

Computer Operating Systems, Practice Session 10

Linux Message Queues

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Today

Computer Operating Systems, PS 10

Message Queues

Usage

Message Queues

- ▶ Message queues are used for **ASYNCHRONOUS** communication among processes.
- ▶ Message queues are kept by the OS.
- ▶ A message placed into the queue is kept in the queue until it is read by the receiver.
- ▶ Many processes/threads may access the queue at the same time (not the same instance).
- ▶ Queue keeps its existence independent of the lifecycle of the processes/threads using the queue.

Some Useful IPC Commands

Two commonly used commands, related to inter-process communication, defined by Linux operating system:

ipcs : provides information on IPC resources currently used by the OS.

ipcrm : can be used for deleting IPC resources currently used by the OS.

-m to remove a shared memory location

-s to remove a semaphore

-q to remove a message queue

E.g:

- ▶ With the `ipcs -q` command, the message queues currently been kept by OS can be seen.
- ▶ `ipcrm -q 123` command deletes the message queue with identifier 123.

Creating a Message Queue

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <sys/types.h>
4 #include <sys/ipc.h>
5 #include <sys/msg.h>
6 #define KEYMQ 500 // key
7
8 void main(){
9     // create a message queue
10    int msqid = msgget(KEYMQ,IPC_CREAT|0777);
11    msqid>0 ?
12    printf("Queue %d is created.\n", msqid) :
13    printf("Queue creation failed.\n");
14 }
```

Creating a Message Queue - Output

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ gcc cr.c
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

----- Message Queues -----

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out
Queue 32769 is created.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

----- Message Queues -----

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0
0x0000000a	32769	musty	777	0	0

Sending a Message

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <string.h>
4 #include <sys/types.h>
5 #include <sys/ipc.h>
6 #include <sys/msg.h>
7 #define msgsz 256 // message size
8
9 struct msgbuf{ // message buffer
10     long mtype; // message type
11     char mtext[msgsz]; // message
12 };
13 void main(int argc, char **argv){
14     // convert input argument to long integer(id of the message queue)
15     int msqid = strtol(argv[1],NULL,10);
16     struct msgbuf msgp; // create a message buffer
17     // convert input argument to long integer (message type)
18     msgp.mtype = strtol(argv[2],NULL,10);
19     strcpy(msgp.mtext, argv[3]); // read message from console
20     // send message from message queue
21     msgsnd(msqid, &msgp, msgsz, 0) == 0 ?
22     printf("Sent.\n") : printf("Cannot send.\n");
23 }
```

Sending a Message - Output

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ gcc snd.c
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

```
----- Message Queues -----
```

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0
0x0000000a	131073	musty	777	0	0

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 10 "Message 1, Type 10"
Sent.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 20 "Message 2, Type 20"
Sent.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 30 "Message 3, Type 30"
Sent.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 40 "Message 4, Type 40"
Sent.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

```
----- Message Queues -----
```

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0
0x0000000a	131073	musty	777	1024	4

Reading a Message

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <string.h>
4 #include <sys/types.h>
5 #include <sys/ipc.h>
6 #include <sys/msg.h>
7 #define msgsz 256 // message size
8 // return immediately if no message of the requested type is in the queue
9 #define msgflg IPC_NOWAIT
10
11 struct msgbuf{ // message buffer
12     long mtype; // message type
13     char mtext[msgsz]; // message
14 };
15 void main(int argc, char **argv){
16     // convert input argument to long integer(id of the message queue)
17     int msqid = strtol(argv[1],NULL,10);
18     // convert input argument to long integer (message type)
19     long msgtyp = strtol(argv[2],NULL,10);
20     struct msgbuf msgp; // create a message buffer
21     // read the message
22     msgrcv(msqid, &msgp, msgsz, msgtyp, msgflg) >0 ?
23     printf("Received: \"%s\" of type=%ld.\n", msgp.mtext, msgp.mtype) :
24     printf("Cannot receive anything.\n");
25 }
```

Reading a Message

- ▶ If `msgtyp` is 0, then the first message in the queue is read.
- ▶ If `msgtyp` is greater than 0, then the first message in the queue of type `msgtyp` is read.
- ▶ If `msgtyp` is less than 0, then the first message in the queue with the lowest type less than or equal to the absolute value of `msgtyp` will be read.

Reading a Message - Output

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ gcc rcv.c
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 0
Received: "Message 1, Type 10" of type=10.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 30
Received: "Message 3, Type 30" of type=30.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 -10
Cannot receive anything.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 -20
Received: "Message 2, Type 20" of type=20.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 131073 40
Received: "Message 4, Type 40" of type=40.
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

```
----- Message Queues -----
key          msqid      owner      perms      used-bytes   messages
0x0000d903  0          musty      777        0            0
0x0000000a  131073     musty      777        0            0
```

Deleting a Message Queue

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 #include <sys/types.h>
4 #include <sys/ipc.h>
5 #include <sys/msg.h>
6
7 void main(int argc, char **argv){
8     // convert input argument to long integer (id of the queue)
9     int msqid=strtol(argv[1], NULL, 10);
10    // remove the message queue
11    printf("Queue %d remov%s.\n", msqid, msgctl(msqid,IPC_RMID,0) ==0?
12           "ed successfully":"al failed");
13 }
```

Deleting a Message Queue - Output

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

```
----- Message Queues -----
```

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0
0x0000000a	32769	musty	777	0	0

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ gcc rm.c
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 10
```

```
Queue 10 removal failed.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ./a.out 32769
```

```
Queue 32769 removed successfully.
```

```
musty@musty-VirtualBox:/media/sf_virtualbox_shared_folder$ ipcs -q
```

```
----- Message Queues -----
```

key	msqid	owner	perms	used-bytes	messages
0x0000d903	0	musty	777	0	0