



Paraméter vizsgálat alapú grid alkalmazások és támogatásuk P-GRADE Portállal

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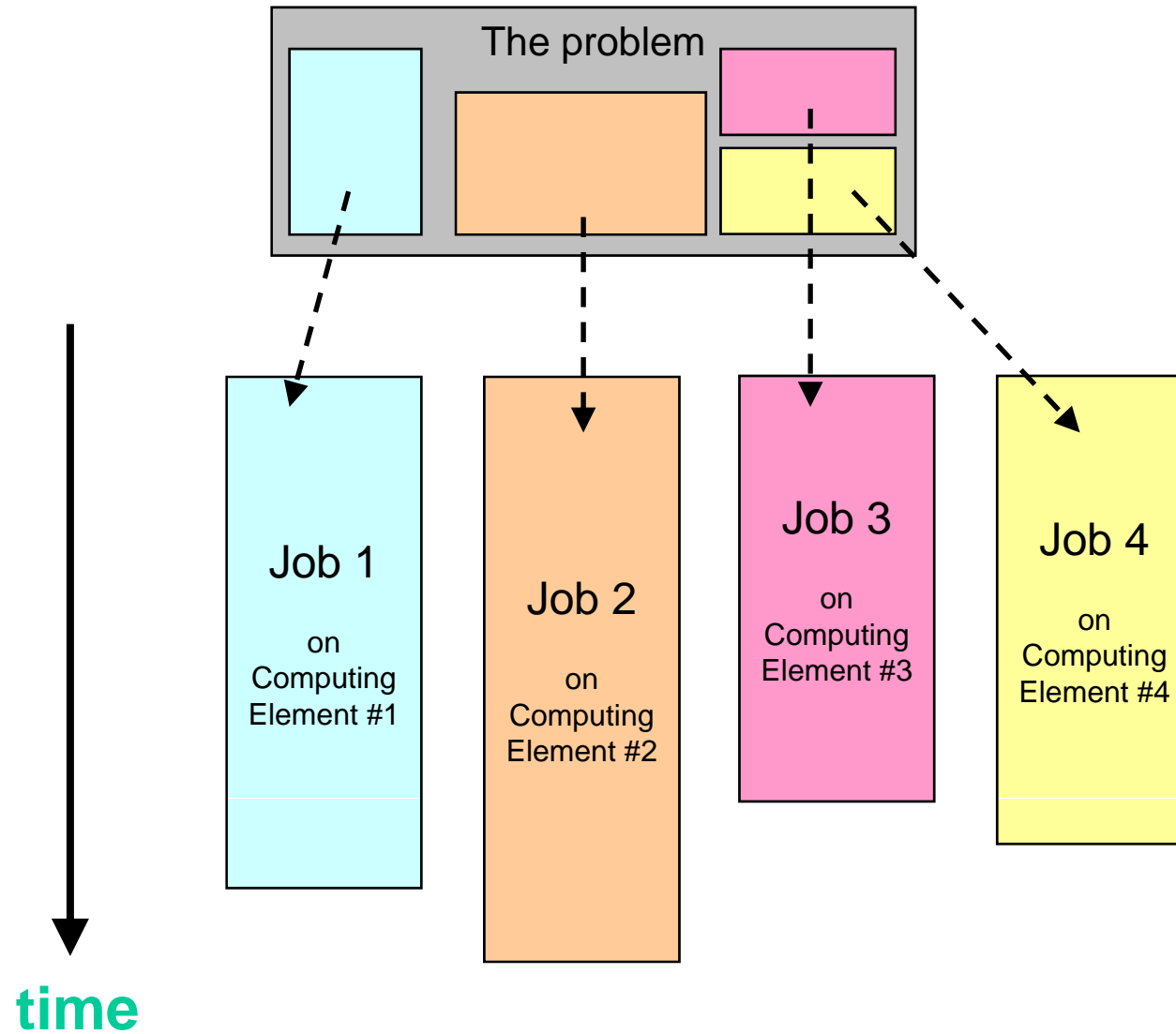


Functional Vs Data parallelism

- Functional Decomposition (Functional Parallelism)
 - Decomposing the problem into different jobs which can be distributed to multiple CEs for simultaneous execution
 - **Different executables run on different CEs**
 - Good to use when there is not static structure or fixed determination of number of calculations to be performed
- Domain Decomposition (Data Parallelism)
 - Partitioning the problem's data domain and distributing portions to multiple instances of the same job for simultaneous execution
 - **Same executables run on different CEs processing different data**
 - Good to use for problems where:
 - data is static (e.g. factoring, solving large matrix or finite difference calculations, parameter studies)
 - dynamic data structure tied to single entity where entity can be subsetted (large multi-body problems)
 - domain is fixed but computation within various regions of the domain is dynamic (fluid vortices models)
- **> 90% of grid applications employ data parallelism (parameter study)**

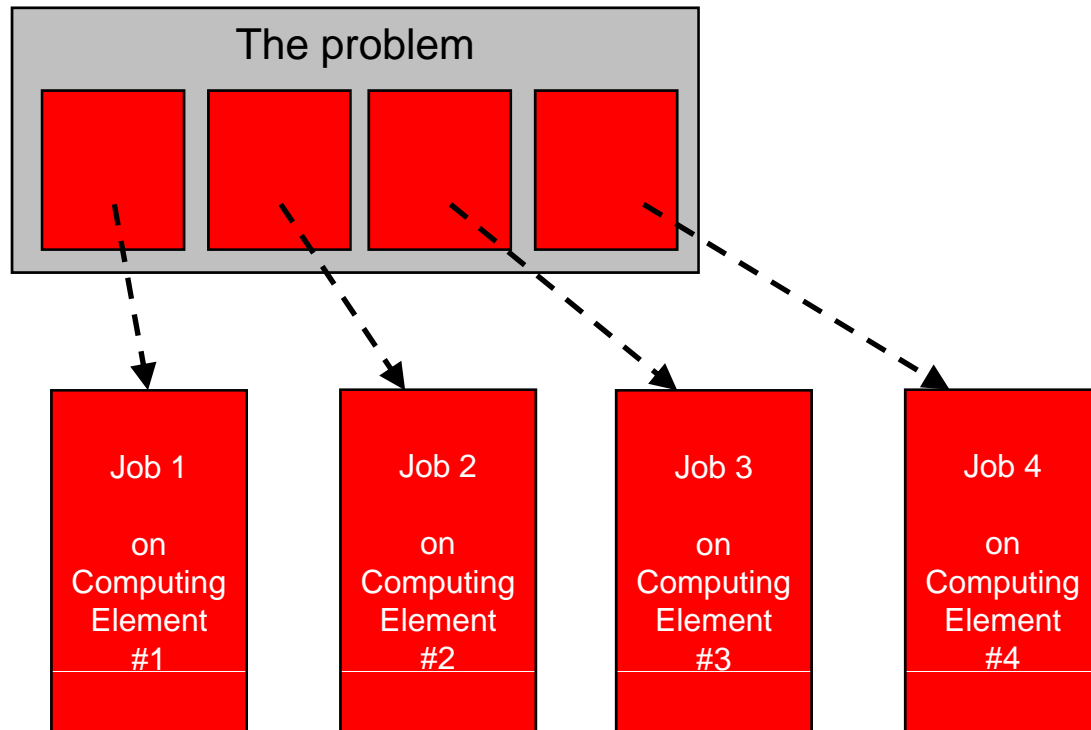


Functional parallelism



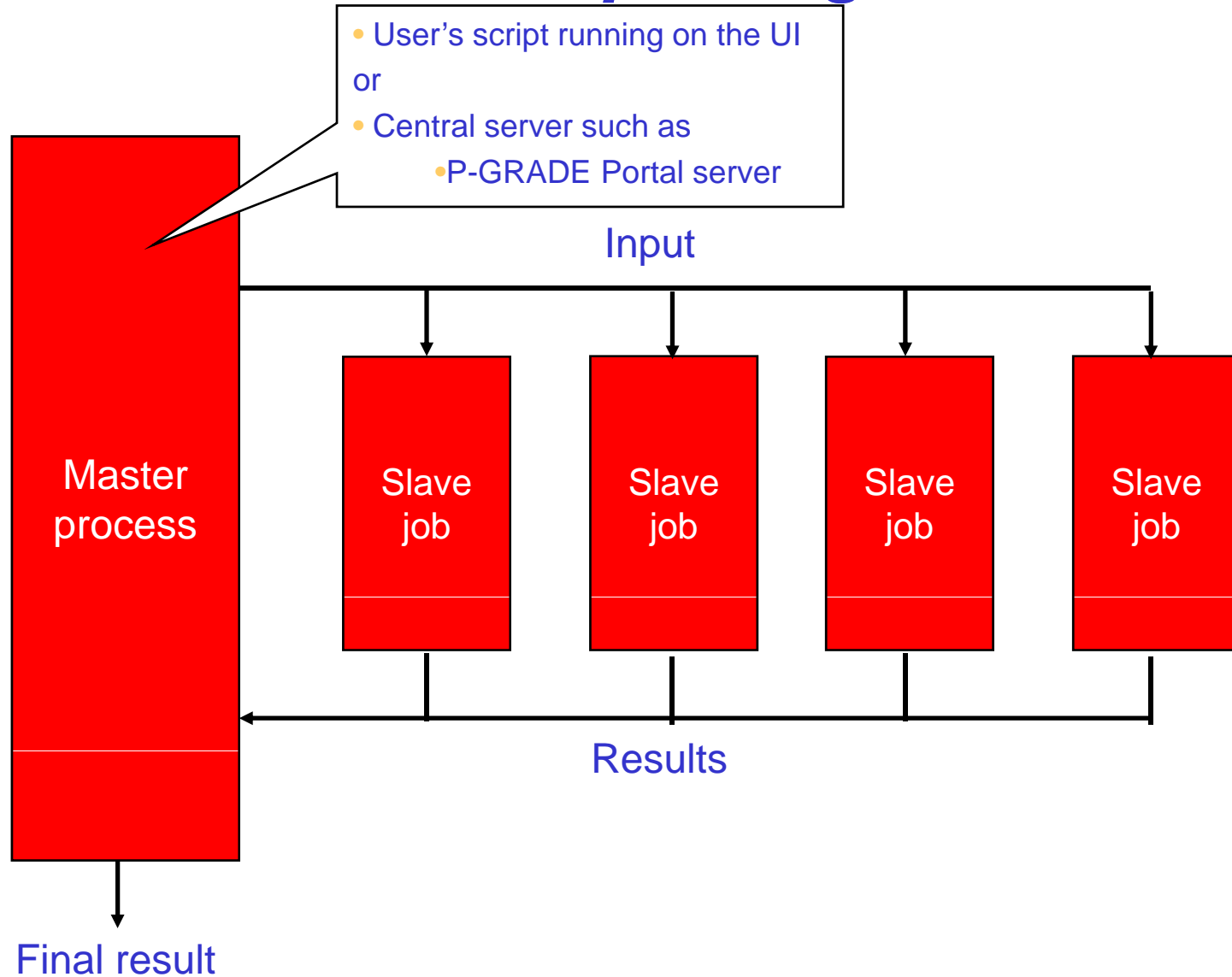


Data parallelism



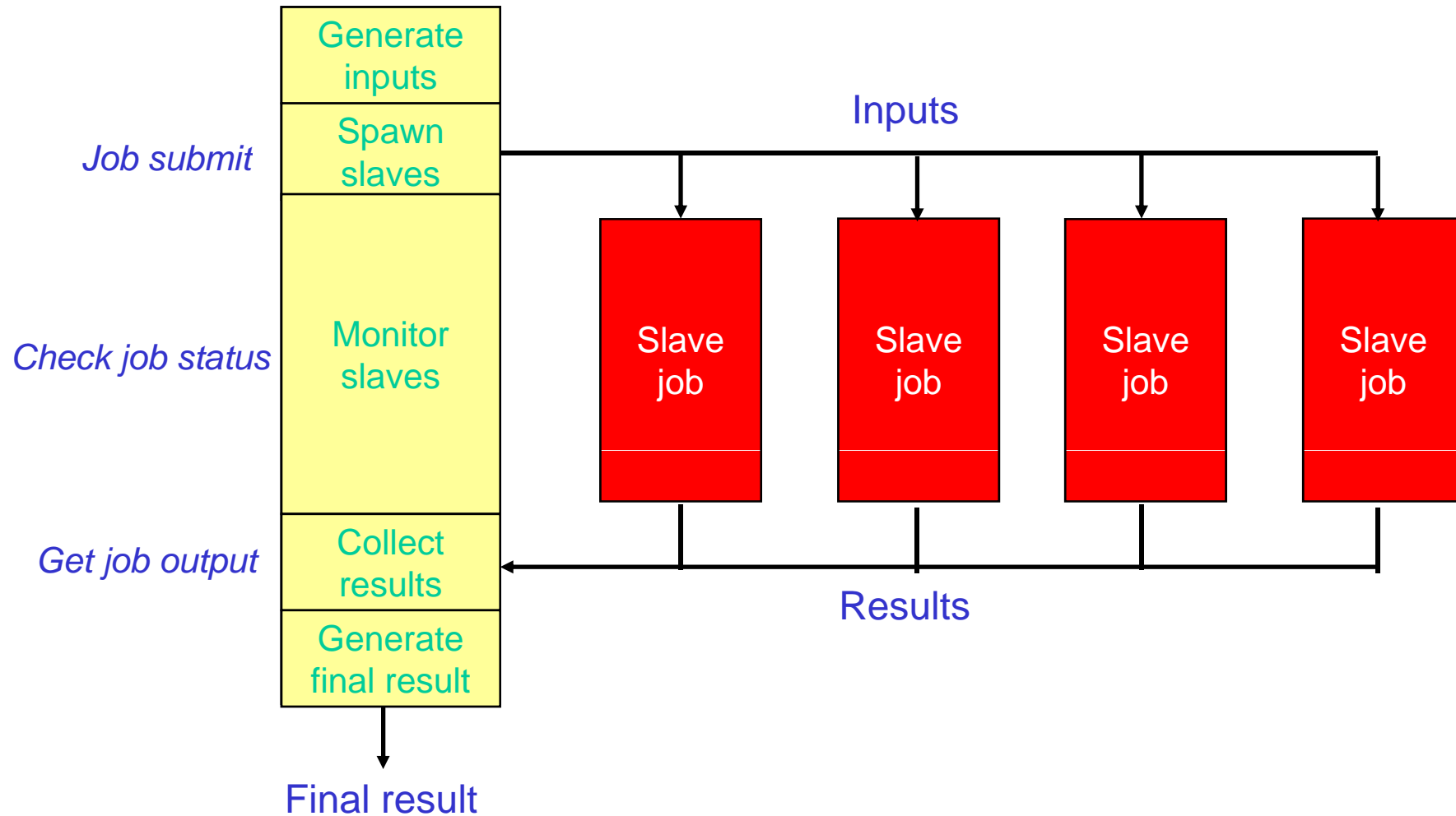


Data parallelism: Master-slave paradigm





Structure of the master

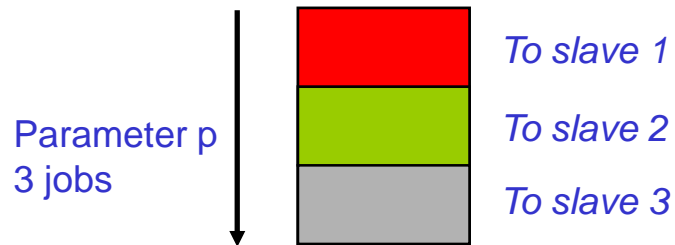




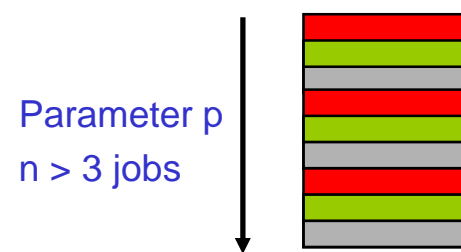
Data splitting techniques

- **One Dimensional Data Distribution**

Block Distribution



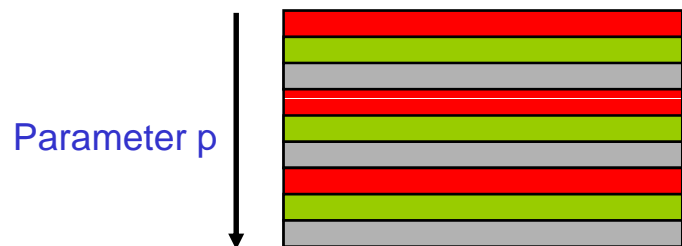
Cyclic Distribution



- **Two Dimensional Data Distribution**

Cyclic block

Parameter q



Block Cyclic



Block Block



- **N Dimensional Data Distribution**



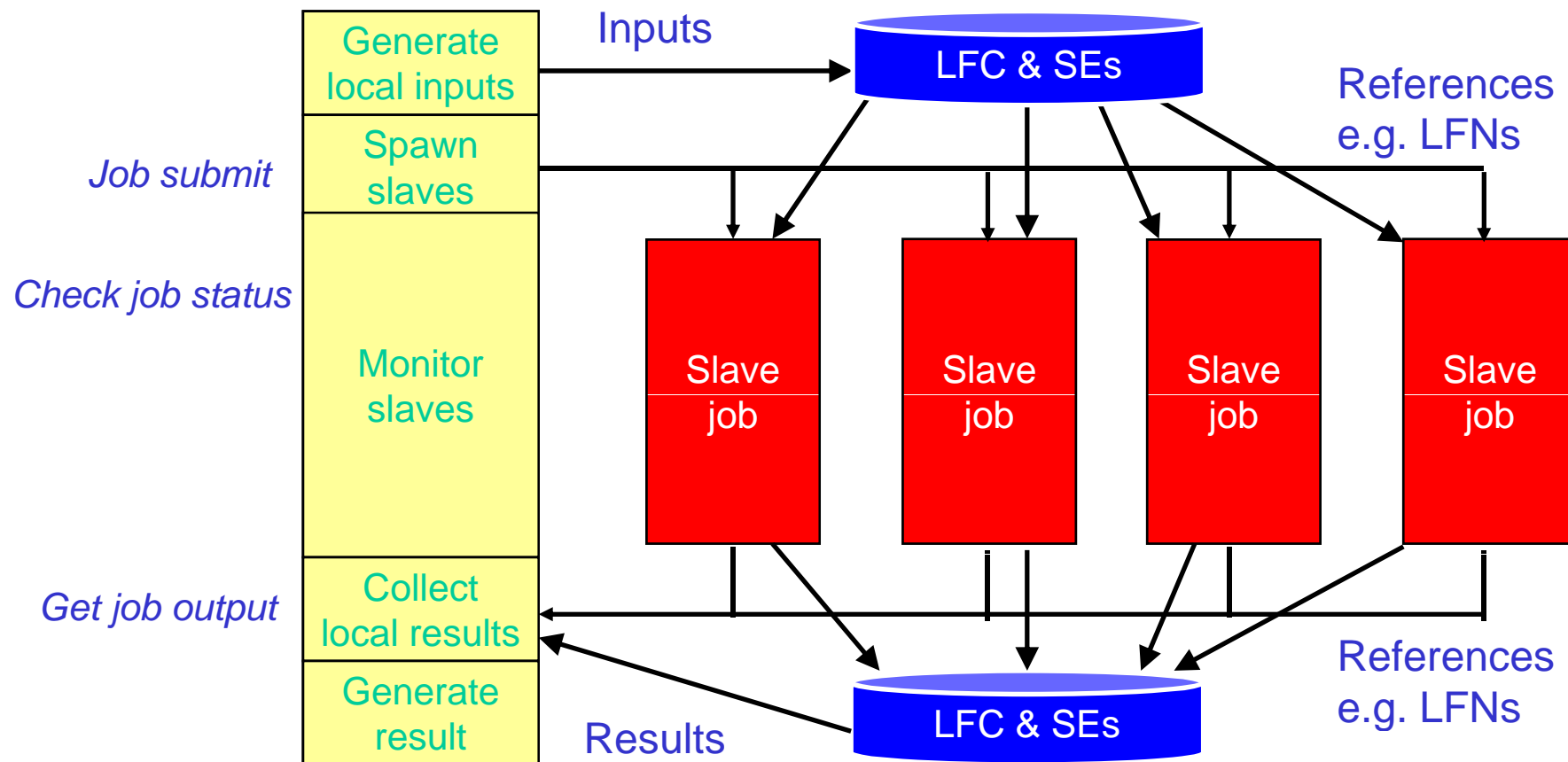
Choose data item size carefully

- Large data → Less jobs → long jobs:
 - Smaller overall submission overhead
 - Middleware overhead 5-10 minutes / job
 - Waiting queue overhead 0-X minutes / job → depends on VO load
 - Unequal utilization of resources
 - Slow and fast resources must do the same amount of work
- More jobs → short jobs:
 - Better load balancing
 - Faster machines do more
 - Overall execution time can be shorter...unless the VO load is high
 - Submission overhead is bigger



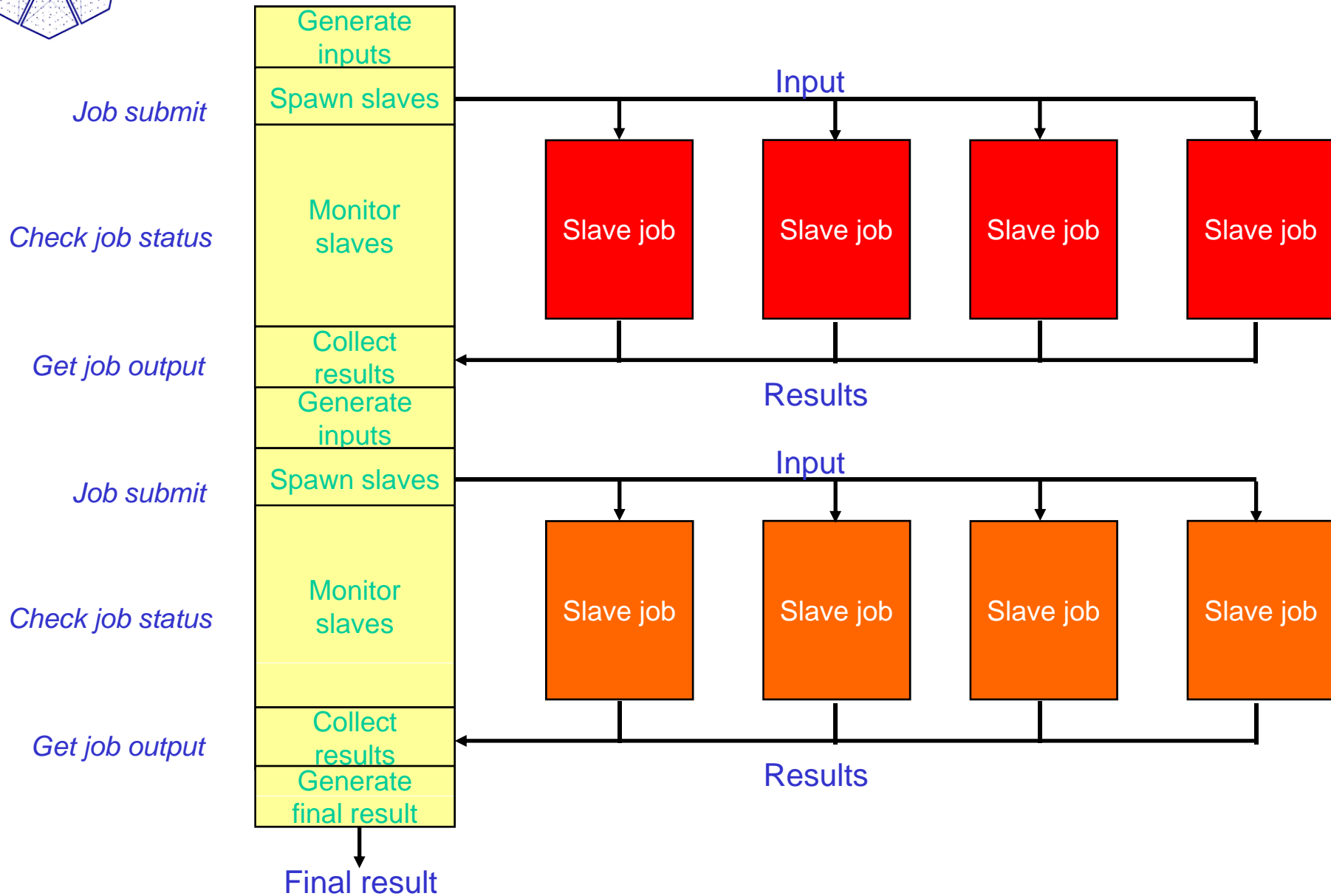
Distribution of large data sets

- Slaves receive only data reference from master and download real data from Storage Element
- Slaves put results into Storage Elements and return LFNs



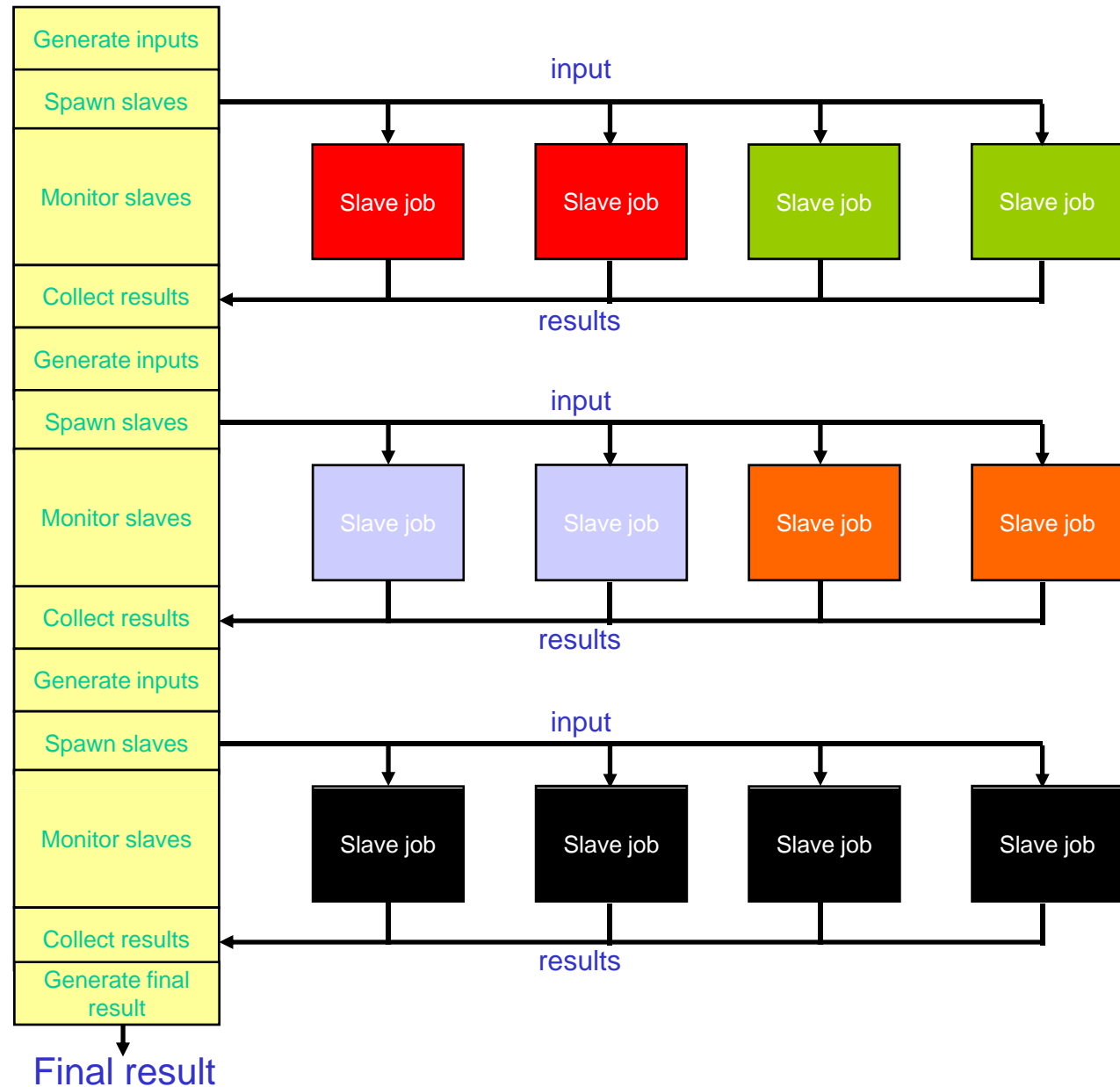


Multi-level master-slave



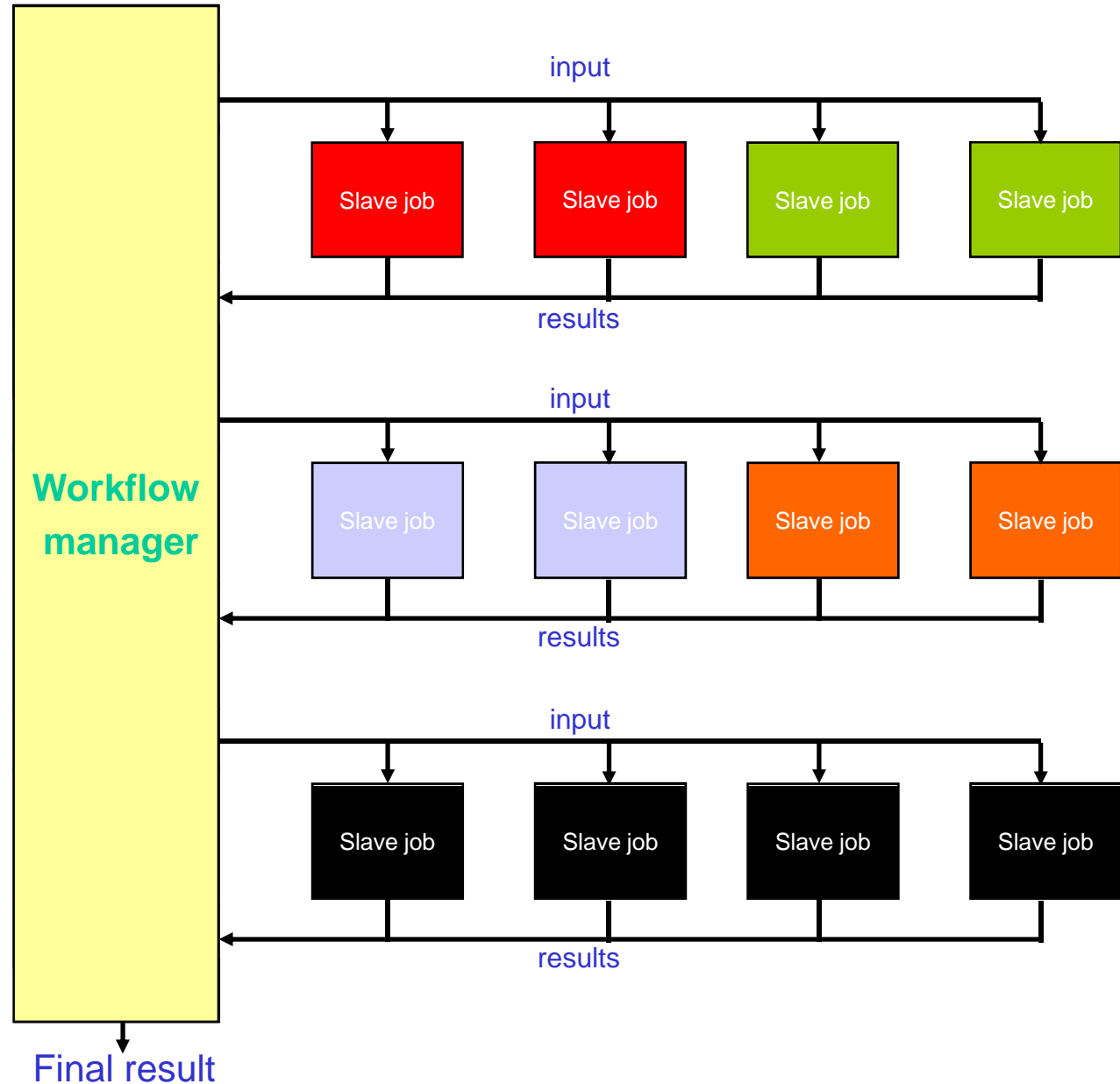
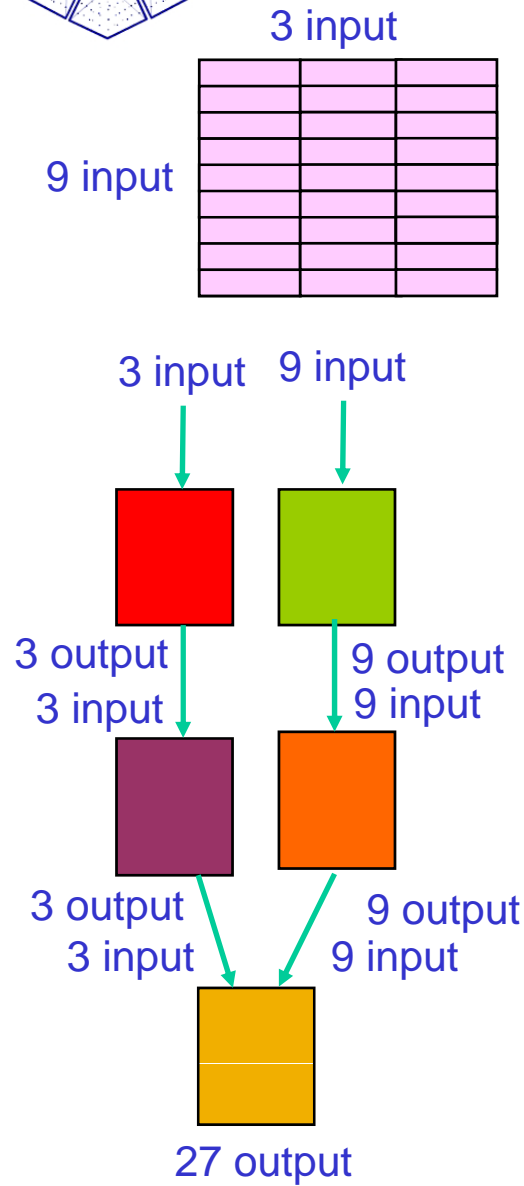


Complex master-slave





Complex master-slave = Parameter study workflow

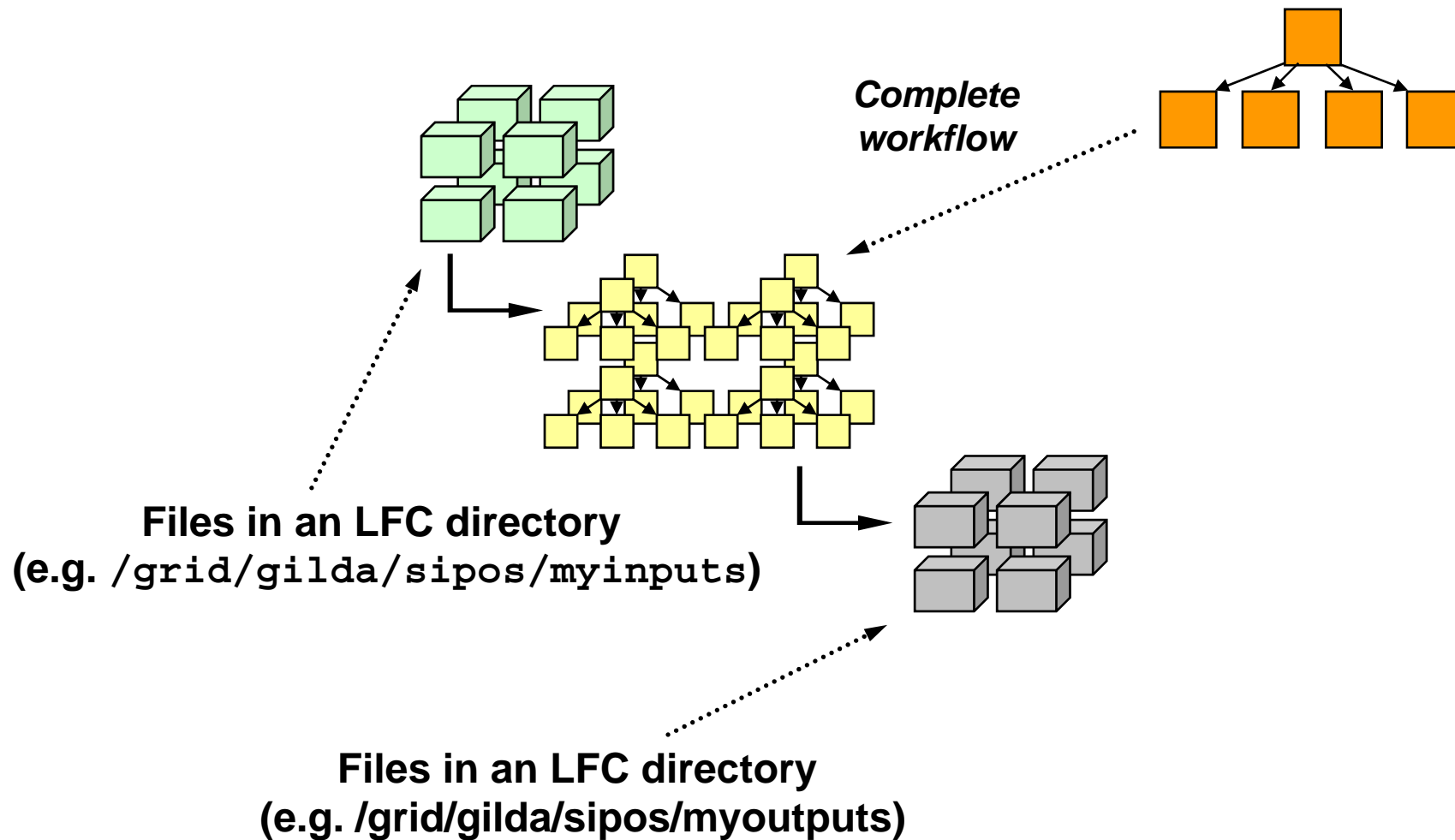




Parameter Study workflow support in P-GRADE Portal

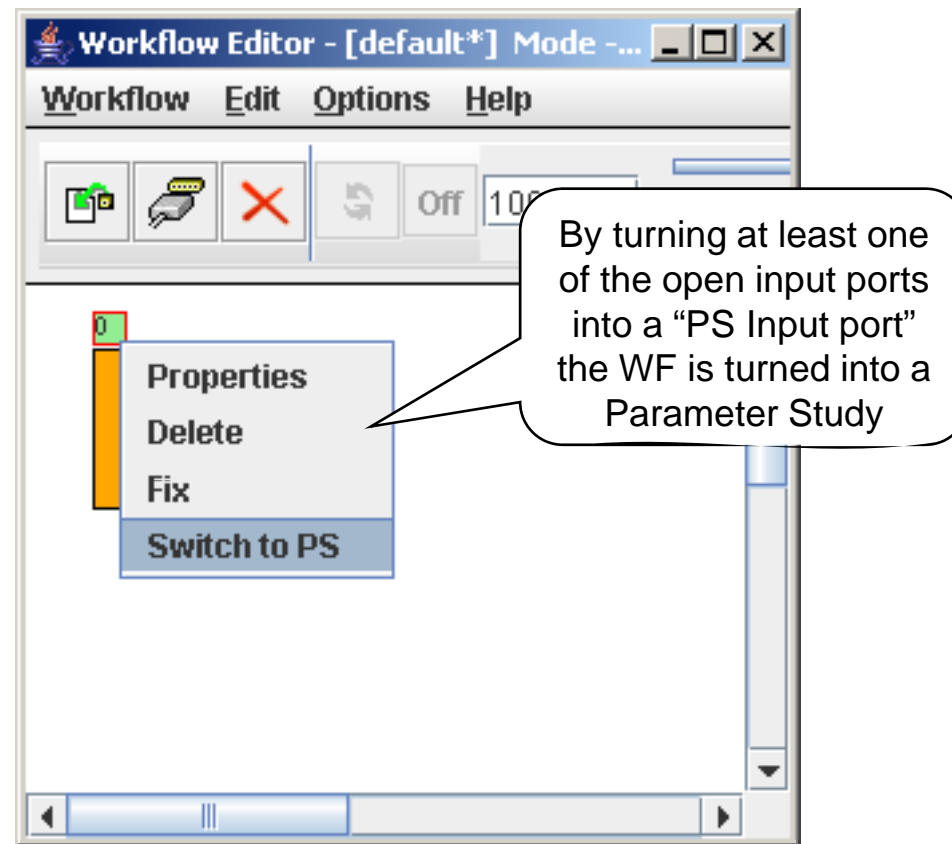


Scaling up a workflow to a parameter study with P-GRADE



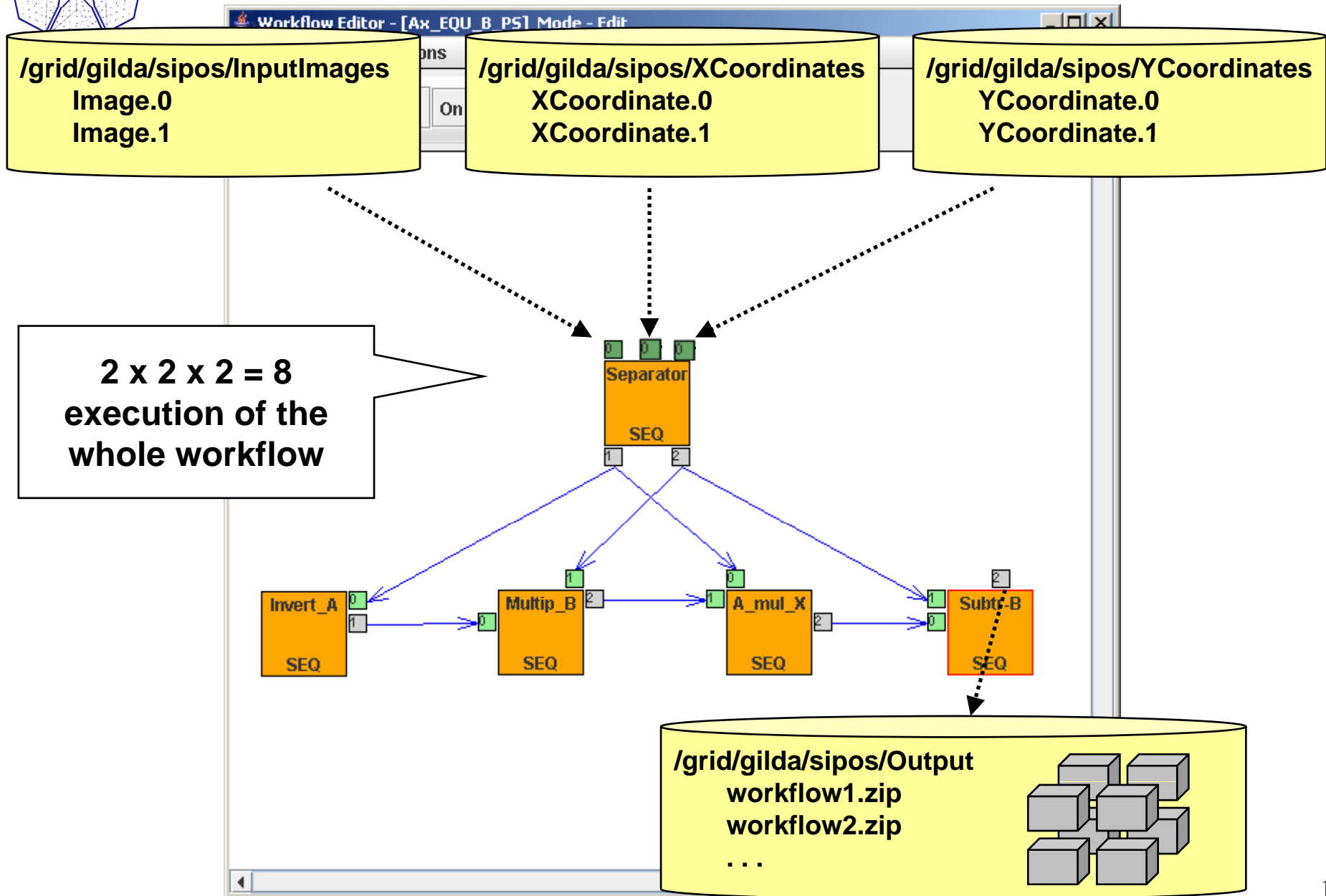


Turning a WF into a parameter study





Input-output files are stored in SEs





PS Input Port of Simple PS

The screenshot shows the Workflow Editor interface with a 'Separator / 0 PS properties' dialog box open. The dialog box contains the following fields and options:

- PS Port name: []
- Type: In Out
- Directory type: Local Remote
- Directory: nann/PS/EQU_AGEN_11_10/A_GEN12
- File Browser: [] managed copy
- Internal File Name: INPUT
- File storage type: Permanent Volatile

Annotations in the image include:

- A green callout bubble pointing to the 'Directory' field with the text: "Remote file **Directory** instead of **FILE** reference".
- A green callout bubble pointing to the 'Directory' field with the text: "Do not use the prefix **lfn:** if the directory is EGEE Grid file catalogue".

The workflow editor background shows two 'SEQ' blocks: 'Invert_A' and 'Multip.'. Arrows indicate data flow between them.



Simple PS Activity 2: placement of result

The screenshot shows the PGrade Grid portal interface. The main window is the 'Workflow Editor' for a workflow named 'MultiplyPS_GILDA_LCG2_gabor'. A 'PS Properties' dialog box is open, showing the following fields:

- Output Directory: /grid/gilda/debrecen00/MatrixPS/results
- Grid: gilda_LCG_2_BROKER
- LCG Catalog Type: lfc edg
- LFC Host: lfc-gilda.ct.infn.it
- SE: aliserv6.ct.infn.it

Below the dialog box, a table lists several Virtual Objects (VOs) with their status, size, and percentage of completion. The first row is highlighted in green, indicating it is the selected VO.

Status	Size	Percentage	Other Info
finished	73 KB	0.07%	Not defined.
	1.039 MB	1.04%	

Menu item **PS Properties** can be called within the **Workflow** menu

The **Output directory** will contain the set of individual compressed files. Each compressed file contains the outputs of an element Workflow have been elaborated over an item of the PS Input Set

Properties of the VO File Catalog

One SE of the chosen VO



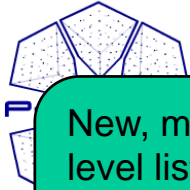
Executing PS workflows

The screenshot shows a web browser window titled "PGrade Grid portal - Windows Internet Explorer". The address bar contains the URL: `http://n43.hpcc.sztaki.hu:8080/gridsphere/gridsphere?cid=77&gs_action=doRefreshList`. The browser interface includes a search bar with "Google" and various toolbars. The main content area displays a table of workflow jobs. The table has columns for job name, status, size, progress, and a set of action buttons. The "PS Details" button for the job "Ax_EQU_B_voice_PS" is circled in red. A callout box points to this button.

Job Name	Status	Size	Progress	Completion	Actions
Ax_EQUAL_B_PS_G_C_sztaki_fork	finished	253 KB	0.25%	✓	PS Details, Submit, Attach, Delete
Ax_EQU_B	init	112 KB	0.11%	N/A	Details, Submit, Attach, Delete
Ax_EQU_B_voice_PS	init	151 KB	0.15%	N/A	PS Details, Submit, Attach, Delete

PS Details for parameter sweep workflows applications

Workflow Manager List PS Details view showing eWF-s



New, middle level list to render the details of a PS Workflow

Statistics shows the progress of the elaboration of the whole PS

The eWorkflow buffer list shows the state of the Workflows being processed.

PGrade Grid portal - Windows Internet Explorer

http://n44.hpcc.sztaki.hu:8080/gridsphere/gridsphere?cid=72&gs_action=doShowWorkflowDetails

RELEASE 2.4

P-GRADE portal

MTA SZTAKI

Logout
Welcome, Peter Kacsuk

Welcome Workflow States Settings Information System Help

Workflow Manager Storage Upload

Workflow Manager

Refresh Back

PS workflow details

PS Workflow	Status	[Output]	[Logs]	[Action]
Ax_EQU_B_voce_PS	submitted	N/A	-	Abort Attach Delete

eWorkflow list

Statistics

Total	Init	Submitted	Rescue	Error	Finished
12	2	5	0	0	5

Workflow	Status	[Output]	[View]	[Action]
Ax_EQU_B_voce_PS.10	submitted	N/A	Details	Suspend Abort
Ax_EQU_B_voce_PS.6	running	N/A	Details	Suspend Abort
Ax_EQU_B_voce_PS.7	running	N/A	Details	Suspend Abort
Ax_EQU_B_voce_PS.8	running	N/A	Details	Suspend Abort
Ax_EQU_B_voce_PS.9	submitted	N/A	Details	Suspend Abort

Message: eWorkflow list successfully shown.

Internet 100%



Details view of the eWF Ax_EQU_B_voce_PS.6

Job level details of an eWorkflow

Workflow Manager

Workflow	Job	Gridname	Hostname	Status	[Logs]	[Output]	[Visualization]	[Action]
Ax_EQU_B_voce_PS.6				running	-	N/A	Visualize	Suspend Abort
	A_mul_X	voce_LCG_2_BROKER	ares02.cyf-kr.edu.pl	running	--		-	
	Invert_A	voce_LCG_2_BROKER	skurut17.cesnet.cz	finished	Out		-	
	Multip_B	voce_LCG_2_BROKER	fangorn.man.poznan.pl	finished	Out		-	
	Separator	voce_LCG_2_BROKER	egee-ce1.gup.uni-linz.ac.at	finished	Out		-	
	Subtr-B	voce_LCG_2_BROKER	unknown	init			-	

Message: Workflow details successfully displayed.

October 13, 2006

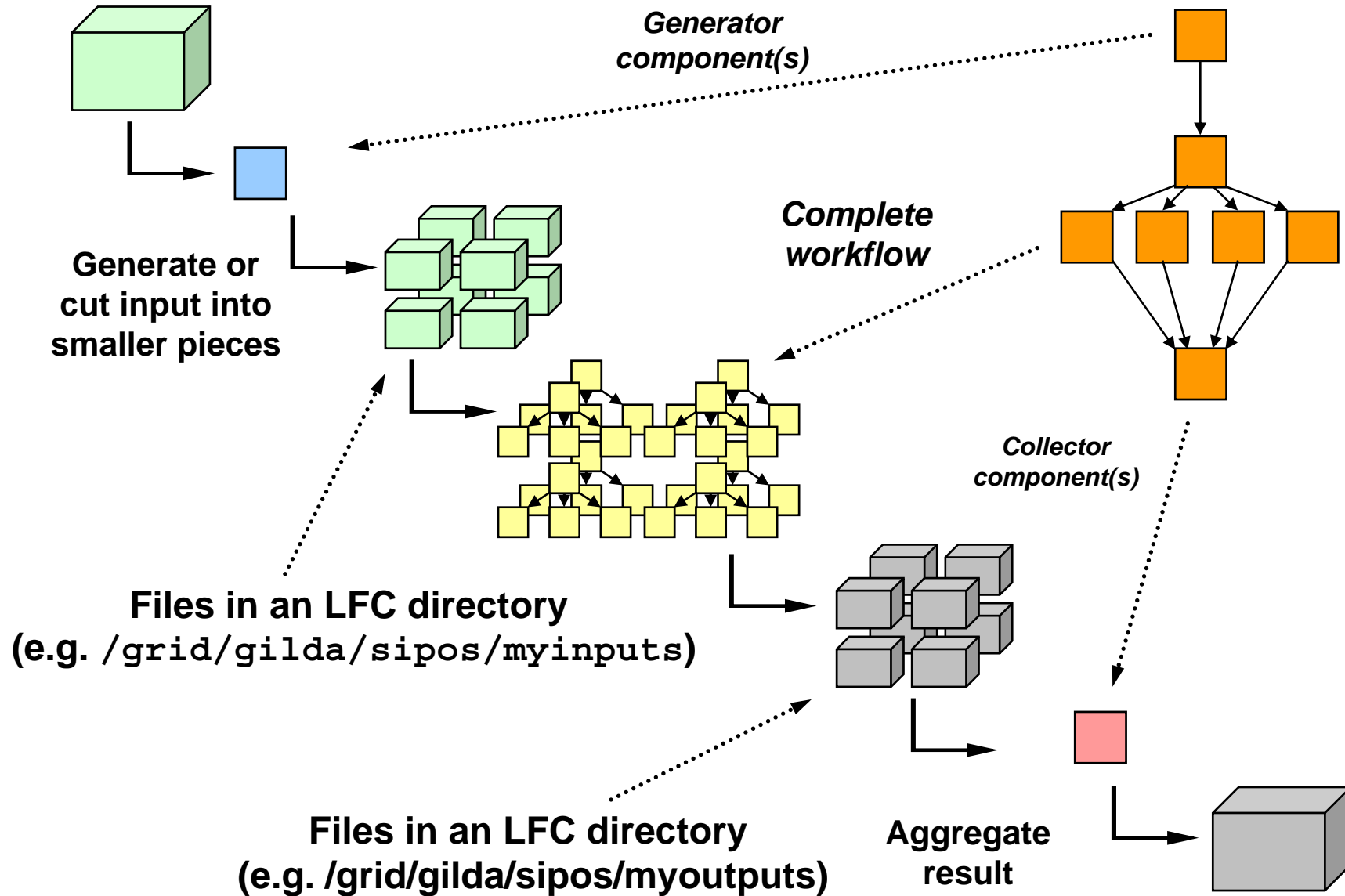
See, that the button **Attach** is missing as there is not to much importance to access the WE until the eWorkflow list is exhausted



Advanced PS WFs in P-GRADE Portal

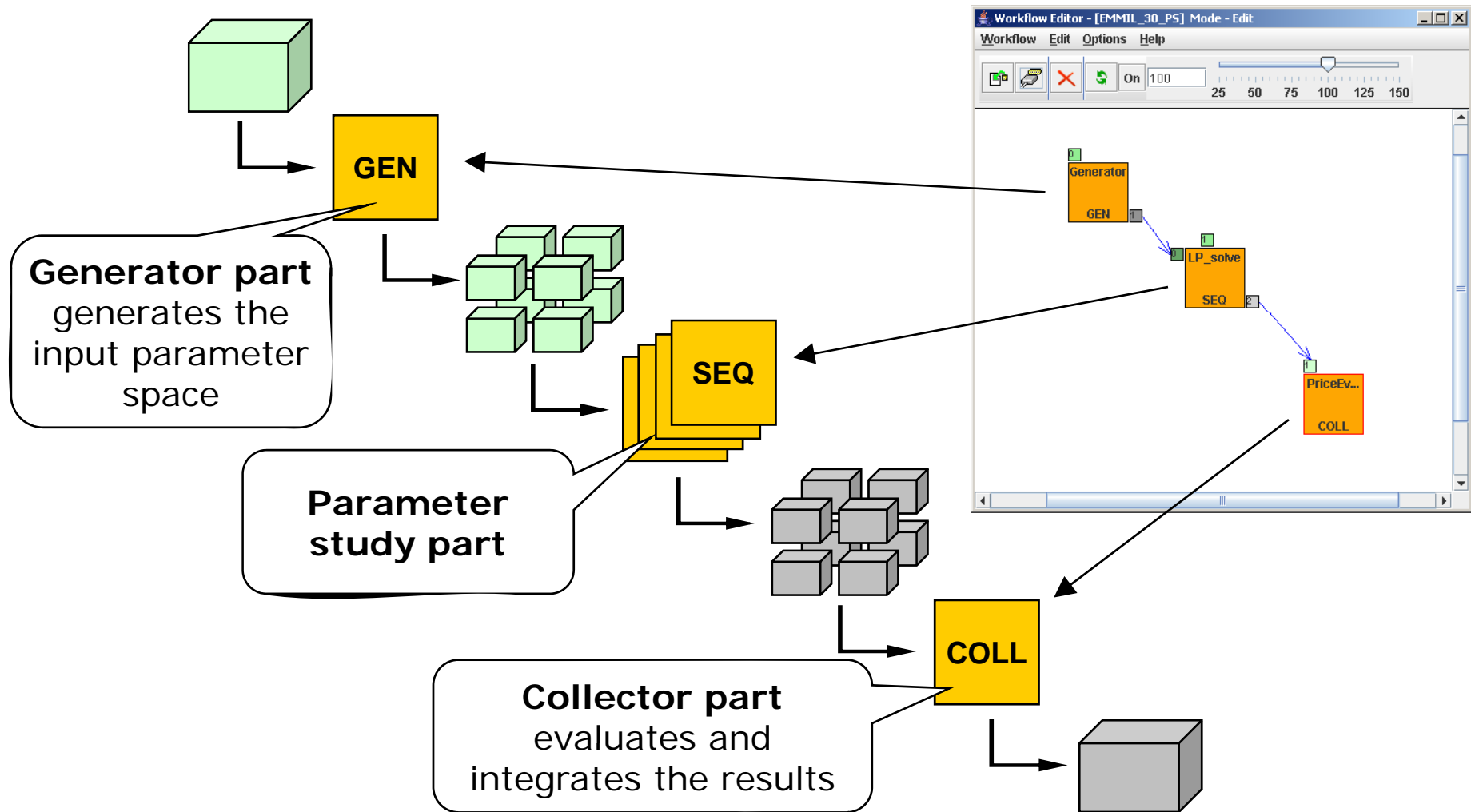


Advanced parameter studies



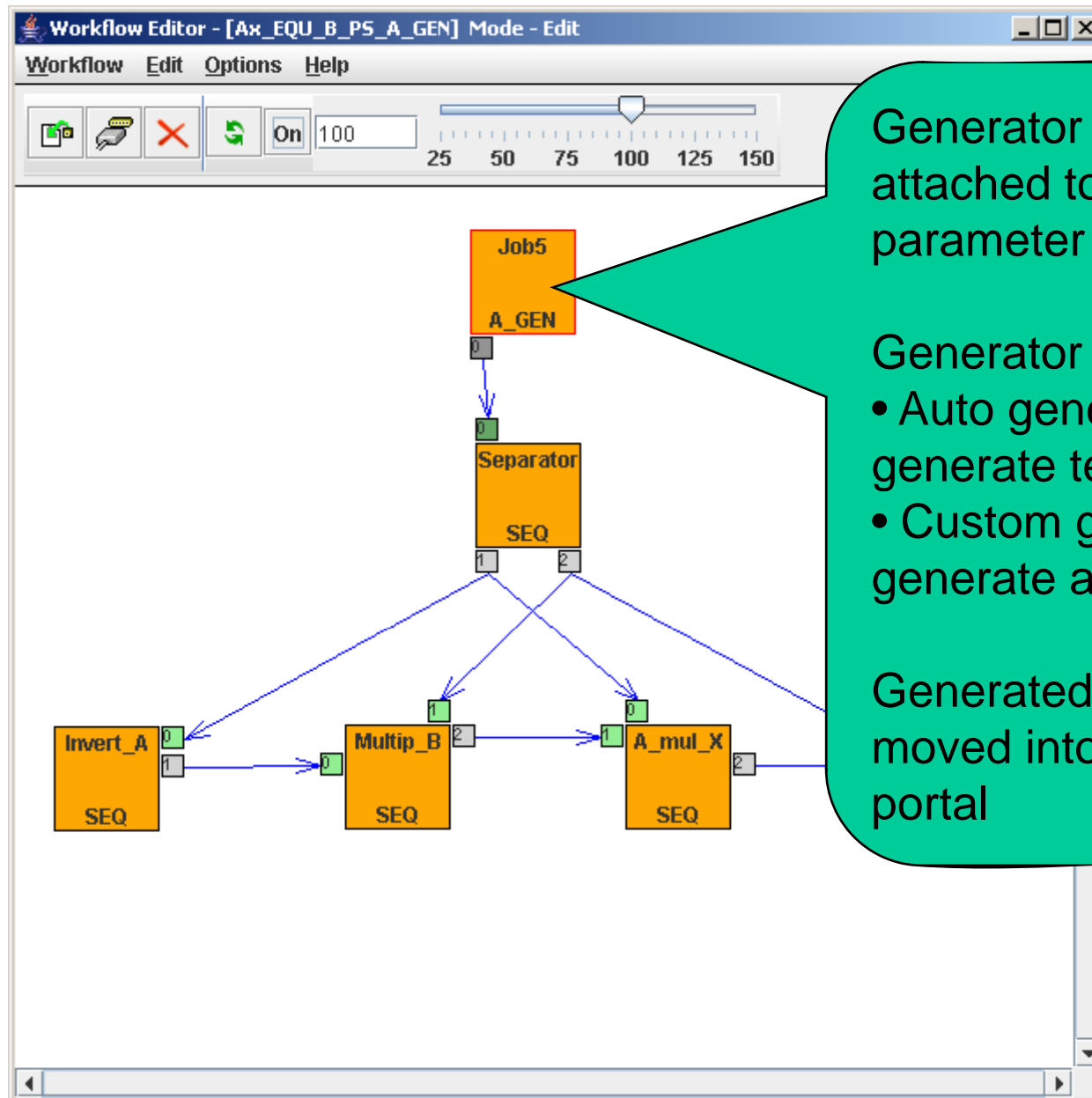


Concept of advanced parameter study workflows



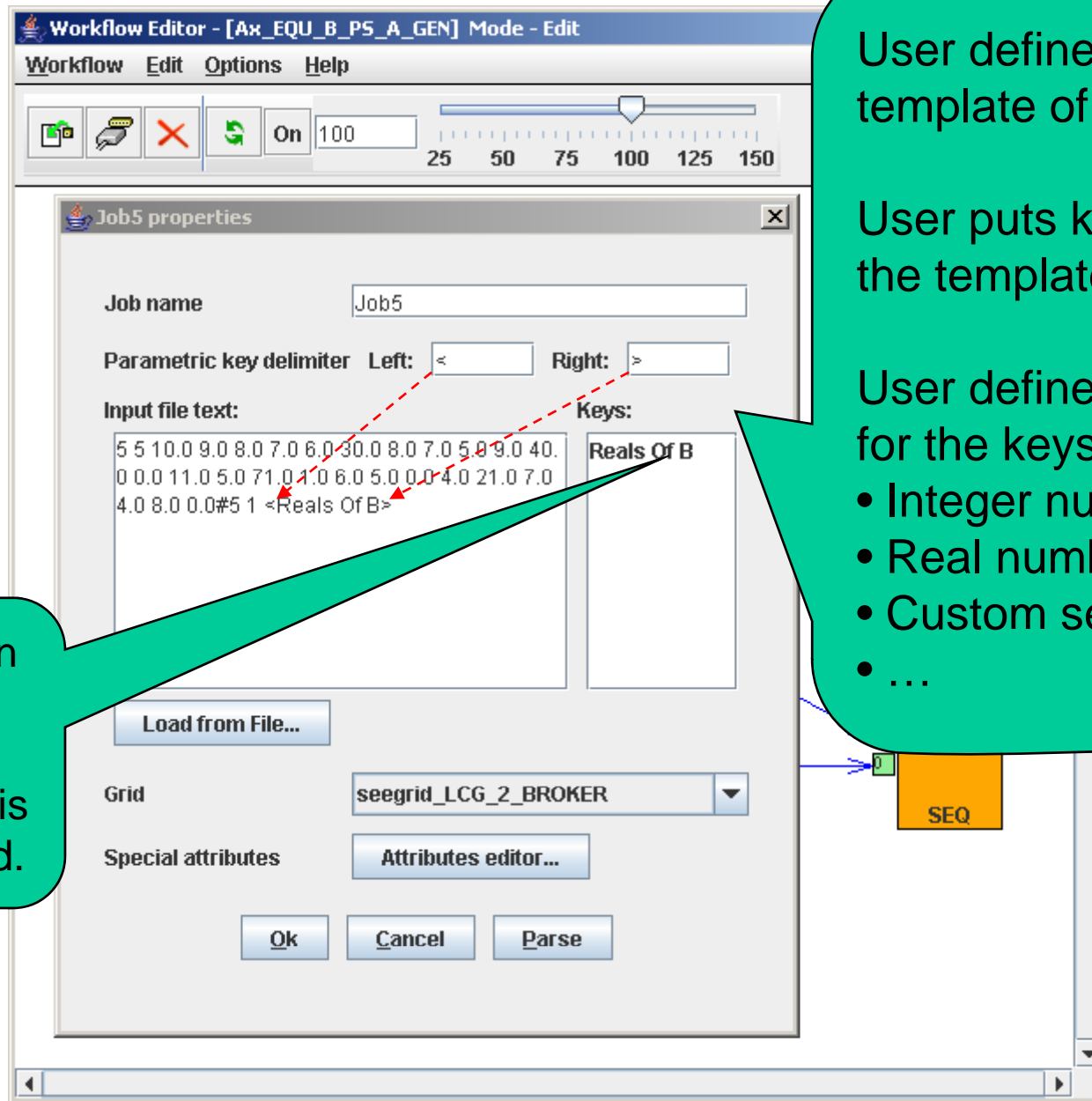


Parameter generator





Definition Window of Auto Generator Job



User defines the template of the text file

User puts keys into the template

User defines values for the keys

- Integer number
- Real number
- Custom set
- ...

By clicking on a key the definition window for this key is opened.



(Auto) Generator Attribute Editor for SE definition

Attribute Editor defines the properties of remote files created by the Generator:

1. Storage Element must be defined if an LCG like (EGEE) file access has been defined in the PS Output Port belonging to the Generator

Workflow Editor - [Job5] Attributes Editor - [Job5]

Output Data Environment

Output Data

Output file	Storage Element	Logical Filename
OUTPUT		/grid/seegrid/hermann/P...

Output Storage Element:

Output SE: se.phy.bg.ac.yu

OK Cancel

Attributes editor...

Ok Cancel Parse



Detailed view of a PS workflow

PGrade Grid portal - Windows Internet Explorer

http://n44.hpcc.sztaki.hu:8080/gridsphere/gridsphere?cid=72&gs_action=doShowWorkflowDetails

File Edit View Favorites Tools Help

PGrade Grid portal

Welcome, Peter Kacsuk

Welcome Workflow Certificates Settings Information System Help

Workflow Manager Storage Upload

Workflow Manager

Refresh Back

PS workflow details

PS Workflow	Status	[Output]	[Logs]	[Action]
Ax_EQU_B_PS_A_GEN_Collector	submitted	N/A	-	Abort Attach Delete

Jobs in generator phase

Job	Status	Type	Gridname	Hostname	[Logs]
Job5	finished	auto-generator	seegrid_LCG_2_BROKER	Portal Server	Out

eWorkflow list Statistics

Total	Init	Submitted	Rescue	Error	Finished
2	0	2	0	0	0

Workflow

Workflow	Status	[Output]	[View]	[Action]
Ax_EQU_B_PS_A_GEN_Collector.1	submitted	N/A	Details	Suspend Abort
Ax_EQU_B_PS_A_GEN_Collector.2	submitted	N/A	Details	Suspend Abort

Jobs in collector phase

Job	Status	Type	Gridname	Hostname	[Logs]
Collector	init	collector	seegrid_LCG_2_BROKER	unknown	--

Message: eWorkflow list successfully shown.

November 13, 2006

Internet 100%

Generator job(s)

Overall statistics of workflow instances

Workflow instances

Collector job(s)

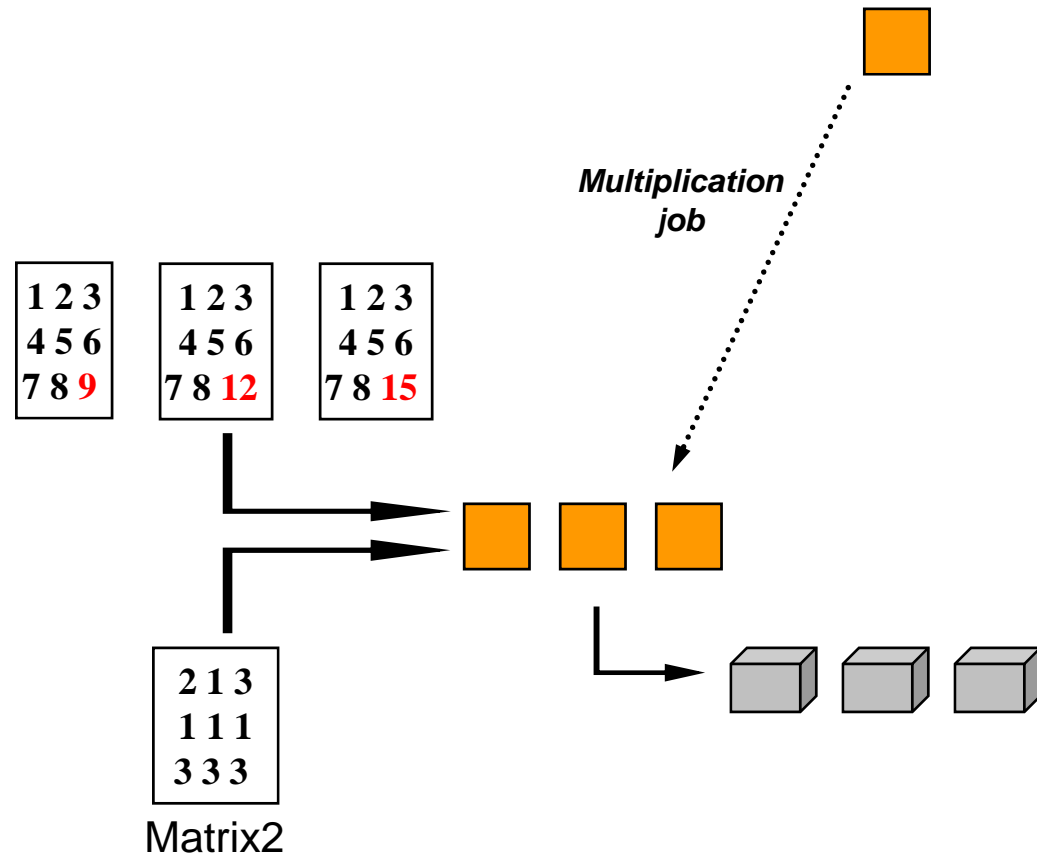


Gyakorlat



Exercise

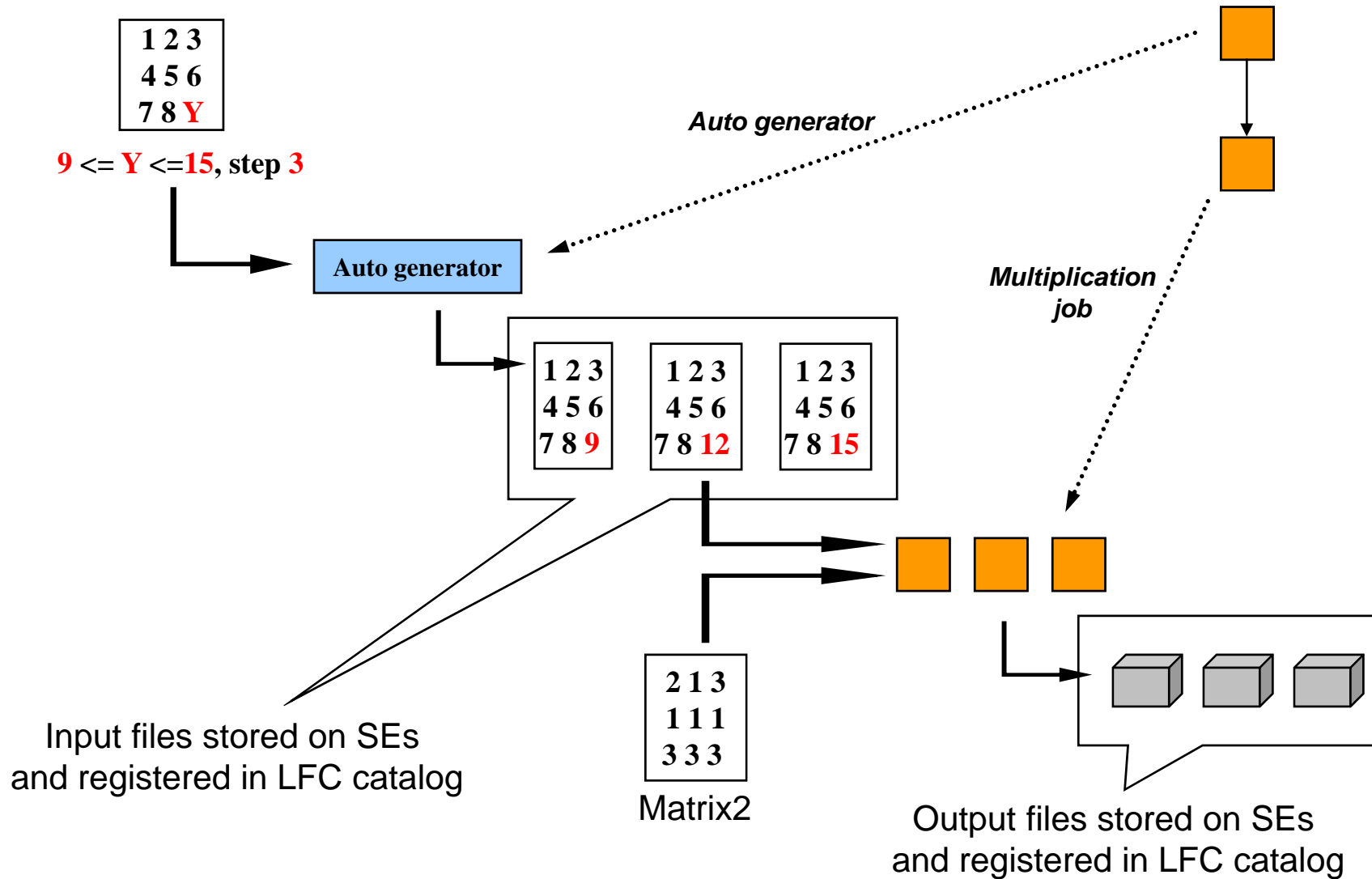
Matrix multiplication PS





Exercise

Matrix multiplication PS

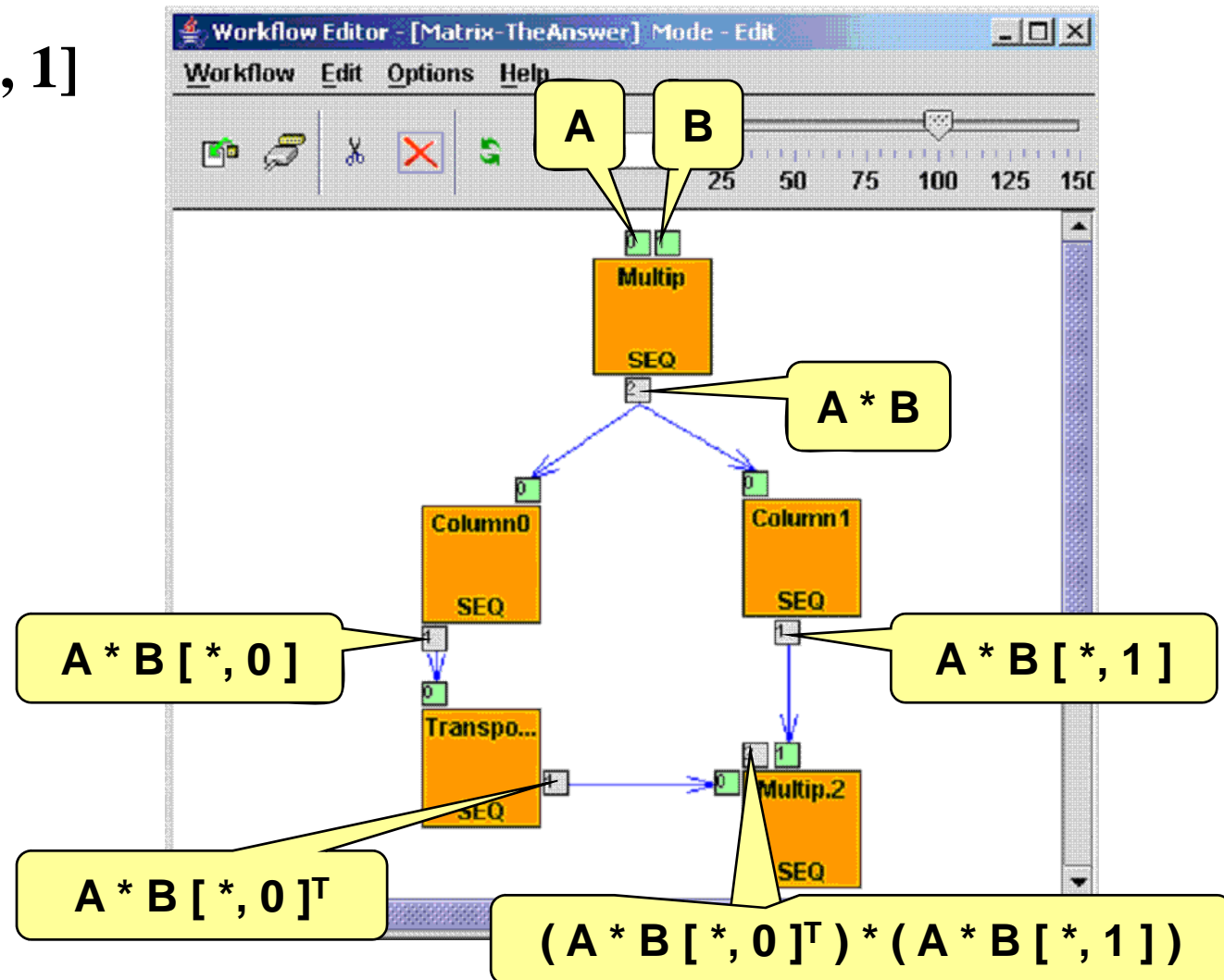




Exercise 2

Turn the matrix operations WF into a parameter study

$$AB[* , 0]^T * AB[* , 1]$$





Learn once, use everywhere
Develop once, execute anywhere

Questions?

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