Light up Your Game with the New Features in APEX

Director of Engineer Content Technology
Rev Lebaredian
PhysX vs APEX

- PhysX provides the basic physics simulation
  - Rigid Bodies
  - Joints / Ragdolls
  - Forcefields
  - Cloth Simulation (can be HW accelerated)
  - Particles/Fluids (can be HW accelerated)

- APEX provides tools / API for more advanced physics features
What is APEX?

APEX is a “Scalable Dynamics Framework”

- **Scalable**: Content adapts to different hardware capabilities
- **Dynamics**: The way things move and interact
- **Framework**: A structured environment

APEX consists of two major components:

- **Authoring:**
  - High-level authoring of dynamic systems
  - DCC plugins, standalone tools, and game engine plug-ins
- **Runtime:**
  - A modular SDK – minimal integration into game engine
  - Leverages PhysX for simulations
APEX Architecture

APEX Core

DCC Plug-In
Standalone APEX Tools

Destruction
Clothing
Particles

Renderer
PhysX SDK

Consoles
PC
PC +GPU

Authoring
Run-time
APEX in Games

and more games in development ...
PhysX/APEX in Chinese Games

Waiting for your Game!
APEX Roadmap

APEX 1.1 – Feb 2012
- APEX Clothing
  - Improved Performance for multiple actors
  - Uniform scaling of actors at creation
  - Support for material overrides
- APEX Destruction
  - GPU Rigid Body Simulation
  - Improved Collision Hull Accuracy
  - LoD based on chunk size
- Tool Workflow Improvements
APEX Roadmap

APEX 1.2 – June 2012

- APEX Clothing
  - New solver with improved performance/behavior
  - Local-space simulation
  - Improved rendering performance
- APEX Destruction
  - Actor state serialization
  - Voronoi Fracturing
  - Fracture individual chunks with different settings
  - Internal Performance Improvements
- APEX Turbulence
  - Interactive massive particle simulation
- Tool Workflow Improvements
APEX Roadmap

APEX 1.3 – in sync with PhysX release

APEX SDK
- APEX Turbulence/Clothing (Standalone Support for non PhysX games)
- Real Time Fracturing
- Improved Android Performance
- Improved Render Buffer Access
- Multiple LOD for Destructible Assets

APEX Authoring Tools
- PhysXlab
  - UV based fracturing
  - Support for hierarchical Voronoi Fracturing
- DCC Tools
  - APEX Destruction Support
- Turbulence Authoring Tool
APEX Turbulence

- New Feature in APEX 1.2
- Real time simulation of large particle system based on Eulerian Fluid Dynamics
- Effect is great for:
  - Death effects
  - Spell effects
  - Smoke effect
  - Weapon effects
APEX Turbulence
APEX Turbulence – Smoke with noise
APEX Destruction

- Fully and partial destructible environments
- PhysXLab tool with preview functionality
- Support for Slicing, Cutout and Voronoi Fracturing
- Fracture with noise
- Hierarchical destruction
- Level of Detail
- Scalability
Fracturing Mode

- **Slicing**
  - APEX 1.0 and above, covered in the next session

- **Cut-out**
  - APEX 1.0 and above, covered in the next session

- **Voronoï**
  - APEX 1.2 and above
PhysX Lab – What is a Slicing Plane?

- No Noise
- No Degree Variation
PhysX Lab – What is a Slicing Plane?

- With Noise
- No Degree Variation
- High Amplitude
- High Grid Density
PhysX Lab – What is a Chunk?

Depth 1 Chunk
PhysX Lab – What is a Chunk?

Depth 1 Chunks are sliced up into Depth 2 Chunks
Voronoi Fracturing Principle
PhysX Lab - Voronoi Fracturing
APEX Destruction
Realtime example of authored destruction asset
Reverse Playback
Tessellation
APEX Clothing

- Hybrid of simulated and skinned clothing
- DCC tools with preview functionality
- Level of Detail
  - physical simulation and graphics
- Animation blending
- Clothing Constraints
APEX Clothing

APEX Clothing provides additional functionality and tools for creating clothing on characters

Key features

- Max Distance allows users to cloth simulation freedom from skinned positions
- Tools give users the ability to paint sections of clothing for better control over simulation
- “Thick Cloth” can be achieved through attachments

This same tech can be used to create ambient cloth effects like debris paper, with the exception of tearing
APEX Clothing DCC Plugins (Max/Maya)
APEX Clothing – MaxDistanceAnimNotify

LOD: 0 Bones: 52 Polygons: 30792 (Display Factor: 1.34)
[Chunk 0] Verts: 3779 (Rigid: 1036 Soft: 2741)
[Chunk 1] Verts: 3509 (Rigid: 2703 Soft: 806)
TOTAL Verts: 19878 (Rigid: 13120 Soft: 6758)
Chunks: 4 Sections: 4
Root Bone Delta: X=0.317 Y=0.000 Z=-0.496
APEX Clothing – Graphical LoD

- Game Engine Controlled
- Different Mesh Resolutions
  - Graphical Mesh
  - Physical mesh
- Seamless switch
  - Positions and velocities transferred
- Scalable:
  - Assets for different platforms
APEX Clothing – Physical LoD

- Resource Controlled
- MaxDistances reduced
- Turns off simulation of small scale movement
- Reduces the number of simulated vertices
APEX Clothing Improvements (APEX 1.2)

- **Support for**
  - New Embedded Solver (PhysX 3.3)
  - PhysX 2.8.4 solver

- **Localspace Support**

Full Inertia  
No Inertia
APEX 1.2 – Embedded Solver

- Improved Collision Handling
  - Tapered Capsule Collider
  - Virtual Particles
- Better Solver Behavior
  - Improved stretch handling
  - Improved bending
  - Variable time stepping
- Better performance
  - both CPU/Consoles and GPU
  - > 2x
- Improved Skinning and Rendering

gameworks.nvidia.com
APEX 1.2 – Embedded Solver DCC Menu
Common Pitfalls

- **Variable Time Stepping**
  - Was an issue in Apex 1.0
  - Improved in Apex 1.1 and 1.2

- **Performance Optimization**
  - Too many solver iterations
  - Too high resolution
  - Self collision

- **Bad Animations**
  - Sudden jump in motion
  - Physically implausible motion without clothing as constraint
  - Pinched collision (penetrating legs, etc.)
Sample characters
APEX Clothing versus PhysX Cloth

PhysX Cloth (2.8.4)
- Ambient cloth effects
- Support for tearing
- Character Clothing not supported out of the box

APEX Clothing
- Character Clothing
- Ambient cloth supported (PhysX 2.8.4)
- Currently NO support for tearing
- 3ds MAX / Maya authoring
- APEX LoD support
Upcoming New Features
APEX Tutorials

APEX & PhysX Tutorials

This page is home base for all of our Apex and PhysX tutorial and sample files. After following these tutorials and working through the sample content, you should have a good foundation of how to author Apex and PhysX content. The knowledge contained here will provide you, the artist, with an expanded creative palette that allows for new creative freedoms to add new kinds of physical effects to your immersive projects. These tutorials demonstrate basic and advanced techniques that can be applied to your game production.

APEX Clothing 3dsMax
The Apex clothing tutorials for 3dsMax guide you through navigating the new UI components, setting up basic and advanced assets, and exporting to a game engine such as Unreal Engine 3.

APEX Clothing Maya
The Apex clothing tutorials for Maya also guide you through navigating the new UI components, setting up a common character asset, and exporting to a game engine such as Unreal Engine 3.

APEX Destruction PhysX Lab
The Apex destruction tutorials will guide you through basic and advanced techniques for fracturing an object and adding it into a game engine. Topics such as mesh prep, using PhysX Lab, and setting up the asset in a game engine such as Unreal Engine 3 are all covered.

Tools
- PhysX & APEX tools can be obtained on Parature.
- Autodesk tools can be obtained through Autodesk.
APEX Tutorials on Nvidia DevZone

- APEX Clothing (3ds Max / Maya)
  - Setup and UI
  - Waving Flag
  - Cape (low)
  - Trenchcoat (medium)
  - Sport Pants (high)
  - Exporting to UE3
  - ...

- APEX Destruction
  - PhysXLab: Slice Fracturing
  - PhysXLab: Cut-Out Fracturing
  - PhysXLab: Jersey Barrier
  - UDK: Fracture Materials
  - PhysXLab: Wood Material
  - UDK: Form Extended Structures
  - UDK: Impact Damage
  - PhysXLab: Full Destruction with Fracture Maps
  - PhysXLab: Multiple FBX
  - ...

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### APEX Downloads

_by Monler Maher, posted May 09 2012 at 08:33AM_

#### APEX 1.1 (BETA) - TOOLS/SDK

<table>
<thead>
<tr>
<th>APEX 1.1</th>
<th>32-bit</th>
<th>64-bit</th>
<th>Notes</th>
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</table>
| 3ds Max DCC plug-in 2.7.2 (v04270200)  
- PhysX 3.1 and PhysX 2.8.4  
- APEX 1.1  
- APEX/UE3: requires Feb/2012 build or newer | 2012  
2011  
2010  
2009 | 2012  
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2009 | Release Notes  
Tutorials |
| Maya DCC plug-in 2.7.2 (v05110400)  
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| PhysXLab 1.1 beta 4  
- PhysX 2.8.4  
- APEX 1.1  
- APEX/UE3: requires Feb/2012 build or newer | 32-bit  
64-bit | 32-bit  
64-bit | Release Notes  
Tutorials |
| APEX 1.1 SDK (build 116) for PhysX 2.8.4 | Win_VC9 | Win_VC9 | Release Notes |
APEX/PhysX Info

- APEX SDK and Tools
  - APEX/PhysX Registered Developer Program

- APEX Tutorials

- APEX in UE3
  - http://udn.epicgames.com/Three/APEXOverview.html

- Thanks to http://physxinfo.com for the game videos

Gameworks.nvidia.com
Questions?