Parallel Computing in R using NetWorkSpaces

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Scientific Computing Associates, Inc.

Pfizer

Shared Workspaces

- Variation on the theme of a workspace.
- The NetWorkSpace object encapsulation uses an Internet-based server to hold the workspace.
- A given NetWorkSpace can be accessed by multiple processes: Any process capable of instantiating an appropriate NetWorkSpace object may retrieve the value of a variable. (Or store (name, value) pairs for that matter.)

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.
> library(nws)
> ws = netWorkSpace('outer space')
> nwsVariable(ws, 'input'); nwsVariable(ws, 'output'); nwsVariable(ws, 'param',
mode = 'single')
>
```

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input = 1002	> input
> input = 1003	[1] 1003

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<pre>> library(nws) > ws = netWorkSpace('outer space') > nwsVariable(ws, 'input'); nwsVariable(ws, 'output'); nwsVariable(ws, 'param', '')</pre>	<pre>mode = 'single') > input [1] 123</pre>
mode = 'single') > input = 123 > input = 456	> input [1] 456 > input
> input = 1001 > input = 1002 > input = 1003	[1] 1001 > input [1] 1002
> input = 111 > output	> input [1] 1003 > [

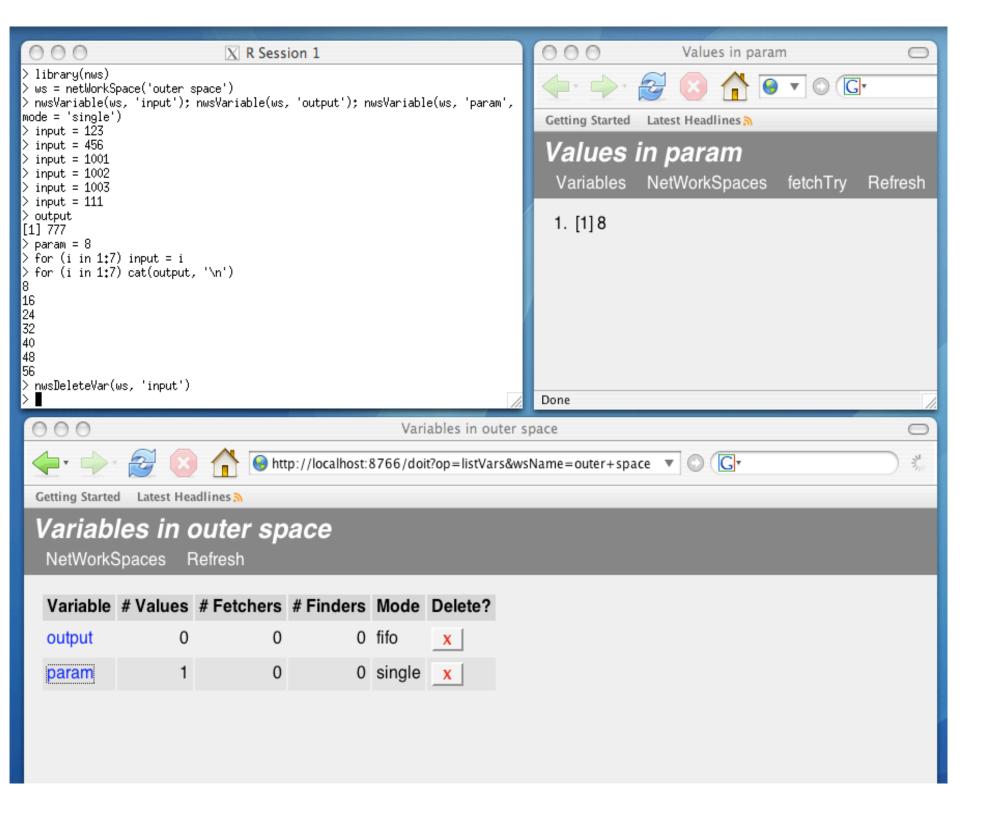
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[1] 777 > []	> output = input * 7 > ■

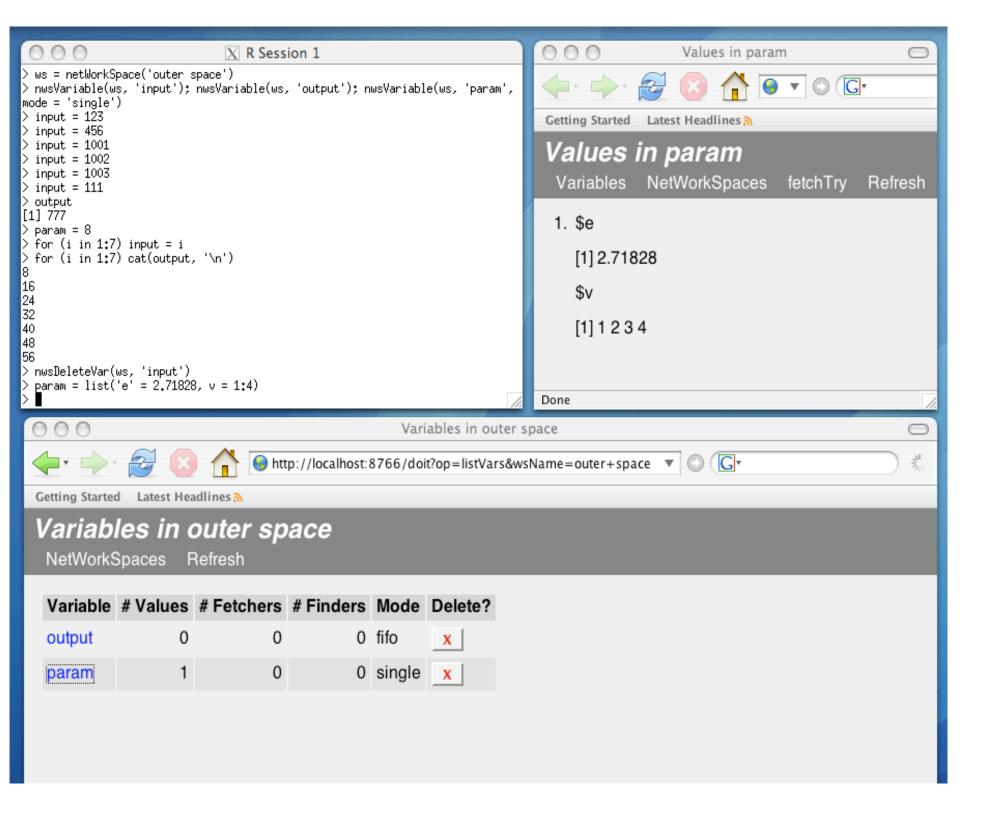
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Natural language support but running in an English locale	Type 'q()' to quit R.
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> input = 111 > output [1] 777 > param = 8	> param [1] 8 > param [1 <u>]</u> 8

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[1] 777 > param = 8 > []	<pre>[1] 8 > while (1) { x = input; cat(x, '\n'); output = x * param } </pre>
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56 > nwsDeleteVar(ws, 'input') > ■	Error in nwsRetrieve(s, ws, xName, "fetch") : retrieval failed > []
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	retrieval failed





Coordination via NetWorkSpaces

- Shared Access: Communication.
- Blocking References: Synchronization.
- Coordination provided within the context of the existing, familiar concept of a "workspace".
- Coordination data has independent existence

Benefits

- Simplifies development:
 - Familiar conceptual foundation
 - Uncoupling in space and time
 - Anonymity
- Promotes flexibility:
 - Dynamic processing ensembles
 - Cross platform
 - Cross environment

Sleigh

- Inspired by snow (Tierney, Rossini, Li, Sevcikova), but snow and sleigh differ in many ways.
- Supports "parallel" apply.
- Implemented on top of NetWorkSpaces.
- Vehicle for launching codes that explicitly use NetWorkSpaces for coordination.

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		Variable #	# Values	# Fetchers	# Finders	Mode	Delete?	
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40 48 56			localhost@1	1	0	0	single	x
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default	[none]	[system]		False	0	x		- And -
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000		NetWorkSpaces	rankCount	1		tting Started Latest Headlines
🔶 🔶 🥪 😂 🚺 🕒 ht	tp://localhost:87	66/doit?op=listWss	task	0	_	alues in localhost@1 /ariables NetWorkSpaces fetchTr
Getting Started Latest Headlines 🔊	_		totalTasks	1		
NetWorkSpaces			worker info	3	1	. 2
Clients Refresh			workerCount	1	Dor	Values in localhost@2
Name	Monitor	Owner	Done	Persiste	nt Va	
Python babelfish	[none]	IPv4Address(TCP, (4654)	'127.0.0.1', 51321)	False	1	Getting Started Latest Headlines Values in localhost@2
R babelfish	[none]	IPv4Address(TCP, (4693)	'127.0.0.1', 51328)	False	2	Variables NetWorkSpaces fetc
default	[none]	[system]		False	0	1. 2
outer space	[none]	IPv4Address(TCP, (4668)	'127.0.0.1', 51322)	False	2	Done
sleigh_ride_0003nwssn2t7l9	Sleigh Monitor	IPv4Address(TCP, (4668)	'192.168.2.1', 51329)	False	10	x

OOO X R Session 1	OOO X Python Session 1
[1] 2197	Python 2.3.5 (#1, Jan 13 2006, 20:13:11)
[[2]] [1] 2744	[GCC 4.0.1 (Apple Computer, Inc. build 5250)] on darwin Type "help", "copyright", "credits" or "license" for more information. >>> from client import NetWorkSpace
[[3]] [1] 3375	ws = NetWorkSpace('outer space') sv = ws.variables('input', 'output', ['param','single']) >>> >>> sv.param 'greetings from R!'
[[4]] [1] 4096	Sreetings from K! >>> sv.param = 'hssssss' >>> ∎
[[5]] [1] 4913	
[[6]] [1] 5832	
[[7]] [1] 6859	
> param = 'greetings from R!' > param [1] "hsssssss" > []	

- MATLAB, octave, python, perl, ruby,
- Software available from: <u>http://nws-r.sourceforge.net</u> (open source for open source systems; commercial for commercial systems: <u>www.lindaspaces.com</u>)
- API used in this talk is a "teaser".
 More serious projects use a richer, but more verbose, API.