TEGRA X1 DEVELOPER TOOLS

SEBASTIEN DOMINE, SR. DIRECTOR SW ENGINEERING
PICK A PLATFORM/API
DEVELOPMENT FLOW

PC

- SW IP Development
- TADP
- JetPack
- Nsight EE
- Nsight Tegra VSE
- Tegra System Profiler
- CUDA Visual Profiler
- Toolchain Setup
- Cross-compilation
- Porting

Remote Device

- Executing
- Debugging CPU/GPU
- Profiling System/CPU/GPU/IO/...
- Prosper
- Cuda-gdb
- Cuda-memcheck
- PerfKit
- CUPTI
- nvprof
JETSON DEVELOPMENT PACK

JetPack
For Linux Ubuntu 14.04

JUMP STARTS developing for Jetson platform
INSTALLS Linux ARM cross-compilation tool chain
INSTALLS Developer tools, CUDA, OpenCV, Libraries
FLASHES Jetson OS Image
REFERENCE documentation and samples
COMPILES code samples, pushes them to devkit
And RUNS one sample...
Tegra Android Development Pack

For Windows, OSX, Linux

JUMP STARTS developing for Tegra on Android
INSTALLS all tools, SDKs, NDKs, Java,...
REFERENCE docs, samples & tutorials
FLASHES Tegra DevKit with OS Image
COMPILES code samples, pushes them to devkit
And RUNS one sample...
### TAP Component Manager

<table>
<thead>
<tr>
<th>Component</th>
<th>Status</th>
<th>Version</th>
<th>Action</th>
<th>Progress</th>
<th>Description</th>
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- **Coordinated updates**
- **Per-component action selection**
- **Concurrent uploads**
- **Multi-component dependency management**
- **Pause/uploads**
- **System tray notification**

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These components can be updated now: Gradle 2.2.1, Nsight Tegra, Visual Studio Edition 2.1.0.15043, PerfKit 4.3.0

More...
NVIDIA® NSIGHT™ ECLIPSE EDITION

Homogeneous application development for CPU+GPU compute platforms

CUDA-Aware Editor

CUDA Debugger

CUDA Profiler

CPU+GPU
NVIDIA® NSIGHT™ TEGRA

Android NDK/JDK application development

Project Management  Android Debugging  Logcat Filtering

GDB+JDB
NSIGHT Tegra

Android Application Development in Visual Studio

- NDK r10d / Android SDK 24.0.2
- Support for external build systems (makefile)
- **IncrediBuild 5.5** support to allow for distributed builds
- **CMAKE 3.1** support
- Multi-architecture APK support
- Faster wireless debugging support
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.

Build Native Android projects in Visual Studio using vs-android, ndk-build or makefiles.
TEGRA GRAPHICS DEBUGGER

Next-gen graphics development tools for TEGRA K1 and beyond...

Supports OpenGL 4.x, OpenGL ES 2.0/3.0/3.1 + numerous extensions
NEW WITH TEGRA GRAPHICS DEBUGGER 2.0

Tegra X1 support

- OpenGL 4.5
- Shader Performance Analysis for Tegra X1
- Capture with source code and Nsight Tegra project generation
Dynamic shader editing

Frame scrubber

API inspector

Current target view

Resource revisions
DEMO LINUX EMBEDDED DEVELOPMENT

PC

eclipse

INTERNAL DEVKIT w/ Tegra X1

Eth0/SSH

HDMI

USB HUB

KBD

MOUSE
DEMO TIME

- Drive CX / T210 / L4T
  - Run the Driver CX app
  - Attach Debugger - scrub with it...
DEMO SHIELD DEVELOPMENT

PC

USB/ADB

SHIELD w/ Tegra X1

HDMI
DEMO TIME

- SHIELD Console / Tegra X1 / Android
  - Sun Temple Demo
  - Load the captured frame in Nsight Tegra, run and have TGD attach to it
TEGRA SYSTEM PROFILER

Multi-core CPU profiler for all Tegra platforms

- Windows, Linux and OSX host application
- Easily prepare a device and deploy application for profiling
- Maximize multi-core A15/A9/Denver CPU utilization
- Quickly identify CPU “hot spots”, “hot paths” and L1/L2 cache issues
- Visualize multi-core CPU activities with a new timeline view
- Time range filtering
DEMO TIME

- Show Profile of the Sun Temple Demo
- Show some reports of findings from other apps
NEW \ WITH Tegra System Profiler 2.3

Tegra X1 support and Expanded system trace

- Tegra X1 A57/A53 support
- NVIDIA Tools Extension Support (NVTX)
- Visualize CPU, GPU and EMC frequencies
- Visualize thread state: running/ready/blocked
- Backtrace Quality Improvements
Identify call chain “hot spots”

Show module ownership

Multi-core utilization

CPU & Memory Controller frequency

Thread core migration

Thread state

NVTX annotation
CUDA VISUAL PROFILER

The Complete CUDA Application Performance Analysis

Trace Activities  Kernel Profiler  Guided Analysis
CUDA PROFILING

- Before Maxwell

Kernel A

Start
Set HW PM Config
Init count

End
Collect HW PM counter
i.e. Stall reasons

Can be long, coarse resolution
CUDA PROFILING

- With Maxwell and Tegra X1

Stages:
- Set HW PM Config
- Init count
- Collect HW PM counter (i.e., Warp scheduling state)
  High Frequency Sampling, with Program Counter location

Combined with Kernel replay and offset of PC sampling start time
CUDA 7.5

Hardware-based Performance Analysis with Source Code Correlation

CUDA-C code correlation

Statistical performance limiter analysis

SASS microcode correlation
CUDA COMMAND LINE TOOLS

CUDA-GDB
- Debug CUDA kernels with CLI
- Debug CPU and GPU code
- Core dump

CUDA-MEMCHECK
- Detect out-of-bounds memory accesses
- Detect race condition in memory accesses
- Init check
- Sync check

NVPROF
- Collect Performance events and metrics
PERFKIT 4.2.3

Hardware and Software Performance Counters

- GPU and software performance counter API
- Performance monitoring
- Automated bottleneck analysis
- Graphics and Compute

http://www.nvidia.com/object/nvperfkit_home.html
NVIDIA PERFWORKS 1.0

HW and SW performance counters for modern GPUs

- New Performance Counters collection engine
  - New user-friendly API
  - Performance Monitoring
  - GPU workload bottleneck analysis
  - User-definable collection ranges with concurrent execution within the range
  - Improved accuracy
- Support for Kepler, Maxwell and higher
- Support DX11, DX12 and OpenGL, Windows and Linux
DEVELOPER TOOLS @ GTC

- Wed 9:30am - **S5656** - Hands-on Lab: Debugging and Automated Error Checking Tools and Techniques for GPU Programming
- Wed 2pm - **S5657** - Hands-on Lab: Optimizing CUDA Application Performance with NVIDIA's Visual Profiler
- Wed 2pm - **S5173** - CUDA Optimization with NVIDIA Nsight Eclipse Edition: A Case Study
- Wed 3:30pm - **S5174** - CUDA Optimization with NVIDIA Nsight Visual Studio Edition: A Case Study
- Thu 1pm - **S5655** - Hands-on Lab: CUDA Application Development Life Cycle with NVIDIA® Nsight™ Eclipse Edition
- Thu 6pm - **S5451** - The Graphics Debugger for Linux
NVIDIA REGISTERED DEVELOPER PROGRAMS

- Everything you need to develop with NVIDIA products
- Membership is your first step in establishing a working relationship with NVIDIA Engineering
  - Exclusive access to pre-releases
  - Submit bugs and features requests
  - Stay informed about latest releases and training opportunities
  - Access to exclusive downloads
  - Exclusive activities and special offers
  - Interact with other developers in the NVIDIA Developer Forums

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Q&A
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