

# Seminar Report: Muty

April 3, 2019

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## **1 Introduction**

En aquesta pràctica el que volem és implementar un servei multicast que respecti diferents ordres, com FIFO, causal o total.

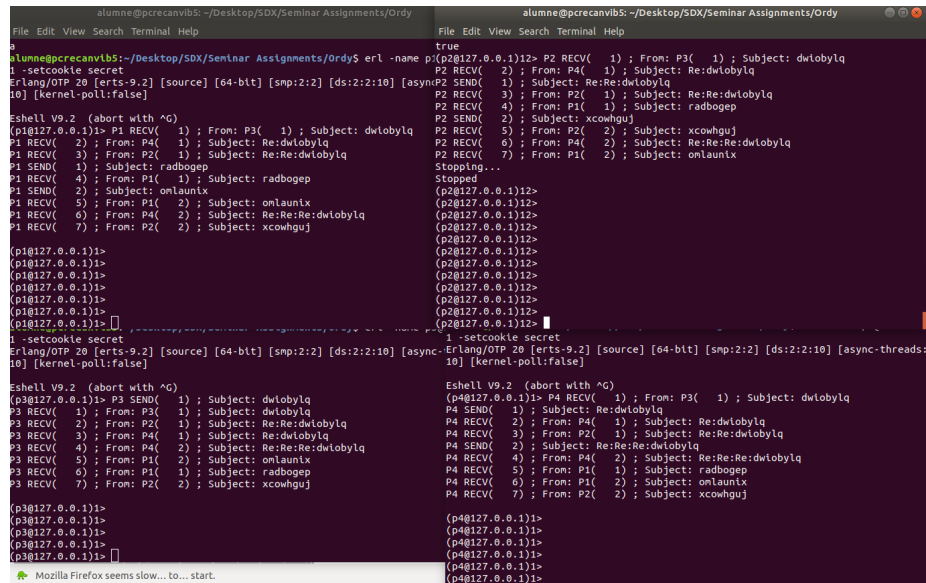
## 2 Experiments

### Basic Multicast

1. Set up the basic multicast system, and use the following test program to experiment with different values for Sleep and Jitter. Sleep stands for up to how many milliseconds the workers should wait until the next message is sent. Jitter stands for up to how many milliseconds the messages are delayed in the network. Duration stands for the duration of the experiment in milliseconds. Note that we are using the name of the multicast module (i.e. basic) as a parameter to the start procedure. We will easily be able to test different multicast implementations. Note also that processes are spawned in different nodes, hence you need to start an Erlang runtime for each process and name it accordingly.
2. Make tests with different Sleep and Work parameters to analyze how this lock implementation responds to different contention degrees.

### Test 1: Sleep time major que Jitter time

La probabilitat de que un missatge sigui enviat metres estem fent multicast, serà més baixa, ja que és més probable que la resta de nodes es trobin en Sleep time.



```
alumne@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/Ordys
File Edit View Search Terminal Help
a
alumne@pcrecanvib5:~/Desktop/SDX/Seminar Assignments/Ordys$ erl -name p1 -sname p1 -setcookie secret
Erlang/OTP 20 [erts-9.2] [source] [64-bit] [smp:2:2] [ds:2:2:10] [async-threads:10] [kernel-poll:false]

Eshell V9.2 (abort with ^G)
(p1@127.0.0.1)> P1 RECV( 1) ; From: P3( 1) ; Subject: dwlobyq
P1 RECV( 2) ; From: P4( 1) ; Subject: Re:dwlobyq
P1 RECV( 3) ; From: P2( 1) ; Subject: Re:Re:dwlobyq
P1 SEND( 1) ; Subject: radboge
P1 RECV( 4) ; From: P1( 1) ; Subject: radboge
P1 SEND( 2) ; Subject: onlaunx
P1 RECV( 5) ; From: P4( 2) ; Subject: onlaunx
P1 RECV( 6) ; From: P4( 2) ; Subject: Re:Re:dwlobyq
P1 RECV( 7) ; From: P2( 2) ; Subject: xcwhguj

(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
(p1@127.0.0.1)>
1 -setcookie secret
Erlang/OTP 20 [erts-9.2] [source] [64-bit] [smp:2:2] [ds:2:2:10] [async-threads:10] [kernel-poll:false]

Eshell V9.2 (abort with ^G)
(p3@127.0.0.1)> P3 SEND( 1) ; Subject: dwlobyq
P3 RECV( 1) ; From: P3( 1) ; Subject: dwlobyq
P3 RECV( 2) ; From: P2( 1) ; Subject: Re:Re:dwlobyq
P3 RECV( 3) ; From: P4( 1) ; Subject: Re:Re:dwlobyq
P3 RECV( 4) ; From: P4( 2) ; Subject: Re:Re:dwlobyq
P3 RECV( 5) ; From: P1( 2) ; Subject: onlaunx
P3 RECV( 6) ; From: P1( 1) ; Subject: radboge
P3 RECV( 7) ; From: P2( 2) ; Subject: xcwhguj

(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>
(p3@127.0.0.1)>

alumne@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/Ordys
File Edit View Search Terminal Help
a
alumne@pcrecanvib5:~/Desktop/SDX/Seminar Assignments/Ordys$ erl -name p2 -sname p2 -setcookie secret
Erlang/OTP 20 [erts-9.2] [source] [64-bit] [smp:2:2] [ds:2:2:10] [async-threads:10] [kernel-poll:false]

Eshell V9.2 (abort with ^G)
(p2@127.0.0.1)> P2 RECV( 1) ; From: P3( 1) ; Subject: dwlobyq
P2 RECV( 2) ; From: P4( 1) ; Subject: Re:dwlobyq
P2 SEND( 1) ; Subject: Re:Re:dwlobyq
P2 RECV( 3) ; From: P2( 1) ; Subject: Re:Re:dwlobyq
P2 RECV( 4) ; From: P1( 1) ; Subject: radboge
P2 SEND( 2) ; Subject: xcwhguj
P2 RECV( 5) ; From: P2( 2) ; Subject: xcwhguj
P2 RECV( 6) ; From: P4( 2) ; Subject: Re:Re:dwlobyq
P2 RECV( 7) ; From: P1( 2) ; Subject: onlaunx

Stopping...
Stopped
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
(p2@127.0.0.1)>
1 -setcookie secret
Erlang/OTP 20 [erts-9.2] [source] [64-bit] [smp:2:2] [ds:2:2:10] [async-threads:10] [kernel-poll:false]

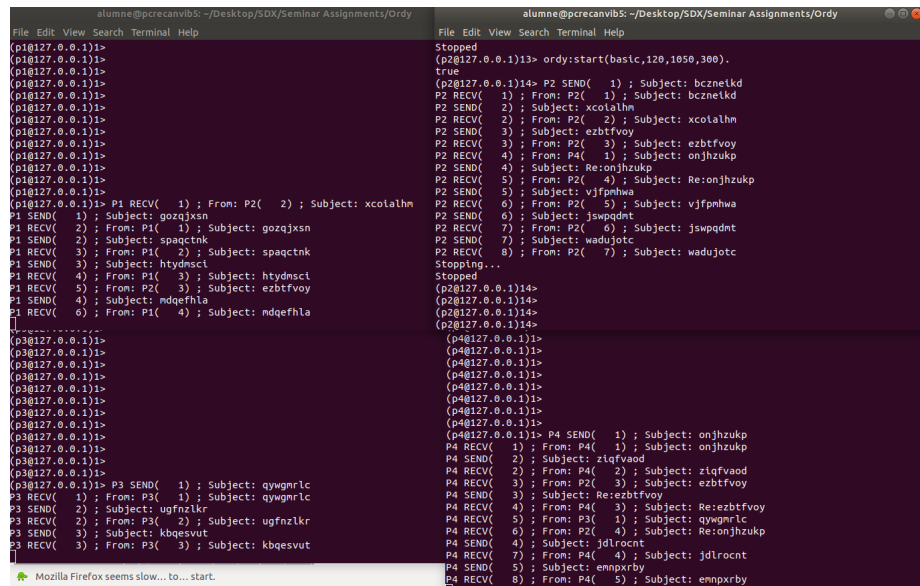
Eshell V9.2 (abort with ^G)
(p4@127.0.0.1)> P4 RECV( 1) ; From: P3( 1) ; Subject: dwlobyq
P4 SEND( 1) ; Subject: Re:dwlobyq
P4 RECV( 2) ; From: P4( 1) ; Subject: Re:Re:dwlobyq
P4 RECV( 3) ; From: P2( 1) ; Subject: Re:Re:dwlobyq
P4 SEND( 2) ; Subject: Re:Re:dwlobyq
P4 RECV( 4) ; From: P4( 2) ; Subject: Re:Re:dwlobyq
P4 RECV( 5) ; From: P1( 1) ; Subject: radboge
P4 RECV( 6) ; From: P1( 2) ; Subject: onlaunx
P4 RECV( 7) ; From: P2( 2) ; Subject: xcwhguj

(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
(p4@127.0.0.1)>
```

Com podem observar a la figura, hi ha diversos missatges, en el que si que es respecta l'ordre FIFO, però també es pot observar com en alguna ocasió els missatges no arriben en ordre.

## Test 2: Sleep time inferior a Jitter time

En aquest cas, és més probable que l'ordre dels missatges es vegi alterat, ja que en el moment en que estem fent multicast, es més probable que hi hagin missatges a ser enviats, de forma que la probabilitat de que un missatge arribi en desordre és major



```
alumn@pcrecanvib: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
(p10127.0.0.1)1>
P1 SEND( 1); Subject: gozqjxsn
P1 RECV( 2); From: P1( 1); Subject: gozqjxsn
P1 SEND( 2); Subject: spaqctnk
P1 RECV( 3); From: P1( 2); Subject: spaqctnk
P1 SEND( 3); Subject: htydmscl
P1 RECV( 4); From: P1( 3); Subject: htydmscl
P1 RECV( 5); From: P2( 3); Subject: ezbtfovoy
P1 SEND( 4); Subject: ndqefhla
P1 RECV( 6); From: P1( 4); Subject: ndqefhla
-----
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
(p30127.0.0.1)1>
P3 SEND( 1); Subject: qywgmrlic
P3 RECV( 1); From: P3( 1); Subject: qywgmrlic
P3 SEND( 2); Subject: ugfnzlktr
P3 RECV( 2); From: P3( 2); Subject: ugfnzlktr
P3 SEND( 3); Subject: kbqesvut
P3 RECV( 3); From: P3( 3); Subject: kbqesvut

alumn@pcrecanvib: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
Stopped
(p20127.0.0.1)13> ordy:start(basic,120,1050,300).
true
(p20127.0.0.1)14> P2 SEND( 1); Subject: bcznetkd
P2 RECV( 1); From: P2( 1); Subject: bcznetkd
P2 SEND( 2); Subject: xcolalhm
P2 RECV( 2); From: P2( 2); Subject: xcolalhm
P2 SEND( 3); Subject: ezbtfovoy
P2 RECV( 3); From: P2( 3); Subject: ezbtfovoy
P2 RECV( 4); From: P4( 1); Subject: onjhzupk
P2 SEND( 4); Subject: Re: onjhzupk
P2 RECV( 5); From: P2( 4); Subject: Re: onjhzupk
P2 SEND( 5); Subject: vjfpnhwa
P2 RECV( 6); From: P2( 5); Subject: vjfpnhwa
P2 SEND( 6); Subject: jswpqdnt
P2 RECV( 7); From: P2( 6); Subject: jswpqdnt
P2 SEND( 7); Subject: wadujotc
P2 RECV( 8); From: P2( 7); Subject: wadujotc
Stopping...
Stopped
(p20127.0.0.1)14>
(p20127.0.0.1)14>
(p20127.0.0.1)14>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
(p40127.0.0.1)1>
P4 SEND( 1); Subject: onjhzupk
P4 RECV( 1); From: P4( 1); Subject: onjhzupk
P4 SEND( 2); Subject: ziqfvaod
P4 RECV( 2); From: P4( 2); Subject: ziqfvaod
P4 RECV( 3); From: P2( 3); Subject: ezbtfovoy
P4 SEND( 3); Subject: Re: ezbtfovoy
P4 RECV( 4); From: P4( 3); Subject: Re: ezbtfovoy
P4 RECV( 5); From: P3( 1); Subject: qywgmrlic
P4 RECV( 6); From: P2( 4); Subject: Re: onjhzupk
P4 SEND( 4); Subject: jdlrocnt
P4 RECV( 7); From: P4( 4); Subject: jdlrocnt
P4 SEND( 5); Subject: emnprrby
P4 RECV( 8); From: P4( 5); Subject: emnprrby
```

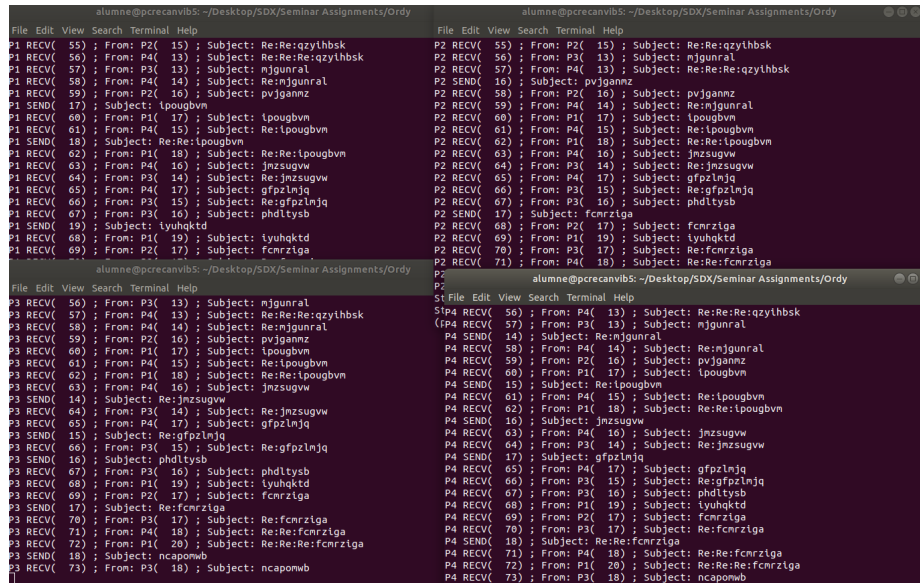
Com podem veure, ara és més fàcil observar desordres en els missatges, degut a que en el període en el que fem multicast, s'estan enviant més missatges.

## Causal order multicast

1. Set up the causal order multicast system, and repeat the previous tests.

### Test 1: Sleep time inferior a Jitter time

Amb el Causal order, haurien de arribar els missatges en l'ordre correcte, ja que comprova que el missatge que s'està rebent és el esperat i que s'han rebut tots els anteriors del procés que l'ha enviat.



```
alumni@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
P1 REC( 55) ; From: P2( 15) ; Subject: Re:Re:qzythbsk
P1 REC( 56) ; From: P4( 13) ; Subject: Re:Re:qzythbsk
P1 REC( 57) ; From: P2( 13) ; Subject: njgunral
P1 REC( 58) ; From: P4( 14) ; Subject: Re:njgunral
P1 REC( 59) ; From: P2( 16) ; Subject: pvjgannz
P1 SEND( 17) ; Subject: lpougbnv
P1 REC( 60) ; From: P1( 17) ; Subject: lpougbnv
P1 REC( 61) ; From: P4( 15) ; Subject: Re:lpougbnv
P1 SEND( 18) ; Subject: Re:Re:lpougbnv
P1 REC( 62) ; From: P1( 18) ; Subject: Re:Re:lpougbnv
P1 REC( 63) ; From: P4( 16) ; Subject: jnzsgvww
P1 REC( 64) ; From: P3( 14) ; Subject: Re:jnzsgvww
P1 REC( 65) ; From: P4( 17) ; Subject: gfpzlnjq
P1 REC( 66) ; From: P3( 15) ; Subject: Re:gfpzlnjq
P1 REC( 67) ; From: P3( 16) ; Subject: phdltysb
P1 SEND( 19) ; Subject: lyuhqktd
P1 REC( 68) ; From: P1( 19) ; Subject: lyuhqktd
P1 REC( 69) ; From: P2( 17) ; Subject: fcnrziga

alumni@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
P2 REC( 55) ; From: P2( 15) ; Subject: Re:Re:qzythbsk
P2 REC( 56) ; From: P3( 13) ; Subject: njgunral
P2 REC( 57) ; From: P4( 13) ; Subject: Re:Re:qzythbsk
P2 SEND( 16) ; Subject: pvjgannz
P2 REC( 58) ; From: P2( 16) ; Subject: pvjgannz
P2 REC( 59) ; From: P4( 14) ; Subject: Re:njgunral
P2 REC( 60) ; From: P1( 17) ; Subject: lpougbnv
P2 REC( 61) ; From: P4( 15) ; Subject: Re:lpougbnv
P2 REC( 62) ; From: P1( 18) ; Subject: Re:Re:lpougbnv
P2 REC( 63) ; From: P4( 16) ; Subject: jnzsgvww
P2 REC( 64) ; From: P3( 14) ; Subject: Re:jnzsgvww
P2 REC( 65) ; From: P4( 17) ; Subject: gfpzlnjq
P2 REC( 66) ; From: P3( 15) ; Subject: Re:gfpzlnjq
P2 REC( 67) ; From: P3( 16) ; Subject: phdltysb
P2 SEND( 17) ; Subject: fcnrziga
P2 REC( 68) ; From: P2( 17) ; Subject: fcnrziga
P2 REC( 69) ; From: P1( 19) ; Subject: lyuhqktd
P2 REC( 70) ; From: P3( 17) ; Subject: Re:fcnrziga
P2 REC( 71) ; From: P4( 18) ; Subject: Re:Re:fcnrziga

alumni@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
P3 REC( 56) ; From: P3( 13) ; Subject: njgunral
P3 REC( 57) ; From: P4( 13) ; Subject: Re:Re:qzythbsk
P3 REC( 58) ; From: P4( 14) ; Subject: Re:njgunral
P3 REC( 59) ; From: P2( 16) ; Subject: pvjgannz
P3 REC( 60) ; From: P1( 17) ; Subject: lpougbnv
P3 REC( 61) ; From: P4( 15) ; Subject: Re:lpougbnv
P3 REC( 62) ; From: P1( 18) ; Subject: Re:Re:lpougbnv
P3 REC( 63) ; From: P4( 16) ; Subject: jnzsgvww
P3 SEND( 14) ; Subject: Re:jnzsgvww
P3 REC( 64) ; From: P3( 14) ; Subject: Re:jnzsgvww
P3 REC( 65) ; From: P4( 17) ; Subject: gfpzlnjq
P3 SEND( 15) ; Subject: Re:gfpzlnjq
P3 REC( 66) ; From: P3( 15) ; Subject: Re:gfpzlnjq
P3 SEND( 16) ; Subject: phdltysb
P3 REC( 67) ; From: P3( 16) ; Subject: phdltysb
P3 REC( 68) ; From: P1( 19) ; Subject: lyuhqktd
P3 REC( 69) ; From: P2( 17) ; Subject: fcnrziga
P3 SEND( 17) ; Subject: Re:fcnrziga
P3 REC( 70) ; From: P3( 17) ; Subject: Re:fcnrziga
P3 REC( 71) ; From: P4( 18) ; Subject: Re:Re:fcnrziga
P3 SEND( 18) ; Subject: ncapomb
P3 REC( 72) ; From: P1( 20) ; Subject: Re:Re:fcnrziga
P3 REC( 73) ; From: P3( 18) ; Subject: ncapomb

alumni@pcrecanvib5: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
P4 REC( 56) ; From: P4( 13) ; Subject: Re:Re:qzythbsk
P4 REC( 57) ; From: P3( 13) ; Subject: njgunral
P4 SEND( 14) ; Subject: Re:njgunral
P4 REC( 58) ; From: P4( 14) ; Subject: Re:njgunral
P4 REC( 59) ; From: P2( 16) ; Subject: pvjgannz
P4 REC( 60) ; From: P1( 17) ; Subject: lpougbnv
P4 SEND( 15) ; Subject: Re:lpougbnv
P4 REC( 61) ; From: P4( 15) ; Subject: Re:lpougbnv
P4 REC( 62) ; From: P1( 18) ; Subject: Re:Re:lpougbnv
P4 SEND( 16) ; Subject: jnzsgvww
P4 REC( 63) ; From: P4( 16) ; Subject: Re:jnzsgvww
P4 REC( 64) ; From: P3( 14) ; Subject: Re:jnzsgvww
P4 SEND( 17) ; Subject: gfpzlnjq
P4 REC( 65) ; From: P4( 17) ; Subject: gfpzlnjq
P4 REC( 66) ; From: P3( 15) ; Subject: Re:gfpzlnjq
P4 REC( 67) ; From: P3( 16) ; Subject: phdltysb
P4 REC( 68) ; From: P1( 19) ; Subject: lyuhqktd
P4 REC( 69) ; From: P2( 17) ; Subject: fcnrziga
P4 REC( 70) ; From: P3( 17) ; Subject: Re:fcnrziga
P4 SEND( 18) ; Subject: Re:Re:fcnrziga
P4 REC( 71) ; From: P4( 18) ; Subject: Re:Re:fcnrziga
P4 REC( 72) ; From: P1( 20) ; Subject: Re:Re:fcnrziga
P4 REC( 73) ; From: P3( 18) ; Subject: ncapomb
```

Com podem veure, el ordre s'ha mantés, es a dir no hem rebut ningun missatge no esperat, es a dir que el missatges del emissor arriben en ordre i que no hi ha cap missatge de resposta enviat abans del primer, però el ordre total no s'ha mantés.

## Test 2: Sleep time superior a Jitter time

El cas de tenir un sleep time menor al Jitter time, no hauria de causar ninguna mena de desordre, en tot cas el que provocarà, és que els missatges triguin més a ser rebuts, ja que els processos estaran en sleep time més estona, com podem veure en la figura.

```
alumni@pcrcanvis: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
P1 RECV( 581) ; From: P3( 145) ; Subject: Re:elzxinuc
P1 RECV( 582) ; From: P3( 146) ; Subject: mqyaldvb
P1 RECV( 583) ; From: P1( 171) ; Subject: Re:Re:xdzpzuno
P1 RECV( 584) ; From: P4( 139) ; Subject: Re:fenjbonz
P1 RECV( 585) ; From: P4( 140) ; Subject: Re:Re:jdeakooq
P1 RECV( 586) ; From: P4( 141) ; Subject: Re:Re:fvlcbgjp
P1 RECV( 587) ; From: P4( 142) ; Subject: dbtzcpl
P1 RECV( 588) ; From: P4( 143) ; Subject: lrtawcfc
P1 RECV( 589) ; From: P4( 144) ; Subject: Re:bqnlhdoe
P1 RECV( 590) ; From: P4( 145) ; Subject: jtbplgyz
P1 RECV( 591) ; From: P4( 146) ; Subject: fznyclns
P1 RECV( 592) ; From: P4( 147) ; Subject: Re:Re:vurttfzoh
P1 RECV( 593) ; From: P4( 148) ; Subject: Re:xdzpzuno
P1 SEND( 172) ; Subject: jdbexspf
P1 RECV( 594) ; From: P1( 172) ; Subject: jdbexspf
P1 RECV( 595) ; From: P4( 149) ; Subject: Re:sgvjntyn
P1 SEND( 173) ; Subject: Re:Re:sgvjntyn
P1 RECV( 596) ; From: P4( 150) ; Subject: chxntowk
P1 RECV( 597) ; From: P4( 151) ; Subject: utbpdfay
P1 RECV( 598) ; From: P4( 152) ; Subject: dnuxyzft
P1 SEND( 174) ; Subject: Re:dnuxyzft
P1 RECV( 599) ; From: P1( 172) ; Subject: Re:Re:sgvjntyn
P1 RECV( 600) ; From: P1( 174) ; Subject: Re:dnuxyzft

P3 RECV( 574) ; From: P3( 176) ; Subject: womuyqba
P3 RECV( 575) ; From: P2( 127) ; Subject: bcgrjthg
P3 RECV( 576) ; From: P2( 128) ; Subject: xgqlqfrc
P3 RECV( 577) ; From: P2( 129) ; Subject: saugwvfc
P3 SEND( 177) ; Subject: jxvklhbl
P3 RECV( 578) ; From: P3( 177) ; Subject: jxvklhbl
P3 RECV( 579) ; From: P4( 144) ; Subject: Re:bqnlhdoe
P3 SEND( 178) ; Subject: Re:Re:bqnlhdoe
P3 RECV( 580) ; From: P4( 145) ; Subject: jtbplgyz
P3 RECV( 581) ; From: P4( 146) ; Subject: fznyclns
P3 RECV( 582) ; From: P4( 147) ; Subject: Re:Re:vurttfzoh
P3 RECV( 583) ; From: P3( 178) ; Subject: Re:Re:bqnlhdoe
P3 RECV( 584) ; From: P1( 130) ; Subject: Re:glfkznsp
P3 RECV( 585) ; From: P1( 131) ; Subject: dltfnepb
P3 RECV( 586) ; From: P1( 132) ; Subject: Re:Re:rehtfzrjgy
P3 RECV( 587) ; From: P1( 133) ; Subject: Re:okmwehrc
P3 RECV( 588) ; From: P1( 134) ; Subject: Re:Re:olzfrmg
P3 RECV( 589) ; From: P1( 135) ; Subject: Re:elzxinuc
P3 RECV( 590) ; From: P1( 136) ; Subject: Re:Re:Re:zykfbjt
P3 RECV( 591) ; From: P1( 137) ; Subject: ncvjdlit

P4 RECV( 567) ; From: P3( 137) ; Subject: caoybljr
P4 RECV( 568) ; From: P3( 138) ; Subject: lhexvfcq
P4 RECV( 569) ; From: P3( 139) ; Subject: Re:Re:fvlcbgjp
P4 SEND( 170) ; Subject: Re:Re:Re:fvlcbgjp
P4 RECV( 570) ; From: P3( 140) ; Subject: Re:fenjbonz
P4 SEND( 171) ; Subject: Re:Re:fenjbonz
P4 RECV( 571) ; From: P3( 141) ; Subject: oklprdzu
P4 RECV( 572) ; From: P3( 142) ; Subject: lxmhtecw
P4 RECV( 573) ; From: P3( 143) ; Subject: Re:xdzpzuno
P4 RECV( 574) ; From: P3( 144) ; Subject: sfxwtcll
P4 RECV( 575) ; From: P3( 145) ; Subject: Re:elzxinuc
P4 RECV( 576) ; From: P3( 146) ; Subject: mqyaldvb
P4 RECV( 577) ; From: P4( 169) ; Subject: Re:Re:Re:dcfgmnxz
P4 RECV( 578) ; From: P4( 170) ; Subject: Re:Re:Re:fvlcbgjp
P4 RECV( 579) ; From: P4( 171) ; Subject: Re:Re:fenjbonz
P4 SEND( 172) ; Subject: skhlocbe
P4 RECV( 580) ; From: P4( 172) ; Subject: skhlocbe
P4 SEND( 173) ; Subject: ncosdmhx
P4 RECV( 581) ; From: P4( 173) ; Subject: ncosdmhx
P4 SEND( 174) ; Subject: frjsglno
P4 RECV( 582) ; From: P4( 174) ; Subject: frjsglno
```

## Total order multicast

1. Set up the total order multicast system, and repeat the previous tests.

### Test 1: Sleep time inferior a Jitter time

Ni el Sleep time ni el Jitter time, haurien de provocar cap desordre, ja que els missatges s'entregaran en ordre de mínim nSeq de la queue. El que si que notarem, es que degut al alt temps de Jitter, s'enviaran més missatges.

```
alumni@pcrecnavib5: ~/Desktop/SDX/Seminar Assignments/OrdY
File Edit View Search Terminal Help
(ok,total)
(p0127.0.0.1)3> P1 RECV( 1) ; From: P2( 1) ; Subject: knlxyapn
P1 SEND( 1) ; Subject: Re:knlxyapn
P1 RECV( 2) ; From: P1( 1) ; Subject: Re:knlxyapn
P1 RECV( 3) ; From: P2( 2) ; Subject: Re:Re:knlxyapn
P1 RECV( 4) ; From: P4( 1) ; Subject: Re:Re:knlxyapn
P1 SEND( 2) ; Subject: hlwyunxr
P1 RECV( 5) ; From: P1( 2) ; Subject: hlwyunxr
P1 RECV( 6) ; From: P2( 3) ; Subject: qzxn timer
P1 RECV( 7) ; From: P3( 1) ; Subject: Re:hlwyunxr
P1 RECV( 8) ; From: P4( 2) ; Subject: xzcstnfq
P1 RECV( 9) ; From: P3( 2) ; Subject: wcknvhao
P1 SEND( 3) ; Subject: rzufnodi
P1 RECV( 10) ; From: P1( 3) ; Subject: rzufnodi
P1 RECV( 11) ; From: P2( 3) ; Subject: Re:rzufnodi
P1 SEND( 4) ; Subject: Re:Re:rzufnodi
P1 RECV( 12) ; From: P1( 4) ; Subject: Re:Re:rzufnodi
P1 RECV( 13) ; From: P2( 4) ; Subject: pgylhgb
P1 RECV( 14) ; From: P4( 3) ; Subject: Re:Re:Re:rzufnodi
P1 RECV( 15) ; From: P2( 5) ; Subject: Re:Re:rzufnodi
P1 SEND( 5) ; Subject: Re:Re:Re:rzufnodi
P1 RECV( 16) ; From: P1( 5) ; Subject: Re:Re:Re:rzufnodi
P1 RECV( 17) ; From: P4( 4) ; Subject: kprutjov
P1 SEND( 6) ; Subject: kprutjov
(p0127.0.0.1)3> P3 RECV( 1) ; From: P2( 1) ; Subject: knlxyapn
P3 RECV( 2) ; From: P1( 1) ; Subject: Re:knlxyapn
P3 RECV( 3) ; From: P2( 2) ; Subject: Re:Re:knlxyapn
P3 RECV( 4) ; From: P4( 1) ; Subject: Re:Re:knlxyapn
P3 RECV( 5) ; From: P2( 3) ; Subject: qzxn timer
P3 RECV( 6) ; From: P1( 2) ; Subject: hlwyunxr
P3 SEND( 1) ; Subject: Re:hlwyunxr
P3 RECV( 7) ; From: P3( 1) ; Subject: Re:hlwyunxr
P3 SEND( 2) ; Subject: wcknvhao
P3 RECV( 8) ; From: P3( 2) ; Subject: wcknvhao
P3 RECV( 9) ; From: P4( 2) ; Subject: xzcstnfq
P3 RECV( 10) ; From: P1( 3) ; Subject: rzufnodi
P3 SEND( 3) ; Subject: Re:rzufnodi
P3 RECV( 11) ; From: P3( 3) ; Subject: Re:rzufnodi
P3 RECV( 12) ; From: P1( 4) ; Subject: Re:Re:rzufnodi
P3 RECV( 13) ; From: P4( 3) ; Subject: Re:Re:Re:rzufnodi
P3 RECV( 14) ; From: P2( 4) ; Subject: pgylhgb
P3 RECV( 15) ; From: P2( 5) ; Subject: Re:Re:rzufnodi
P3 RECV( 16) ; From: P1( 5) ; Subject: Re:Re:Re:rzufnodi
P3 RECV( 17) ; From: P4( 4) ; Subject: kprutjov
P3 SEND( 4) ; Subject: kprutjov
(p0127.0.0.1)4> P4 RECV( 1) ; From: P2( 1) ; Subject: knlxyapn
P4 RECV( 2) ; From: P1( 1) ; Subject: Re:knlxyapn
P4 SEND( 1) ; Subject: Re:knlxyapn
P4 RECV( 3) ; From: P4( 1) ; Subject: Re:Re:knlxyapn
P4 RECV( 4) ; From: P2( 2) ; Subject: Re:Re:knlxyapn
P4 RECV( 5) ; From: P1( 2) ; Subject: hlwyunxr
P4 RECV( 6) ; From: P2( 3) ; Subject: qzxn timer
P4 RECV( 7) ; From: P3( 1) ; Subject: Re:hlwyunxr
P4 SEND( 2) ; Subject: xzcstnfq
P4 RECV( 8) ; From: P4( 2) ; Subject: xzcstnfq
P4 RECV( 9) ; From: P3( 2) ; Subject: wcknvhao
P4 RECV( 10) ; From: P1( 3) ; Subject: rzufnodi
P4 RECV( 11) ; From: P3( 3) ; Subject: Re:rzufnodi
P4 RECV( 12) ; From: P1( 4) ; Subject: Re:Re:rzufnodi
P4 SEND( 3) ; Subject: Re:Re:Re:rzufnodi
P4 RECV( 13) ; From: P4( 3) ; Subject: Re:Re:Re:rzufnodi
P4 RECV( 14) ; From: P2( 4) ; Subject: pgylhgb
P4 RECV( 15) ; From: P2( 5) ; Subject: Re:Re:rzufnodi
P4 SEND( 4) ; Subject: kprutjov
P4 RECV( 16) ; From: P4( 4) ; Subject: kprutjov
P4 RECV( 17) ; From: P1( 5) ; Subject: Re:Re:Re:rzufnodi
P4 SEND( 5) ; Subject: Re:Re:Re:Re:rzufnodi
Stopped
(p0127.0.0.1)31>
```

### Test 2: Sleep time superior a Jitter time

Igual que en el cas anterior, tots els processos rebran els missatges en el mateix ordre, però degut a que el Sleep time, és més alt el numero de missatges rebuts serà menor, tal i com podem veure:

```

alunne@prccravnib5:~/Desktop/SOX/Seminar Assignment/Ord
File Edit View Search Terminal Help
P1 REC0V 61) From: P1( 30) ; Subject: Re:kyogonfr
P1 REC0V 62) From: P1( 31) ; Subject: hqkyrlcp
P1 REC0V 63) From: P3( 12) ; Subject: ptecluk
P1 REC0V 64) From: P3( 13) ; Subject: oujqkms
P1 SEND0 32) Subject: hfyvntu
P1 REC0V 65) From: P1( 32) ; Subject: hfyvntu
P1 SEND0 33) Subject: mlejowtu
P1 REC0V 66) From: P1( 33) ; Subject: mlejowtu
P1 REC0V 67) From: P4( 9) ; Subject: skdxkwn
P1 REC0V 68) From: P2( 13) ; Subject: pwjavexn
P1 SEND0 34) Subject: Re:pwjavexn
P1 REC0V 69) From: P1( 34) ; Subject: Re:pwjavexn
P1 SEND0 35) Subject: xogagbl
P1 REC0V 70) From: P1( 35) ; Subject: xogagbl
P1 REC0V 71) From: P4( 10) ; Subject: owrdnjb
P1 SEND0 36) Subject: owrdnjb
P1 REC0V 72) From: P4( 11) ; Subject: gwakfztt
P1 REC0V 73) From: P4( 12) ; Subject: ewocnktu
P1 REC0V 74) From: P1( 36) ; Subject: Re:owrdnjb
P1 SEND0 37) Subject: owrdnjb
P1 REC0V 75) From: P1( 37) ; Subject: edxczcf
P1 SEND0 38) Subject: yfhrksku
P1 REC0V 76) From: P1( 38) ; Subject: yfhrksku
Stopped
(P28127.0.0.1)32=
alunne@prccravnib5:~/Desktop/SOX/Seminar Assignment/Ord
File Edit View Search Terminal Help
P4 REC0V 67) From: P4( 13) ; Subject: erdkfsxw
P4 REC0V 68) From: P4( 14) ; Subject: bgkqsvth
P4 SEND0 30) Subject: Re:bgkqsvth
P4 REC0V 69) From: P4( 15) ; Subject: kbyunqe
P4 SEND0 70) From: P2( 30) ; Subject: Re:bgkqsvth
P4 SEND0 31) Subject: bhwtyvrq
P4 REC0V 71) From: P2( 31) ; Subject: bhwtyvrq
P4 SEND0 32) Subject: pqbyzux
P4 REC0V 72) From: P2( 32) ; Subject: pqbyzux
P4 REC0V 73) From: P1( 12) ; Subject: wdyrxhnl
P4 REC0V 74) From: P1( 11) ; Subject: Re:xbnuzvgq
P4 REC0V 75) From: P1( 12) ; Subject: Re:xbnuzvgq
P4 REC0V 76) From: P1( 13) ; Subject: kxstvyrv
P4 REC0V 77) From: P1( 14) ; Subject: zangrlwb
P4 REC0V 78) From: P4( 16) ; Subject: awhltbop
P4 REC0V 79) From: P4( 17) ; Subject: jstfchp
P4 REC0V 80) From: P4( 18) ; Subject: lkcvddp
P4 REC0V 81) From: P4( 19) ; Subject: waqexojl
P4 SEND0 33) Subject: Re:waqexojl
P4 REC0V 82) From: P4( 20) ; Subject: dzufzqfj
P4 SEND0 83) From: P2( 33) ; Subject: Re:waqexojl
Stopping...
Stopped
(P28127.0.0.1)32=
P4 REC0V 76) From: P3( 16) ; Subject: mlhwtap
P4 REC0V 77) From: P3( 17) ; Subject: naeytsop
P4 REC0V 78) From: P3( 18) ; Subject: yondtpe1
P4 SEND0 38) Subject: Re:yondtpe1
P4 REC0V 79) From: P3( 19) ; Subject: caddgttl
P4 SEND0 39) Subject: Re:caddgttl
P4 REC0V 80) From: P3( 20) ; Subject: xhlfecwg
P4 SEND0 40) Subject: Re:xhlfecwg
P4 REC0V 81) From: P3( 21) ; Subject: thsrkuea
P4 REC0V 82) From: P3( 22) ; Subject: zjvorkfg
P4 SEND0 41) Subject: Re:zjvorkfg
P4 REC0V 83) From: P3( 23) ; Subject: lveznrbp
P4 REC0V 84) From: P3( 24) ; Subject: Re:knmyxaqs
P4 REC0V 85) From: P3( 25) ; Subject: cjjgtbep
P4 REC0V 86) From: P3( 26) ; Subject: ofkwtbuc
P4 REC0V 87) From: P4( 38) ; Subject: Re:yondtpe1
P4 REC0V 88) From: P4( 39) ; Subject: Re:caddgttl
P4 REC0V 89) From: P4( 40) ; Subject: Re:xhlfecwg
P4 REC0V 90) From: P4( 41) ; Subject: Re:zjvorkfg
P4 SEND0 42) Subject: czfvtkoq
P4 REC0V 91) From: P4( 42) ; Subject: czfvtkoq

```

2. We have a lot of messages in the system. Derive a theoretical quantification of the number of messages needed to deliver a multicast message as a function of the number of workers and check experimentally that your formulation is correct

$$\text{Basic} = 1 * \text{send} + n * \text{multicast} + n * \text{deliver} = 2 * n + 1.$$

$$\begin{aligned} \text{Total} &= 1 * \text{send} + n * \text{request} + n * \text{proposal} + n * \text{agreed} + n * \\ \text{deliver} &= 4 * n + 1. \end{aligned}$$

N = numero de workers.

### 3 Open questions

1. Basic Multicast: Are the posts displayed in FIFO, causal, and totalorder? Justify why.

Cap de les opcions. En aquesta versió bàsica utilitzem la funció send-after que fa servir el Jitter per treure un temps de retard random, per tant, si tenim el cas d'un worker que té temps de resposta ( o d'enviar un altre missatge multicast) prou petit, llavors aquest segon worker enviarà abans que el primer worker, els missatges multicast.

2. Casual Order Multicast: Are the posts displayed in FIFO, causal, and totalorder? Justify why.

El vector clock fa que hi hagi una relació happened-before entre els missatges, per tant, es respectarà l'ordre causa. FIFO també ja que 2 missatges enviats pel mateix procés s'hauran de lliurar segons ho indiqui el vector clock. Però pel contrari no es respecta l'ordre total, ja que no hi ha una relació entre missatges de diferents processos enviats al mateix temps. En aquesta versió el paràmetre Jitter perd importància a causa de l'ordre que implica els vectors clock i la cua.

3. Total Order Multicast: Are the posts displayed in FIFO, causal, and totalorder? Justify why.

L'Ordre FIFO no es compleix ja que la posició de cada missatge depèn del jitter amb que arriba als processos. Aquests no tenen un ordre intern dels missatges que emeten a diferència de la versió causal.

L'ordre causal tampoc es compleix. No s'ha establert relació de happened-before entre missatges.

L'ordre total sí que es respecta perquè tots els processos reben la mateixa seqüència de missatges.



## **4 Personal opinion**

El lab practicat ens ha ajudat a clarificar els conceptes explicats a teoria i ha exemplificat de manera clara un dels protocols en més èxit que s'utilitza actualment.