

Towards Efficiency Computing with Alinea

07 Oct 2015
DKRZ, Hamburg

Florent Lebeau
flebeau@allinea.com



allinea

Agenda

8:30 - Introduction to Allinea tools and latest changes

8:45 - Profile and Optimize with Allinea Forge

9:00 - Debug with Allinea Forge

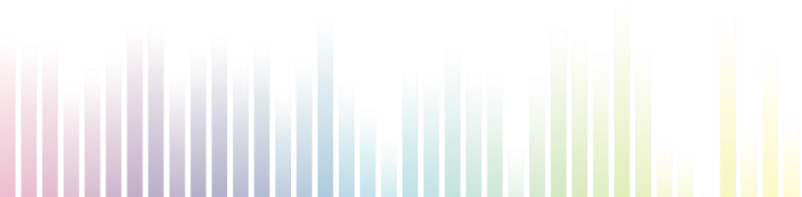
9:30 - MPIOM with Allinea Forge

9:45 - Wrap-Up and questions

Afternoon - Hands-on Session on Your Application



Introduction to Alinea Tools



Allinea : an expanding company

- **HPC tools company since 2002**
 - Leading in HPC software tools market worldwide
 - Global customer base
- **Helping the HPC community design the best applications**
 - Unrivaled productive and easy-to-use development environment...
 - ... To help reach the highest level of performance and scalability
- **Helping HPC production make the most of their clusters**
 - Unique solutions to reduce HPC systems operating costs
 - Innovative approach to facilitate cutting-edge challenges resolution

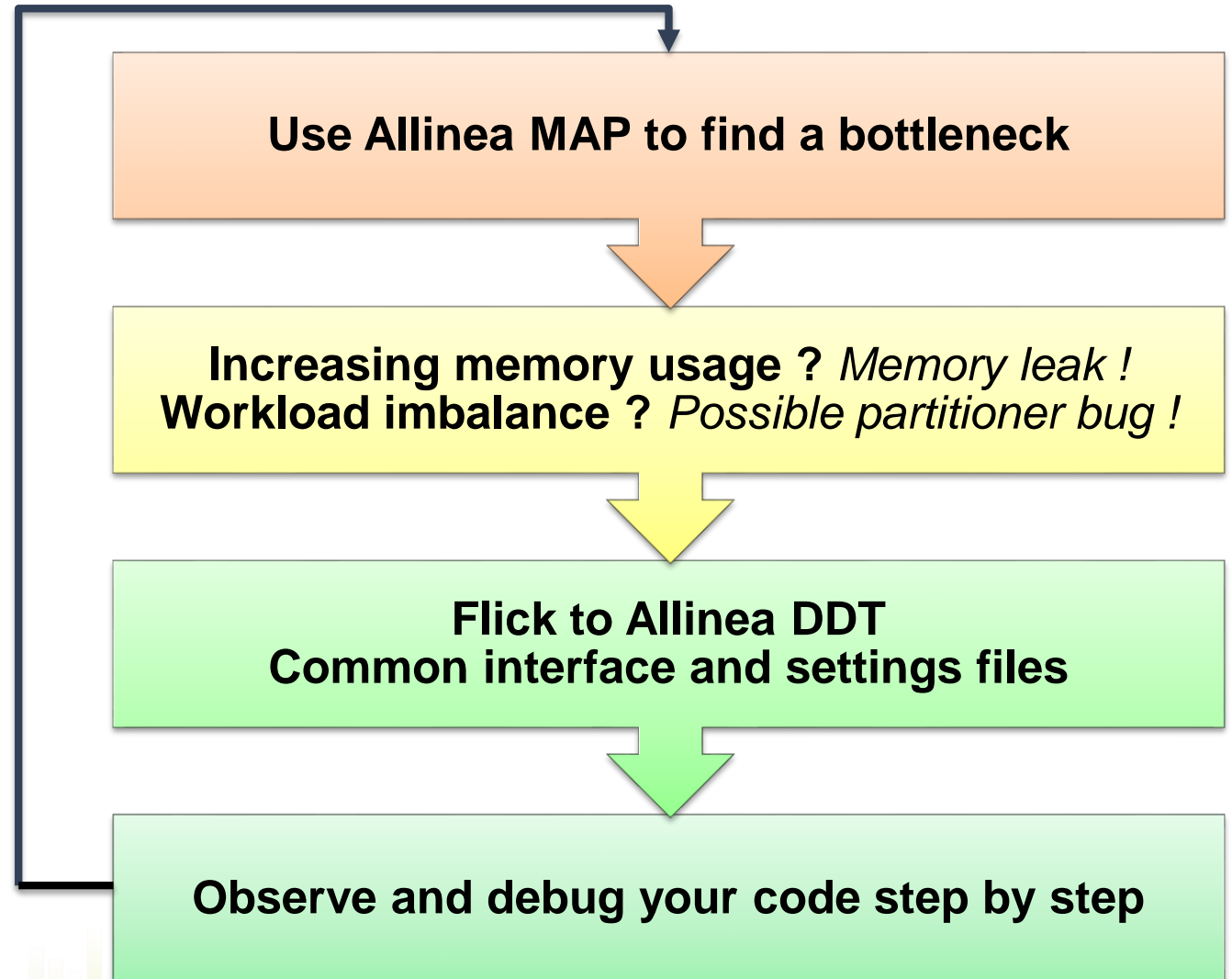
Need to dive into the code ?

- **Allinea Forge: a modern integrated environment for HPC developers**
 - Rebranding of Allinea Unified (Allinea DDT + Allinea MAP)
- **Supporting the lifecycle of application development and improvement**
 - Productively debug code with Allinea DDT
 - Enhance application performance with Allinea MAP
- **Designed for productivity**
 - Consistent easy to use tools
 - Fewer failed jobs
- **Available to you**



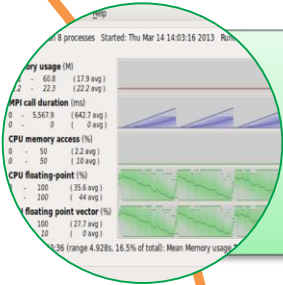
Allinea Forge

One Unified Solution



Allinea MAP

Performance made easy



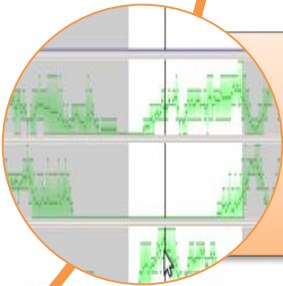
Low overhead measurement

- Accurate, non-intrusive application performance profiling
- Seamless – no recompilation or relinking required



Easy to use

- Source code viewer pinpoints bottleneck locations
- Zoom in to explore iterations, functions and loops

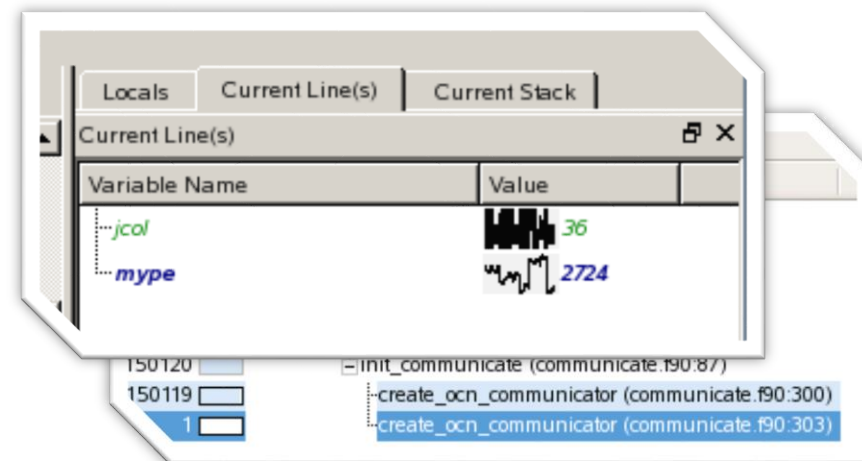
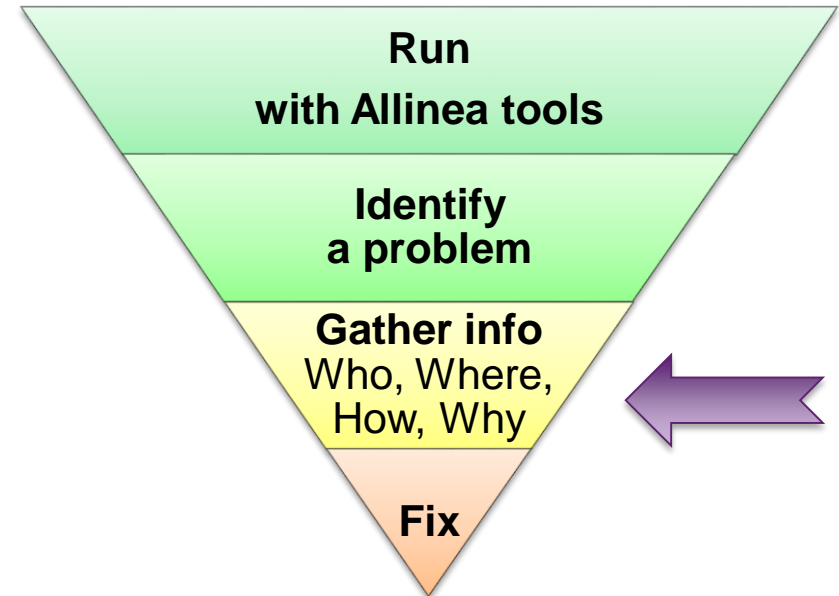


Deep

- Measures CPU, communication, I/O and memory to identify problem causes
- Identifies vectorization and cache performance

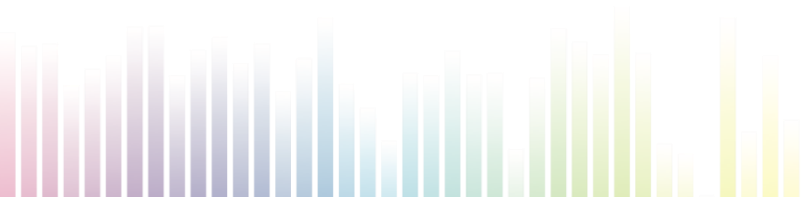
Allinea DDT helps to understand

- **Who had a rogue behaviour ?**
 - Merges stacks from processes and threads
- **Where did it happen?**
 - Allinea DDT leaps to source automatically
- **How did it happen?**
 - Detailed error message given to the user
 - Some faults evident instantly from source
- **Why did it happen?**
 - Unique “Smart Highlighting”
 - Sparklines comparing data across processes

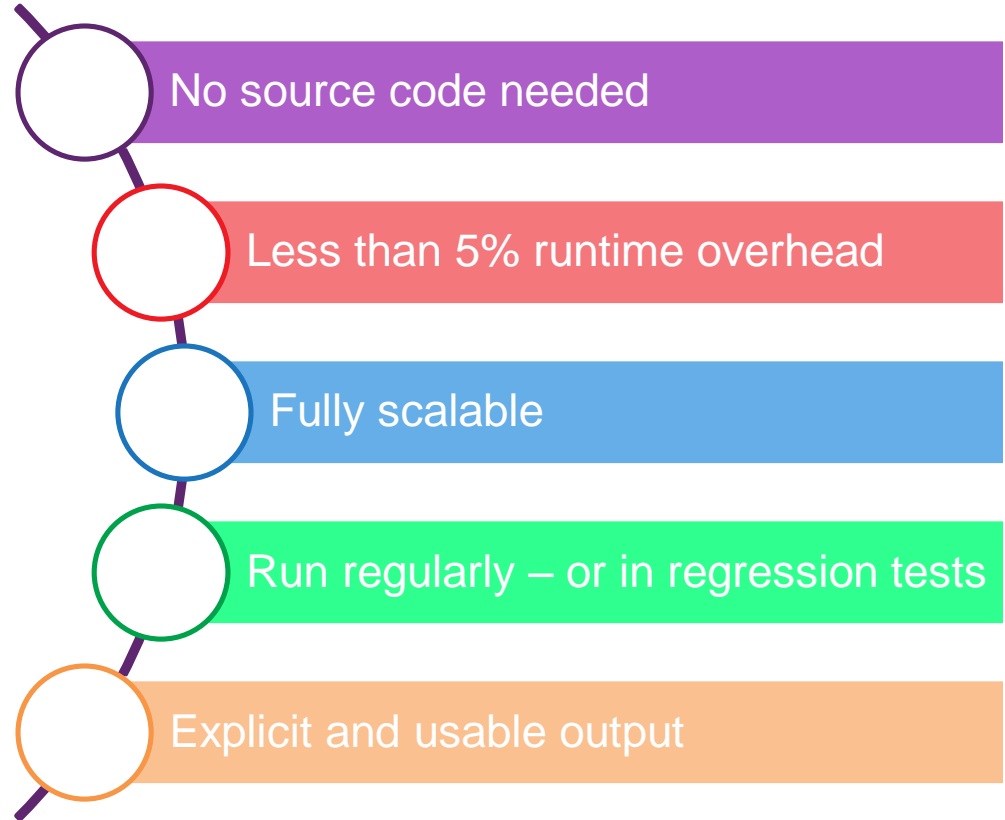
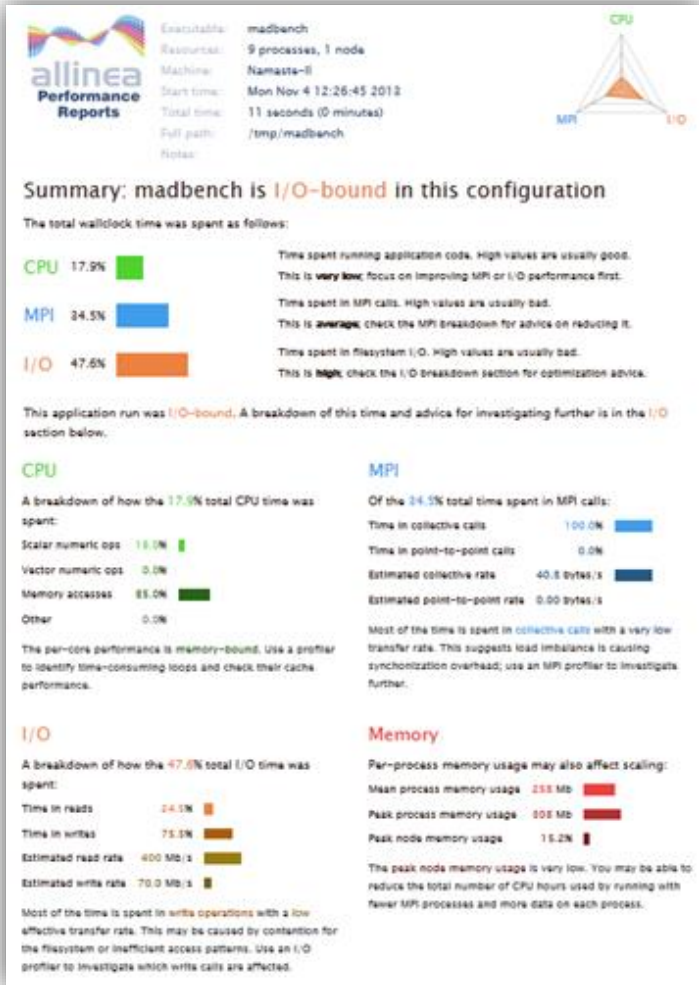


Improve cluster efficiency

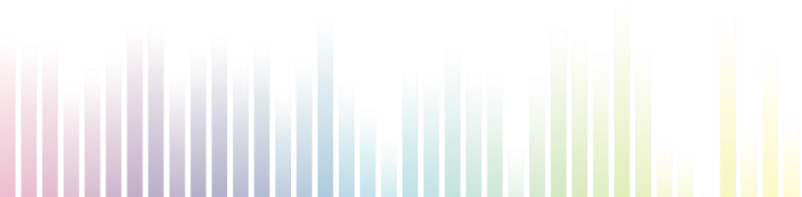
- “Optimization” is not always synonym of “efficiency”
 - Cluster productivity or cluster usage
- Possible efficiency needs during production
 - Define and enforce best practices (scale, parameters...)
 - Provision and validate cluster upgrades and changes
 - Detect & resolve hardware or software faults impacting performance
- Effortless one-touch reports with allinea
 - Generates explicit and readable reports with metrics and explanations
 - Understand optimized HPC applications effortlessly



Better runs, quickly



Profile and Optimise with Alinea Forge



The quest for the Holy Performance

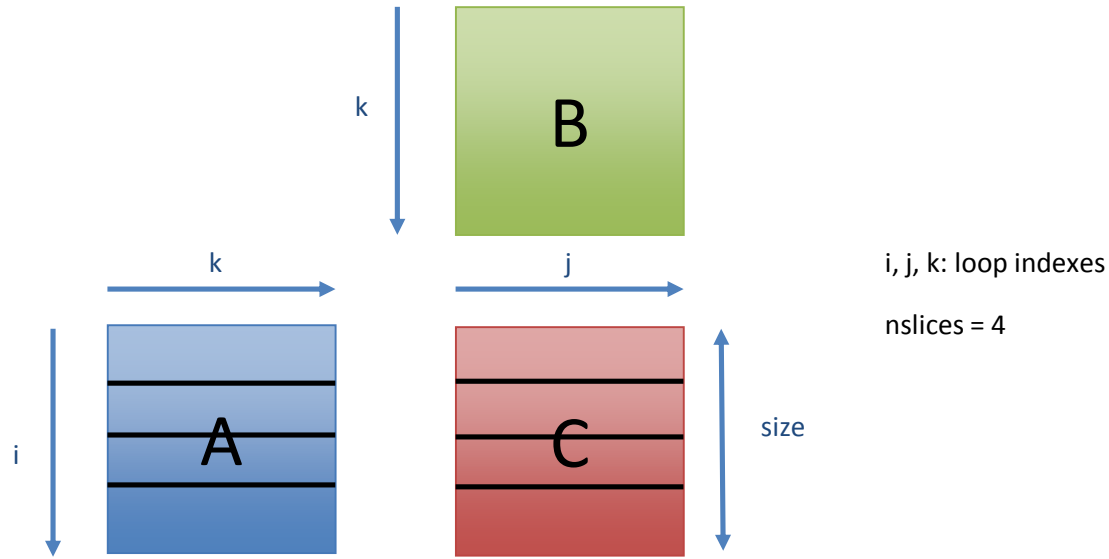


Code optimisation can be time-consuming.

Efficient tools can help you focus on the most important bottlenecks.

Tutorial:

Matrix Multiplication: $C = A \times B + C$



Algorithm

- 1- Master initializes matrices A, B & C
- 2- Master slices the matrices A & C, sends them to slaves
- 3- Master and Slaves perform the multiplication
- 4- Slaves send their results back to Master
- 5- Master writes the result Matrix C in an output file

Getting Started on Mistral

- Load the environment

```
$ module load intelmpi/5.0.3.048 intel/15.0.2 allinea-forge/5.1-43967
```

- Prepare the code for profiling

```
$ mpiifort -g -ffast-math -O3 -cpp mmult1.f90 -o mmult1_f90.exe -lm  
$ mpiicc -g -ffast-math -O3 -std=c99 mmult1.c -o mmult1_c.exe -lm
```

- Modify job script to prefix the mpirun command

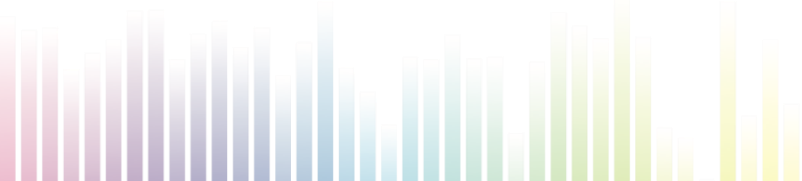
```
map --profile srun ./mmult1_X.exe
```

- Submit job

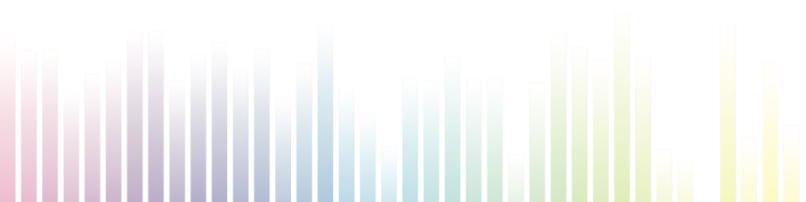
```
$ sbatch mmult1_X.sub
```

- View result

```
$ map mmult1_X_Yp_YYYY-MM-DD-HH-MM.map
```



Resolving Bugs with Alinea Forge



Debugging by Magic



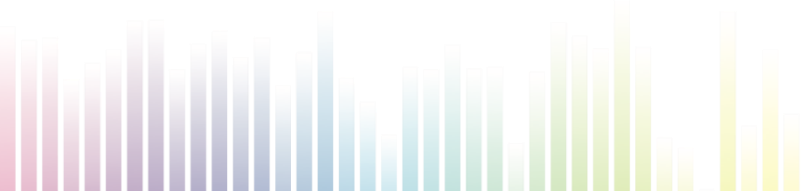
Any technology sufficiently advanced is indistinguishable from magic.

Unpredictable, dangerous, irresistible.



Debugging by magic

- Memory errors can be obvious (segfaults ...)
- Sometimes not
- Allinea DDT memory debugging tool enables automatic error detection
 - By activating dmalloc library
 - By adding guard pages
 - On the host as well as on the Xeon Phi
- Different levels of detection brings different debugger behaviour



Getting Started on Mistral

- Load the environment

```
$ module load intelmpi/5.0.3.048 intel/15.0.2 allinea-forge/5.1-43967
```

- Prepare the code for profiling

```
$ mpiifort -g -ffast-math -O0 -cpp mmult2.f90 -o mmult2_f90.exe -lm  
$ mpiicc -g -ffast-math -O0 -std=c99 mmult2.c -o mmult2_c.exe -lm
```

- Modify job script to prefix the mpirun command

```
ddt --connect srun ./mmult2_X.exe
```

- Launch Allinea DDT in the background

```
$ ddt &
```

- Submit job

```
$ sbatch mmult2_X.sub
```



MPIOM with Allinea Forge



Getting Started with MPIOM on Mistral

- Load the environment

```
$ module load intelmpi/5.0.3.048 intel/15.0.2 allinea-forge/5.1-43967
```

- Prepare the code for profiling

- Make sure the executable has been compiled with **-g**

- Modify job script to prefix the mpirun command

- Replace

```
srun --cpu-freq=2500000 --kill-on-bad-exit=1 --cpu_bind=verbose,cores --  
distribution=block:block ${mpilaunch_args} -n ${ncpus} ${MODDIR}/${MODBIN}
```

- By

```
map --profile -mpiargs="--cpu-freq=2500000 --kill-on-bad-exit=1 --cpu_bind=verbose,cores --  
distribution=block:block ${mpilaunch_args}" -n ${ncpus} ${MODDIR}/${MODBIN}
```

- Submit job

```
$ sbatch tp04140.job
```

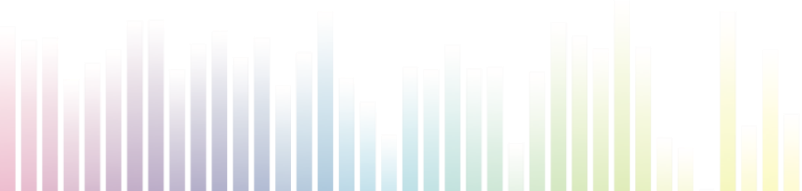
- View result

```
$ map mpiom_X_Yp_YYYY-MM-DD-HH-MM.map
```



Summary

- Develop *your* efficiency with allinea forge
 - Optimize your code to reach your goals with allinea MAP
 - Reduce the number of failed jobs with allinea DDT
- Improve cluster usage with allinea performance reports
 - Squeeze more jobs within a given time frame
 - Increase research by freeing machine time without hardware investment
 - Help application support teams focus on the right issues



Thank you

Your contacts :

- Technical questions?
- Sales team:

flebeau@allinea.com

sales@allinea.com



allinea

Hands-on session on your application

