MST Construction in $O(\log \log n)$ Communication Rounds

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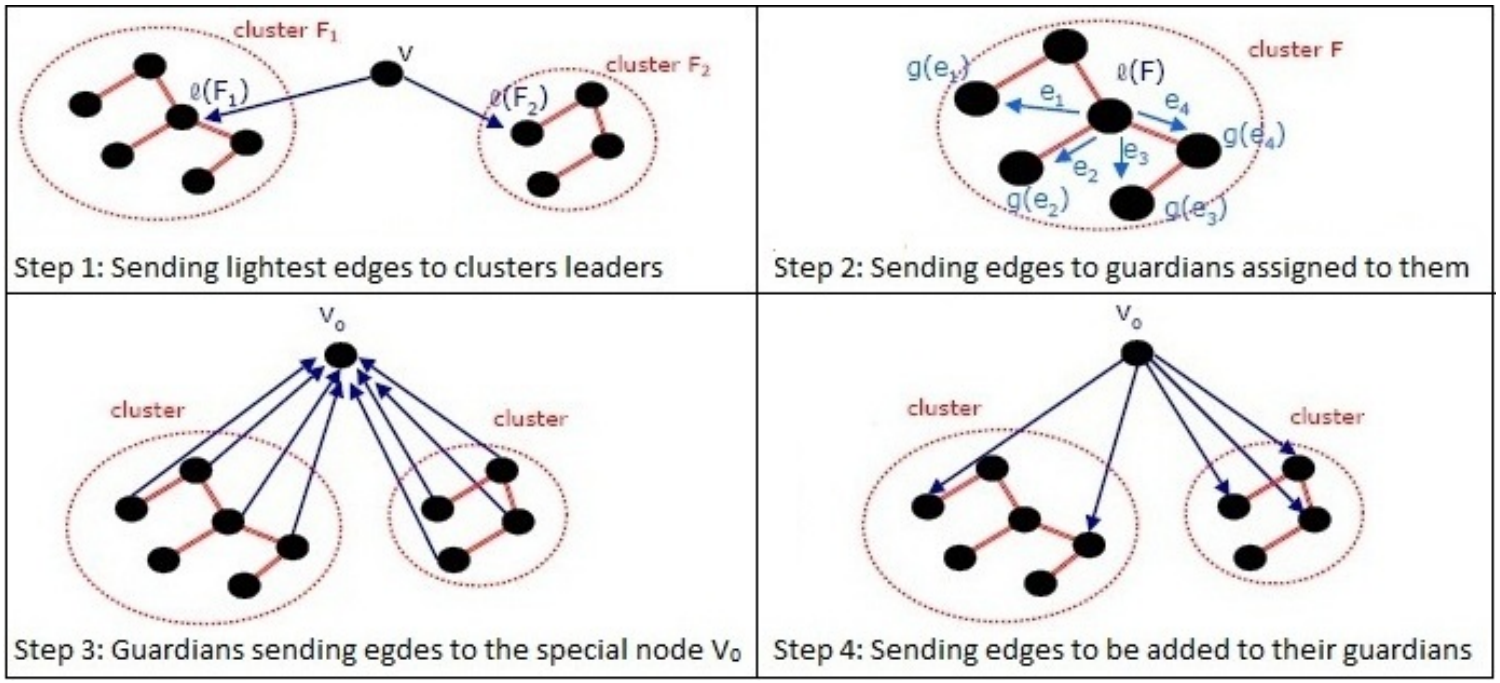
The Algorithm



- V_0: A special node in the graph, e.g., the node with the smallest ID in the graph.
- $l(F)$: A leader of cluster F, e.g. the node with the smallest ID in the cluster.
- $g(e)$: A guardian node assigned to each minimum weight edge e.

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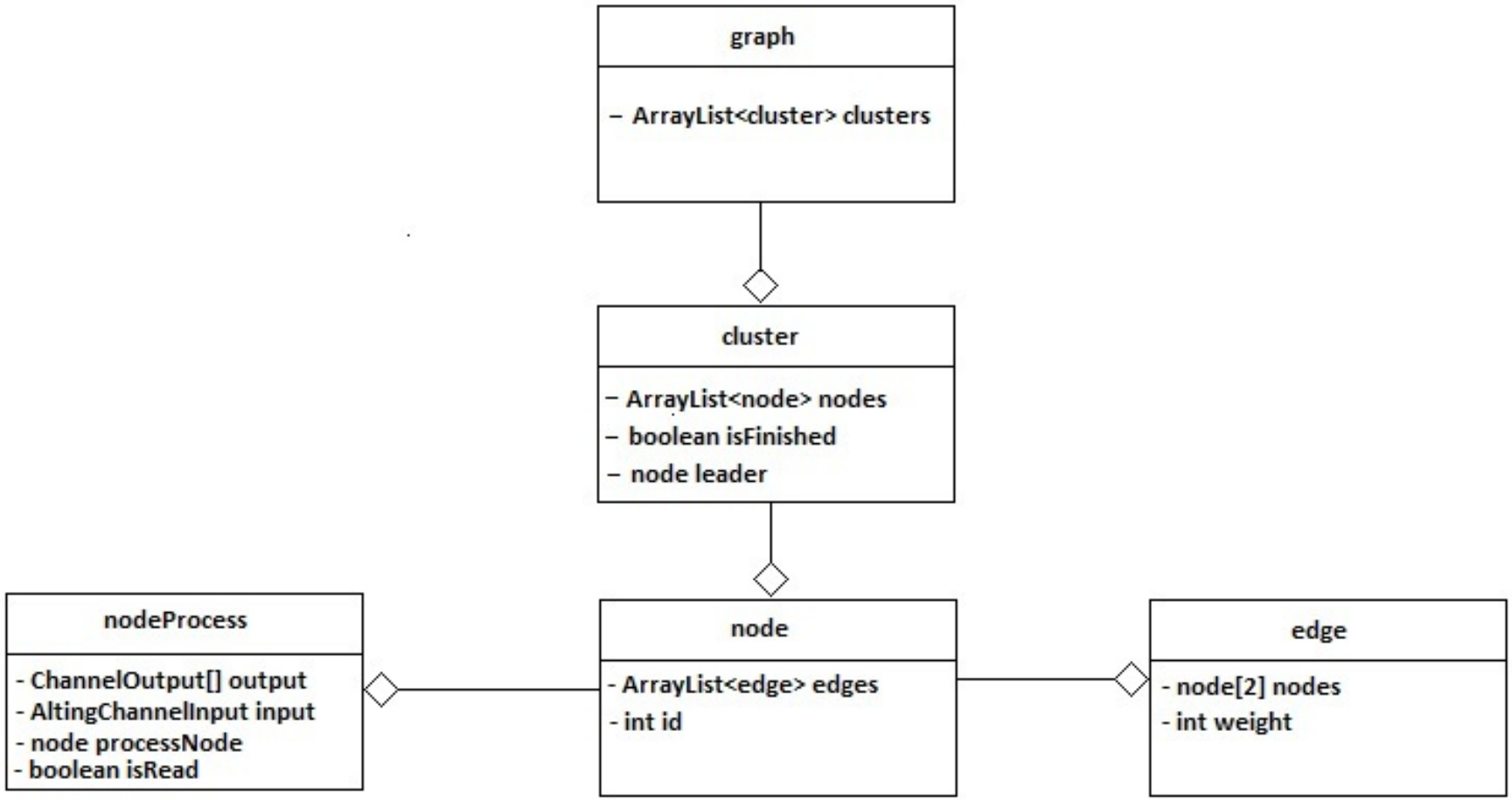
Classes


graph
– ArrayList<cluster> clusters
cluster
– ArrayList<node> nodes
– boolean isFinished
– node leader
nodeProcess
- ChannelOutput[] output
- AltingChannelInput input
- node processNode
- boolean isRead
node
- ArrayList<edge> edges
- int id
edge
- node[2] nodes
- int weight

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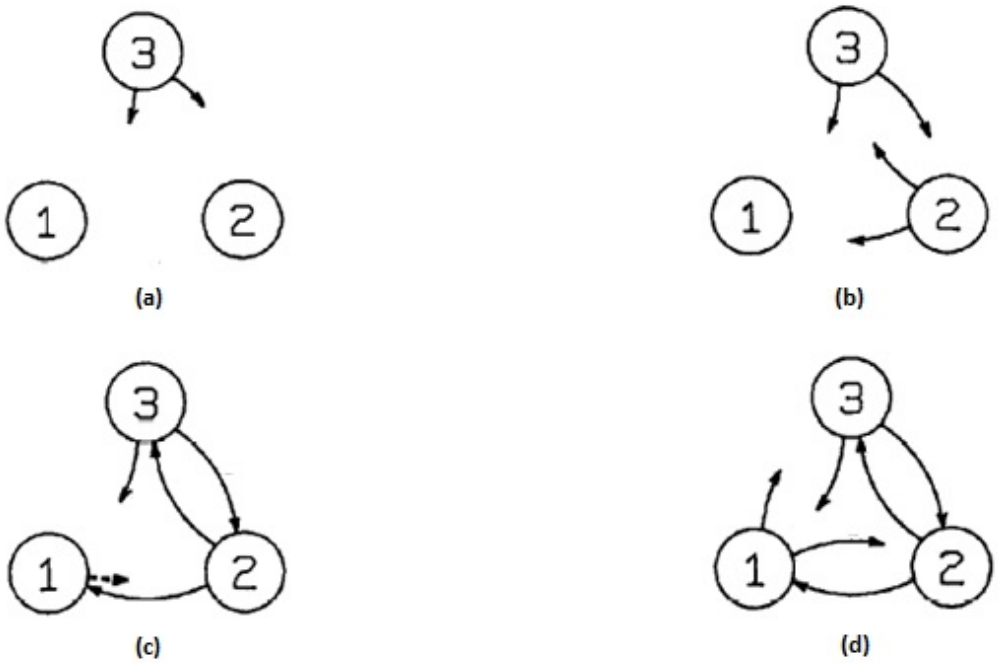
The Model



- Nodes are considered as processes which are wired together using One2OneChannels
- Channels communication is synchronized.

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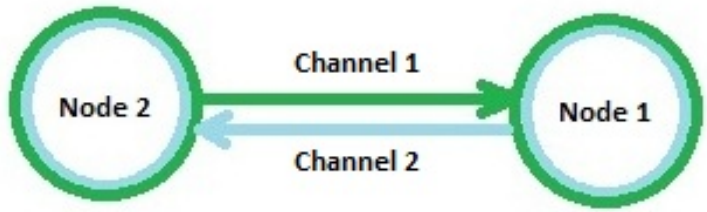
Dead Lock

- Two processes executing a receive (read) command and waiting the other process to send (write)
- Both processes will be locked
- A single process can either send or receive but not both
- Each node has two processes running in parallel



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```
1   public class nodeProcess implements CSProcess{
2       private boolean isRead;
3       private ChannelOutput[] output;
4       private AltingChannelInput[] input;
5       private node processNode;
6       public nodeProcess(final ChannelOutput[] out) {
7           ....
8       }
9       public nodeProcess(final AltingChannelInput[] in) {
10          ....
11       }
12       public void run () {
13          if (isRead) {
14              ....
15          }
16          else{
17              ....
18          }
19   }
```

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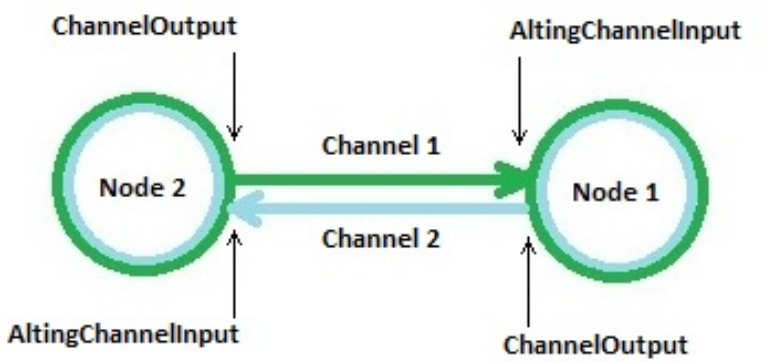
Communication Channels

final One2OneChannel[] inputOutputChannels = Channel.createOne2One(totalNumberOfChannel);



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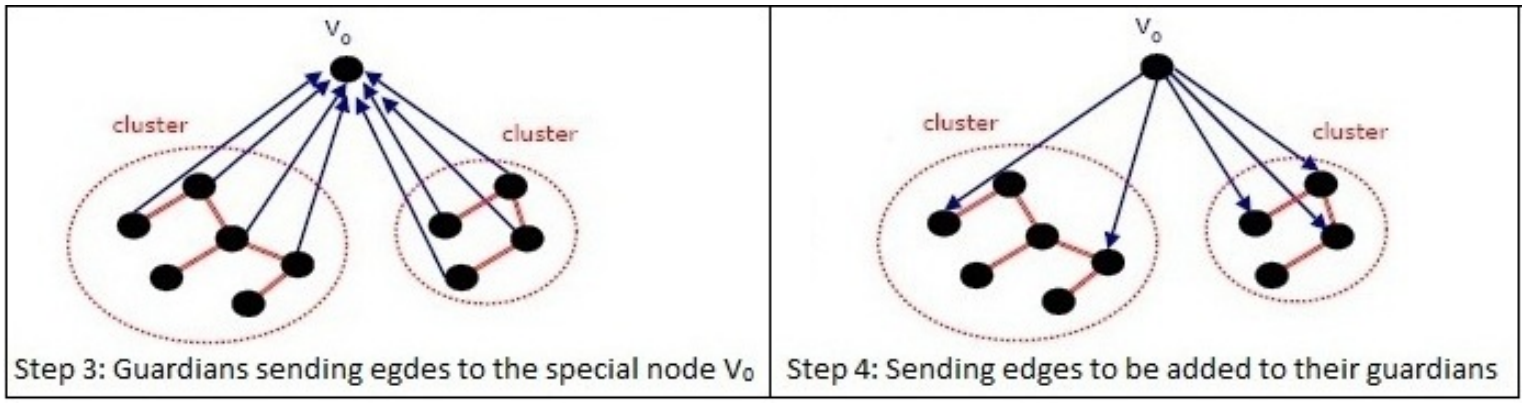
Parallelism




```
Parallel par = new Parallel;
CSProcess[] activeProcesses = new CSProcess[] {
        new Parallel(ActiveSendingProcs),
        new Parallel(ActiveReceivingProcs)}
par = new Parallel(activeProcesses);
par.run ();
par.releaseAllThreads();
```

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Sending and Receiving

- Sending:
  output[index].write(message);
- Receiving:
  Alternative alt = new Alternative(input);
  int index;
  index= alt.fairSelect();
  input[index].read();

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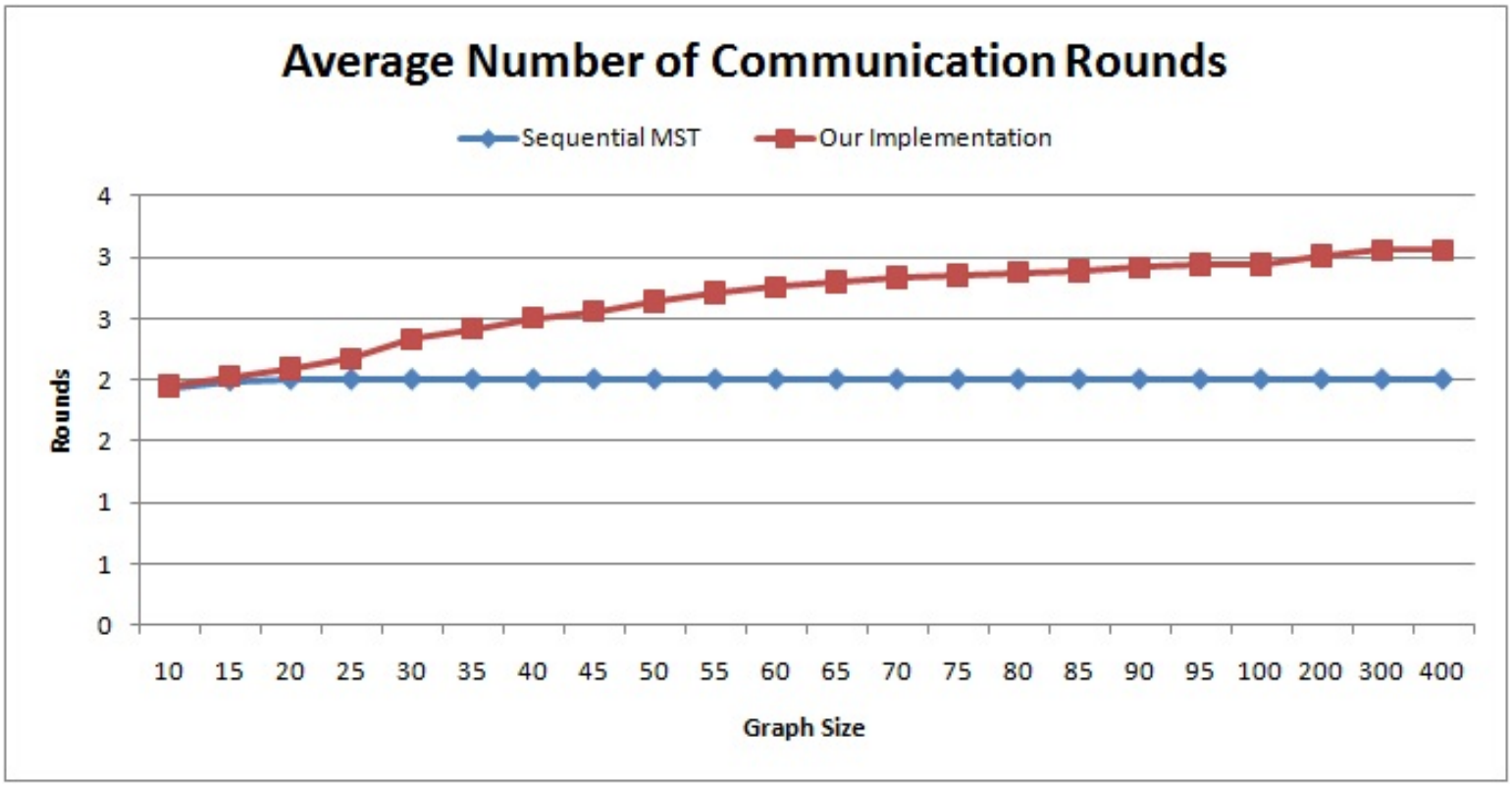
Our Implementation vs Sequential Implementation of an Algorithm by Gallagher, Humbles, and Spira



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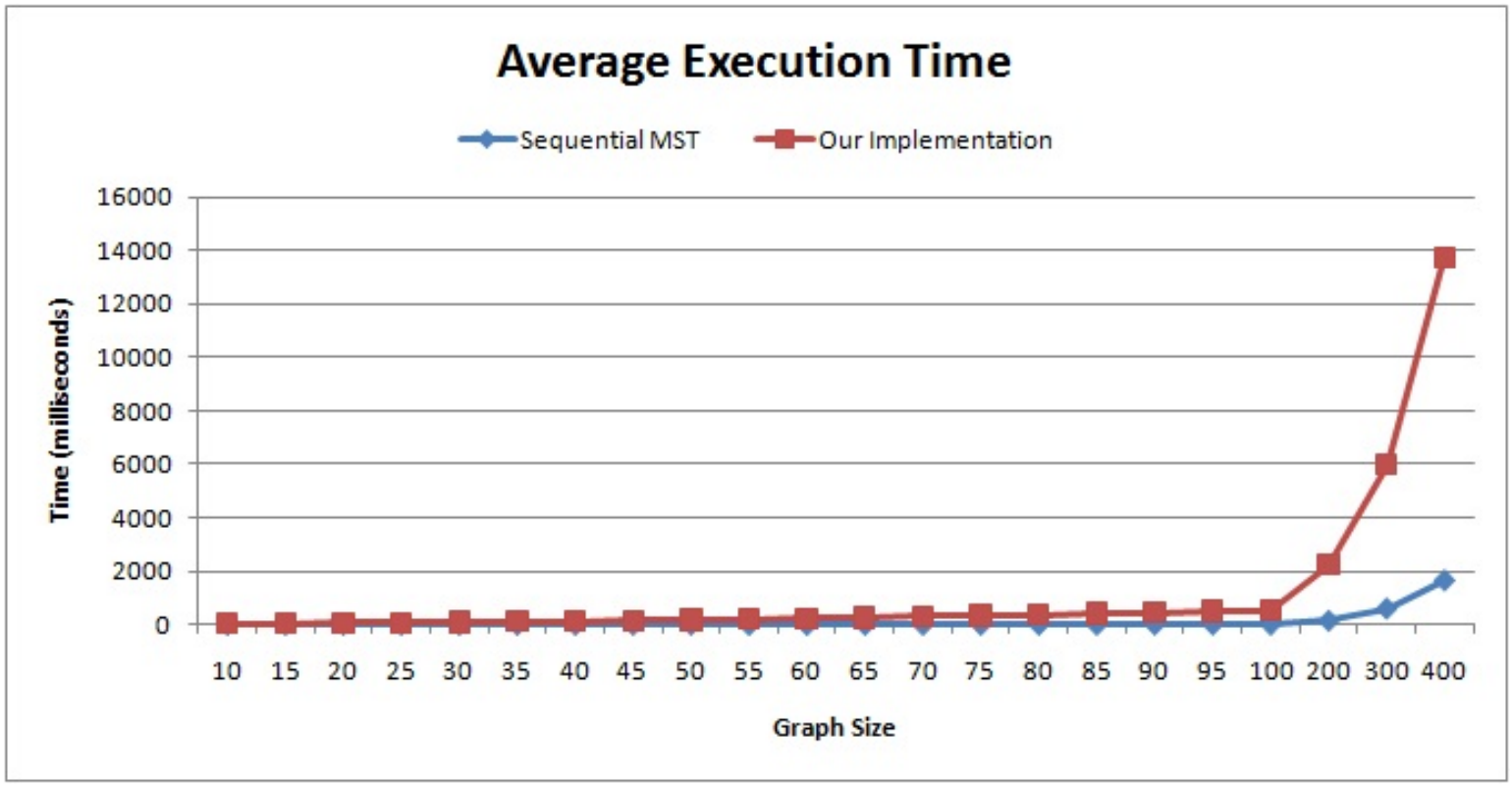

Possible Improvements

- Applying a simple synchronizer.
- Extension to handle messages of large size.
- Optimizing the implementation.