ParsEvalMPI: comparison of gene structure annotations in parallel

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Bioinformatics and Computational Biology

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Gene prediction (annotation)

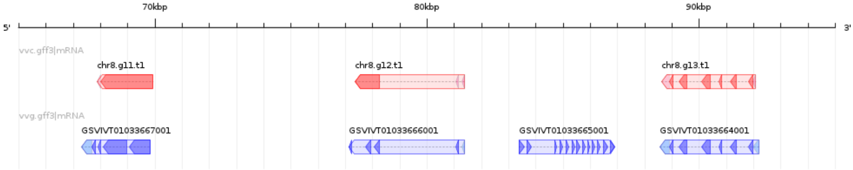
Input

String representing DNA sequence

Output

Regions (coordinates) of sequence that correspond to genes and their structural components

Comparing annotations



Previous implementation

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Program overview

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- delegation

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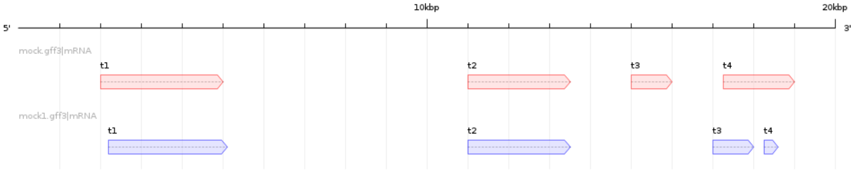
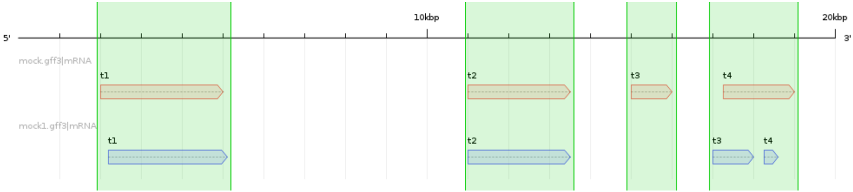
- global analysis

Delegation


10kbp
20kbp
5'
3'
mock.gff3|mRNA
t1
t2
t3
t4
mock1.gff3|mRNA
t1
t2
t3
t4

Delegation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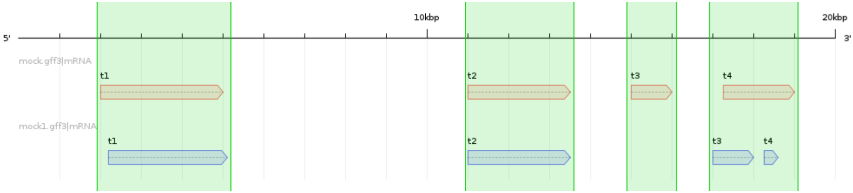
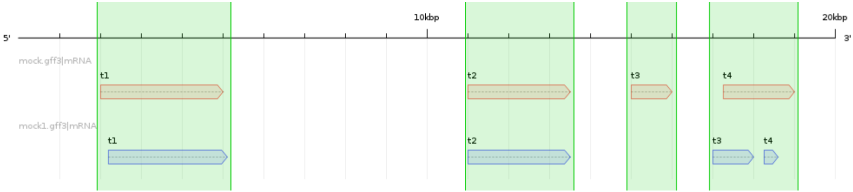


1. all data on all processors

Delegation



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2. even distribution of DNA

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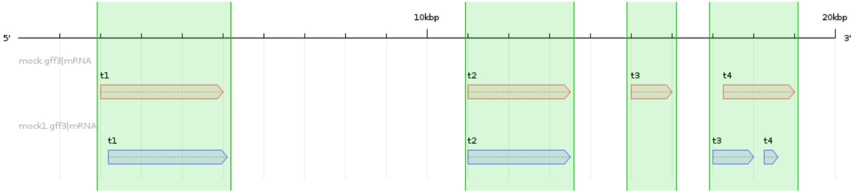

1. all data on all processors
2. even distribution of DNA
3. even distribution of genes

Local and global analysis

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- Global analysis

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  - send local vector to global vector on root processor
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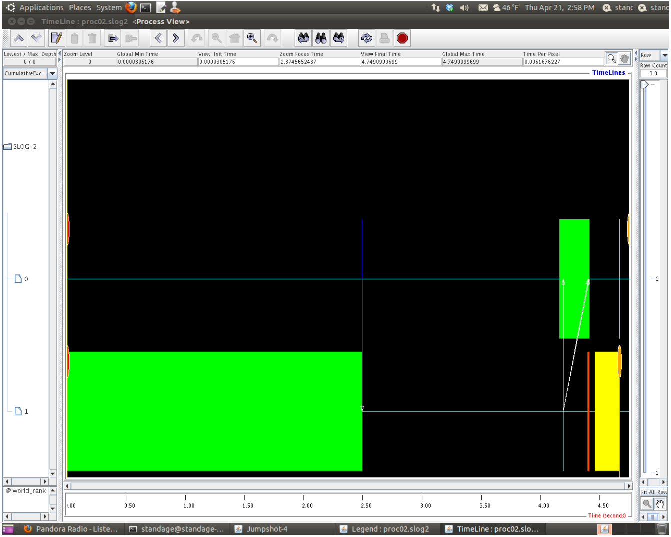
  - receive local vectors from each processor
  - analyze combined global vector, print scores

Load balancing

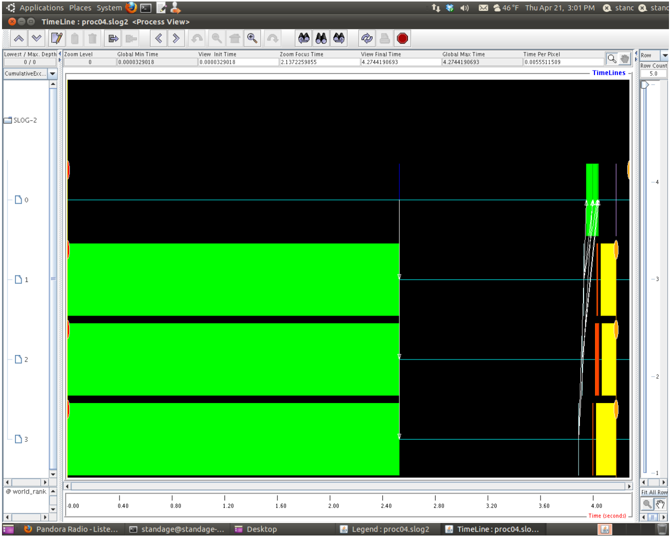


TimeLine : proc02.slog2 <Process View>

Lowest / Max. Depth	Zoom Level	Global Min Time	View Init Time	Zoom Focus Time	View Final Time	Global Max Time	Time Per Pixel
0 / 0	0	0.0000305176	0.0000305176	2.3745652437	4.7490999699	4.7490999699	0.0061676227

Row Count 3.0

Load balancing



TimeLine : proc04.slog2 <Process View>

Lowest / Max. Depth: 0 / 0

Zoom Level: 0

Global Min Time: 0.0000329018

View Init Time: 0.0000329018

Zoom Focus Time: 2.1372259855

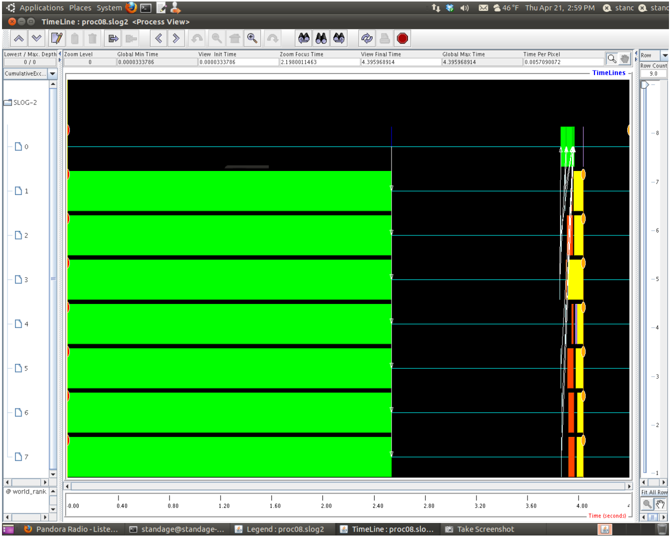
View Final Time: 4.2744190693

Global Max Time: 4.2744190693

Time Per Pixel: 0.0055511509

Row Count: 5.0

Load balancing

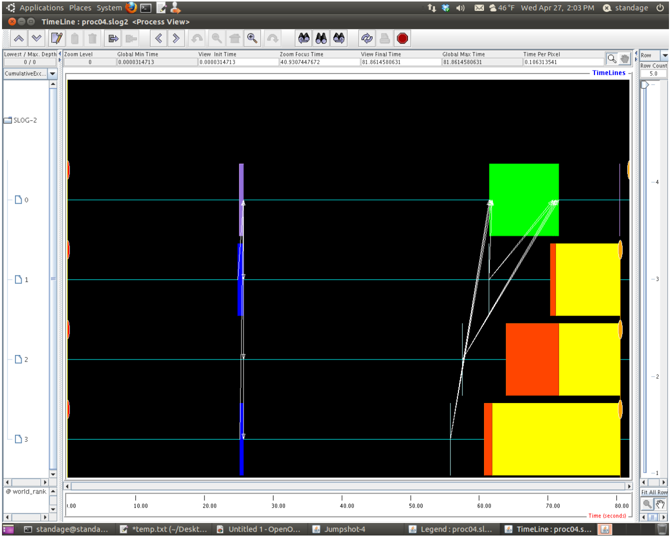


TimeLine : proc08.slog2 <Process View>

Lowest / Max. Depth	Zoom Level	Global Min Time	View Init Time	Zoom Focus Time	View Final Time	Global Max Time	Time Per Pixel
0 / 0	0	0.0000333786	0.0000333786	2.1980011463	4.395968914	4.395968914	0.0057090072

Row Count 9.0

Load balancing



TimeLine : proc04.slog2 <Process View>

Lowest / Max. Depth: 0 / 0

Zoom Level: 0

Global Min Time: 0.0000314713

View Init Time: 0.0000314713

Zoom Focus Time: 40.9307447672

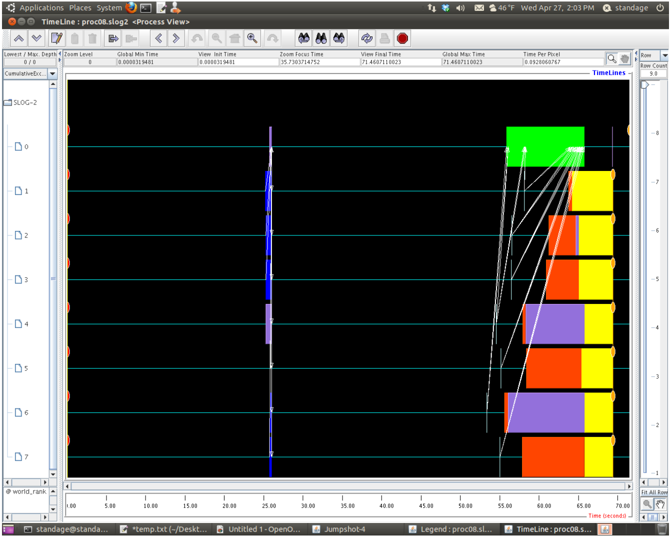
View Final Time: 81.8614580631

Global Max Time: 81.8614580631

Time Per Pixel: 0.106313541

Row Count: 5.0

Load balancing



TimeLine : proc08.slog2 <Process View>

Lowest / Max. Depth: 0 / 0

Zoom Level: 0

Global Min Time: 0.0000319481

View Init Time: 0.0000319481

Zoom Focus Time: 35.7303714752

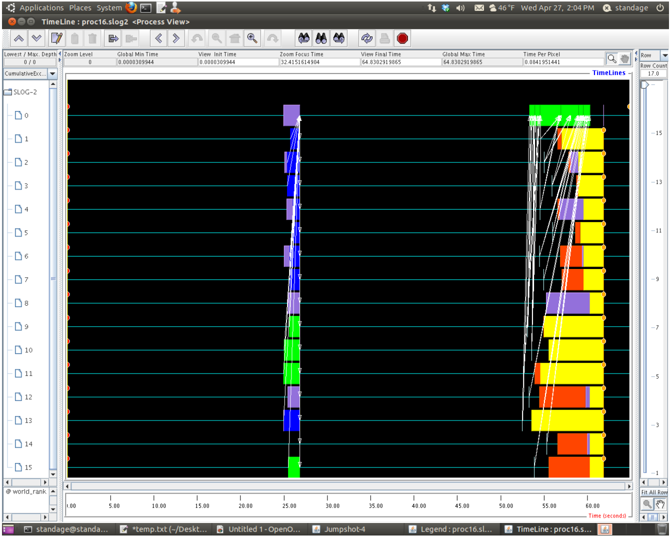
View Final Time: 71.4607110023

Global Max Time: 71.4607110023

Time Per Pixel: 0.0928060767

Row Count: 9.0

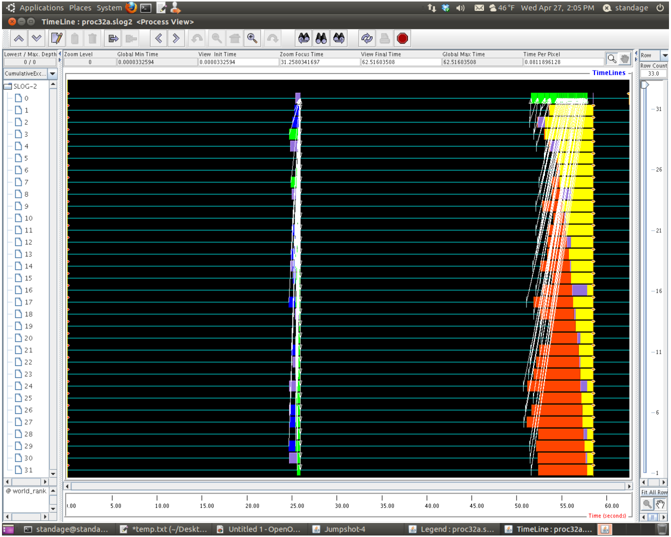
Load balancing



TimeLine : proc16.slog2 <Process View>

Lowest / Max. Depth: 0 / 0
Zoom Level: 0
Global Min Time: 0.0000309944
View Init Time: 0.0000309944
Zoom Focus Time: 32.4151614904
View Final Time: 64.8302919865
Global Max Time: 64.8302919865
Time Per Pixel: 0.0841951441
Row Count: 17.0

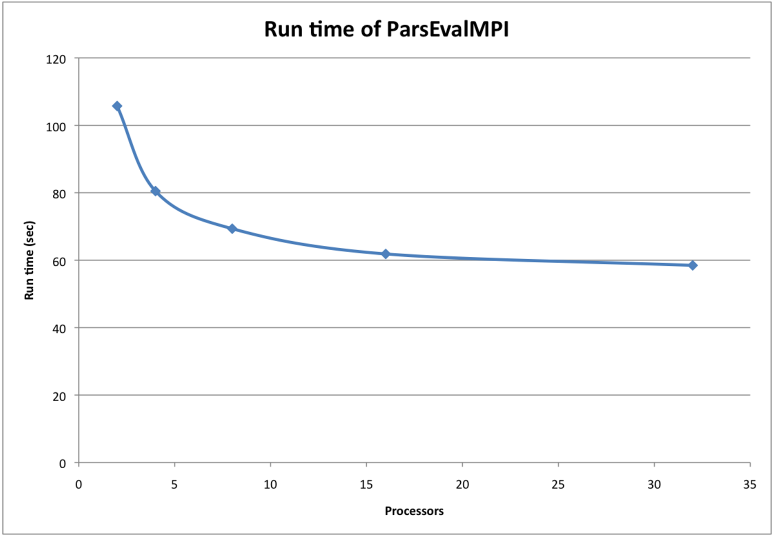
Load balancing



TimeLine : proc32a.slog2 <Process View>

Lowest / Max. Depth: 0 / 0
Zoom Level: 0
Global Min Time: 0.0000332594
View Init Time: 0.0000332594
Zoom Focus Time: 31.2580341697
View Final Time: 62.51603508
Global Max Time: 62.51603508
Time Per Pixel: 0.0811896128
Row Count: 33.0

Scalability



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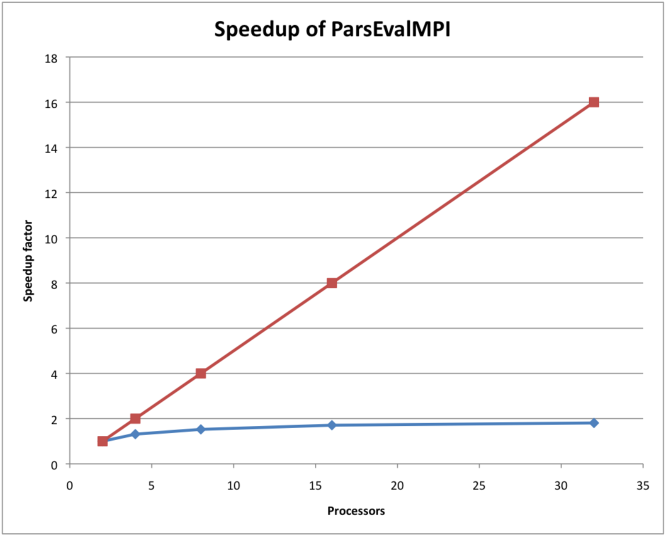

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- Ugly
  - copying data

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  - maximum scaling factor of 2?!?!
  - perhaps try OpenMP
- Significant improvement