Introduction to Game Development

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2006, Build 1
Introduction to Game Development

- Game platform
- Game types
- Game team
- Game development pipeline
- Production tools
- System analysis
- Wang’s method
**Game Platform**

- **PC**
  - Single player
  - Match Makings
  - MMOG (Massive Multi-player Online Game)
  - Web-based Games

- **Console**
  - Sony PS2 / PS3
  - MS Xbox / Xbox 360
  - Nintendo GameCube / WII

- **Arcade**
  - Coin up

- **Mobile**
  - Nintendo GBA
  - Nintendo DS
  - Sony PSP
  - Hand-held
Game Development on PC (1/2)

- PC is designed for general office application.
- Not for entertainment purpose
- A virtual memory system
  - Unlimited system memory
- But video memory is limited.
  - For frame buffers, z buffers, textures, vertices, ...
- PCI / AGP might be a problem for performance.
- Open architecture
  - Hardware driver version issue
  - Different capabilities
  - Different performance
- Compatibility test is very important.
- Patches
  - Game shipping in CD/DVD Rom
  - Installed on hard disk
Game Development on PC (2/2)

- **Input devices**
  - Mouse
    - “一鼠到底”
  - Keyboard
    - Hotkeys
    - Typing
  - Mouse + keyboard

- **Network**
  - PC with networking is common.
  - Match-makings using game lobby
  - MMOG

- **Development is easy to setup.**
  - Visual C/C++ with DirectX
Specific hardware designed for games

Single user OS

Single process OS

Closed system

Native coding environment
  - Proprietary SDK
  - Hardware related features

Limited resources
  - Memory for everything
    - 32MB for PS2
    - 64MB for Xbox
    - But 512MB for next-gen console

One console runs, the others do!

No keyboard, no mouse

Use gamepad
Certification required

Next-gen console hardware features:

- Multiple core CPU
  - Xbox 360: Three-core Power PC (3.2G)
  - Wii: Due-core Broadway
  - PS3: IBM Cell (7 core)

- GPU
  - Xbox 360: ATI (500MHz), DX9 + HLSL
  - Wii: ATI Hollywood
  - PS3: NVIDIA RSX@550MHz, OpenGL ES + cg

- Video output:
  - Xbox 360: D4 (1080i/720p)
  - Wii: D2 (480i/480p)
  - PS3: D5 (1080i/1080p)

- Memory:
  - Xbox 360: 512MB
Game Development for Consoles (3/4)

- Wii: 512MB flash
- PS3: 256MB system + 256MB video

- Web browser:
  - Xbox 360: none
  - Wii: yes
  - PS3: yes

- Controller sensor:
  - Xbox 360: none
  - Wii: yes - 3 axes
  - PS3: yes - 6 axes

- USB 2.0
  - Xbox 360: 3
  - Wii: 2
  - PS3: 4

- Hard disk
  - Xbox 360: 20GB (optional)
Wii: none
PS3: 20GB / 60GB

WiFi:
- Xbox 360: yes
- Wii: yes
- PS3: none / yes

HDMI:
- Xbox 360: none
- Wii: none
- PS3: yes (1.3)

光碟機:
- Xbox 360: DVD, HD DVD (optional)
- Wii: Wii 專用 (12cm), GC 專用 (8cm)
- PS3: Blu-ray
Game Types

- RPG (Role playing games)
- AVG (Adventure games)
- RTS (Real-time strategy games)
- FPS (First-person shooting games)
- RSLG (戰棋)
- STG
- Sports
- Action
- Puzzle games
- Table games
- MMORPG
  - Massive Multiple Player Online Role Playing Games
Game Team Members

- 開發團隊
  - 製作人
  - 執行製作人
  - 企劃團隊
  - 程式團隊
  - 美術團隊

- 行銷業務團隊
  - 產品經理 (PM)

- 測試團隊

- 遊戲審議委員會
  - Game project approval

- 遊戲經營團隊
  - 線上遊戲 game master (GM)
  - Customer services
  - MIS
Game Producer 遊戲製作人

- Team leader (usually)
- 資源管理 (Resource management)
- 行政管理 (Administration)
- 專案管理 (Project management)
- 向上負責 (Upward management)
- 團隊的決策
- 風險管理
遊戲執行製作人

- 專案管理執行
- **Daily** 運作
  - House keeping
  - Meeting coordinator
  - Schedule checking
  - Cross-domain communication
- **Usually not a full-time job position**
  - A position for training and becoming a producer
故事設計 (Story telling)
腳本設計 (Scripting)
玩法設計 (Game play design)
角色設計 (Character design)
動作設計 (Animation design)
關卡設計 (Level design)
特效設計 (Effect design)
物件設計
介面設計 (User Interface design)
遊戲調適 (Game tuning)
數值設定 (Numerical setup)
AI 設計 (Game AI design)
音效設定 (Sound FX setup)
場景設定 (Scene setup)
Game document writing
Game quality checking
Visual setup for game design
- 2D setup
- 3D setup

Graphics design and production
- 場景 (Terrain)
- 人物 (Character)
- 建模 (Models)
- 材質 (Textures)
- 動作 (Motion / Animation)
- 特效 (FX)
- User Interface
- 行銷支援 (封面. 海報..等)
■ 遊戲程式 (Game Program) 撰寫
■ 遊戲開發工具 (Game Tools) 開發
  ■ Level editor
  ■ Scene editor
  ■ FX editor
  ■ Script editor
  ■ Game editor
■ 遊戲 Data exporters from 3D animation Software
  ■ 3dsMax / Maya / Softimage
■ Game engine development
■ Game technique research
■ Online game server development
遊戲開發流程

Basic Procedures for Game Development

- 發想 (Idea)
  - 概念批准 (Concept approval)

- 提案 (Proposal)
  - 雛形 (prototype)

- 製作 (Production)
  - Pre-alpha

- 整合 (Integration)
  - Alpha

- 測試 (Testing)
  - Beta
    - 除錯 (Debug)
    - 調適 (Tuning)
遊戲發想 (Concept Design)

- 遊戲類型 (Game types)
- 遊戲世界觀 (Game world)
- 故事 (Story)
- 遊戲特色 (Features)
- 遊戲玩法 (Game play)
- 遊戲定位 (Game product positioning)
  - Target player
  - Marketing segmentation / positioning
- 競爭對手評估
- 風險評估 (Risk)
  - SWOT (Strength/Weakness/Opportunity/Threat) 分析
- 產出物
  - Concept Design Document (CDD)
遊戲提案 (Proposal)

- 系統分析 (System analysis)
- GDD 撰寫 (Game design document)
- MDD 撰寫 (Media design document)
- TDD 撰寫 (Technical design document)
- 遊戲專案建立 (Game project)
  - Schedule
  - Milestones / Check points
  - Risk management
- 測試計畫書
- 團隊建立 (Team building)
- 產出物
  - GDD
  - MDD
  - TDD
  - The Team
遊戲開發 (Production)

- 美術量產製作
  - Modeling
  - Textures
  - Animation
  - Motion
  - FX

- 程式開發 (Coding)

- 企劃數值設定
- ...

量產！
遊戲整合 (Integration)

- 關卡串聯 (Level integration)
- 數值調整 (Number tuning)
- 音效置入 (Audio)
- 完成所有美術
- 程式與美術結合
- Testing within the game team
- Focus group (User study)
  - Release some playable levels for focus group.
  - Get the feedback from focus group to adjust the game play.
  - Invited outside game players but evaluation in-house
遊戲測試 (Test)

- **Alpha 測試**
  - 除錯 (Debug)
  - Make the game stable

- **Beta 測試**
  - 數值微調
  - Game play 微調
  - 對線上遊戲而言 (MMOG)
    - 封閉測試 (Closed beta)
      - Invited game players
    - 開放測試 (Open beta)
      - Free for public players

- **極限測試 (Critical testing)**
  - Only for MMOG
  - Continuously implementing
  - For servers
Game Development Tools for Programming (1/2)

- **System Tools**
  - **Visual C/C++**
    - .Net 2003
    - VC/C++ 7.1
    - Visual C/C++ 6.0 + SP5
  - **NuMega BoundsChecker**
    - Finding memory leaking
  - **Intel vTune**
    - Finding computation performance bottlenecks
    - for CPU
  - **PIX**
    - Finding graphics performance bottlenecks
    - For GPU
Game Development Tools for Programming (2/2)

- **SDKs**
  - **System API**
    - Win32 SDK or MFC
    - **DirectX SDK** or OpenGL
    - Socket library
  - **Middleware (Game engine)**
    - Renderware
    - Unreal
    - ...
  - **Physics**
    - ODE
Game Development Tools for Artists

- **3D tools**
  - Autodesk 3dsMax
  - Maya
  - Softimage XSI

- **2D tools**
  - Photoshop
  - Illustrator

- **Motion tools**
  - Motion capture devices
  - Motion Builder
  - FiLMBOX

- **Etc**
  - Z Brush
Pre-production Stage - System Analysis

- **Thing-to-do**
  - Brain storming
  - Integration
  - Scheduling
  - Major technical specification
  - Resource allocation
    - Engine used
    - Production tools
    - Human resources
    - Budgets
  - Check points
  - Milestones
  - Project management

- **Tools**
  - MS Project
    - Must
Pre-production Stage - Production Specification (1/6)

- Sorted by content
  - Scene
    - Terrain
      - For visual
      - For terrain following
  - Static objects
  - Dynamic objects
    - Animated by artists
    - Animated procedurally
  - Scene management system
- Characters
- Data
  - Bone-skin
  - Vertex animation
  - Segments
  - Skins
Pre-production Stage - Production Specification (2/6)

- Motion
  - Pose management
    - Playing
  - Motion blending
  - Motion connection

- Production issues
  - Tools used
    - Animated by artists
    - Animated procedurally

- Special FX
  - Environment
  - Scene
  - Characters
  - Combat
  - Sound
  - Etc
Pre-production Stage - Production Specification (3/6)

- User interface
  - Menus
  - Dialogue
  - Mini-map

- Sorted by production
  - Modeling
    - Triangular mesh
      - Vertex animation
    - Vertex colors
      - Rendered to vertices
    - Vertex normals
      - Smoothing groups
  - Texturing
    - Multiple textures
  - Skin weights
Pre-production Stage - Production Specification (4/6)

- Level-of-details

- Textures
  - Lightmap
    - Rendered to textures
  - Bump map
  - Texture blending
  - Normal map
  - Environment cube map
  - Texture formats
  - Texture pixel formats
  - Alpha channel

- Animation
  - Character animation
  - Texture animation
  - Texture coordinate animation
  - Vertex animation
Pre-production Stage - Production Specification (5/6)

- **Dynamics**
  - Particle system
  - Rigid-body dynamics
  - Soft-body dynamics

- **Lighting**
  - Static lighting
    - On vertices
      - Vertex color
    - With textures
      - Lightmap
  - Dynamic lighting
    - Geometry lighting
      - Lights
      - Materials
    - Image lighting
      - Diffuse map
Pre-production Stage - Production Specification (6/6)

- 2D images
  - Image format used
  - Opacity issues
- Game data
  - Portals
    - For game levels
  - Triggers
    - By locations
    - By timers
Game Systems (1/3)

- Control system
  - User input
    - Mouse or keyboard
    - Keyboard layout
  - Camera control
    - View angle
    - Interaction with player
  - A “walk through” system
- Combat system
  - Controls
  - Motion management and blending
  - NPC AI
  - FX
    - Visual
    - Audio
Game Systems (2/3)

- **Reward system**
  - Number system
  - Levels
  - Damage

- **User Interface**
  - Menu
  - Mini-map
  - Messages
    - Blood bar
    - Caption

- **Game FXs**
  - Combat FXs
  - Environment FXs
  - Scene FXs
  - Character FXs
  - Sound FXs
Game Systems (3/3)

- Village system
  - Scripting
  - Story
  - Trading

- Network
  - Data packing
  - Encryption
  - Data synchronization

- The main program
  - Main loop
  - Level management
  - Game flow management
  - Configuration
  - Save / Load
  - Cheat code system
Wang’s Method for Game Development (1/5)

- **Background (assumed)**
  - 10 months production period (except the game design period)
    - 1 month for pre-production
    - 8 months for game production
    - 1 month for testing
  - Single player game design or the client program for a network game
  - Two well-experienced programmers inside
    - One for main program
    - One for auxiliary systems
  - With a well-trained graphics production team
    - Assume the graphics mass production is not the bottleneck.
  - Assume there are no technical challenge inside
Wang’s Method for Game Development (2/5)

Wang’s method:

- Walk Through

<table>
<thead>
<tr>
<th>Scene specification test</th>
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</thead>
<tbody>
<tr>
<td>Character specification test</td>
</tr>
<tr>
<td>The main program framework</td>
</tr>
<tr>
<td>Game control system</td>
</tr>
<tr>
<td>Camera system</td>
</tr>
<tr>
<td>Terrain following</td>
</tr>
<tr>
<td>One scene ready</td>
</tr>
<tr>
<td>One character ready (Stand-by, walk, run)</td>
</tr>
<tr>
<td>Sky box or sky dome ready</td>
</tr>
<tr>
<td>Motion management</td>
</tr>
</tbody>
</table>

2.5 Months
Wang’s Method for Game Development (3/5)

Combat System Framework

- Add combat control (Attack, stun, ...)
- Move forward in combat (root-base)
- Hip-rotation in combat (root-base)
- Attack collision
- One NPC ready (Stun at least)
- Mini-map

1 Month
Wang’s Method for Game Development (4/5)

<table>
<thead>
<tr>
<th>NPC in Combat</th>
<th>Some NPCs ready (with attack, …)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPC AI</td>
</tr>
<tr>
<td></td>
<td>FX system ready</td>
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<tr>
<td></td>
<td>Inventory system ready</td>
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<tr>
<td></td>
<td>Some FXs ready</td>
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<tr>
<td></td>
<td>Combat UI ready</td>
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<tr>
<td></td>
<td>Configuration system ready</td>
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<tr>
<td></td>
<td>Reward system ready</td>
</tr>
</tbody>
</table>

2 Months
<table>
<thead>
<tr>
<th>Levels</th>
<th>Cheat-code system</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level data ready</td>
</tr>
<tr>
<td></td>
<td>Cut-scene system</td>
</tr>
<tr>
<td></td>
<td>Village system</td>
</tr>
<tr>
<td></td>
<td>Full menu flow OK</td>
</tr>
<tr>
<td></td>
<td>Dialogue system</td>
</tr>
<tr>
<td></td>
<td>Major graphics data production ready</td>
</tr>
<tr>
<td></td>
<td>Save/Load</td>
</tr>
</tbody>
</table>

2.5 Months