

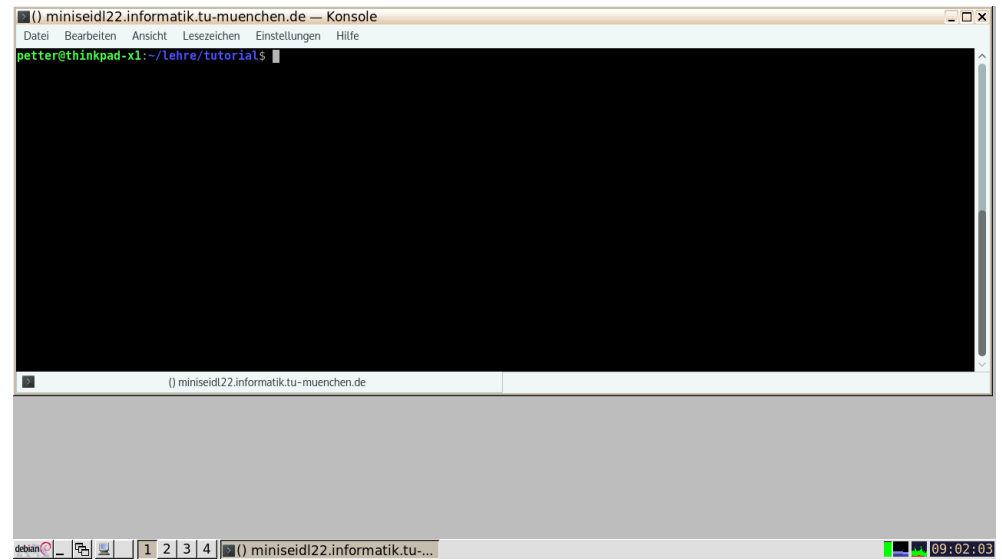
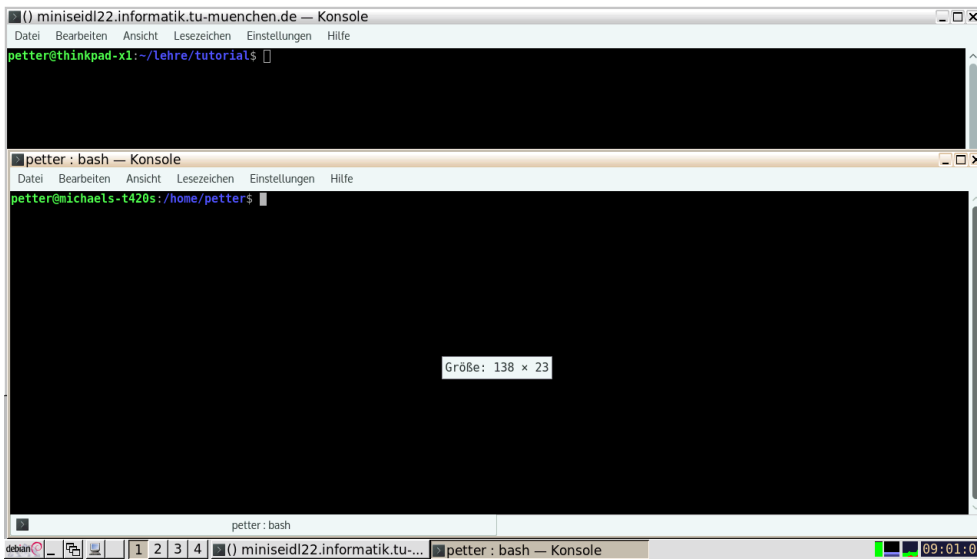
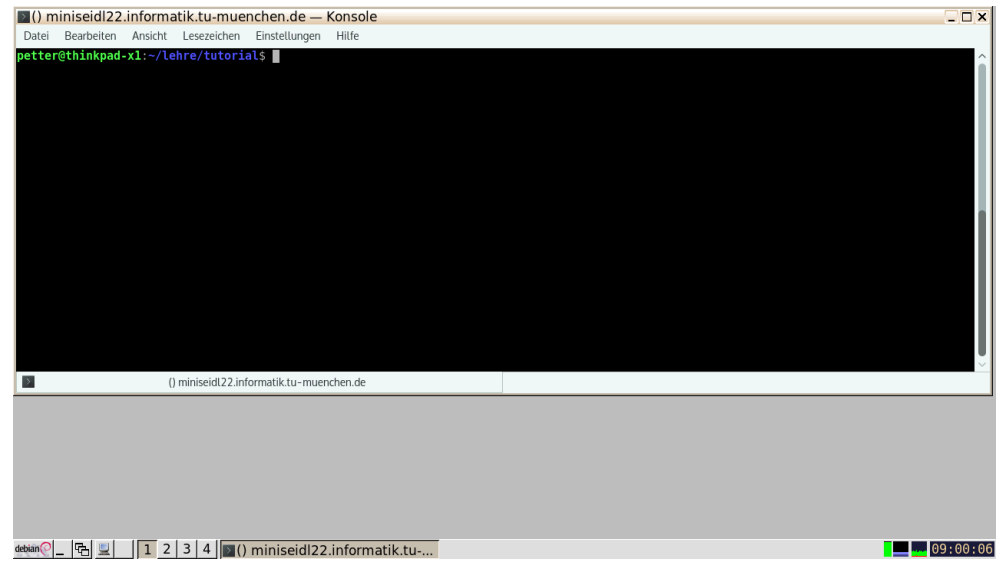
Script generated by TTT

Title: Petter: Programmiersprachen_Uebung
(02.12.2016)

Date: Fri Dec 02 09:00:07 CET 2016

Duration: 55:51 min

Pages: 51



```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
1 // gcc -pthread bumper.c -o bumper
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #define NUM_THREADS 4
6
7 char heap[2^20];
8 char* firstFree = &heap[0];
9
10 char* myalloc(int size) {
11     char* start = firstFree;
12     firstFree = firstFree + size;
13     //if (start+size>sizeof(heap)) garbage_collect();
14     if (start+size>2^22) ;
15     return start;
16 }
17
18 void *allocator(void *threadid) {
19     for (int i=0; i<1000000000; i++)
20         myalloc(1);
21 }
22
23
24
25
26 int main(int argc, char *argv[]) {
27     pthread_t threads[NUM_THREADS];
28     int rc;
29     long t;
30
31     for(t = 0; t < NUM_THREADS; t++) {
32         printf("In main: creating thread %ld\n", t);
33     }
34 }
UU:***-F1 bumperstm.c Top (1,0) (C/L FlyC:0/8 company Abbrev)
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
1 // gcc -pthread bumper.c -o bumper
2
3
4 // gcc -pthread bumper.c -o bumper
5 #include <pthread.h> // pthread_create, pthread_exit
6 #include <stdio.h> // printf
7 #include <stdlib.h> // exit
8 #define NUM_THREADS 4
9
10 char heap[2^20];
11 char* firstFree = &heap[0];
12
13 char* myalloc(int size) {
14     char* start = firstFree;
15     firstFree = firstFree + size;
16     //if (start+size>sizeof(heap)) garbage_collect();
17     if (start+size>2^22) ;
18     return start;
19 }
20
21 void *allocator(void *threadid) {
22     for (int i=0; i<1000000000; i++)
23         myalloc(1);
24 }
25
26 }
27
28 int main(int argc, char *argv[]) {
29     pthread_t threads[NUM_THREADS];
30     int rc;
31     long t;
32 }
UU:***-F1 bumperstm.c Top (4,0) (C/L FlyC:0/8 company Abbrev)
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
petter@thinkpad-x1:~/lehre/tutorial$ ls -~/ctl-1.2/
include/ lib/
petter@thinkpad-x1:~/lehre/tutorial$ ls -~/ctl-1.2/
include lib
petter@thinkpad-x1:~/lehre/tutorial$ emacs bumper
bumper.c bumperlocked.c bumpersemaphore.c
petter@thinkpad-x1:~/lehre/tutorial$ cp bumper.c bumperstm.c
petter@thinkpad-x1:~/lehre/tutorial$ emacs -nw bumperstm.c
petter@thinkpad-x1:~/lehre/tutorial$
UU:***-F1 bumperstm.c Top (1,0) (C/L FlyC:0/8 company Abbrev)
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
1 // gcc -pthread bumper.c -o bumper
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #define NUM_THREADS 4
6
7 char heap[2^20];
8 char* firstFree = &heap[0];
9
10 char* myalloc(int size) {
11     char* start = firstFree;
12     firstFree = firstFree + size;
13     //if (start+size>sizeof(heap)) garbage_collect();
14     if (start+size>2^22) ;
15     return start;
16 }
17
18 void *allocator(void *threadid) {
19     for (int i=0; i<1000000000; i++)
20         myalloc(1);
21 }
22
23 }
24
25
26 int main(int argc, char *argv[]) {
27     pthread_t threads[NUM_THREADS];
28     int rc;
29     long t;
30
31     for(t = 0; t < NUM_THREADS; t++) {
32         printf("In main: creating thread %ld\n", t);
33     }
34 }
UU:***-F1 bumperstm.c Top (1,0) (C/L FlyC:0/8 company Abbrev)
```



```
emacs@thinkpad-x1
1 // export CTL=/home/petter/ctl-gc -I$CTL/include -L$CTL/lib -lctl-cmt-word-64 -o bumper
2 #stm
3 #include <pthread.h> // pthread_create, pthread_exit
4 #include <stdio.h> // printf
5 #include <stdlib.h> // exit
6 #define NUM_THREADS 4
7 #include <ctl_cmt_word_64.h>
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(Thread *t,int size) {
12     char* start;
13     TxStart(t,0);
14     start = TxLoad(t,&firstFree);
15     TxStore(t,&firstFree,start+size);
16     firstFree = firstFree + size;
17     TxCommit(t);
18     //if (start+size>sizeof(heap)) garbage_collect();
19     if (start+size>2^22);
20
21     return start;
22 }
23
24 void *allocator(void *threadid){
25     Thread* t = TxNewThread();
26     for (int i=0;i<100000000;i++)
27         myalloc(t,1);
28     TxEndThread(t);
29
30 }
31
32 -:** bumperstm.c Top (1,31) (C/l FlyC:1/0 company Abbrev)
```

```
emacs@thinkpad-x1
1 // export CTL=/home/petter/ctl-1.2; gcc -pthread bumperstm.c -I$CTL/include -L$CTL/lib -lctl-cmt-word-64 -o
2 bumperstm
3 #include <pthread.h> // pthread_create, pthread_exit
4 #include <stdio.h> // printf
5 #include <stdlib.h> // exit
6 #define NUM_THREADS 4
7 #include <ctl_cmt_word_64.h>
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(Thread *t,int size) {
12     char* start;
13     TxStart(t,0);
14     start = TxLoad(t,&firstFree);
15     TxStore(t,&firstFree,start+size);
16     firstFree = firstFree + size;
17     TxCommit(t);
18     //if (start+size>sizeof(heap)) garbage_collect();
19     if (start+size>2^22);
20
21     return start;
22 }
23
24 void *allocator(void *threadid){
25     Thread* t = TxNewThread();
26     for (int i=0;i<100000000;i++)
27         myalloc(t,1);
28     TxEndThread(t);
29
30 }
31
32 -:--- bumperstm.c Top (1,119) (C/l FlyC:1/0 company Abbrev)
```

```
() miniseid122.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
~/Lehre/proglang [master] + 6...20 1]
09:05 $ ls
slides_slides2012_slides2013_slides2014_slides2015_tumlogos.tex uebungen
~/Lehre/proglang [master] + 6...20 1]
09:05 $ cd ..
petter@thinkpad-x1:~/Lehre$ cd tutorial/
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumperlocked.c bumpersemaphore.c #bumperstm.c# bumperstm.c bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$ emacs bumperstm.c &
[1] 3469
petter@thinkpad-x1:~/Lehre/tutorial$
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-XNb88yK3L5: Verbindungsaufbau abgelehnt
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-NGN3WrJ1Y9: Verbindungsaufbau abgelehnt
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-I240vG4Glo: Verbindungsaufbau abgelehnt
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-V6ch2pighv: Verbindungsaufbau abgelehnt
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-Hcl4WkyDm: Verbindungsaufbau abgelehnt
(emacs:3469): GConf-WARNING **: Client failed to connect to the D-BUS daemon:
Failed to connect to socket /tmp/dbus-baa5H8TRFV: Verbindungsaufbau abgelehnt
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
() miniseid122.informatik.tu-muenchen.de
```

```
() miniseid122.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
start = TxLoad(t,&firstFree);
bumperstm.c:15:13: warning: passing argument 2 of 'TxStoreCMT' from incompatible pointer type [-Wincompatible-pointer-types]
TxStore(t,&firstFree,start+size);
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0,
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'volatile intptr_t * {aka volatile long int *}' but argument is of type 'char **'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
bumperstm.c:15:24: warning: passing argument 3 of 'TxStoreCMT' makes integer from pointer without a cast [-Wint-conversion]
TxStore(t,&firstFree,start+size);
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0,
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'intptr_t {aka long int}' but argument is of type 'char *'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
bumperstm.c:19:17: warning: comparison between pointer and integer
if (start+size>2^22);
bumperstm.c: In function 'main':
bumperstm.c:50:13: warning: format 'td' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("td\n",firstFree-&heap[0]);
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumperlocked.c bumpersemaphore.c bumperstm bumperstm.c bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$ ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
() miniseid122.informatik.tu-muenchen.de
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
TxStore(t,&firstFree,start+size);
^
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0:
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'volatile intptr_t * {aka volatile long int *}' but argument is of type 'char **'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:15:24: warning: passing argument 3 of 'TxStoreCMT' makes integer from pointer without a cast [-Wint-conversion]
TxStore(t,&firstFree,start+size);
^
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0:
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'intptr_t {aka long int}' but argument is of type 'char *'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:19:17: warning: comparison between pointer and integer
if (start+size>2^22) ;
^
bumperstm.c: In function 'main':
bumperstm.c:50:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n",firstFree-&heap[0]);
^
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
45184578

real    0m7.852s
user    0m12.080s
sys     0m18.600s
petter@thinkpad-x1:~/lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'volatile intptr_t * {aka volatile long int *}' but argument is of type 'char **'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:15:24: warning: passing argument 3 of 'TxStoreCMT' makes integer from pointer without a cast [-Wint-conversion]
TxStore(t,&firstFree,start+size);
^
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0:
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'intptr_t {aka long int}' but argument is of type 'char *'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:18:17: warning: comparison between pointer and integer
if (start+size>2^22) ;
^
bumperstm.c: In function 'main':
bumperstm.c:49:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n",firstFree-&heap[0]);
^
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.701s
user    0m11.784s
sys     0m18.308s
petter@thinkpad-x1:~/lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
```

```
emacs@thinkpad-x1
1 // export CTL=/home/petter/ctl-1.2; gcc -pthread bumperstm.c -I$CTL/include -L$CTL/lib -lctl-cmt-word-64 -o
2 bumperstm
3 #include <pthread.h> // pthread_create, pthread_exit
4 #include <stdio.h> // printf
5 #include <stdlib.h> // exit
6 #define NUM_THREADS 4
7 #include <ctl_cmt_word_64.h>
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(Thread *t,int size) {
12 char* start;
13 TxStart(t,0);
14 start = TxLoad(t,&firstFree);
15 TxStore(t,&firstFree,start+size);
16 TxCommit(t);
17 //if (start+size>sizeof(heap)) garbage_collect();
18 if (start+size>2^22) ;
19
20 return start;
21 }
22
23 void *allocator(void *threadid){
24 Thread* t = TxNewThread();
25 for (int i=0;i<100000000;i++)
26 myalloc(t,1);
27 TxEndThread(t);
28
29 }
-:-- bumperstm.c Top (16.0) (C/l FlyC:1/0 company Abbrev)
Wrote /home/petter/lehre/tutorial/bumperstm.c
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:15:24: warning: passing argument 3 of 'TxStoreCMT' makes integer from pointer without a cast [-Wint-conversion]
TxStore(t,&firstFree,start+size);
^
In file included from /home/petter/ctl-1.2/include/ctl_cmt_word_64.h:18:0:
from bumperstm.c:6:
/home/petter/ctl-1.2/include/ctl.h:332:13: note: expected 'intptr_t {aka long int}' but argument is of type 'char *'
extern void TxStoreCMT(Thread * const Self, intptr_t volatile *addr,
^
bumperstm.c:18:17: warning: comparison between pointer and integer
if (start+size>2^22) ;
^
bumperstm.c: In function 'main':
bumperstm.c:49:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n",firstFree-&heap[0]);
^
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.701s
user    0m11.784s
sys     0m18.308s
petter@thinkpad-x1:~/lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".

petter@thinkpad-x1:~/lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
power management:
processor      : 3
vendor id     : GenuineIntel
cpu family    : 6
model         : 78
model name    : Intel(R) Core(TM) i7-6600U CPU @ 2.60GHz
stepping      : 3
microcode     : 0x9e
cpu MHz       : 841.845
cache size    : 4096 KB
physical id   : 0
siblings      : 4
core id       : 1
cpu cores     : 2
apicid        : 3
initial apicid : 3
fpu           : yes
fpu_exception : yes
cpuid level   : 22
wp            : yes
flags         : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe s
yscall nx pdpe1gb rdtscp lm constant tsc art arch perfmon pebs bts rep good nopl xtopology nonstop tsc aperfmperf eagerfpu pni pclmulqdq dt
es64 monitor ds cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc deadline timer aes xsave avx f
16c rdrand lahf_lm abm 3dnowprefetch ept intel_pt tpr_shadow vmmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms in
vpcid rtm mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp
bugs          :
bogomips     : 5616.00
clflush size : 64
cache alignm : 64
address sizes : 39 bits physical, 48 bits virtual
power management:

petter@thinkpad-x1:~/Lehre/tutorial$
```

```
emacs@thinkpad-x1
1 // export CTL=/home/petter/ctl-1.2; gcc -pthread bumperstm.c -I$CTL/include -L$CTL/lib -lctl-cmt-word-64 -o
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #define NUM_THREADS 4
6 #include <ctl_cmt_word_64.h>
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(Thread *t,int size) {
12 char* start;
13 TxStart(t,0);
14 start = TxLoad(t,&firstFree);
15 TxStore(t,&firstFree,start+size);
16 TxCommit(t);
17 //if (start+size>sizeof(heap)) garbage_collect();
18 if (start+size>2^22);
19
20 return start;
21 }
22
23 void *allocator(void *threadid){
24 Thread* t = TxNewThread();
25 for (int i=0;i<10000000;i++)
26 myalloc(t,1);
27 TxEndThread(t);
28 }
29
30 --- bumperstm.c Top (13,15) (C/l FlyC:1/0 company Abbrev)
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
cpu MHz       : 841.845
cache size    : 4096 KB
physical id   : 0
siblings      : 4
core id       : 1
cpu cores     : 2
apicid        : 3
initial apicid : 3
fpu           : yes
fpu_exception : yes
cpuid level   : 22
wp            : yes
flags         : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe s
yscall nx pdpe1gb rdtscp lm constant tsc art arch perfmon pebs bts rep good nopl xtopology nonstop tsc aperfmperf eagerfpu pni pclmulqdq dt
es64 monitor ds cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc deadline timer aes xsave avx f
16c rdrand lahf_lm abm 3dnowprefetch ept intel_pt tpr_shadow vmmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms in
vpcid rtm mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp
bugs          :
bogomips     : 5616.00
clflush size : 64
cache alignm : 64
address sizes : 39 bits physical, 48 bits virtual
power management:

petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".

petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread bumperrtm.c -o bumperrtm
bumperrtm.c:5:21: fatal error: immintr.h: Datei oder Verzeichnis nicht gefunden
#include <immintr.h>
^
compilation terminated.
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
emacs@thinkpad-x1
1 // gcc -pthread bumperrtm.c -o bumperrtm
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #include <immintr.h>
6 #define NUM_THREADS 4
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(int size) {
12 char* start;
13 int s = 0;
14 do {
15 if ((s = xbegin()) == _XBEGIN_STARTED)
16 {
17 start = firstFree;
18 firstFree = firstFree + size;
19 _xend();
20 }
21 } while (s != _XBEGIN_STARTED);
22
23 //if (start+size>sizeof(heap)) garbage_collect();
24 if (start+size>2^22);
25 return start;
26 }
27
28 void *allocator(void *threadid){
29 for (int i=0;i<10000000;i++)
30 myalloc(1);
31 }
32 --- bumperrtm.c Top (1,40) (C/l FlyC:1/0 company Abbrev)
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
bumperrtm.c:5:21: fatal error: immintr.h: Datei oder Verzeichnis nicht gefunden
#include <immintr.h>
^
compilation terminated.
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
gcc -pthread bumperrtm.c -o bumperrtm
bumperrtm.c: In function 'myalloc':
bumperrtm.c:24:17: warning: comparison between pointer and integer
    if (start+size>2^22);
        ^
bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
           ^
In file included from /usr/lib/gcc/x86_64-linux-gnu/6/include/immintrin.h:83:0,
                 from bumperrtm.c:5:
/usr/lib/gcc/x86_64-linux-gnu/6/include/rtmmintrin.h:50:1: error: inlining failed in call to always_inline '_xbegin': target specific option mismatch
_xbegin (void)
^
bumperrtm.c:15:12: note: called from here
    if ((s=_xbegin()) == _XBEGIN_STARTED)
        ^
In file included from /usr/lib/gcc/x86_64-linux-gnu/6/include/immintrin.h:83:0,
                 from bumperrtm.c:5:
/usr/lib/gcc/x86_64-linux-gnu/6/include/rtmmintrin.h:61:1: error: inlining failed in call to always_inline '_xend': target specific option mismatch
_xend (void)
^
bumperrtm.c:19:9: note: called from here
    _xend();
    ^
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
emacs@thinkpad-x1
1 // gcc -pthread bumperrtm.c -o bumperrtm
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #include <immintrin.h>
6 #define NUM_THREADS 4
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc (int size) {
12     char* start;
13     int s = 0;
14     do {
15         if ((s=_xbegin()) == _XBEGIN_STARTED)
16             {
17                 start = firstFree;
18                 firstFree = firstFree + size;
19                 _xend();
20             }
21     } while (s!=_XBEGIN_STARTED);
22
23     //if (start+size>sizeof(heap)) garbage_collect();
24     if (start+size>2^22) ;
25
26     return start;
27 }
28
29 void *allocator(void *threadid){
30     for (int i=0;i<10000000;i++)
31         bumperrtm.c Top (5,19) (C/l FlyC:0/10 company Abbrev)
Wrote /home/petter/lehre/tutorial/bumperrtm.c
```

```
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compilation terminated.
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
gcc -pthread bumperrtm.c -o bumperrtm
bumperrtm.c: In function 'myalloc':
bumperrtm.c:24:17: warning: comparison between pointer and integer
    if (start+size>2^22);
        ^
bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
           ^
In file included from /usr/lib/gcc/x86_64-linux-gnu/6/include/immintrin.h:83:0,
                 from bumperrtm.c:5:
/usr/lib/gcc/x86_64-linux-gnu/6/include/rtmmintrin.h:50:1: error: inlining failed in call to always_inline '_xbegin': target specific option mismatch
_xbegin (void)
^
bumperrtm.c:15:12: note: called from here
    if ((s=_xbegin()) == _XBEGIN_STARTED)
        ^
In file included from /usr/lib/gcc/x86_64-linux-gnu/6/include/immintrin.h:83:0,
                 from bumperrtm.c:5:
/usr/lib/gcc/x86_64-linux-gnu/6/include/rtmmintrin.h:61:1: error: inlining failed in call to always_inline '_xend': target specific option mismatch
_xend (void)
^
bumperrtm.c:19:9: note: called from here
    _xend();
    ^
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
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Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mrtm bumperrtm.c -o bumperrtm
bumperrtm.c: In function 'myalloc':
bumperrtm.c:24:17: warning: comparison between pointer and integer
    if (start+size>2^22);
        ^
bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
           ^
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumperrtm.c  bumperlocked.c  bumperrtm  bumperrtm.c~  bumpersemaphore.c  bumperstm  bumperstm.c  bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real    0m2.739s
user    0m0.310s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real    0m7.501s
user    0m1.784s
sys     0m17.268s
petter@thinkpad-x1:~/Lehre/tutorial$
```



```
emacs@thinkpad-x1
1 // gcc -pthread -mrtm bumperrtm.c -o bumperrtm
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #include <imintrin.h>
6 #define NUM_THREADS 4
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 char* myalloc(int size) {
12     char* start;
13     int s = 0;
14     do {
15         if ((s = _xbegin()) == _XBEGIN_STARTED)
16             {
17                 start = firstFree;
18                 firstFree = firstFree + size;
19             }
20     } while (s != _XBEGIN_STARTED);
21     //if (start+size>sizeof(heap)) garbage_collect();
22     if (start+size>2^22);
23     return start;
24 }
25
26 void *allocator(void *threadid){
27     for (int i=0; i<10000000; i++)
28     }
29 }
30
31 bumperrtm.c Top (1.46) (C/l FlyC:0/10 company Abbrev)
```

```
() miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mrtm bumperrtm.c -o bumperrtm
bumperrtm.c: In function 'myalloc':
bumperrtm.c:24:17: warning: comparison between pointer and integer
if (start+size>2^22);
^
bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n", firstFree-&heap[0]);
^
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumperrtm.c bumperlocked.c bumperrtm bumperstm bumperstm.c bumperstm.c-
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real 0m2.739s
user 0m10.516s
sys 0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real 0m7.501s
user 0m11.784s
sys 0m17.268s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
() miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
bumperrtm.c:24:17: warning: comparison between pointer and integer
if (start+size>2^22);
^
bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n", firstFree-&heap[0]);
^
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumperrtm.c bumperlocked.c bumperrtm bumperstm bumperstm.c bumperstm.c-
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real 0m2.739s
user 0m10.516s
sys 0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000
real 0m7.501s
user 0m11.784s
sys 0m17.268s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$ man _ATOMIC_HLE_ACQUIRE
Kein Handbucheintrag für _ATOMIC_HLE_ACQUIRE vorhanden
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
emacs@thinkpad-x1
1 // gcc -pthread -mhle -mrtm bumperhle.c -o bumperhle
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #define NUM_THREADS 4
6
7 char heap[2^20];
8 char* firstFree = &heap[0];
9
10 int mutex = 0;
11 int hle_lock() {
12
13 }
14 int hle_unlock() {
15 }
16
17 char* myalloc(int size) {
18     char* start;
19     hle_lock();
20     start = firstFree;
21     firstFree = firstFree + size;
22     hle_unlock();
23     //if (start+size>sizeof(heap)) garbage_collect();
24     if (start+size>2^22);
25     return start;
26 }
27
28
29 void *allocator(void *threadid){
30     for (int i=0; i<10000000; i++)
31     }
32 }
33
34 bumperhle.c Top (12.2) (C/l FlyC:0/10 company Abbrev)
Auto-saving... done
```



```
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if (start+size>2^22);

bumperrtm.c: In function 'main':
bumperrtm.c:53:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n", firstFree-&heap[0]);
^
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumperlocked.c bumperrtm bumpersemaphore.c bumperstm bumperstm.c bumperstm.c-
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.739s
user    0m10.516s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.501s
user    0m11.784s
sys     0m17.268s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$ man _ATOMIC_HLE_ACQUIRE
Kein Handbucheintrag für _ATOMIC_HLE_ACQUIRE vorhanden
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".

miniseidl22.informatik.tu-muenchen.de
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:36:11
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
if (start+size>2^22);

bumperhle.c: In function 'main':
bumperhle.c:58:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
printf("%d\n", firstFree-&heap[0]);
^
real    0m0.056s
user    0m0.036s
sys     0m0.012s
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumperhle.c bumperlocked.c bumperrtm.c bumpersemaphore.c bumperstm.c
bumperhle bumperhle.c- bumperrtm bumperstm bumperstm.c-
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperhle
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m3.359s
user    0m13.320s
sys     0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.472s
user    0m11.056s
sys     0m17.384s
petter@thinkpad-x1:~/Lehre/tutorial$

miniseidl22.informatik.tu-muenchen.de
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:37:06
```

```
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petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumperhle.c bumperlocked.c bumperrtm.c bumpersemaphore.c bumperstm.c-
bumperhle bumperhle.c- bumperrtm bumperstm bumperstm.c-
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperhle
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m3.359s
user    0m13.320s
sys     0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperstm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.472s
user    0m11.056s
sys     0m17.384s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.802s
user    0m11.000s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$

miniseidl22.informatik.tu-muenchen.de
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:37:19
```

```
emacs@thinkpad-x1
1 // gcc -pthread -mhle -mrtm bumperhle.c -o bumperhle
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #include <xmintrin.h>
6 #define NUM_THREADS 4
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 int mutex = 0;
12 int hle_lock() {
13     while(!_atomic_exchange_n(&mutex, 1, __ATOMIC_ACQUIRE|__ATOMIC_HLE_ACQUIRE))
14         _mm_pause();
15     return 1;
16 }
17 int hle_unlock() {
18     _atomic_store_n(&mutex, 0, __ATOMIC_RELEASE|__ATOMIC_HLE_RELEASE);
19     return 1;
20 }
21
22 char* myalloc(int size) {
23     char* start;
24     hle_lock();
25     start = firstFree;
26     firstFree = firstFree + size;
27     hle_unlock();
28     //if (start+size>sizeof(heap)) garbage_collect();
29     if (start+size>2^22);
30
--- bumperhle.c Top (1,52) (C/l FlyC:0/8 company Abbrev)

emacs@thinkpad-x1
1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:37:46
```

```
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In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m7.472s
user    0m11.056s
sys     0m17.384s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.802s
user    0m11.080s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mhle -mrtm bumper
bumper.c bumperhle.c bumperlocked.c bumperownlock.c- bumperrtm.c bumpersemaphore.c bumperstm.c
bumperhle bumperhle.c- bumperownlock.c bumperrtm bumperrtm.c- bumperstm
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mhle -mrtm bumperownlock.c -o bumperownlock
bumperownlock.c: In function 'myalloc':
bumperownlock.c:29:17: warning: comparison between pointer and integer
    if (start+size>2^22);
        ^
bumperownlock.c: In function 'main':
bumperownlock.c:58:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
        ^
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
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In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.802s
user    0m11.080s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mhle -mrtm bumper
bumper.c bumperhle.c bumperlocked.c bumperownlock.c- bumperrtm.c bumpersemaphore.c bumperstm.c
bumperhle bumperhle.c- bumperownlock.c bumperrtm bumperrtm.c- bumperstm
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread -mhle -mrtm bumperownlock.c -o bumperownlock
bumperownlock.c: In function 'myalloc':
bumperownlock.c:29:17: warning: comparison between pointer and integer
    if (start+size>2^22);
        ^
bumperownlock.c: In function 'main':
bumperownlock.c:58:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
        ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperownlock
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.454s
user    0m9.230s
sys     0m0.004s
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
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power management:
processor
vendor_id       : GenuineIntel
cpu family     : 6
model          : 78
model name     : Intel(R) Core(TM) i7-6600U CPU @ 2.60GHz
stepping      : 3
microcode     : 0x9e
cpu MHz       : 818.090
cache size    : 4096 KB
physical id   : 0
siblings      : 4
core id       : 1
cpu cores     : 2
apicid        : 3
initial apicid : 3
fpu           : yes
fpu exception : yes
cpuid level   : 22
wp            : yes
flags         : fpu vme de pse tsc msr pae mce cx8 apic sep ntrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe s
vscale nx pdpe1gb rdtscp lm constant tsc art arch perfmon pebs bts rep good nopl xtopology nonstop tsc aperfmperf eagerfpu pni pclmulqdq dt
es64 monitor ds cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc deadline timer aes xsave avx f
16c rdrand lahf_lm abm 3dnowprefetch ept intel_pt tpr_shadow vmmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms in
vpcid rtm mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp
bugs
bogomips      : 5616.00
clflush size  : 64
cache alignment : 64
address sizes : 39 bits physical, 48 bits virtual
power management:

petter@thinkpad-x1:~/Lehre/tutorials
```

```
emacs@thinkpad-x1
1 // gcc -pthread -mhle -mrtm bumperhle.c -o bumperhle
2 #include <pthread.h> // pthread_create, pthread_exit
3 #include <stdio.h> // printf
4 #include <stdlib.h> // exit
5 #include <xmintrin.h>
6 #define NUM_THREADS 4
7
8 char heap[2^20];
9 char* firstFree = &heap[0];
10
11 int mutex = 0;
12 int hle_lock() {
13     while(!_atomic_exchange_n(&mutex, 1, __ATOMIC_ACQUIRE))
14         _mm_pause();
15     return 1;
16 }
17 int hle_unlock() {
18     _atomic_store_n(&mutex, 0, __ATOMIC_RELEASE);
19     return 1;
20 }
21
22 char* myalloc(int size) {
23     char* start;
24     hle_lock();
25     start = firstFree;
26     firstFree = firstFree + size;
27     hle_unlock();
28     //if (start+size>sizeof(heap)) garbage_collect();
29     if (start+size>2^22);
30 }
-:-- bumperownlock.c Top (18,44) (C/l FlyC:0/8 company Abbrev)
Wrote /home/petter/lehre/tutorial/bumperownlock.c
emacs@thinkpad-x1
```

```
emacs@thinkpad-x1
16 }
17 int hle_unlock() {
18     __atomic_store_n(&mutex, 0, __ATOMIC_RELEASE);
19     return 1;
20 }
21
22 char* myalloc(int size) {
23     char* start;
24     hle_lock();
25     start = firstFree;
26     firstFree = firstFree + size;
27     hle_unlock();
28     //if (start+size>sizeof(heap)) garbage_collect();
29     if (start+size>2^22) ;
30
31     return start;
32 }
33
34 void *allocator(void *threadid){
35     for (int i=0;i<10000000;i++){
36         myalloc(1);
37     }
38 }
39
40
41 int main(int argc, char *argv[]) {
42     pthread_t threads[NUM_THREADS];
43     int rc;
44     long t;
45
46     --- bumperownlock.c 29% (37,2) (C/l FlyC:0/8 company Abbrev)
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:41:27
```

```
() miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

processor      : 3
vendor_id     : GenuineIntel
cpu family    : 6
cpu model     : 78
model name    : Intel(R) Core(TM) i7-6600U CPU @ 2.60GHz
stepping      : 3
microcode    : 0x9e
cpu MHz       : 818.090
cache size   : 4096 KB
physical id   : 0
siblings     : 4
core id      : 1
cpu cores    : 2
apicid       : 3
initial apicid : 3
fpu          : yes
fpu exception : yes
cpuid level  : 22
wp           : yes
flags        : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe s
yscall nx pdpe1gb rdtscp lm constant tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc aperfmperf eagerfpu pni pclmulqdq dt
es64 monitor ds cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc deadline_timer aes xsave avx f
16c rdrand lahf_lm abm 3dnowprefetch epb intel_pt tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms in
vpcid rtm mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp
bugs
bogomips     : 5616.00
clflush size : 64
cache alignm : 64
address sizes : 39 bits physical, 48 bits virtual
power managem:

petter@thinkpad-x1:~/lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
() miniseidl22.informatik.tu-muenchen.de
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:45:10
```

```
() miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

yscall nx pdpe1gb rdtscp lm constant tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc aperfmperf eagerfpu pni pclmulqdq dt
es64 monitor ds cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc deadline_timer aes xsave avx f
16c rdrand lahf_lm abm 3dnowprefetch epb intel_pt tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms in
vpcid rtm mpx rdseed adx smap clflushopt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp
bugs
bogomips     : 5616.00
clflush size : 64
cache alignm : 64
address sizes : 39 bits physical, 48 bits virtual
power managem:

petter@thinkpad-x1:~/lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".

petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperrtm
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.859s
user    0m10.680s
sys     0m0.000s
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperownlock
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.837s
user    0m11.016s
sys     0m0.000s
petter@thinkpad-x1:~/lehre/tutorial$
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:48:36
```

```
() miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

In main: creating thread 3
40000000

real    0m2.859s
user    0m10.680s
sys     0m0.000s
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumperownlock
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m2.837s
user    0m11.016s
sys     0m0.000s
petter@thinkpad-x1:~/lehre/tutorial$ g++ -pthread -fpermissive -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22) ;
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n", firstFree-&heap[0]);
                           ^
petter@thinkpad-x1:~/lehre/tutorial$ ls
bumper.c bumpergcc.c bumperhle bumperhle.c bumperownlock bumperownlock.c bumperrtm.c bumpersemaphore.c bumperstm.c
bumpergcc bumpergcc.c bumperhle bumperhle.c bumperlocked.c bumperownlock.c bumperrtm bumperstm.c bumperstm.c
petter@thinkpad-x1:~/lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
debian 1 2 3 4 miniseidl22.informatik.tu-... emacs@thinkpad-x1 09:49:04
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
sys 0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperownlock
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real 0m2.837s
user 0m1.016s
sys 0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c bumpergcc.c bumperhle bumperhle.c~ bumperownlock bumperownlock.c~ bumperrtm.c bumpersemaphore.c bumperstm.c
bumperstm.c~ bumperstm.c~ bumperlocked.c bumperlocked.c bumperownlock.c bumperrtm bumperrtm.c~ bumperstm bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
^C
real 0m14.044s
user 0m31.488s
sys 0m19.624s
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
sys 0m19.624s
petter@thinkpad-x1:~/Lehre/tutorial$ Xlib: extension "XInputExtension" missing on display "localhost:11.0".
[1]+  Fertig emacs bumperstm.c
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real 0m3.791s
user 0m8.372s
sys 0m5.204s
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real 0m3.791s
user 0m8.372s
sys 0m5.204s
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -mrtm -mhle -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -mrtm -mhle -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2^22);
        ^
bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf("%d\n",firstFree-&heap[0]);
                   ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./gnugcc
-bash: ./gnugcc: Datei oder Verzeichnis nicht gefunden

real 0m0.003s
user 0m0.004s
sys 0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real 0m3.827s
user 0m8.424s
sys 0m5.368s
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

bumpergcc.c: In function 'int main(int, char**)':
bumpergcc.c:46:36: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf(" %d\n",firstFree-&heap[0]);
                           ^
petter@thinkpad-x1:~/Lehre/tutorial$ g++ -pthread -fpermissive -mrtm -mhle -fgnu-tm bumpergcc.c -o bumpergcc
bumpergcc.c: In function 'char* myalloc(int)':
bumpergcc.c:17:18: warning: ISO C++ forbids comparison between pointer and integer [-fpermissive]
    if (start+size>2*22);
    ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./gnugcc
-bash: ./gnugcc: Datei oder Verzeichnis nicht gefunden

real    0m0.003s
user    0m0.004s
sys     0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumpergcc
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m3.827s
user    0m8.424s
sys     0m5.368s
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c  bumpergcc.c  bumperhle  bumperhle.c~  bumperownlock  bumperownlock.c~  bumperrtm.c  bumpersemaphore.c  bumperstm.c
bumpergcc  bumpergcc.c~  bumperhle.c  bumperlocked.c  bumperownlock.c  bumperrtm  bumperstm  bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
miniseidl22.informatik.tu-muenchen.de — Konsole
Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m3.827s
user    0m8.424s
sys     0m5.368s
petter@thinkpad-x1:~/Lehre/tutorial$ ls
bumper.c  bumpergcc.c  bumperhle  bumperhle.c~  bumperownlock  bumperownlock.c~  bumperrtm.c  bumpersemaphore.c  bumperstm.c
bumpergcc  bumpergcc.c~  bumperhle.c  bumperlocked.c  bumperownlock.c  bumperrtm  bumperstm  bumperstm.c~
petter@thinkpad-x1:~/Lehre/tutorial$ head -n 1 bumperlocked.c
// gcc -pthread bumperlocked.c -o bumperlocked
petter@thinkpad-x1:~/Lehre/tutorial$ gcc -pthread bumperlocked.c -o bumperlocked
bumperlocked.c: In function 'myalloc':
bumperlocked.c:26:17: warning: comparison between pointer and integer
    if (start+size>2*22);
    ^
bumperlocked.c: In function 'main':
bumperlocked.c:55:13: warning: format '%d' expects argument of type 'int', but argument 2 has type 'long int' [-Wformat=]
    printf(" %d\n",firstFree-&heap[0]);
                ^
petter@thinkpad-x1:~/Lehre/tutorial$ time ./bumperlocked
In main: creating thread 0
In main: creating thread 1
In main: creating thread 2
In main: creating thread 3
40000000

real    0m0.903s
user    0m5.368s
sys     0m0.000s
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
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return start;
}

void *allocator(void *threadid){
    for (int i=0;i<10000000;i++)
        myalloc(1);
}

int main(int argc, char *argv[]) {
    pthread_t threads[NUM_THREADS];
    int rc;
    long t;

    for(t = 0; t < NUM_THREADS; t++) {
        printf("In main: creating thread %ld\n", t);
        rc = pthread_create(&threads[t], NULL, allocator, (void *)t);
        if(rc) {
            printf("ERROR: return code from pthread_create() is %d\n", rc);
            exit(-1);
        }
    }
    for(t = 0; t < NUM_THREADS; t++) {
        pthread_join(threads[t],NULL);
    }

    printf(" %d\n",firstFree-&heap[0]);

    /* last thing that main() should do */
    pthread_exit(NULL);
}
petter@thinkpad-x1:~/Lehre/tutorial$
```

```
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Datei Bearbeiten Ansicht Lesezeichen Einstellungen Hilfe

    exit(-1);
}
}
for(t = 0; t < NUM_THREADS; t++) {
    pthread_join(threads[t],NULL);
}

printf(" %d\n",firstFree-&heap[0]);

/* last thing that main() should do */
pthread_exit(NULL);
}
petter@thinkpad-x1:~/Lehre/tutorial$ head -n 20 bumperlocked.c
// gcc -pthread bumperlocked.c -o bumperlocked
#include <pthread.h> // pthread_create, pthread_exit
#include <stdio.h> // printf
#include <stdlib.h> // exit
#define NUM_THREADS 4

char heap[2*20];
char* firstFree = &heap[0];

char* myalloc(int size) {
    char* start;
    // start= firstFree;
    // firstFree = firstFree + size;

    start= atomic_fetch_add(&firstFree,size,_ATOMIC_RELAXED);

    // GCC uses AT&T Syntax, thus swaps operands:
    // asm("lock; xadd %0, %1" :
    //      "=m"(start), "=m"(firstFree):
petter@thinkpad-x1:~/Lehre/tutorial$
```