Touch On the Consumer Desktop and In Large-Format

Geoff Walker
NextWindow
November 11, 2010
(FPD International 2010)
Agenda

- Introduction
- Touch on the consumer desktop (15” – 30”)
- Touch in large format ( > 30”)
- Conclusions
- Appendix
  - NextWindow products on display at FPD International 2010
About NextWindow

NextWindow

- Develops & manufactures optical touchscreens
- Currently focused on two touch-screen markets
  - Windows-7 consumer monitors and all-in-one computers
  - Large-format display applications for signage and education
- Global presence
  - New Zealand (HQ), Singapore (Ops), USA, Taiwan, Korea, Japan
  - Manufacturing in China, Thailand and Malaysia
  - 138 employees, 67 in R&D
- Brief history
  - 2000: Founded by CTO and private investors
  - 2003: First product to market (optical touch for large displays)
  - 2005: Entered USA market
  - 2006: First major volume contract (HP TouchSmart AiO)
  - 2008: Established Taiwan office with ODM focus
  - 2009: Engaged with many PC OEMs & ODMs on Win-7 products
  - 2010: Acquired by SMART Technologies
Touch Isn’t Just About Mobile Devices

Touch on mobile devices (especially on 200M phones) is driving the industry, but it’s NOT the only interesting part of the market!

Source: Apple
Touch Is Spreading Everywhere!

There’s beginning to be an assumption that all consumer devices should be touch-enabled.
But…
There Are 14 Touch Technologies!

<table>
<thead>
<tr>
<th>Touch Technology</th>
<th>Mobile (2” – 17”)</th>
<th>Stationary Enterprise (10” – 30”)</th>
<th>Stationary Consumer (15” – 30”)</th>
<th>Large-Format (&gt;30”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Resistive</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Analog Multi-Touch Resistive (AMR)</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Digital Multi-Touch Resistive (DMR)</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Acoustic Wave (SAW)</td>
<td></td>
<td>H</td>
<td>F</td>
<td>L</td>
</tr>
<tr>
<td>Traditional Infrared (IR)</td>
<td></td>
<td>H</td>
<td>F</td>
<td>H</td>
</tr>
<tr>
<td>Waveguide Infrared (from RPO)</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Capacitive</td>
<td></td>
<td>H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected Capacitive (ITO) (P-cap)</td>
<td>H</td>
<td>F</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Projected Capacitive (wires) (P-cap)</td>
<td></td>
<td>L</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>Optical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acoustic Pulse Recognition (APR from Elo)</td>
<td>F</td>
<td>H</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>Dispersive Signal Touch (DST from 3M)</td>
<td></td>
<td></td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>Embedded (in-cell &amp; on-cell)</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vision-Based (like Microsoft Surface)</td>
<td></td>
<td></td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Force Sensing (no current supplier)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H = High-volume   L = Low-volume   F = Future
What Are We NOT Going To Talk About?

🔹 Stationary devices 10” – 30” in enterprise applications

🔹 NextWindow believes that multiple touch technologies will continue to dominate for a combination of application, technical and business reasons
  - Kiosks = SAW or surface capacitive
  - Casino gambling = Surface capacitive
  - Point of sales (POS) = 5-wire resistive or traditional infrared
  - Industrial control = 5-wire resistive
  - Outdoor device control = Projected capacitive
  - Medical device = 4-wire resistive, SAW or APR…

( There is no perfect touch technology! )
Touch On the Consumer Desktop
In the Beginning:
The HP TouchSmart AiO

Gen-1
2007

Gen-2
2008

Gen-3
2009

Gen-4
2010

Source: HP
And Then Came Windows 7

- Windows 7 fully enables desktop touch (Oct-09)
  - Touch & multi-touch is a highly visible characteristic of Win-7
    - Win-7 supports up to ~100 touch points
  - Touch API is easy for ISVs to use to touch-enable applications
    - Applications can define their own custom gestures
  - Most PC OEMs have launched multiple desktop touch products
    - ~90% AiOs, ~10% monitors
Consumer Desktop Touch Hardware

- **AiOs & monitors with Win-7 touch**
  - 30+ products from 14 OEMs
  - Acer, Asus, Dell, ECS, Fujitsu, Gateway, HP, Ilyama, Lenovo, Medion, MSI, NEC, Samsung, Sony

- **Low-end AiOs with single-touch**
  - Estimated at 10

- **AiOs with no touch**
  - Estimated at 30

- **Consumer monitors with single-touch**
  - None
Consumer Desktop Examples

ASUS

Medion

NEC

Sony

Dell

Lenovo
Consumer Desktop Applications

- Consumer software applications enhanced to take advantage of Windows-7 touch
  - Estimated at 40
    - Art & creativity, media management, reading, games, educational…
    - Mostly consumption-oriented
  - More applications are coming, but progress is slow

- Enterprise vertical (e.g., CAD, GIS)
  - Beginning to see some specialized applications

- Enterprise horizontal (e.g., Office)
  - No significant applications yet
Consumer Desktop
Touch Market Forecast

- **Aggregate consumer desktop touch market forecast**
  - Based on information from Credit Suisse, Daiwa Capital, Morgan Stanley, iSuppli, DisplaySearch and NextWindow

<table>
<thead>
<tr>
<th>Category</th>
<th>2010 Units</th>
<th>2011 Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market</td>
<td>Penetration</td>
</tr>
<tr>
<td>AiOs</td>
<td>10M</td>
<td>45%</td>
</tr>
<tr>
<td>Monitors</td>
<td>139M</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

- **What’s needed to make the market grow faster?**
  - More touch-enabled applications from independent software vendors (ISVs)
    - Applications for Windows-7 tablets may migrate to the desktop
  - More touch optimization in the Windows user interface
    - Not likely to happen until Windows-8 in 2012, although some enhancements have been made in the latest SDK
Market Requirements for Touch On the Consumer Desktop

- The requirements are surprisingly simple
  - Size range 15” to 30”
  - Low cost (around $2 per diagonal inch)
  - Multi-touch that meets the Windows-7 Logo requirements

- Touch technologies that meet the requirements (3)
  - Optical
  - Surface acoustic wave (SAW)
  - Analog multi-touch resistive (AMR)
Touch technologies that DON’T meet the requirements (11)

- Projected capacitive and traditional infrared
  - Too expensive – although these two are closest to emerging
- Analog resistive, surface capacitive, acoustic pulse recognition (APR) and force-sensing
  - No multi-touch
- Embedded (in-cell & on-cell), digital multi-touch resistive and waveguide infrared
  - Too small
- Dispersive signal technology (DST) and vision-based
  - Too big
Why Optical Touch Is Best On the Consumer Desktop

✧ **Touch with any object**
  - Use a finger, stylus, paintbrush, glove, credit card, eraser, etc.
  - More versatile than SAW’s soft touch-object, AMR’s non-sharp touch-object or pro-cap’s finger-only

✧ **Zero-force touch**
  - Effortless interaction with the screen
  - Much easier than SAW’s or AMR’s typical 80 grams of force

✧ **High optical performance**
  - No dimming or fuzzing in the displayed image
  - Better performance than the light-absorbing films in AMR
Why Optical Touch Is Best On the Consumer Desktop…2

- **Object size recognition**
  - Allows an application to make decisions based on what is being used to touch the screen
  - SAW doesn’t support object-size recognition

- **Highly durable touch surface**
  - Glass doesn’t have a wear-out mechanism
  - Much more durable than AMR’s PET top surface
## Consumer Desktop Touch Technology Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Optical</th>
<th>SAW</th>
<th>AMR</th>
<th>Projected Capacitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size range 15” – 30”</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>Touch with any object</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Light touch</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Multi-touch</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Object size recognition</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Fast response and drag</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Low profile (flush surface)</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>High durability</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>High optical performance</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>Narrow border width</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Insensitive to EMI &amp; RFI</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>Easy integration</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Low cost</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>Shipping in high volume</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Simple sensor manufacturing</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>High MTBF</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Multiple sources</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
</tbody>
</table>

[H] = High (Best)  [M] = Medium (OK)  [L] = Low (Worst)
How Optical Touch Works

LED reflecting directly into the optical sensor

Touch Point

Optical Sensor Pixel Position

Light Intensity
Touch In
Large-Format
Large-Format Touch Hardware

 Touch display platforms
  ❖ LCD and plasma displays over 30”
    ■ Touch is available integrated into display bezels and as an overlay
    ■ Incremental cost for large-format touch is still relatively high; NextWindow’s latest new product helps drive down the cost

 What are we NOT going to talk about?
  ❖ Front & rear projection (including touch tables)
  ❖ Opaque interactive whiteboards
Large-Format Applications

Two main market segments by size

- #1: Information access, collaboration and interactive digital signage
  - 32” – 65”
- #2: Education/training and conference rooms
  - 46” and larger
Interactive Digital Signage

✧ Digital signage
  ❖ Current non-interactive digital signage business model is based on advertising impressions, similar to other media such as print or TV

✧ Interactive is different
  ❖ Interactive content
    ■ Requires much deeper content that changes more frequently
  ❖ Interactive business model
    ■ Requires a business model based on the value of interactivity
Interactive Digital Signage…2

✦ Value of interactivity
  ❖ Interaction yields information about user wants and desires
  ❖ Information can be used to precisely target the most appropriate demographic and obtain instant feedback on a product

✦ Capabilities
  ❖ User-controlled content
  ❖ Targeted messaging
  ❖ Dynamic promotional offers to cross-sell or up-sell
  ❖ Sales tools to guide customers through product selection
  ❖ Testing multiple ad campaigns with different themes and appeals
  ❖ A pay-for-performance model with the benefit of paying only for viewers with demonstrated interest
  ❖ Determining which venue is most effective at attracting the targeted audience
  ❖ Mining the resulting data for patterns, connecting the ads that attract customers to the things that they buy
Market Growth Factors

- Continued display & touch-screen cost reduction
- Increased use of touch everywhere
- Market segment growth drivers
  - Interactive information: Increased digital data availability
  - Collaboration: ROI & productivity studies
  - Interactive digital signage: Validated new business model
  - Education: Increased government spending
  - Conference rooms: Increased capital investment
- What about TV?
  - Touch on small-screen TVs (all-in-one TV-monitor) is natural
  - Gestures are a potential “10-foot interface” on big-screen TVs
  - Touch can be the “arm’s-length interface” when the TV is being used for non-TV applications (IWB, Internet access, etc.)
“Camera-based optical touch offers high optical performance, robustness and scalability, and is a very strong candidate for the signage and professional market. In addition, its cost-effective scaling is an advantage against competing technologies such as IR.”

“By 2013, optical imaging will emerge as the leading single touch-screen technology in the signage and professional display market, accounting for 25.6 percent of worldwide unit shipments. The dominant use for optical imaging touch-screen technology will be in conference rooms.”

Source: iSuppli, “Touch Screen Interfaces Continue to Drive Growth in Signage and Professional Applications” Report, 12/09
iSuppli’s Large-Format Touch Forecast

Large-Format Touchscreens in Interactive Information, Education, Training, Conference & Signage
(transparent touch only)

Units Shipped/Year

2007 2008 2009 2010 2011 2012 2013

97% CAGR

Data from iSuppli’s “Emerging Display Technologies 4Q-09 Special Report”
Market Requirements for Touch In Large-Format

- The requirements are relatively simple
  - Size range 30” to 100+”
  - Work on top of LCD or PDP
  - Low cost
  - Low profile height and narrow border width

- Touch technologies that meet the requirements (6)
  - Optical
  - Traditional infrared (IR) \[\text{Majority}\]
  - Projected capacitive (wires on film)
  - Surface acoustic wave (SAW)
  - Acoustic Pulse Recognition (APR from Elo)
  - Dispersive Signal Technology (DST from 3M)
Market Requirements for Touch In Large-Format...2

- Touch technologies that DON’T meet the requirements (8)
  - Analog resistive, analog multi-touch resistive (AMR), digital multi-touch resistive (DMR), surface capacitive, waveguide infrared, and embedded (in-cell & on-cell)
    - Too small
  - Vision-based
    - Requires projection
  - Force sensing
    - No suppliers
What About Multi-Touch?

**History**

- The iPhone, Microsoft Surface, Windows-7 and the iPad all focused attention on multi-touch; Windows-8 will take it further

**Outlook**

- Since there still aren’t any clear applications for single users with more than two touches, **multi-person gaming** will probably drive multi-touch on large displays
  - Multi-user is more significant than one user with multiple fingers
  - Identifying which user is touching is still a problem
  - 4 users x 2 fingers each = 8 touches
- Reality is that **point-and-click** (single touch) is still very common on large displays
Why Optical Touch Is Best for Large-Format

✧ **Touch with any object**
  ❖ Unlike pro-cap’s finger-only or SAW’s soft touch-object

✧ **Zero-force touch**
  ❖ Lighter than DST & APR; much lighter than SAW

✧ **Object size recognition**
  ❖ Better than pro-cap; others don’t support object-size recognition

✧ **High optical performance**
  ❖ No visible wires like in pro-cap film

✧ **Insensitive to EMI and RFI**
  ❖ Unaffected by interference, unlike pro-cap
Why Optical Touch Is Best for Large-Format...

- **Lowest cost**
  - Most economical large-format touch-screen solution
- **Scalable to >100 inches**
  - No added components needed, unlike IR
- **High MTBF**
  - Minimal components, unlike IR
- **Multiple sources**
  - Unlike sole-source DST & APR
# Large-Format Touch Technology Comparison

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Optical</th>
<th>IR</th>
<th>P-Cap (Film)</th>
<th>SAW</th>
<th>APR</th>
<th>DST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touch with any object</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Touch with a small object</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Light touch</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>No unintended touch</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Multi-touch</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Touch-and-hold</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Object size recognition</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Measures Z-axis</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>High optical performance</td>
<td>H</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Flush surface (low profile)</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Resistant to contaminants</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Insensitive to EMI and RFI</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Insensitive to ambient infrared</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Works with plastic substrate</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Low cost</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>Scalable</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Simple sensor manufacturing</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>High MTBF</td>
<td>H</td>
<td>L</td>
<td>M</td>
<td>M</td>
<td>H</td>
<td>M</td>
</tr>
<tr>
<td>Multiple sources</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

- **H** = High (Best)  
- **M** = Medium (OK)  
- **L** = Low (Worst)
Conclusions

- Desktop touch and large-format touch are emerging
  - Growth in consumer desktop touch is dependent on Windows-7 application programs to create consumer demand
  - Growth in large-format touch is dependent on continued reduction in the cost of large displays
    - Interactive information and education are the two largest existing market segments
    - Interactive digital signage is a high-potential market segment that needs a validated new business model

- There are 7 different touch technologies in the combined desktop & large-format space
  - Large number of choices adds confusion
  - There is no perfect touch technology, but optical is the strongest contender in both areas
Appendix

NextWindow products on display at FPD International 2010
(See us in Booth 4725)
DesktopTouch 2S
Optical Touch-Screen Components

- High-volume OEM desktop components
- 15” to 30” as a kit, on-glass or glassless
- Two cameras and Microsoft Windows-7 multi-touch logo
- Standard and low-profile versions
- Highly durable
- USB interface
- Low cost
2500 ProfileTouch
Optical Touch-Screen Components

- High-volume OEM large-format monitor components
- Standard sizes from 30” to 50” as a kit or on-glass
- Compatible with any display technology
- Microsoft Windows-7 multi-touch ready
- Low profile and thin borders
- USB powered
- Lower cost than competitive touch technologies
2150 ProfileTouch
Optical Touch-Screen Components

- Low-volume large-format integration components
- Standard sizes from 30” to 120” as a kit (all sizes) or on glass (up to 50”)
- Compatible with any display technology
- Microsoft Windows-7 multi-touch ready
- USB Plug & Play or serial interface
- USB powered
2700 OverlayTouch
Optical Touch-Screen Overlay

- Attachable by an end-user over almost any large display
- Standard sizes from 30” to 82”
- Adds touch to any computer application
- Microsoft Windows-7 multi-touch ready
- Once-only four-point calibration with no drift
- USB Plug & Play or serial interface
- USB powered