

Just tired of endless loops!  
or parallel: Stata module for parallel computing

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Stata Conference Baltimore  
July 27–28, 2017

Thanks to Stata users worldwide for their valuable contributions. The usual disclaimers applies.

# Agenda

Motivation

What is it and how does it work

Benchmarks

Syntax and Usage

Concluding Remarks

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- ▶ Implementing parallel computing, even for these “embarrassingly parallel” problems, however, is not easy.
- ▶ Stata/MP exists, but only parallelizes a limited set of internal commands, not user commands.
- ▶ `parallel` aims to make this more convenient.

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  - ▶ Thus having a quad-core computer can lead to a 400% speedup.

## Simple usage

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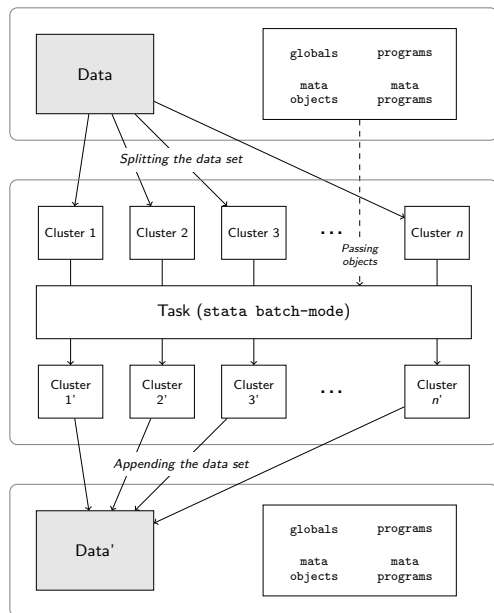
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## How does it work?



Starting (current) stata instance loaded with data plus user defined globals, programs, mata objects and mata programs

A new stata instance (batch-mode) for every data-clusters. Programs, globals and mata objects/programs are passed to them.

The same algorithm (task) is simultaneously applied over the data-clusters.

After every instance stops, the data-clusters are appended into one.

Ending (resulting) stata instance loaded with the new data.

User defined globals, programs, mata objects and mata programs remind unchanged.



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  - ▶ Table of seeds for each bootstrap resampling
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- ▶ If the list of tasks is data-dependent then the “nodata” alternative mechanism allows for more flexibility.

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- ▶ Recover gracefully from child failures. Currently no re-try support.

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# Benchmarks

## Bootstrap with parallel bs

```
sysuse auto, clear expand 10
```

```
// Serial fashion
```

```
bs, rep($size) nodots: regress mpg weight gear foreign
```

```
// Parallel fashion
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parallel setclusters $number_of_clusters
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```

Problem size	Serial	2 Clusters	4 Clusters
1,000	2.93s ×2.69	1.62s ×1.48	1.09s ×1.00
2,000	5.80s ×2.85	3.13s ×1.54	2.03s ×1.00
4,000	11.59s ×3.01	6.27s ×1.62	3.86s ×1.00

**Table:** Absolute and relative computing times for each run of a basic bootstrap problem. For each given problem size, the first row shows the time in seconds, and the second row shows the relative time each method took to complete the task relative to using parallel with four clusters. Each cell represents a 1,000 runs.

# Benchmarks

## Simulations with `parallel sim`

```
prog def mysim, rclass
  // Data generating process
  drop _all
  set obs 1000
  gen eps = rnormal()
  gen X = rnormal()
  gen Y = X*2 + eps

  // Estimation
  reg Y X
  mat def ans = e(b)
  return scalar beta = ans[1,1]
end

// Serial fashion
simulate beta=r(beta), reps($size) nodots: mysim

// Parallel fashion
parallel setclusters $number_of_clusters
parallel sim, reps($size) expr(beta=r(beta)) nodots: mysim
```

## Benchmarks

Simulations with `parallel sim` (cont.)

Problem size	Serial	2 Clusters	4 Clusters
1000	2.19s ×3.01	1.18s ×1.62	0.73s ×1.00
2000	4.36s ×3.29	2.29s ×1.73	1.33s ×1.00
4000	8.69s ×3.40	4.53s ×1.77	2.55s ×1.00

**Table:** Absolute and relative computing times for each run of a simple Monte Carlo exercise. For each given problem size, the first row shows the time in seconds, and the second row shows the relative time each method took to complete the task relative to using parallel with four clusters. Each cell represents a 1,000 runs.

Code for replicating this is available at  
<https://github.com/gvegayon/parallel>

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nodata]: stata.cmd
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## Helper commands

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parallel bs [, expression(exp-list) programs(namelist) mata seeds(string)  
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parallel append [files], do(command/dofile) [in(in) if(if) expression(expand-exp)  
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## Additional Utilities

```
parallel version/clean/printlog/viewlog/numprocessors
```

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  - ▶ `__pllID_finitoNUM`
- ▶ Can keep these around by specifying the **keep** or **keeplast** options

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### parallel doesn't suit ...

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- ▶ (already) fast commands
- ▶ Regressions, ARIMA, etc.
- ▶ Linear Algebra
- ▶ Whatever Stata/MP does better (on single machine)

## Use in other Stata modules

- ▶ EVENTSTUDY2: Perform event studies with complex test statistics
- ▶ MIPARALLEL: Perform parallel estimation for multiple imputed datasets
- ▶ Synth\_Runner: Performs multiple Synthetic Control estimations for permutation testing



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- ▶ Install, contribute, find help, and report bugs at <http://github.com/gvegayon/parallel>

Thank you very much!

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