Parallel programming in Chapel

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slides and code examples at at ...

1D diffusion equation:

$$\frac{\partial T(x,t)}{\partial t} = k\frac{\partial^2 T}{\partial x^2}$$

discretize the time derivative:

$$\frac{\partial T_i^{(n)}}{\partial t} \approx \frac{T_i^{(n)} + T_i^{(n-1)}}{\Delta t}$$

discretize the second-order spatial derivative:

$$\frac{\partial^2 T_i^{(n)}}{\partial x^2} \approx \frac{T_{i+1}^{(n)} - 2T_i^{(n)} + T_{i-1}^{(n)}}{(\Delta x)^2}$$

The original PDE becomes a fully explicit finite-difference equation:

$$T_i^{(n+1)} \approx T_i^{(n)} + \frac{k\Delta t}{(\Delta x)^2}\left(T_{i+1}^{(n)} - 2T_i^{(n)} + T_{i-1}^{(n)}\right)$$

Given the initial pulse $T(x,0) = \exp(-\left[\frac{(x-0.5)}{0.01}\right]^2)$ with $x \in [0,1]$, find the solution at time $t = 1$ assuming periodic boundary conditions.

Chapel base language

Task parallelism

Data parallelism

- one
- two

Advanced language features

- one
- two

- one
- two