Introduction

Touch-enabled, LCD-based Interactive Whiteboards (IWBs) are transforming classrooms around the world. A major advance over previous IWBs that utilized projectors, these new solutions transform classrooms by supporting new ways to develop, present and share content in real time—including the ability of the students in class and others—such as outside experts, students working from home and other teachers—to take control of the whiteboard using their own devices. Some of the specific ways Touch-enabled, LCD-based IWBs transform classrooms include:

- Providing a decisive alternative to traditional, teacher-led classroom environments
- Supporting new teaching/learning experiences and usage models
- Empowering students to play an active role in learning
- Enabling visual, auditory and kinesthetic learning modes
- Encouraging more collaboration and interactivity

Touch-enabled, LCD-based IWBs also provide numerous operational/cost advantages compared to older, Projector-based systems. For example, LCD-based systems are more versatile, easier and less expensive to manage and maintain and overcome many of the specific disadvantages of projectors, such as focusing/calibration, burnt-out bulbs, noise, heat, shadows, contrast/lighting problems and more.

Take advantage of this short selling guide and learn more about the benefits of Touch-enabled, LCD-based IWBs, Intel®-based solution recipes for these systems and steps you can follow to effectively position Intel®-based solutions with your education clients.

The First Projector-based Interactive Whiteboards

Whiteboards (and their legendary predecessor, the blackboard) have long played a central role in education. Using chalk or dry-erase markers, they provide an easy way for teachers to stand at the front of the classroom and present content, supporting the traditional instructor-led teaching approach.

Two decades ago, the first interactive whiteboards (IWBs) began to appear. These first-generation IWBs—which are still being actively marketed and are in wide use—consist of an electronic, interactive surface (the “whiteboard”) attached to a computer and a projector.
How Projector-based IWBs Work: A projector displays content from a computer onto the whiteboard’s surface, which is made from one of a range of interactive technologies (infrared; resistive, touch-based; electromagnetic or ultrasonic). Standing at the board (or at the computer), instructors can easily present content, write new content, drag and copy, access online sources and ultimately save whatever is on the whiteboard for distribution and/or to use in the future.

Limitations of Projector-based IWBs

Projector-based IWBs were (and still are) a major breakthrough in educational technology. However, over time, limitations of Projector-based IWBs have become apparent—both instructional limitations and operational disadvantages:

Instructional Limitations: Projector-based IWBs cannot be easily adapted to newer, more collaborative and interactive teaching/learning methods. Projector-based IWBs primarily support the traditional, one-to-many, instructor-led teaching model that has long dominated the classroom:

- The teacher develops and presents all content, typically standing at the whiteboard at the front of the classroom (or at the computer).
- There is no integration with student devices, for example enabling a student using a PC, laptop or tablet to take control and present content on the IWB.
- There is no ability to connect with experts or students outside the classroom, enabling them to present content.
- The presentation is primarily one-to-many, i.e., teacher to the entire classroom. There is little or no ability to use the IWB to facilitate 1:1 or small-group interaction.

Operational Limitations: Some of the primary operational disadvantages of Projector-based IWBs include:

- Usability: Training is needed to enable teachers to get full value out of using these systems.
- Image: Because the image is projected, it is low-contrast; shadows and lighting impact visibility. To get good visibility, a large screen is needed: 100 inches and up.
- Maintenance: Projector lamps regularly burn out; dust builds up on the projector; because the projector is ceiling mounted, a technician is needed to provide maintenance, adding to the cost.

Touch-enabled LCD-based Interactive Whiteboards

Interactive whiteboards are evolving once again with the new generation of Touch-enabled, LCD-based IWBs. These systems do not need a projector. Instead of a specialized interactive surface, they make use of industry-standard, touch-enabled displays. Instead of a computer, content can be managed with small, powerful media players. Perhaps most important, they are able to be wirelessly controlled by a wide range of devices.

LCD-based IWBs go significantly beyond what is possible using Projector-based IWBs (1) supporting a true Transformation in Classroom/Teaching/Learning Environments and (2) offering a wide range of Operational and Cost Advantages. Let’s look at each of these:

1. Transformation in Classroom/Teaching/Learning Environments

Touch-enabled, LCD-based IWBs are changing how teaching and learning take place in the classroom. Here are some of the most common examples of this transformation:
Interactive Whiteboards

Teachers as Instructors and Facilitators: The presentation of content no longer needs to be primarily instructor-led with the teacher at the front of the classroom. Instead of a one-way transmission of information, instruction can now be collaborative. Students in class (working from home or elsewhere), outside experts and others can contribute content via their own devices. Teachers can serve as traditional “instructors,” but now they can also be “facilitators,” orchestrating the contributions of students and other experts.

Teaching Methods: Using the combination of the Touch-enabled, LCD-based IWBs and access to student devices (PCs, laptops, tablets, etc.), instruction can easily be one-to-many, one-to-few (i.e., small group learning) and one-to-one (personalized instruction)—as well as involve remote, real-time collaboration with experts and others outside the classroom.

Real-Time Classroom Collaboration: Teachers, students and others (using their own devices) can actively collaborate in real time—working together to research, develop and present content, solve problems and complete exercises as part of a shared learning environment.

Personalized Learning Modes: Touch-enabled, LCD-based IWBs make it easier for:

- Visual learners to see what is taking place as it develops at the board
- Auditory learners to benefit from audio reinforcement and class discussion
- Kinesthetic (tactile) learners to benefit from touching/marking at the board and at their own devices and then seeing it projected on the board

2. Operational/Cost Advantages

In addition to their impact on teaching and learning, Touch-enabled, LCD-based IWBs offer numerous operational/cost advantages:

- Ease of Use: Touch-enabled, LCD-based IWBs use the familiar tap and swipe that users of tablets know well—no training or learning curve required.
- Image/Display: The image on the LCD is high-contrast, eliminating or minimizing visibility/lighting issues. Because the image is higher contrast, and is also viewable on student devices, the screens needed are smaller (less expensive, less cumbersome) than screens required with projector-based solutions. A typical screen size is under 84 inches, compared to at least 100 inches for projector-based systems.
- Eliminating Projector Drawbacks: Because there is no projector, there are no focusing/calibration issues, no burnt-out bulbs, noise, heat, shadows, contrast/lighting problems, etc.
- Maintenance/Management: The ongoing operational maintenance of LCD-based IWBs is easier and less expensive using Intel® remote management architecture functionality (Intel® vPro®).
- Versatility: These are true “multimedia” solutions: the LCD touch screen and media player make it easy to access a wide range of resources in real time, including impromptu searches, app downloads, video calls/conferences and many more.
- Schoolwide Solution: LCD-based whiteboards can be used outside the classroom—in hallways and other venues—as part of a schoolwide solution for instruction, information display, scheduling, promotions or emergency warnings—all centrally managed.
## AT-A-GLANCE TABLE: Projector-based IWBs Versus Touch-enabled LCD-based IWBs

<table>
<thead>
<tr>
<th>Display Technology</th>
<th>Projector and specialized display</th>
<th>No projector; industry-standard LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile Control</td>
<td>No mobile control</td>
<td>Wide range of mobile devices can connect to and control system</td>
</tr>
<tr>
<td>Content Delivery and Management</td>
<td>From computer/teacher laptop, via projector on to IWB surface; instruction is usually pre-arranged in a class “lesson” format</td>
<td>From computer or integrated media player directly to screen; easy to access a wide range of resources in real time, including impromptu searches, app downloads, video calls/conferences and more</td>
</tr>
<tr>
<td>Instructional Control of Content</td>
<td>Teacher controls the development and presentation of all content</td>
<td>Content control can be shared by teachers, students, experts and others in and outside the classroom</td>
</tr>
<tr>
<td>Instructional Modes</td>
<td>Instructor-led, typically front of classroom; 1:many</td>
<td>Many options: Instructor-led, student-led, collaborative; 1: many, 1: few; 1:1; instructor can be anywhere using mobile device</td>
</tr>
<tr>
<td>Image/Resolution</td>
<td>Projected, low-contrast image; shadows and lighting impact image</td>
<td>High resolution; Fully operational and visible even in full daylight; Excellent contrast</td>
</tr>
<tr>
<td>Screen Size</td>
<td>Requires screen size of 100” and up</td>
<td>No need for large screen; high contrast of image and ability to view images in real time on student devices means display sizes of 65”-84” are sufficient</td>
</tr>
<tr>
<td>Initial Capital Investment</td>
<td>High initial capital investment including cost of projector, specialized display surface, ceiling installation, network/electrical wiring</td>
<td>Low initial capital investment—primarily LCD display mounted on wall</td>
</tr>
<tr>
<td>Remote Management</td>
<td>No remote management—management/ maintenance involves regular classroom visits by teacher/local IT/IS engineer</td>
<td>Remote management options via Intel® vPro™—removing need for regular classroom visits and local IT/IS engineer support</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>High ongoing operating costs—regular lamp replacement, cost of access to ceiling-mounted projectors and other factors cause higher ongoing maintenance costs</td>
<td>Lower operational cost due to elimination of projector and remote/centralized management/maintenance for standardized LCD IWB architecture (i.e., Intel® vPro™)</td>
</tr>
<tr>
<td>Maintenance and Repair</td>
<td>High maintenance: Lamp burn out requires frequent, specialized (costly) lamp replacements; dust build-up inside projector requires technician visit for cleaning; lamp contrast deterioration—need for replacement at 6-month intervals; fan noise in projector</td>
<td>Low maintenance</td>
</tr>
<tr>
<td>Environmental Issues</td>
<td>Projectors are noisy and heat up; High energy costs; often needs the classroom to be dark (blinds/curtains)</td>
<td>No noise, low-heat; LCD reduces power consumption; visible in a wide range of environments</td>
</tr>
<tr>
<td>Replacement Cycle</td>
<td>3-5 year</td>
<td>7-9 year</td>
</tr>
</tbody>
</table>

### IWB Market Snapshot
- Out of 38 million classrooms around the world, it’s estimated that 12 percent have IWBs now and that the number will grow to 20 percent by 2016, a nearly 16 percent CAGR for the period 2014-2018. (Source: FutureSource Consulting)
- Current IWB market dominated by projector-based solutions with trend of replacement with Touch-enabled LCD-based IWB systems.
- Microsoft OS is predominant due to abundance of Microsoft-based educational content and Microsoft-based/supported codecs.
- LCD-based IWBs are a key part of display market: 1 of 7 LCDs worldwide in 2013 were used for IWBs. (Source: FutureSource Consulting)
- IWBs are part of required classroom setup in many education districts.
### TABLE: Intel® Solution Recipes for Interactive Whiteboards

<table>
<thead>
<tr>
<th>BASIC</th>
<th>MAINSTREAM</th>
<th>ADVANCED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOLUTION: Projector-based IWB</td>
<td>SOLUTION: Touch-enabled, LCD-based IWB optional Remote Management</td>
<td>SOLUTION: Touch-enabled, LCD-based IWB with Remote Management</td>
</tr>
<tr>
<td>Customers May Have One or More of the Following Characteristics:</td>
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</tr>
<tr>
<td>✓ Wants to leverage current investment in projector-based IWBs—existing systems, software, teacher and/or tech experience</td>
<td>✓ Has investment in projector-based IWBs—but is frustrated by lack of connectivity, inflexibility, operational issues/costs</td>
<td>✓ Innovative, student-centered institution—secondary or higher education</td>
</tr>
<tr>
<td>✓ New to IWBs—wants to support traditional instructor-based teaching modes</td>
<td>✓ New to IWBs and wants to support new student-centered/collaborative teaching modes</td>
<td>✓ Plans campus-wide investment—wants operational cost savings, remote management capabilities (Intel® vPro™)</td>
</tr>
<tr>
<td>✓ Not interested in supporting access to content via student devices</td>
<td>✓ Wants to consider remote/centralized management</td>
<td>✓ MAJOR MARKETS: Primary and secondary schools; higher education</td>
</tr>
<tr>
<td>✓ MAJOR MARKETS: Primary schools</td>
<td>✓ MAJOR MARKETS: Primary and secondary schools; higher education</td>
<td></td>
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<tr>
<td>TYPICAL PLATFORM:</td>
<td>TYPICAL PLATFORM:</td>
<td>TYPICAL PLATFORM:</td>
</tr>
<tr>
<td>Intel® Core™ i3/i5/i7</td>
<td>Intel® Core™ i3 (no Intel® vPro™) Intel® Core™ i5 (w Intel® vPro”)</td>
<td>Intel® Core™ i5/i7 (w Intel® vPro”)</td>
</tr>
<tr>
<td>External computing unit</td>
<td>Standardized, pluggable display</td>
<td>Standardized, pluggable display</td>
</tr>
<tr>
<td>Projector  specialized display</td>
<td></td>
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</tbody>
</table>
**Selling Interactive Whiteboards**

Use the following table as a quick reminder when selling IWBs. The bullet points here summarize key buying triggers—buyer “hot buttons,” value/outcomes and potential concerns/objections:

1. **Identify the “hot buttons” of the potential buyer.** In educational institutions this can include:
   - Creating platform/environment (e.g., more opportunities) for student-centered learning
   - Supporting individual learning styles—driving quality of learning
   - Support for growing use of student-used devices (PCs, laptops, tablets, etc.)
   - Dissatisfaction with current whiteboard technologies: problems with quality, cost, downtime (burnt bulbs), management, etc.

2. **Be Prepared to Talk Value**
   - **Improved Outcomes**
     - Increasing quality of instruction: variety and creativity in individual/group task/assignments
     - Supporting student-centered learning environments in which students play an active role using their own PCs, tablets and other devices
     - Increasing support for different/individual learning modes: visual, auditory, kinesthetic (tactile)
     - Enhancing ability of instructors to provide 1:many, 1:small group, 1:1 learning
     - Enabling students to search and use material that they feel best meets their own individual understanding of the task/assignment
     - Supporting “instructor is facilitator”—orchestrating more performance by students, access to outside experts
   - **Improved Student Experience**
     - More engaging, high-tech environment
     - More options for collaborative, student-led education
     - Better able to access new/changing instructional material
     - Better able to adapt to the changing needs of different students
     - More active, engaged environment increasing student retention
   - **Simpler, Better, More Cost-Effective Solution**
     - Fewer parts in need of tech support: projector bulbs, ceiling-mounted projector
     - Easy to use—little learning curve for instructors, students
     - Integration with wide range of devices
     - Industry-standard operating system
     - Schoolwide management of content on all displays

3. **Be Prepared to Address Key Buying Concerns/Objections**
   - Overall cost of the system
   - Cost of management and maintenance
   - Hidden costs
   - Longevity and scalability
   - Reliability
   - Integration with existing IT solutions
   - Potential disruption of installation
   - Training staff to use the system
Why Intel®-based Solutions?
Interactive whiteboard systems that make use of Intel® technologies—including Intel® Core™ i3/i5/i7 processors, discrete (NUC) and pluggable, OPS modules—provide standardized platforms that are uniquely suited to support the long-range transformation of educational environments while addressing scalability, flexibility and concerns over cost and remote management:

Performance
Intel® processors enable enhanced performance and lower CPU utilization, supporting the development, presenting and sharing of the kind of dynamic, rich content that drives higher levels of student engagement.

Complete Solutions—Easier Sharing
Intel provides standardized solutions for whiteboards including hardware, software and management. Basing whiteboard solutions on Intel® technologies provides platforms on which a wide range of software and innovative classroom/teaching/learning experiences can be supported.

Scalability and Faster Time to Market
Software for interactive whiteboards is scalable up and down the Intel stack, supporting rapid, cost-effective development of IWB solutions at every price point. Solution developers can choose the best processor to suit the whiteboard application.

Ease of Management/Lower Total Cost of Ownership (TCO)
• Intel® Active Management Technology (Intel® AMT)—Intel® Active Management Technology (Intel® AMT) (a feature of Intel® Core™ i5 and i7 processors with Intel® vPro™ technology) enable IWBs to be monitored proactively, managed and repaired remotely, even if the whiteboard is powered off or the operating system is not functioning, ultimately lowering IT support costs.
• Initial upfront capital investment in IWBs based on Intel® technologies supports lower, more predictable long-term operating expense, ultimately leading to lower total cost of ownership.

Investment Protection
Backwards and forwards compatibility and up to seven-year life cycle of Intel® processors “future-proofs” clients, supporting stability and long-term investment protection.