

# Parallelware Trainer

Half-Day Tutorial at BSC PATC

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Available at [www.appentra.com/a-hands-on-intro-parallelware-trainer-2018/](http://www.appentra.com/a-hands-on-intro-parallelware-trainer-2018/)



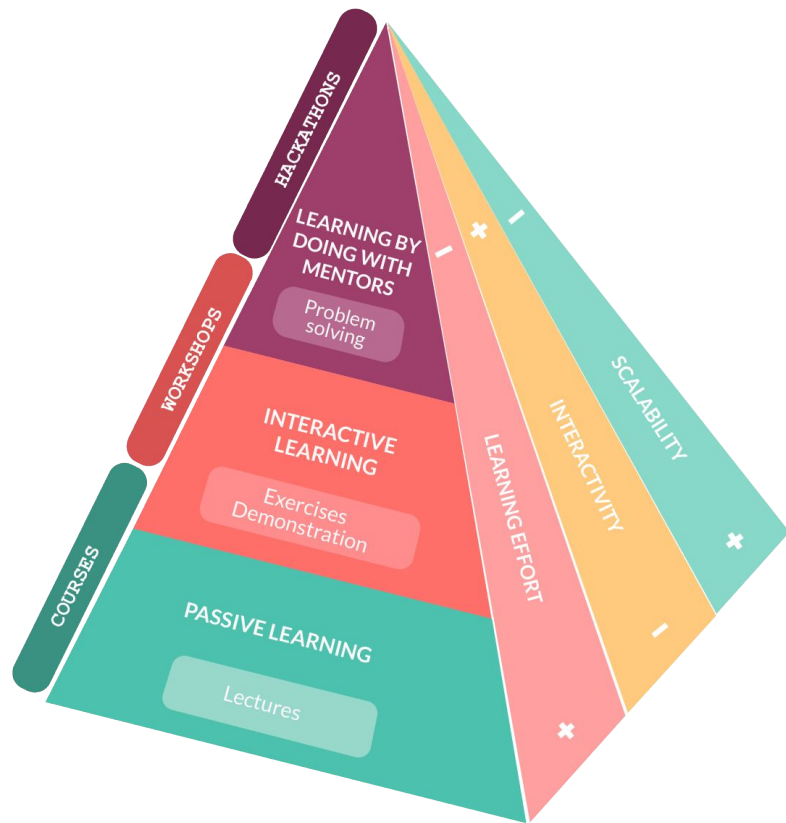
# Motivation

- **Paralleware Trainer provides:**
  - An interactive learning experience for OpenMP and OpenACC
  - Helps you understand where and how to parallelize in real codes
  - Speeds-up the development of parallel applications
    - Improves speed of identification of opportunities for parallelization
    - Helps you insert the correct syntax
    - Minimizes the introduction of bugs and race conditions.

# PARALLELWARE TRAINER

An interactive tool that acts as your mentor

“Tell me, I will forget,  
Show me, I may remember,  
Involve me, I will understand.” - Confucius



THE HPC EDUCATION & TRAINING PYRAMID

# How Parallelware Trainer can support you

	Applications code features	Programming language features	Examples of benchmarks
<p>+</p> <p>source code complexity level</p> <p><b>Real HPC Applications</b> Code size 10<sup>6</sup> SLOCs</p>	<p>Production-quality huge codes running complex simulations on supercomputers.</p> <p>Typically organized in modules with a complexity similar to a mini-app.</p>	<p>Fully-featured C/C++ Fortran codes</p>	<p>ORNL's ACME ORNL's GTC</p>
<p><b>Mini Applications (MiniApps)</b> Code size 1000s SLOCs</p>	<p>Mid-size codes representative of compute intensive real applications codes.</p> <p>Very suitable for HPC developers working on snippets of real applications codes.</p>	<p>Fortran</p> <p>User-defined data-types (structs) Procedure calls</p>	<p>CORAL Benchmarks, NAS Parallel Benchmarks ORNL's XRayTrace</p>
<p><b>Micro Benchmarks</b> Code size 100s SLOCs</p>	<p>Well-known compute intensive small codes.</p> <p>Very suitable for HPC training.</p>	<p>C</p> <p>Array data-types No procedure calls</p>	<p>Matrix-Matrix-Vector multiplication, Mandelbrot sets, Number Pcompilation, DAXPY, MATVEC, MATMUL, SPMV, Coulomb</p>

# Parallel Patterns: Making the most of your opportunities to parallelize

## What is a Parallel Pattern?

- The Parallelware analysis will help you to identify regions that are opportunities for parallelization:
  - These are 'intrinsically parallel' - areas that are already highly suited with little/no modification to being executed in parallel.
- Parallelware Trainer can then help you introduce parallelism in these areas.
  - Helps you find parallel patterns in your code.
  - Helps to design the best parallel implementation and the options available.
  - Facilitates parallel implementation

### parallel forall

```
1 for (j=0; j<n; j++)
2 {
3     T = B[j];
4     A[j] = T;
5 }
```

### parallel scalar reduction

```
1 for (j=0; j<n; j++)
2 {
3     T = B[j];
4     A += T;
5 }
```

### parallel sparse reduction

```
1 for (j=0; j<n; j++)
2 {
3     T = B[j];
4     A[B[j]] += T;
5 }
```

# HANDS-ON LAB: a walkthrough

- **Launch Parallelware Trainer:**

- Login to the remote machine: `boada.ac.upc.edu`

Connect using your account “nct010XX” (e.g. nct01026 - nct01055):

```
$ ssh -YX <username>@boada.ac.upc.edu
```

- Launch Trainer:

```
$ /scratch/nas/1/marenaz/pwtrainer-0.5.3-x86_64-linux-ubuntu-14.04/pwtrainer &
```

- **Run the Pi calculation example:**

- Copy the sample codes to your \$HOME directory in boada:

```
$ cp /scratch/nas/1/marenaz/samples.tgz $HOME
```

- Open the PI project following instructions in the worksheet.

# HANDS-ON LAB

## Remote execution on “mt1.bsc.es” @BSC using SLURM

Add ssh key to avoid asking for password

- boada\$ ssh-keygen// Generates new SSH key (press ENTER three times)
- boada\$ ssh-copy-id <username>@mt1.bsc.es // Transfer new SSH key to mt1.bsc.es

Edit script “./samples/remote\_on\_mt1.config”

- Set “REMOTE\_USER=<USERNAME>” // Your account “NCT010xx” at PATC
- Make sure variable “REMOTE\_HOST=mt1.bsc.es”

Profile setup: Open the setup of the “Parallel” execution console

- Select “remote\_run\_on\_mt1.sh” in “Custom execution script”
- Run the project (press F6 or click “Play” button)

**DEMO with REMOTE  
execution!!**

# Parallelware Trainer

Learn more



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