Nintendo DS Overview

Mark Jawad
Senior Software Engineer
Software Development Support Group

Topics

- Unique System Features
- Software Ecosystem
- Hardware review
  - User Interfaces
  - Graphics
  - Audio
  - Wireless
  - Media options
- Development Software
  - SDK
  - Additional Tools
- Getting Started
- Developer Support

Unique system features

- Dual Screens
  - Brings many new possibilities to game design
  - More information on-screen helps empower the player
- Touch Screen
  - Very intuitive to use
  - Accessible to nearly everyone
- Microphone
  - Helps people connect to the machine, and to others when voice chat is employed

Unique system features

- Onboard real-time clock
  - Track the time of day, day of week, etc
  - Unlock extras on your favorite Holidays
- Access to User Settings
  - Allows you to make a connection with the player
    - Name, favorite phrase
    - Color
    - Birthday

Unique system features

- Accessory Options (via GBA Cartridge / Option Pak slot)
  - Use your existing GBA games to unlock content in the DS game, or unlock content inside the GBA pak
  - Work with us to build your own Option Pak
- Sleep Mode
  - Players can simply close the cover if they need to put the game down for a while
  - Games can be put on hold for many days before the power runs low

Software Ecosystem

- Casual Titles
  - Nintendogs, Brain Age, etc use microphone and stylus to interact with the player
  - Not always considered to be traditional games
    - But fun and entertaining anyway!
- Mainstream games
  - MarioKart, New Super Mario Bros.
- Hardcore
  - Super Princess Peach

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  - ~~Super Princess Peach~~ Metroid Prime Hunters

We broke the status quo

- Cost-effective development platform
  - Simple to program
  - Content doesn't require 50+ person teams
  - Fast development cycle
  - Very reasonable devkit costs
- Unapologetic graphic hardware
  - Yes, it's a feature
  - Part of overall, balanced system design

Processing Cores

- Lots of onboard processing power
  - Main Processor
    - 67.028MHz (4x speed of GBA)
  - Additional onboard processors @ 33.514MHz (2x speed of GBA)
    - Subprocessor for handling of external devices
    - Math co-processor for division and square root acceleration
    - 3D geometry transform engine
  - DMA engines for bulk data transfers
    - Offload the work from the CPUs

Memory

- More memory than GBA
  - 4MB main memory
  - 656KB VRAM
- Larger ROM storage capacity than GBA
- Main CPU has on-die working buffers
  - Instruction and data caches
  - More internal (off bus) work RAM

Touchpad & Microphone

- Handled by the ARM7 Subprocessor
- Both can be polled for the current value
- Both have auto-sampling feature
  - TP can be sampled up to 4 times per frame at 60Hz
  - MIC can be sampled up to 32 kHz
- Lots of cool software for interfacing with these devices

Touchpad & Microphone

User Interface Possibilities

- Touch Pad
  - Simple controls; select, draw, etc.
    - Use large icons; small ones are difficult for some people to accurately select
  - Complex controls: handwriting and shape recognition libraries
- Microphone
  - Voice Recognition Library
  - Voice Communication Library

LCD Specifications

- Each LCD capable of displaying 262,144 colors
  - 6 bits each for R, G, B
- Screen size is 256x192
- Constant refresh rate of 60Hz
- Multiple display modes:
  - Can show 2d/3d graphics generated from onboard graphics engines
  - Can show bitmap images stored in VRAM or transmitted from main memory
- Image capture feature available at runtime
  - Save the current picture to VRAM

2D Graphics

- Each LCD has a dedicated 2d Graphics Engine attached to it.
- 2d Engines are upgraded versions of those found in GBA.
  - Can handle more colors all around
  - Larger virtual screen sizes for backgrounds
  - Also has upgraded scale/rotation options for background images
  - More VRAM available than in previous gen

2d Graphics
(page 2)

- 128 sprites per engine
  - Come in various sizes, from 8x8 to 64x64
  - Possible color options: 16, 256, or 32K colors
  - Up to 16 palettes each of 16c and 256c
- 4 background layers per engine
  - Range in size from 128x128 to 1024x1024
  - Possible color options: 16, 256, or 32K colors
  - One of the layers on 2d Engine A can display output from the 3d graphics engine

3d Graphics

- Geometry Transform unit can handle about 2K polygons / frame
  - Slightly less in practice depending on primitive types used (quad strip, tri list, etc)
- Basic Lighting and texturing available
- Has toon shading, edge marking for stylized graphics look
- Matrix transforms available for vtx, nrm, and texcoords

3d Graphics
(page 2)

- Has anti-aliasing, fog, and transparency
  - But no texture filtering
    - So make sure to design assets for the hardware
- All rendering done via Line Buffers!
  - No concept of a Frame Buffer on the DS
- 3d system is sufficient for an entire game
  - Works best when used in conjunction with 2d graphics engines

Audio overview

- Stereo Sound via speakers as well as headphone jack
- Up to 16 simultaneous voices
- Sound hardware can handle voice types
  - PCM, ADPCM
  - PSG (sine wave generators)
  - White Noise
- Slides from previous DevCon are a fantastic reference!

Wireless features

- Local area wireless communication
  - DS to DS
  - Wii to DS (certain restrictions apply)
- Internet communications via Nintendo Wi-Fi Connection
  - DS to DS (for game play)
  - DS to Server (for score tracking, matchmaking, etc)

Media Options
Game Cards

- There are two types of technology behind DS Cards
  - Mask ROM
    - Faster reads (about 5.5MB/sec)
    - Smaller capacity (up to 512 Mbit in size)
  - One-Time ROM
    - Slower reads (only about 1.2 MB/s)
    - Larger capacity (currently up to 2 Gbit in size)
    - Re-orders for One-Time ROMs can be supplied slightly faster than for Mask ROMs

Media Options
Backup Memory

- All games must use backup memory
  - Save game passwords are a thing of the past
- Various types and sizes are available
  - EEPROM comes in 4-, 64-, and 512- KBit sizes
  - FLASH available in 2Mbit and 4MBit parts
  - Others may be available in the future

Media Options

Expansion possibilities

- GBA slot on bottom is not only for backwards compatibility
- We currently offer a Rumble Pak accessory for all to use
- You can work with Licensing to create your own Option Pak if you like
- There are a few titles out there already (both 1st and 3rd party) that use custom peripherals

Media Options
Downloadable content

- DS games can wirelessly replicate themselves to other players in the vicinity
  - Lets many people enjoy the game even if they don't have the game card
  - Content is limited by what can fit in RAM
- DS Download Stations can serve game demos to potential buyers
  - 9800 retail locations all over the country

Development Software

- Nintendo Provides:
  - CodeWarrior dev tools
    - Compiler
    - IDE
  - Core SDK tools and libraries
    - We give you source code to the libraries! *WooHoo!*
  - Stand-alone Debugger
  - Lots of middleware (discussed later today)

SDK Features

- Basics:
  - OS, GX, CARD, WM, SND, MI, CP, TP, MIC, FS, CTRDG, PAD, RTC
- Extras:
  - CHT, DGT, ENV, FX, MATH, VIB
- Build tools
- ROM Creation utilities

Additional Software Goodies

included in the SDK

- Overlay system
  - Use when you can't fit the entire program into RAM
- Thread system
- IS-NITRO-DLL
  - Lets the DS communicate with a PC
    - Production DS via IS-NITRO-UIC tool
    - IS-NITRO-EMULATOR tool can connect directly
  - Great for game tweaking, file serving, etc

Getting Started

Two options:

1. Use base SDK and provide your own tools
   - Slower startup for your team
   - Full control over how everything works
2. Use SDK and Middleware
   - Get started faster
   - Slightly less control over how things work

Getting Started

- Plot out your memory map
  - Main RAM usage
    - You get up to 2.5MB to boot with
    - And about 3.75MB total
  - VRAM usage
    - Especially for 2d BGs and palettes
- Design for data streaming
- Prepare ahead of time for Wireless play
  - Especially if using internet connectivity

Development Support

- Support via:
  - Warioworld.com
  - Online newsgroups
  - Us!
    - support@noa.nintendo.com
    - lotcheck@noa.nintendo.com
    - submissions@noa.nintendo.com
    - developmentparts@noa.nintendo.com

Recap

- Versatile platform
- Easy to develop for
  - And very cost effective
- Make the game that you want to make
  - 2d only
  - 2d / 3d hybrid
  - 3d only
- Connected to the ‘net
- Over 11.3 Million people in North America have one