PARALLEL PROCESSING

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9

PARALLEL PROGRAMMING

- How to write a parallel program?
- Which language to use?
  - Linda
  - MPI
  - OpenMP

PARALLEL PROGRAMMING

- Linda
  - **Tuple Space**: The primary concept in Linda is that of a tuple space, an abstraction via which processes communicate.
  - **Primitives:**
    - **out:** out(t) adds tuple t to tuple space. OUT("add",X,Y,Z)
    - **in**: in(t) attempts to match some tuple t in tuple space to the template m and, if a match is found, removes t from tuple space. IN("add",X,Y,Z)

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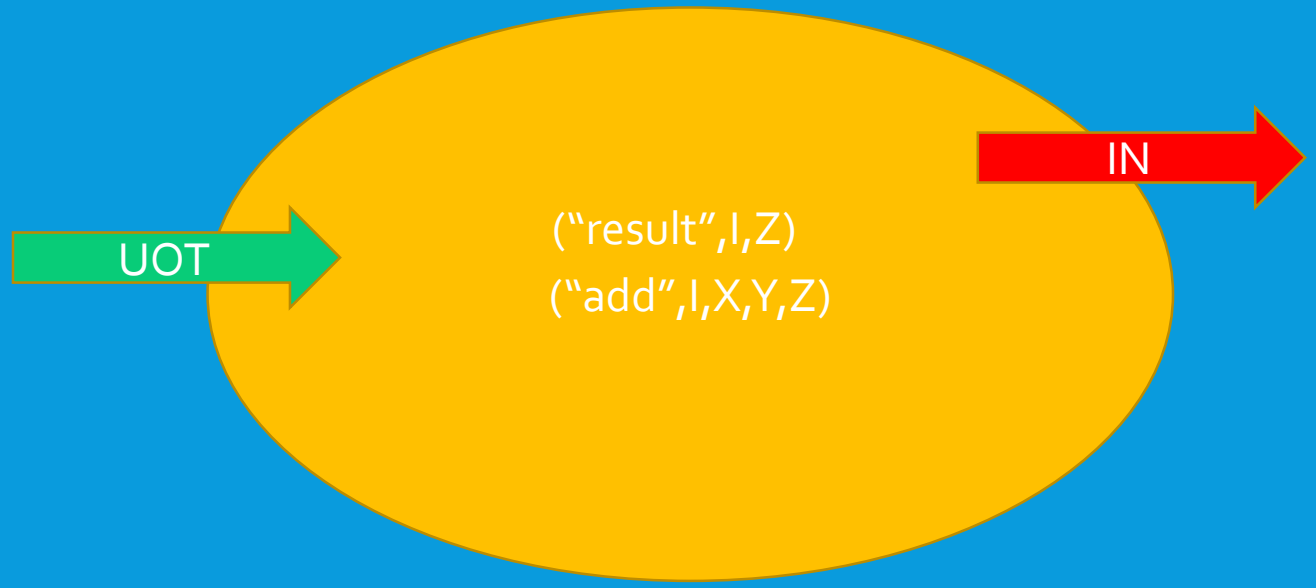
- Linda



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- MPI (Message Passing Interface)
  - Portable message passing standard.
  - Provide set of synchronization and communication functionality between a set of processes.
  - Examples:
    - MPI_Send : to send a message from one process to another process.
    - MPI_Bcast: to broadcast a message.

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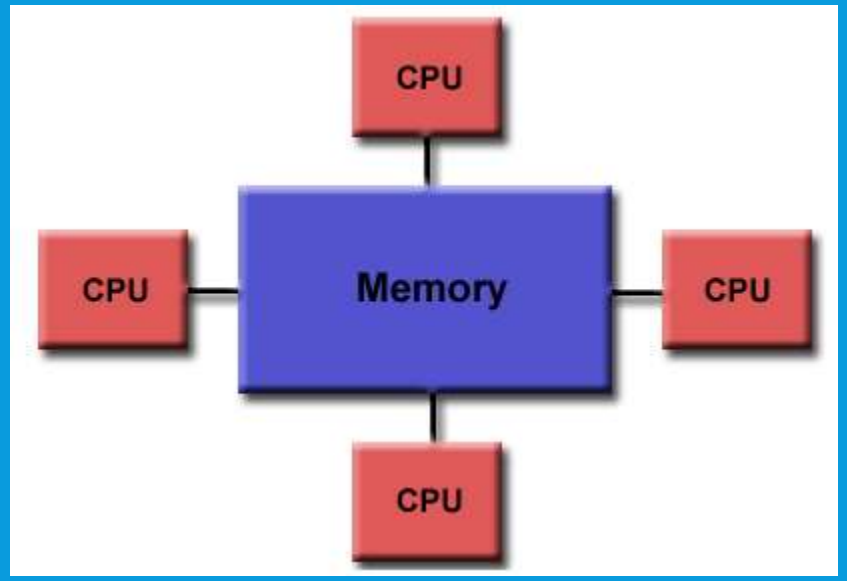
- OpenMP (**Open Multi-Processing**): Application Program Interface (API) with a set of compiler directives and library routines for shared memory parallel programming.



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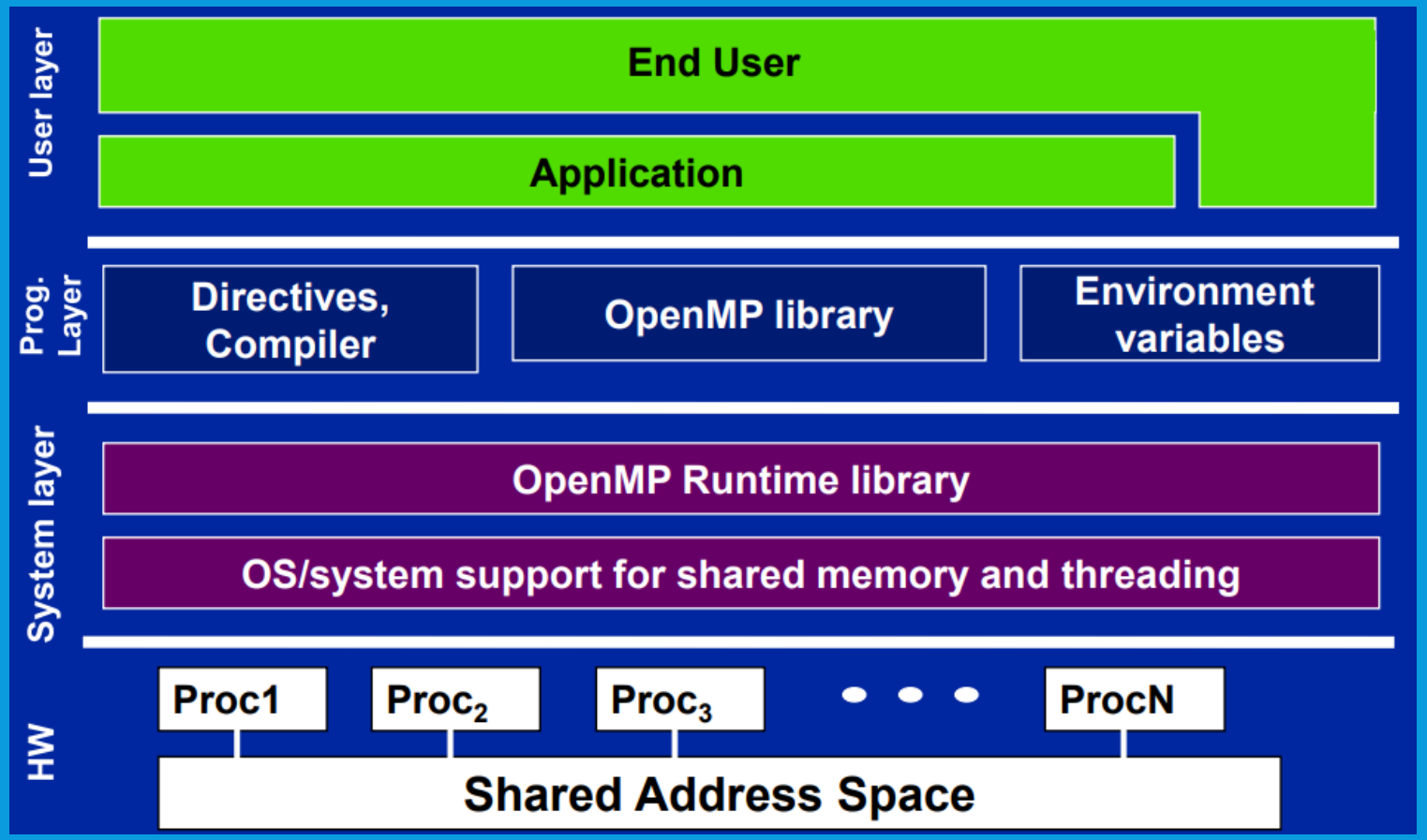

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- OpenMP has directives that allow the programmer to:
  - specify the parallel region
  - specify whether the variables in the parallel section are private or shared
  - specify how/if the threads are synchronized
  - specify how to parallelize loops
  - specify how the work is divided between threads (scheduling)

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- OpenMP is not something that you install. It comes with your compiler. You just need a decent compiler that supports OpenMP and you need to know how to enable OpenMP support since it is usually disabled by default.
- The standard compiler for Windows comes from Microsoft and it is the Microsoft Visual C/C++ compiler from Visual Studio. (but it supports OpenMP 2.0)
- GCC (freely available) support newer OpenMP versions.
- The following is a tutorial on how to use OpenMP:

https://helloacm.com/simple-tutorial-with-openmp-how-to-use-parallel-block-in-cc-using-openmp/

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- Make sure to use the correct compiler
  - Linux and OS X gcc -fopenmp
  - PGI Linux pgcc -mp
  - Intel windows icl /Qopenmp
  - Intel Linux and OS X icpc –openmp

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- You may use any of the following GCC compilers:
  - https://sourceware.org/cygwin/
  - http://mingw-w64.org/doku.php

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- Timothy Mattson from Intel:
- https://www.youtube.com/watch?v=nE-xN4Bf8XI&list=PLLX-Q6B8xqZ8n8bwjGdzBJ25X2utwnoEG