GPU Computing Master Clss

Development Tools

Generic CUDA debugger goals

- Support all standard debuggers across all OS
  - Linux – GDB, TotalView and DDD
  - Windows – Visual studio
  - Mac - XCode
- Support CUDA runtime APIs
- Support CUDA driver APIs
- Unified debug environment
  - Provide simultaneous access to CUDA and host variables
  - Present CUDA threads same as host threads
  - Present CUDA memory same as host memory
- Support single and multi GPU debugging
- Attach to a running process – local or remote.

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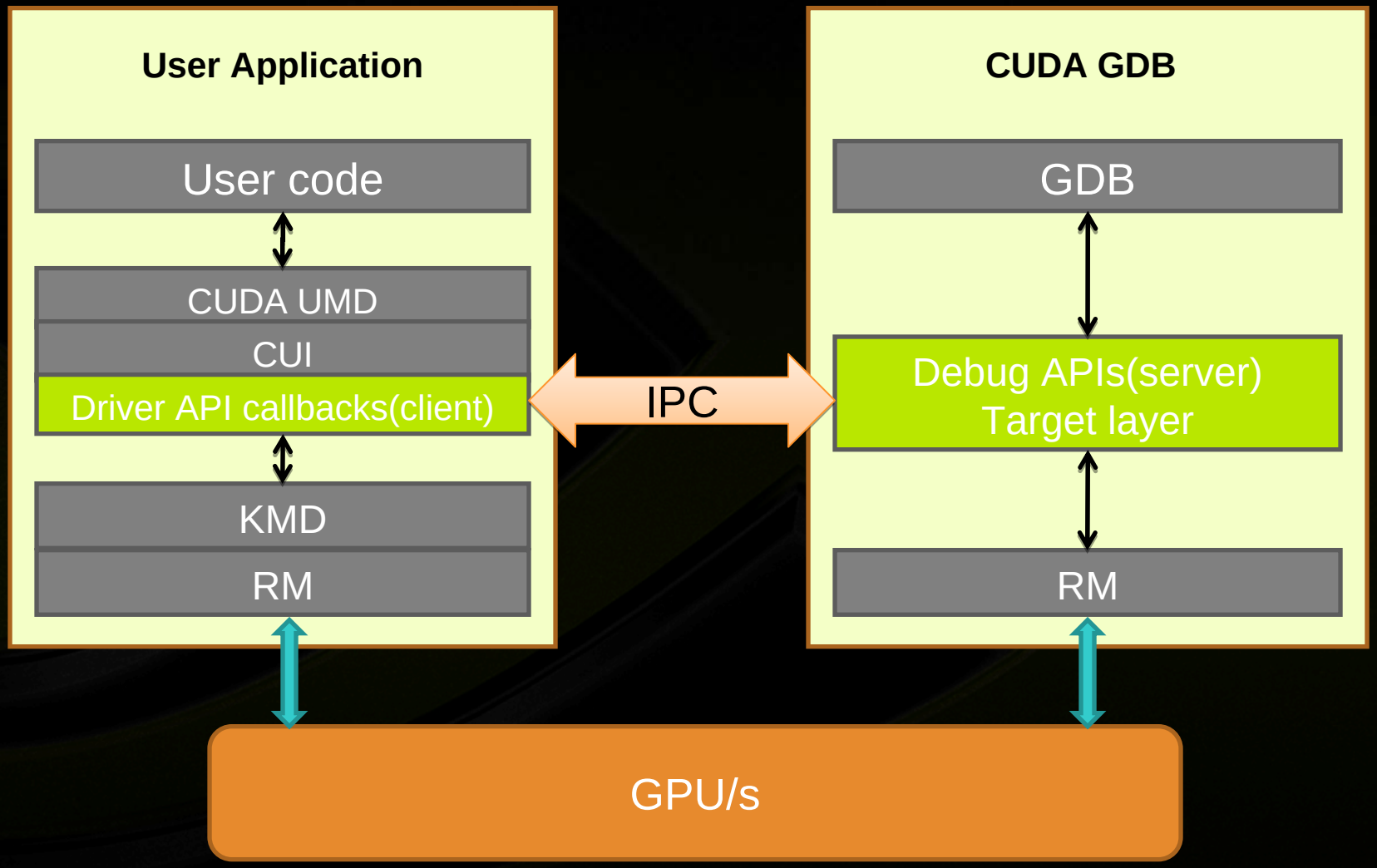
Linux debugger model



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IPC – Driver APIs to Debug APIs

- Driver API callbacks retrieves the fatbin/SASS line information
- Debug APIs translates the SASS information to actual GPU address
- Debug APIs tracks all memory allocations
- Driver and Debug APIs report and manage kernel launch, execution and termination.

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Current Status

- CUDA-GDB 3.0 Beta shipping to customers supporting:
  - New CUDA Memory Checker
  - Support for all the OpenCL features
  - Early support for Fermi Architecture
  - etc…

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Upcoming Roadmap

- Migrate to standard binary formats – DWARF and ELF
- Performance Improvement
- New debug APIs to enable external customers
- Support source and assembly level debugging
- Support for Apps with multiple host threads using CUDA
- Support for Apps using multi-GPUs

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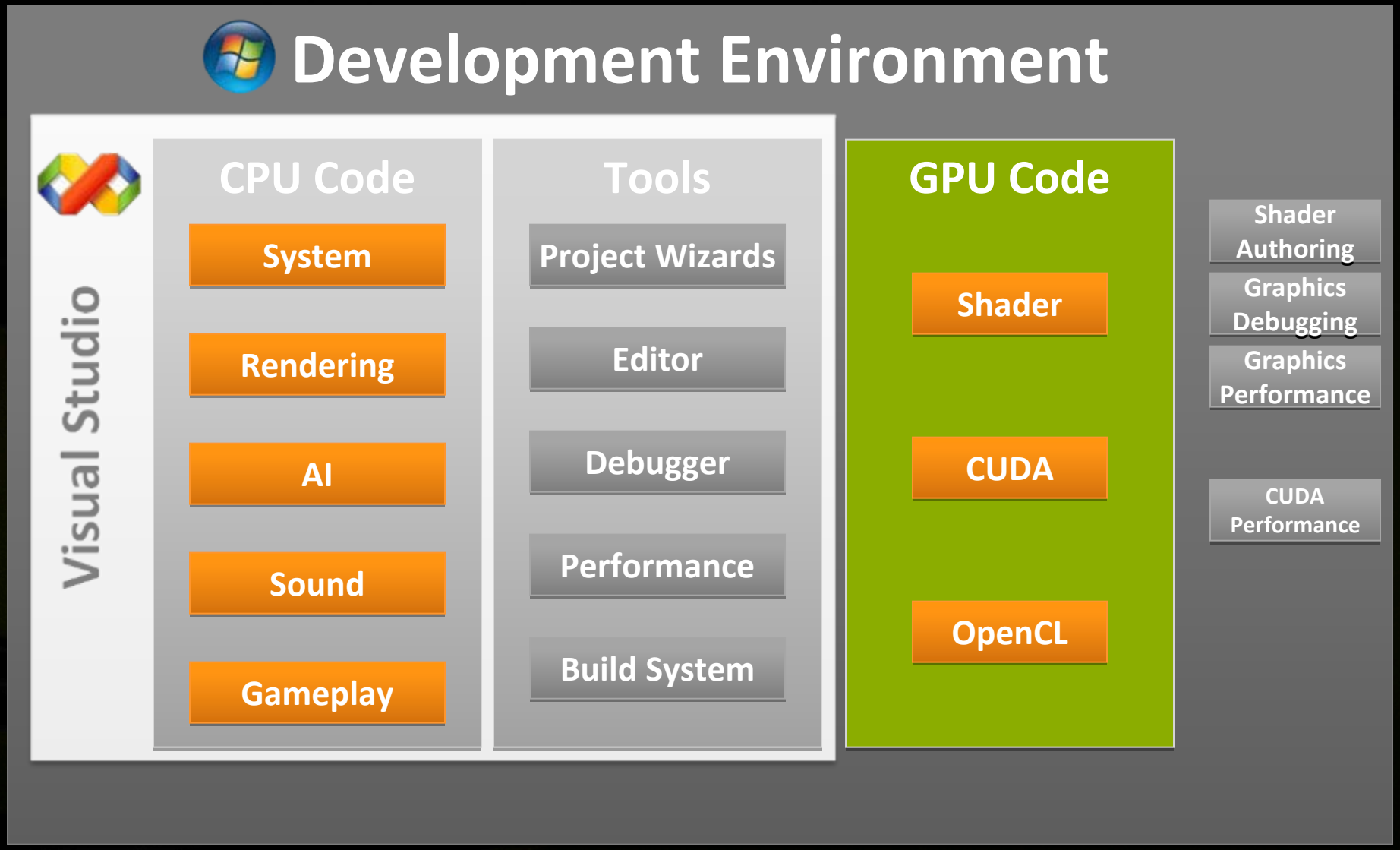
Windows Development



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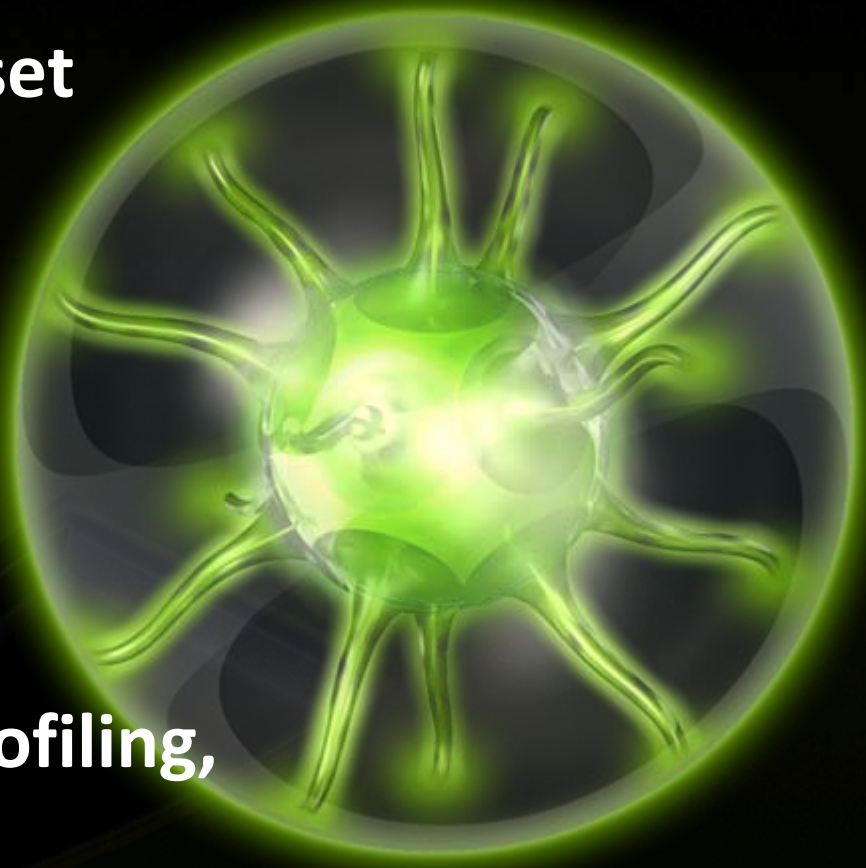
NVIDIA Nexus

Next-generation
development toolset

Homogeneous development
for CPU and GPU

Seamless debugging, profiling,
and visualization



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The Nexus 1.0 Release

A full **Visual Studio-integrated** development environment

Supporting

CUDA C, DirectCompute,

OpenCL, DirectX 11,
DirectX 10, OpenGL

Requires Windows Vista or Windows 7, Visual Studio 2008 SP1

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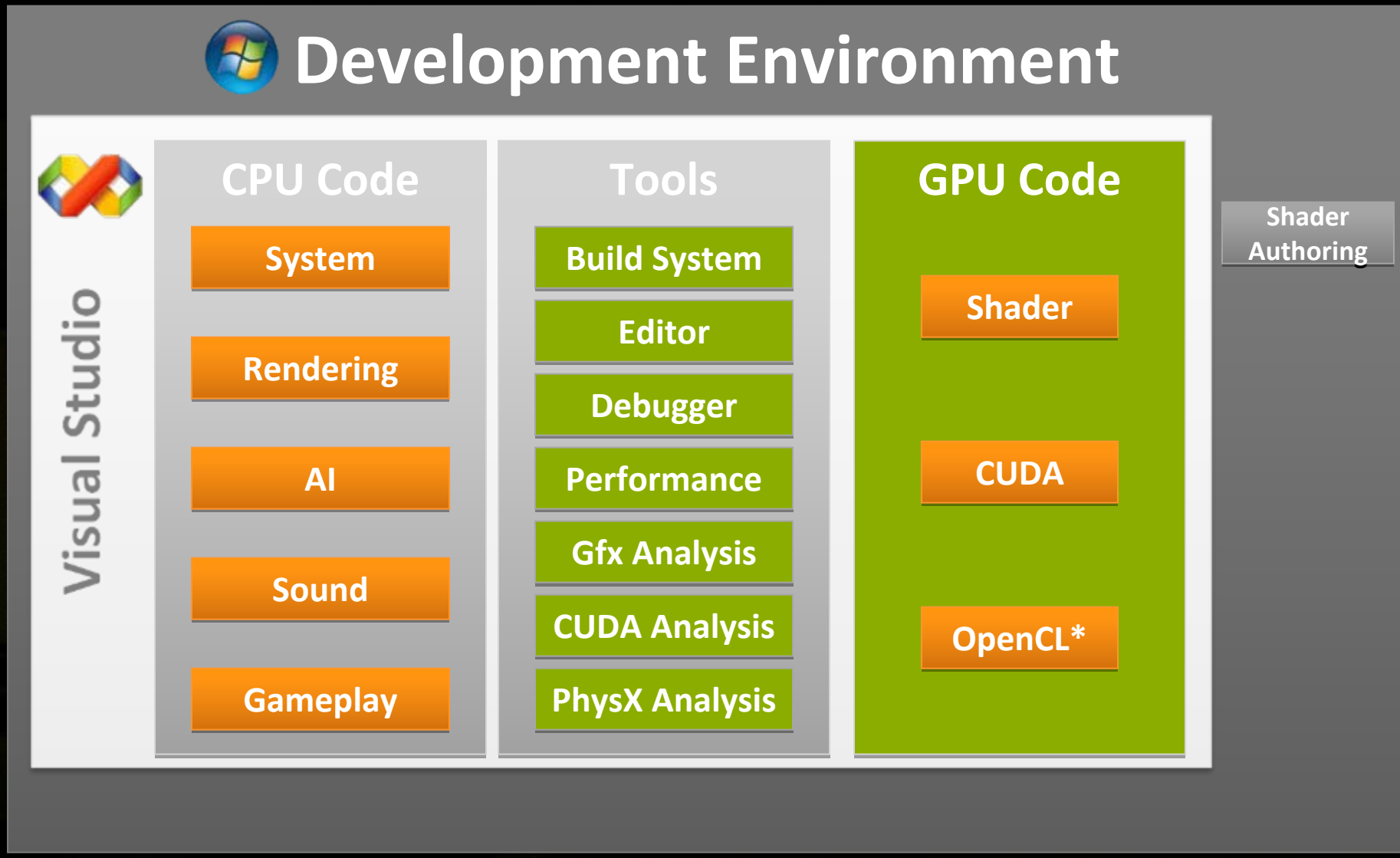
The Nexus Ecosystem



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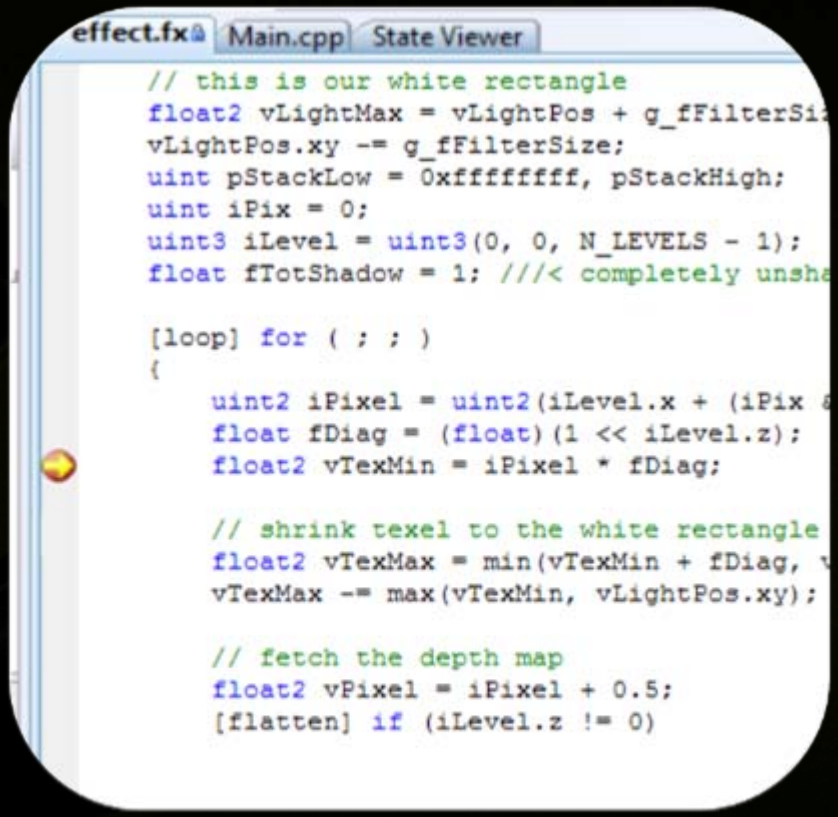
Code Authoring

Strong integration with the Visual Studio Shell.

Syntax highlighting

Code completion

Nexus toolbar, menu, and project wizards



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Code Debugging

Step through GPU code, and examine program values.

FluidSim.cpp

```
extern "C"
__global__ void
matrixMul( float* C, float* A, float* B, int wA, int wB)
{
    // Block index
    int bx = blockIdx.x;
    int by = blockIdx.y;

    // Thread index
    int tx = threadIdx.x;
    int ty = threadIdx.y;

    // Index of the first sub-matrix of A processed by the block
    int aBegin = wA * BLOCK_SIZE * by;
```

test.cpp

```
dim3 threads(BLOCK_SIZE, BLOCK_SIZE);
dim3 grid(WC / threads.x, HC / threads.y);
matrixMul<<< grid, threads >>>(d_C, d_A, d_B,
WA, WB);
```

Call Stack | Locals

Name	Name	Value	Type	Language
Test.exe!F	thid	24	int	CUDA
Test.exe!G	offset	1	int	$GPU@Fermi
Test.exe!w	temp	0x0012edbc	float [1024]	C++
Test.exe!_	[0]	5.0000000	float	C
Test.exe!w	[1]	9.0000000	float	C
kernel32.dl	[2]	1.0000000	float	
[Frames be	[3]	1.0000000	float	
	[4]	6.0000000	float	
	[5]	7.0000000	float	
	[6]	6.0000000	float	
	[7]	4.0000000	float	

Call Stack | Breakpoints | Command Window | Immediate Window | Output | Pending Checkins

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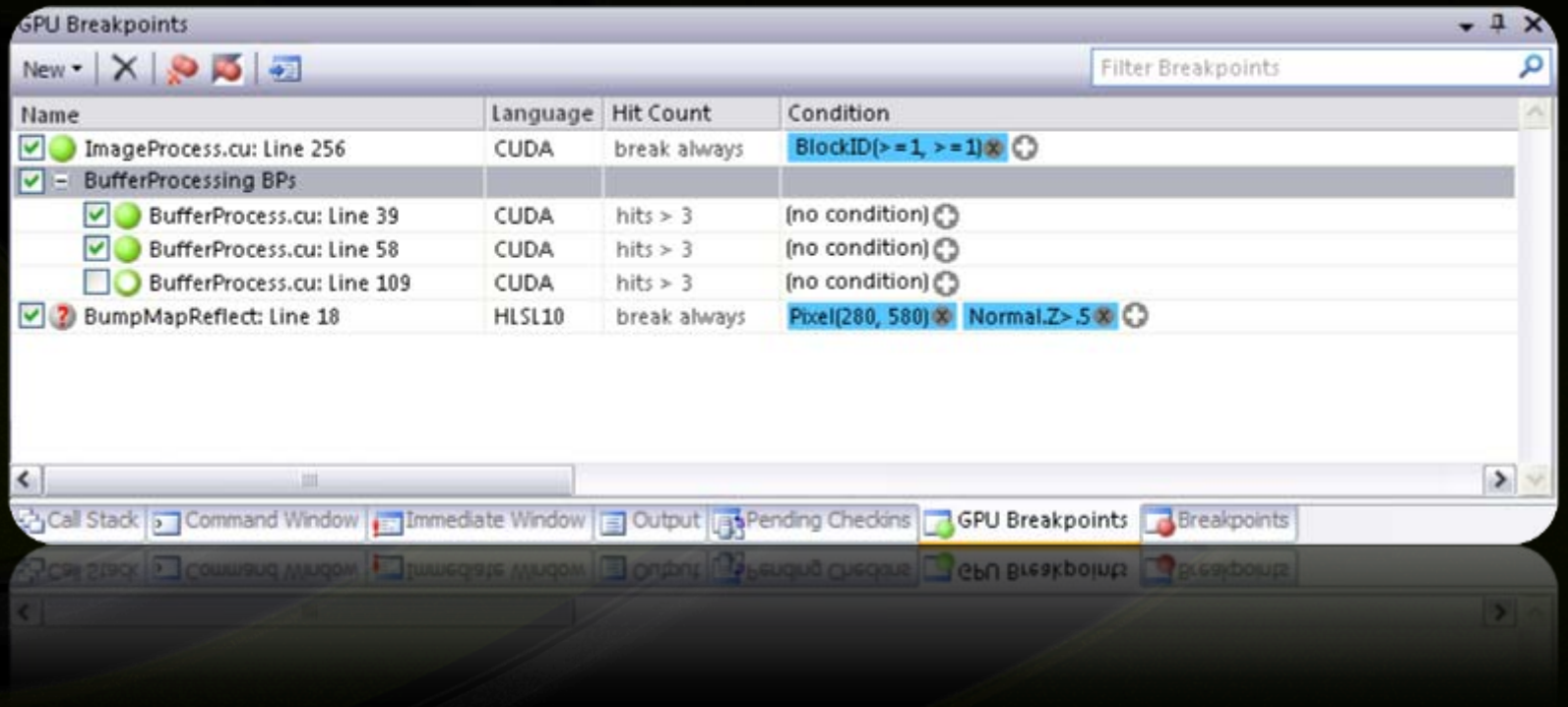
Code Debugging

Power-up your breakpoints with parallel-aware conditionals.



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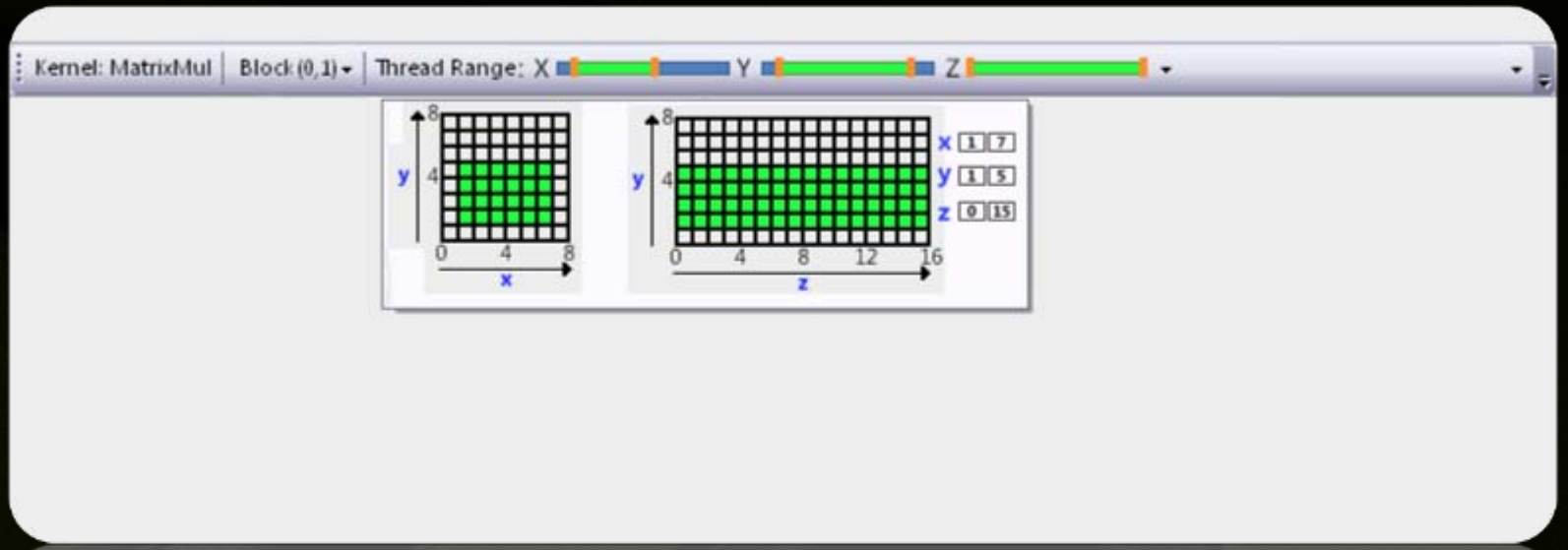
Code Debugging

Manage debugging across thousands of threads.



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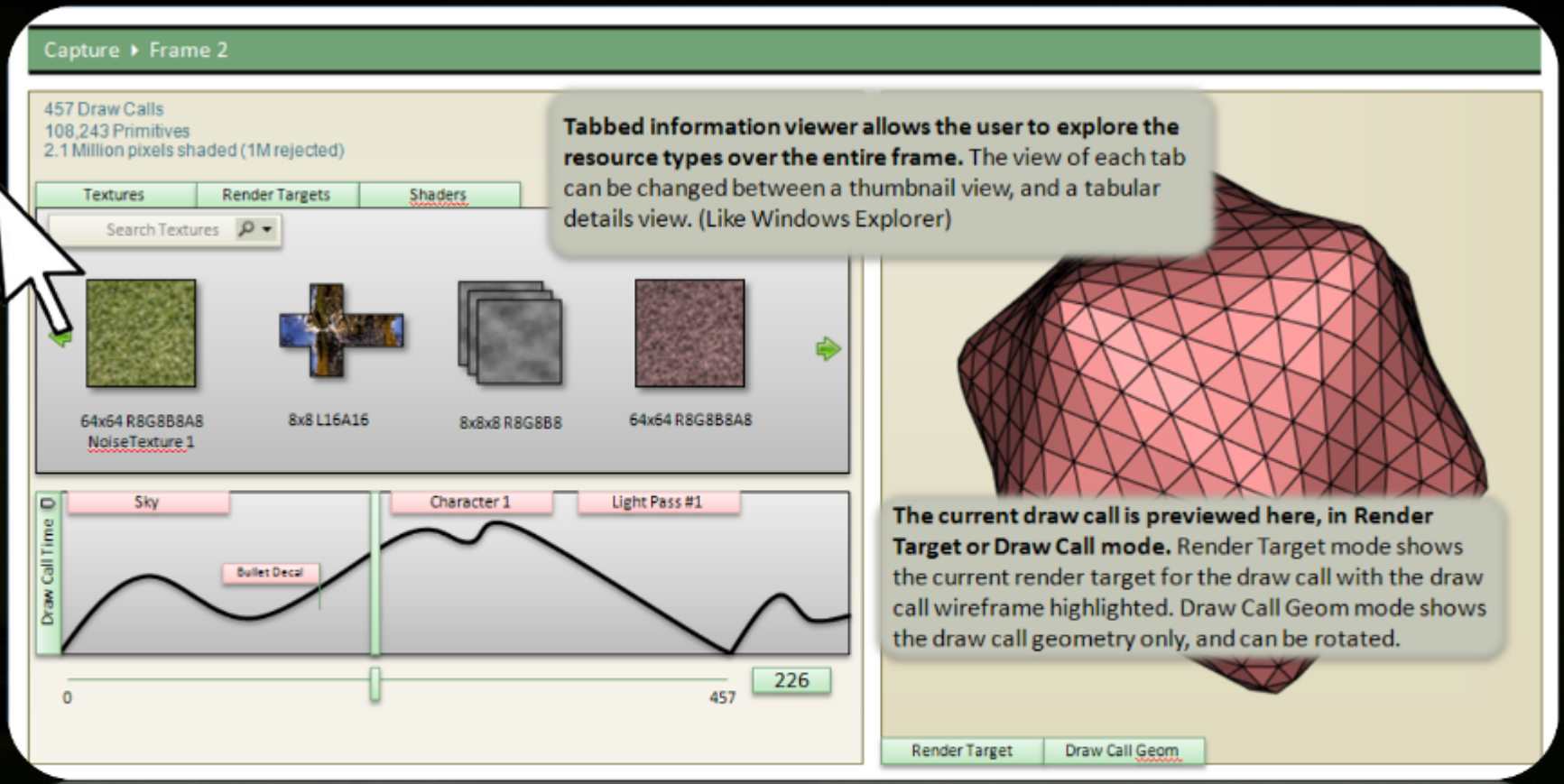
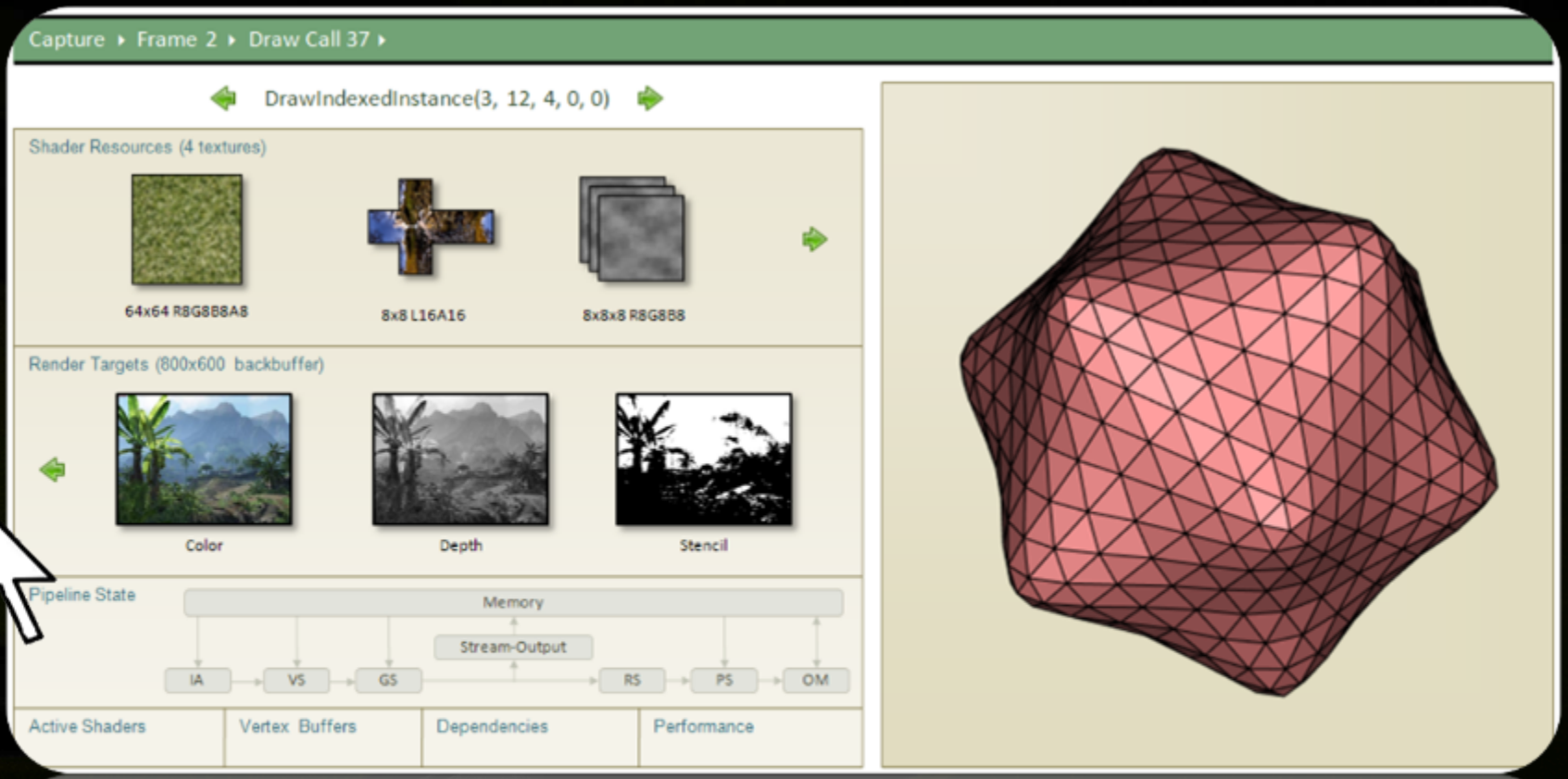
Graphics

Drill down from examining a frame…



Graphics

…to a draw call…



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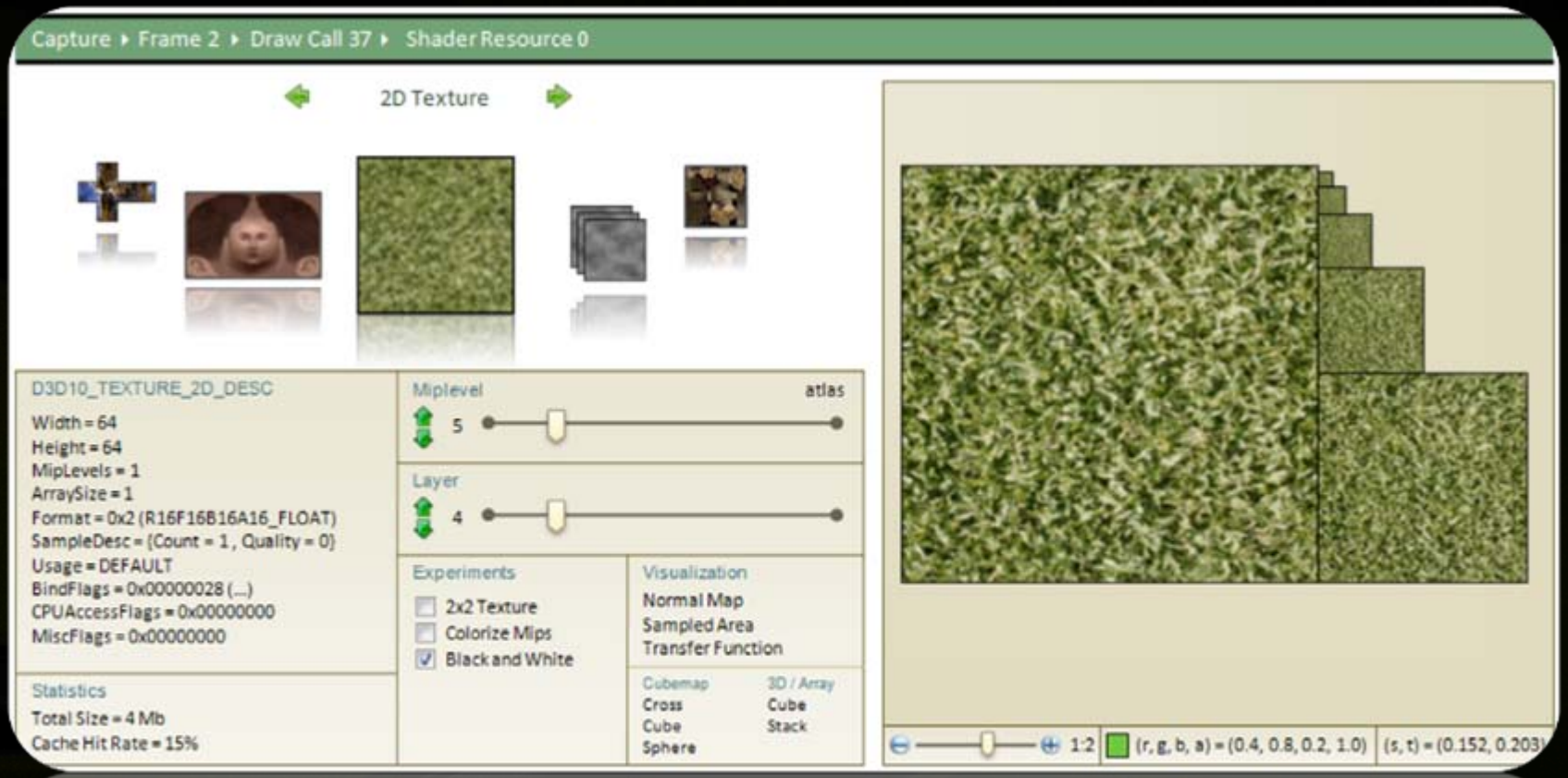
Graphics

…to specific resources and GPU state.



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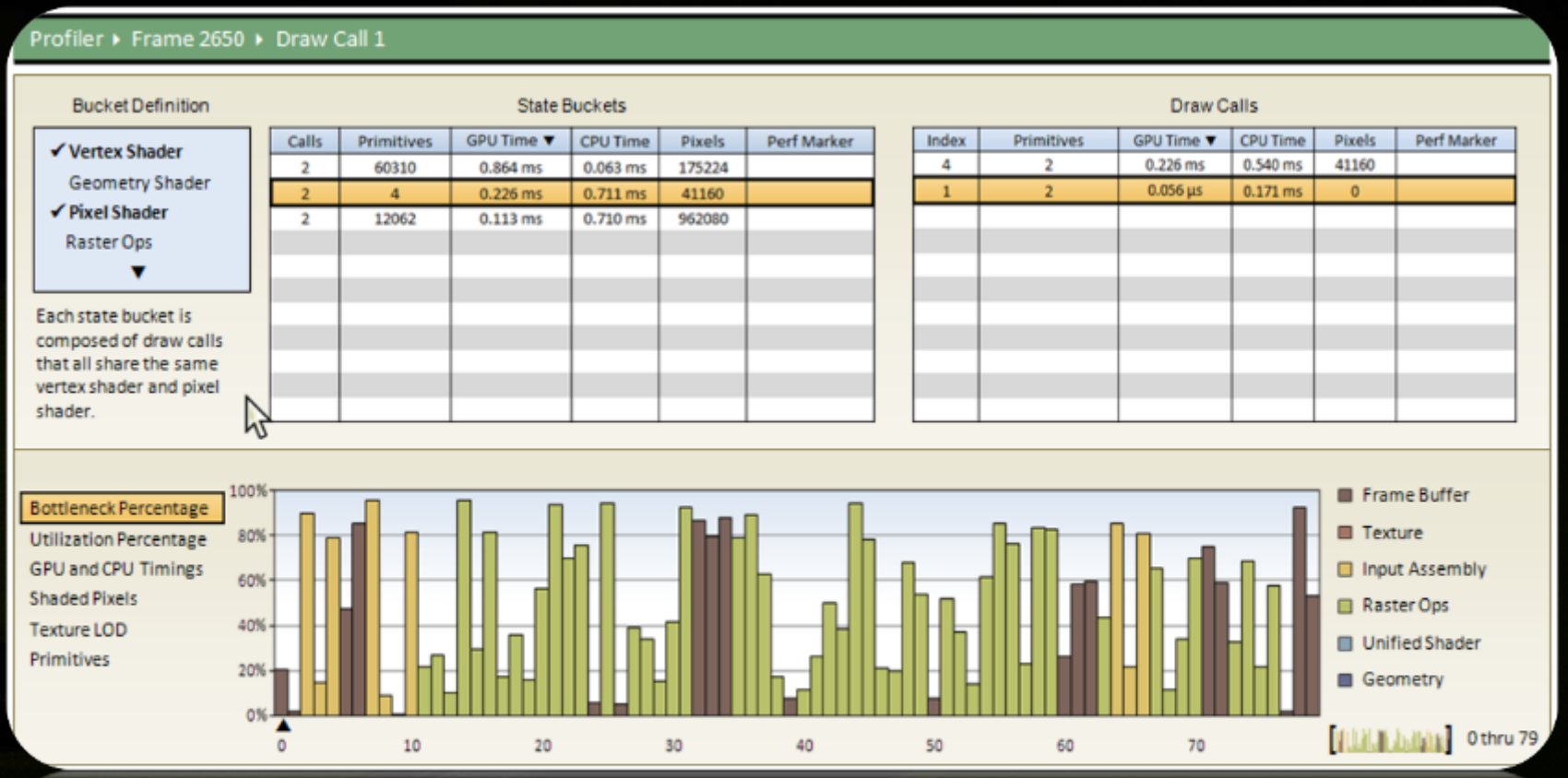
Graphics

See GPU usage on a per-draw call basis.



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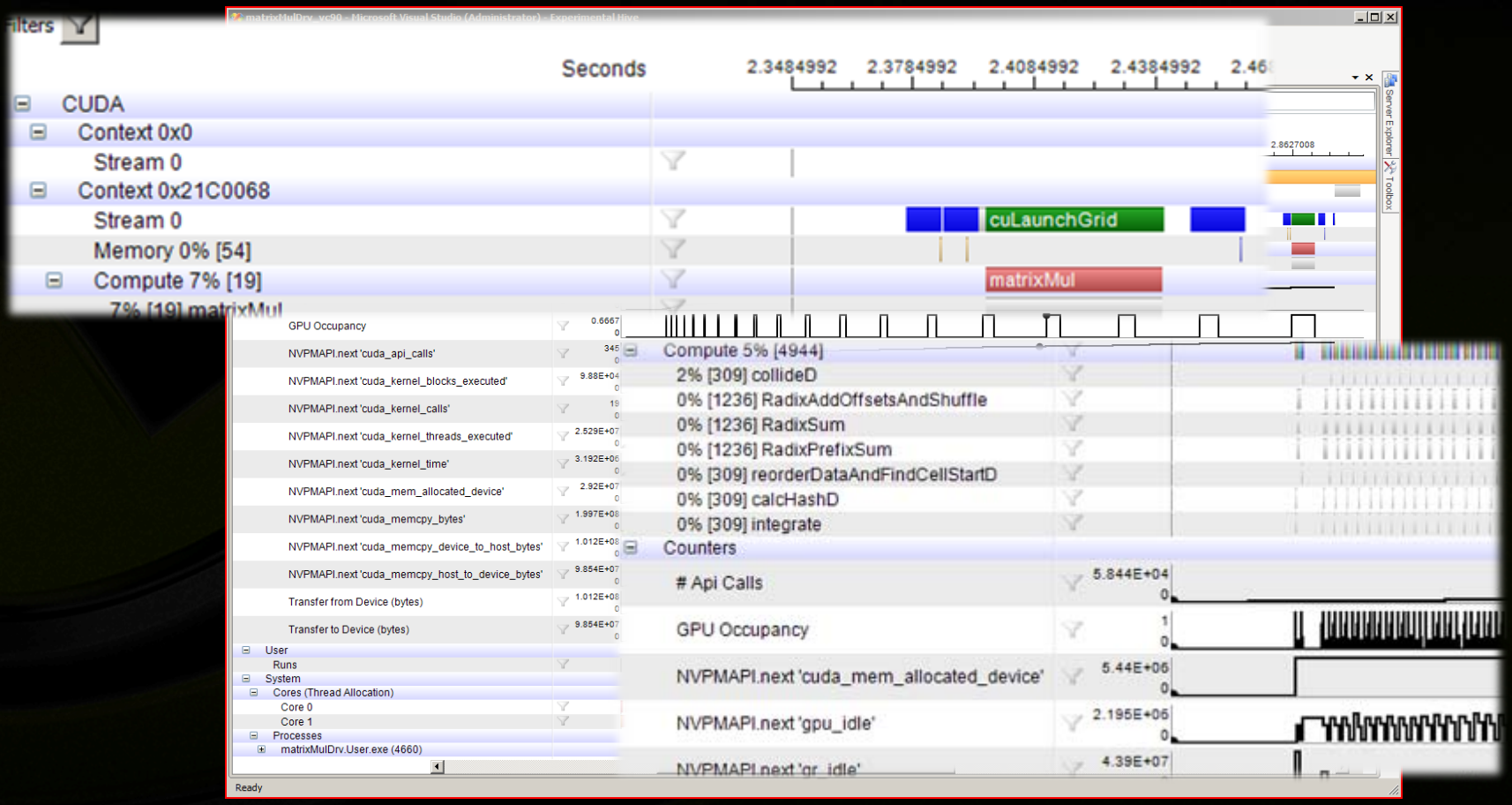
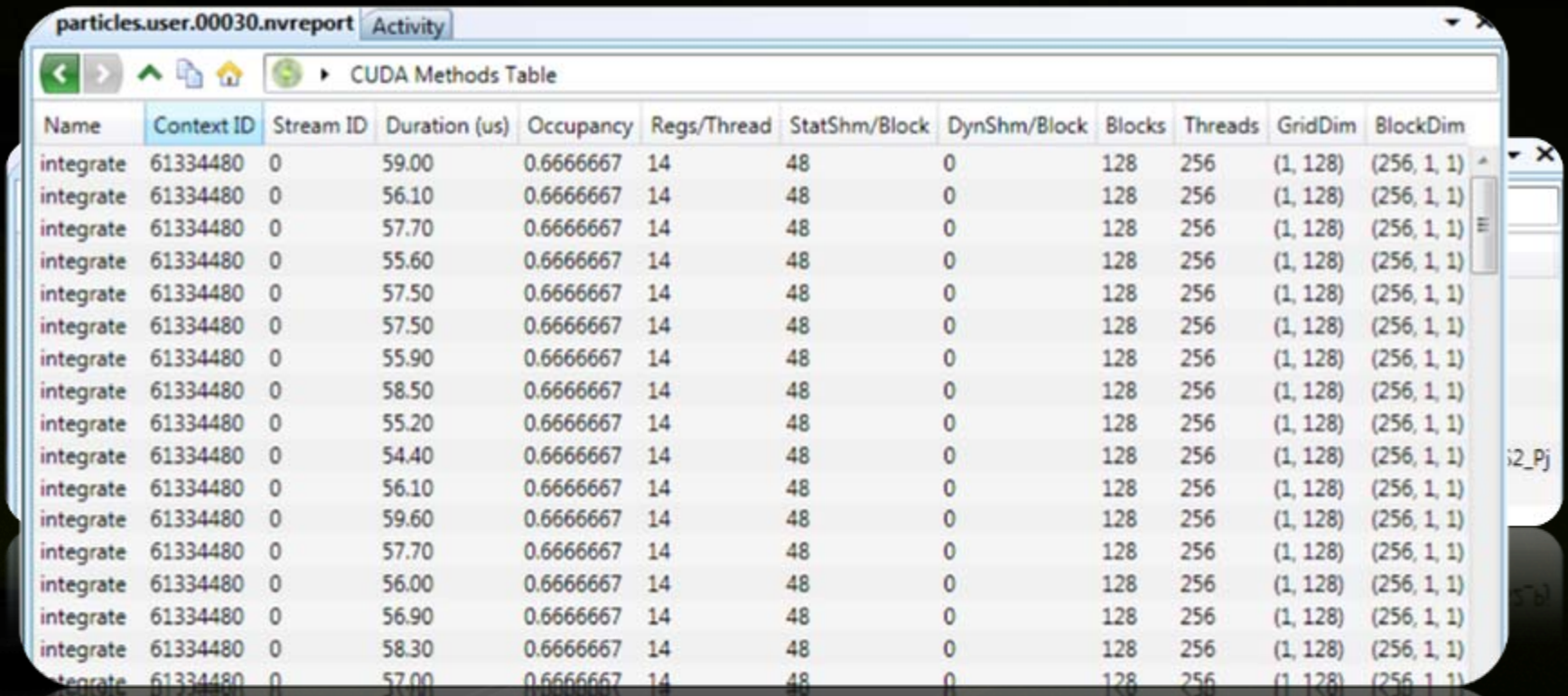
Analysis

View performance from higher level using correlated CPU, GPU, thread, and OS data.



Analysis

Get detailed performance information for every kernel.



Name	Context ID	Stream ID	Duration (us)	Occupancy	Regs/Thread	StatShm/Block	DynShm/Block	Blocks	Threads	GridDim	BlockDim
integrate	61334480	0	59.00	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	56.10	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	57.70	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	55.60	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	57.50	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	57.50	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	55.90	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	58.50	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	55.20	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	54.40	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	56.10	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	59.60	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	57.70	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	56.00	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	56.90	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)
integrate	61334480	0	58.30	0.6666667	14	48	0	128	256	(1, 128)	(256, 1, 1)

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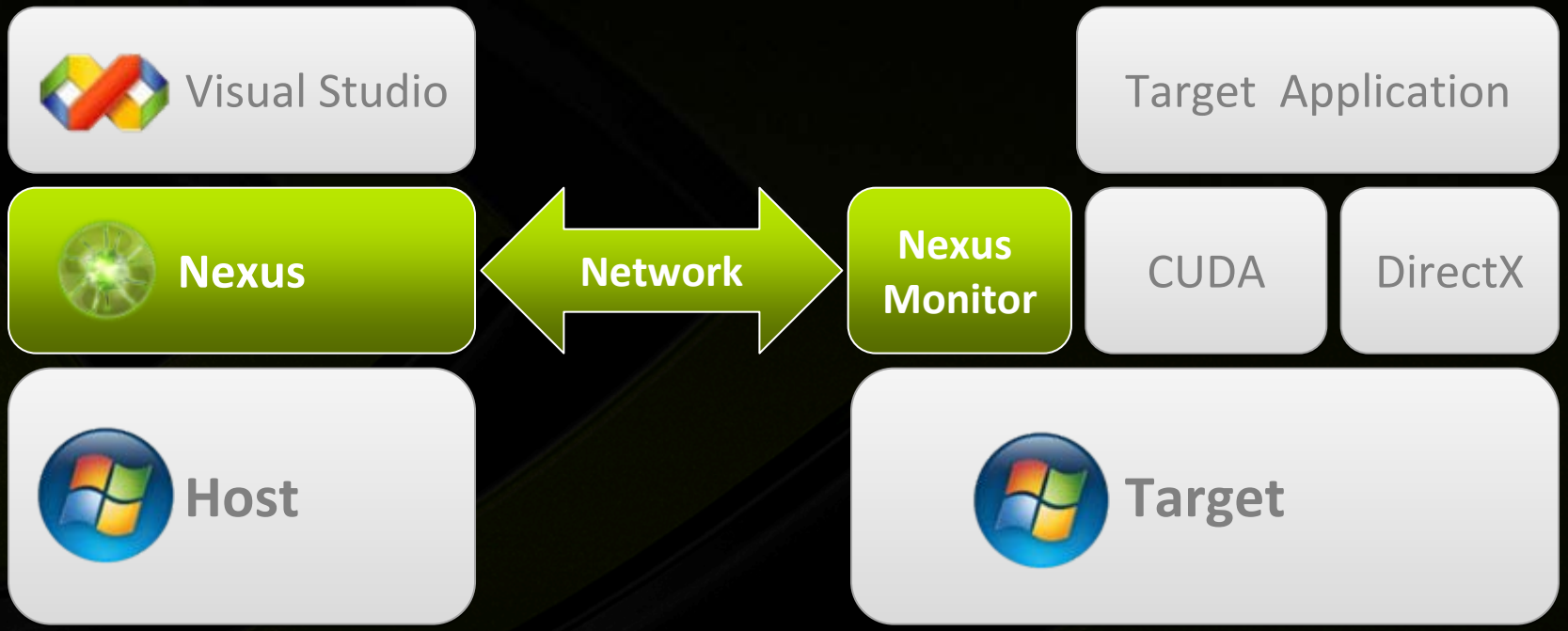
Nexus everywhere

Debug, visualize, and optimize your code remotely.



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