Operating Systems (CS3000)

Lecture – 12
(Inter Process Communication)

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN AND MANUFACTURING, KANCHEEPURAM

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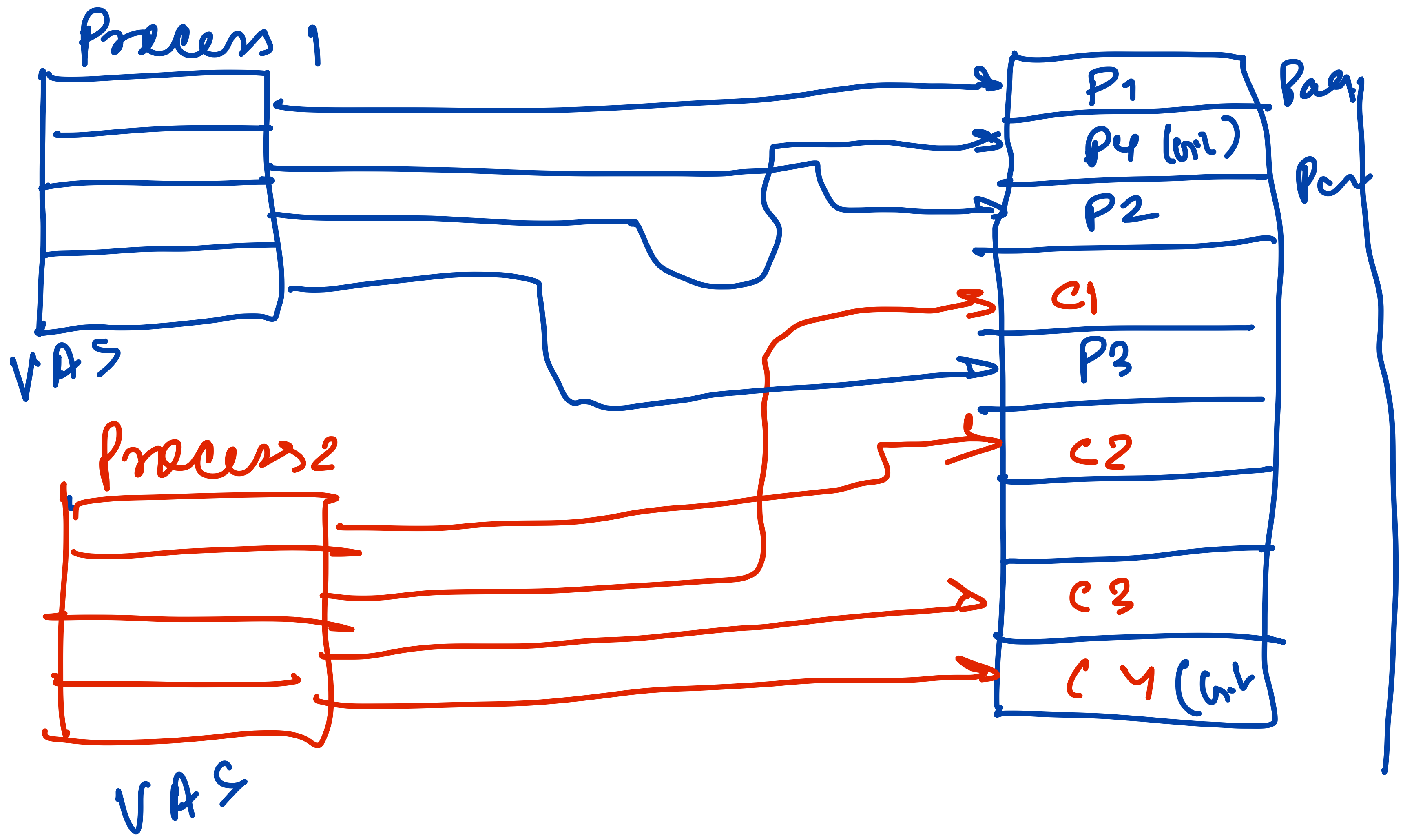
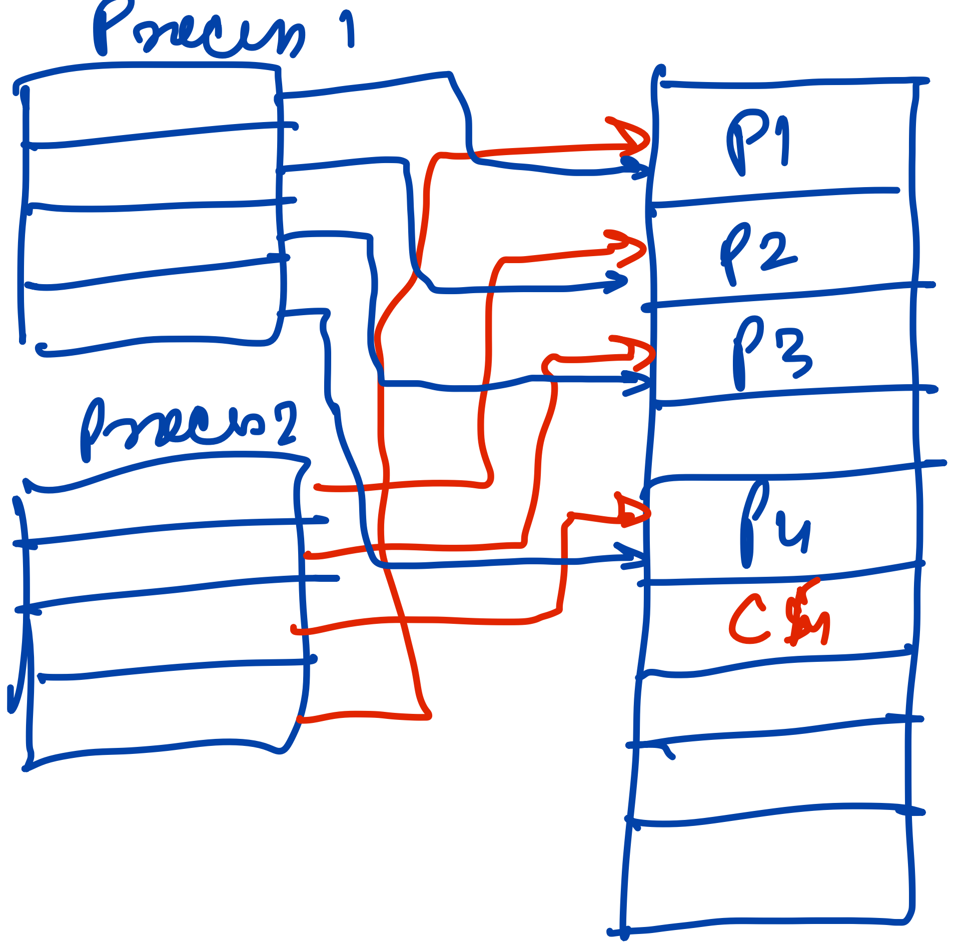
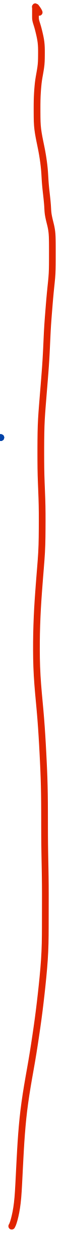


Process 1
VAS
Process2
VAS
P1
P4 (on 2)
P2
C1
P3
C2
C3
C4 (on 2)
Page
Pc


Process 1
Process 2
P1
P2
P3
P4
C5M


IPC

- Processes within a system may be **independent** or **cooperating**
- Cooperating process can affect or be affected by other processes
    - Same computer or networked computers

IPC

- Reasons for cooperating processes:
  - Computation speedup
    - Multiple processing cores
    - Distributed computing
- Modularity
  - Subtasks into separate processes or threads
- Client-Server Computing

- Cooperating processes need **Inter-Process Communication** (**IPC**)
- Many IPC mechanisms

IPC

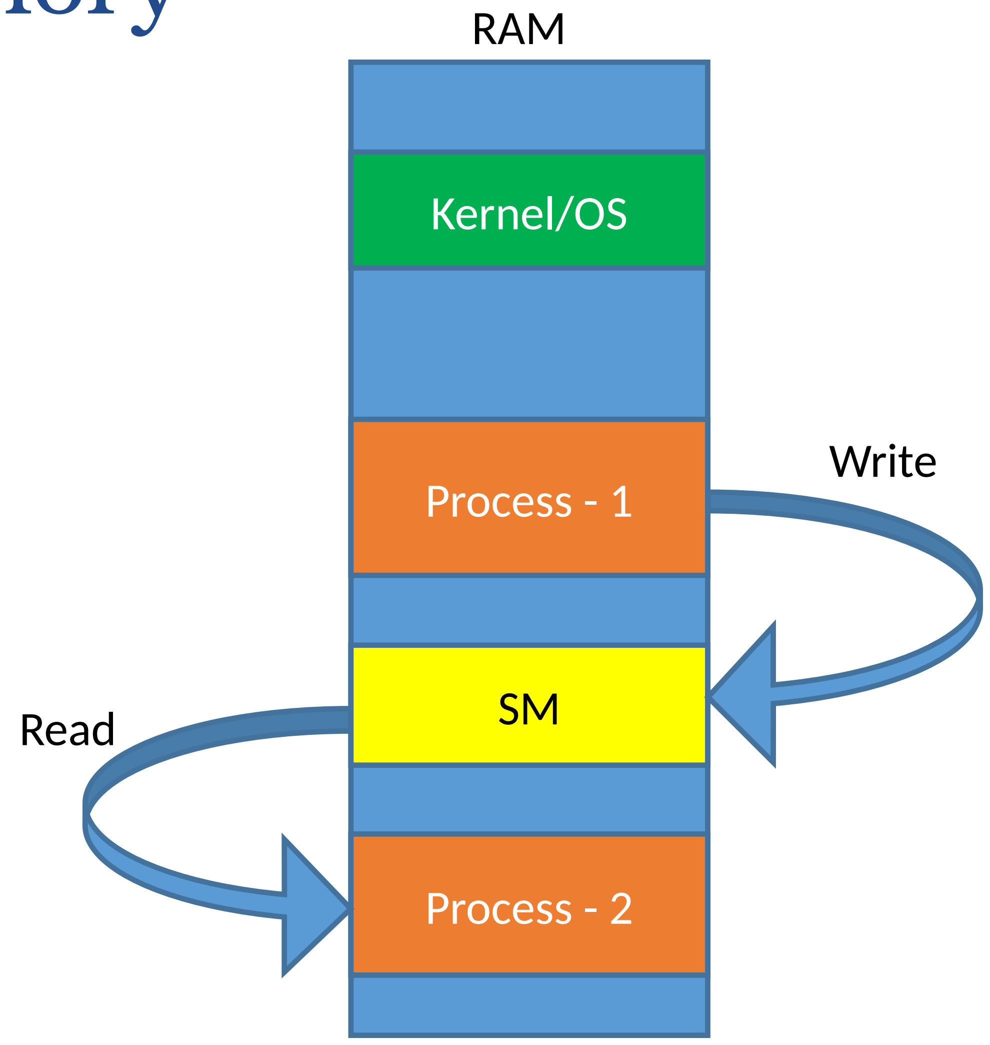
3 Ways

- Shared Memory
- Message Passing
- Pipes
- Signals

Shared Memory

- Process1
  - Create SM
  - Attach SM to it's address Space
  - Write Data into SM

- Process 2
  - Attach SM to it's address Space
  - Read Data from SM written by Writer



Process 1

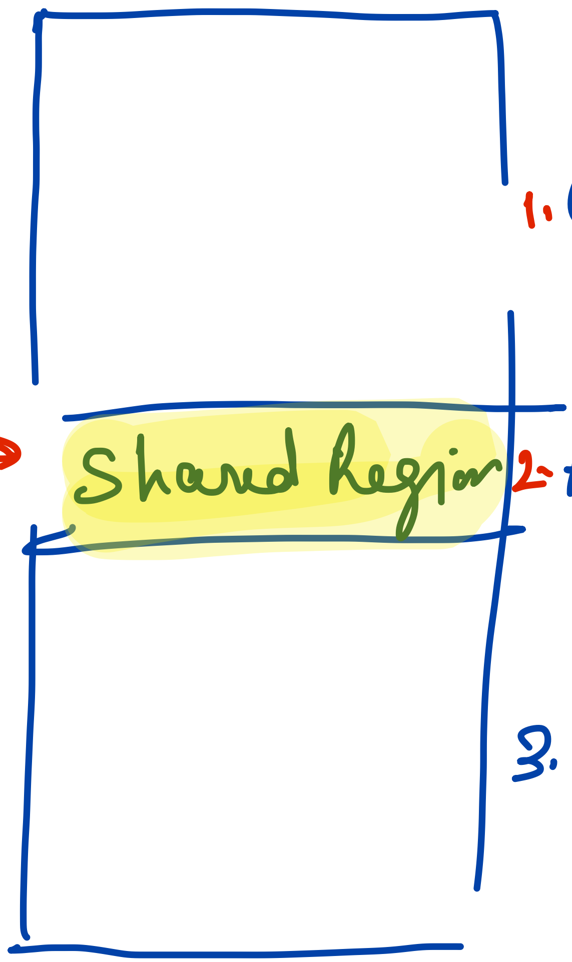
1. Create the shared region and get the i'd

2. Attach with the SR.

Perform operations

3. Detach

4. Remove the pointer // only one process will perform who will complete at last



Process 2

1. Get the i'd of the already exists shared region

2. Attach the shared region

Perform operations

3. Detach

Functions used in SM

- shmget() ▭ to Create the SM
- shmat() ▭ to attach the SM with the address space of the process
- shmdt() ▭ to detach the SM
- shmctl() ▭ to Destroy the SM

shmget()

- **int shmget**(**key_t** key, **size_t** size, **int** shmflg);

- **key**-> Unique value that identifies the SM.
- **size-**> Size of the SM in bytes
- **shmflg** -> Permissions on the SM
- Retuns valid identifier of SM
  - Used in shmat()
- Incase of Unsuccessful -> Returns -1

- **#include<sys/ipc.h>**
- **#include<sys/shm.h>**

shmat()

- **void* shmat**(**int** shmid, **const void *** shmaddr, **int** shmflg);
- **shmid** -> value returned by shmget().
- **shmaddr** -> where to attach the SM in the address space of the calling function
  - Address not know so write NULL. If shmaddr is a NULL pointer, the segment is attached at the first available address as selected by the system.
  - OS will assign it at a suitable location.
- **shmflg** -> if shmaddr is NULL, shmflg is 0.
- Incase of Unsuccessful -> Returns -1
- **#include<sys/types.h>**
- **#include<sys/shm.h>**

shmdt()

- **int shmdt**(**void *** shmaddr)
  - shmdt **detaches** the shared memory segment located at the address specified by shmaddr from the address space of the calling process

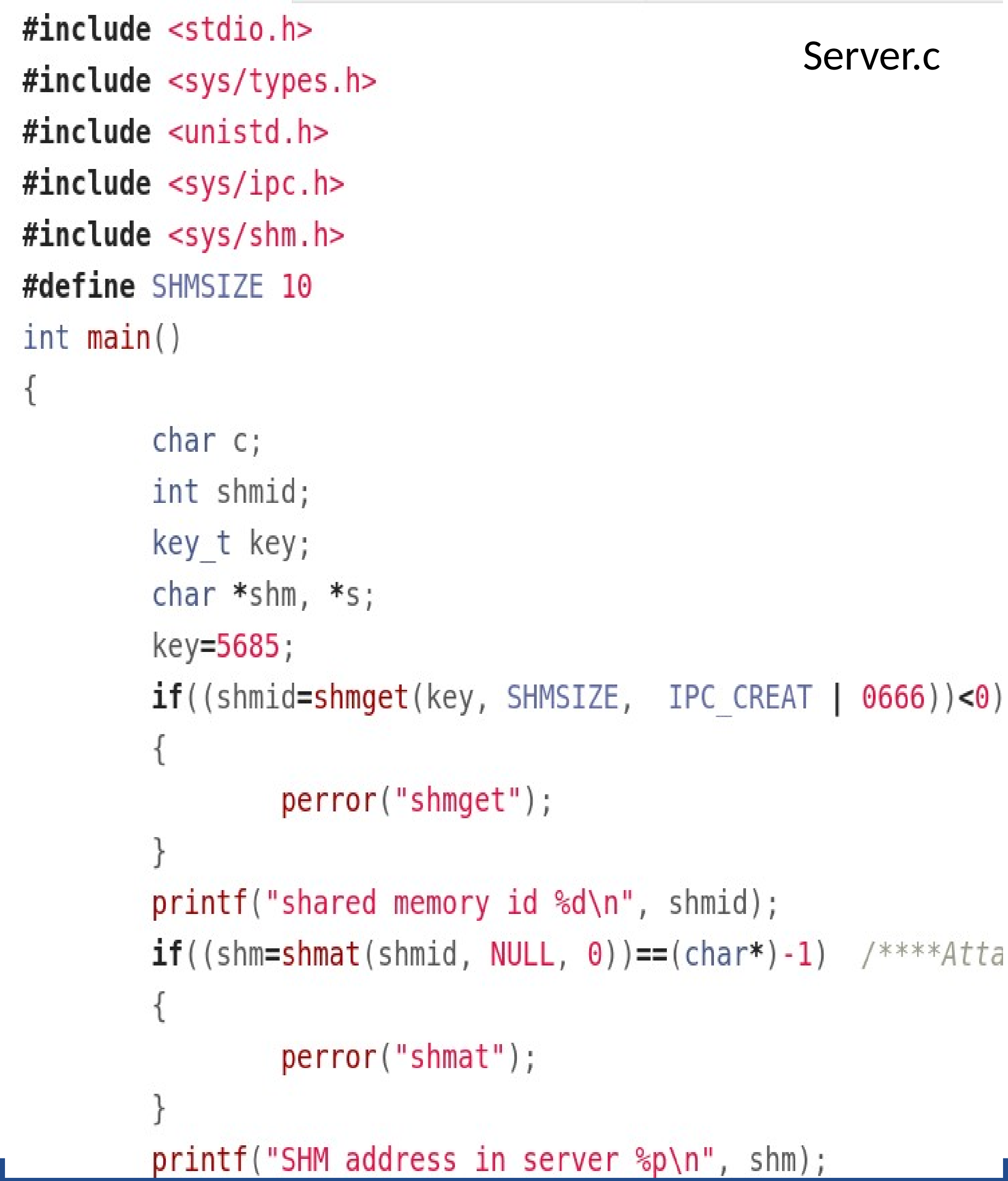
  - On success, it returns 0, on error –1

  - Detaching the shared memory doesn’t delete it
    – it just makes that memory unavailable to the current process

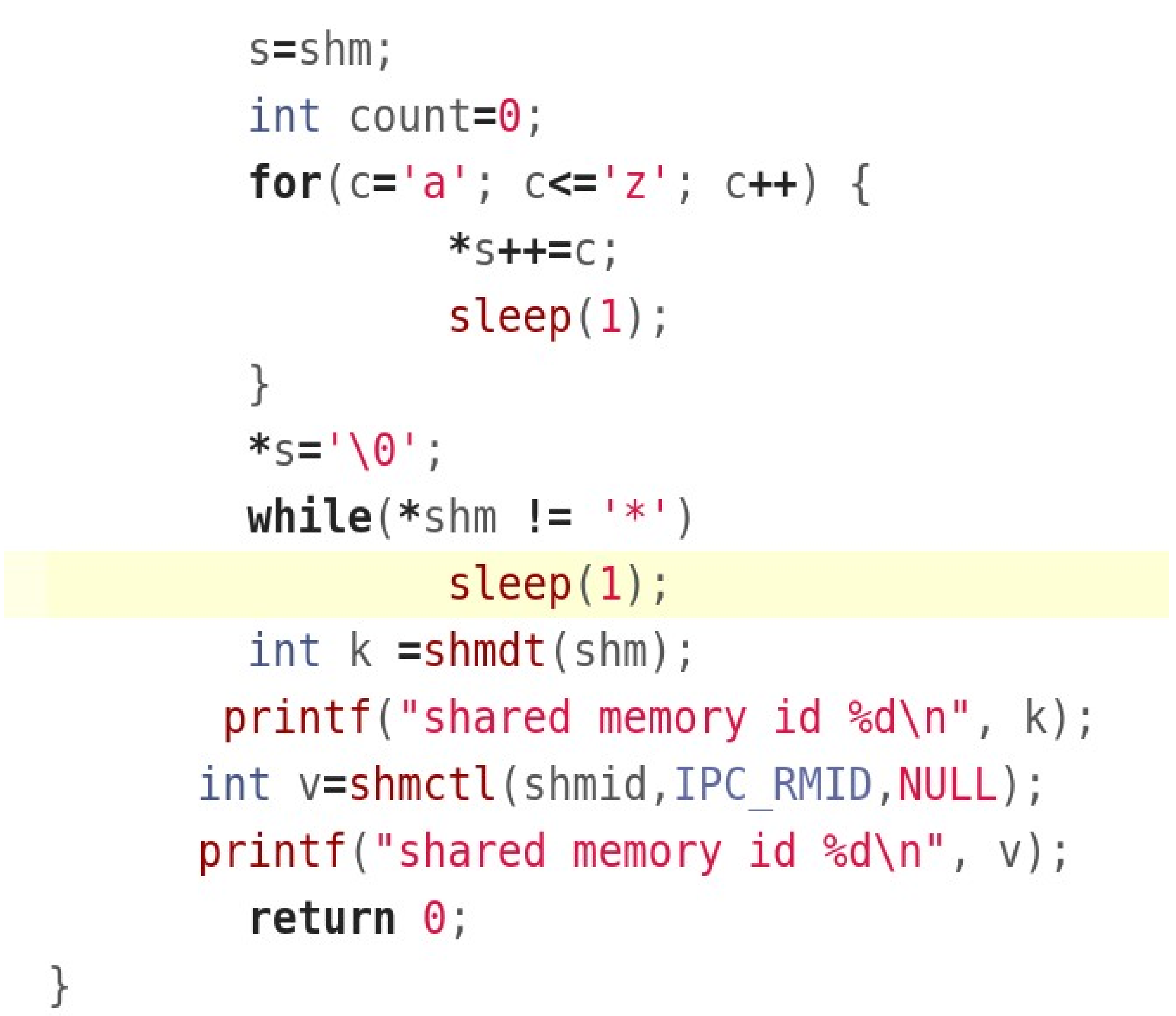
shmctl()

- **int shmctl**(**int** shmid, **int** command, **struct shmid_ds** *buf);
  - returns information about a shared memory segment and can modify it
  - **shmid** -> value returned by shmget().
  - **IPC_STAT**: Retrieve the status of the shared memory segment.
  - **IPC_SET:** Set the status of the shared memory segment.
  - **IPC_RMID**: Remove the shared memory segment.
  - This is a pointer to a **struct shmid_ds** structure that is used to get or set information about the shared memory segment
  - On success, it returns 0, on failure, –1

Server.c

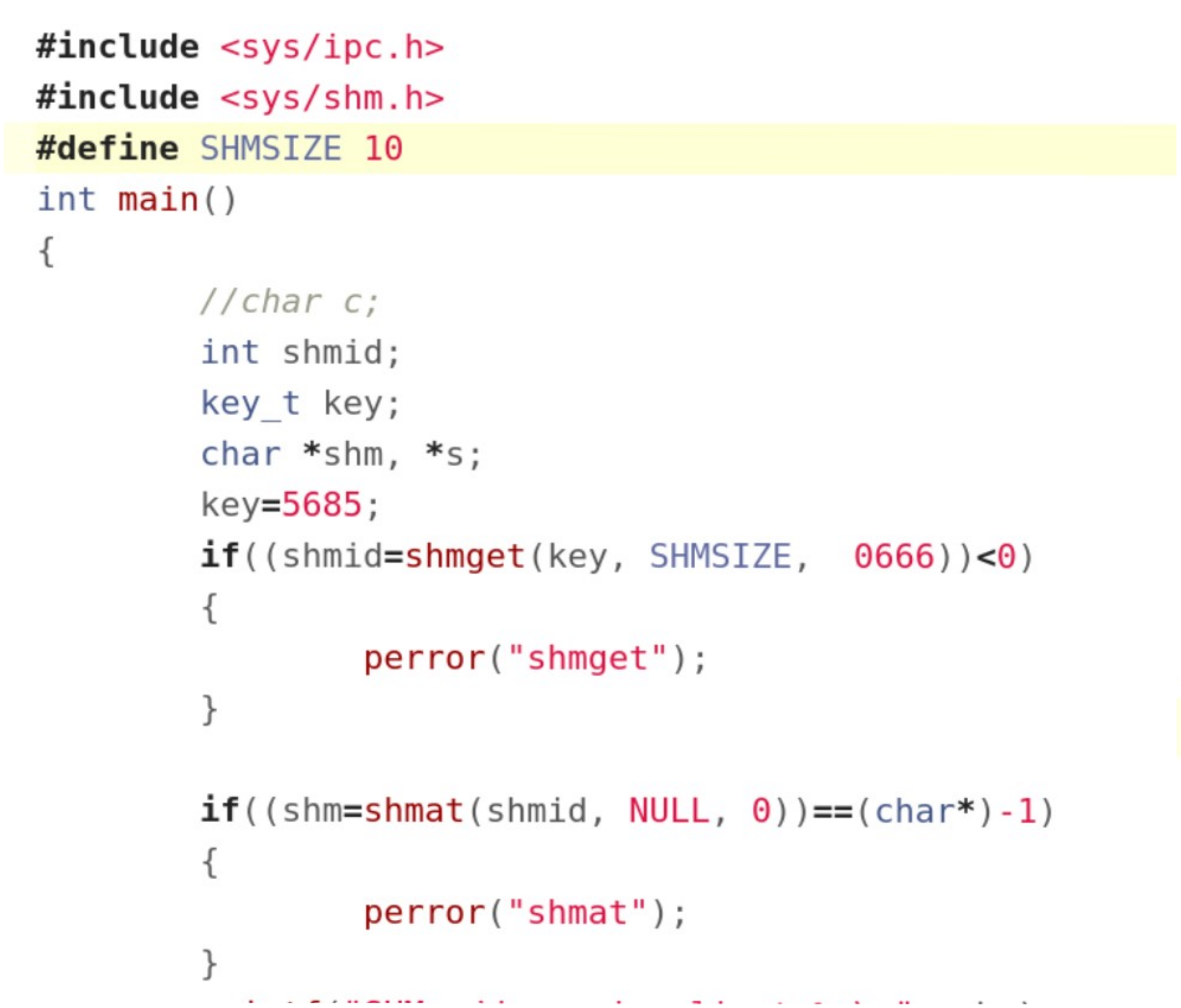


```
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>
#include <sys/ipc.h>
#include <sys/shm.h>
#define SHMSIZE 10
int main()
{
        char c;
        int shmid;
        key_t key;
        char *shm, *s;
        key=5685;
        if((shmid=shmget(key, SHMSIZE,  IPC_CREAT | 0666))<0)
        {
                perror("shmget");
        }
        printf("shared memory id %d\n", shmid);
        if((shm=shmat(shmid, NULL, 0))==(char*)-1)  /****Atta
        {
                perror("shmat");
        }
        printf("SHM address in server %p\n", shm);
```



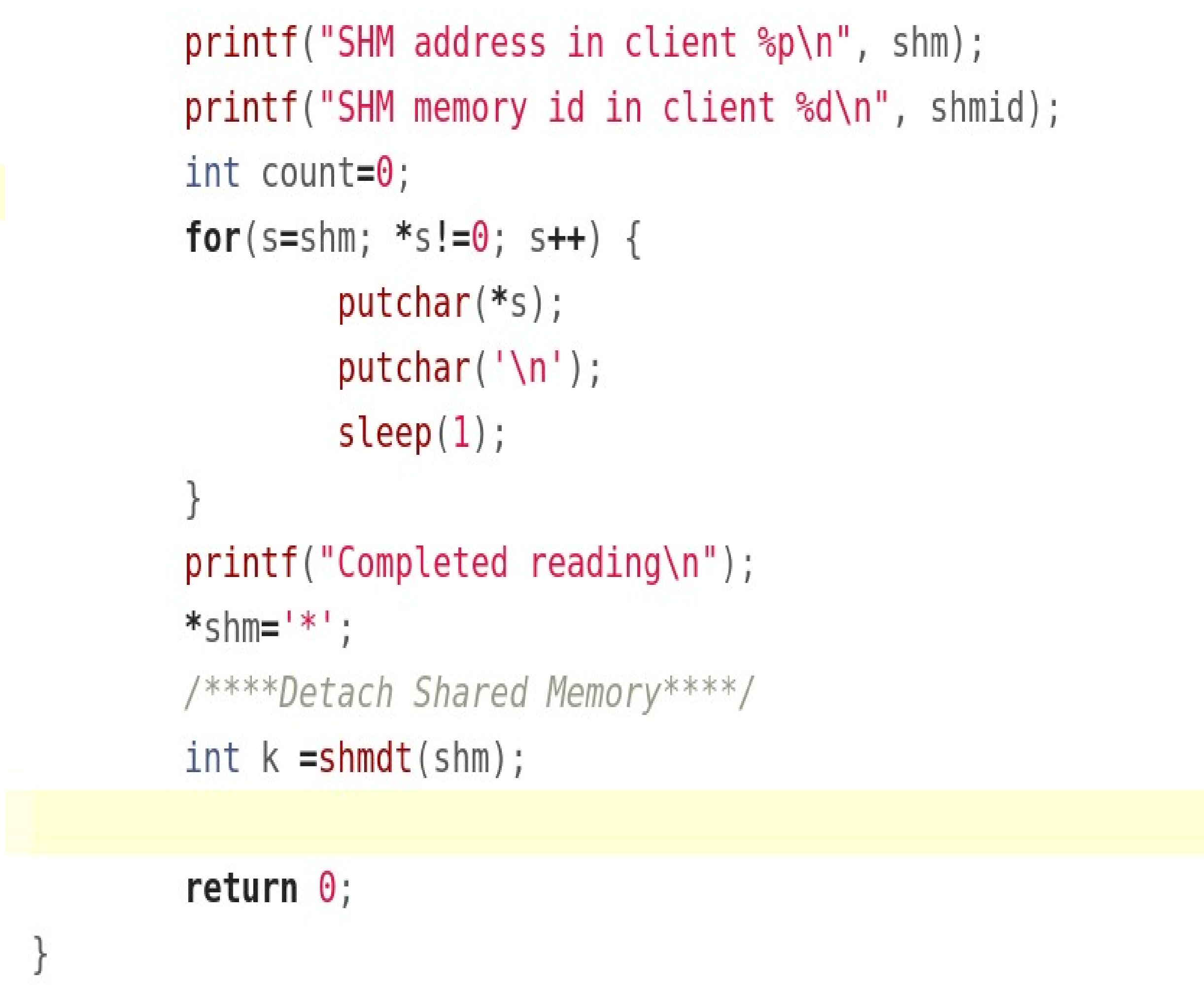
```
        s=shm;
        int count=0;
        for(c='a'; c<='z'; c++) {
                *s++=c;
                sleep(1);
        }
        *s='\0';
        while(*shm != '*')
                sleep(1);
        int k =shmdt(shm);
       printf("shared memory id %d\n", k);
      int v=shmctl(shmid,IPC_RMID,NULL);
      printf("shared memory id %d\n", v);
        return 0;
}
```

client.c



```c
#include <sys/ipc.h>
#include <sys/shm.h>
#define SHMSIZE 10
int main()
{
        //char c;
        int shmid;
        key_t key;
        char *shm, *s;
        key=5685;
        if((shmid=shmget(key, SHMSIZE,  0666))<0)
        {
                perror("shmget");
        }

        if((shm=shmat(shmid, NULL, 0))==(char*)-1)
        {
                perror("shmat");
        }
```



```c
        printf("SHM address in client %p\n", shm);
        printf("SHM memory id in client %d\n", shmid);
        int count=0;
        for(s=shm; *s!=0; s++) {
                putchar(*s);
                putchar('\n');
                sleep(1);
        }
        printf("Completed reading\n");
        *shm='*';
        /****Detach Shared Memory****/
        int k =shmdt(shm);

        return 0;
}
```

Thank You

Any Questions?