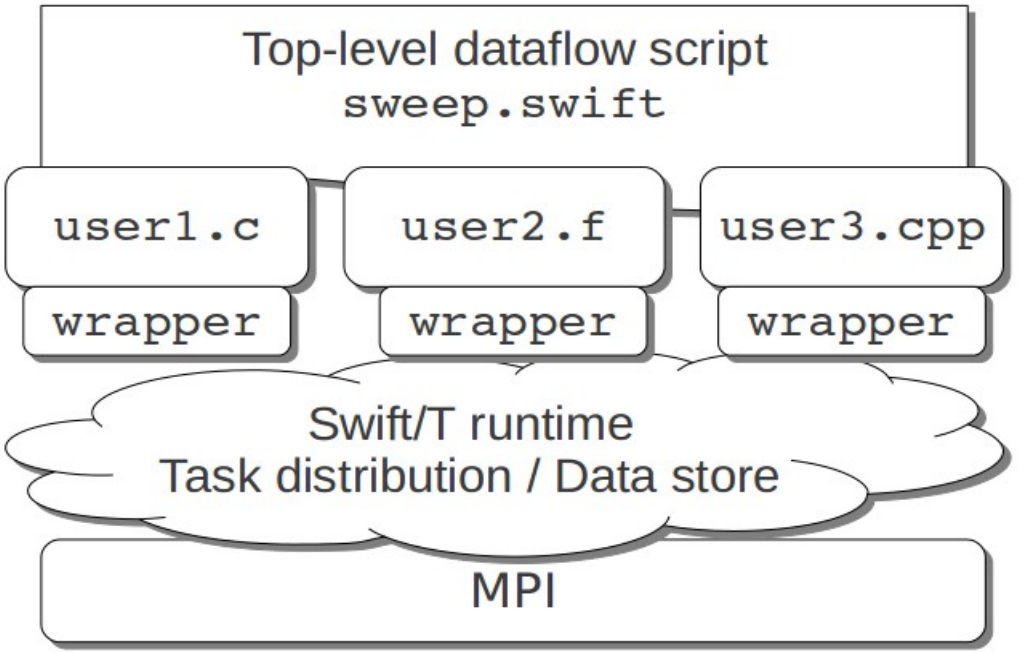
Swift/T: the Low Level Bits

Swift Developer Training Session
22 March 2013

Presenter: Tim Armstrong

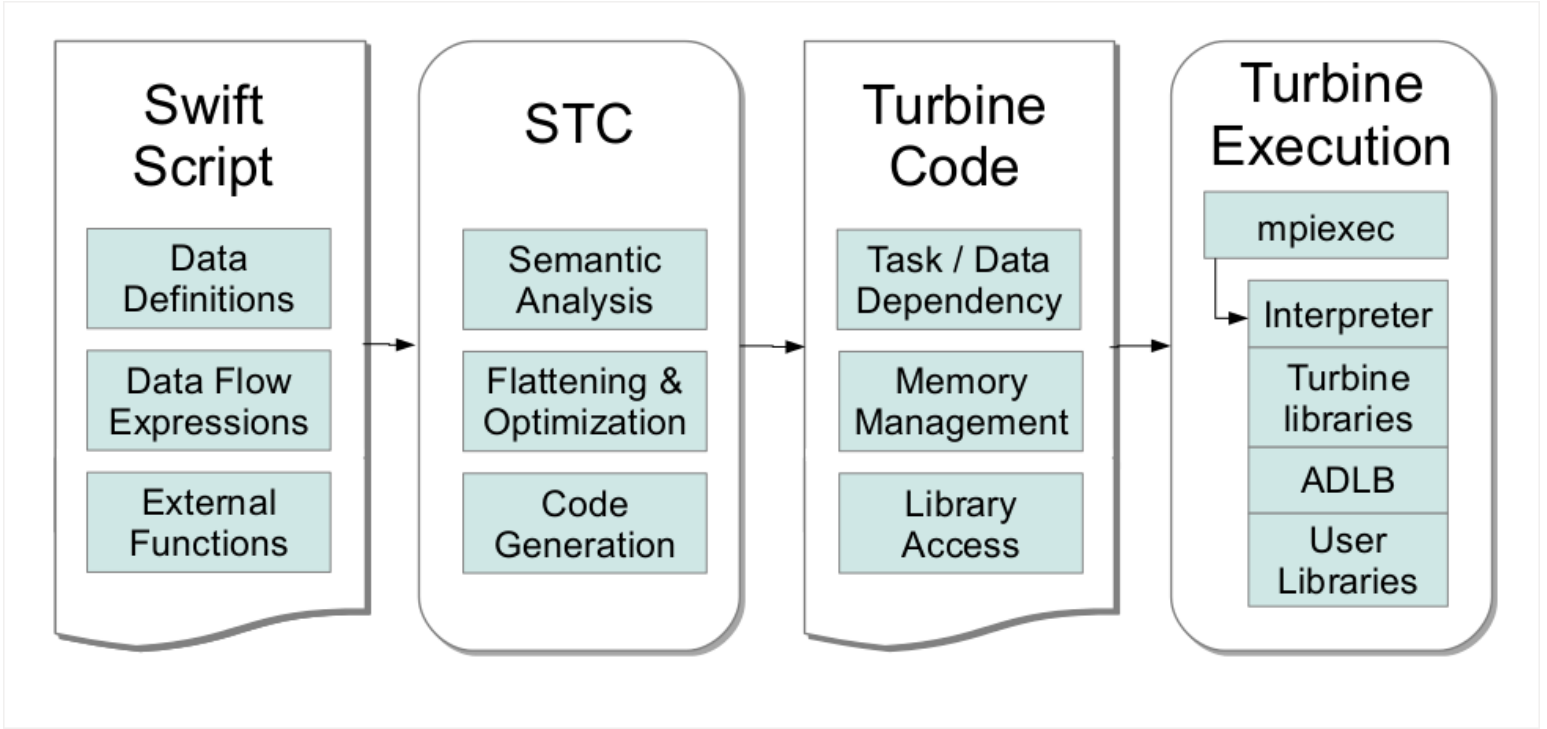
Topics for today

- Swift/T Architecture
- What is MPI?
- ADLB: scalable task dispatcher



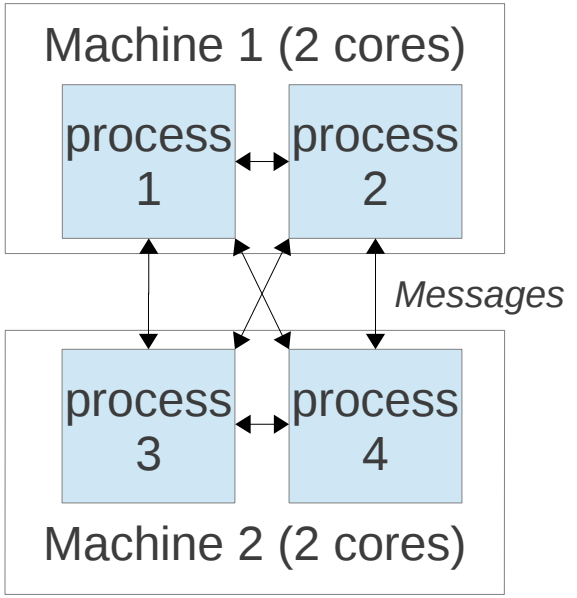
Swift/T Toolchain

- Compiler: STC
- Runtime: Turbine → ADLB → MPI
- Demo!



MPI Background

- Low-level, high performance
- Official standard with several implementations
- Basic features:
  - Point-to-point messages
  - Collective ops (e.g. broadcast)
- ***Very*** efficient on high performance clusters: message latency < 1 microsecond



Running MPI

- MPICH is developed at Argonne
- Compiling: `mpicc`
- Launching: `mpiexec`
  - Run Hello World on 4 cores of one node

    ```
    mpiexec -n4 ./program  # Compiled binary
    mpiexec -n4 tclsh program.tcl # script
    ```
  - Run across multiple desktops with ssh

    ```
    mpiexec -n8 -hosts deneb,antares ./program
    ```
- Turbine launch script calls `mpiexec`

MPI Demo!

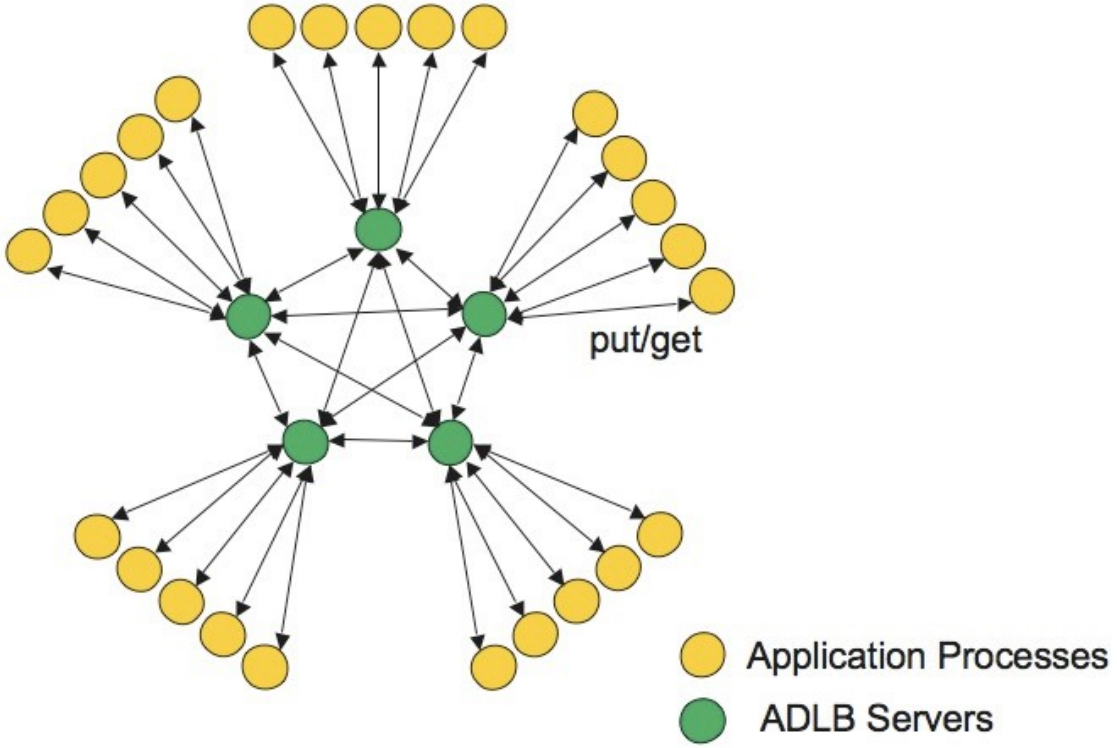
- Hello world example

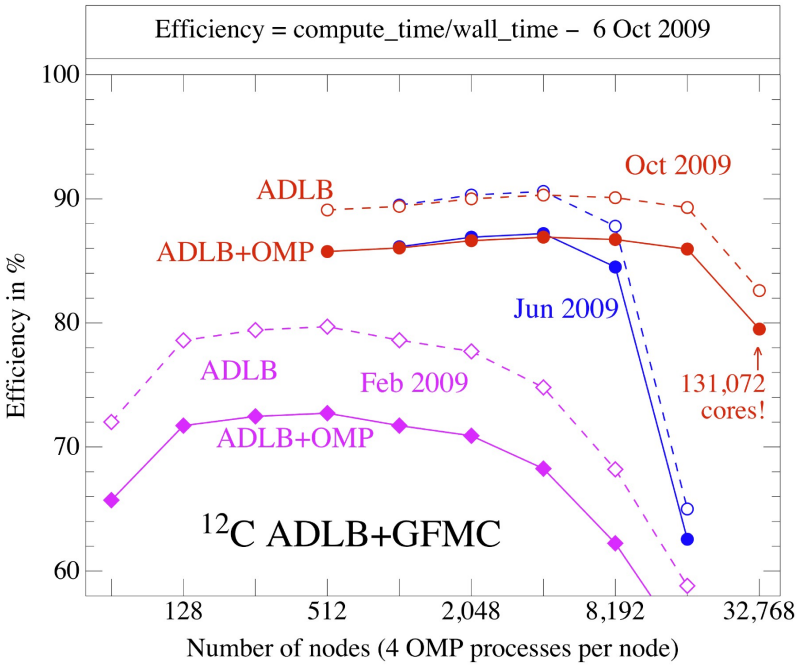
ADLB

- What is ADLB?
  - Scalable task pool/dispatch:
    - ADLB_Put(...) adds a task
    - ADLB_Get(...) gets a task according to some criteria
  - Distributed data store: *(extension for Swift/T)*
    - Write-once variables (int, string, float, etc)
    - “Containers”: for Swift arrays
    - Notifications when variable closed

ADLB Architecture

- ***Servers*** are used for task pool and data store
- Servers balance work amongst themselves
- Scales to large machine





Diagrams courtesy of E. Lusk, R. Butler

ADLB Demo

- ***Batcher*** is a simple ADLB application that executes a list of command lines
- Demo!

Trying Swift/T

- Please give it a try, even if just on a laptop!
  - I can assist getting started
  - Bug reports, extensions, tests,welcome.
- Contributing to Swift/T
  - System is complex but modular
  - We'll discuss more in future weeks
  - Library functions → implement in Tcl
  - Runtime performance → ADLB
  - Language features → STC frontend
  - Optimizations → STC intermediate representation