Pamper your Pet with CPU Power

Brad Werth
Intel Corporation

Austin GDC 2008
But first, a kitten
Pets are part of the authorship you give to your players

Movement is key to pet personality

Rock wallaby, or...

... pet rock?

Public domain courtesy of commons.wikimedia.org
How it’s done today

Courtesy of Clayton Hughes (http://www.claytonhughes.com/projects.html)
Can we Build a Better Pet using bones?

- Bones are easy to compute
  - more bones
  - funky bones
Can we Build a Better Pet **without** using bones?

- What about the skin?
We can use cloth for soft-body characters
Here’s how cloth is simulated

\[ f \sim k \times (d' - d) \]
Watch it drop!
It’s easy to make a ghost with classic cloth
Torsion models resistance to bending and twisting

\[ f \sim (k'd' + k''d'') \]
Torsion forces give you more control over the surface
Make an ooze
Make a carpet
Kitty!

Public domain courtesy of commons.wikimedia.org
A pet cannot live on tension and torsion alone

• Non-local connections
  – Prevents stretching and folding while forces propagate

• Velocity damping (friction)
  – Prevents jittering

• Acceleration damping
  – Prevents explosive oscillation

• Rotation damping (viscosity)
  – Prevents rotational oscillation
Highly-detailed pets require a lot of computation

move pet relative to target

for each node:

apply gravity, damping, friction

collide against obstacles
On a multi-core CPU, we can defer the calculation

move pet relative to target

for each node:

// calculate forces and normals
apply gravity, damping, friction
collide against obstacles
Don’t just defer it, parallelize it

Courtesy of Intel® Threading Building Blocks

class ConnectionForcesContext
{
    ConnectionForcesContext();
    ConnectionForcesContext(ConnectionForcesContext &context, tbb::split);
    void join(const ConnectionForcesContext &context);
}

void Pet::calculateConnectionForces(ConnectionForcesContext *pContext)
{
    tbb::parallel_reduce(
        tbb::blocked_range<unsigned int>(0, c, uGrainSize),
        *pContext
    );
}

www.threadingbuildingblocks.org
Keep “spare” cores busy during other computation

single-threaded mode here

work is spread across 3 threads

we do work in the gap

main thread could finish the job here

4 pieces on 3 threads
Meow!

Public domain courtesy of commons.wikimedia.org
Simple updates

• Not all your users have multi-core processors -- what to do?
What’s next?

• Integration with standard model formats
• Play nice with bone-and-skin
• Math note: change to Verlet integration
What was it all about?

• Pets/characters are a valuable part of your game design
• Animation is key to character personality
• More CPU resources are available today
• Scale your character animations to reward users with better hardware
Have a ball
Check it out

• [www.intel.com/software/gdc](http://www.intel.com/software/gdc)
• bradley.j.werth@intel.com

Public domain courtesy of commons.wikimedia.org