
Google
Developers

Point, Click, Tap, Touch

Building Multi-Device Web Interfaces

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Google I/O 13

Touch screens are everywhere

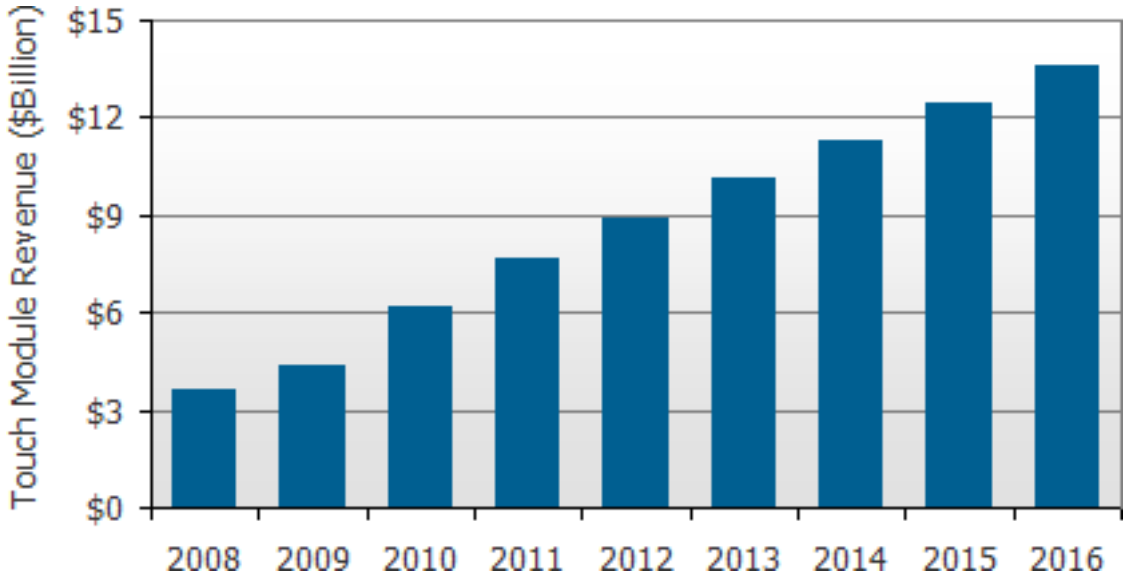
Most mobile devices have touch.

Mobile use projected to overtake desktop use by 2014.

~25% of Windows 8 laptop sales have a touchscreen.

Source: The Guardian http://goo.gl/PVL6o

Touch Screen Module Revenue Forecast



Source: Display Search http://goo.gl/5OhKS

The web has a powerful touch event API

`touchstart, touchmove, touchend, touchcancel`
(eg. scrolling on android).

Touches on the screen have consistent identifiers.

Works for mobile as well as touch on desktop.

Good support across modern mobile browsers (iOS, Android, etc).

Most touch devices support 10+ simultaneous points.
DEMO

Design suggestions

Tip 1: Touch interfaces require bigger targets

1. Physical size ≠ device pixels (pixels per inch)
2. Device pixels ≠ CSS pixels (device pixel ratio)

Device	Calculation	Size in px
Nexus 4	1/(device pixel ratio) (dpi) (inch per mm) (phys size) = (1/2 cps/dpx) (320 dpx/in) (1/25.4 in/mm) (9 mm)	**57 px**
Nexus 7	(1/**1.325**) **216** (1/25.4) 9	**58 px**
Nexus 10	(1/**2**) **300** (1/25.4) 9	**53 px**
Chromebook Pixel	(1/**2**) **239** (1/25.4) 9	**42 px**

Optimal touch target size range is 42 to 58 px.

Tip 2: Don't rely on hover

CSS hover (`:hover`), JS hover (`mouseover/mouseout`)

Touch has no true hover state, but browsers fake it on tap.

Avoid hover, especially with underlying links.

DEMO

Touch laptops enable new interactions

Responsive input

Maps

Object transforms

Source: smus.com

Avoiding Common Problems

Problem 1: Assuming touch support implies no mouse

```js
if ('ontouchstart' in window)
  element.addEventListener('touchstart', activate);
else
  element.addEventListener('mousedown', activate);
```

Breaks mouse input on touchscreen laptops!

Example

Solution: Listen to both mouse and touch events

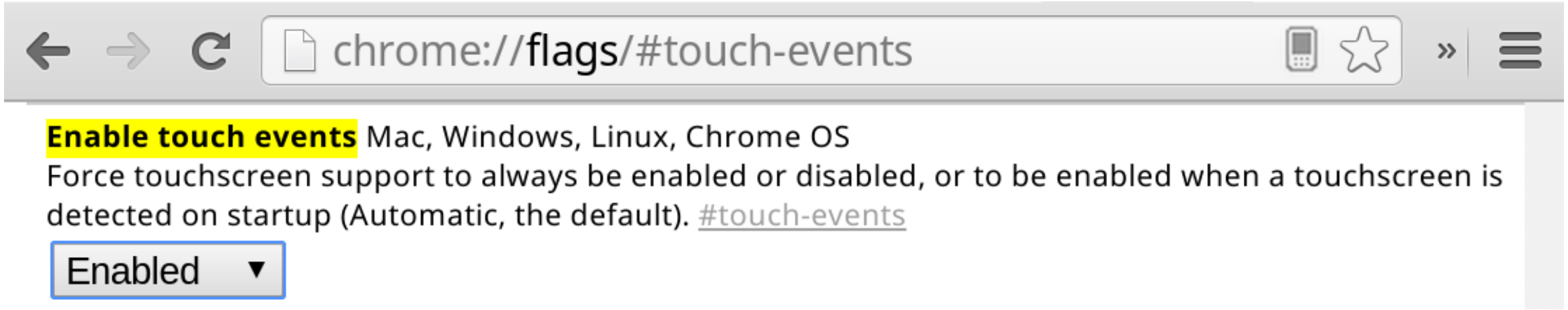
Call **`preventDefault`** in the touch handler to avoid redundant mouse events.

```js
element.addEventListener('touchstart', activate);
element.addEventListener('mousedown', activate);
function activate(event) {
  ...
  event.preventDefault();
}
```

DEMO

Solution: Enable touch event support to test

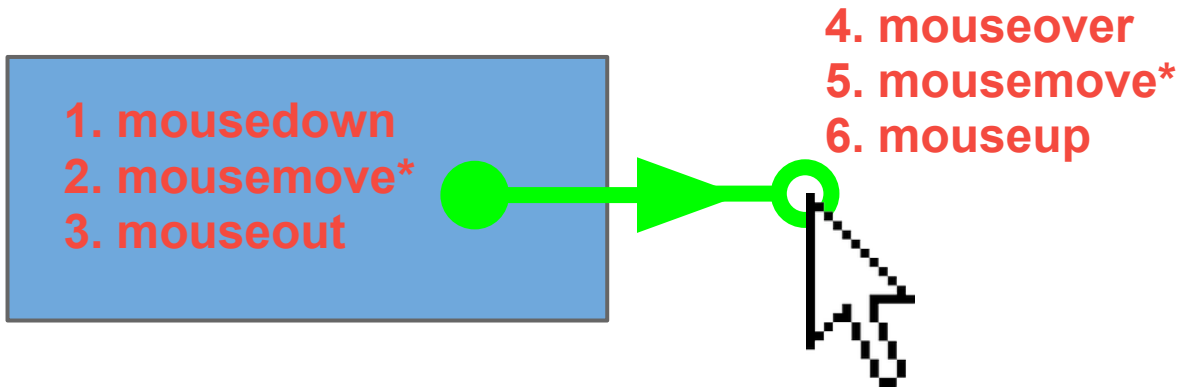
You can test that you haven't broken mouse support by enabling the flag:



We hope to turn this on by default when more sites fix this bug.

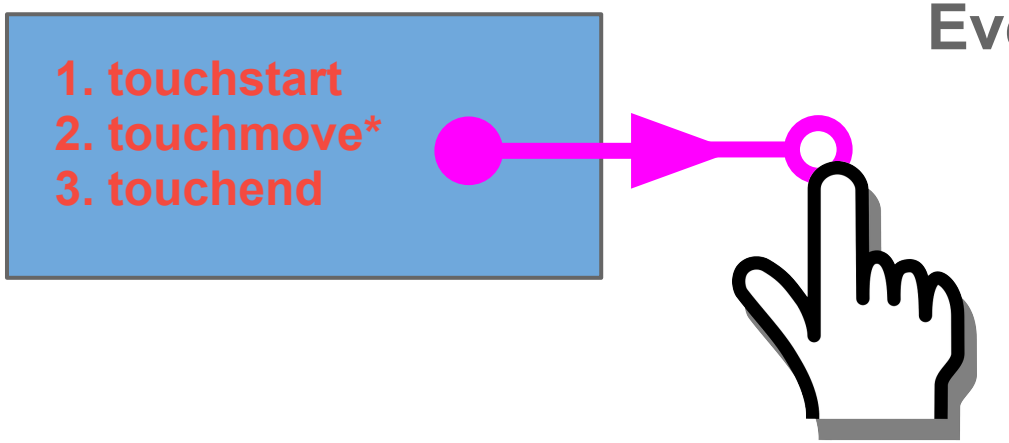
Problem 2: Touch event targeting isn't the same as mouse

MouseEvent targets the element under the cursor



TouchEvent targets the node where the touch started

Even when it's moved or removed!



Solution: Put handlers directly on the touched element

Necessary only when it could be removed or moved in the DOM

```js
element.addEventListener('touchstart', function(event) {
  ...
  event.target.addEventListener('touchmove', onMove);
  event.target.addEventListener('touchend', onEnd);
  event.target.addEventListener('touchcancel', onEnd);
}
```

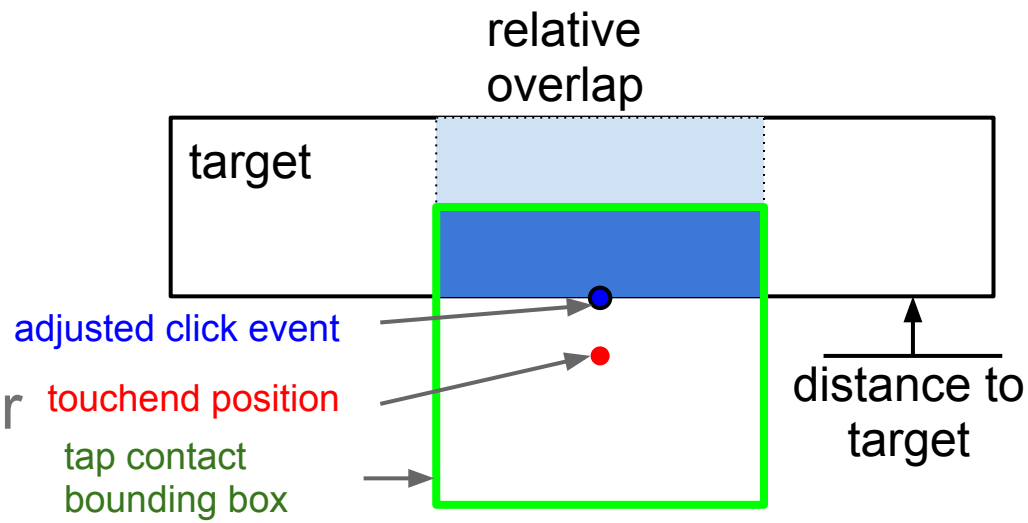
Demo element removal

Problem 3: Making it harder to hit small targets

Touch center point too imprecise for targeting

Chrome provides **"touch adjustment"**
On gestures (tap, long-press, etc.)

- Score all touchable elements under the finger
- Adjust position to the most likely target



Touch events themselves are never modified

[Demo]

Solution: put click handlers on each tappable element

For touch adjustment to work properly:

1. Activation must rely on 'click'
   (or 'contextmenu', 'mousedown', 'mouseup', or :active)

2. Each activatable element must have its own event handler
   (or other signal indicating it's tappable)

Extra effort is required for #2 if you rely on event delegation

Demo: Gmail star

Problem 4: Gesture APIs are browser specific

How to detect pinch, rotate, etc?

GestureEvent

MSGesture

Not another proprietary gesture API!

Solution: Rely on libraries for gesture detection

Several libraries doing this well cross-browser today, eg: Hammer.js

JS

```
Hammer(element).on('transformstart', function(event) { ... }
Hammer(element).on('transform', function(event) {
  update(event.gesture.scale, event.gesture.rotation);
}
Hammer(element).on('transformend', function(event) { ... }
```

DEMO

Many others, eg:

- TouchSwipe jQuery plugin
- Touchy jQuery plugin
- QUO JS
- Deeptissue JS

Performance

Problem 5: the click event is delayed on mobile devices

Implemented for double-tap-to-zoom gesture.

Approx. 300ms delay of `click` event on most touch-enabled browsers.

Causes pages to feel slow or unresponsive.

Solution: use a good fastclick library

Fastclick libraries listen for **`touchend`** instead.

In Chrome desktop, no click delays at all.

In Chrome for Android, no delays for fixed viewports (**`user-scalable=no`**).

Make sure your fastclick library knows that!
(eg. https://github.com/ftlabs/fastclick)

Problem 6: touchmove can fire very quickly

```js
function renderEverything(event) {
  // TODO: Render code goes here.
}
document.addEventListener('touchmove', renderEverything);
```

Often much faster than 60 Hz (render speed)

Movements of many fingers may get coalesced into one **`touchmove`** event, but very platform-dependent.

Impact varies depending on browser. DEMO

Solution: avoid expensive operations in event handlers

Do not re-render **`event.touches`** array on touchmove.

Store **`event.touches`** and use **`requestAnimationFrame`**.

JS

```
function updateTouches(event) { touches = event.touches; }
document.addEventListener('touchmove', updateTouches);
window.requestAnimationFrame(renderEverything);
function renderEverything() {
  // TODO: Render code goes here.
  window.requestAnimationFrame(renderEverything);
}
```

Problem 7: Touch handlers can cause scroll jank

Jank-free smooth touch scrolling is critical to engagement!

Chrome tries to scroll on the GPU thread, but event handling on main thread.

If there is a touch handler, scrolling must wait to see if **`event.preventDefault`** is called.

JS

```
function reallyFast(event) {}
document.addEventListener('touchstart', reallyFast);
document.addEventListener('touchmove', reallyFast);
```

DEMO

Solution: Avoid unnecessary use of touch event handlers

Ask yourself: do you really need that touch handler?

By default, touch input generates common DOM events.

`click, scroll, contextmenu` all fire.

Touch also sets CSS pseudo classes like `:active`

You don't always need to implement touch-specific event handlers.

Solution: Keep touch event regions small

Ask yourself: does your touch area need to be so large?

Chrome keeps track of which parts of the page have touch event handlers.

For each part of your page, decide between:

- smooth scrolling **OR**
- touch event handling

Don't add touch handlers to the document or body!

Future of touch on the web

Goals for future directions with touch on the web

Reduce the need to use touch events directly

- eg: Touch support for HTML5 drag-and-drop APIs

Give developers more control over browser default behavior

- eg. customizing scrolling behavior so you don't have to reimplement scrolling yourself in JavaScript

Better cross-browser support

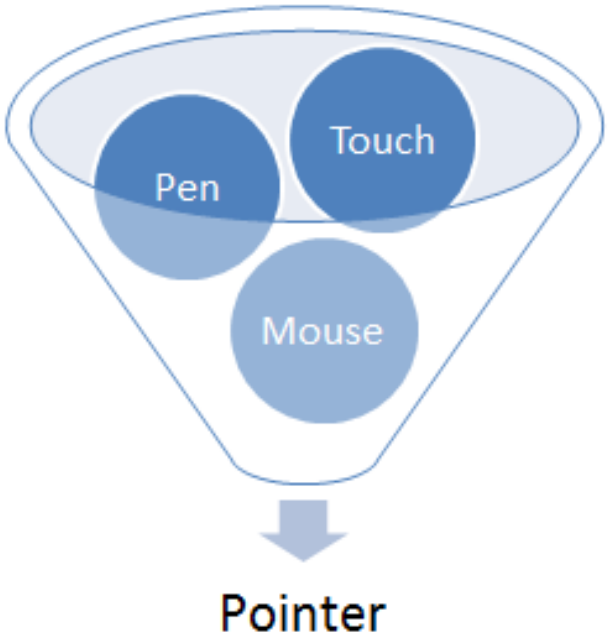
- Working with Microsoft to standardize some of the touch features from IE10

Pointer events

Standardizing input model from IE10. Key design points:

- abstraction and extensibility
- touch extends the MouseEvent model
- touch behavior specified declaratively

Discussion: public-pointer-events@w3.org



Microsoft built a prototype for chromium

Beginning experimental support in Blink

Try one of the early pointer events polyfills:

- hand.js - handjs.codeplex.com/
- Polymer PointerEvents - github.com/polymer-project/PointerEvents
- Points.js - https://github.com/Rich-Harris/Points

Some benefits of pointer events

Scroll jank impossible - specify desired behavior declaratively:

touch-action: none

- touch drag doesn't scroll
- get all events

touch-action: auto

- touch drag scrolls
- still get 'down' event
- on scroll get 'cancel' event

Code sharing demo

Mouse+Touch (131 lines, 56% shared)

Mouse+Pointer (89 lines, 97% shared)

Conclusion

Make your site a joy to use with touch!

Tell us about the problems you have and what we can improve!

Resources

Come talk to us in the Chrome 'Questions' bar after the talk

Touch Events: www.w3.org/TR/touch-events/

Touch event discussion: public-webevents@w3.org

Pointer Events: www.w3.org/TR/pointerevents/, Learn more

H5R Article: www.html5rocks.com/en/mobile/touchandmouse/

Rick's G+ stream for touch issues and questions: www.rbyers.net/plus

Dump events test page: www.rbyers.net/eventTest.html

Thank You!

Please submit feedback: **http://goo.gl/wuvkR**

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Solution: Emulate mouse targeting with elementFromPoint

JS

```
element.addEventListener('touchmove', function(event) {
  ...
  var touch = event.targetTouches[0];
  var over = document.elementFromPoint(touch.clientX, touch.clientY);
  var last = lastover[touch.identifier];
  if (over != last) {
    last.dispatchEvent(makeEvent('my-touchout'), ...);
    over.dispatchEvent(makeEvent('my-touchover'), ...);
    lastover[touch.identifier] = over;
  }
}
```

Demo mouse+touch drag and drop