



NVIDIA GRID™ LINK SDK

Kevin Klemmick - NVIDIA GRID™ Link Technical Director, Dictator of Earth

AGENDA

10:00 am — 11:00 am Xun Wang, Max Paklin, Bojan Vukojevic,
Khurrum Islam - The Technology Behind
NVIDIA GRID™ Game Streaming

11:30 am — 12:00 pm Donny Johnson- Data Analytics from the
NVIDIA GRID™ Service

12:15 pm — 12:45 pm Eric Young-Developing Games
for NVIDIA GRID™

12:45 pm — 1:15 pm Kevin Klemmick- NVIDIA GRID™ Link SDK -
Integrating Your Game with NVIDIA GRID™

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At a high level, this is what our architecture looks like:

At it's core.. our platform consists of specially designed highly performant and highly reliable GRID GPUs, hosted in server class systems. This runs on a custom virtualization SW stack, that enables us to utilize our high quality geforce drivers, and geforce experience

Each game runs in it's own virtualization environment, safe from other tenants on the cloud. A web service ties together a cluster of this rendering power. And our low latency streaming technology that <http://unity3d.com/events/roadshow> call Gamestream delivers that to the SHIELD devices.

All of this scaled out, made reliable, monitored and secure on the Amazon web services platform.

OUTLINE OF THIS TALK

The NVIDIA GRID™ Link SDK

- What is it and What Does it Do?

SDK Overview

- Module Overview
- Architecture
- Framework and Standards
- API Methods

Future Plans

Questions and Answers

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INTRODUCING THE NVIDIA GRID™ LINK SDK

What is it?

- A C/C++ Library that can be Linked into your game to Allow Integration with the NVIDIA GRID™ Cloud Gaming Platform

What Does It Do?

- Allows Us to Work with Game Developers to Solve Some Cloud Gaming Challenges

Why do This?

- Better User Experience when Playing Streaming Games
- Reduced Barriers to Entry - Higher Convergence Rates for Developers

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Allows GRID some external control of the game in order handle situations unique to cloud gaming – Save files when a user disconnects or quits, for example.

API MODULES

NVIDIA GRID™ LINK API MODULES

PROGRAM CONTROL

Pause Game
Trigger Game Save
Exit Game

USER DATA

Cloud Save and Restore
of Saved Games and Preferences

GAME SETTINGS

Localization
Disable User Changes
Optimize Graphics Settings

USER INTERFACE

Native Text Entry

PATCH CONTROL

Check for Required Patches
Keep Game Patched to Newest Version

USER ACCOUNT CONTROL

Account Federation for Seamless
Game Login and Sign Up

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Modules and what challenges they address

Program control

Allows us to take action for the user if something happens to them – disconnection from our service, for example.

Pause the game and wait for the user to return.

Save game state and shut down

User saves

storage

Since file system is virtualized, we need to move game saves and user preferences to cloud

Implements a cloud storage solution for developers

Game Settings

runtime.

Since we share VMs and don't have language specific installs, we set the games locale at

Disable changing of certain user settings, such as fullscreen/windowed mode.

Determining and set optimal graphics options (future)

User Interface

Screens are smaller and devices have no keyboards

Native virtual keyboard allows for easy text entry.

Keeping Games Patched

Don't want user waiting to download a patch and we want to keep all games up to date

Check if the current version is runnable – fence game if not.

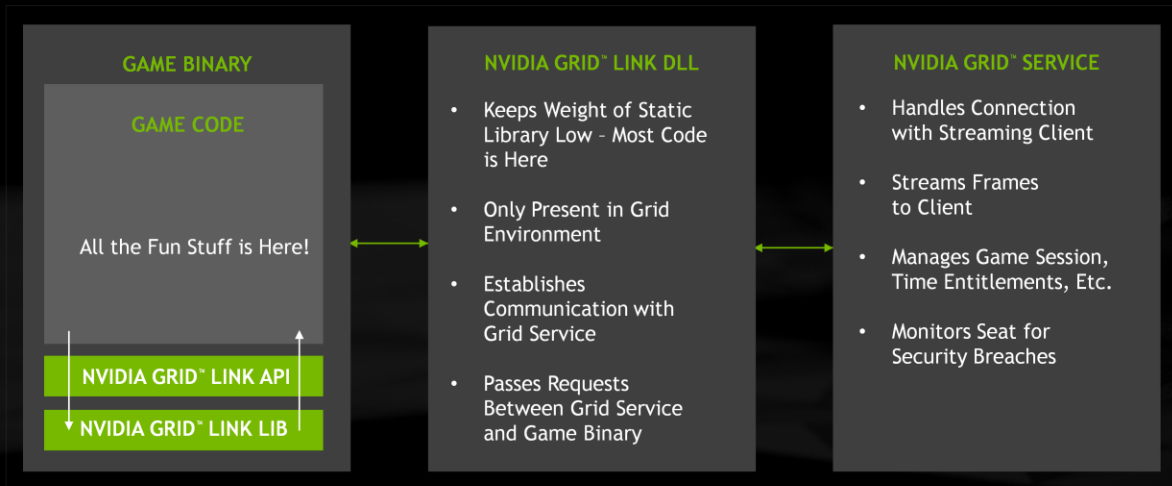
Pre-patching games so they are always ready to play

Account Federation

developers

Lower barriers to entry for users – single sign-on solution that works for users and game

ARCHITECTURE OVERVIEW



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developers

FRAMEWORK AND STANDARDS

C/C++ API provided

Windows Only

Initialized at Game Startup, Shutdown at Exit

All Methods are Safe to Call in All Cases

- Outside of NVIDIA GRID™ Environment API Calls are all Simply No-ops

Most API methods return integer results

- Zero Means Success, Error Otherwise

All Developer Implemented Methods Return Success/Fail or not Implemented

- Developer can Implement Methods Incrementally, or not at all if not Desired or Needed

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The SDK package provides a file with method stubs you can include into your project directly. Stubs return a “Not Implemented” result by default

Including the stub files and linking to the library is super easy.

When application developer implements these methods, they should return “Success” or “Failure” as appropriate

Not Implemented is default value – it let’s GRID know that level of control is not available.

Success means the requested operation completed successfully – response to this can block for otherwise asynchronous operations

Failure mean the requested operation was attempted but failed

Developer implemented methods can be implemented in stages as appropriate – not everything needs to be done in order for it to work.

Developer determines level of integration that’s right for them – developer is free to implement as many or as few methods as is appropriate for their game and business model

GENERAL FUNCTIONALITY

`InitializeGRIDLinkSDK()`

- Called Once at Application Start

`ShutdownGRIDLinkSDK()`

- Called Once at Application Exit

`bool IsGRIDEnabled()`

- Returns True if Running in NVIDIA GRID™ Environment
- Allows Application to Make NVIDIA GRID™/Streaming Behavior Modifications if Desired

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SDK methods

PROGRAM CONTROL

RequestApplicationPause()

- Sent if a User Pages Out of the NVIDIA GRID™ Client on Client Machine or Disconnects from the NVIDIA GRID™ Session
- Implemented as a Pause for Single Player Games, Game Specific for Multi-player

RequestApplicationSave()

- Sent if a NVIDIA GRID™ Session is Ending for Any Reason
- Gives Application a Chance to Save Data Before Exit - Generally as an Autosave

RequestApplicationExit()

- Sent When a NVIDIA GRID™ Session Ends
- Gives Application a Chance to Clean Up and Exit Gracefully - Task Kill Otherwise

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Red means developer implemented method

GAME SETTINGS

LockUserOptions(UserOptions uoOptions)

- Tells Application to Lock Certain User Options
- Options will be Set Optimally for the Host VM by NVIDIA's Onboarding Process

SetLocale(const char* pchLanguageCode)

- Informs Application of User's Language-Country Preferences

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RequestApplicationPause called on client disconnects – allow the game to determine how to handle this.

LockUserOptions used to disable options that are not available or not appropriate to change when running under grid.

-Passes a set of flags – but generally this is going to be used to disable graphics setting changes such as resolution or windowed mode.

SetLocale tells the game what language-culture to run in (standard <lang>-<COUNTRY> format)

-Does require all supported languages to be pre-installed and dynamically selectable

PATCH CONTROL

`IsUpdateRequired(bool* pbUpdateRequired)`

- Query Made by NVIDIA GRID™ Service at Application Start
- Should Return True if Application is not Usable at Current Version

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Should return false only if the game is unplayable at the current patched level – not all clients require the game to be completely up to date

We don't do any in-session patching – if a client is detected as unplayable, we fence the game and will trigger a game patch

Eventually developers will be able to upload builds and schedule them for release

USER DATA

`const Char* GetStorageLocation()`

- Provides the Application with a Directory Path Save Games and User Preferences Can be Saved to in Order to Persist These
- Previous Saved Files Will be Retrieved and Placed Here Prior to Application Start

`NotifyFilesUpdated()`

- Notifies the NVIDIA GRID[™] Service That the Game has Completed Saving or Updating Some Files
- Will Be Done at End of Session - But This Allows on Demand Updates

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Provide a virtualized location to write save files to. Files will be restored to this location on subsequent sessions.

USER INTERFACE

`RequestKeyboardOverlayOpen(GridScreenPosition position)`

- Pops Up a Native Text Input Keyboard for Easy Text Entry on any Device

`RequestKeyboardOverlayClose()`

- Closes Native Text Input Keyboard

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USER ACCOUNT CONTROL

`bool RequestGRIDAccessToken(byte** token)`

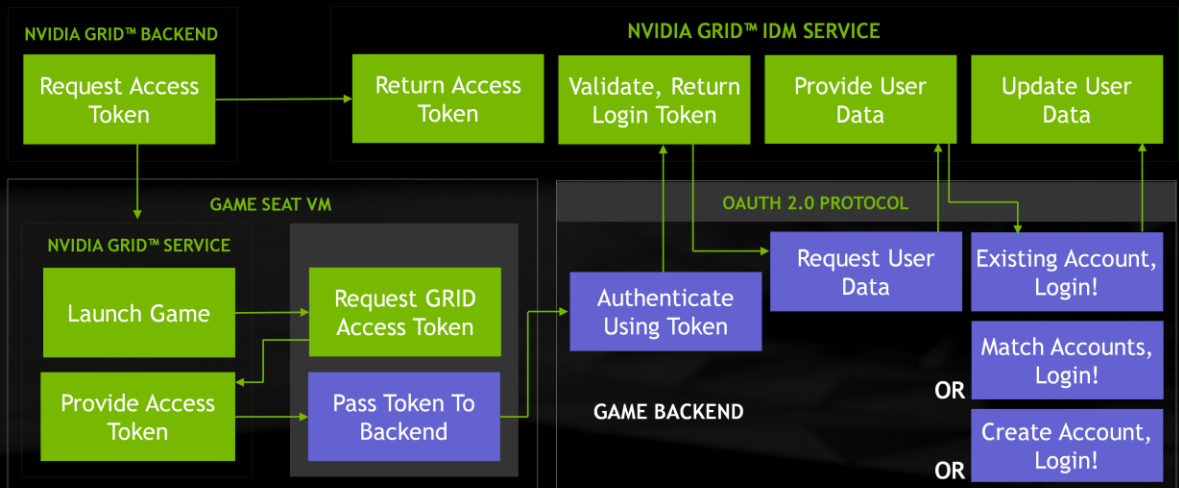
- Obtains a NVIDIA GRID™ Access Token That can be Used by Application Backend in Order to Authenticate a User without Additional Credential Entry or Account Sign Up
- Returns True on Success, False Otherwise. False is Only Expected in Cases Where GRID Does Not Have an Account Federation Agreement with the Application Developer, or if Outside of GRID Environment

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For games that require a user to log-in, we can improve the user experience by doing single-sign-on. Similar to a log-in through Facebook method, this allows GRID to become a source for user data and avoids having the user to input a lot of data at run-time.

AUTHENTICATION FLOW



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TESTING AND DEBUGGING

NVIDIA GRID™ Environment can be Simulated and Tested Through Use of a Test dll

- Developer Can Test all Methods Locally on Their Development Machine

Automated Test Application Provided

- Calls Developer Implemented Methods to Test and Verify Implementation.

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FUTURE PLANS

Access to GRID Store from Application

- In-game and DLC Purchases made Easy

Command Line Tool and Web Portal for Developers

- Upload New Builds as Part of Your Release Pipeline and Schedule Release Dates

Support for Other Programming Languages

- .NET or Others as Required

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Q & A

Questions?

Would You Like to Know More?

- To sign up or have questions, contact:
GridLinkSDK-info@exchange.nvidia.com

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