What is new in Mono? July 2013

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Agenda

- Today:
  - What is new in Mono-land.
  - Major Work-in-Progress Projects

- Tomorrow:
  - Brainstorming session
  - Future of Mono and .NET

MONO 3.2

Mono 3.2

- Core .NET 4.5 support
  - Base Class Libraries
  - C# 5
- Available today:
  - Desktop
  - Server
  - Mobile
- 2.10.x is no longer supported

What is new in Mono 3.2

- Vastly improved SGen GC
  - Now the default!
- Micro-optimizations
  - Mobile-driven
- Consume PCL binaries
- Shipping OSS Microsoft frameworks
- New Mono frameworks

SGen Garbage Collector

- Our Precise, generational collector

- Now the default for Mono
  - “mono” now runs mono –gc=sgen
  - libmono is Boehm
  - libmono-sgen is Sgen

- Sgen is now faster on almost every workload
- MonoDevelop/Xamarin Studio
  - Been using it as a default since February

What is new?

- Major collectors:
  - Copy collector (old, reference code)
  - Mark and Sweep
- Minor collectors:
  - Now with support for cementing
- Help game developers love GC
- dtrace probes

Mark and Sweep

- Dynamic heap by default
  - Can specify fixed heap if desired
- Allocates blocks of memory to bucket sizes
  - Think of the spirit to “slab” allocation
  - Support changes in workloads with evacuation
- Concurrent Marking, Lazy Sweeping

Disabling Major Collector

New API on Mono.Runtime (mscorlib.dll)

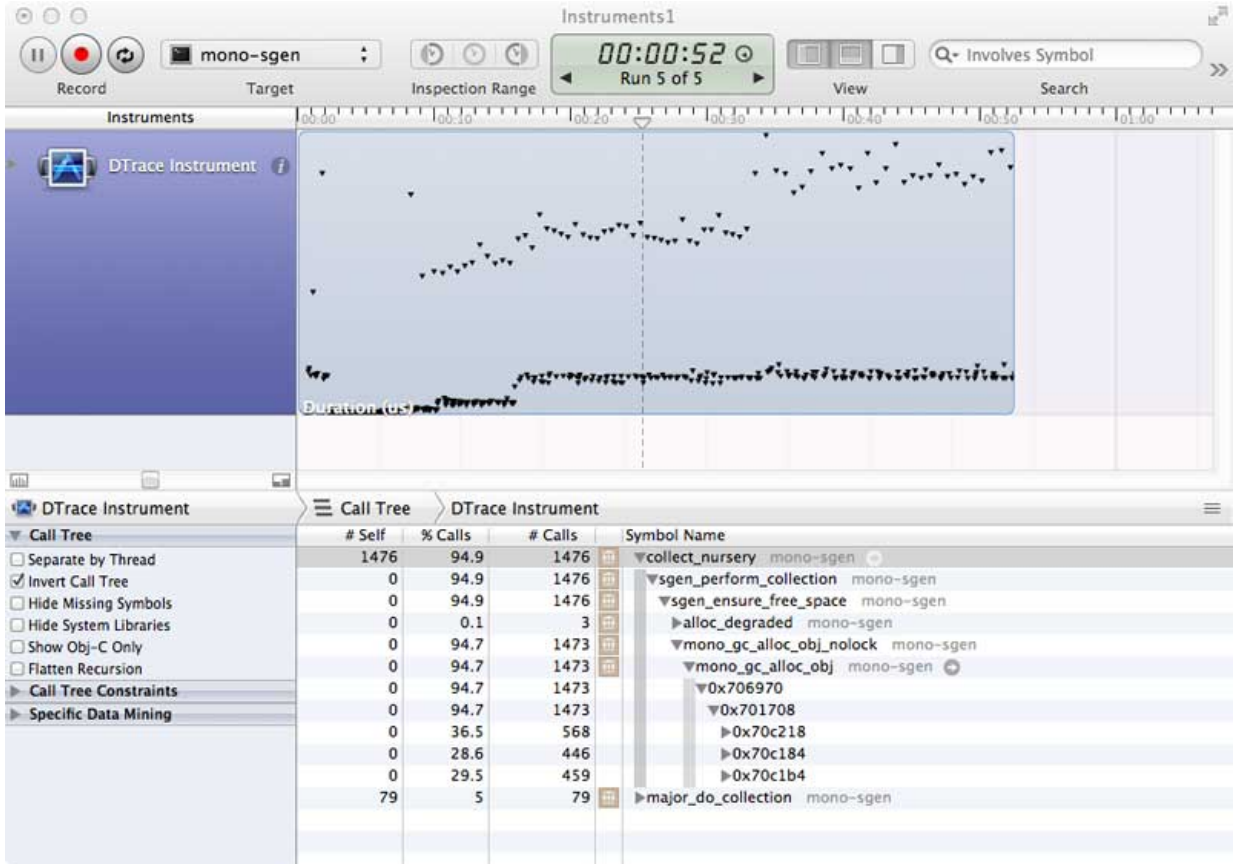
```
if (!Mono.Runtime.SetGCAllowSynchronousMajor(false))
    Console.WriteLine("Sorry, the GC won't cooperate.");

// your low-latency code here

Mono.Runtime.SetGCAllowSynchronousMajor(true);
```

- Exposed on Mobile.
- Use System.Reflection to find it on desktop editions.

dtrace probes on MacOS



Major collections and minor collections pause times visualized

http://schani.wordpress.com/2012/11/02/sgen-and-dtrace/

STATIC BUILD IMPROVEMENTS

Static Compilation

- For systems that don’t support JITing
  - Apple’s iOS devices
  - Consoles (PlayStation, Xbox)
  - Security: when not shipping IL

- Limited generics support
  - Static analysis limitations
  - Some dynamisms in .NET idioms
    - LINQ and Value Types

“Attempting to JIT compile method”

```
System.ExecutionEngineException: Attempting to JIT
compile method Foo[]:Bar`1
```

“Attempting to JIT compile method”

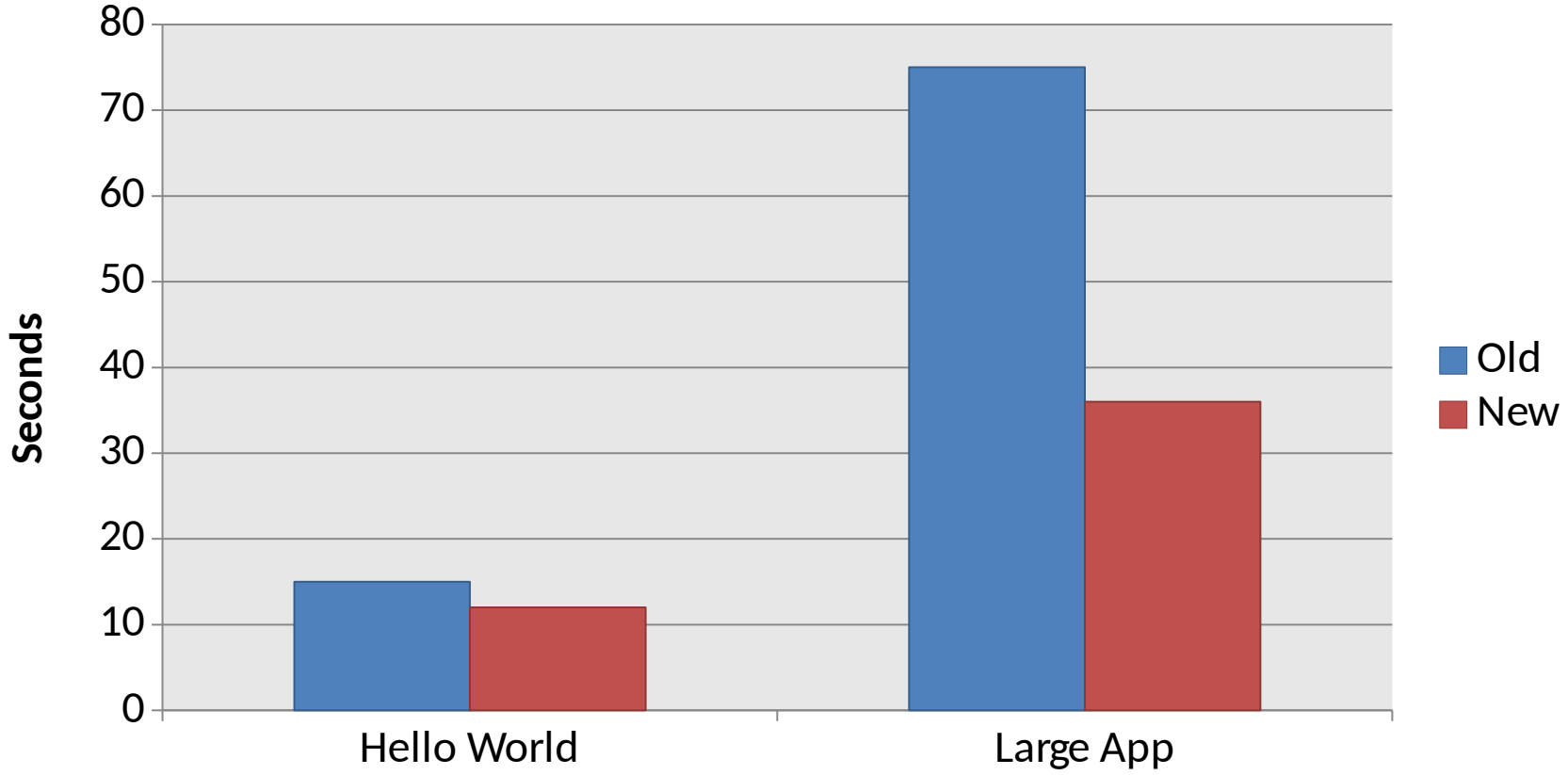
System.ExecutionEngineException: Attempting to JIT compile method Foo[]:Bar`1

FIXED!

iOS Development Improvements

- Improve development cycle
- Incremental Builds
  - Disable linker (compile everything)
  - Cache resulting native code aggressively
- Incremental Upload
  - Only uploads changes
  - Main executable, libraries or resources

Incremental Deployment (With Build Caching)



Deployment times can now be as short as one second.

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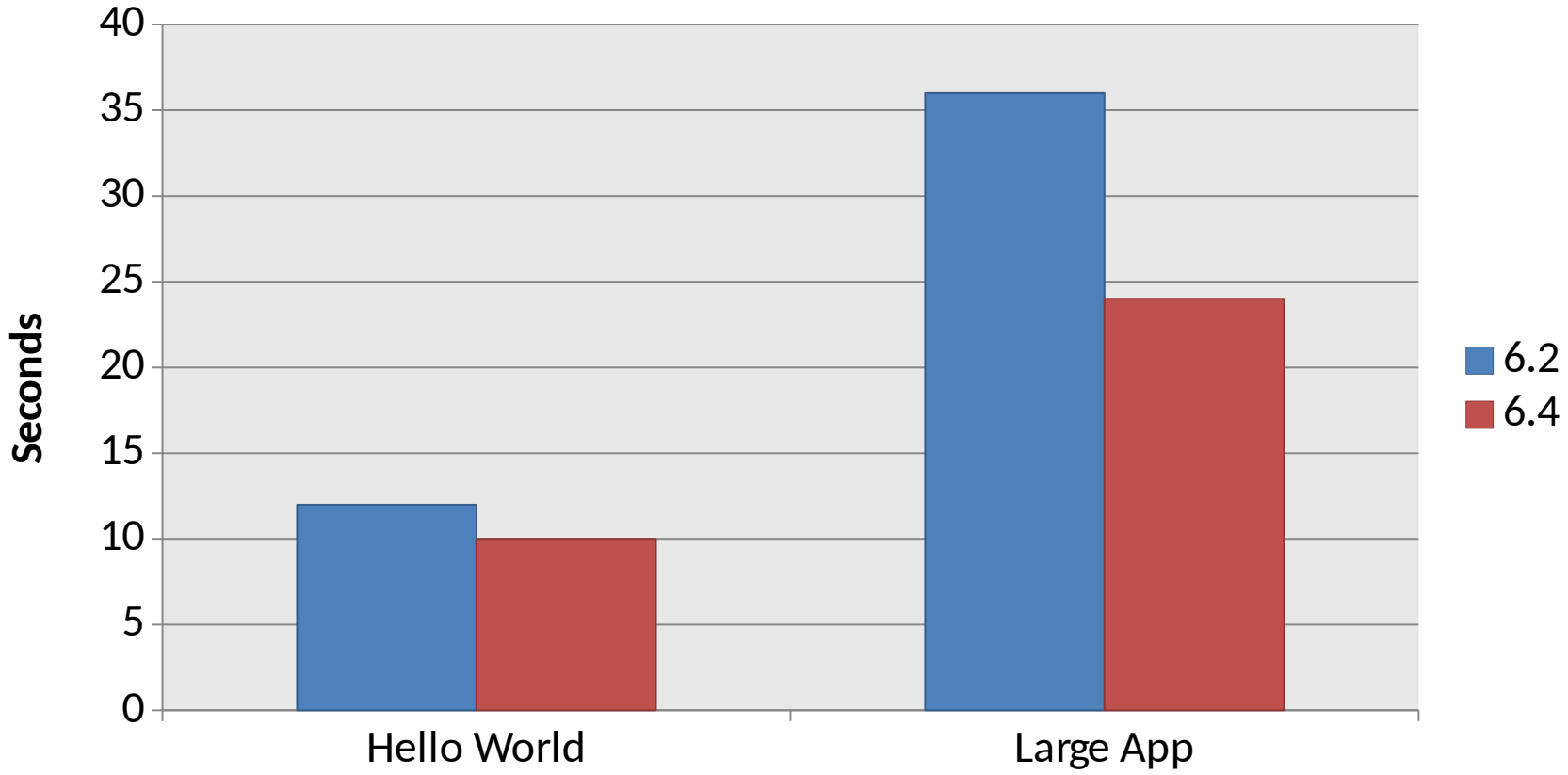

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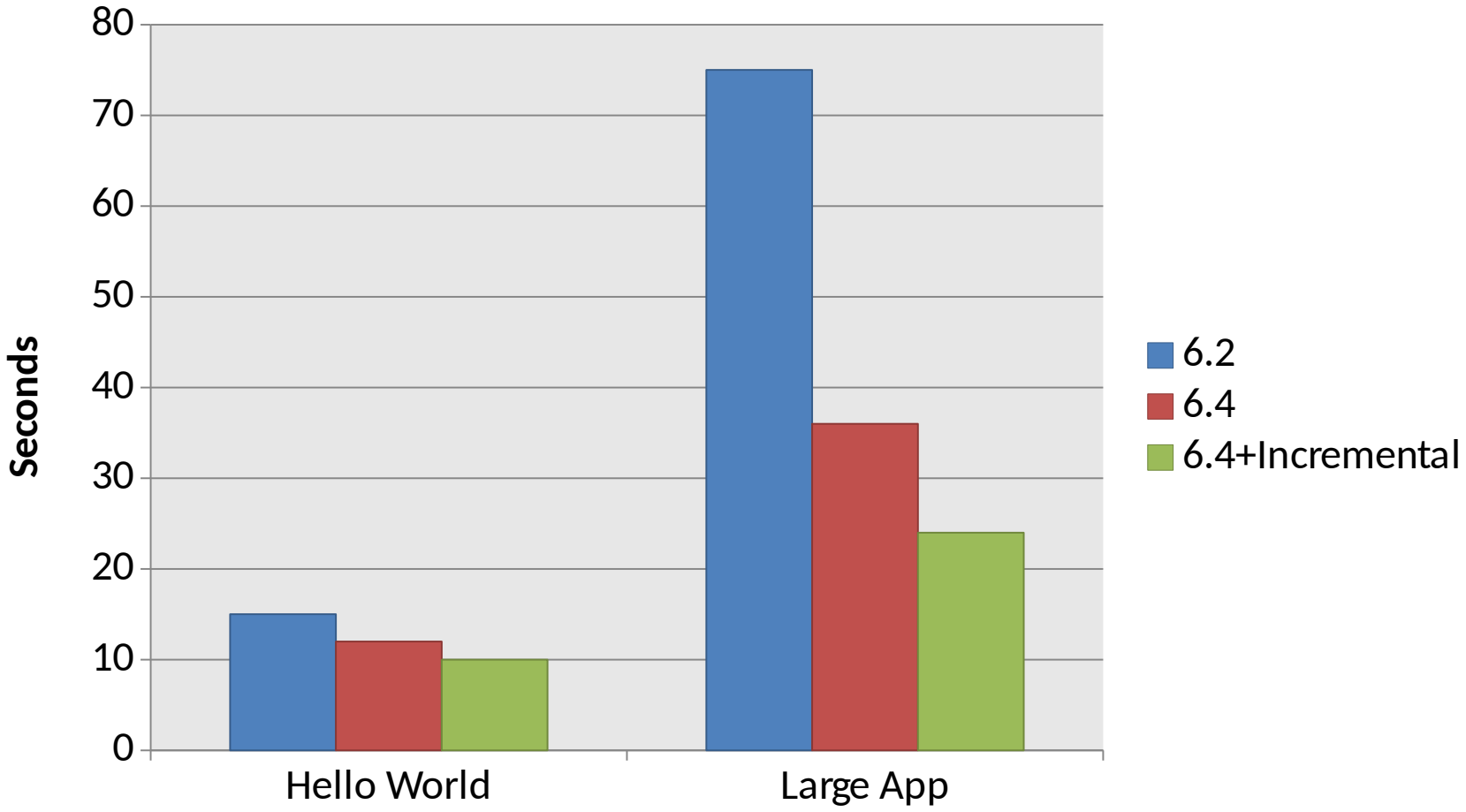
Build Speed Improvements



MICROSOFT OPEN SOURCE CODE

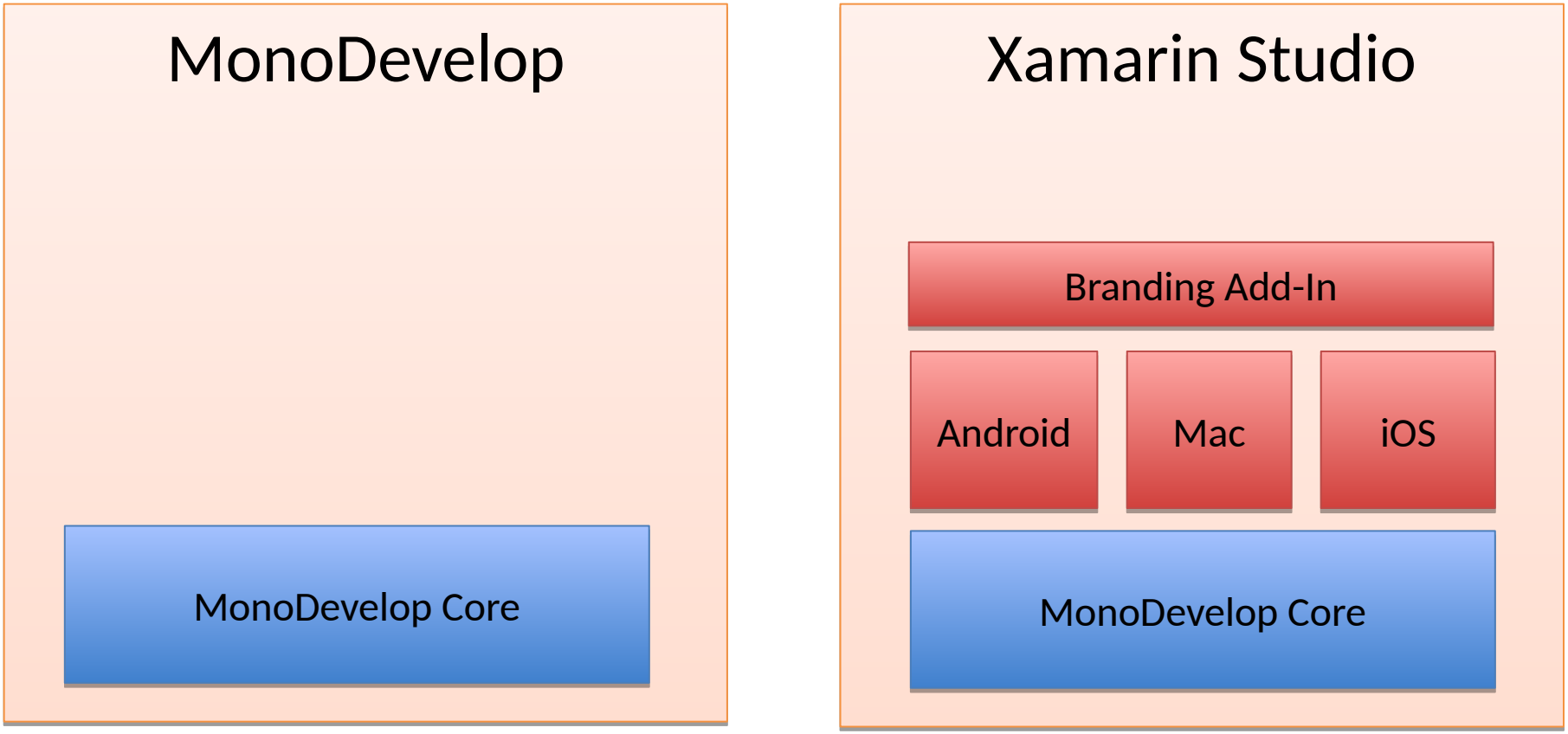
Now Bundled with Mono

- Reactive Extensions
  - Possible on iOS with new code gen changes

- F# everywhere

- Razor
- Entity Framework
- ASP.NET WebStack

MonoDevelop / Xamarin Studio



Open source

Commercial

CROSS PLATFORM FRAMEWORKS

Cocos2D XNA

- XNA port of the popular Cocos2D API
  - Over 4,000 games built with this API
  - Well documented, well known

- MonoGame brings it everywhere
  - iOS, Android, Windows Phone (7 and 8)
  - Mac
  - Windows (GL, DX, , Windows Store)
  - Xbox360, Ouya
  - Play Station Mobile (PS Vita + Sony Androids)

Using Cocos2D XNA Today

- Available as:
  - NuGet Packages
  - Templates for VS and Xamarin Studio

- Source code:
  - http://github.com/mono/cocos2d-xna

- Getting Started:
  - http://docs.xamarin.com/guides/cross-platform/cocos2d_xna

Angry Ninjas - Full Open Source Game

https://github.com/xamarin/AngryNinjas

Cocos2D Crash Course

- Mike Bluestein’s talk tomorrow

Xamarin.Mobile

- Base class library for mobile services
- Mike Bluestein's talk

Xamarin.Auth

- Clients for OAuth 1 and OAuth 2
  - Includes variations
- Stores user credentials
- Support non-standard auth schemes
- Cross Platform

Xamarin.Auth

```
using Xamarin.Auth;

var auth = new OAuth2Authenticator(
  clientId: "App ID from https://developers.facebook.com/apps",
  scope: "",
  authorizeUrl: new Uri("https://m.facebook.com/dialog/oauth/"),
  redirectUrl: new Uri("http://www.facebook.com/connect/login_success.html"));

auth.Completed += (sender, eventArgs) => {
  DismissViewController(true, null);
  if (eventArgs.IsAuthenticated) {
    //Use eventArgs.Account to do wonderful things
  }
}
PresentViewController(auth.GetUI(), true, null);
//1. Create the service
```

Xamarin.Social

- Posts statuses, links, images/media to social networks
  - Access social network APIs using authenticated requests.
  - Automatically and securely store user credentials using Xamarin.Auth.
  - Cross Platform

- Extensible, currently has support for:
  - App.net
  - Facebook
  - Flickr
  - Pinterest
  - Twitter

Using Xamarin.Social

```
var facebook = new FacebookService {
  ClientId = MyFacebook_AppId
  RedirectUrl = new System.Uri(MyRedirectUrl)
};

//2. Create an item to share
var item = new Item { Text = "Xamarin.Social is the bomb" };
item.Links.Add (new Uri("http://github.com/xamarin/xamarin.social"));

//3. Present the UI on iOS
var shareController = facebook.GetShareUI(item, result => {
  //result lets you know if the user shared the item or canceled
  DismissViewController(true, null);
});
PresentViewController(shareController, true, null);
```

Now all Open Source

- All frameworks:
  - Cocos2D XNA
    - http://github.com/mono/cocos2d-xna
  - Xamarin.Auth
    - http://github.com/xamarin/Xamarin.Auth
  - Xamarin.Mobile
    - http://github.com/xamarin/Xamarin.Mobile
  - Xamarin.Social
    - http://github.com/xamarin/Xamarin.Social

- Taking patches!

WORK IN PROGRESS

PLAYSCRIPT

PlayScript

- Started by Zynga
  - Xamarin working to integrate into Mono
  - Rescuing Flash Developers!

- ActionScript look-alike language
  - Superset of ActionScript
  - With C# 5 features
  - Optional strongly-typed
    - Encouraged for performance

PlayScript Compiler

- Dual Compiler
  - playsc foo.play
    - Compiles PlayScript to foo.exe
  - playsc bar.cs
    - Compiles C# to bar.exe
  - playsc foo.play bar.cs
    - Compiles PlayScript foo.play and C# bar.cs
    - Into foo.exe

- Allows blending C# and PlayScript code in one assembly

PlayScript Compiler

- Based on Mono's C# compiler
  - Altered to accept PlayScript language

- Side effects:
  - Compiler as a service support for PlayScript
  - Full Xamarin Studio integration
    - code completion
    - Docs
    - Project support

PlayScript Libraries

- pscorlib
  - Provides core library for PlayScript/ActionScript
- Flash Stage3D
  - GPU accelerated framework
  - Used by gaming frameworks

Ported Frameworks

- Starling Framework
- 2D Game Engine
- Powers Angry Birds

- Away3D
- 3D Game Engine
- Physics

PlayScript today

- Compiles existing large ActionScript projects
  - Some missing language features
  - Actively working to improve language
  - Merging into Mono (playscript branch)
  - Everywhere Mono runs

- On GitHub:
  - Project: http://github.com/playscript

C++ INTEROP

Evolving Cxxi

- Couple of years ago Cxxi project was launched
- Used GCC-XML to parse C++ definitions
- Runtime creation of C# to C++ bridges
  - Reflection.Emit
  - Pluggable VTable ABIs

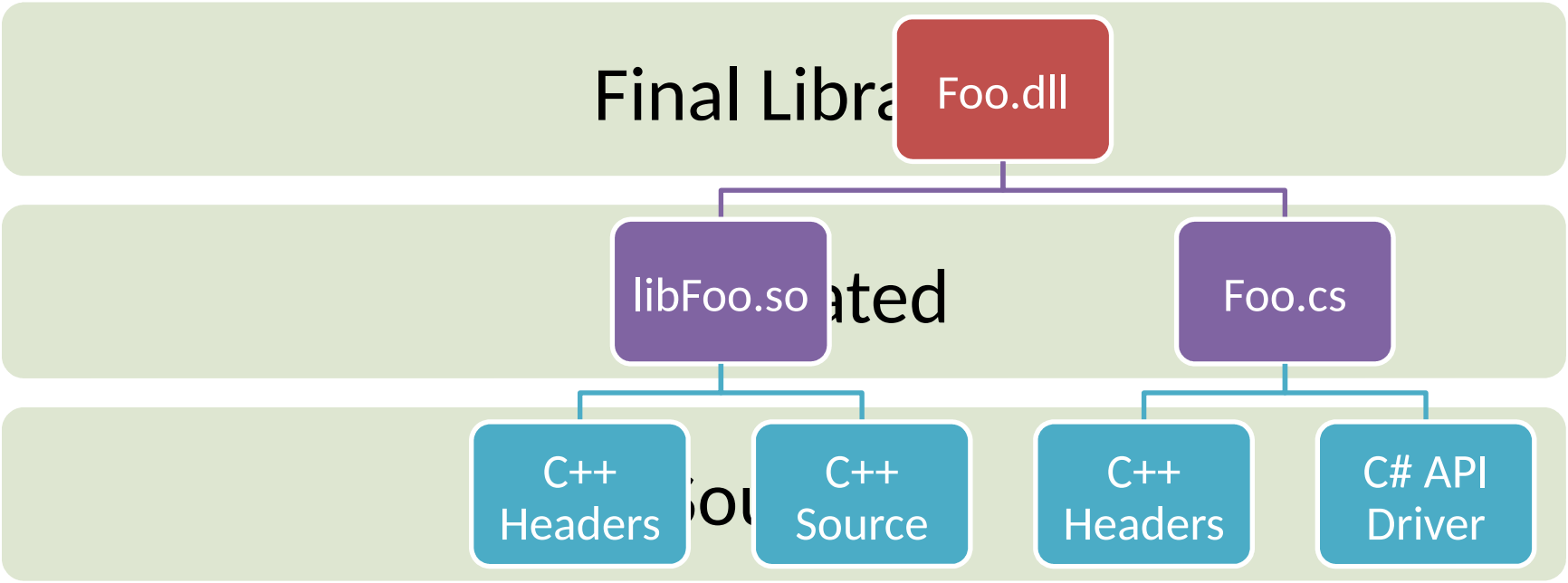
CppSharp

- New C++ binding technology from Mono

- Produces C# libraries to consume C++ code
  - Use Clang for higher fidelity
  - Static compilation (to support iOS, Consoles)
  - Customize binding for .NET consistency
  - Direct calls to C++ (no intermediate glue)
  - Imports C++ Doxygen docs into C# docs

http://github.com/mono/CppSharp

Generating a binding



```
public class Sample : ILibrary
{
  public Sample(LanguageGeneratorKind kind) : base("Sample", kind) {}

      public override void SetupPasses(Driver driver, PassBuilder passes)
  {
    passes.RenameDeclsUpperCase(RenameTargets.Any);
    passes.FunctionToInstanceMethod();
  }

  public override void Preprocess(Driver driver, Library lib)
  {
    lib.SetClassAsValueType("Foo");
    lib.SetNameOfFunction("FooAdd", "FooCalc");
    lib.IgnoreClassField("Foo", "b");
  }

  static class Program
  {
    public static void Main(string[] args)
    {
      ConsoleDriver.Run(new Sample(LanguageGeneratorKind.CPlusPlusCLI));
      ConsoleDriver.Run(new Sample(LanguageGeneratorKind.CSharp));
    }
  }
```

NATIVE INTEROP

Assembly in C#

- Allow developers to inline assembly code
  - Micro-optimizations
  - Optimize a code path
  - Use arch-specific features

- You can not get more native than that.

Assembly in C#

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Example

```
unsafe intClear(IntPtr buffer, int count)
{
    asm.BindIntPtr(0, buffer);
    asm.BindInt(1, count);
    asm.Emitx86(@"
      push %ecx
     push %edi
     mov %eax,%edi
     mov %ebx,%ecx
     xor %eax,%eax
       rep stosb
       mov $1,%eax
     pop %edi
     pop %ecx
   ");
    return asm.FetchInt(0);
}
```

In case there are any doubts

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- Let Mono know which parameters you will pass

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- Assembly code as a string
- Assembled by LLVM
- Mono JIT Calling conventions

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Passing parameters, extracting

- Input parameters:
  - asm.BindXXX (int incomingParameter, XXX value);
- Emit assembly code:
  - asm.Emit (string code)
  - Assembled with LLVM assembler
  - Injected into resulting assembly
  - Follow Mono native rules for preserving register usage
- Output parameters:
  - asm.FetchXXX (int resultParamter)

How it works

- Platform.Native.dll
  - Contains stub methods
  - Allows same source to build on .NET and Mono

- Follow our previous efforts:
  - Like SIMD
  - On Mono, the runtime recognizes some calls

EmitXxx ignored for other platforms

```
//Highly optimized native way of getting a native one!
unsafe int GetOneConstant()
{
    asm.EmitX86("mov $1,%eax");
    asm.EmitArm("mov r0,#1");
    asm.EmitX64("mov $1,%rax");
    return asm.FetchInt(0);
}
```

For more complex code, use asm.Arch:

```
unsafe int GetOneConstant()
{
    if (asm.Arch == Arch.x86) {
            asm.EmitX86("mov $1,%eax");
     return asm.FetchInt(0);
   } else
     return 1;
}
```

WHAT IS NEXT?

Future for Mono

- Community feedback on features needed
- Brainstorming session tomorrow!
  - Where should Mono and .NET go?
  - Bring your favorite feature request