NVIDIA APEX:
High-Definition Physics with Clothing and Vegetation

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Outline

- **Introduction**
  - APEX: A Scalable Dynamics Framework

- **APEX Clothing Module**
  - In-Depth Demonstration

- **APEX Vegetation Module**
  - SpeedTree v5.0
  - APEX run-time

Scalable Dynamics Content

APEX Destruction

APEX Vegetation

APEX Clothing
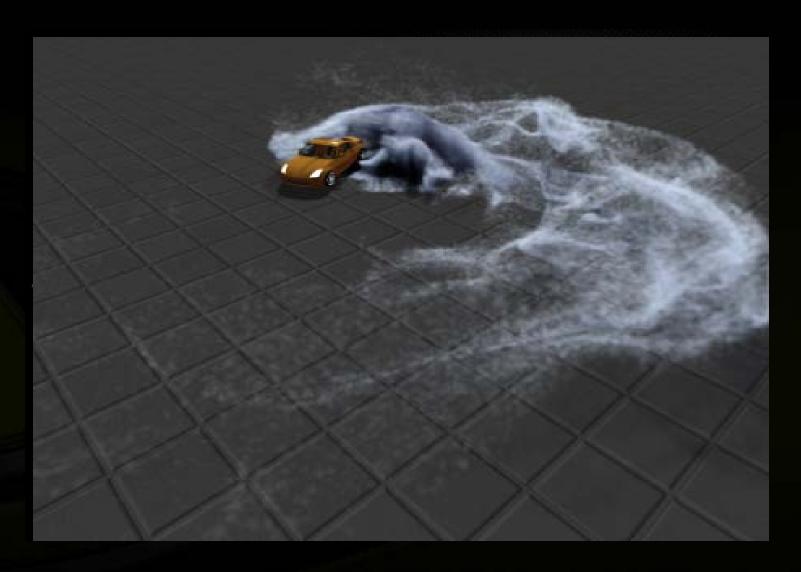
APEX Turbulence

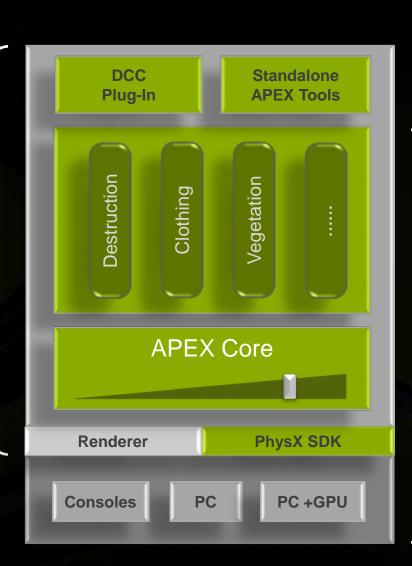# APEX Destruction

APEX Turbulence

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 plugins
  - Runtime:
    - A modular SDK – minimal integration into game engine
    - Leverages PhysX for simulations

APEX Architecture

Authoring

DCC Plug-In

Standalone APEX Tools

Destruction

Clothing

Vegetation

......

APEX Core

Renderer

PhysX SDK

Consoles

PC

PC +GPU

Run-time

APEX is Artist Focused

- Artist level abstractions of dynamic systems
  - "Destructible bunker" vs. "collection of bricks"
- Intuitive and easy to use

APEX is Easy to Integrate

- **Already integrated into leading game engines**
  - UE3, Gamebryo, HeroEngine, ...

- **APEX modules are plug & play**
  - Clothing, Vegetation, Destruction
  - More modules in development

- **APEX is already used for AAA content**
  - Licensed by major publishers
  - NVIDIA developed APEX modules are free for PhysX developers
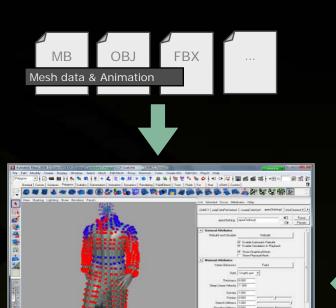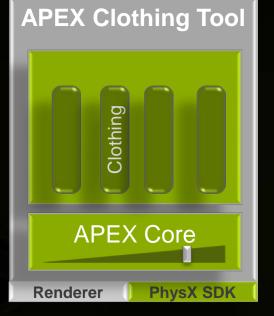
APEX Clothing Module

Outline

- Authoring pipeline
- Runtime pipeline
- Maya authoring example
- Clothing parameter overview
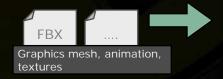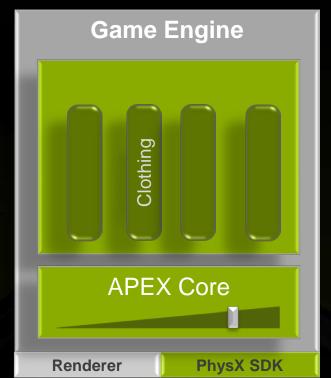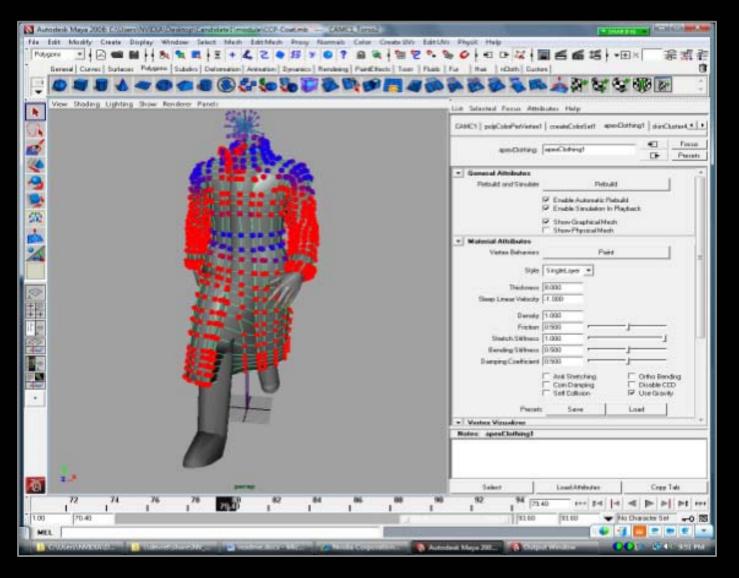- HeroEngine integration

Authoring Pipeline

Runtime Pipeline

ACA

APEX Clothing Asset File

FBX | **....**

Graphics mesh, animation, textures

Game Engine

Clothing

APEX Core

Renderer | **PhysX SDK**

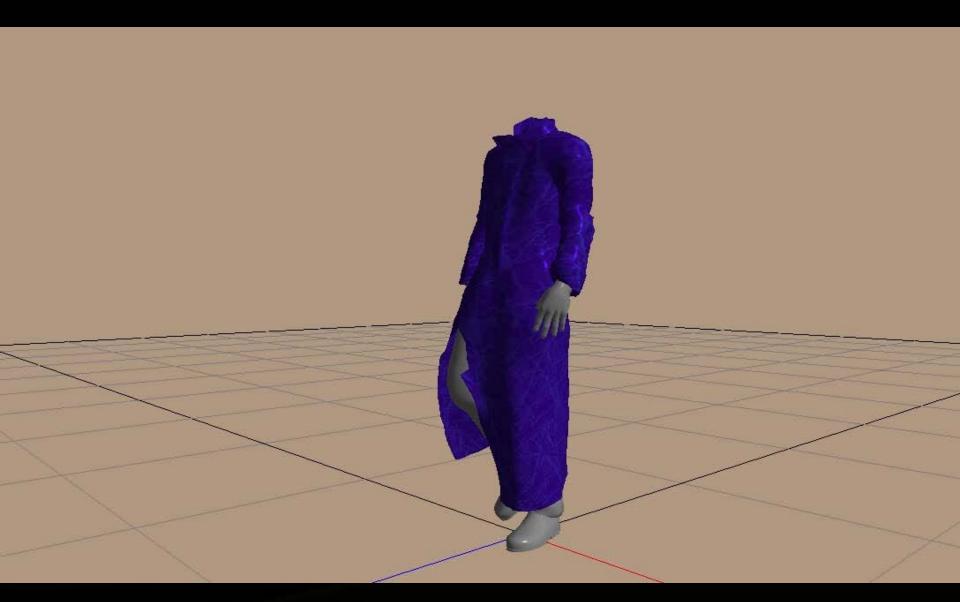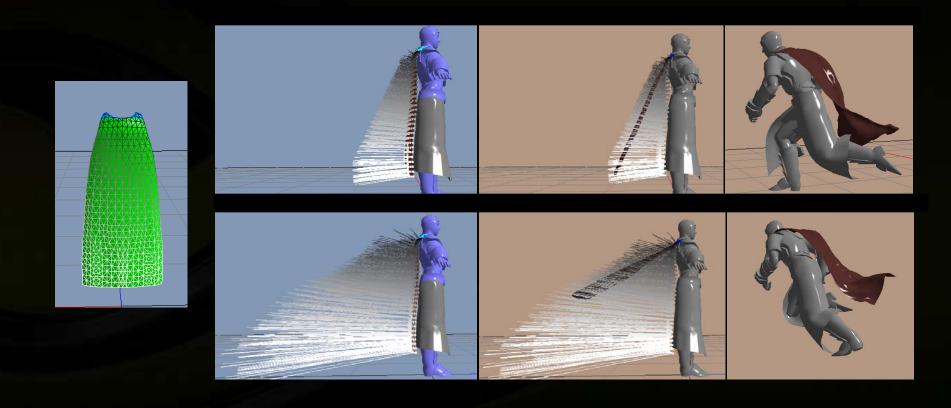# APEX Clothing Plug-in (Maya)

Motion Radius

- **Allows the artist to constrain the simulation**

Collision Shapes

- **Semi-automatic or manual generation**
  - Convex collision volumes
  - Primitive collision volumes
  - Mix of primitives and convexes

A – Collision

- **Use animation mesh as a collision mesh**

Scalability

- **Number of physically simulated characters**

High Fidelity Clothing

Clothing assets © Optitex

Soft Body Characters

HeroEngine Clothing Integration

- **HeroEngine by SIMUTRONICS**
  - **MMOG engine licensed by:**
    - **Bioware Corp, Trianit Virgin Games, Mindfuse, Stray Bullet Games, Awomo, HSC Labs, ..**

- **APEX Clothing integration**
  - **Completed within 1.5 man month**
  - **LoD support**
  - **Effects system (Wind)**
  - **APEX Clothing debug render functionality**

HeroEngine

HeroEngine
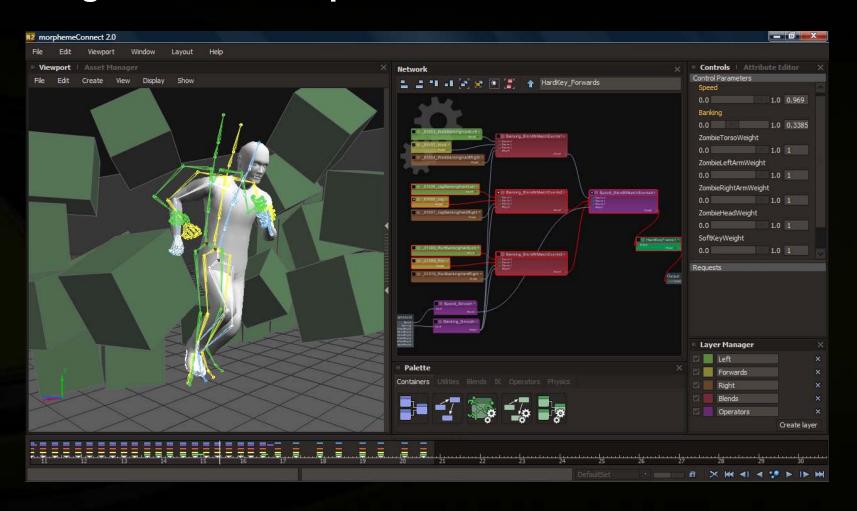
HeroEngine – Clothing Visualization

Upcoming Features

- **Integration with Morpheme 2.0**
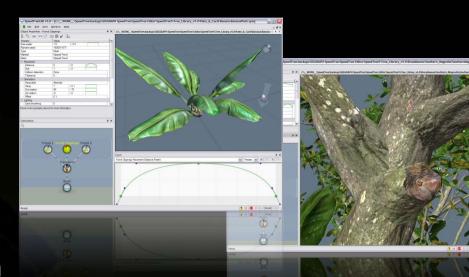
Outline

- **SpeedTree 5.0 preview**
- **SpeedTree and APEX**
- **Modeling pipeline**
- **Compilation pipeline**
- **Run-time pipeline**
- **Modeler demonstration**
- **APEX sample application**
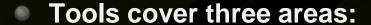
SpeedTree v5.0
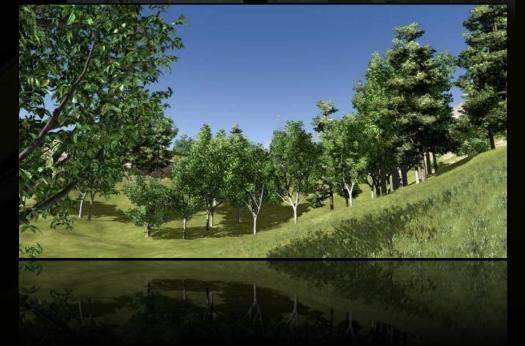
- **Complete redesign of toolset**
- **Tree centric modeling**
- **Improved SDK**
- **Fully integrated with APEX**
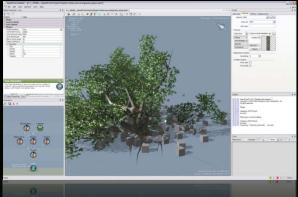
- **Tools cover three areas:**
  - Modeling
  - Compiling
  - SDK

SpeedTree and APEX

- **Dynamics directly integrated into modeling tool**
- **Compiler tool creates all required APEX assets**
- **SpeedTree runtime is integrated into APEX Vegetation**
- **Reference application**
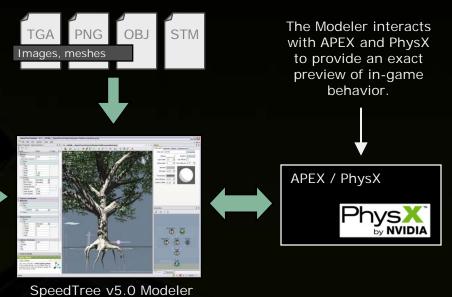
- **Seamless, comprehensive path to dynamic trees**

Modeling Pipeline

- **Library trees are APEX ready**
  - **Plug & Play**
- **Create your own physical trees**
  - **Bones, Joints, Branch Density,..**
- **Full preview capabilities**
  - **Destruction**
  - **Deformation**
  - **Leaf Particles**

TGA PNG OBJ STM

Images, meshes

The Modeler interacts with APEX and PhysX to provide an exact preview of in-game behavior.

SpeedTree v5.0 Modeler

APEX / PhysX

PhysX™
by NVIDIA

SPM

Procedural files
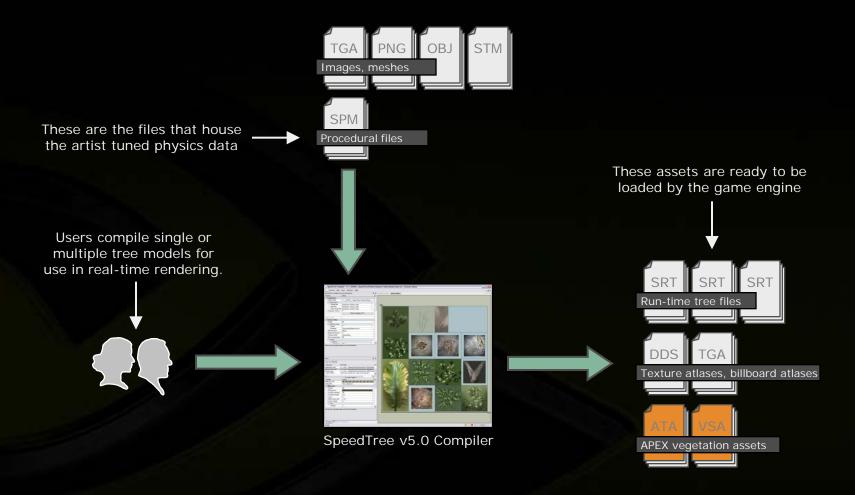
All physics related data resides in here until compile for real-time use

Compilation Pipeline

TGA PNG OBJ STM

Images, meshes

SPM

Procedural files

These are the files that house the artist tuned physics data

Users compile single or multiple tree models for use in real-time rendering.

These assets are ready to be loaded by the game engine

SpeedTree v5.0 Compiler

SRT SRT SRT

Run-time tree files

DDS TGA

Texture atlases, billboard atlases

ATA VSA

APEX vegetation assets

Run-Time Pipeline

These are the assets created
by the SpeedTree Compiler

SRT SRT SRT
Run-time tree files

DDS TGA
Texture atlases, billboard atlases

ATA VSA
APEX vegetation assets

SpeedTree SDK

speedtree

APEX / PhysX

PhysX
by NVIDIA

Game Engine

APEX uses the SpeedTree SDK to
manage large groups of trees and
abstracts which are physical and
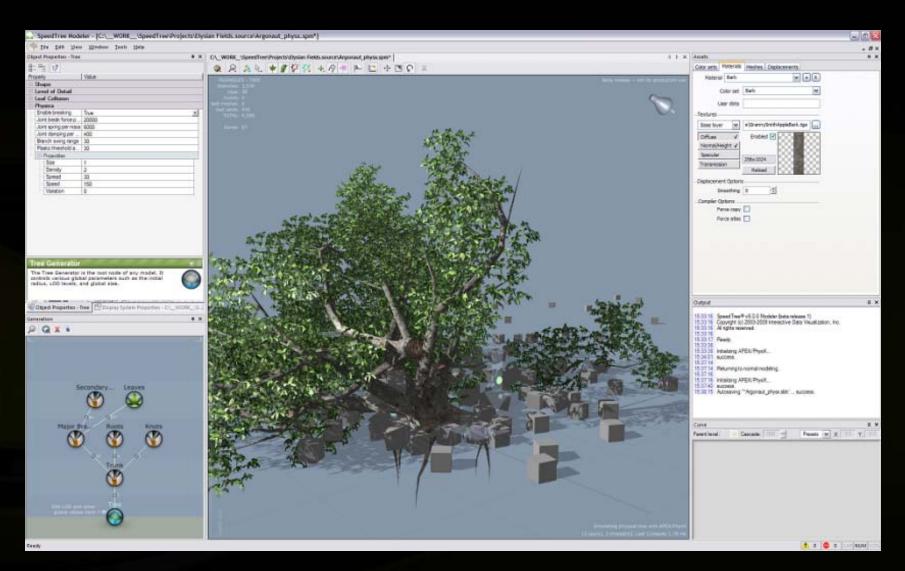which are not. APEX acts as the
common render interface.

SpeedTree 5.0 Modeler - Demo

APEX Vegetation – Sample App.

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APEX Vegetation – Sample App.

Summary

- **APEX is provides lots of different modules**
- **APEX is artist focused and easy to use**
- **APEX is modular and easy to integrate**
- **APEX is being integrated into UE3 and Gamebryo**
- **APEX is a scalable dynamics framework**
- **APEX has been licensed by major publishers**
- **APEX is already used to create AAA content**

- **APEX is free for PhysX developers**

How To Reach Us

- **During GDC**
  - **Expo Suite 656, West Hall**
  - **Developer Tool Open Chat, 1:30 to 2:30 pm (25th-27th)**
- **Online**
  - **Twitter: nvidiadeveloper**
  - **Website: http://developer.nvidia.com**
  - **Forums: http://developer.nvidia.com/forums**
- **IDV (Speedtree)**
  - **Website: www.speedtree.com**