

# Profiling and Debugging Tools for High-performance Android Applications

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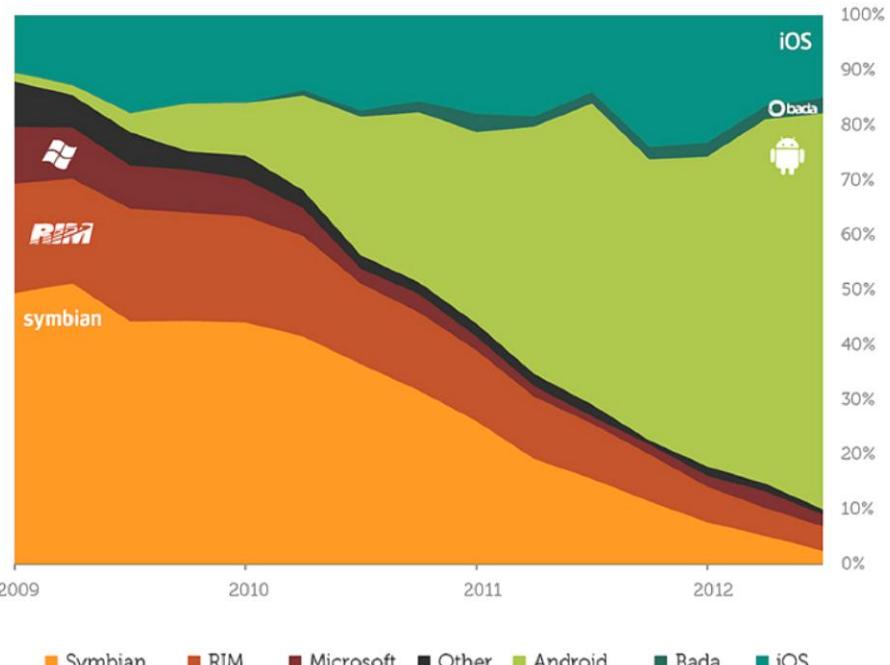
# Android By The Numbers

1.3M Android activations per day

750M Android devices worldwide

1.68B in Google Play Revenue (2012)

Android activations predicted to double in 2013



Source: VisionMobile estimates, IDC, Canalys, Gartner, OS vendors

Source: Developer Economics 2013 | [www.DeveloperEconomics.com](http://www.DeveloperEconomics.com) | January 2013  
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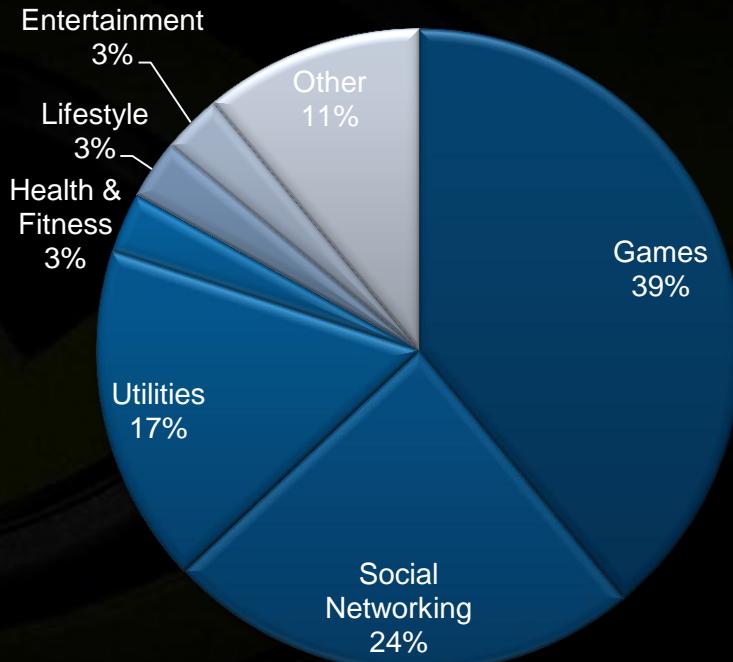


Sources: Eric Schmidt, Andy Rubin, IHS iSuppli forecast

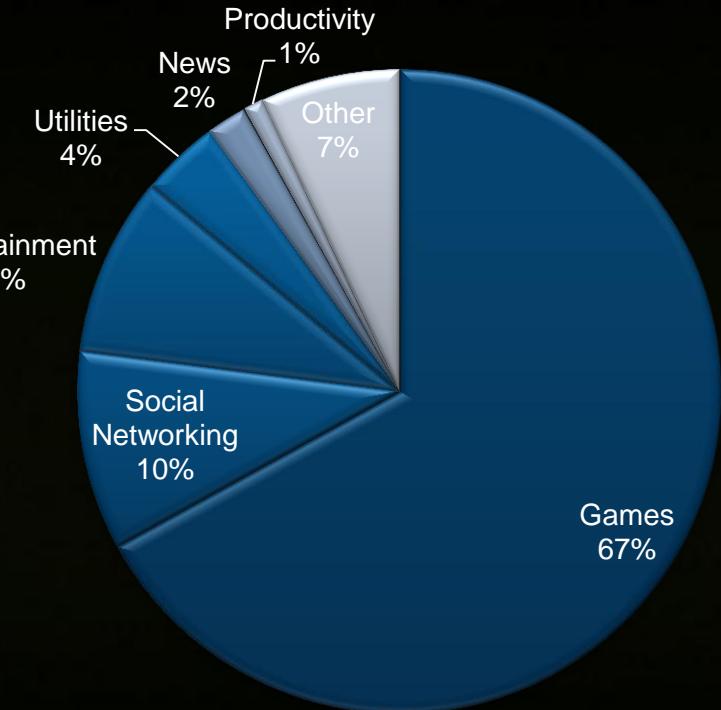
# Android

# App Categories

## Smartphones



## Tablets



# Android



# Native Development Kit (NDK)

Native	Code languages, such as C / C++
Java	Not required — <i>Implement your application using NativeActivity</i>
Tools	To generate and embed native code libraries
System	Headers and libraries for managed resources
<b>No Silver Bullet</b>	It is <b>NOT</b> a silver-bullet for performance issues — <i>you can still shoot yourself in the foot</i>
<b>Not Standalone</b>	It does <b>NOT</b> replace the Android SDK
<b>Not 4 Standard</b>	It is <b>NOT</b> meant for standard Android applications — <i>image processing, physics, AR, facial recognition</i>
<b>No Alternative</b>	It is <b>NOT</b> for alternative programming languages — <i>chicken, etc</i>

# Android

# Why use the Android NDK?



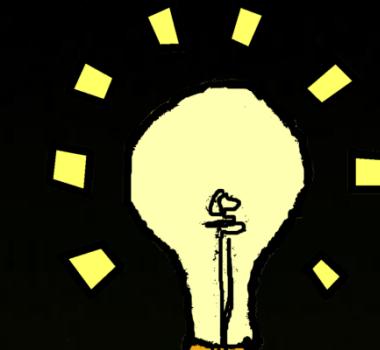
Cross-Platform



Code Reuse



NEON / Vector (vfp)



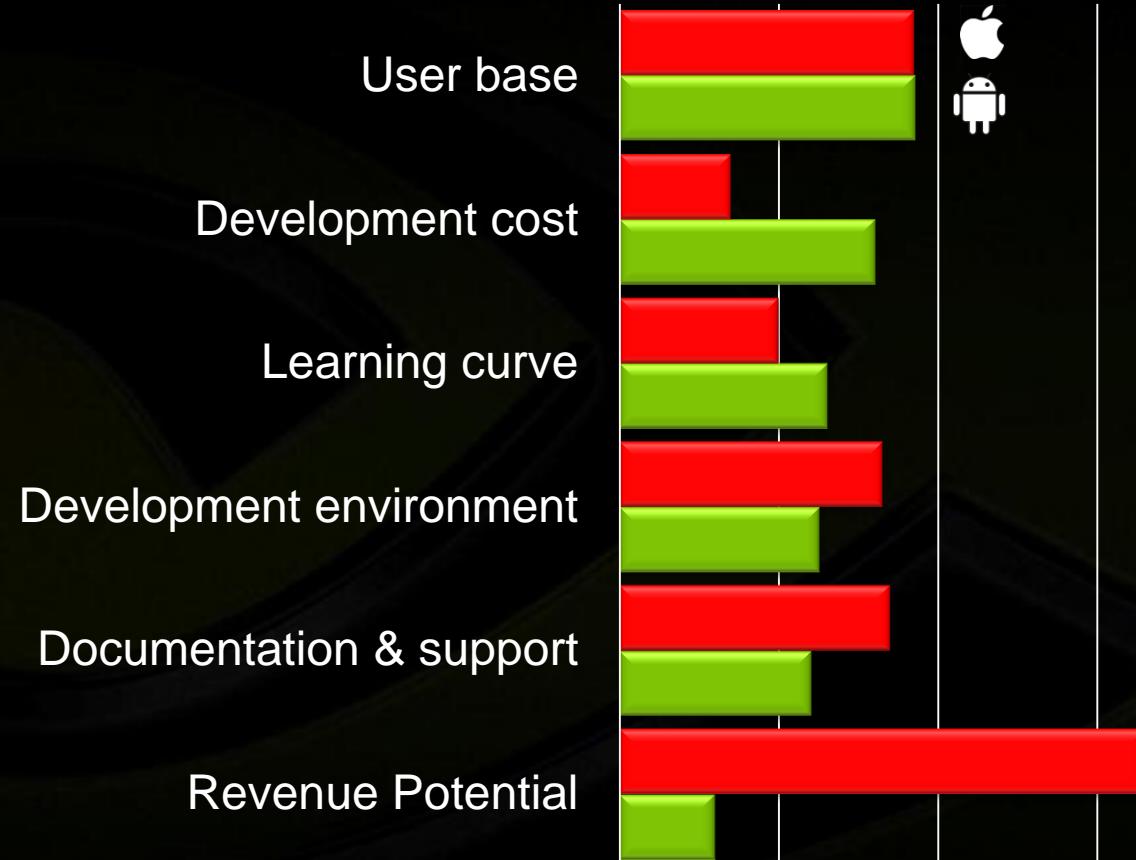
Perf / Watt



High-performance  
CPU-intensive

# Android

# Developer Perceptions ~~Misconceptions~~



## Setup and Configuration



## Native Debugging



## Eclipse

# Tegra Android Development Pack



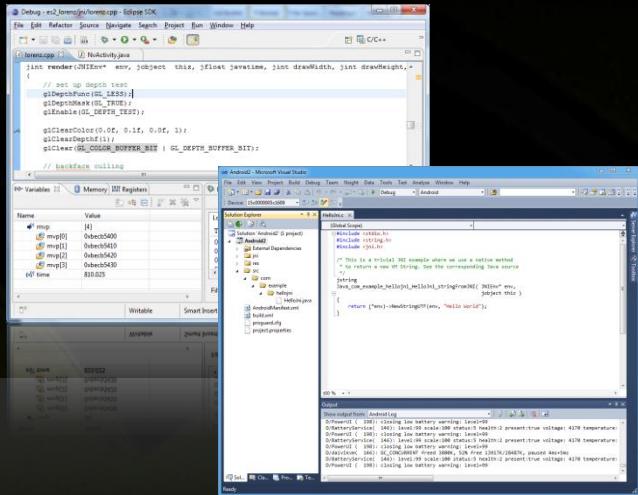
- **GET STARTED** in minutes NOT hours
- **INSTALS** all tools required for Tegra Android
- **CPU DEBUGGING** with Nsight Tegra
- **GPU DEBUGGING** with PerfHUD ES
- **OPTIMIZE** applications with Tegra Profiler
- **REFERENCE** docs, samples & tutorials
- **OPTIMIZED** for Tegra Android development
- **FLASHES** Tegra DevKit with OS Image
- **CONFIGURED** for debugging and profiling
- **INCLUDES** Kernel symbols and DS-5 support

<http://developer.nvidia.com/develop4tegra>



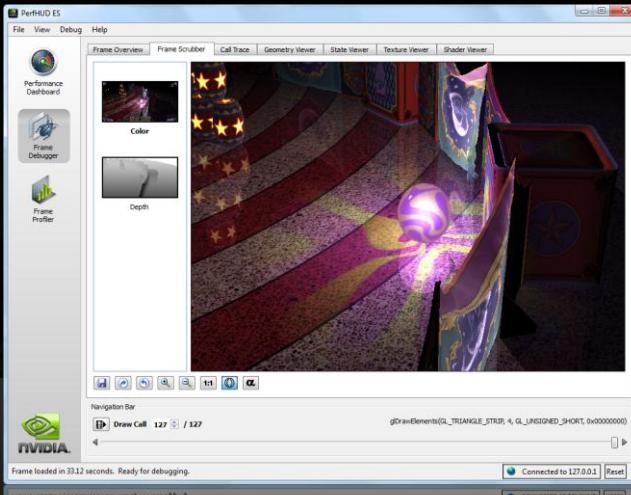
# Tegra Developer Tools

## Native Android Development Tools



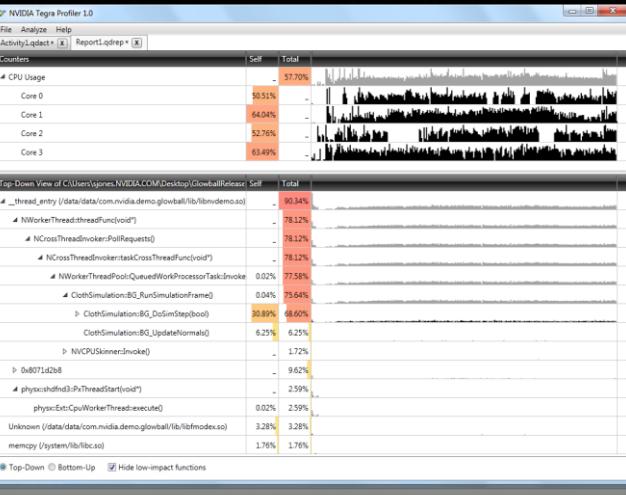
### Nsight Tegra

Visual Studio and Eclipse integrations  
Full Android build management  
Native Android CPU debugging  
Breakpoints in both Java and Native



### PerfHUD ES

Examine and debug OpenGL ES frames  
Automated bottleneck analysis  
Edit shaders at runtime



### Tegra Profiler

Maximize multi-core CPU utilization  
Quickly identify CPU “hot spots”  
Identify thread contention issues

<http://developer.nvidia.com/develop4tegra>



# “The most powerful solution for Android game development”

“... as much time as it took to get a console game engine to honour the Android lifecycle, it would have taken twice that without NVIDIA’s developer tools for Android.” -- *TickTock Games*

“PerfHUD ES is by far my favourite thing about Android development. It’s helped us make substantial improvements to the rendering performance of our game.” -- *Fireproof Studios*

“...I expect in some parallel universe there’s another version of me building Android games without NVIDIA’s Nsight Tegra debugger, and he sure looks pissed off! ” -- *Strawdog Studios*



A Goatee  
In old Science Fiction series that's the whole difference between good and evil.



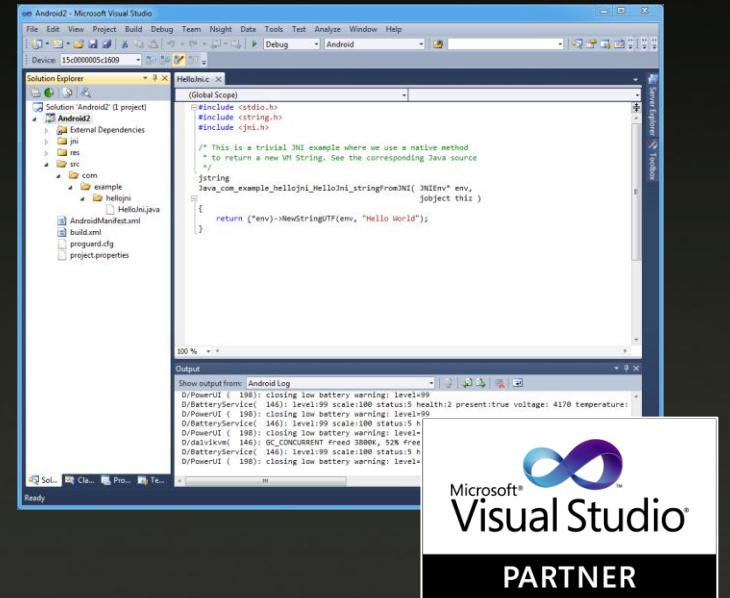
# Tegra Developer Tools

## Nsight Tegra, Visual Studio Edition



### Key Benefits

- Visual Studio integrated Android development
- INCREASED build and runtime performance
- Multi-core native Tegra Android GDB DEBUGGING
- Seamlessly debug Java and native C/C++ code
- Manage and build Tegra Android applications
- Familiar environment for Tegra Android development
- Android specific features integrated into Visual Studio (like LOGCAT)



<http://developer.nvidia.com/develop4tegra>

# Nsight Tegra, Visual Studio Edition



Build native Android projects in Visual Studio using vs-android, ndk-build or makefiles.

Android GDB debugging in Visual Studio

Set breakpoints in both Java and Native (C/C++)

Use the familiar Visual Studio Locals, Watches, Memory and Breakpoints windows.

<http://developer.nvidia.com/NsightTegra>



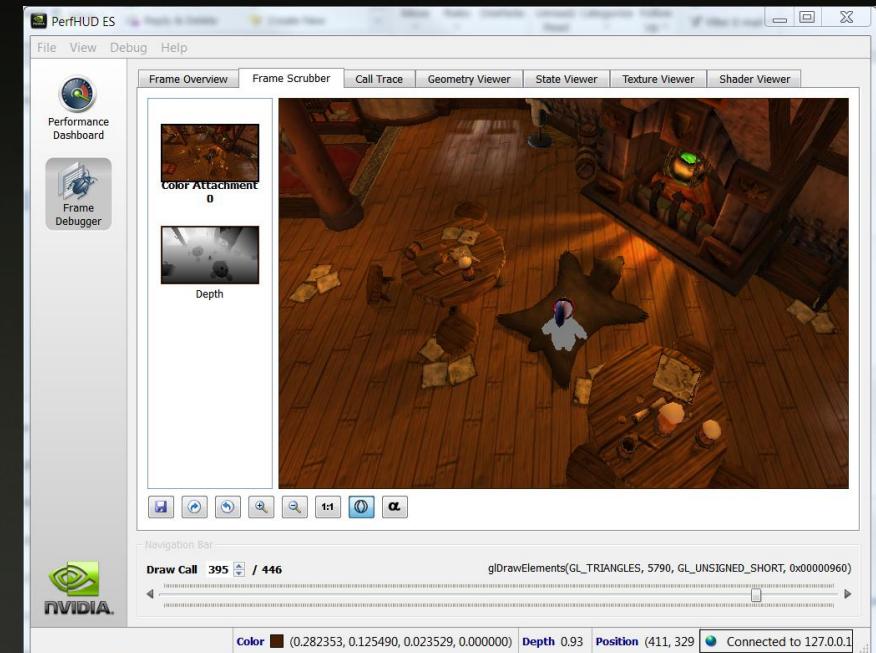
# Tegra Developer Tools

## PerfHUD ES



### Key Benefits

- Examine OpenGL ES frames to reveal rendering problems
- Debug OpenGL ES API calls, parameters, return values and errors
- Execute directed tests to identify rendering bottlenecks
- Edit and apply shaders dynamically at runtime
- Monitor CPU and GPU utilization



<http://developer.nvidia.com/phes>



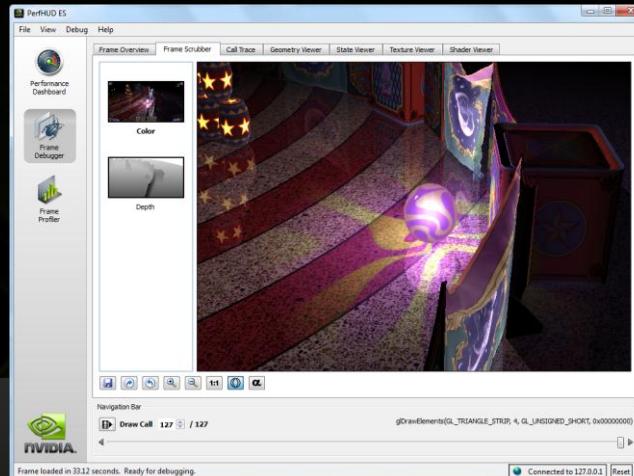
# PerfHUD ES for Android

## OpenGL ES Graphics Debugging and Profiling



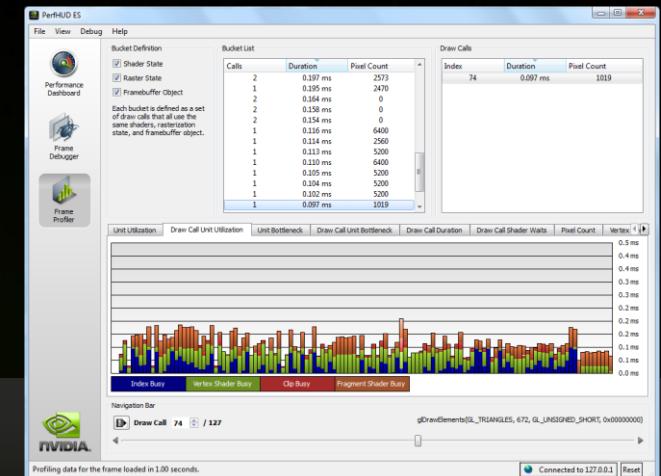
### Performance Dashboard

Graph pertinent frame statistics in real-time  
Directed tests help identify performance issues  
Monitor memory usage and draw call efficiency



### Frame Debugger

See the current frame draw call by draw call  
Scrub through all of the draw calls in a frame  
Examine all aspects of the rendered frame, including API calls, errors, geometry, textures, shaders and pipeline state



### Frame Profiler

“Bucket” draw calls that share common render state  
Examine in-depth profiling data for each draw call in the frame  
Examine “buckets” and draw calls by cost

<http://developer.nvidia.com/phes>



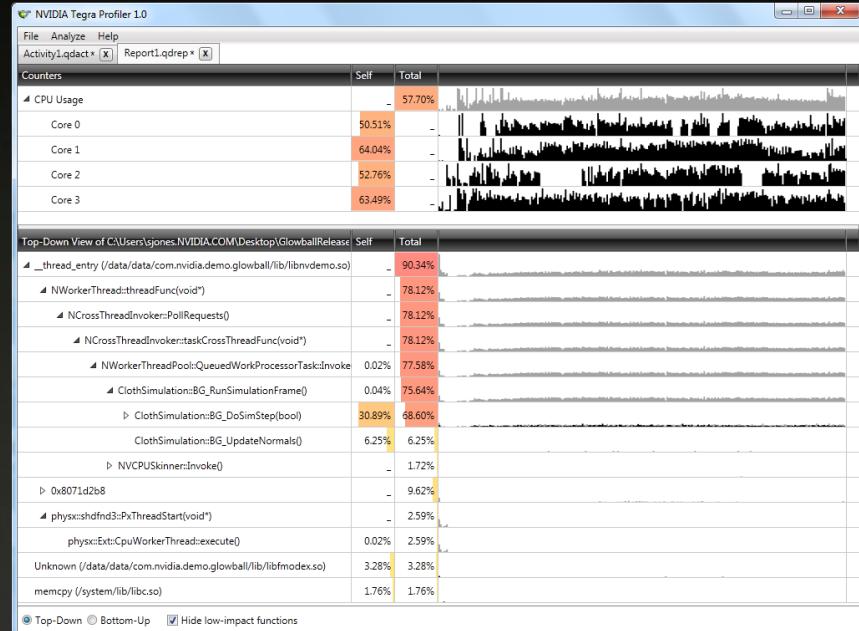
# Tegra Developer Tools

## Tegra Profiler (Windows only)



### Key Benefits:

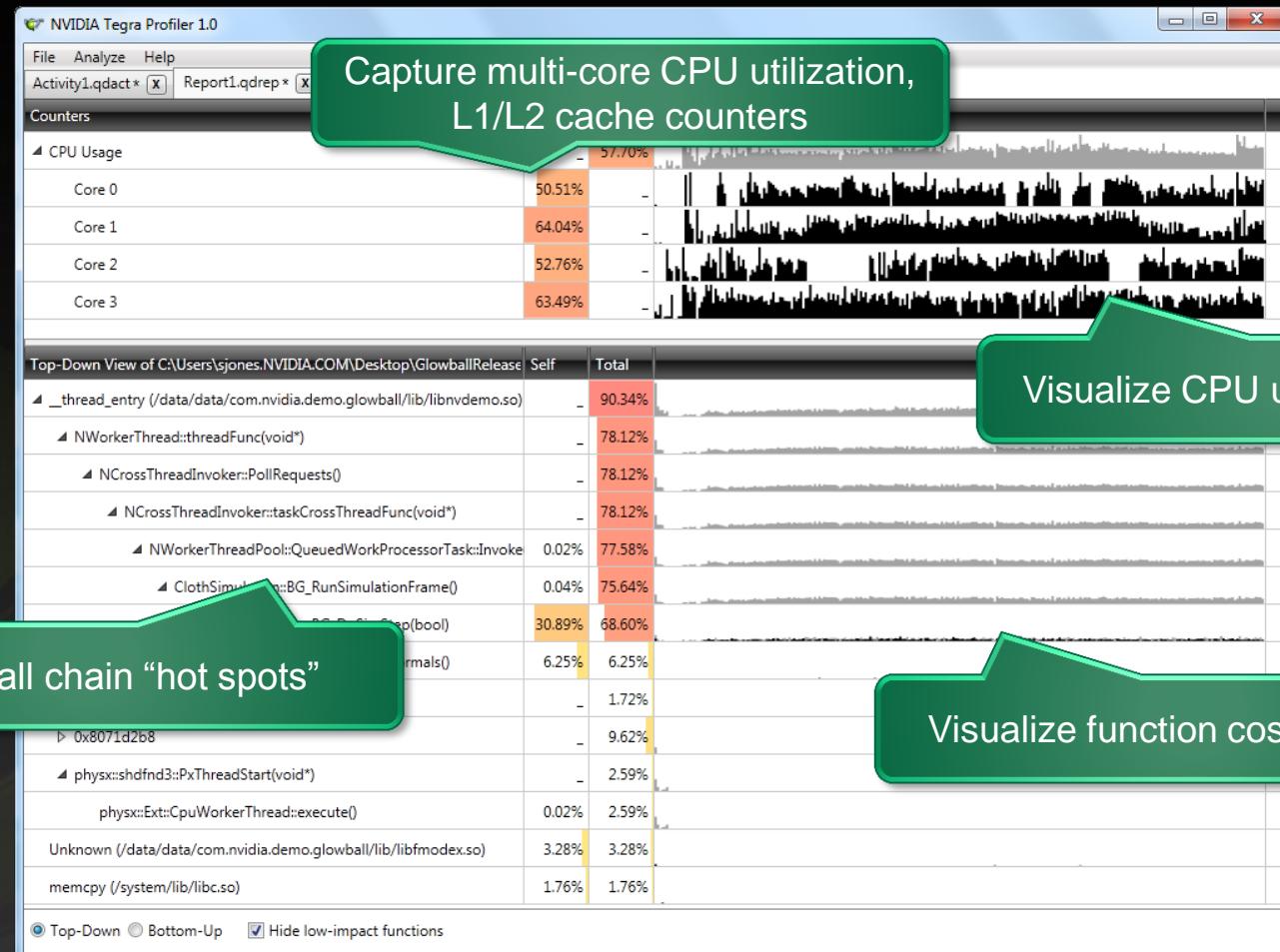
- Maximize multi-core CPU utilization
- Quickly find CPU hot spots and cache issues
- Easily deploy applications for profiling
- Visualize CPU thread state
- Display OpenGL ES frame boundaries
- Instrument source with custom annotations



<http://developer.nvidia.com/develop4tegra>



# Tegra Profiler for Android



<http://developer.nvidia.com/tegra-profiler>

# Tegra Developer Tools Supported Devices



	Nsight Tegra, Visual Studio Edition	PerfHUD ES	Tegra Profiler
<b>ASUS Transformer (TF201 / TF300T / TF700T)</b>	✓	✓	✗
<b>HTC One X / One X+</b>	✓	✓	✗
<b>ASUS Nexus 7</b>	✓	✓	✓
<b>NVIDIA SHIELD</b>	✓	✓	✓
<b>Ouya</b>	✓	✓	✓
<b>NVIDIA Cardhu (DevKit)</b>	✓	✓	✓
<b>NVIDIA Dalmore (DevKit)</b>	✓	✓	✓
<b>NVIDIA Pluto (DevKit)</b>	✓	✓	✓

# Tegra Developer Tools System Requirements



	Host Platform	Device	Device OS	Requires	Cost (\$)
<b>Nsight Tegra, Visual Studio Edition</b>	Win7	Tegra only <i>(non-Tegra devices supported on a limited basis)</i>	Android 4.0+ (ICS)	Visual Studio 2010 <i>(Visual Studio Express not supported)</i>	\$0*
<b>PerfHUD ES</b>	Win7, OSX, Ubuntu Linux	Tegra only	Android 4.0+ (ICS)	---	\$0*
<b>Tegra Profiler</b>	Win7	Tegra DevKits <i>(Cardhu, Dalmore, Pluto, Shield)</i>	Android 4.0+ (ICS)	---	\$0*
<b>NVIDIA Debug Manager (NVDM)</b>	Win7, OSX, Ubuntu Linux	All Android Devices <i>(QA limited on non-Tegra devices)</i>	Android 4.0+ (ICS)	Eclipse	\$0*
<b>Tegra Android Development Pack (TADP)</b>	Win7, OSX, Ubuntu Linux	Tegra only	N/A	---	\$0*

\*Requires Tegra Registered Developer Program Membership



# Tegra Developer Tools

## What's coming?



### Nsight Tegra, Visual Studio Edition

- Super-fast apk/file deployment and sync
- Logcat filtering (ala Eclipse)
- Visual Studio 2012
- Windows 8 support

### Tegra Profiler

- Host support for OSX and Ubuntu Linux

# Need Help?

The Tegra Registered Developer Program:

<http://developer.nvidia.com/develop4tegra>

Support Forums: <http://devtalk.nvidia.com>

Support Email: [devtools-support@nvidia.com](mailto:devtools-support@nvidia.com)

