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ClusterUL

Grid e-Services for Multi-Layer SOM Neural Network Simulation

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2007



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Outline



- Overview
- Multi-Layer SOM Background
- Architecture and Design
- Local Implementation
- Grid Proposal Environment - GRIDSOM
- Conclusions



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Overview



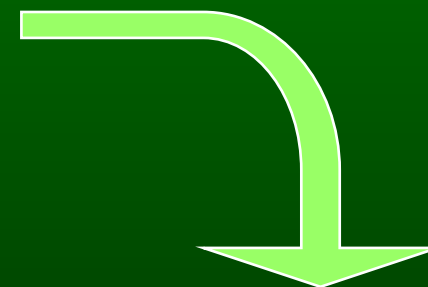
ILID – Instituto Lusitana de Investigação e
Desenvolvimento
(Lusitana R&D Institute)

Vila Nova de Famalicão

8 - R&D Centers

(Lisboa, Porto, Famalicão)

1. Energy e Gestão Industrial (CLEGI)
2. Ciências Sociais e Humanas
3. Ciências Jurídicas
4. Arquitectura
5. Centro Lusitana de Matemática
6. Centro Lusitana de Recursos Humanos (CIDRHU)
7. Centro Lusitana de Turismo, Inovação e Serviços (TIS)
8. Centro Lusitana de Economia e Gestão



**Intelligent Tool
Wear Monitoring**

<http://www.fam.ulusiada.pt/ilid/MIFC/index.htm>



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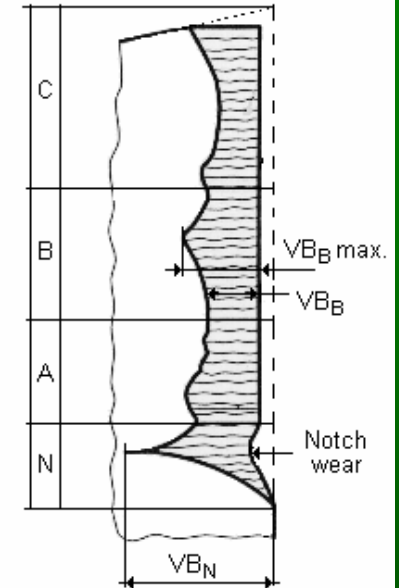
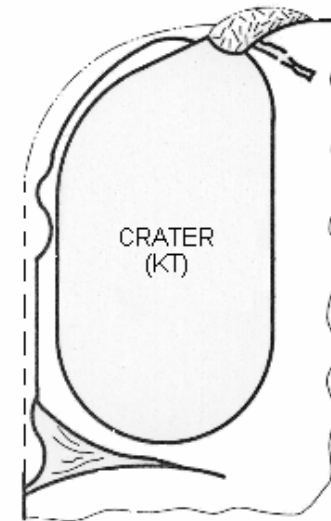
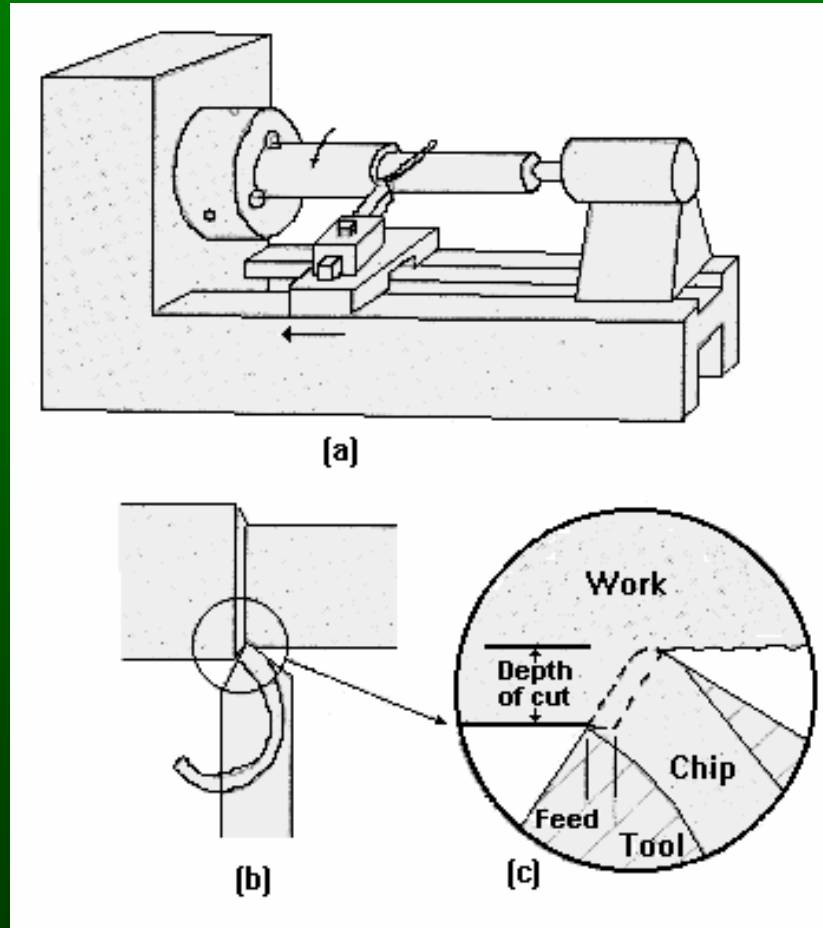


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Intelligent Tool Wear Monitoring



Cutting Process



VB_N - Length of wear notch
 VB_B - Average flank wear land
 KT - Crater depth

Wear monitoring



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Our Problem



Experiments were
conducted on a CNC

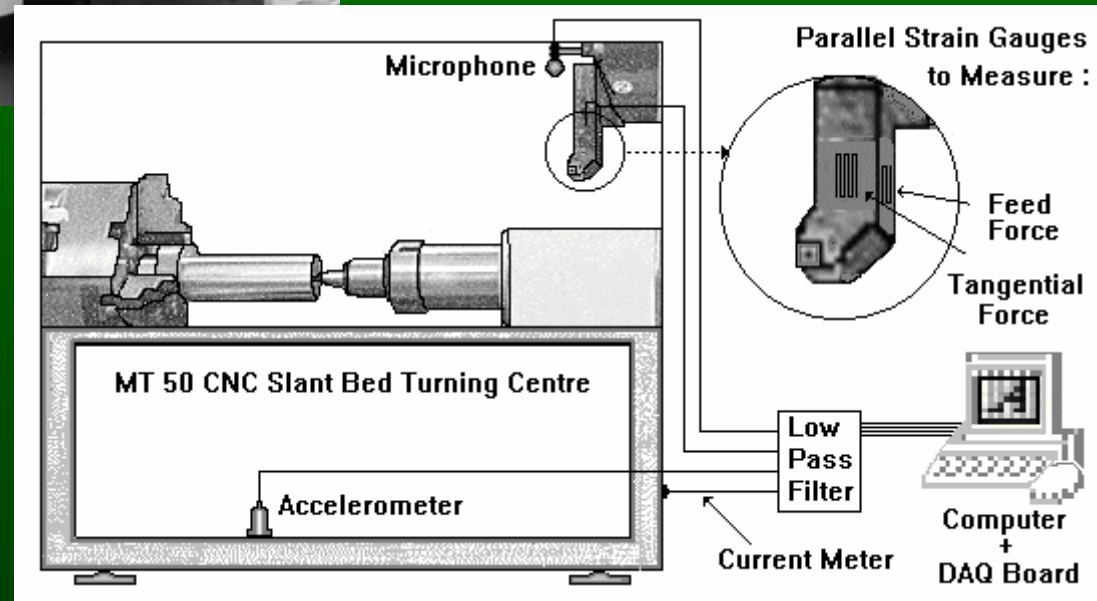


Non intrusive sensors

Modeling technique
based on artificial
neural networks



SOM





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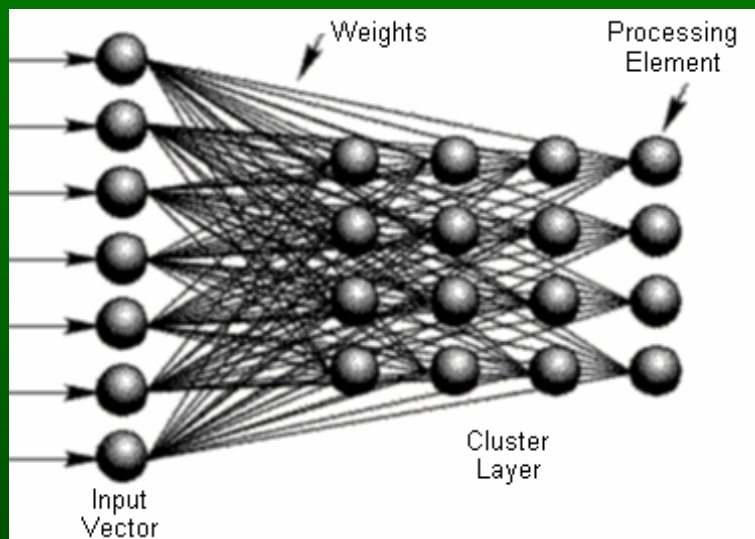


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Multi-Layer SOM Background



Clustering Method



1. Randomly initiate weights;
2. Present input vector;
3. Determine the distance between input feature vector and each output node;
4. Adjust weights according to winning frequency;
5. Select neuron with minimum distance to input feature vector;
6. Update weights;
7. Back to step 2.

Division of the output map into several sub-maps



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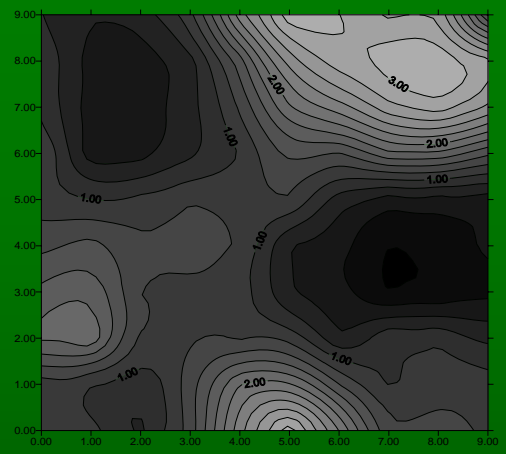


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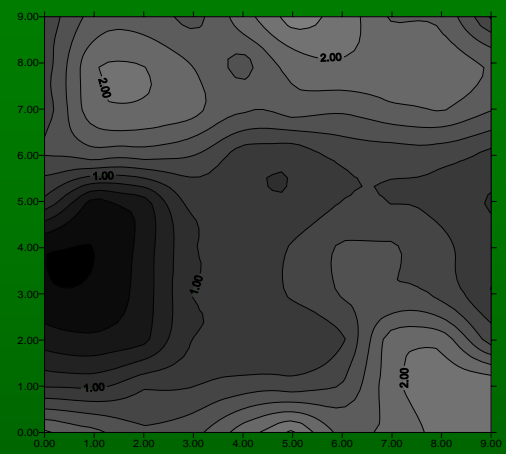
Multi-Layer SOM Results



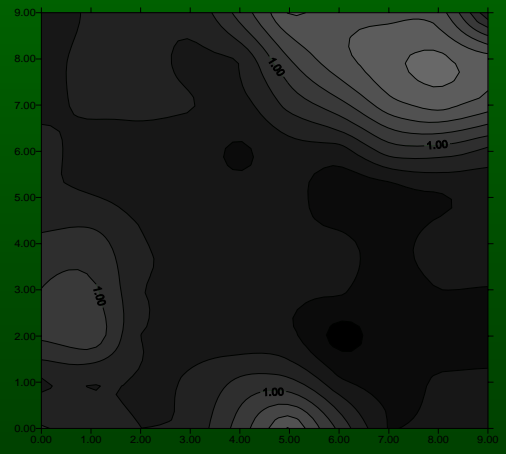
The sub-maps
are treated as
jobs in the
GRID
computing
environment



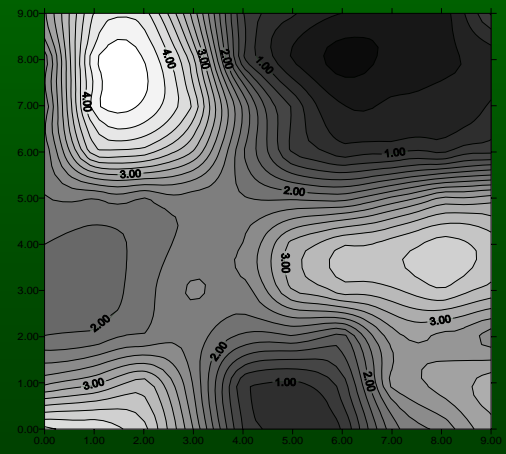
Contour plot - tool with $VB_B=0.05$ mm



Contour plot - tool with $VB_B=0.17$ mm



Contour plot - tool with $VB_B=0.21$ mm



Contour plot - tool with $VB_B=0.31$ mm



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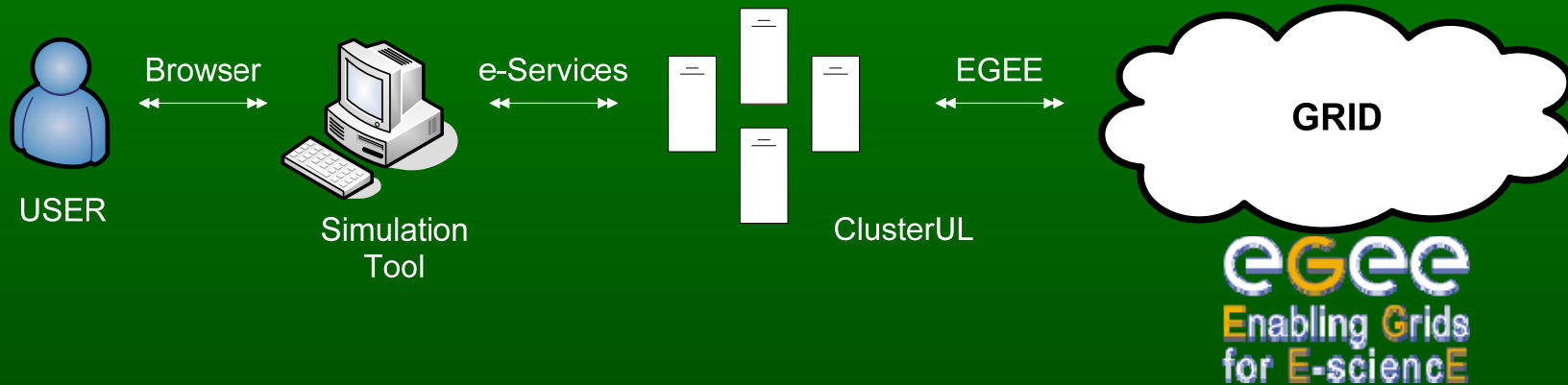


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Our Aim

A **lightweight** architecture to support the execution of neural networks simulation tasks across the Grid infrastructure.



- Security
- Authentication
- Encryption



- Model Design
- Build Simulation
- Monitor



- Results



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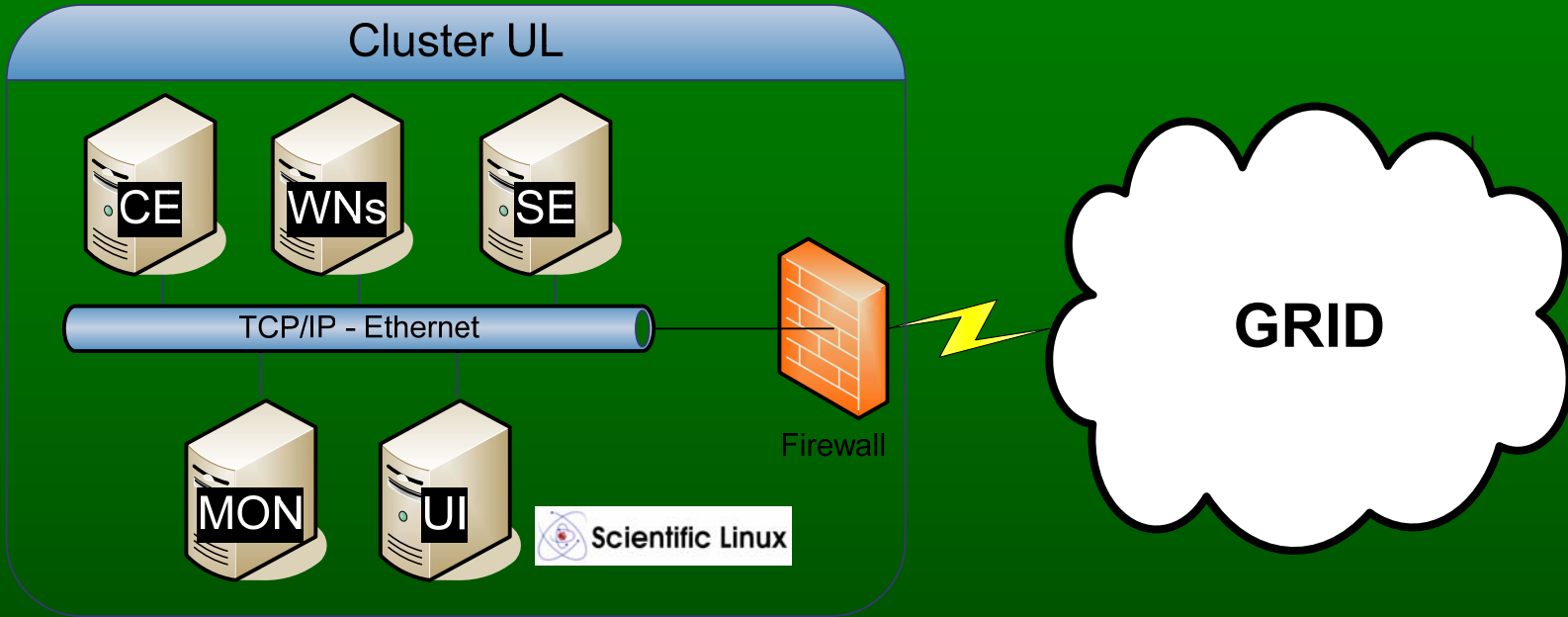


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Architecture and Design



Local Resources:



Architecture (processor type)	P IV 2GHz
Operating system	SL (Linux)
Grid middleware	gLite
Job Manager	LCG

Number of Nodes	15
Memory per Node	512 MB
Disk per node	80 GB
Cluster Storage	1 TB



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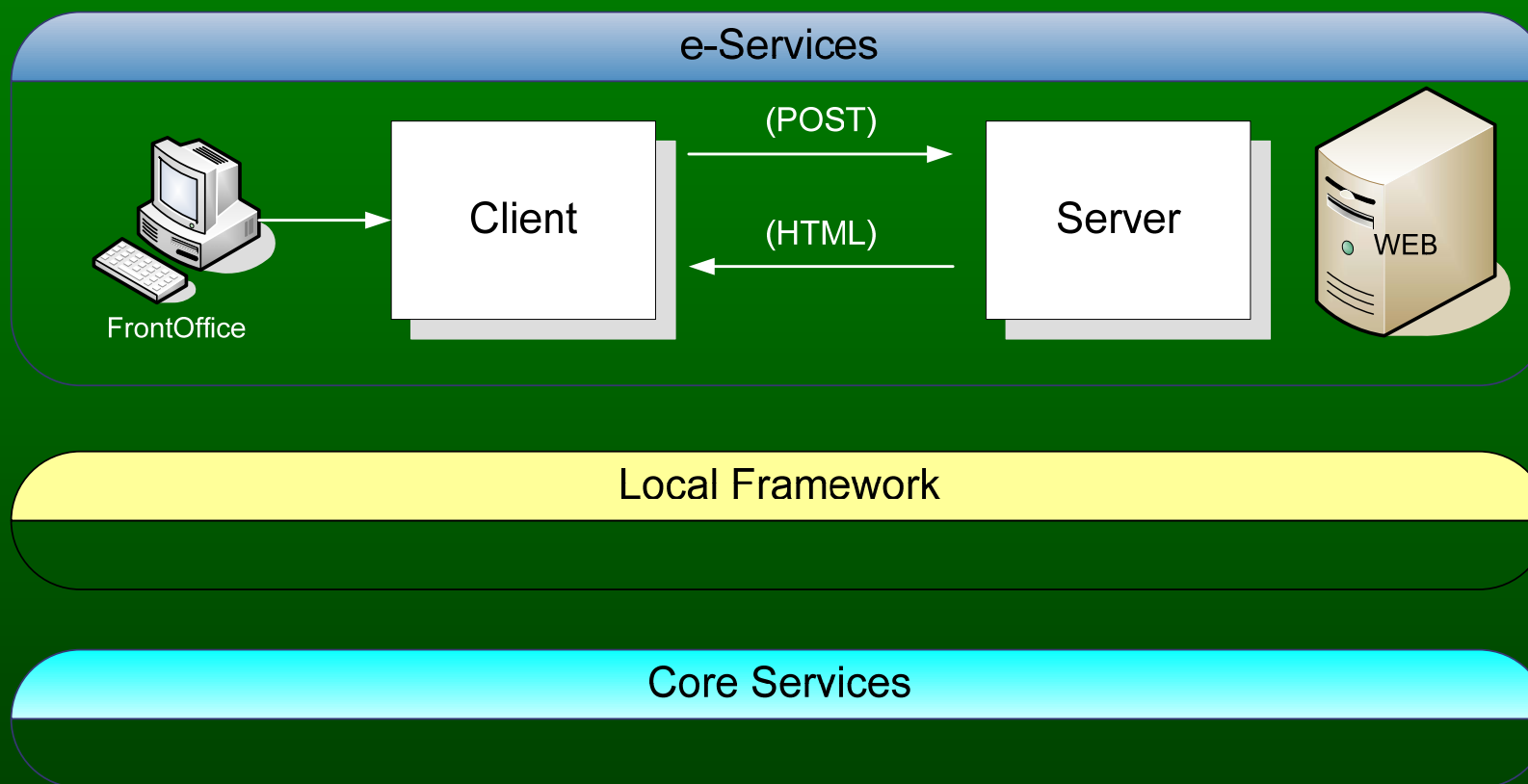


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Architecture and Design



Layer Model





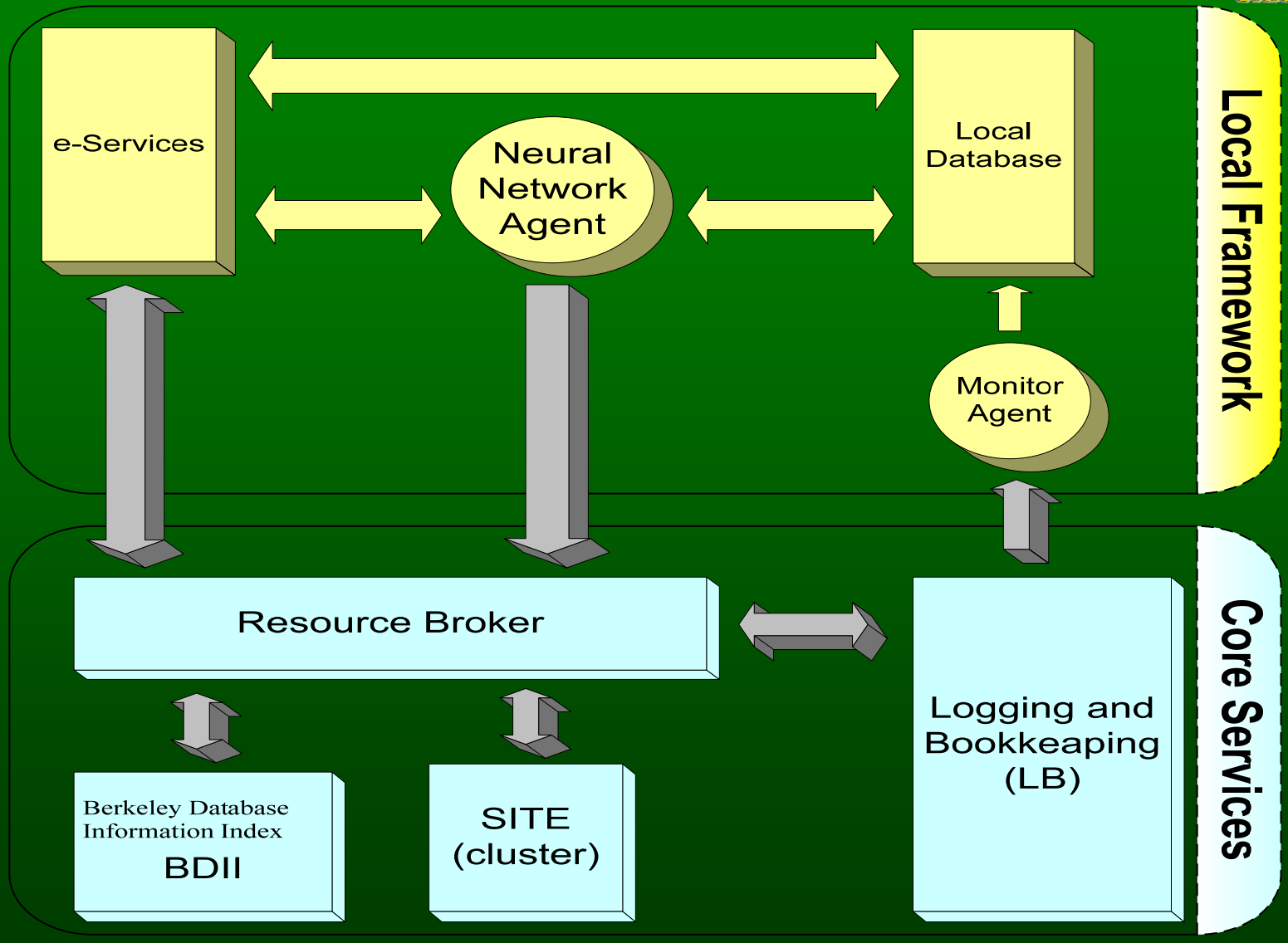
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Architecture and Design





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Neural Network Agent



- Manage and control tasks.
- Distribution of work load.
- Control neural network learning and recognition.
- Interface the communication between neural network layers.

Local Service



Local Database



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Monitor Agent



- Submit jobs that are waiting in the Database.
- Querying the Logging and Bookkeeping.
- Collect those that have already been successfully finished.
- Re-submit unfinished jobs.
- Update the database with the jobs states.





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Hybrid Approach



- Network Agent
 - Simulation Algorithm
 - Database Store Results
- Monitor
 - Looks for new Jobs in Database
 - Launch Jobs to the GRID
 - Collect Results of job execution

“Fast Application Migration to GRID”



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GRIDSOM



Prototype

WEB Registration

The screenshot shows a web browser window titled "Registo" with a sub-header "OpenCA". The main heading is "GRIDSOM" in blue. Below it are navigation links: "ClusterUL", "Tarefas", "Estado", "Certificados", and "Admin". The form is titled "Form de Registo" and contains the following fields and buttons:

- Login:
- Password:
- Password:
- Email:
- User Cert:
- User Key:
-

<http://gridsom.fam.ulusiada.pt>



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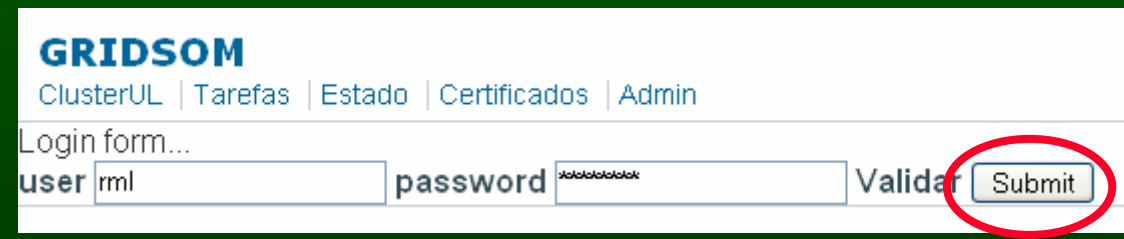


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GRIDSOM



Start Simulation





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Generate .JDL File



GRIDSOM

[ClusterUL](#) | [Tarefas](#) | [Estado](#) | [Certificados](#) | [Admin](#)

1234Upload:

Tipo:

Tamanho: 5.6611328125 Kb

Ficheiro Temp: /tmp/phpBKXAxO

Ficheiro enviado para: /tmp/rml-9785f4af2250d42dd9cf957f2ab74aff/dados.dat
1426232271390 ficheiro .JDL seguinte foi enviado com sucesso:

Task Inserida.

apache Exec...

org.gjt.mm.mysql.Driver

UI01 (cciu1pc17)

```
Type = "Job";  
Executable = "script.sh";  
StdOutput = "std.out";  
StdError = "std.err";  
InputSandbox = {"script.sh", "SOMGcalc.class", "dados.dat", "mapa.dat"};  
OutputSandbox = {"std.out", "std.err"};  
[rml@ui01 rml]$
```



Tasks in Database



Current Tasks – In the Outbox

id_task	1	5
user_login	fernando	rml
data	2007-05-13 02:37:13	2007-05-13 14:40:55
vo	swetest	swetest
jdl_file	[BLOB - 195 B]	[BLOB - 195 B]
sh_file	[BLOB - 46 B]	[BLOB - 46 B]
inbox_dat_file	[BLOB - 5.7 KiB]	[BLOB - 5.7 KiB]
inbox_java_file	[BLOB - 3.9 KiB]	[BLOB - 3.9 KiB]
outbox_result	[BLOB - 221 B]	[BLOB - 0 B]
outbox_error	[BLOB - 0 B]	[BLOB - 0 B]

- The Neural Network Agent will queue the initial job of this task



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Monitor Launch Jobs



```
luis@ecunipci7)
Existem 4 tarefa(s) para serem escolanadas ã GRID
taskID = 8 queueID = 3
USER: rml
Gerar certificado para o proxy ...

DIRECTORIO: /tmp/rml-3/job.jdl
----RESULT--

Selected Virtual Organisation name (from --vo option): swetest
Connecting to host rb02.lip.pt, port 7772
Logging to host rb02.lip.pt, port 9002

*****
                        JOB SUBMIT OUTCOME
*****
The job has been successfully submitted to the Network Server.
Use edg-job-status command to check job current status. Your job identifier (edg_jobId) is:
- https://rb02.lip.pt:9000/YuI00QF-hyo517-ctEupZA
*****
```



Queued Jobs in Database



Job status stored in (*grid_status*)

?	...	inbox_map_file	outbox_result	grid_job_id	j...	grid_status
1	1	0 0 0 0.5487059912593728 0.91628792...	0 0 0.54870599125...	https://rb02.lip.pt:9000/Nmn2B60e...	2	Done (From Grid)
2	1	0 0 1 0.5487059912593728 0.91628792...	0 0 0.01033957 0.0...	https://rb02.lip.pt:9000/M6_PIC7QM...	2	Done (From Grid)
3	1	0 0 1 0.01033957 0.01033957 0.010339...	0 0 0.01033957 0.0...	https://rb02.lip.pt:9000/n6HPpkcL6...	2	Done (From Grid)
5	5	0 0 0 0.2564351387475541 0.78808073...	NULL	https://rb02.lip.pt:9000/Odidrf6EwM...		ToSubmit

?	t...	inbox_map_...	outbox_result	outbox_result_...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.548...	0 0 0.5487059...		https://rb02.lip.pt:9000/Nmn2B60eSXBOuHxooThCHA	2	Done (From Grid)	2
2	1	0 0 1 0.548...	0 0 0.0103395...		https://rb02.lip.pt:9000/M6_PIC7QM-uxv3LVBW81Ow	2	Done (From Grid)	2
3	1	0 0 1 0.010...	0 0 0.0103395...		https://rb02.lip.pt:9000/n6HPpkcL6v8gl946ISqvGQ	2	Done (From Grid)	2
5	5	0 0 0 0.256...	NULL	NULL	https://rb02.lip.pt:9000/Odidrf6EwMFu3ZZplTgN8Q		Ready	1

?	t...	inbox_map_file	outbox_result	outbox...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.5487059...	0 0 0.548705...		https://rb02.lip.pt:9000/Nmn2B60eSXBOuHxooThCHA	2	Done (From Grid)	2
2	1	0 0 1 0.5487059...	0 0 0.010339...		https://rb02.lip.pt:9000/M6_PIC7QM-uxv3LVBW81Ow	2	Done (From Grid)	2
3	1	0 0 1 0.0103395...	0 0 0.010339...		https://rb02.lip.pt:9000/n6HPpkcL6v8gl946ISqvGQ	2	Done (From Grid)	2
5	5	0 0 0 0.2564351...	NULL	NULL	https://rb02.lip.pt:9000/Odidrf6EwMFu3ZZplTgN8Q	1	Waiting	1

?	ta...	inbox_map_file	outbox_result	outb...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.54870599...	0 0 0.548705...		https://rb02.lip.pt:9000/Nmn2B60eSXBOuHxoo...	2	Done (From Grid)	2
2	1	0 0 1 0.54870599...	0 0 0.010339...		https://rb02.lip.pt:9000/M6_PIC7QM-uxv3LVBW...	2	Done (From Grid)	2
3	1	0 0 1 0.01033957...	0 0 0.010339...		https://rb02.lip.pt:9000/n6HPpkcL6v8gl946ISqv...	2	Done (From Grid)	2
5	5	0 0 0 0.25643513...	NULL	NULL	https://rb02.lip.pt:9000/Odidrf6EwMFu3ZZplTgN...		Scheduled	1



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Monitor Getting Job Status



?	ta...	inbox_map_file	outbox_result	outb...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.54870599...	0 0 0.548705...	?	https://rb02.lip.pt:9000/Nmn2B60eSXB0uHxoo...	2	Done (From Grid)	2
2	1	0 0 1 0.54870599...	0 0 0.010339...	?	https://rb02.lip.pt:9000/M6_PIC7QM-uxv3LVBW...	2	Done (From Grid)	2
3	1	0 0 1 0.01033957...	0 0 0.010335...	?	https://rb02.lip.pt:9000/n6HPpkcL6v8gl946ISqv...	2	Done (From Grid)	2
5	5	0 0 0 0.25643513...	NULL	NULL	https://rb02.lip.pt:9000/Odidrf6EwmFu3ZZplTgN...	2	Done (From Grid)	1

Job Done ! But FAIL



```
Não existem tarefas para serem escalonadas à GRID
Existem 1 tarefa(s) escalonadas na GRID
id_queue = 5 grid_job_id = https://rb02.lip.pt:9000/jalv_PITuCMQMrq_z7i00g
USER: rml
Estado: Scheduled
JOB NA GRID queue_id: 5
Actualizando o seu estado na base de dados.
```

Job re-submit !



Monitor Getting Results



?	ta...	inbox_map_file	outbox_result	o...	grid_job_id	j...	grid_status	...	log
1	1	0 0 0 0.5487059912593...	0 0 0.54870599125...	QA	https://rb02.lip.pt:9000/Nmn2...	2	Done (From Grid)	2	
2	1	0 0 1 0.5487059912593...	0 0 0.01033957 0.0...	QA	https://rb02.lip.pt:9000/M6_PL...	2	Done (From Grid)	2	
3	1	0 0 1 0.01033957 0.010...	0 0 0.01033957 0.0...	QA	https://rb02.lip.pt:9000/n6HP...	2	Done (From Grid)	2	
5	5	0 0 0 0.2564351387475...	0 0 0.25643513874...	QA	https://rb02.lip.pt:9000/jalv_P...	1	Done (From Grid)	2	

Job Done !



Neural Network Agent – Generate a new iteration

?	inbox_map_file	outbox_re...	outbo...	grid_job_id	j...	grid_status	...	log
1	1	0 0 0 0.548705...	0 0 0.548...	https://rb02.lip.pt:9000/...	2	Done (From Grid)	2	
2	1	0 0 1 0.548705...	0 0 0.010...	https://rb02.lip.pt:9000/...	2	Done (From Grid)	2	
3	1	0 0 1 0.010339...	0 0 0.010...	https://rb02.lip.pt:9000/...	2	Done (From Grid)	2	
5	5	0 0 0 0.256435...	0 0 0.256...	https://rb02.lip.pt:9000/...	2	Done (From Grid)	2	
6	5	0 0 1 0.256435...	NULL	https://rb02.lip.pt:9000/...	1	Not Submitted	0	NULL

Until the end of simulation

Monitor – Submit this new iteration:

?	...	inbox_map_file	outbox...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.548705991259372...	0 0 0.5...	https://rb02.lip.pt:9000/Nmn2...	2	Done (From Grid)	2
2	1	0 0 1 0.548705991259372...	0 0 0.0...	https://rb02.lip.pt:9000/M6_P...	2	Done (From Grid)	2
3	1	0 0 1 0.01033957 0.01033...	0 0 0.0...	https://rb02.lip.pt:9000/n6HP...	2	Done (From Grid)	2
5	5	0 0 0 0.256435138747554...	0 0 0.2...	https://rb02.lip.pt:9000/jalv_...	2	Done (From Grid)	2
6	5	0 0 1 0.256435138747554...	NULL	https://rb02.lip.pt:9000/1Sm...	1	Scheduled	1



End Simulation

Neural Network Agent – Publish the final results.

id_task	1	5
user_login	fernando	rml
data	2007-05-13 02:37:18	2007-05-13 14:40:55
vo	swetest	swetest
jdl_file	[BLOB - 195 B]	[BLOB - 195 B]
sh_file	[BLOB - 46 B]	[BLOB - 46 B]
inbox_dat_file	[BLOB - 5.7 KiB]	[BLOB - 5.7 KiB]
inbox_java_file	[BLOB - 3.9 KiB]	[BLOB - 3.9 KiB]
outbox_result	[BLOB - 221 B]	[BLOB - 221 B]
outbox_error	[BLOB - 0 B]	[BLOB - 0 B]

?	t...	inbox_map_file	outbox_result	out...	grid_job_id	j...	grid_status	...
1	1	0 0 0 0.5487059...	0 0 0.54870...	🔍	https://rb02.lip.pt:9000/Nmn...	2	Done (From Grid)	2
2	1	0 0 1 0.5487059...	0 0 0.01033...	🔍	https://rb02.lip.pt:9000/M6_...	2	Done (From Grid)	2
3	1	0 0 1 0.0103395...	0 0 0.01033...	🔍	https://rb02.lip.pt:9000/n6HP...	2	Done (From Grid)	2
5	5	0 0 0 0.2564351...	0 0 0.25643...	🔍	https://rb02.lip.pt:9000/jalv_...	2	Done (From Grid)	2
6	5	0 0 1 0.2564351...	0 0 0.01033...	🔍	https://rb02.lip.pt:9000/zlwG...	2	Done (From Grid)	2
7	5	0 0 1 0.0103395...	0 0 0.01033...	🔍	https://rb02.lip.pt:9000/-zClu...	2	Done (From Grid)	2



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User Collect Results



Download de Final Data

GRIDSOM
ClusterUL | Tarefas | Estado | Certificados | Admin

Extrair o outbox's...
outbox_result
outbox_error

Atualizar a Listagem de Tarefas

Logout - Terminar Sessão

GRIDSOM
ClusterUL | Tarefas | Estado | Certificados | Admin

Opening

You have

Tarefa 5 - Concluída

Pendentes: 0
Concluídas: 1

What: Atualizar a Listagem de Tarefas

Logout - Terminar Sessão
 Save to disk

Do this automatically for files like this from now on.

OK Cancel



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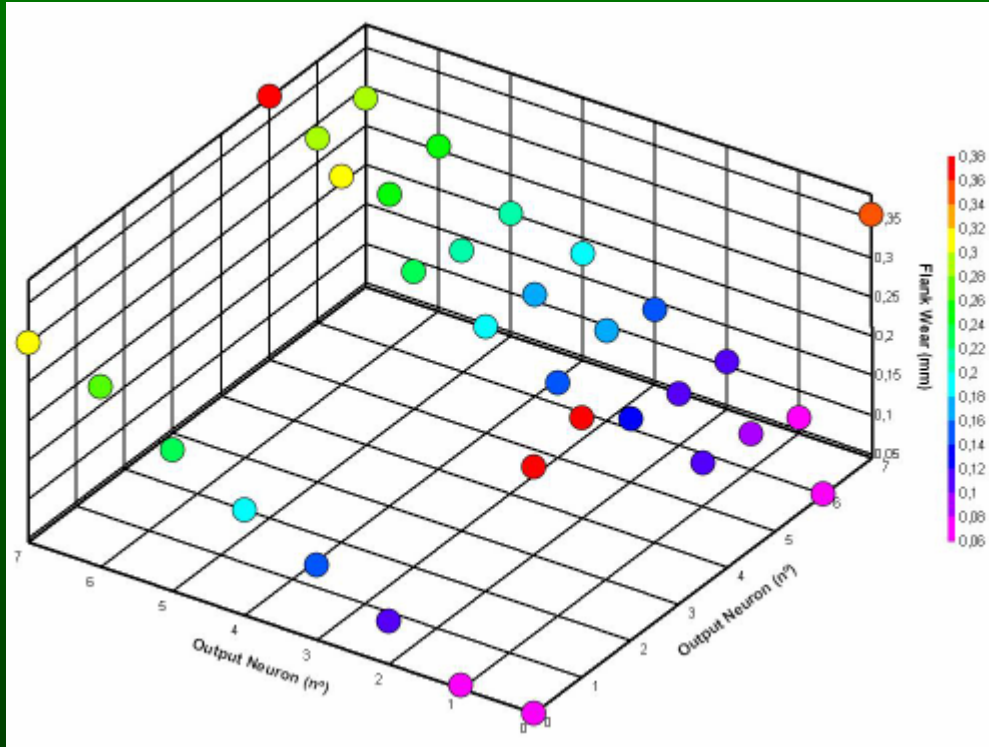


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Data Visualization



Data Analysis (outside GRIDSOM)





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Conclusions and Future Developments



- Prototype successfully tested
- Hybrid approach
- SSL layer
- Migrate to New Scheduling System
- Virtual Organization
- Core services



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Many Thanks



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