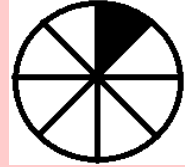

Parallel Programming using Python

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Motivation - Exercise

- Draw straight lines (approx. 2 inches each) on the given paper
  - Student who got maximum number of lines will be the

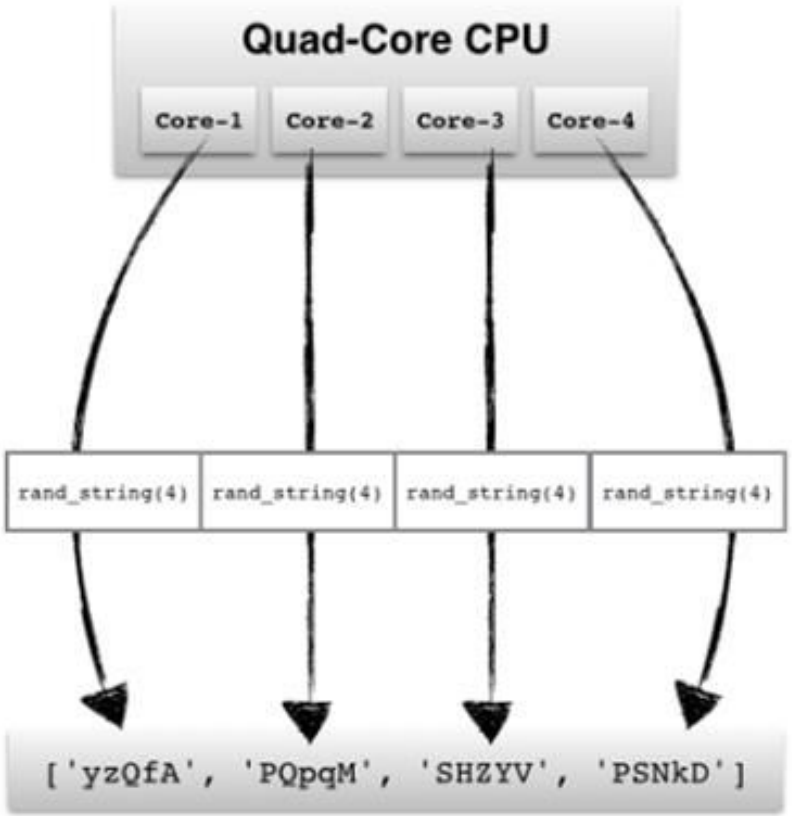
WINNER

- How to draw the same pattern of lines with more speed?
  - What is required to achieve this goal?
  - What additional resources you need?

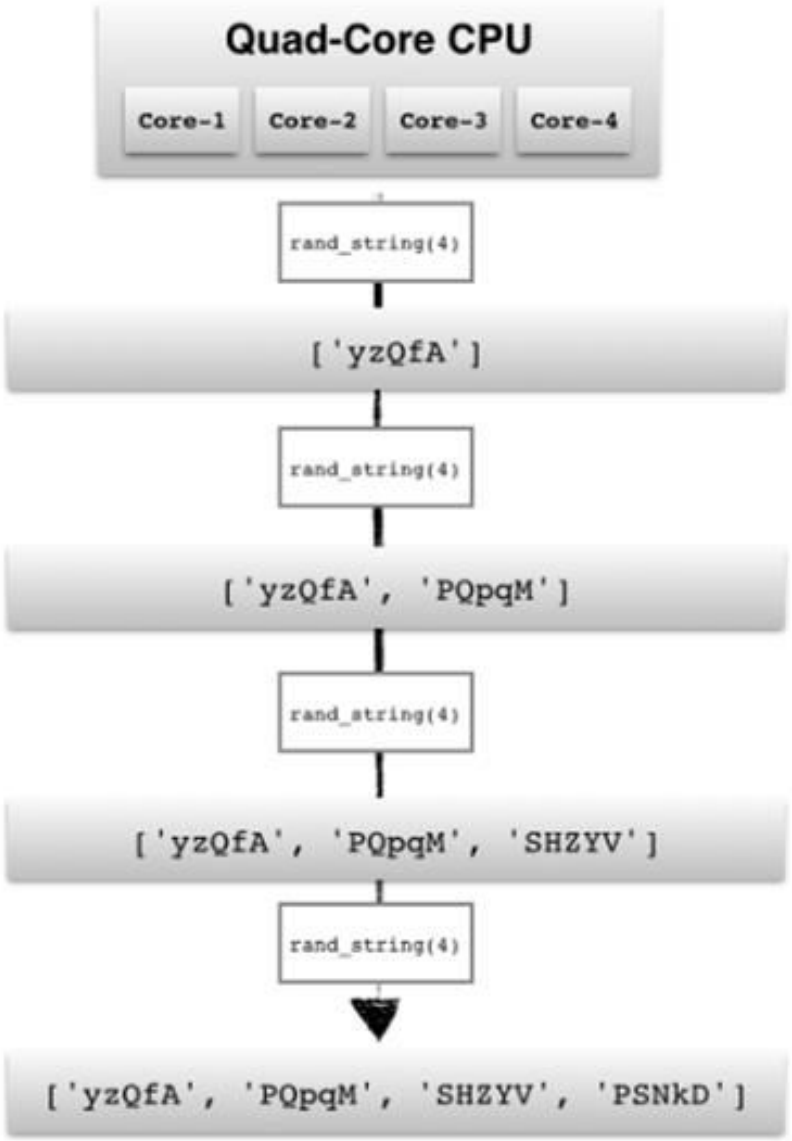
Introduction

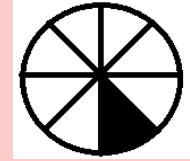
- We are living in the era of parallel architectures
  - From Mobile Phones to Supercomputers
- Python core concepts:
  - Statements interpreter
  - Serial processing
  - Single – threading (thread – safe mechanism)
- Mismatch between Software and Hardware
  - Hardware needs parallelism
  - Software doing sequential

[parallel processing]



[serial processing]





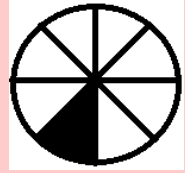
Multithreading vs Multiprocessing

Multithreading

- Sub-Tasks
- Shared Memory
- Explicit Synchronization

Multiprocessing

- Safer Approach
- Communication Overhead
- Distributed Memory



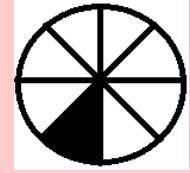
Threads and Processes Example

only_sleep() and crunch_numbers()

Multiprocessing Module in Python

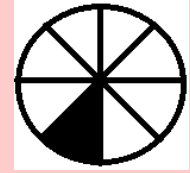
Multiprocessing Module

- Official Documentation: https://docs.python.org/dev/library/multiprocessing.html
- Process class: Basic Approach
  - Create new process per task
- Pool class: Simplified Approach
  - Offloading task to the existing pool of worker processes



Random Strings Example

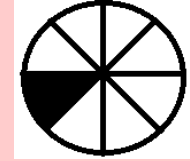
Process Class



Cube Example

Pool Class

Practical Applications



Kernel Density Estimation

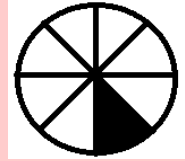
Parzen – Window Method

Checking Uptime of Websites

Jetpack Monitor and Uptime Robot

Jackpack Monitor and Uptime Robot

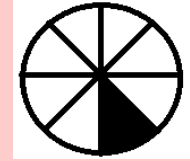
- The application goes very frequently over a list of website URLs and checks if those websites are up.
- Every website should be checked every 5-10 minutes so that the downtime is not significant.
- Instead of performing a classic HTTP GET request, it performs a HEAD request so that it does not affect your traffic significantly.
- If the HTTP status is in the danger ranges (400+, 500+), the owner is notified.
- The owner is notified either by email, text-message, or push notification.



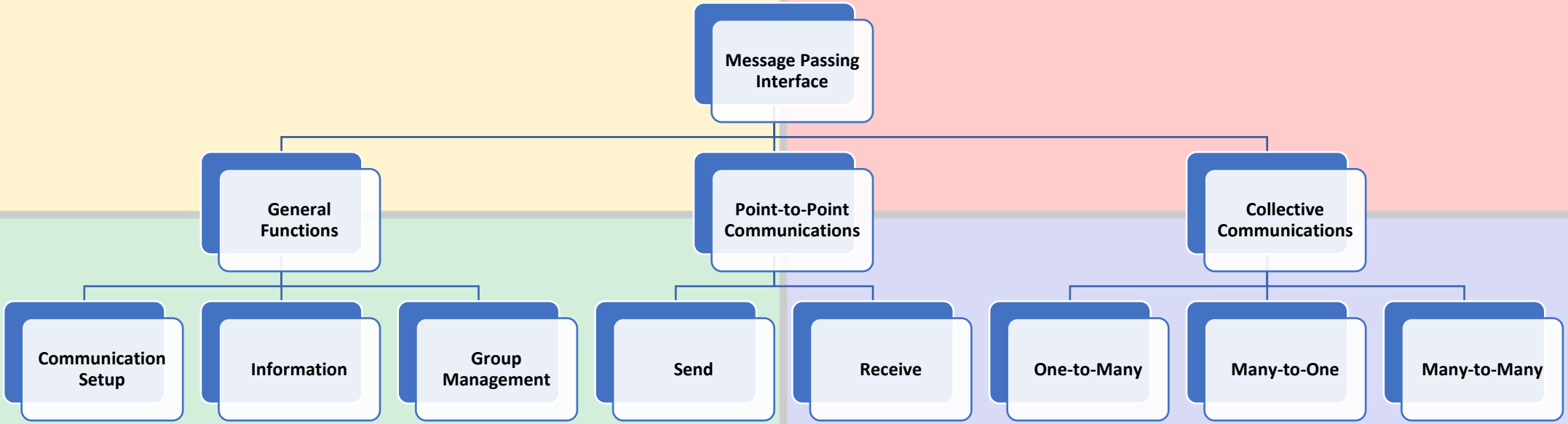
Setting up Python MPI Cluster

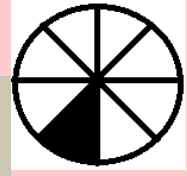
Installations

- geo_scipy: *source activate geo_scipy*
- mpi4py: *conda install mpi4py*



Writing Parallel Programs in Python MPI


Message Passing Interface
General Functions
Point-to-Point Communications
Collective Communications
Communication Setup
Information
Group Management
Send
Receive
One-to-Many
Many-to-One
Many-to-Many



MPI Examples

- Communicators and Ranks
- Point-to-Point Communication
- Collective Communication
  - Broadcasting
  - Scattering
  - Gathering
  - Reduction

Jetpack Monitor and Uptime Robot

- What MPI Functions you need to implement it?
- Data Partition Scheme?
- Results Collections?

Be in Contact

Google Classroom Code: 453l2g

print(“Thank You”)