Liszt Updates
Chinmayee Shah, Gilbert Bernstein, Elliott Slaughter, Sean Treichler
Philip Levis, Alex Aiken, Pat Hanrahan

Language Design

Applications
  Spring-mass
  Soleil (CFD)
  Lulesh

Domain Libraries
  Mesh
  Grid
  Particles

Platforms
  CPU
  GPU
  Cluster

Unified Liszt Relations

Example Code

local Tetmesh = require 'domains.tetmesh'
local dragon = Tetmesh.Load 'dragon.veg'

dragon.edges:NewField('stiffness',L.float):Load(2)
dragon.vertices:NewField('acc',L.vec3f):Load({})
...

define fields of data

local liszt ComputeForces(v : dragon.vertices)
  var force : L vec3f = (0,0,0)
  for e in v.edges do
    var diff = e.head.pos - v.pos
    force = e.stiffness * (e.rest_len - diff)
  end
  v.acc = force / v.mass
end
...

define per element computation

for i = 1, 300 do
  dragon.vertices:foreach(ComputeForces)
end

sequence of data parallel computations

Partitioning Across Nodes

Computation: c(1,0).velocity - c(-1,0).velocity

Stencil Analysis

Ghost Regions

Partition Tree

foreach call

Task 1
Task 2
Task 3
Task 4

Liszt Computations
computations over ghost + central regions

Planner
(typed) computation + relation → partition data

How to partition across & within nodes?

What ghost regions to use?

• Determine ghost strategy after aggregating different access patterns
• Multiple instances vs one common instance on local node (shared memory)

Legion Integration

Liszt relations

Liszt computations

Legion logical regions

Legion tasks

Legion Multi-Node Results

Legion Multi-Core Results

1 partition  19.7s/step
2 partitions  11.2s/step (1.8x)
4 partitions  5.7s/step (3.5x)