



BA-SID

2013 One-Day Conference

Geoff Walker
Senior Touch
Technologist



The Future of Touch Technology



Context & Contents

- ❖ This talk: Touch-only, mostly hardware, lots of opinions
 - No gestures
 - No haptics
 - No software

- ❖ Windows 8
- ❖ Touch penetration
- ❖ P-cap
- ❖ Future focus



Windows 8

- ❖ Will drive touch in consumer market, not enterprise
- ❖ Slow start has the entire PC industry very concerned
 - One major reason for the slow start is lack of Win-8 hardware
- ❖ Intel's user-testing on clamshells produced very surprising results



Touch Penetration...1

❖ Tablets

- 100%

❖ Phones

- Heading very high, very quickly (DS: 95% in 2018)

❖ Ultrabooks

- Just starting, but accelerating rapidly (DS: 37% in notebooks in 2018)
- Clamshell vs. “hybrid”

❖ All-in-Ones (AiO)

- Dropped in 2012 due to Win-7 touch adoption & Win8 anticipation
- Should rise, particularly with “adaptive” devices (DS: 23% in 2018)
- Three touch technologies now available for AiOs



Touch Penetration...2

- ❖ What does it take to drive touch into clamshells?
 - Lower cost
 - Touch apps that create consumer pull
 - Touch that's easier or more convenient than alternative input methods
 - Touch that feels natural and responds quickly (low latency!)
 - Touch that's fun and satisfying
 - Windows 8



Touch Penetration...3

❖ Large-format

- Significant opportunity as displays become even lower-cost, but more work needs to be done on reducing touchscreen cost
- Significant competition between touch technologies
 - Camera-based optical (e.g., NextWindow)
 - Vision-based (e.g., Samsung SUR40)
 - FTIR (FlatFrog's "PSD" & RAPT)
 - P-cap (currently with wire electrodes)
 - "Traditional" (1.5-touch) infrared
 - "High finger-count multi-touch infrared" (no market name yet)



<http://www.youtube.com/watch?v=mVEESR8kY0I>



Touch Penetration...4

❖ Commercial markets

- Shrinking share of total touch units & revenue accentuates the gap between commercial and consumer

❖ Healthcare

- Very long product lead-time is driving strong adoption of p-cap
- Edge-to-edge glass, multi-touch, & light touch are all important

❖ Casino gaming

- Casinos want to attract the Millennium Generation
- Multi-touch is very important; edge-to-edge glass perhaps less

❖ Point-of-Sales (POS)

- Edge-to-edge glass is the only driver, and “flat-edge” resistive is “good enough”



P-Cap...1

- ❖ Dominance in < 15 inches
 - 83% p-cap in 2012 (DisplaySearch)
- ❖ Today's OEM cost for 13.3" p-cap is \$55 to \$85
- ❖ Intel's touchscreen cost-reduction focus (mostly p-cap)
 - ITO-replacement materials
 - Metal mesh, silver nanowires, carbon nanotubes, conductive polymers
 - It's not really about the **material**; it's about the **process**
 - Easier/simpler/higher-yield lamination
 - Supply-chain improvements
 - Glass → plastic
 - Alternative touch technologies



P-Cap...2

- ❖ Signal-to-noise ratio (SNR) is critical
 - Today's "artificial finger" stylus is a lowest-common denominator
 - Very-high SNR enables use with fingernail, #2 pencil, various objects
- ❖ Other technical advancement areas
 - EMI/RFI immunity
 - Operation with water on the screen
 - Finger-hover or touch-and-press
 - More coming...



(Back-Story on Stylus)

- ❖ In 2007, Steve Jobs famously said, “Stylus, yeeecchh!”
- ❖ In 2008, Microsoft decided to emphasize the finger in Windows-7 touch over the stylus from the (perceived) failed Tablet PC
- ❖ The result is that for the last six years, we’ve been in an artificially pro-finger-touch world
 - Remember the stylus on the Palm PDA and the Handspring Trio?
 - Stylus has been around a LONG time and it’s NOT going away
- ❖ Windows 8 may cause stylus to re-emerge and become important again



❖ Stylus (with touch, of course)

- Samsung's Galaxy Notes use Wacom electromagnetic resonance (EMR), which requires a second sensor under the LCD
- EMR may become a legacy technology
 - Expiration of Wacom's batteryless-pen patent is having an interesting effect
- P-cap stylus (both passive & active) with touch is the future
 - Passive (2 mm tip) vs. active (~1 mm tip + hover)
 - N-Trig is currently the active stylus UX leader, equal to Wacom
 - More than 4 p-cap controller companies have active styli



❖ Active-stylus use cases

- Quick sketches
- Artistic drawings
- Engineering design
- Note-taking with background recognition (searchable)
- Annotating existing documents
- Precision pointing device for Win-8 desktop mode with high-DPI LCDs

❖ Samsung is doing an incredible job of popularizing stylus



❖ In-cell (“embedded touch”)

- Shipping in 3+ high-volume smartphones (after 10 years!)
- Sony Xperia P, HTC EVO Design 4G, iPhone 5
- Sony-Synaptics architecture (actually hybrid in-cell/on-cell) should obsolete all other previous in-cell architectures
 - “Pressed” capacitive, light-sensing, contact-sensing, etc.
- Expansion beyond phone-size seemed difficult due to timing, but one SID DisplayWeek 2013 touch-paper documents a 12” version

❖ How it works

- Uses existing internal metal in groups to form drive and sense electrodes; segments the ITO static-shield on IPS displays if needed
- Uses VCOM as the drive signal, changing it from noise to signal
- Touch controller cooperates with the LCD TCON on timing



- ❖ **On-cell** touch has become the standard for OLED, yet it hasn't become very popular with LCD makers
 - It may not solve enough problems on LCDs
 - It's still basically like putting a discrete touchscreen on top of the color filter; connectivity is messy with a separate flex and controller
 - Double-sided processing of the color filter/touch sensor is still a problem
 - Some experimentation is in progress with ITO-replacement based touch sensors

- ❖ Display industry is moving towards single-branding for all forms of embedded touch
 - For example, "Touch In Display" from CMI
 - The key question: Who adds the touch, the display manufacturer or the touch-module maker?



Future Focus

- ❖ User experience (UX)
- ❖ Front-of-screen coatings
- ❖ Cost reduction
- ❖ Display manufacturers vs. touch-module manufacturers
- ❖ The next big touch market



Legal Disclaimer

All products, computer systems, dates, and figures specified are preliminary based on current expectations, and are subject to change without notice.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel® products, visit [Intel Performance Benchmark Limitations](#).

Results have been estimated based on internal Intel® analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

Results have been simulated and are provided for informational purposes only. Results were derived using simulations run on an architecture simulator or model. Any difference in system hardware or software design or configuration may affect actual performance.

Intel® does not control or audit the design or implementation of third party benchmarks or Web sites referenced in this document. Intel® encourages all of its customers to visit the referenced Web sites or others where similar performance benchmarks are reported and confirm whether the referenced benchmarks are accurate and reflect performance of systems available for purchase.

Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

Intel®, processors, chipsets, and desktop boards may contain design defects or errors known as errata, which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Hyper-Threading Technology requires a computer system with a processor supporting HT Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information including details on which processors support HT Technology, see <http://www.intel.com/info/hyperthreading>.

Intel® Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.

Intel® Turbo Boost Technology requires a PC with a processor with Intel® Turbo Boost Technology capability. Intel® Turbo Boost Technology performance varies depending on hardware, software and overall system configuration. Check with your PC manufacturer on whether your system delivers Intel® Turbo Boost Technology. For more information, see <http://www.intel.com/technology/turboboost>.

64-bit computing on Intel® architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.

Lead-free: 45nm product is manufactured on a lead-free process. Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package.

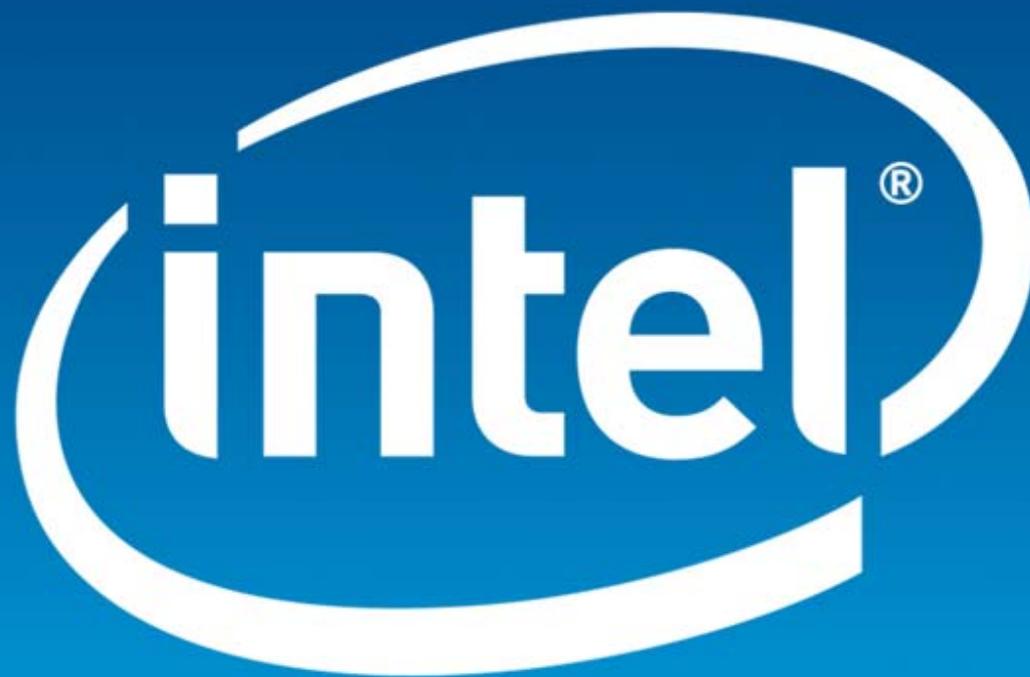
Halogen-free: Applies only to halogenated flame retardants and PVC in components. Halogens are below 900 PPM bromine and 900 PPM chlorine.

Intel®, Intel® Xeon®, Intel® Core™ microarchitecture, and the Intel® logo are trademarks or registered trademarks of Intel® Corporation or its subsidiaries in the United States and other countries.

© 2008 Standard Performance Evaluation Corporation (SPEC) logo is reprinted with permission

Roadmap not reflective of exact launch granularity and timing - please refer to ILU guidance

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.



Sponsors of Tomorrow.™