POETS Demonstrations

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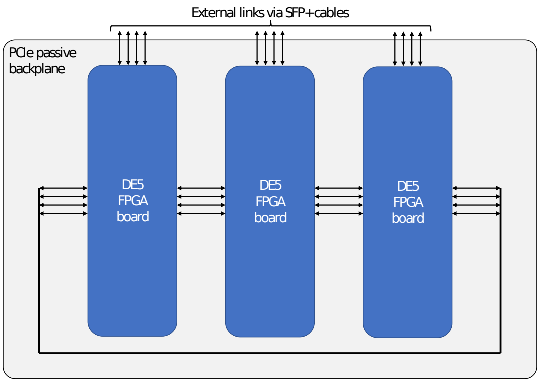
Introduction

POETS - **P**artially **O**rdered **E**vent **T**riggered **S**ystems - is a technology based upon the idea of having an extremely large number of small cores, embedded within an extremely fast, hardware, parallel communications infrastructure. Communication between cores is carried out using small, fixed size, hardware data packets, referred to as *messages*.

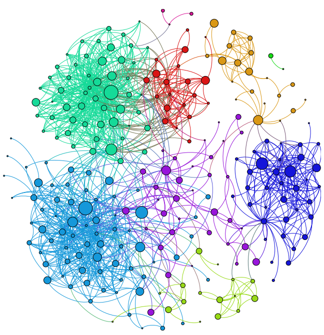


The POETS project describes the research and development of hardware featuring such a topology, a software infrastructure, and applications which can benefit from this platform.

The prototype hardware, maintained at the University of Cambridge, features 12 FPGAs, each of which contains 64 concurrent cores connected by a Network-on-Chip for passing messages which are fixed at 64 bytes. Each core supports 16 threads, totalling 12288. FPGAs are fully interconnected, and these inter-FPGA links are 10 Gbps.

At DATE 2019, we will demonstrate applications running on the prototype POETS hardware. Over the internet, these machines provide data of the running applications which is used to generate visualisations of these applications in real time. The demonstrated applications are discussed below.

Graph Traversal Algorithms



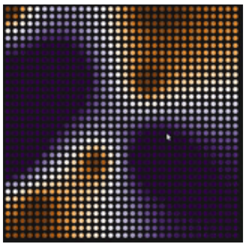
Technological advances in the last decade have made it possible to collect large volumes of data and construct graphs of unprecedented scales, powering applications such as drug discovery and fraud detection. As more data is collected, these applications become increasingly dependent on our ability to run complex algorithms on large graphs, a computational problem that scales poorly on conventional computers.

The connectivity of the POETS hardware offers a medium to represent and run computations on graph data structures. Graph nodes are mapped to individual devices that self-coordinate to run analyses by exchanging messages along graph edges. This approach provides better scalability for larger graphs which can be traversed in relatively similar time scales.

This demo will calculate the shortest path between pairs of graph nodes. This runs on top of remote POETS hardware, and is visualised at the conference to see this running in real-time.

Heat Dissipation Simulation

Heat dissipation is an interesting application for use with POETS. Traditional computing would need to iterate over each cell in an object and calculate the new temperature value, based on surrounding cell temperatures. This can be lengthy for larger areas.



Using POETS technology, messages can be sent to pass the temperature values to neighbours only when a change in the temperature has occurred, and cells can calculate this concurrently.

The heat source in this demonstration can be the cursor of the laptop on which the visualisation runs, allowing for an exhibitor to spread the heat themselves. This leads to heat trails which can be seen dissipating. This demonstration aims to show the capabilities of POETS technology, which can react to stimulus at run time, via the internet.

Particle Simulations

Particle simulations can feature many thousands of particles and the interactions between them need to be calculate. Iterating over each bead to calculate this can be a lengthy process in simulators run on conventional computers.

A particle simulation with POETS splits the simulated volume into smaller, equal units. Each then performs calculations concurrently, of the interactions of particles within the unit, and the particles of neighbouring units, passed between in messages.

This demonstration will show the entire volume of a simulation in real-time as it runs in Cambridge. Particles will be move and interacting, forming structures which can be seen based on the properties of the particles being simulated.

This demo can also be interacted with - allowing the cursor to become a highly repulsive particle at the edge of the volume. This should show beads reactively moving away from the cursor in real-time, while continuing the standard interactions with surrounding particles.