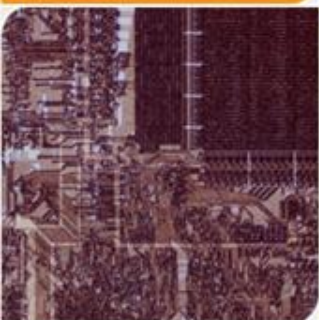


# CS4803/CS8803 PGC Design and Programming of Game Consoles

Spring 2012

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# What Will We Learn?

- ~~Game programming~~
- ~~Game architecture~~
- Graphics programming
- Computer architecture case studies → Game consoles
- Graphics processor hardware
- FPGA programming
- CUDA/OpenCL programming
- Embedded processor programming (Nintendo DS programming)



# Game Console

- CPU
- GPU



# Who Should Take ?

- If you want to develop
  - Xbox 720 Xbox 1440?
  - Playstation 4,5,6 ?
- If you want to program efficiently using those hardware.
  - ARM Processors, Nintendo DS
- Learn the details of graphics hardware
- Experience with FPGA Programming
- Background
  - CS2200



# Course Info

- <http://www.cc.gatech.edu/~hyesoon/spr12/index.html>

4 weeks Nitendo DS programming/ ARM processors

4 weeks Graphics processors, introduction to graphics,  
CUDA programming

4 weeks FPGA programming

3 weeks FPGA programming + case study



# Changes from Last Year's Course

- **FPGA Labs**
  - **Boards**
- Lab days: have programming experience with some other programming platforms
- The importance of CUDA programming is reduced (not because CUDA becomes less important)

# Why Game Consoles?





# Effects of Game Industries

- Leading the industry
- Game processors are used for other applications
  - GPGPU:
  - Medical image processing
  - Scientific applications
- Movie industries





# Requirements for GC

- Time constrain
- Lots of Data
- Heavy use of graphics
- Both Integer/floating point operations are important
- Floating point → low precision
- Stream applications
- Embedded systems
- Various I/O devices
- No comparability issues (no reason to support legacy code)
- All the platform is stable:
- Platform optimizations



- No TA
  - Help each other!
  - Use newsgroup to post and ask questions
- Newsgroup activity is counted as class participation points.
- [cs4803pgc-2012@googlegroups.com](mailto:cs4803pgc-2012@googlegroups.com)

# News from CES 2012



## CES 2012: Intel enters the lucrative smartphone market

Intel teams up with Lenovo and Motorola for launch later this year, of the K800, an atom-based smartphone

**Charles Arthur** and agencies  
guardian.co.uk, Tuesday 10 January 2012 23.34 EST  
[Article history](#)



Intel CEO Paul Otellini holds an Intel smartphone reference design during a keynote address at CES. Photograph: Steve Marcus/Reuters

## Sony's new tablet



▶ CAPTION

Jack Dempsey, AP

## GAMING BLEND

# Epic Fail: Microsoft Fails To Announce Xbox 720 At CES 2012

Author: William Usher

published: 2012-01-09 21:05:45



As if it really needs to be drilled home, Microsoft DID NOT announce a new console at this year's Consumer Electronics Show. The keynote intro came and went without even a whisper of a new console, despite a little bit of goading from Ryan Seacrest towards Microsoft's Steve Ballmer to reveal any additional info on products for 2012, there was nothing. I suppose their announcement about no longer doing **keynote speeches** or having booths at the show should have been a hint enough.



# GAME WORKLOADS



# Game Workload Characterizations

- Still graphics is the major performance bottlenecks
- Previous research: emphasis on graphics
  - 2D/3D graphics tests
- Example: 3DMark Vantage
  - CPU and GPU tests
  - visual and game-play effects
  - CPU side: Physics Simulation and AI
  - Rendering tests (both CPU and GPU)

<http://www.3dmark.com/>

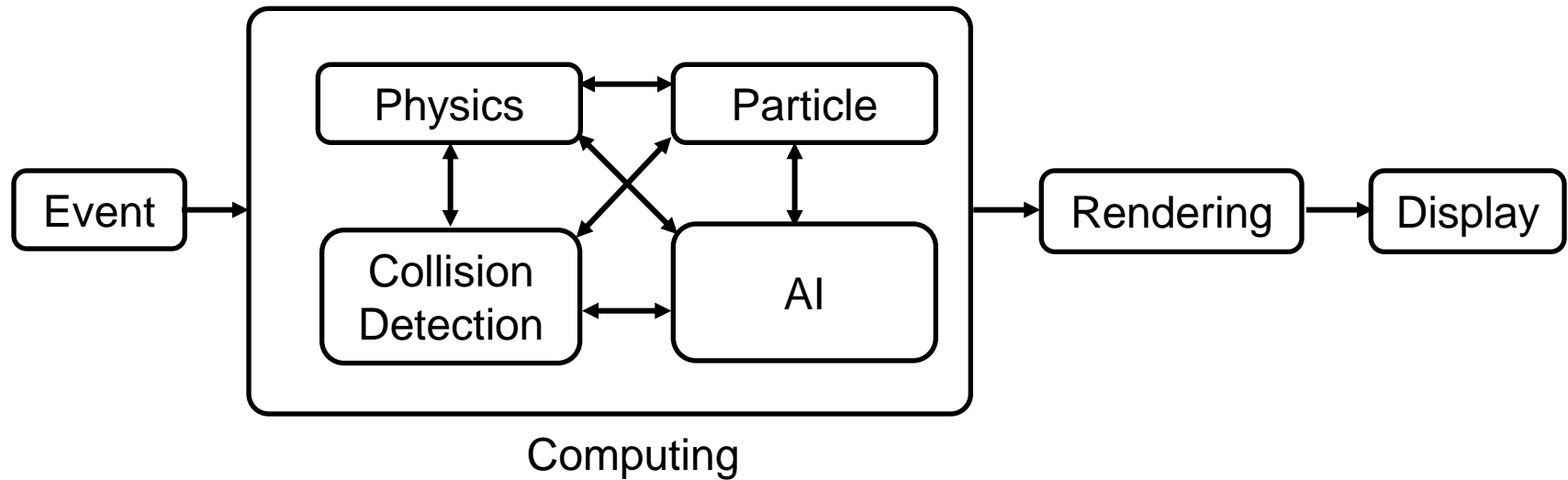


# Game workloads

- Several genres of video games
  - First Person Shooter
    - Fast-paced, graphically enhanced
    - Focus of this presentation
  - Role-Playing Games
    - Lower graphics and slower play
  - Board Games
    - Just plain boring



# Overview of Game Engine



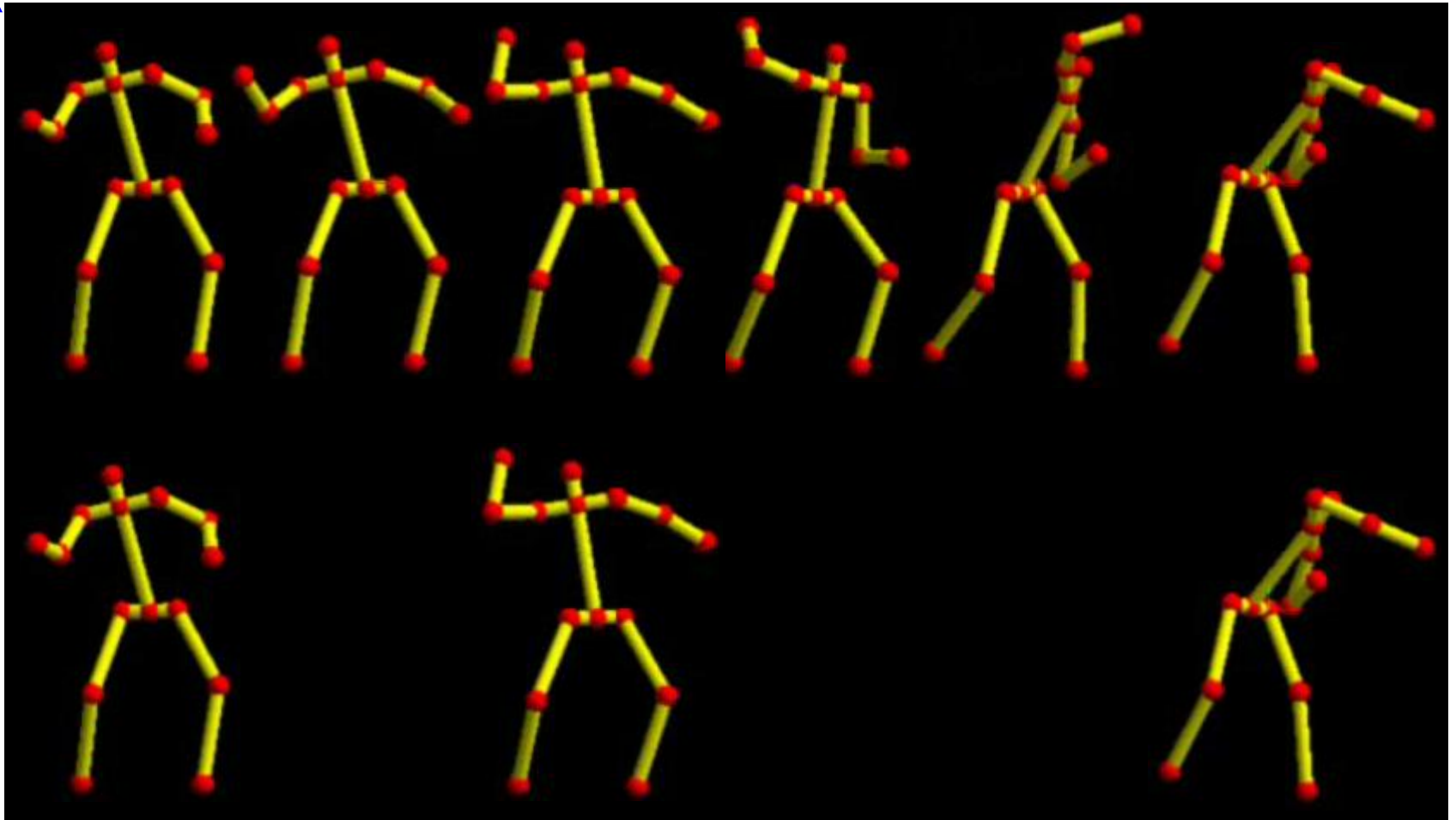




# Frame Rates

- Current game design principles:
  - higher frame rates imply the better game quality
- Recent study on frame rates [Claypool et al. MMCN 2006]
  - very high frame rates are not necessary, very low frame rates impact the game quality severely

# A First Cut: Reduce Frame Rates



Snapshots of animation [Davis et al. Eurographics 2003]

# Game workloads

