Enabling Customizable, Future-Proof Architectures with Intel® Intelligent Touch and Display Module Platform

DFI is an Intel partner that has adopted the IT-DM Platform solution for their Interactive Display Market Applications

Executive Summary

The Interactive Display Market is an innovation and technology driven market. Every year there are new products with novel hardware, architectures, and silicon. This fast cadence of change has created a market need for future-proof technologies that is increasingly harder for ASIC and ASSP based silicon products to keep pace with. What's more, the market is seeing an increase in vertical applications that require the solution vendors (e.g. digital signage, video wall, etc.) to spend additional time integrating their panel designs to meet the application need.
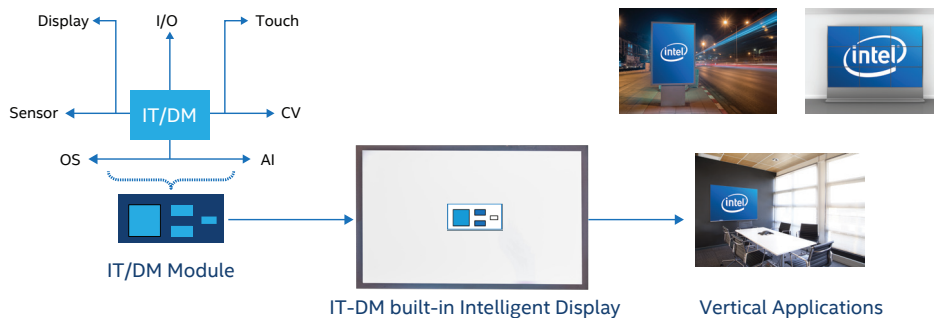
Figure 1. Intel's Modular IT-DM Architecture

Leveraging Intel's deep expertise in FPGA design and vast customer ecosystem to derive market requirements Intel has developed the Intelligent Touch and Display Module (IT-DM) Platform solution. This solution gives customers the ability to use Intel's fast, flexible, and proprietary touch, display, and computer vision FPGA architectures. For example, IT-DM's flexibility provides the capability to break-up or combine the architectures depending on the use cases. This allows customers to design boards that will only be used in one specific application like a display controller or single boards that can be used in multiple applications like display, touch, and computer vision. Additionally, IT-DM-based solutions can output custom display resolutions up to 8k60HZ, and lower touch latency into the 10 ms range depending on the application. These technological advancements are enabled for Intel® FPGA customers through Intel IT-DM, which leverages Intel's proprietary video and image processing solutions. Overall, Intel's FPGA and Intel eASIC™ products provide an edge in the interactive display market by reducing go-to-market time, delivering flexible architectures, and optimizing product designs.
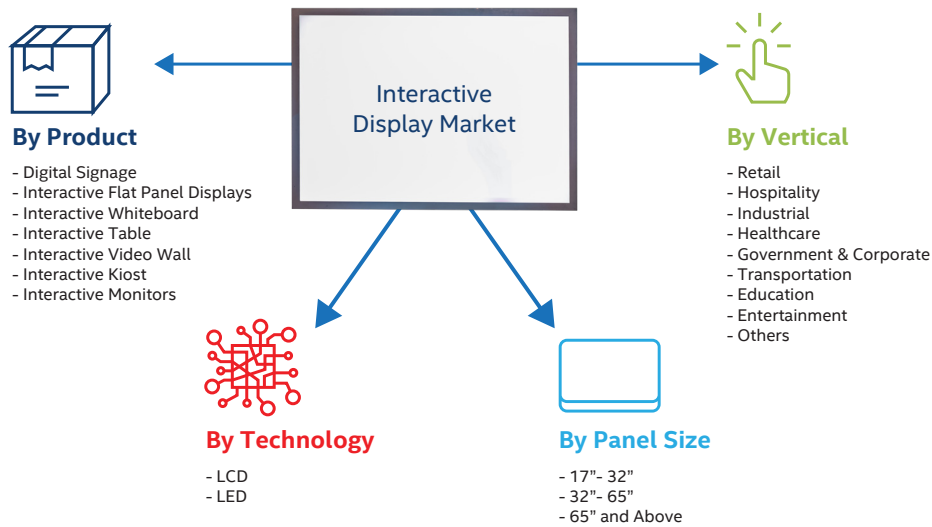
Authors

Garrett Wyatt
Visual Retail Marketing Manager
NCLG, Intel

Zana Ilhan
Video and Vision Segment Manager
NCLG, Intel

By Product

- Digital Signage
- Interactive Flat Panel Displays
- Interactive Whiteboard
- Interactive Table
- Interactive Video Wall
- Interactive Kiost
- Interactive Monitors

Interactive Display Market

By Vertical

- Retail
- Hospitality
- Industrial
- Healthcare
- Government & Corporate
- Transportation
- Education
- Entertainment
- Others

By Technology

- LCD
- LED

By Panel Size

- 17"- 32"
- 32"- 65"
- 65" and Above

Introduction

The display panel market is a feature driven market that is continuously demanding higher resolutions, enhanced connectivity protocols, content protection, and compression technologies. Solution vendors need a way to adapt to new technologies quickly in a standardized way. With these general problems in mind, Intel spent over a year and half meeting and surveying with key stakeholders in its immense interactive display market ecosystem to understand the specific pain points. Then Intel used this knowledge to construct a solution architecture that is cost effective, future proof, and customizable to fit many vertical applications.

Challenge

Interactive display panel vendors have been seeing an increase in demand for:

- Higher resolutions like 4K120Hz, 4K240Hz, 5K, 6K, 8K30Hz, 8K60Hz, 8K120Hz, HDR etc.
- New connectivity protocols such as HDMI 2.1, DP1.4, DP2.0, Thunderbolt™ 3, video over network (IP) like SMPTE ST2110, etc.
- Content protection and compression technologies like HDCP, JPEG2000, etc.

In addition, vertical application vendors are putting in significant additional design effort to be able to utilize the screens with different vertical applications.

Solution

Intel's IT-DM is an architecture solution that solves business challenges that many original equipment manufacturers (OEMs) and solution vendors experience.

Intel IT-DM Platform is an architecture solution that contains a number of key hardware and software based components to enable standard vertical-ready interactive professional displays. IT-DM includes integrated operating systems, display sensors, display agnostic boards, flexible hardware, smart I/O switching, advanced touch, computer vision, artificial intelligence, and Intel's Video and Image Processing suite. In addition, the IT-DM solution will support next generation protocols like HDMI 2.1 and DP1.4. As well as, display resolutions up to 8K60HZ and greater.

Intel IT-DM brings an operating system agnostic platform that supports clouds services, remote management, and enterprise scale updates, etc. Also, the solution contains integrated display sensors giving you the ability to handle sensor events in a standard way. Furthermore, since Intel IT-DM is a display agnostic solution, it protects you against the quick cadence of new technologies. Meaning that each year when new technologies are introduced like 4k,8k, DP 1.4, HDMI 2.1, etc., Intel IT-DM solution stays relevant and futureproof by offering flexible hardware architectures that allow the latest business logic to be ported onto without having to re-design the hardware. Another offering is smart I/O switching, which allows the IT-DM solution to switch I/Os intelligently based on business application.
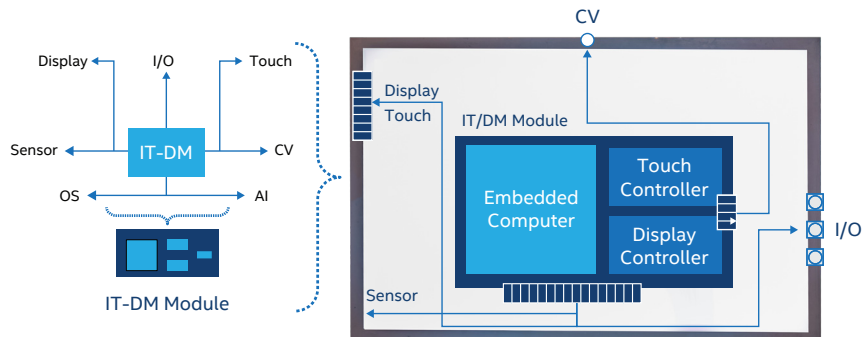
Figure 2. IT-DM Vertical-Ready Display Panel

The power of the Intel silicon specified in Intel IT-DM solution paired with your touch technology leads to advanced, faster, and enhanced touch experiences. In some applications, the display agnostic touch controller was able to process touch events in the sub 10 ms range (from 30+). In addition, the computer vision artificial intelligence (AI) module of IT-DM enables objects and

people recognition/detection to allow business applications like content management systems to make context aware business decisions as required. Further, with the artificial intelligence capabilities all the gathered information can be collected and analyzed to find powerful patterns to increase the applications efficiency. Also, the solution takes advantage of Intel's pluggable form factors (Intel OPS, SDM, etc), and other media player architectures.
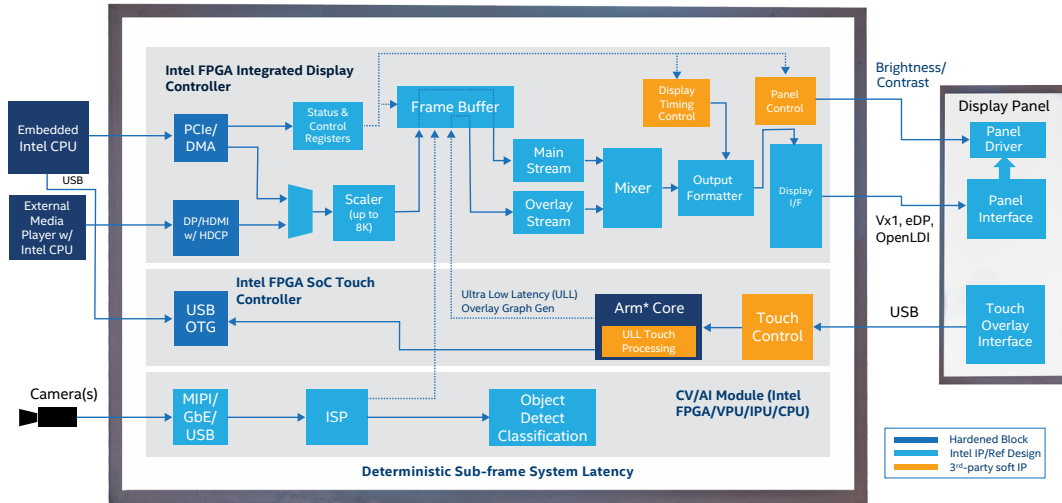

Figure 3. Intelligent Touch and Display Module. (3) Boards – Display, Touch, and Computer Vision

The building blocks of Intel IT-DM are a display controller module, touch controller module, and computer vision module. Each of these modules can be designed as a single board or broken up into multiple components as required. The architecture solution behind each module

contains a number of key intellectual property (IP) cores that can be customized, optimized, and productized based on the application. The light blue blocks are IPs that are available free of charge from Intel and can be paired with 3rd party IPs (orange blocks) to create a distinct competitive board solution.
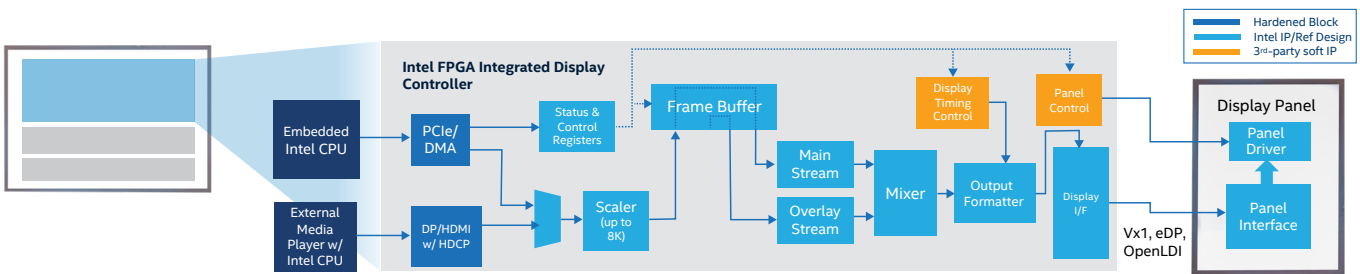

Figure 4. IT-DM Display Controller Board Architecture

As mentioned above, Intel IT-DM platform solution can be designed as a single board like the display controller board designed by Intel's partner DFI. DFI created the first production-ready display controller that is fully compliant with Intel IT-DM specification. DFI gives original design manufacturer (ODM) services for vertical display applications.

The board includes:

- LVDS interface supports up to 8k60Hz
- V-by-one interface supports up to 8k60Hz
- DisplayPort 1.4
- HDMI 2.1
- Under 10 watts of power consumption
- Form Factor – 130 mm x 162.7 mm
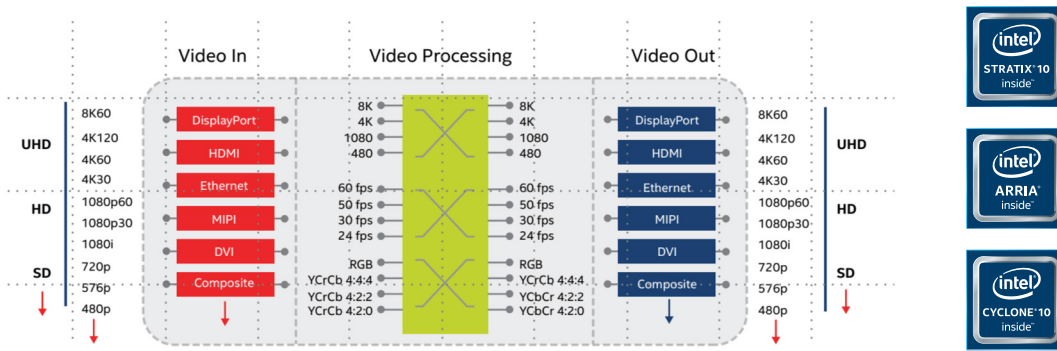

Figure 5. DFI Display Controller – Top View

Figure 6. Video Scaling with Intel's Video and Image Processing Suite

DFI's display controller is able to handle Any-to-Any conversion by using Intel FPGA IP blocks. In addition, it can take inputs from multiple sources and display in custom resolutions and orientations.
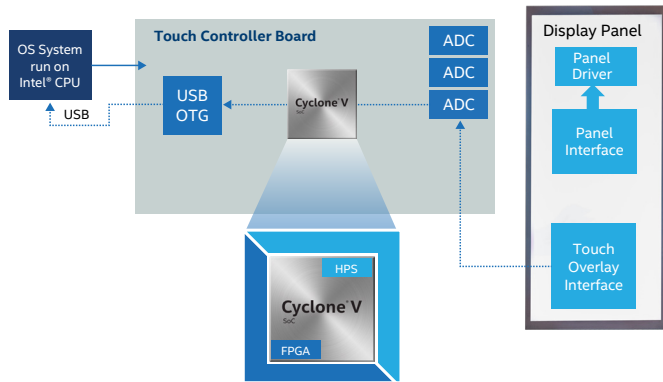

Figure 7. Touch controller board design with Intel's IT-DM solution platform

Intel IT-DM touch controllers bring advanced touch control technologies for interactive display applications. Like interactive flat panels, displays, touch tables, whiteboards, and kiosks, etc. Top touch technologists are implementing their technology on Intel FPGA fabric, and using the Arm* core of the Intel FPGA SoC to control real-time touch streams. Thus, standard and simplified Intel SoC-based touch controller architectures are able to lower touch latency and simplify the complexity of the touch controller hardware design. IT-DM touch controllers enable simplified connectivity to the host system over standard USB-based interface. It also supports MPP (Microsoft Pen Protocol) to support integration of standard Microsoft-based pen and stylus components with IT-DM based platforms. As a result, this helps touch controller applications to be able to work with standard windows platforms without requiring a specific driver.
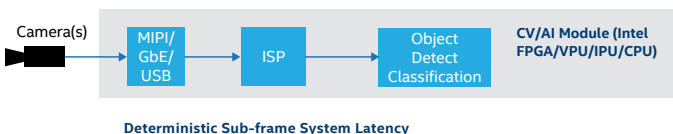
Intel IT-DM compact computer vision module is based on Intel silicon offerings like FPGAs, vision processing units (VPUs), and CPUs, etc. The module integrates future-proof computer vision and AI technologies seamlessly to IT-DM based vertical applications.

Conclusion

Intel IT-DM platform solution is ready for production, and Intel partners such as DFI have already started implementing the solution. There is a variety of paths forward depending on the business model.

ODMs:
Original design manufacturers can design their IT-DM boards using Intel's:

- IP solutions such as Video and Image Processing Suite, Vx1, HDMI 2.1, and DP1.4
- Board design specifications
- IT-DM architectures
- Design support

OEMs:
Original equipment manufacturers (OEMs) can buy production-ready boards that are ready to be integrated into their systems from Intel partners like DFI for display controller applications and Sigma Sense for touch.

Solution Vendors:
Solution vendors can work with Intel to be connected to the right Intel partner who is designing a board to meet their business needs.

Learn more about Intel IT-DM at https://www.intel.com/content/www/us/en/broadcast/products/programmable/overview.html

Figure 8. Computer Vision Board Design with Intel's IT-DM Solution Platform