“Post-PC Computing” Is Not a Vision

Talk, by Allen Wirfs-Brock

Strange Loop 2011, September 20, 2011

It’s increasing obvious that we are in the midst of a transformation of computing that will be as significant and disruptive as the emergence of personal computing was thirty years ago. There are technical advancements that enable this change, just like there were for personal computing. But this time it seems less clear where the changes are taking us. The PC era wasn’t just the result of random-walk application of emerging technologies. It was a revolution that was shaped by a shared vision. Where’s our vision? Is there a goal that is shaping the current revolution? Is it really just about mobility, clouds, HTML, content, and “not PCs”? Change is roaring at us and that makes this a great time for innovative technologists. But let’s find our shared vision and see if we can be intentional about using our innovations to shape the next era of computing.

“Post-PC Computing” Is Not a Vision

Allen Wirfs-Brock

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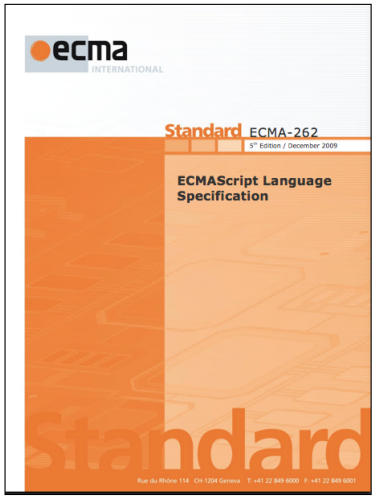
A little background about me

- Compilers, Smalltalk virtual machines, GCs, language design, development tools
- Launched first commercial Smalltalk: Tektronix 4404
- Digitalk/Parcplace-Digitalk: Enterprise Scale Smalltalk
- (Re-) Instantiations: JOVE Java optimizing compiler, Eclipse tools
- Microsoft: JavaScript/ECMAScript 5
- Mozilla: Future of JavaScript and the Web platform

http://youtu.be/8yxCJfayW-8



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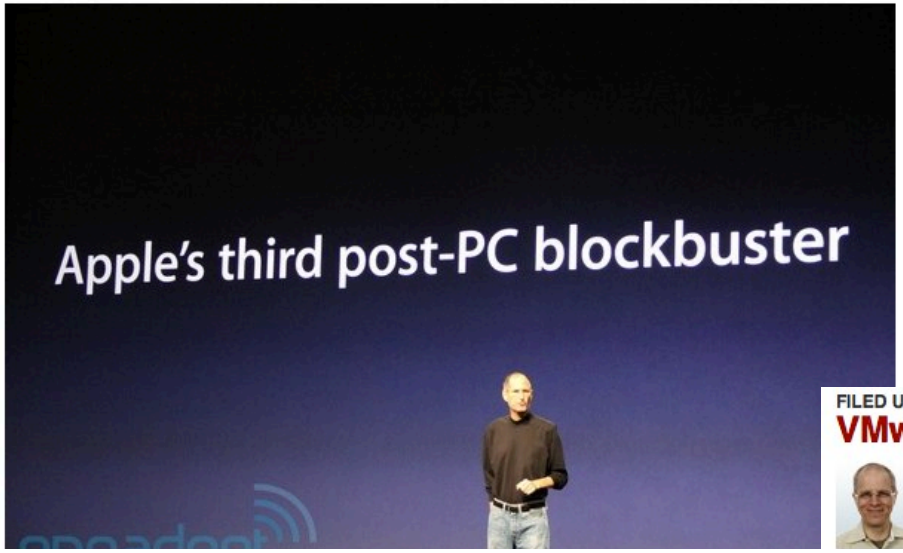
TODAY @ PCWORLD

Are We Really Living in a Post-PC World?

By Jason Cross, PCWorld Mar 4, 2011 1:30 PM

Among the many ear-catching bon mots issued forth from Steve Jobs recently is the assertion that we're living in, or at the very least *entering*, the post-PC era. It started last year at the D8 conference, when the Apple CEO said that PCs are going to be "like trucks" in that they'll still be around and useful for certain work, but only a smaller percentage of the users will need one. More recently at the iPad 2 launch, Jobs re-confirmed this post-PC mantra.



Post-PC

iCloud to be the corner stone for Apple's post-PC era

By Édouard PLANTE | Culture, Social July 5th, 2011

Illustration: Sandra Kuan

FILED UNDER: BUSINESS TECH

VMware boss focuses on post-PC era at VMworld

By: Jay Greene

AUGUST 29, 2011 6:41 PM PDT

Print E-mail

Remembering the Post-Mainframe Computing Era?

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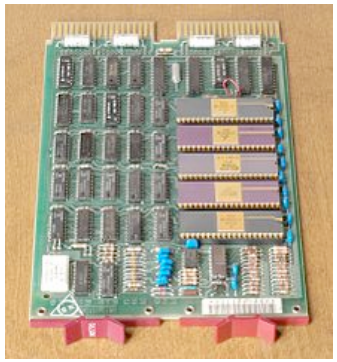
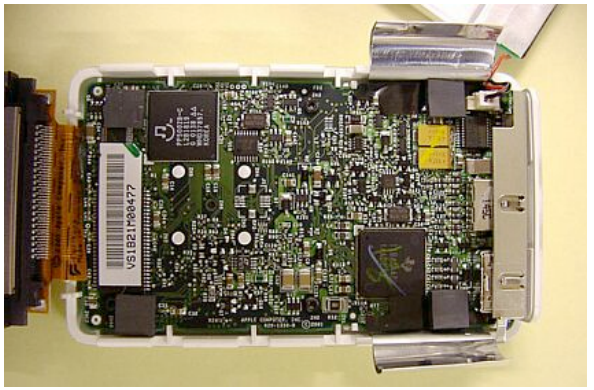
Post-Post-Mainframe Era?

Hardware evolution doesn't define a computing era





Computing eras are about the impact of computing on society

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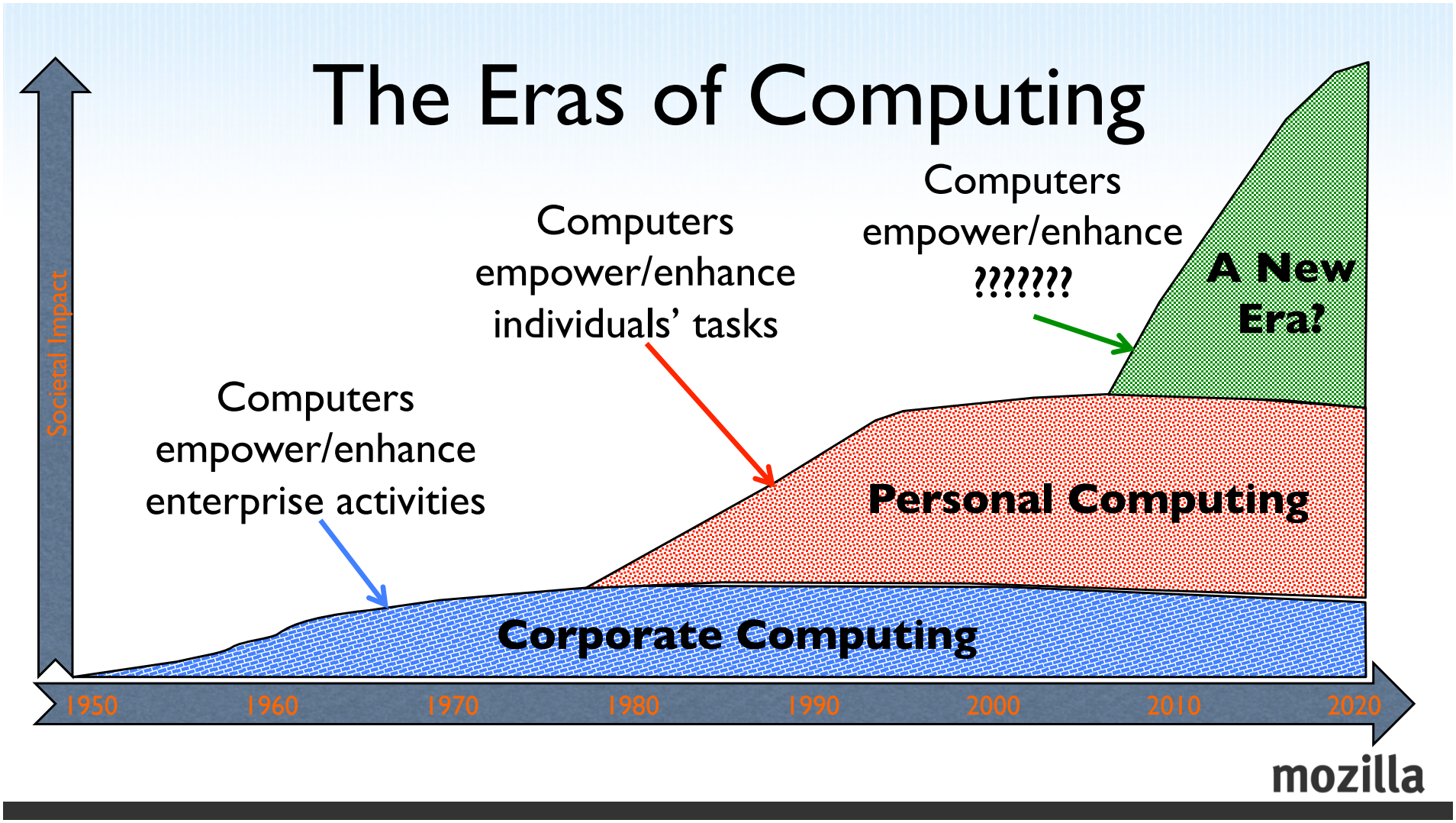
The Eras of Computing
Societal Impact
Computers empower/enhance enterprise activities
Computers empower/enhance individuals' tasks
Computers empower/enhance ???????
A New Era?
Personal Computing
Corporate Computing
1950
1960
1970
1980
1990
2000
2010
2020
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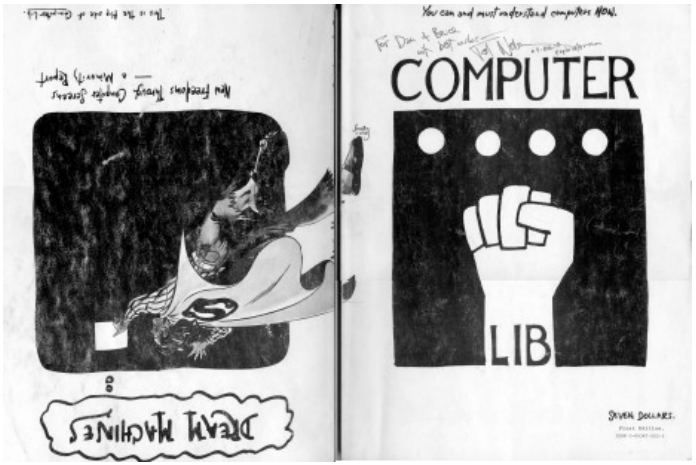
The PC Era was built around a revolutionary vision



Microelectronics
and the Personal Computer

Rates of progress in microelectronics suggest that in about a decade many people will possess a notebook-size computer with the capacity of a large computer of today. What might such a system do for them?

by Alan C. Kay

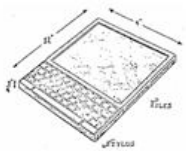
response to the viewer's wishes, the computer medium is active: it can respond to queries and experiments and can even engage the user in a two-way conversation.

The evolution of the personal computer has followed a path similar to that of the printed book, but in 40 years rather than 600. Like the handmade books of the Middle Ages, the massive com-

and organize a large quantity of information about their patients, enabling them to perceive significant relations that would otherwise be imperceptible. Composers should be able to hear a composition as they are composing it, notably if it is too complex for them to play. Businessmen should have an active briefcase that contains a working simulation of their company. Educators

puter, viewed as a medium, can s
late any other medium if the meth
of simulation are sufficiently well
scribed. Moreover, unlike conventi
mediums, which are passive in the s
that marks on paper, paint on ca
and television images do not chan

**COMPUTER SIMULATIONS generat
& Sutherland Computer Corporation sh
possible to present on a compact persona
ic-simulation programs that revise an in
motion of objects in projected three-dim
National Aeronautics and Space Admin
the interior of the space shuttle. The seq
ministration, shows the movement of tan
puter to simulate real or imagined phen**



EXPERIMENTAL PERSONAL COMPUTER was built at the Xerox Palo Alto Research Center in part to develop a high-level programming language that would enable nonexperts to write sophisti-

computing on learning. The machine is completely self-contained, consisting of a keyboard, a pointing device, a high-resolution picture display and a sound system, all connected to a small processing unit

n|w Fachhochschule Nordwestschweiz
Pädagogische Hochschule

Alan Kay: A Personal Computer
for Children of All Ages

Xerox Palo Alto Research Center 1972

If we are entering a new era of computing, what is the vision?

- The Mobile Era?
- The Cloud Era?
- The Tablet Era?
- The Games and Media Player Era?
- The Monetize the User Era?

The Ambient Computing Era

- Devices not Computers
- Ubiquitous access to information
- Computer augmented life

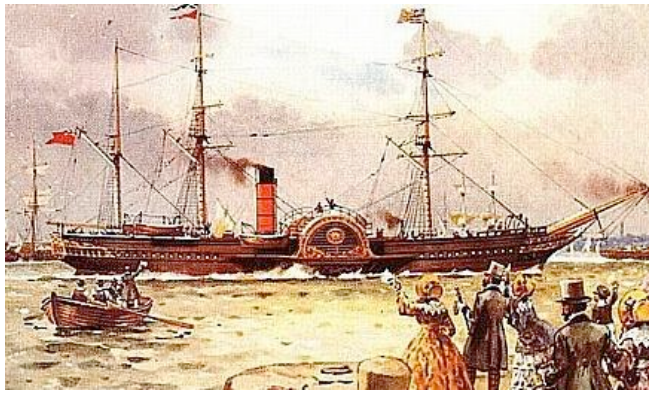
Computers enhance the world I live in. I need my stuff (data and apps) right now, wherever I am, using whatever device is available. I can't live without it!

Other Common Labels

- Pervasive
- Ubiquitous
- Ambient Intelligence
- The Internet of Things

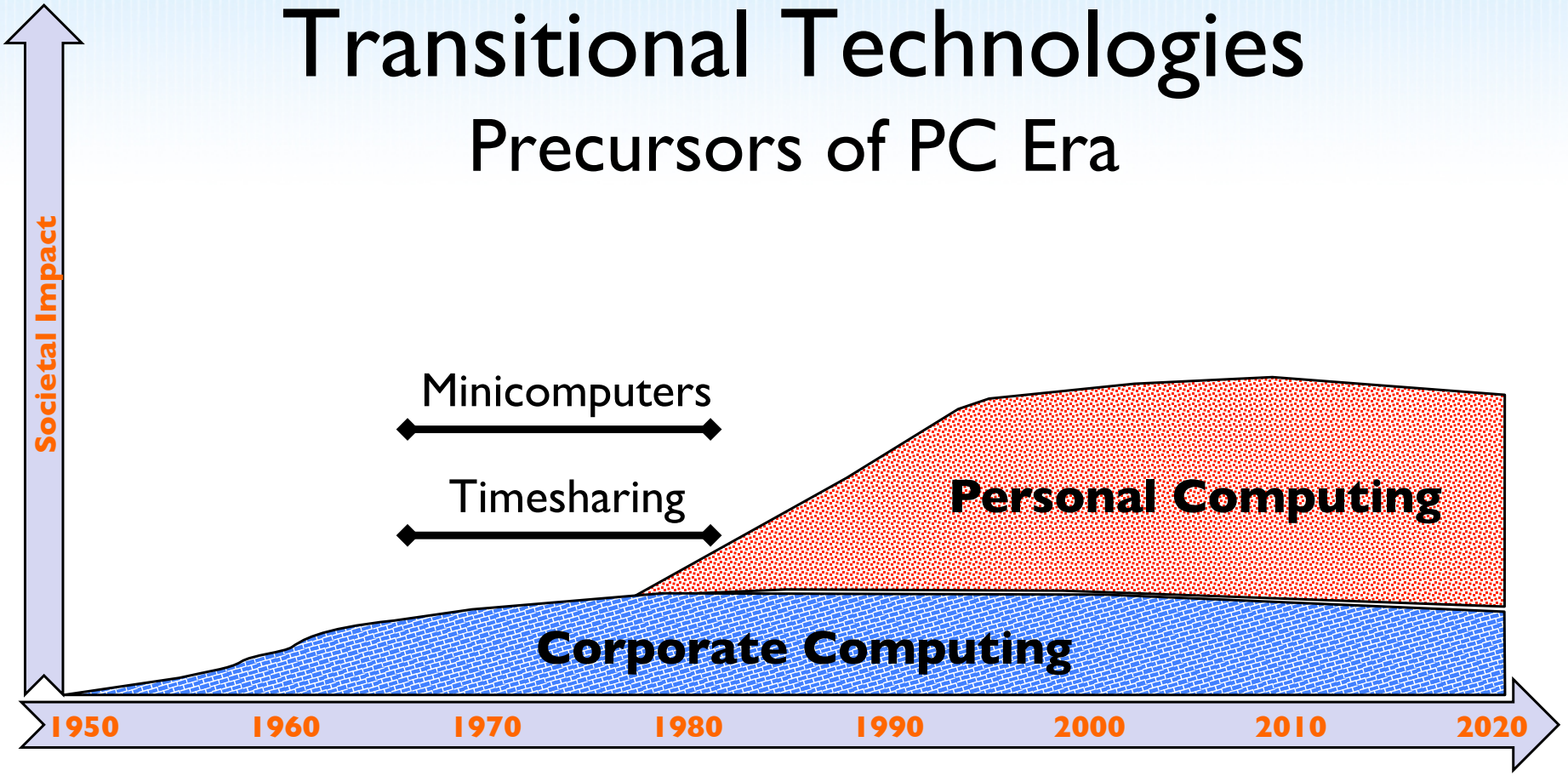
Transitional Technologies

- Precursors of fundamental change
- Exhibit some characteristics of what will come
- Firmly root in the status quo



Transitional Technologies

Precursors of PC Era



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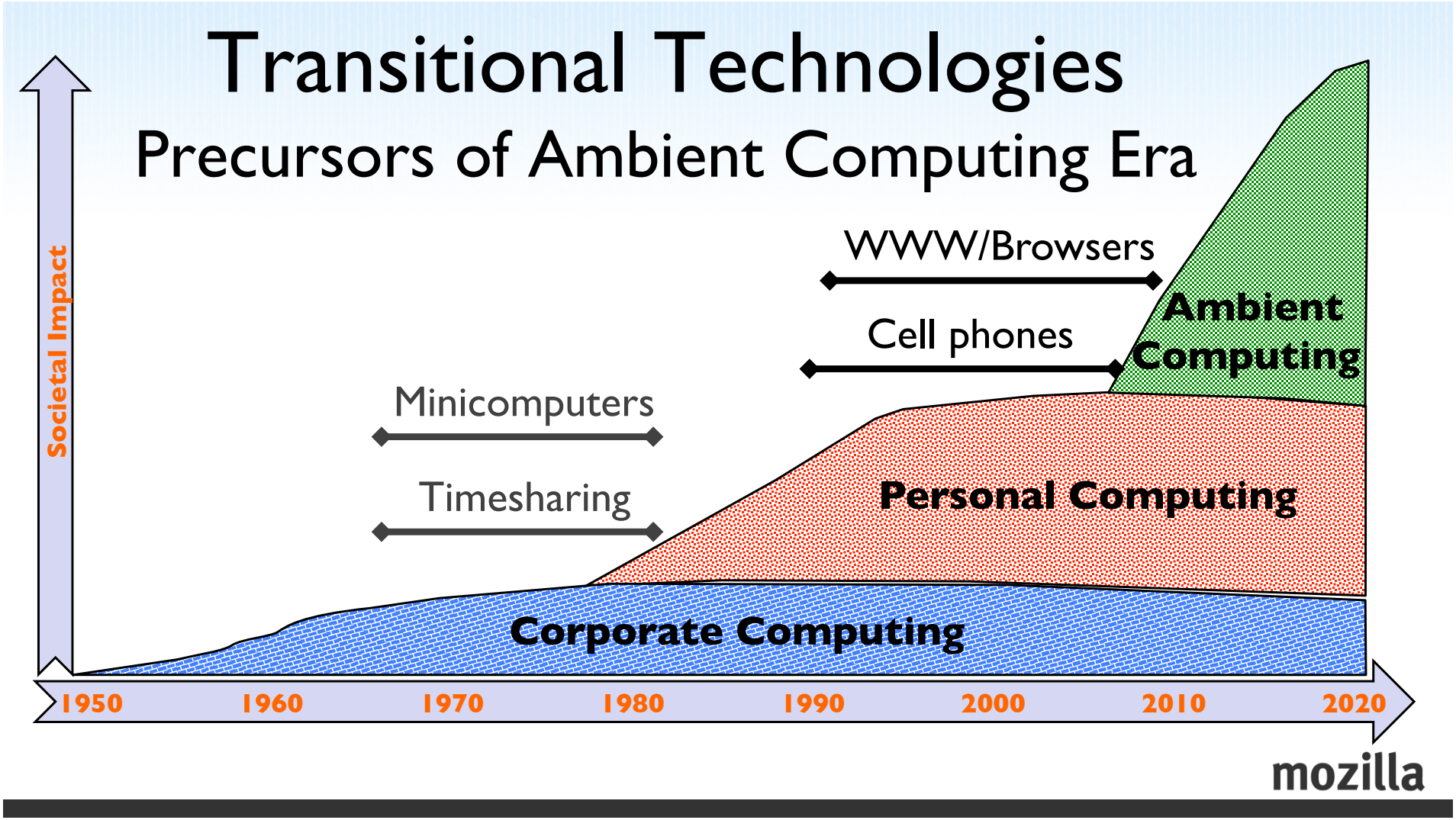
Transitional Technologies
Precursors of Ambient Computing Era
Societal Impact
WWW/Browsers
Cell phones
Minicomputers
Timesharing
Ambient Computing
Personal Computing
Corporate Computing
1950
1960
1970
1980
1990
2000
2010
2020
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The Cell Phone

- Always with you
- Always connected
- But initially dedicated into a single use case
- Legacy business models

The WWW/Web Browser

- First real ubiquitous web of information
- Universal client/server computation model (HTTP/REST)
- Universal presentation platform
- Availability more important than performance
- A Web Browser is a classic PC application

Why are these only transitional

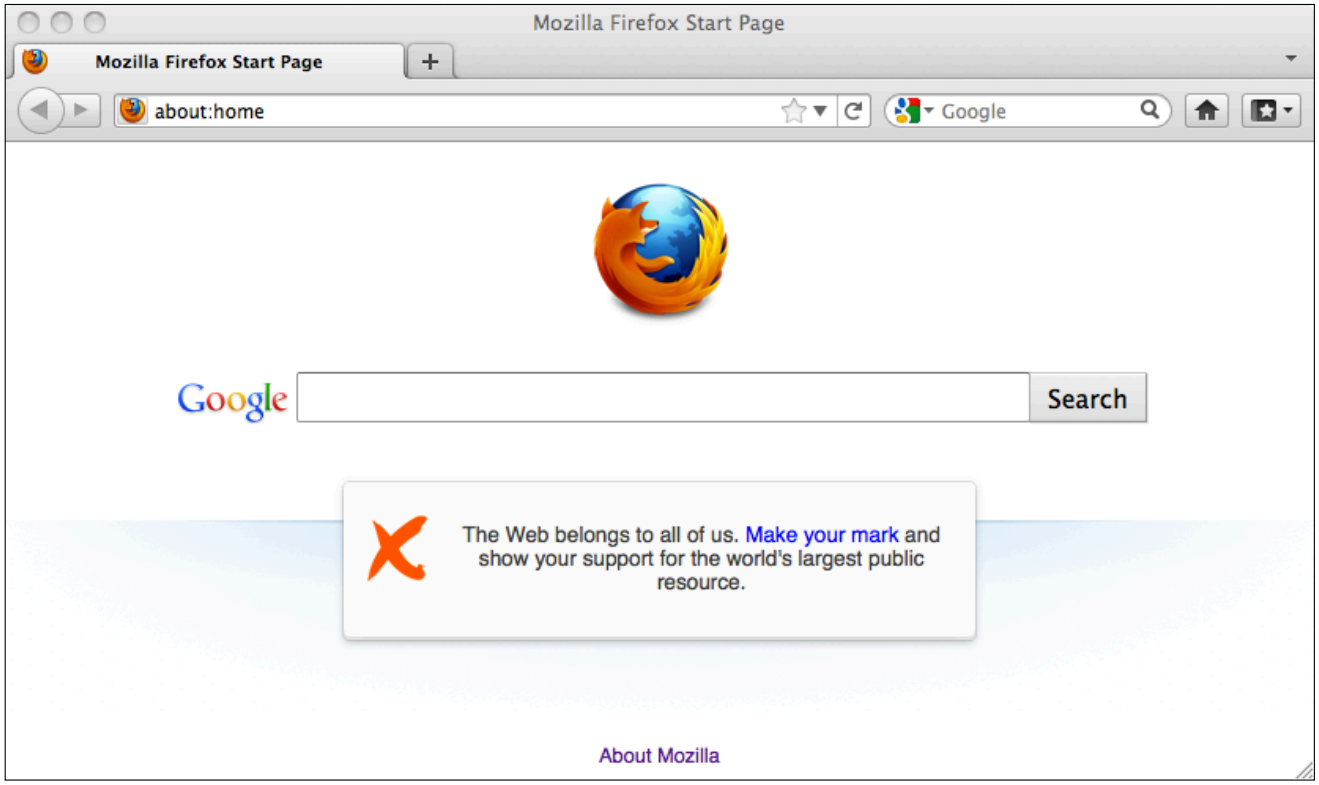
- Telephony is just an application
- Wireless communications now common part of most devices
- WWW data access is an essential part of most applications
- Users don't "go to a pc" to use the web any more
- Growing focus on solutions (apps) not tools (the browser)
- When something becomes ubiquitous, it disappears

Every Computing Era Has a Dominant Application Platfrom

- Corporate Computing Era: IBM Mainframes
- Personal Conmputing Era: Microsoft/Intel PC
- Ambient Computing Era: T.B.D (or is it?)

Created by Market Demand,
"Good Enough" Technical Foundation,
and Superior Business Execution

What do you have when you strip away the PC application part of a web browser?



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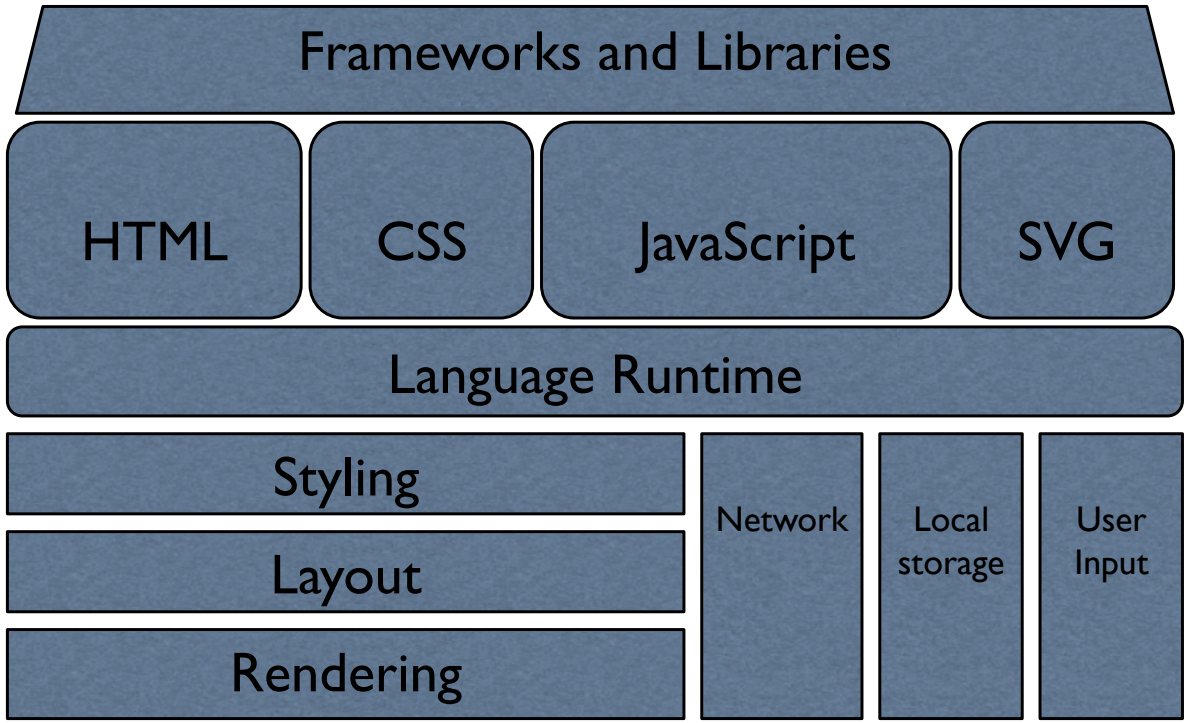
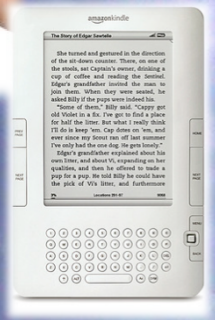
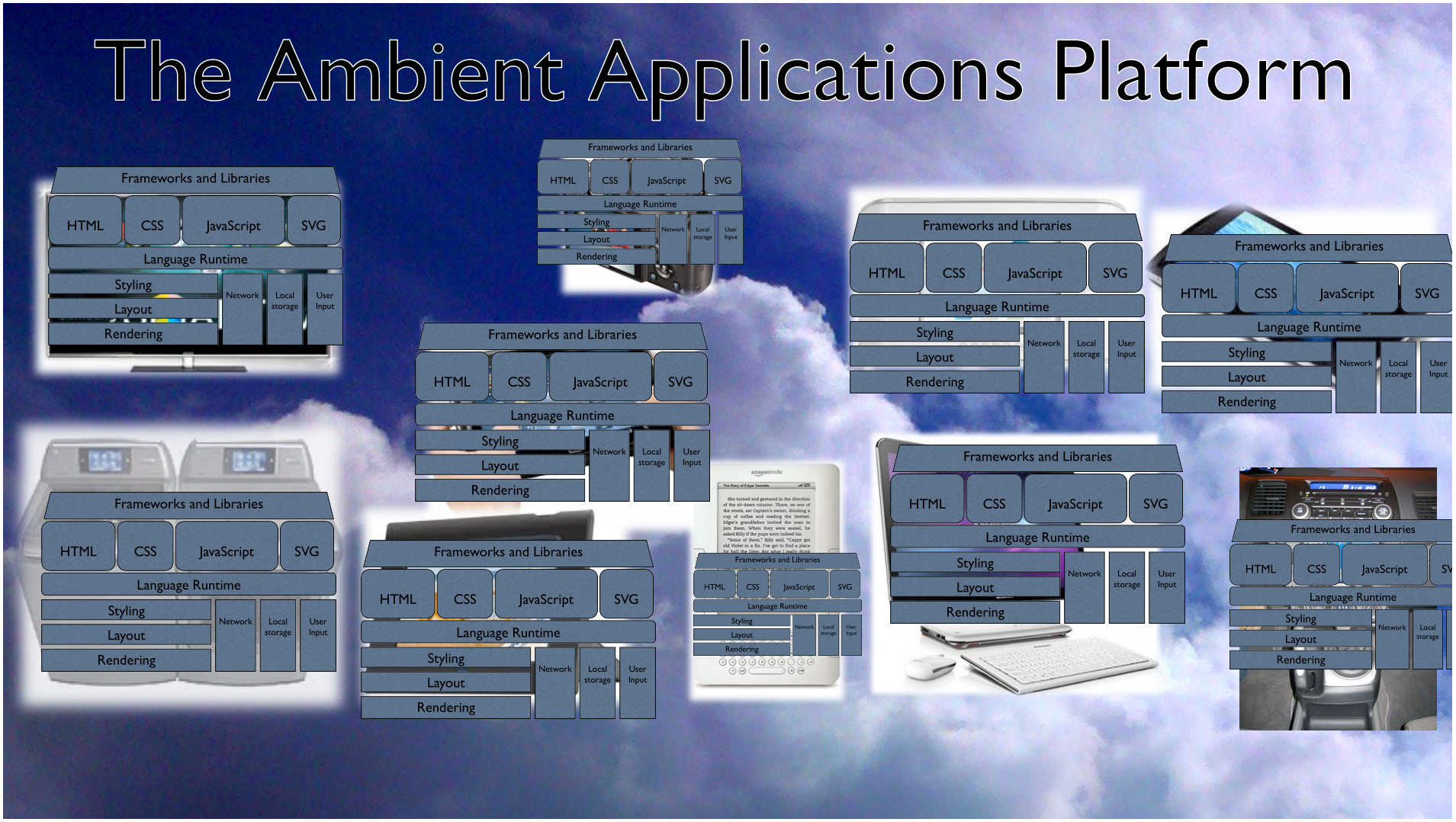


The Ambient Applications Platform



The Ambient Applications Platform

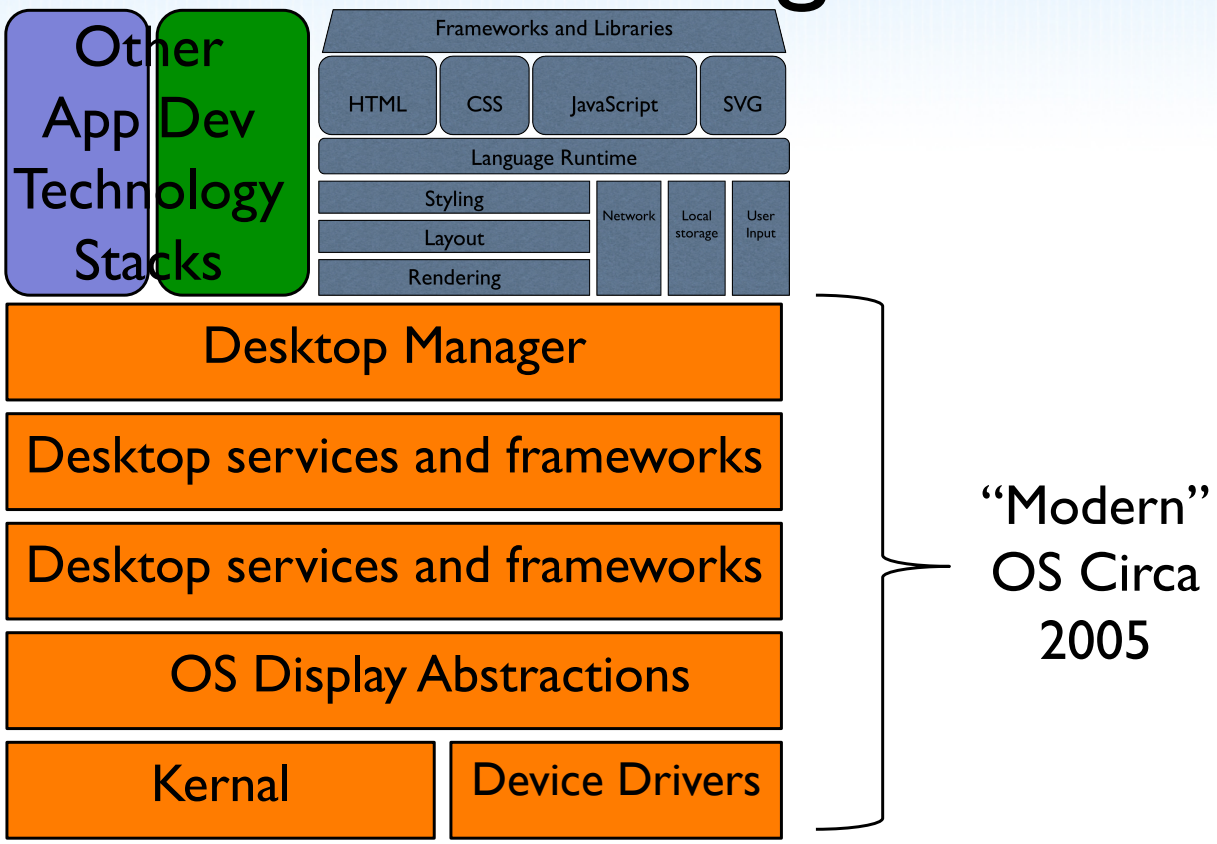


Web Apps vs. "Apps"

- HTML/CSS/JavaScript/WebApp APIs
- Server via: HTTP, JSON, XML, Sockets
- Works on any device
- Task specific "Chromeless" UIs emerging
- "App Stores" about to emerge

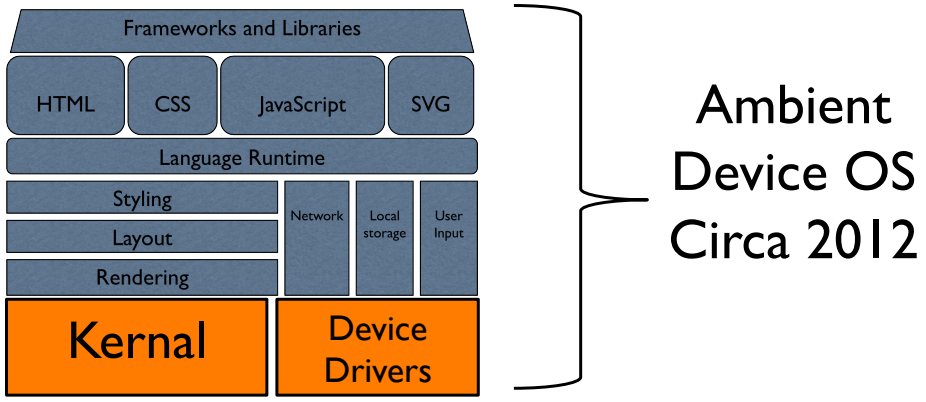
- Proprietary Language+Frameworks (Java, Objective-C, C#, etc.)
- Server via: HTTP, JSON, XML, Sockets
- Works only within a device family
- Task specific "Chromeless" UIs
- Tied to a specific "App Store"

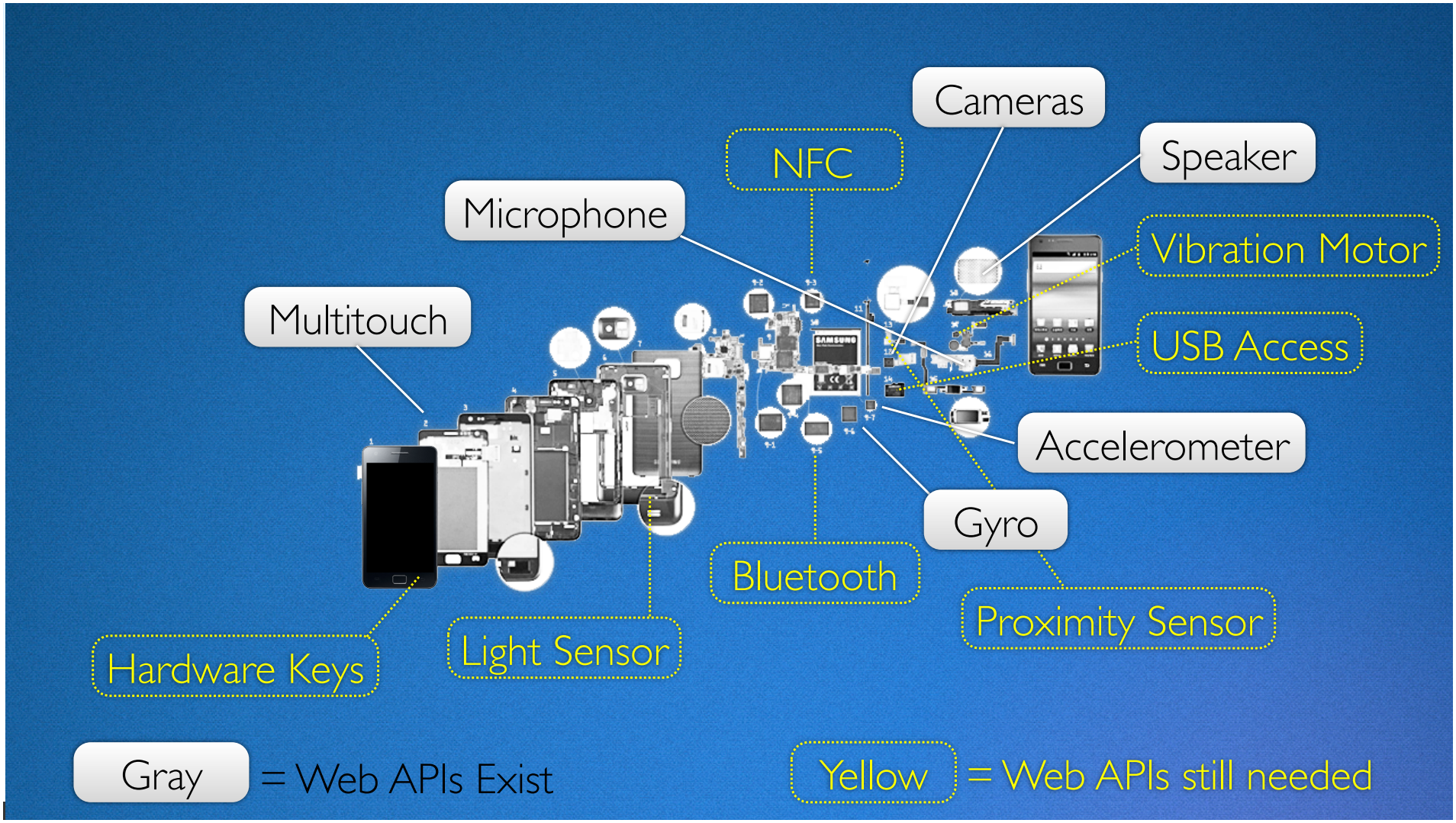
New Platform Emergence



New Platform Emergence

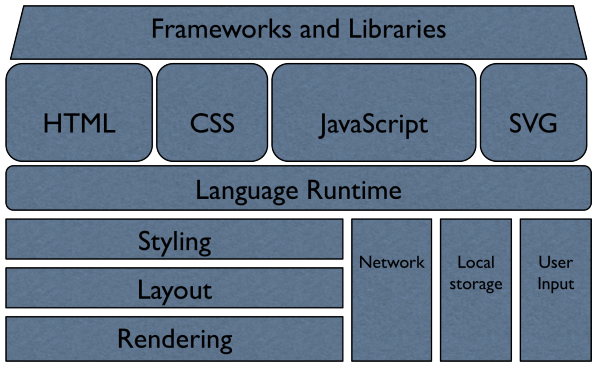
- Mozilla Boot to Gecho
- Chrome OS
- Plam/HP WebOS
- Etc.




Cameras
NFC
Speaker
Microphone
Vibration Motor
Multitouch
USB Access
Accelerometer
Gyro
Bluetooth
Proximity Sensor
Hardware Keys
Light Sensor
Gray = Web APIs Exist
Yellow = Web APIs still needed

Proprietary Silos

or a Standards-based Open Platform?



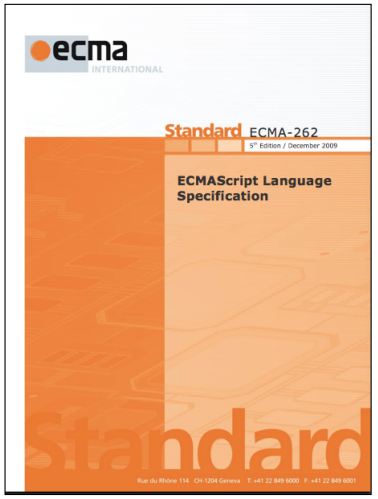
Walled Gardens

Areas of real concern

- Is it possible for a vender neutral standards-based open platform to achieve similar dominance?
- Cumbersome standardization processes
  - Really! W3C, Ecma, WhatWG, IETF, Kronos, …
- Who really drives innovation?
- Slow rate of change
- Who provides the implementations?

Each Computing Era has had a Canonical Programming Language

- Corporate Computing Era – COBOL/Fortran
- Personal Computing Era – C
- Ambient Computing Era – JavaScript ??



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Why JavaScript?

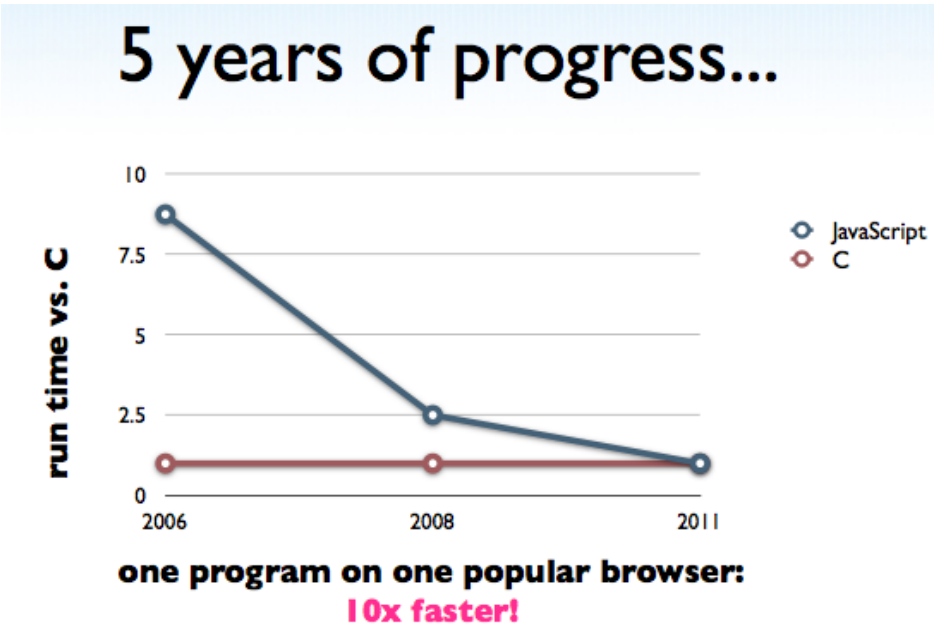
Because "Worse is Better"

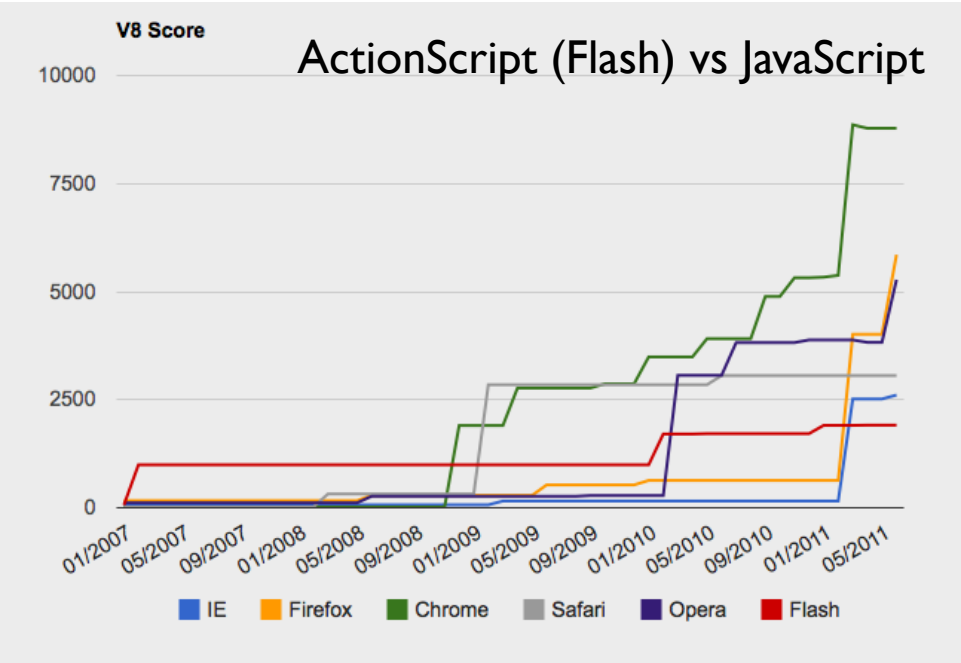
Dick Grabriel
http://www.dreamsongs.com/WorseIsBetter.html

- It's there – It's working
- It's good enough
- It's getting better
- What could replace it?
- How could that happen?

http://odetocode.com/Blogs/scott/archive/2009/03/18/signs-that-your-javascript-skills-need-updating.aspx

JavaScript Performance Over Time





http://people.mozilla.com/~dmandelin/KnowYourEngines_Velocity2011.pdf

http://iq12.com/blog/as3-benchmark/

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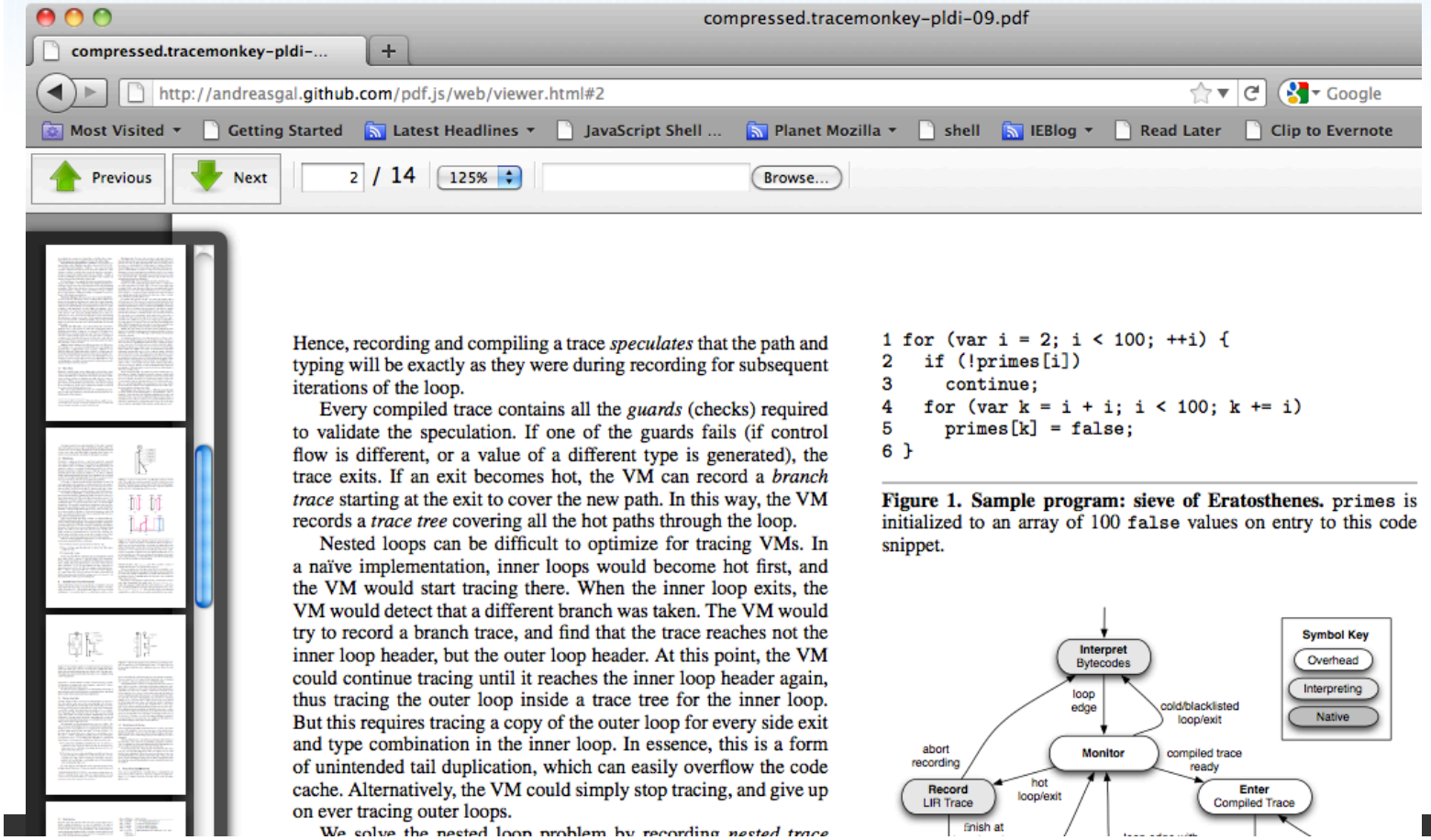
PDF Renderer in JavaScript

http://andreasgal.github.com/pdf.js/web/viewer.html

https://github.com/andreasgal/pdf.js



Hence, recording and compiling a trace *speculates* that the path and typing will be exactly as they were during recording for subsequent iterations of the loop.

Every compiled trace contains all the *guards* (checks) required to validate the speculation. If one of the guards fails (if control flow is different, or a value of a different type is generated), the trace exits. If an exit becomes hot, the VM can record a *branch trace* starting at the exit to cover the new path. In this way, the VM records a *trace tree* covering all the hot paths through the loop.

Nested loops can be difficult to optimize for tracing VMs. In a naïve implementation, inner loops would become hot first, and the VM would start tracing there. When the inner loop exits, the VM would detect that a different branch was taken. The VM would try to record a branch trace, and find that the trace reaches not the inner loop header, but the outer loop header. At this point, the VM could continue tracing until it reaches the inner loop header again, thus tracing the outer loop inside a trace tree for the inner loop. But this requires tracing a copy of the outer loop for every side exit and type combination in the inner loop. In essence, this is a form of unintended tail duplication, which can easily overflow the code cache. Alternatively, the VM could simply stop tracing, and give up on ever tracing outer loops.

We solve the nested loop problem by recording *nested trace*

```
1 for (var i = 2; i < 100; ++i) {
2   if (!primes[i])
3     continue;
4   for (var k = i + i; i < 100; k += i)
5     primes[k] = false;
6 }
```

Figure 1. Sample program: sieve of Eratosthenes. `primes` is initialized to an array of 100 `false` values on entry to this code snippet.

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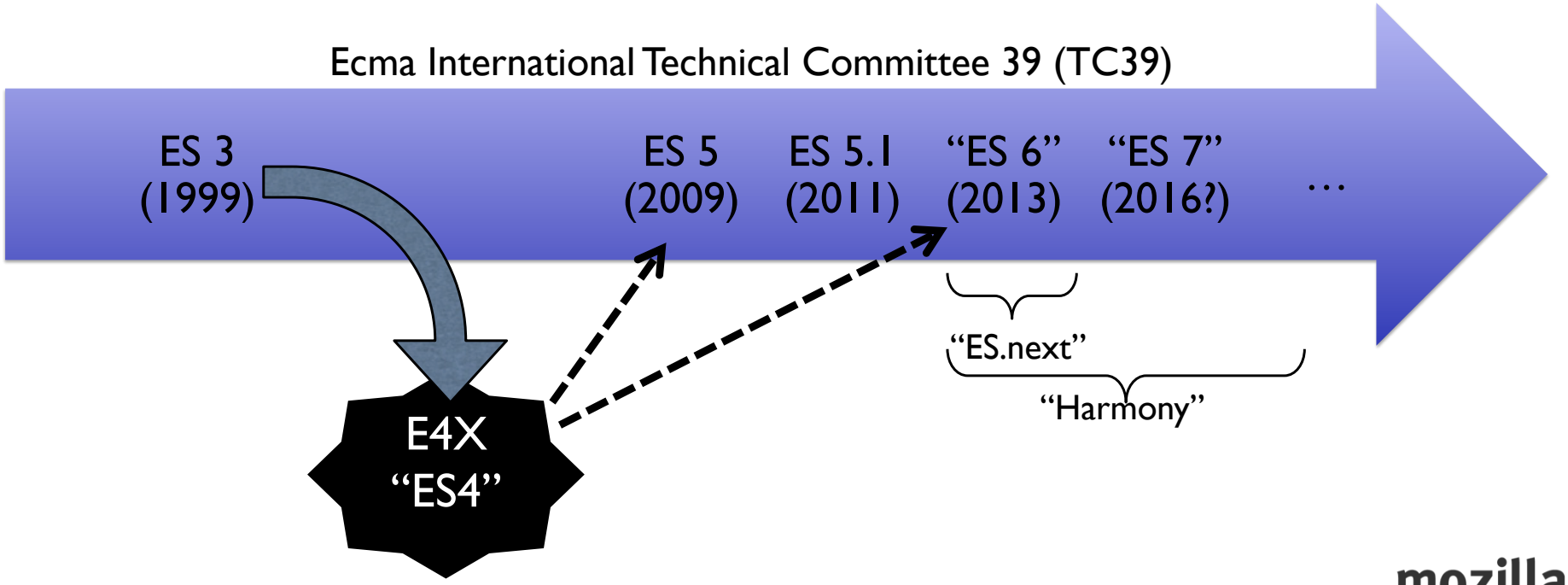
Evolving JavaScript
The ECMAScript Standards Process



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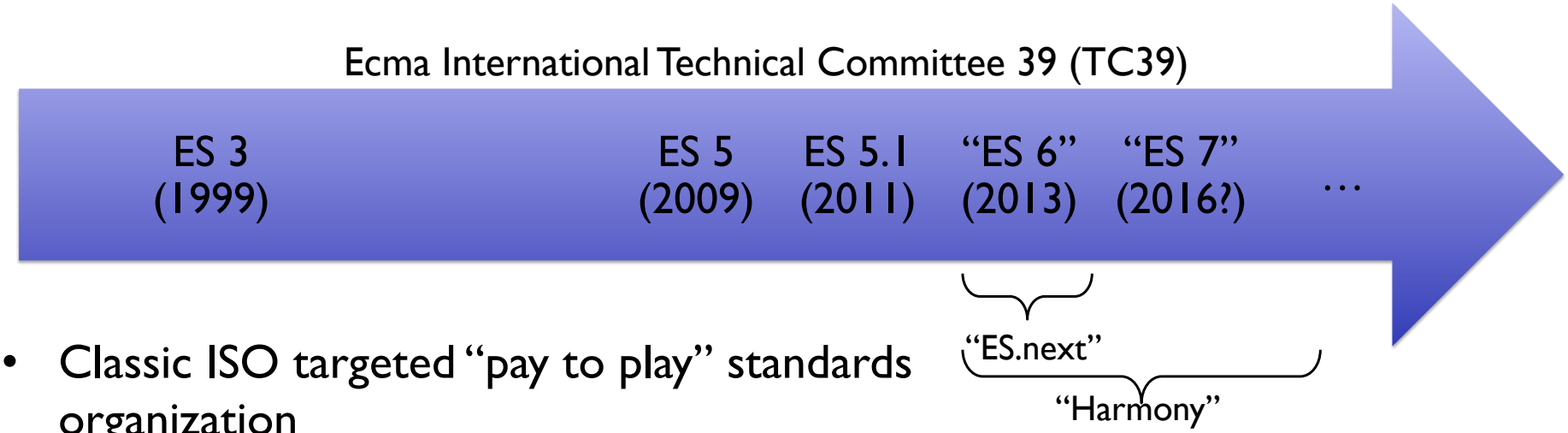
The ECMAScript Standards Process



- Classic ISO targeted "pay to play" standards organization
- Open public discussion list es-discuss@mozilla.org
- Working documents all publically available at wiki.ecmascript.org

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Interoperability is TC39's highest priority

- A detailed and highly prescriptive specification
- Large, non-normative test suite for implementers

ecmascript test262
http://test262.ecmascript.org/

8.7.2 PutValue (V, W)

1. If Type(*V*) is not Reference, throw a **ReferenceError** exception.
2. Let *base* be the result of calling GetBase(*V*).
3. If IsUnresolvableReference(*V*), then
   a. If IsStrictReference(*V*) is **true**, then
      i. Throw **ReferenceError** exception.
   b. Call the [[Put]] internal method of the global object, passing GetReferencedName(*V*) for the property name, *W* for the value, and **false** for the *Throw* flag.
4. Else if IsPropertyReference(*V*), then
   a. If HasPrimitiveBase(*V*) is **false**, then let *put* be the [[Put]] internal method of *base*, otherwise let *put* be the special [[Put]] internal method defined below.
   b. Call the *put* internal method using *base* as its **this** value, and passing GetReferencedName(*V*) for the property name, *W* for the value, and IsStrictReference(*V*) for the *Throw* flag.
5. Else *base* must be a reference whose base is an environment record. So,
   a. Call the SetMutableBinding (10.2.1) concrete method of *base*, passing GetReferencedName(*V*), *W*, and IsStrictReference(*V*) as arguments.
6. Return.

The following [[Put]] internal method is used by PutValue when *V* is a property reference with a primitive base value. It is called using *base* as its **this** value and with property *P*, value *W*, and Boolean flag *Throw* as arguments. The following steps are taken:

1. Let *O* be ToObject(*base*).
2. If the result of calling the [[CanPut]] internal method of *O* with argument *P* is **false**, then
   a. If *Throw* is **true**, then throw a **TypeError** exception.
   b. Else return.
3. Let *ownDesc* be the result of calling the [[GetOwnProperty]] internal method of *O* with argument *P*.
4. If IsDataDescriptor(*ownDesc*) is **true**, then
   a. If *Throw* is **true**, then throw a **TypeError** exception.
   b. Else return.
5. Let *desc* be the result of calling the [[GetProperty]] internal method of *O* with argument *P*. This may be either an own or inherited accessor property descriptor or an inherited data property descriptor.
6. If IsAccessorDescriptor(*desc*) is **true**, then
   a. Let *setter* be *desc*.[[Set]] (see 8.10) which cannot be **undefined**.
   b. Call the [[Call]] internal method of *setter* providing *base* as the **this** value and an argument list containing only *W*.
7. Else, this is a request to create an own property on the transient object *O*
   a. If *Throw* is **true**, then throw a **TypeError** exception.

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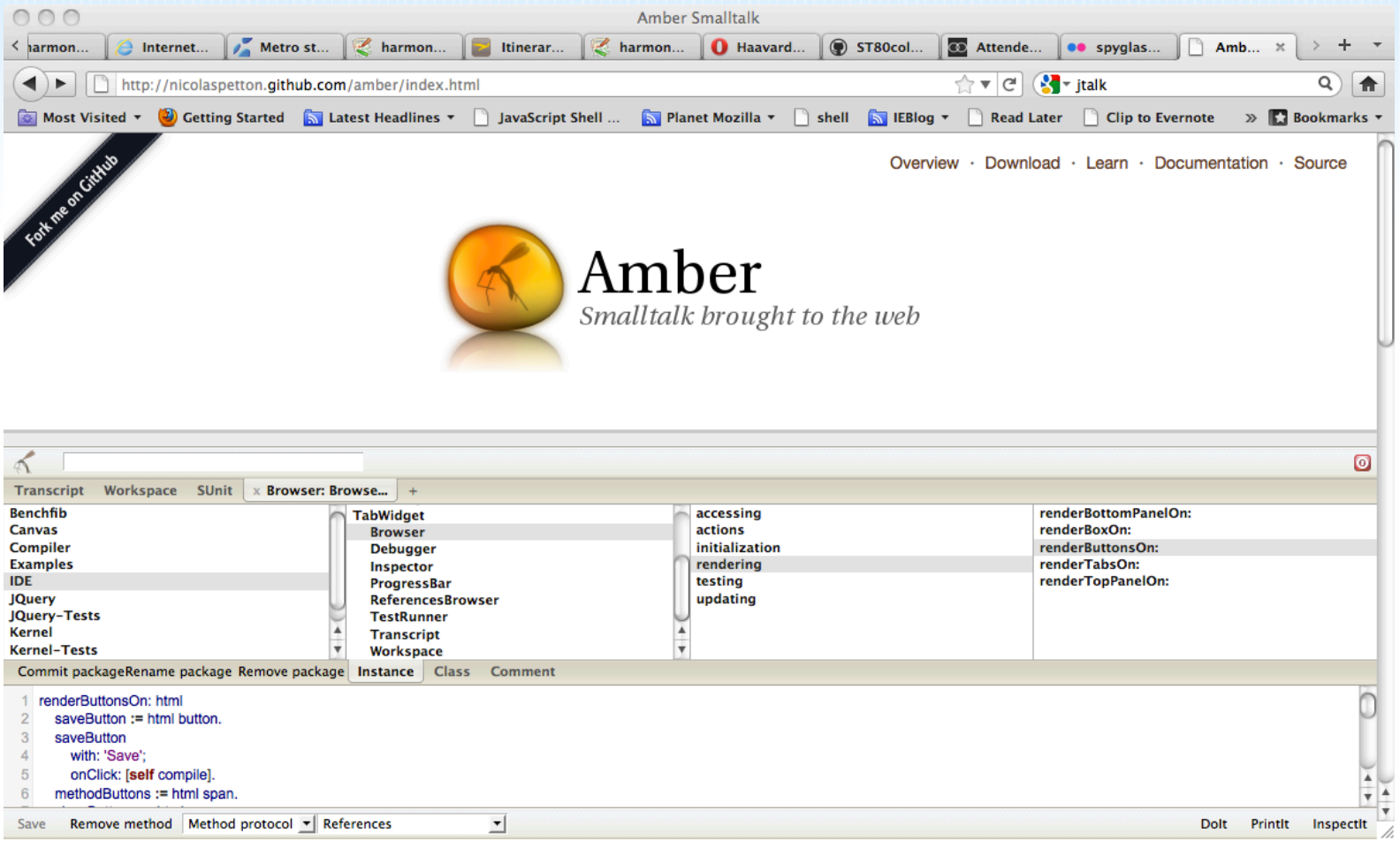
Evolving JavaScript
ECMAScript Harmony Goals

1. Be a better language for writing:
   A. complex applications;
   B. libraries (including the DOM) shared by those applications;
   C. code generators targeting the new edition.
2. …

http://wiki.ecmascript.org/doku.php?id=harmony:harmony



http://amber-lang.net/index.html

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Some ES.next Features

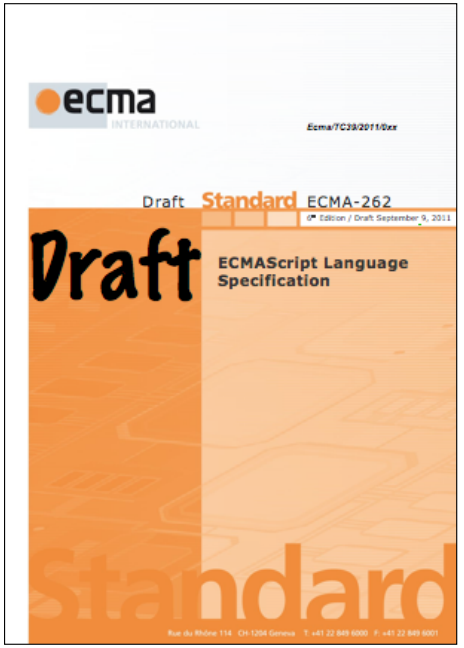
- Block scoping: let, const, functions
- Default value parameters, rest parameters, spread operator

```
function f(a, b=2) { };
function g(req, …args) {
   foo(…args)
}
```

- Destructuring in assignment, declarations and formal parameters.

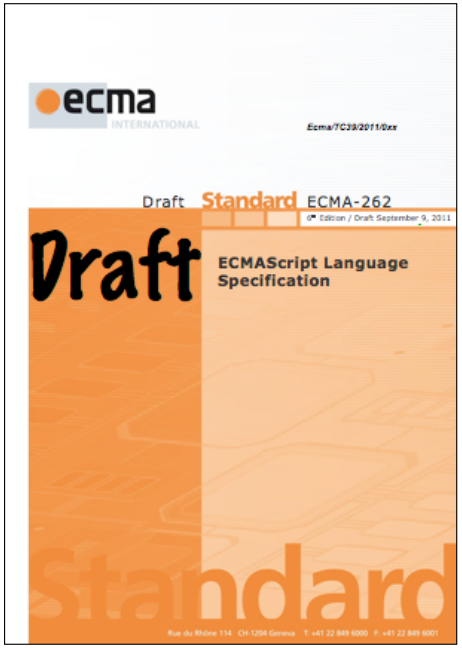
```
let {x,y} = getPoint( );
let [first, …remainder] = someArray;
```

http://wiki.ecmascript.org/doku.php?id=harmony:proposals



Major ES.next Enhancements

- Modules
- Sanding-boxing module loaders
- Proxy Objects – low level behavioral intercession
- Control abstraction via iterators and generators
- Array comprehensions, String interpolation
- super references
- Encapsulated state via gensym-like private names
- Better support for class-style inheritance



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New Object Composition Operators

<| "subclass" .{ } "extend"

```
let test1 = {first: 1} <| {second: 2};  console.log(test1.first); //1

let test2 = test1 <| [0,2,3];           console.log(test2.first); //1
test2[49] = "I'm a real array";         console.log(test2.length);//50

let test3 = test2 <| function() {};     console.log(test3.first); //1

test3.{third: 3,
       sum() {return this.first+this.second+this.this}
      };

console.log(test3.third)  //3
Console.log(test3.sum())  //6
```

A “Class” pattern

```
const className = superClass <| function(/*constructor parameters * /) {
  //constructor body
  super.constructor(/*arguments to super constructor * /);
  this.{
    //per instance property definitions
  }
}.prototype.{
  //shared instance properties defined on prototype
}.constructor.{
  //class (ie, constructor) properties
};
```

Pattern-based “Classes”?

```
const ArrayedCollection = SequenceableCollection <| function(elements=0) {
    super.constructor(elements);
  }.prototype.{
    get size() {return this.basicSize}
    at(index) {return this.basicAt(Math.floor(index))}
    atPut(index,value) {return this.basicAtPut(Math.floor(index),value)}
    add(newObject) {this.shouldNotImplement()}
  }.constructor.{
    newWithAll(size,value) {
      return (new this(size)).atAllPut(value);
      }
    with(...args) {
      const newCollection = new this(args.length);
      let i = 1;
      args.forEach(function(element) {newCollection.atPut(i++,element)});
      return newCollection;
    }
};
```

https://github.com/allenwb/ESnext-experiments

Or Syntactic Classes?

```
Class ArrayedCollection extends SequenceableCollection {
  constructor (elements=0) {
    super (elements);
  }
  get size() {return this.basicSize}
  at(index) {return this.basicAt(Math.floor(index))}
  atPut(index,value) {return this.basicAtPut(Math.floor(index),value)}
  add(newObject) {this.shouldNotImplement()}
  static newWithAll(size,value) {
    return (new this(size)).atAllPut(value);
    }
  static with(...args) {
    const newCollection = new this(args.length);
    let i = 1;
    args.forEach(function(element) {newCollection.atPut(i++,element)});
    return newCollection;
  }
};
```

http://wiki.ecmascript.org/doku.php?id=harmony:classes

What happening on the server?

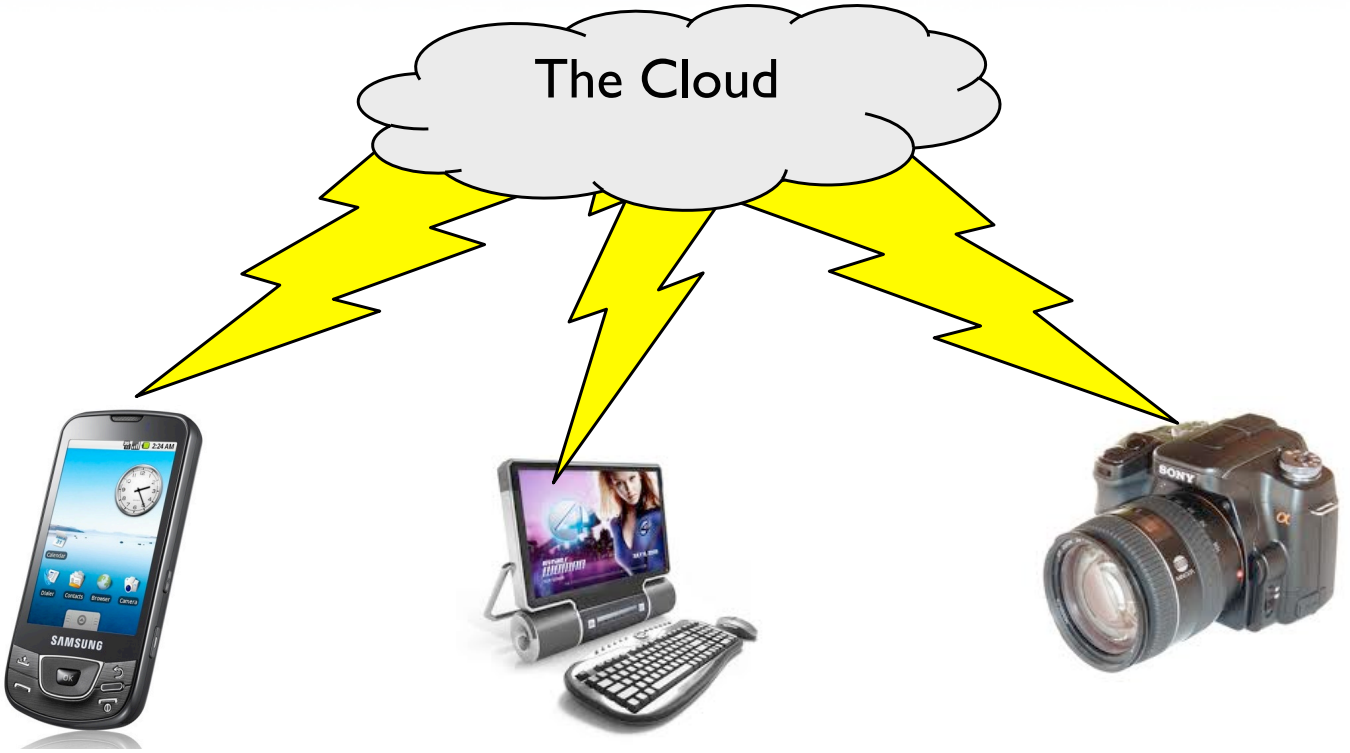
- The server-side of applications don't have the the "single platform" imperative of clients: Java, .Net, Python, Ruby
- Growing interest in also using JavaScript for the server portion of applications

Developers want to use same skills and technical resources on both client and server

- node.js (http://nodejs.org/) has exploded on the scene

```
//hello world server
var http = require('http');
http.createServer(function (req, res) {
   res.writeHead(200, {'Content-Type': 'text/plain'});
   res.end('Hello World\n');
 }).listen(1337, "127.0.0.1");
console.log('Server running at http://127.0.0.1:1337/');
```

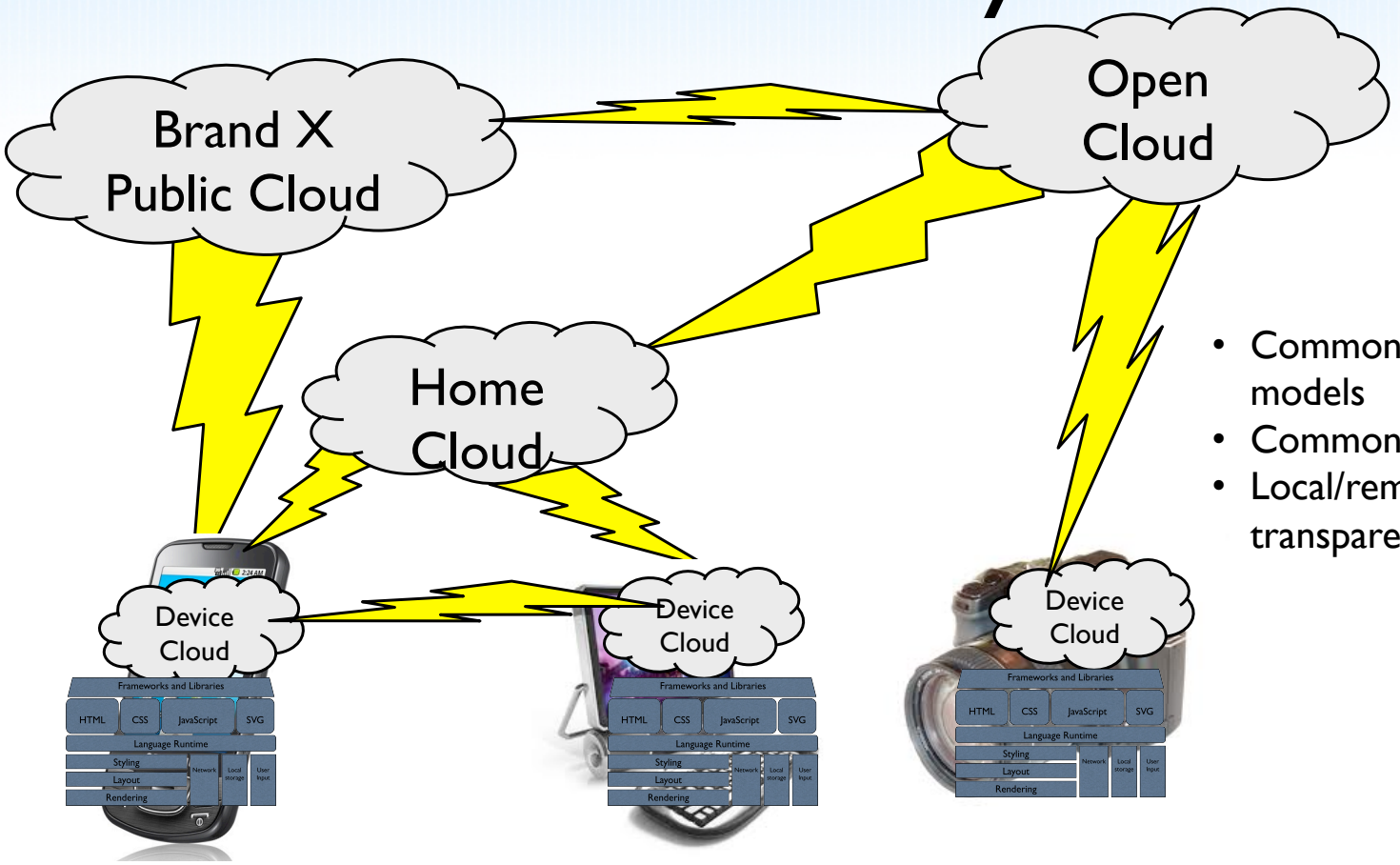
What About “The Cloud”



Concurrency/Using Multicores

- The Browser App Platform uses a very simple no shared state concurrency model.
  - Web Workers
  - PostMessage and JSON data records
  - Event loops / Continuation passing style
- Essentially the same model as browser ←→ webserver
- Can be fully distributed, not just client/server.

Clouds All the Way Down?



- Common programming models
- Common APIs
- Local/remote cloud transparency

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Users: Customers or Merchandise?

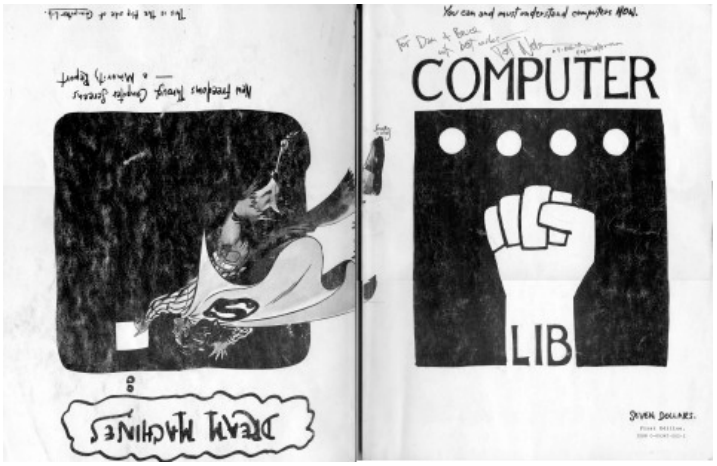
- Are we building devices and services that empower people
- Or, are we just trying to attract their attention so we can turn them into monetizable assets?

User Sovereignty

- How can we keep the user in control?
- Some of the key issue,
  - Identity
  - Privacy
  - Freedom to use want we choose
  - Reliable storage of our digital assets
  - Durability of data and applications

We Need Vision, Not Strategy

We Need Vision, Not Strategy



We Need Revolutionaries & Dreamers

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This is the most exciting time for the computing industry since the 1980's.

Enjoy it!

Follow up

http://www.wirfs-brock.com/allen/posts/category/post-pc-computing