	Easy	Medium	Complex	Easy

Basic: Stand-alone display

The most basic deployment approach for interactive flat panel displays is simply to install them on their own, without attaching a computer. The resulting classroom environment lacks rich media, reducing student engagement and pedagogical flexibility.

Lacking the computing power of a true networked computer, stand-alone interactive flat panel displays cannot typically be managed using standard IT tools. The CPU has lower performance and typically runs an older version of Android, leaving the stand-alone display unable to take advantage of the Windows, Linux and Chrome ecosystems. In addition, insufficient standardization among manufacturers leads to mismatched OSs and the need to train educators on multiple platforms, increasing complexity and TCO.

Good: Teacher laptops

The most prevalent approach for computing resources is to connect the teacher's laptop to the display using an HDMI cable. Because HDMI cannot provide touchscreen support, a second cable is required for USB connectivity to provide touch capabilities, which is not always possible. This consideration makes wireless connectivity impractical, and the teacher laptop must remain tied to the panel rather than filling other uses. Connecting cables and other setup tasks can be cumbersome, creating frustration and delaying the start of class, while continually plugging and unplugging cables causes wear on physical connectors.

Hosting educational content on personal laptops also interferes with sharing materials among teachers, including scenarios where substitute teachers do not have access to those laptops with the instructional materials they need. The portability of laptops on and off network can also introduce challenges with manageability, increasing complexity, security concerns and TCO.

Better: Dedicated PCs

An alternative to connecting teacher laptops to interactive flat panel displays is to purchase dedicated stand-alone PCs. These are commonly desktop mini-computers co-located with the display. A prevalent problem with this model is the potential for theft, particularly because the equipment is typically deployed on a cart or in a classroom, where it is difficult to secure it properly.

This approach does provide the potential for teachers to use their personal laptops as a second screen, which can be helpful for tasks ranging from taking attendance to consulting reference materials. While teachers do not need to connect cables with each use, missing cables or misconnections by previous users can cause headaches. Stand-alone PCs in these implementations also tend to have limited manageability. The PC must be managed on its own, and the panel must be managed using a separate tool. Multiple tools from diverse manufacturers create sprawl and complexity that can drive up maintenance costs and TCO.

Best: OPS modules

Using an OPS module to provide computing resources also provides a second screen for teachers, and it requires no cables for connection to the interactive flat panel display, helping eliminate negative impacts on usability. Likewise, the potential for theft is dramatically reduced, because the module can only be connected to power through the dedicated connector, making it difficult or impossible to use on its own. Using an OPS module also offers access to the wider general-purpose and education-focused software ecosystem based on Windows and Linux.

OPS modules take advantage of existing management best practices and tools. Top-tier manageability at parity with other endpoints on the school network enables more efficient support, higher reliability and more robust cybersecurity for the entire network. Administrators also have the ability to remotely (or automatically) turn off the display to extend its life. These factors streamline day-to-day operations, optimize results in and out of the classroom and help reduce TCO.

OPS optimizes sustainability and upgradeability. Performance can be increased simply by replacing the OPS module, retaining the value of current interactive display investments. Schools can extend the digitalization of facilities, including control over lighting, heating and air conditioning, sensors and air quality. Standard peripherals such as cameras, speakers and printers can be connected transparently, and educational content can be stored on the network or in the cloud. The solution also optionally includes Wi-Fi connectivity for students as well as Intel® vPro™ technology for state-of-the-art remote manageability.

OPS advances the state of educational technology

First introduced through a strategic relationship between Intel, Microsoft, NEC and other key industry players in 2010, OPS is the industry standard for connecting computers to interactive flat panel displays using a single universal internal slot. OPS provides a cost-effective way for schools to deploy more computing assets into the smart classroom, delivering a high-performance, collaborative multimodal environment to supercharge learning.

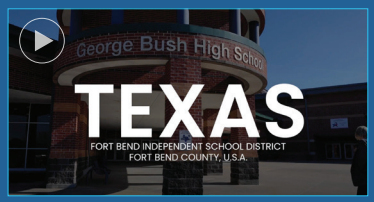
The single-unit integration of OPS plus display makes equipment easily portable, with no cables or multiple chassis to be concerned with. The modules provide a full-OS compute experience with the applications, educational content and peripherals such as microphones, cameras and printers that teachers need. After some years of use, computing resources can be refreshed simply by sliding the module out and sliding a new one in.

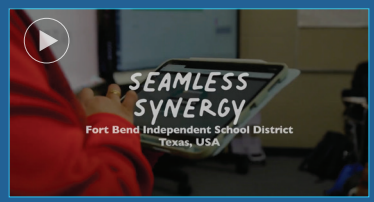
With an OPS-enabled interactive flat panel display, teachers can access all their files as well as online materials easily, for a robust classroom experience. When the lesson calls for it, the teacher can switch from a whiteboard to resources such as live data, multimedia and high-resolution online maps, engaging digital-native students with enhanced learning opportunities. The technology is seamlessly integrated into the classroom, so a 21st-century curriculum can provide the baseline foundations for instructional excellence.

OPS can help make multimodal learning based on visual, auditory and kinesthetic elements the de facto standard. The accompanying technology transparency and ease of use also make it possible to train all faculty on the shared technology for optimal adoption and ease of use. Teachers can rely on the second computer to drive lessons while using their laptops for other functions that range from taking attendance to capturing notes and feedback on their course materials during class.

Success stories of OPS-powered flat panel interactive displays

Fort Bend, Texas schools adopted OPS technology and reaped instructional, financial and IT benefits. Watch the videos below to learn from the people who deployed it and how OPS is helping deliver 21st-century education. Click image to view video.





Building the classroom of the future

Platform innovations engineered into the latest Intel® Core™ Ultra processors put AI to work in service to teachers and students alike. Multimedia capabilities such as noise cancellation, lighting correction and background blur help ensure a high-quality learning environment. Language translation, gesture recognition and object tracking make smart classrooms even smarter, helping schools excel in their mission. Teachers can harness generative AI to help generate and enhance content, even on the fly during class time. The future is bright.

Read the white paper.

For school IT departments, OPS dramatically streamlines deployment and maintenance. Modules can simply be shipped to schools and installed by non-technical users, with no direct involvement by a technician. OS updates, software patches and other modifications can likewise be pushed out over the wire, without an IT presence on-site at each school. OPS units can be fully managed using IT's software tools of choice, and security benefits are achievable with Intel's full security ecosystem in addition to the theft resistance mentioned above.

Available Intel vPro technology extends manageability with an out-of-band channel to remotely repair corrupted drivers and other software. These capabilities work even if the unit is powered off or the OS becomes inoperable, optimizing uptime and security along with TCO. OPS modules benefit from the power of Intel® Core™ i5 and i7 processors for blazing performance, stunning visuals and enhanced collaboration. These cutting-edge CPUs offer a high-performance architecture with advanced graphics and AI acceleration using Intel® Deep Learning Boost.

Conclusion

The OPS standard integrates advanced, future-focused capabilities into interactive flat panel displays for smart classrooms. It enables schools to enhance their digital teaching technologies including AI, engaging students with immersive, collaborative curricula and supporting resources.

OPS reduces challenges for educators by streamlining and standardizing display hardware, eliminating cables and discouraging theft of computing equipment. IT gains substantial advantages from simpler deployment and enhanced manageability. School districts and administrators gain the ability to deliver enhanced digital education technology, for better learning outcomes while helping reduce costs.

Educational excellence, enabled by OPS

Deploying OPS modules for interactive flat panel displays provides school districts with forward-looking advantages, from the classroom to the IT department to the school board budget committee.

- **Improved classroom experiences**, streamlining usability and maximizing student engagement and ecosystem resources for educators.
- **Superior security and manageability**, with full cyber capabilities and holistic remote manageability provided by Intel vPro technology.
- **Budget and investment protection**, with outstanding TCO, simple upgradeability and reduced potential for theft.

Learn More

www.intel.com/education

MarketScale: Unlocking the Future of Education with OPS 2.0

0924/GR/MESH/PDF 356885-001US