

Birds on the Wall

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The CoSMoS Project

- Developing reusable software engineering techniques and design patterns for complex systems modelling and simulation
 - ... as you've just heard from Fiona
- Driven by case studies
 - Both textbook examples and research applications
- Using process-oriented techniques to build scalable massively-concurrent simulations
 - Eric will go into more detail on this next



The Tromsø Display Wall

- 22-megapixel back-projected display
 - 28 projectors, each 1024x768
 - 28 3.2GHz Pentium 4 PCs with gigabit network
 - Link to larger cluster downstairs
 - Inspired by Princeton project; now several around
- Standard interface to various input devices
 - Hand gestures, 3D sound, keyboard and mouse...
- Existing applications include weather forecasting and collaborative ophthalmology



The Tromsø Display Wall



Complex Systems on the Wall

- Lots of detail on big simulations – get up close!
- Experiment and show multiple outcomes...
- ... or multiple perspectives ...
- ... or multiple levels of scale
- Convenient interaction
- Bring your friends – easy to point and discuss

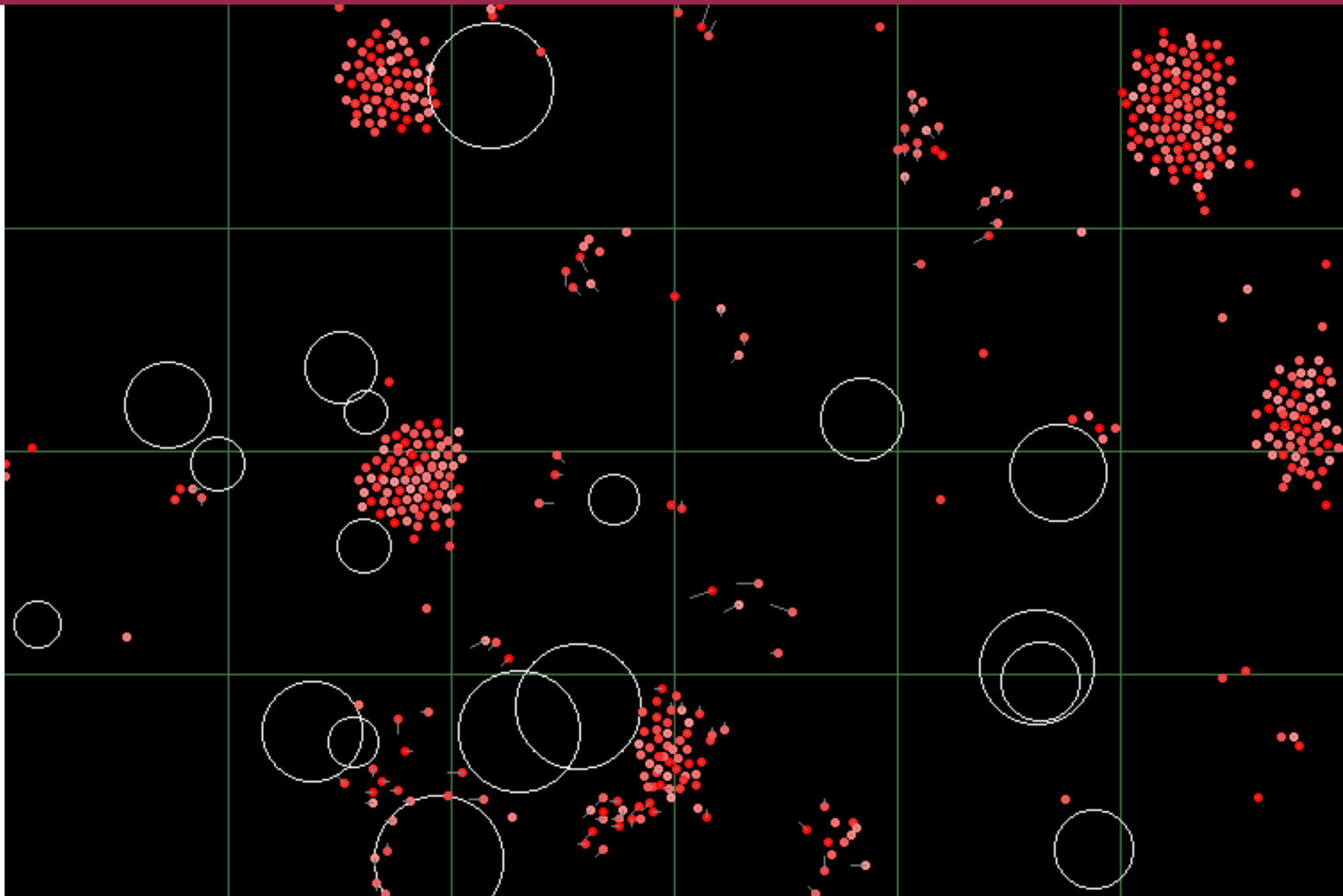


Occoids

- Reynolds' boids: simulated bird flocking
 - 2D (or 3D or...) continuous space
 - One of our first case studies, but we've found it very useful as an example...
- Massively-concurrent occam-pi implementation
 - Agents are processes
 - Regions of space are processes
 - Agents communicate with different regions as they move around



Occoids



Distributing Occoids

- We want to distribute the simulation across a cluster of machines – bigger simulations!
 - Have boids migrate between machines
- Problem: need to minimise network load
 - Aggressive local caching and proxy processes
- Problem: minimise effects of network latency
 - Used asynchronous messaging (instead of cheap synchronous) along with patterns that make it safe
 - Developed Trap, an effective network messaging framework



Video 1



Interactive Occoids

- The real power of the Display Wall comes from being able to easily interact with a simulation
- Added an interface to the Display Wall messaging framework to read gestures
 - Add new boids and trees to the simulation
 - Control predators
 - Control wind speeds
- (This is not in the paper, but please ask us for more details if you're interested!)



Video 2, 3



Conclusions

- We've developed a scalable concurrent implementation of the boids model
- Modified it to run efficiently on clusters like the Display Wall with distributed visualisation
 - For the technical details, see the paper!
- We've extracted design patterns and reusable software components from this work, and have since used the same techniques to develop other distributed simulations
- Any questions?

