# Language Delay

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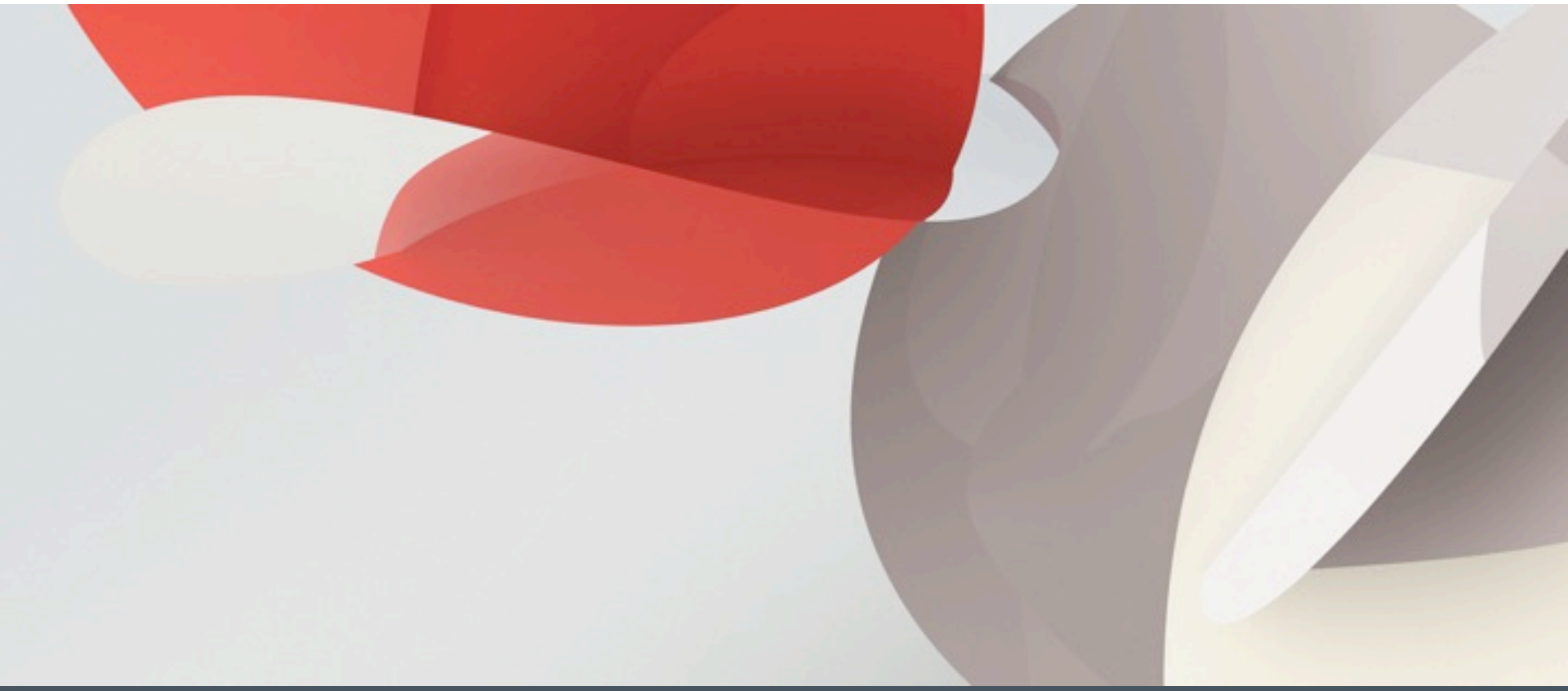


# Vocalization

# Vocalization

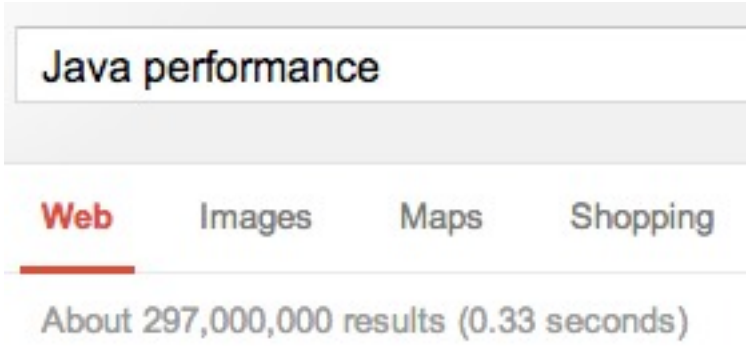
- Java was introduced in 1995 as a way to increase programmer productivity
  - Safe & secure
  - Simplified language with garbage collector
  - Portable
  - Object Oriented

- C++ (introduced in 1985) remained focused on performance and staying close to the hardware
  - Stay as efficient and as portable as C
  - Zero-overhead principle
  - Multi-paradigm

# Java


"Webpages that are optimized for Safari on iOS display and operate as designed (with the exception of any elements that rely on unsupported technologies, such as plug-ins, Flash, and Java)." – Apple

# Java


Java performance
Web
Images
Maps
Shopping
About 297,000,000 results (0.33 seconds)

# C++ on developer productivity

# C++

```
struct _LIBCPP_VISIBLE piecewise_construct_t { };
//constexpr
extern const piecewise_construct_t piecewise_construct;// = piecewise_construct_t();

template <class _T1, class _T2>
struct _LIBCPP_VISIBLE pair
{
    typedef _T1 first_type;
    typedef _T2 second_type;

    _T1 first;
    _T2 second;

    // pair(const pair&) = default;
    // pair(pair&&) = default;

    _LIBCPP_INLINE_VISIBILITY pair() : first(), second() {}

    _LIBCPP_INLINE_VISIBILITY pair(const _T1& __x, const _T2& __y)
        : first(__x), second(__y) {}

    template<class _U1, class _U2>
        _LIBCPP_INLINE_VISIBILITY
        pair(const pair<_U1, _U2>& __p
#ifndef _LIBCPP_HAS_NO_ADVANCED_SFINAE
                ,typename enable_if<is_constructible<_T1, _U1>::value &&
                                    is_constructible<_T2, _U2>::value>::type* = 0
#endif
                                    )
            : first(__p.first), second(__p.second) {}

    _LIBCPP_INLINE_VISIBILITY
    pair(const pair& __p)
        NOEXCEPT (is_nothrow_copy_constructible<first_type>::value &&
```

# Complete std::pair
# 372 Lines

# The compiler provided the copy and move constructors

"We're getting an error that has something to do with rvalue references and std::pair."

# Vocalization

1>c:\Program Files (x86)\Microsoft Visual Studio 10.0\VC\include\utility(163): error C2220: warning treated as error - no 'object' file generated
1> c:\Program Files (x86)\Microsoft Visual Studio 10.0\VC\include\utility(247) : see reference to function template instantiation 'std::_Pair_base<_Ty1,_Ty2>::_Pair_base<_Ty,int>(_Other1 &&,_Other2 &&)' being compiled
1> with
1> [
1> _Ty1=std::_Tree_iterator<std::_Tree_val<std::_Tmap_traits<Mondo::num32,Mondo::CPhotoshopFormat *,std::less<Mondo::num32>,std::allocator<std::pair<const Mondo::num32,Mondo::CPhotoshopFormat *>>,false>>>,
1> _Ty2=bool,
1> _Ty=std::_Tree_iterator<std::_Tree_val<std::_Tmap_traits<Mondo::num32,Mondo::CPhotoshopFormat *,std::less<Mondo::num32>,std::allocator<std::pair<const Mondo::num32,Mondo::CPhotoshopFormat *>>,false>>>,
1> _Other1=std::_Tree_iterator<std::_Tree_val<std::_Tmap_traits<Mondo::num32,Mondo::CPhotoshopFormat *,std::less<Mondo::num32>,std::allocator<std::pair<const Mondo::num32,Mondo::CPhotoshopFormat *>>,false>>>,
1> _Other2=int

# Vocalization

```
template<class U, class V> pair(U&& x, V&& y);
```

- A pair<T, bool> was being constructed as “make_pair(x, false)”
- And generating a warning that an int was being converted to a bool...
- How?

# Vocalization

```
ADMStandardTypes.h: #define false   0
AGFConvertUTF.cpp:  #define false   0
ASBasic.h:          #define false   0
ASBasicTypes.h:     #define false   0
ASNumTypes.h:       #define false   0
ASTypes.h:          #define false   0
basics.h:           #define false   ((Bool32) 0)
common.h:           #define false   0
config_assert.h:    #define false   0
ConvertUTF.cpp:     #define false   0
CoreExpT.h:         #define false   0
ICCUtils.h:         #define false   0
isparameter.cpp:    #define false   0
PITypes.h:          #define false   FALSE
piwinutl.h:         #define false   FALSE
PSSupportPITypes.h: #define false   FALSE
stdbool.h:          #define false   false
t_9_017.cpp:        #define false   0
WinUtilities.h:     #define false   FALSE
```

# <Placeholder>

- Insert your own beautiful code here.

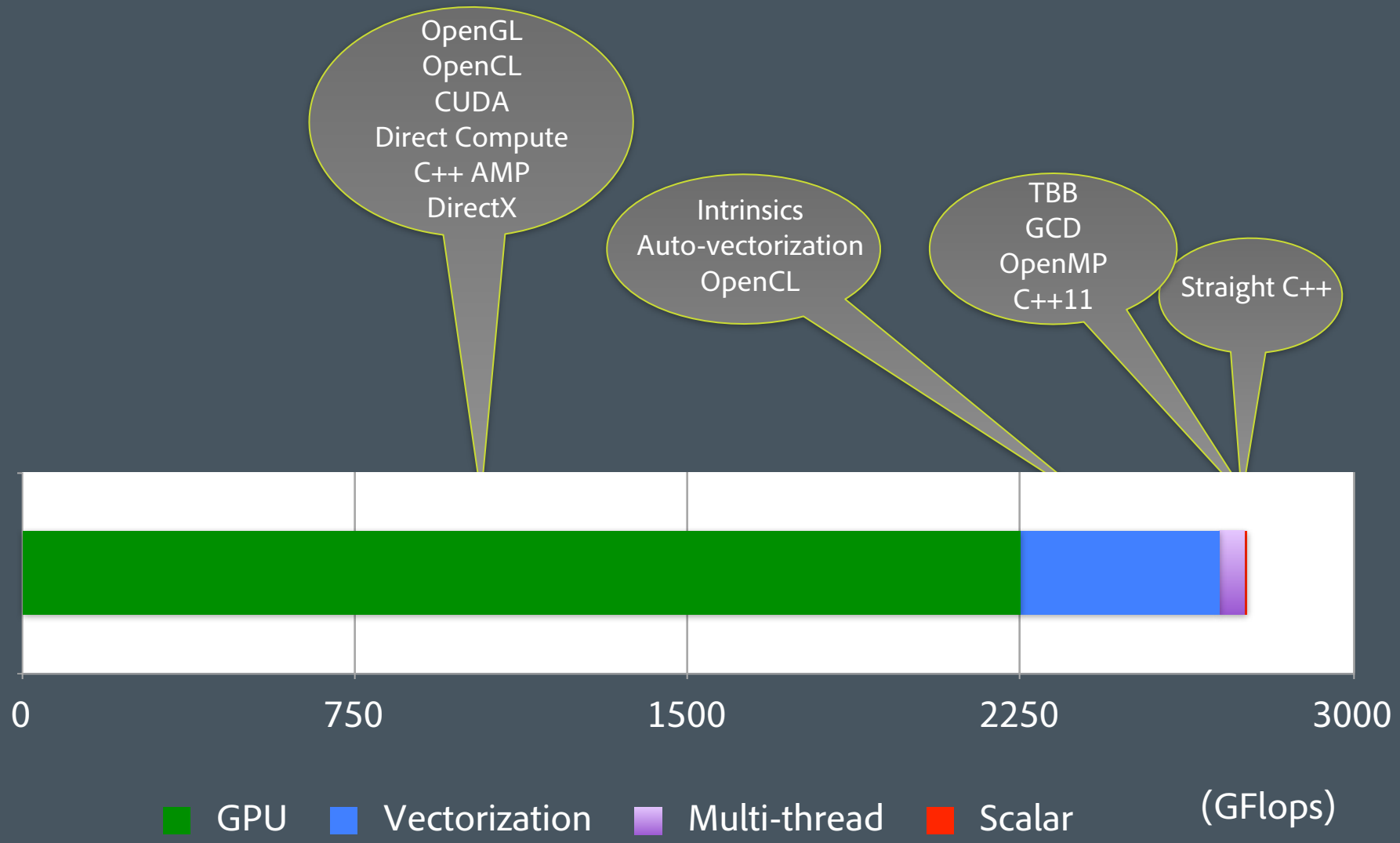
# What are we trying to say?

# Verbalization

# Demo

Adobe Revel

# Desktop Compute Power (8-core 3.5GHz Sandy Bridge + AMD Radeon 6950)








Adobe

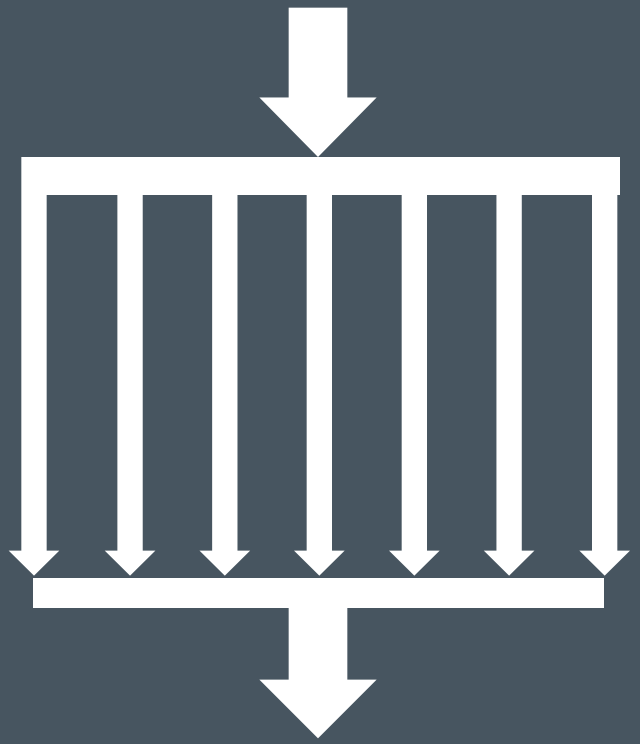
The hardware has changed dramatically in the last 20 years (when typically a single scaler CPU was 100% of the machine)

Languages are much the same

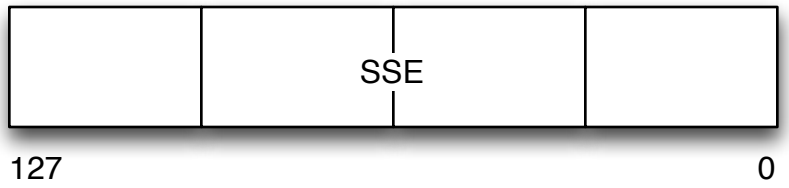
# Two kinds of parallel

Functional

Data Parallel



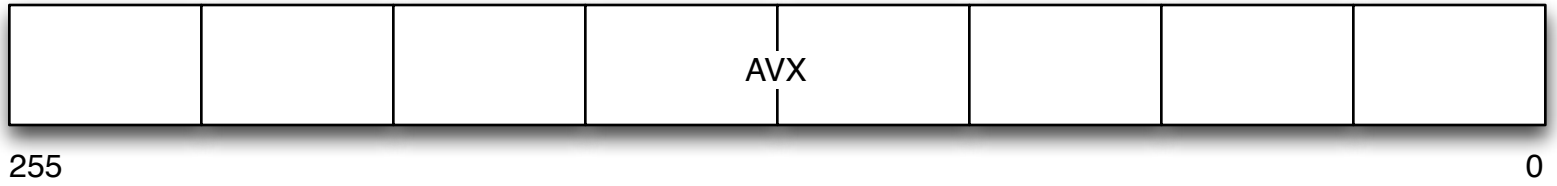
# Vectorization




- Intrinsics: great speed potential, but…

```
__m128i vDst = _mm_cvttps_epi32(_mm_mul_ps(_mm_cvtepi32_ps(vSum0), vInvArea));
```

  - Moving target: MMX, SSE, SSE2, SSE3, SSE 4.1, SSE 4.2, AVX, AVX2, AVX3




- Solutions:
  - Auto-vectorization `#pragma SIMD`
  - CEAN `Dest[:] += src[start:length] + 2;`
  - OpenCL

# GP-GPU

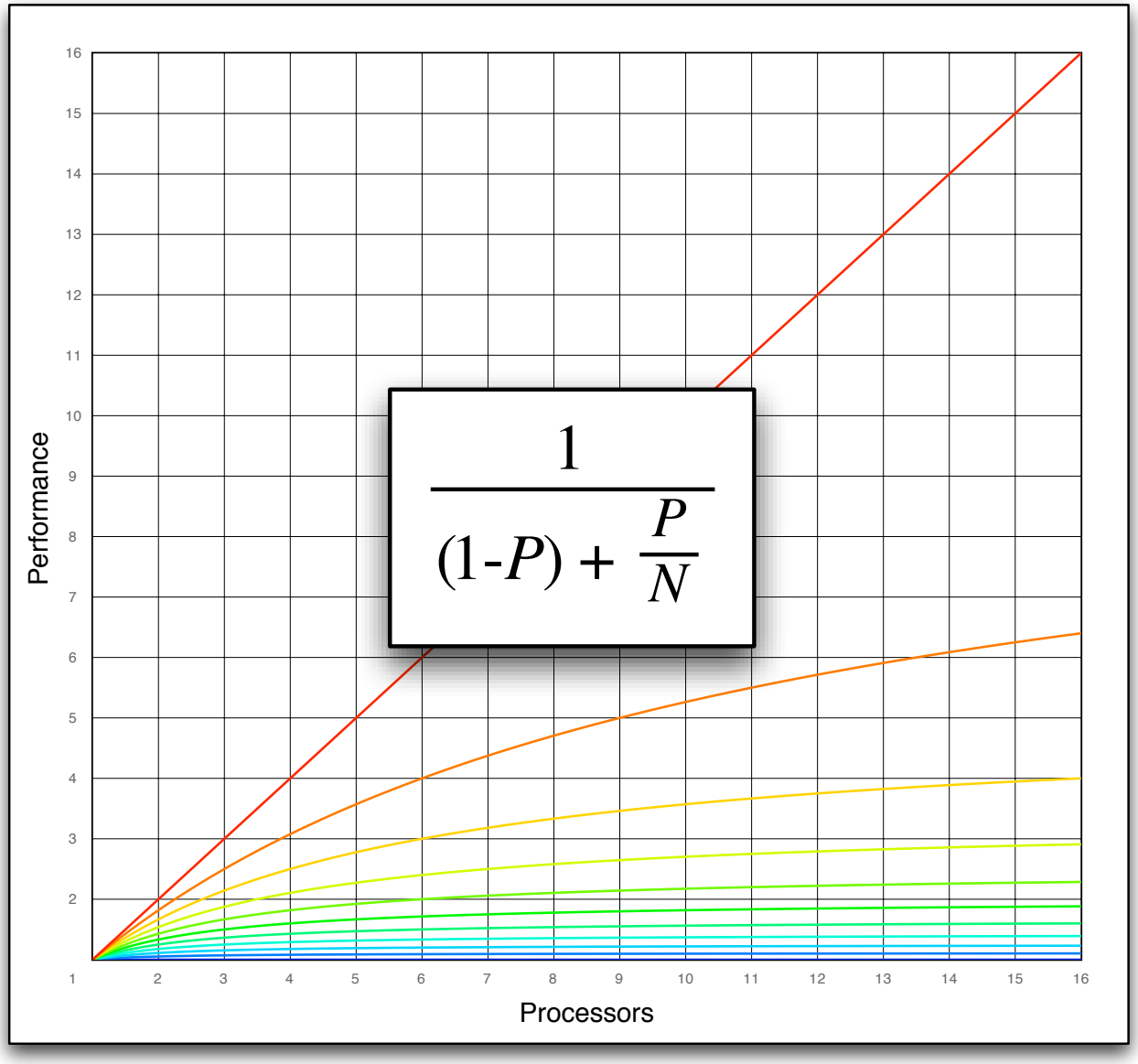


| | | | |
|---|---|---|---|
| Data Parallel | 300 | : | 1 |
| Sequential | 1 | : | 10 |

# Verbalization

- Typical object oriented paradigms of using shared references to objects breaks down in a massively parallel environment
- Sharing implies either single threaded
  - Or synchronization

# Amdahl's Law



# Verbalization

- To utilize the hardware we need a fundamentally different vocabulary
  - Functional? Declarative? Reactive?

- So far the only solutions that unlock the hardware are primitive and proprietary
  - Typically some form of constrained C-like language

# Verbalization

- Without addressing vectorization, GPGPU, and scalable parallelism, mainstream languages are just a scripting system to get to the other 99% of the machine through other specialized languages and libraries

Common languages don't provide the words we need to verbalize

# What are we trying to express?

# Oration

# Content Ubiquity

- Ubiquitous access to:
  - calendar
  - contacts
  - notes & tasks
  - e-mail (corporate and personal)
  - A full web experience
  - Music
    - iTunes Music Match
    - Spotify
    - Pandora
  - Movies
    - Netflix
    - Vudu
- Photos
  - Flickr
  - Facebook
  - Adobe Revel
- Documents
  - Google Docs
  - Microsoft Office
  - Evernote
- Everything...

*Content ubiquity* is access to all your information, on all your devices, all of the time

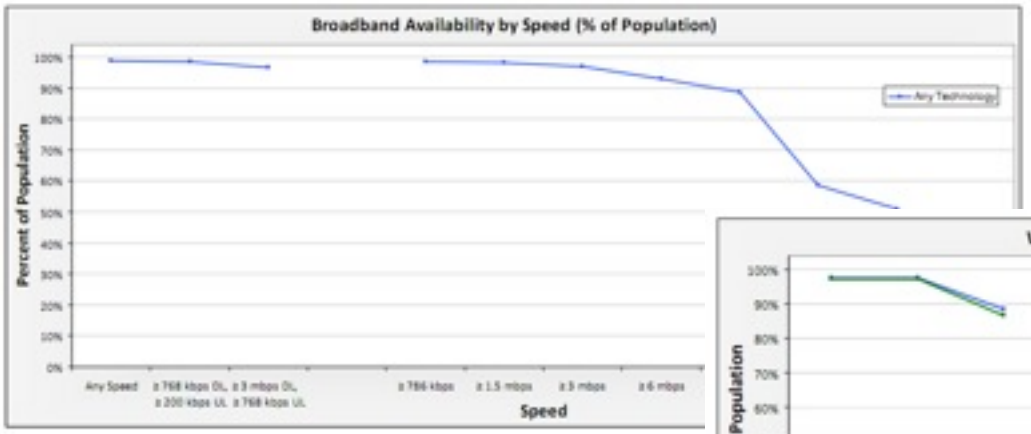
# The Problem

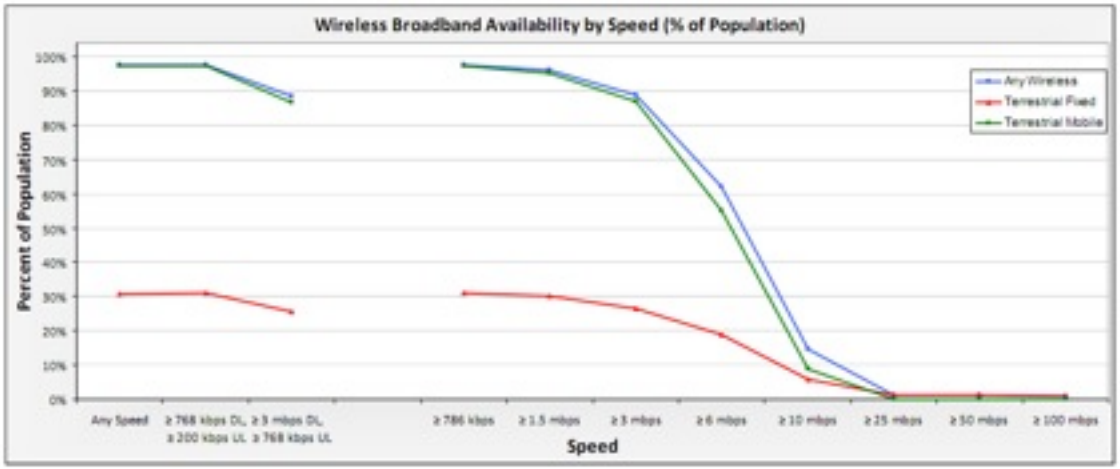
- Ubiquity has gone mainstream
  - A typical US household now has 3 TVs, 2 PCs, and 1 Smartphone
    - 1 in 3 households has an internet connected TV
  - A typical US worker has access to a PC at work or is provided an e-mail solution for communication
- The deluge of digital information has become a challenge to manage
  - How do I get this contract to my phone?
  - How do I get this video from my phone to my PC?
  - Which computer has the latest version of this photo?

**Content ubiquity has become the expectation**

# The Technology is Here Now

- ≥ 3mbps broadband is available to 98% of the US population
- ≥ 3mbps mobile broadband is available to 99%
- US ranks 26th in broadband subscriptions per capita
  - Nearly every other tier one market is ahead of US
  - France (12), Germany (18), UK (19), Japan (27)



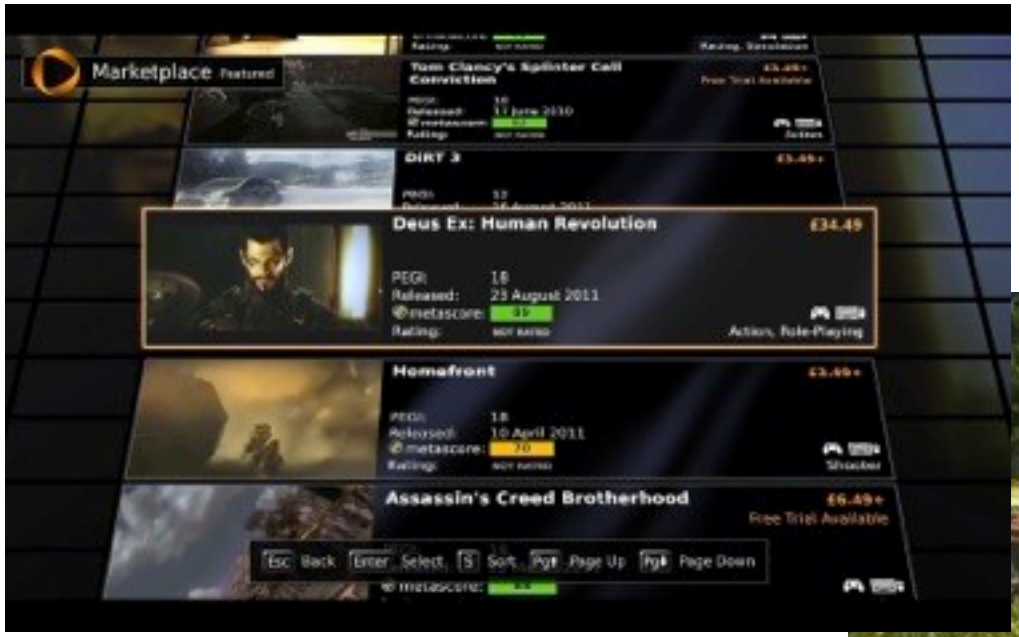



# No Excuses

- Your data set is not too large


# No Excuses

- Your application is not too interactive




# No Excuses

- Current hardware is capable enough
  - Typical: 2x1GHz cores, 512GB RAM, 32GB SSD, GPU, 802.11n
  - Revel runs the entire ACR image pipeline on an iPad 1 (half the above capabilities)

# The Players



# The Opportunity

- Focus on content ubiquity
  - all your content, instantly, on any available device
  - zero management overhead

- Users don't want to care about "The Cloud," users want their content

# The Challenge

- Content Ubiquity isn't a feature you can bolt-on
  - Dropbox, and similar technologies that require management and synchronization aren't the solution

- Achieving a seamless experience requires rethinking…
  - data model to support incremental changes
  - transactional models to support dynamic mobile environment
  - editor model to support partial editing (proxies, pyramid)
  - UI model to support touch, small devices, 10 foot interfaces
  - heavily asynchronous environment dealing with (relatively) high network latencies and trying to achieve zero latency on UI

# Content Ubiquity Opens the Door to Sharing and Collaboration

- If you can make changes available to other devices immediately then you can make changes available to other apps immediately (works with sandboxing technology)

- If you can make documents available to all your devices then you can make documents available to others - supporting both collaboration and sharing

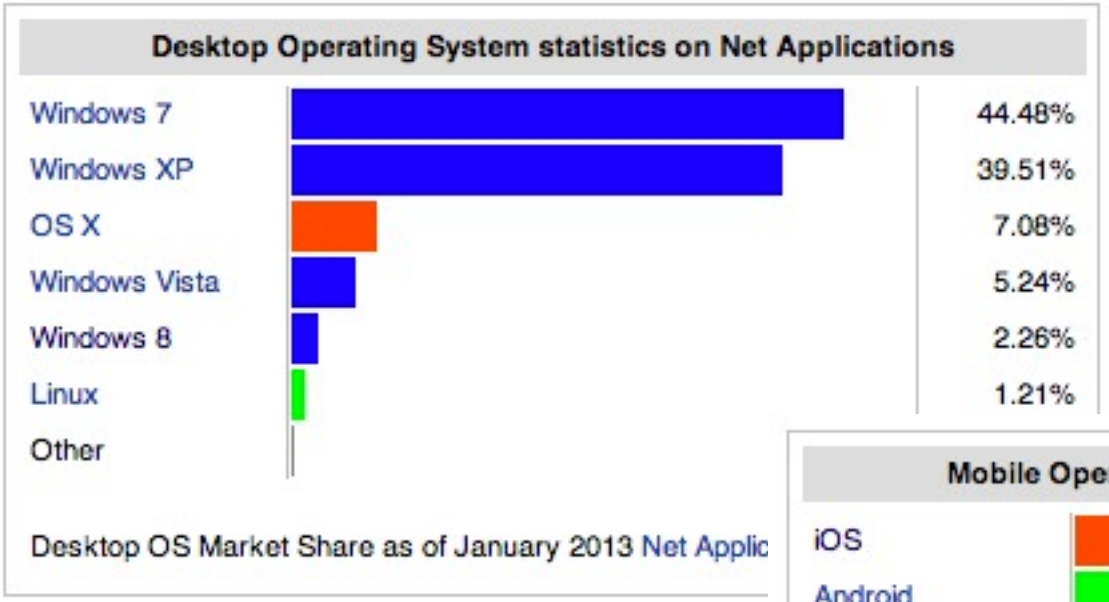
# The Business

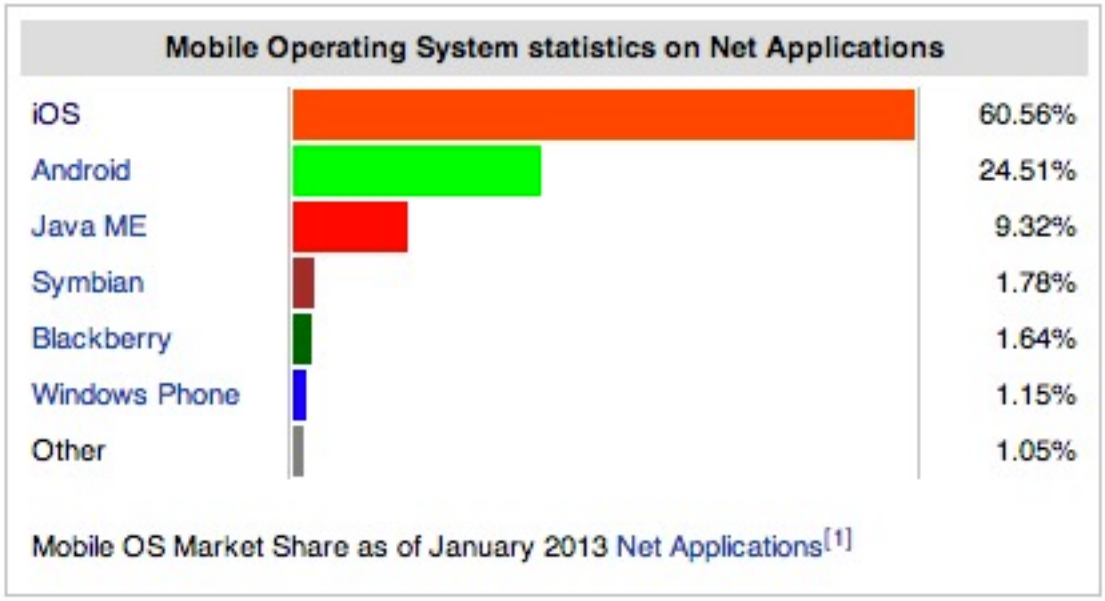
- In 2011 smartphone sales exceeded PC sales
- Tablets are expected to exceed PC sales by 2015
- There are 220M internet connected televisions
- Low margin, high volume
- Highly competitive, low barrier to entry

- **Server and support costs dwarf development costs**

# Language Pain

- The market is very fragmented



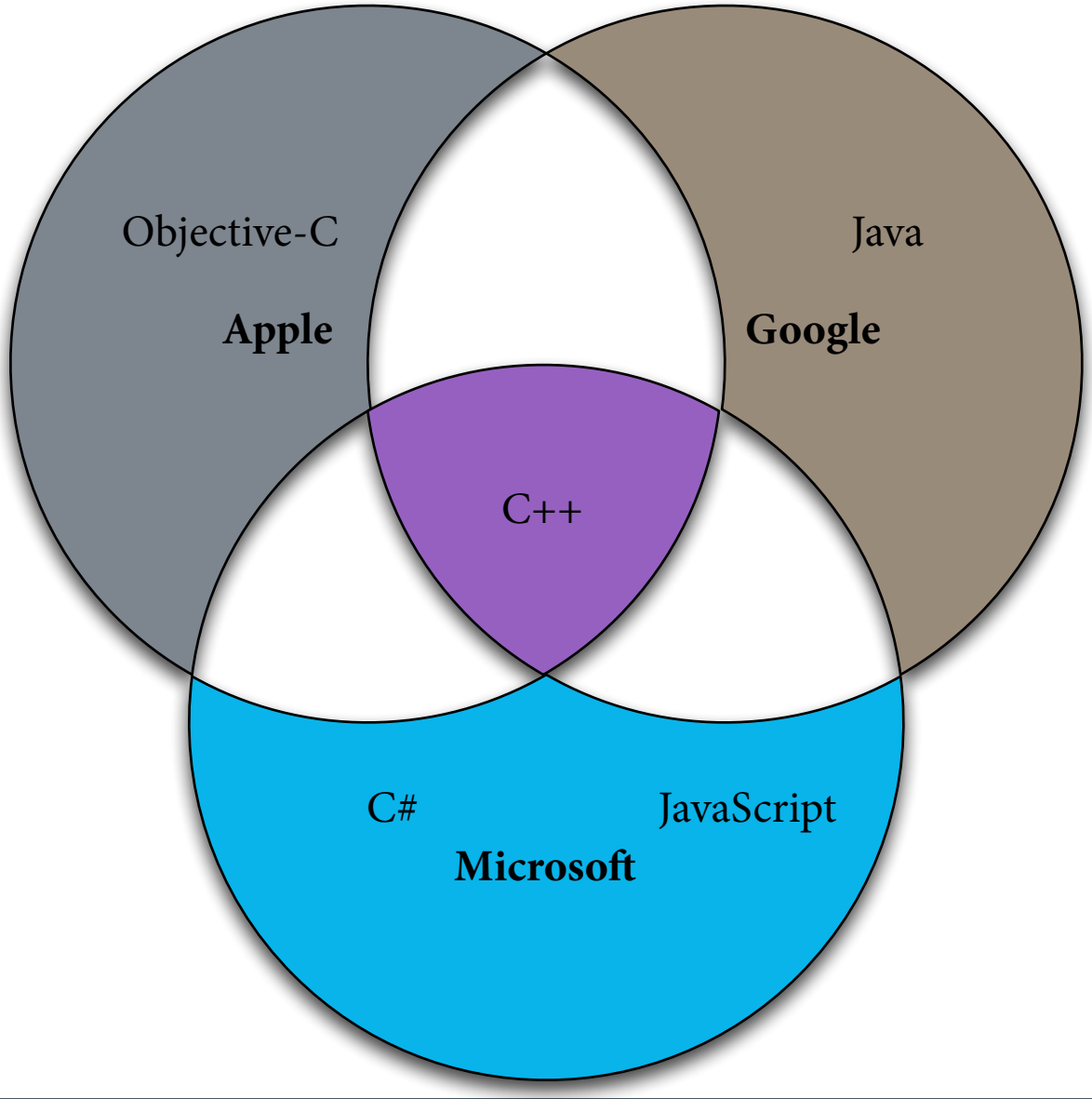
# Language Pain

- To provide a solution requires you write for multiple platforms

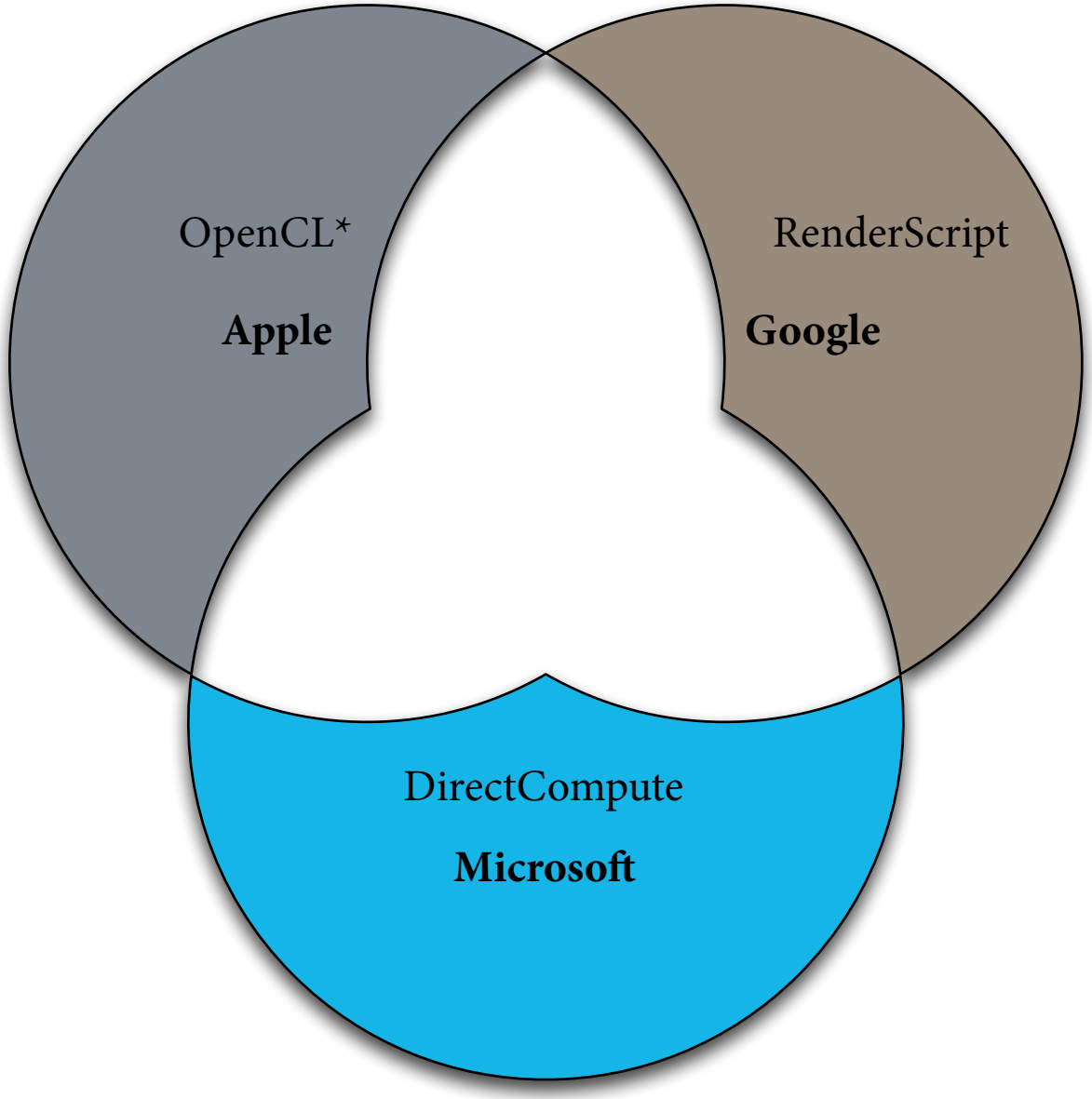
- And many vendors are focusing  on proprietary technology and languages

- Apple: Objective-C, Objective-C++, OpenCL, OpenGL, OpenGL ES
- Microsoft: C#, JavaScript, C++/CX, Direct-X, DirectCompute, C++AMP
- Google: Java, C/C++ through JNI, RenderScript Compute, OpenGL ES
- Browser: JavaScript, WebGL, C/C++ through Native Client (Chrome Only)
- NVIDIA: CUDA (OS X, Windows, Linux)
- Linux (Server Side): C/C++, Java, JavaScript, Python, Ruby, etc...

# Platform Languages



# General Purpose-GPU Languages



# Language Pain

- Vendor lock-in on commodity technologies only serves to slow development
  - including incorporating vendor specific technology that provides user benefit

# Today it seems that we can only point and grunt

We need a common language to talk about systems

with a vocabulary that scales to modern hardware


Adobe