CGDC

中国游戏开发者大会

CHINA GAME DEVELOPERS CONFERENCE

Making Dreams Come True: Global Illumination with Enlighten

Derek Lamberti, Geomerics, an ARM® company
Nathan Li, ARM

About Geomerics

- Geomerics has been bringing Enlighten to games since 2007
  - Started as a spin-out from Cambridge University
  - High quality, scalable dynamic global illumination solution
- Recent titles using Enlighten include:
  - Battlefield Hardline
  - Battlefield 4
  - Dragon Age: Inquisition
  - Lords of the Fallen
  - Plants vs Zombies: Garden Warfare
- Acquired by ARM in 2013

About ARM

- World leading semiconductor IP
  - Founded in 1990
  - 1060 processor licenses sold to more than 350 companies
  - > 10bn ARM-based chips in 2013
  - > 50bn ARM-based chips to date
- Business model
  - Designing and licensing of IP
  - Not manufacturing or selling on chips

Geomerics
An ARM company

Why ARM and Global Illumination?

- ARM is the world #1 semiconductor IP company
- ARM's aim: enable the best 3D graphics experiences
  - Lighting is key
  - Efficient dynamic global illumination is critical

  →**Invest in Enlighten, the proven dynamic GI solution**

- Benefits to Enlighten developers:
  - Investment and security
  - High quality IP delivery
  - Full support for mobile strategy

Geomerics
An ARM company

Talk Outline

- What is Enlighten?
- Why use it?
- How does it work?
- Where can I get it?

Geomerics
An ARM company

“This is gorgeous! I remember having dreams about this kind of dynamic indirect lighting back when I was building the Unreal Engine 1 renderer!”

– Tim Sweeney, CEO, Epic Games

Geomerics
An ARM company

Realistic Rendering Demo

Talk Outline

- **What is Enlighten?**
- Why use it?
- How does it work?
- Where can I get it?

Geomerics
An ARM company

What is Enlighten?

- Enlighten is global illumination middleware
- Unlike traditional baking

Lights and materials can move and change at runtime

- Runtime means **in editor** as well as **in game**
- Faster workflow – instant feedback means you can light a scene in seconds!

Geomerics
An ARM company

Realistic Rendering Workflow

Talk Outline

- What is Enlighten?
- **Why use it?**
- How does it work?
- Where can I get it?

Geomerics
An ARM company

Why Use Enlighten?

- Enlighten handles all lighting requirements for your game
- Consistent and high quality dynamic lighting solution
- Enables new game experiences through dynamic lighting and materials
- No need for workarounds – have your cake and eat it!

Geomerics
An ARM company

“When we got our hands on the Unity 5 beta, we just enabled Enlighten and removed all the fake GI point lights and everything looked better, ran faster and GI worked perfectly in real-time when disabling or animating lights.”

– Ville Kivistö, CEO and Co-Founder of Mindfield Games

Geomerics
An ARM company

PRE-ALPHA
POLLEN
POLLENGAME.COM

PRE-ALPHA
M
POLLEN
POLLENGAME.COM

Subway Demo

Talk Outline

- What is Enlighten?
- Why use it?
- ➢ **How does it work?**
- Where can I get it?

Geomerics
An ARM company

How Does Enlighten Work?

- Enlighten precompute
- Enlighten runtime
- Runtime engine integration

Geomerics
An ARM company

How Does Enlighten Work?

- Enlighten precompute

Geomerics
An ARM company

How Does Enlighten Work?

- Enlighten runtime

Geomerics
An ARM company

Enlighten Integration

Geomerics
An ARM company

Enlighten Integration

- Enlighten runtime

Geomerics
An ARM company

How Does Enlighten Work?

- Additionally, can use Enlighten for fully baked lighting

Geomerics
An ARM company

Enlighten Workflow

- How do I work with Enlighten?

  1. Configure Enlighten output
  2. Run Enlighten precompute
  3. Set up materials and lights – with instant results!

Geomerics
An ARM company

Configure Enlighten Output

- Outputs are similar to a traditional light map baker

  1. Light Maps (textures)
  2. Spherical Harmonic Probes (light probes)
  3. Reflection Captures (cube maps)

Geomerics
An ARM company

Configure Enlighten Output

- Outputs are similar to a traditional light map baker

1. **Light Maps (textures)**
2. Spherical Harmonic Probes (light probes)
3. Reflection Captures (cube maps)

Geomerics
An ARM company

Generate UV Coordinates for Light Maps

- Enlighten has automated tools to generate light map UV coordinates
- Specify **output pixel size** in real world units
- Enlighten run-time light maps are indirect light only – can use larger pixels
- Balance **quality** with **performance and memory**

Geomerics
An ARM company

UV Chart Generation and Merging

chart generation

chart merging

Geomerics
An ARM company

Perspective
Lit
Show
10
10°
0.25
2
Level: RoomNightEnlighten (Persistent)

Configure Enlighten Output

- Outputs are similar to a traditional light map baker

  1. Light Maps (textures)
  2. **Spherical Harmonic Probes (light probes)**
  3. Reflection Captures (cube maps)

Geomerics
An ARM company

Generate Spherical Harmonic Probes

- Probes are used for all dynamic meshes and some static meshes
- Enlighten has automated tools to generate probe locations in either
  - Regular 3D grids
  - Sparse octrees
- Specify **probe spacing** and **volume** where probes are required

Geomerics
An ARM company

Perspective
Lit
Show
10
10°
0.25
2
Level: RoomNightEnlighten (Persistent)

Configure Enlighten Output

- Outputs are similar to a traditional light map baker

  1. Light Maps (textures)
  2. Spherical Harmonic Probes (light probes)
  3. **Reflection Captures (cube maps)**

Geomerics
An ARM company

Author Locations for Reflection Captures

- Placed in the scene by hand
- Usually require extra mark-up for rendering time
- Simple example: a box to allow “box projection” in shader
- More complicated schemes are possible
  - See for instance blog/paper/talks by Sébastien Lagarde

https://seblagarde.wordpress.com/2012/09/29/image-based-lighting-approaches-and-parallax-corrected-cubemap/

Perspective
Lit
Show
Level: RoomNightEnlighten (Persistent)

Large Worlds Support

- Enlighten is highly scalable, from small environments to large worlds e.g. Dragon Age: Inquisition

- Enlighten is developing a separate terrain path with specialized LOD support
  - More scalable
  - More flexible at runtime
  - Higher performance

Geomerics
An ARM company

Enable Your Artists with Forge

- **Forge is a new lighting editor and pipeline tool for Enlighten**
- Modular design and source code - fast engine integration
- Plug-ins for Max and Maya – fast iteration times
- Full support for physically based shading

Geomerics
An ARM company

Talk Outline

- What is Enlighten?
- Why use it?
- How does it work?
- **Where can I get it?**

Geomerics
An ARM company

Available for Any Engine / Platform

- The real-time GI solution for Unity 5
- Pre-integrated into Unreal Engine 3 and 4
- A standalone SDK for proprietary engines

- The runtime is optimised for many platforms
  - PC

    Windows®, Mac OS X®, Linux
  - Console

    Xbox 360®, Xbox One™, PlayStation® 3, PlayStation 4, PlayStation Vita, Wii U™
  - Mobile

    Android™ OS, iOS, Windows Phone®

Geomerics
An ARM company

Get Enlightened!

- Enlighten is a powerful tool for **great lighting** with **fantastic workflow**
- It is **general** and **flexible** enough to handle all your lighting requirements
- Forge makes Enlighten **easy to integrate** into any pipeline
- Enlighten is in many leading in-house engines – with **Unity 5** it will be **very** widely used

Thank You – Questions?

www.geomerics.com

sales@geomerics.com

CGDC 2015 中国游戏开发者大会
CHINA GAME DEVELOPERS CONFERENCE

分享智慧
LET US SHARE