Portable Multitasking Real- Time Kernel Design and Implementation on DSP Systems

by Yin, Yen- tau

Advisor: Dr. J.S. Hu

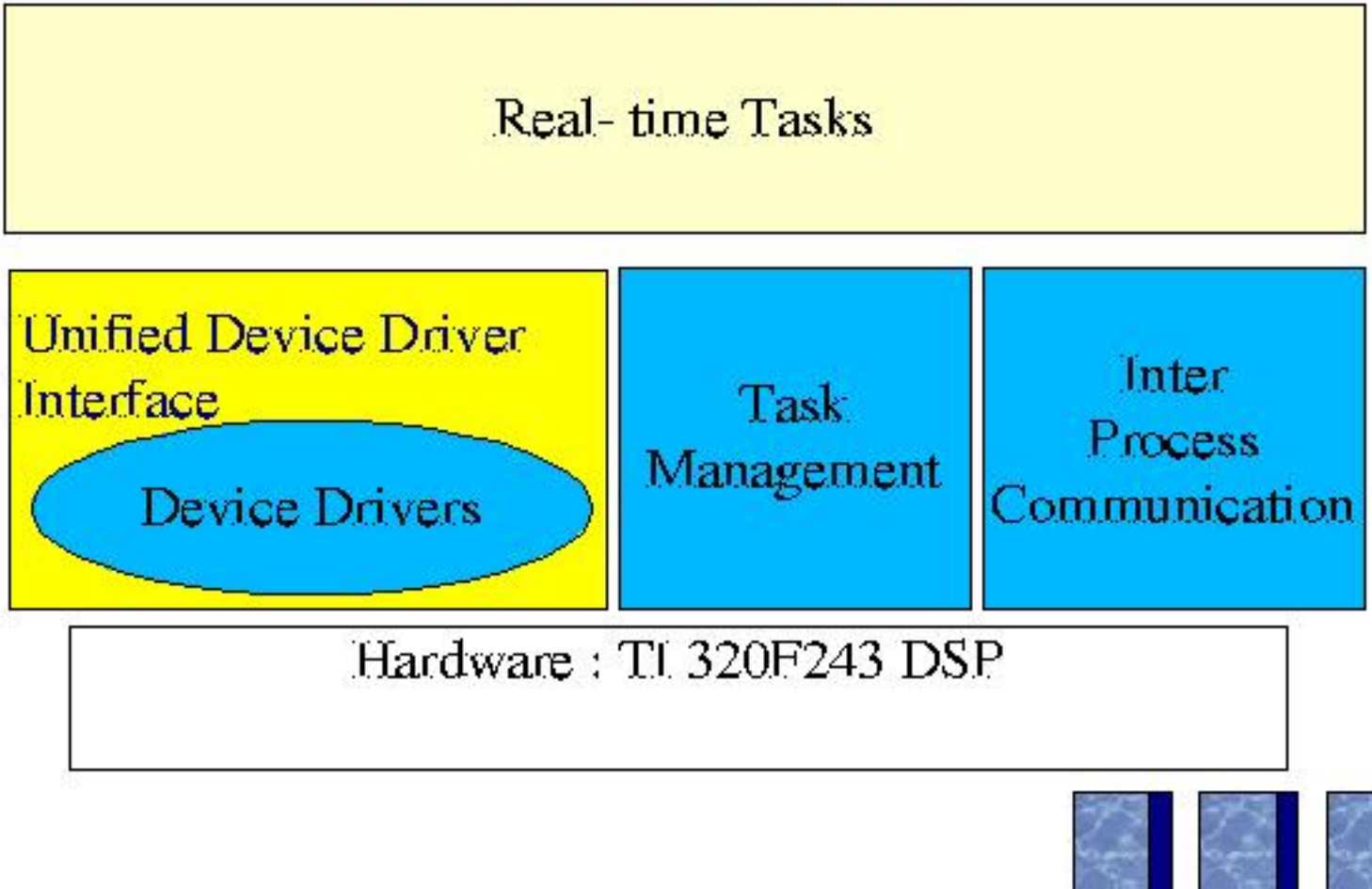
Outline

- Introduction
- Taunix System Architecture
- Task Management
- Device Drivers
- Inter Process Communication
- Communication Network - SECS-I protocol
- Future Works
- Live Demo

Introduction

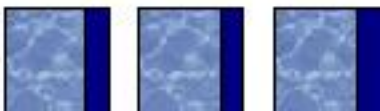
- Motivation
- The problems this thesis tries to solve

Taunix System Architecture



Task Management

- Portable context switch facility
  setjmp/longjmp
- Priority- based scheduling
  16/32- level fixed priority scheduling
- Periodical task
  1. one- shot or periodic
  2. with simple priority policy



Portable Context Switch

Use jumping buffer to form Task Control Block (TCB)

Jumping Buffer:

TOS
AR1
AR0
AR6
AR7

TCB:

```
void    (*ret_addr)();
void *  stack_pointer;
void *  stack_frame;
int     AR6
int     AR7
char    state;
char *  caption;
```

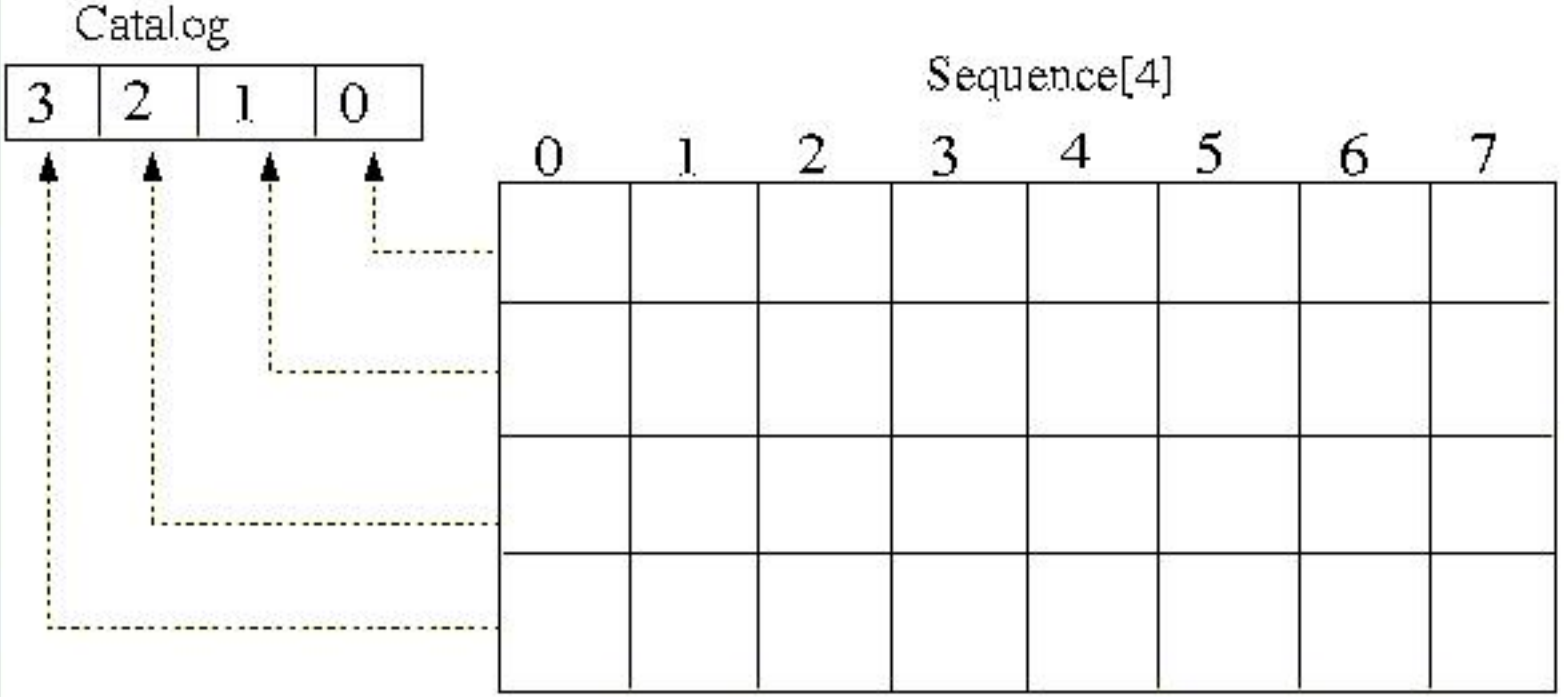
Portable Context Switch (cont.)

Use POSIX standard function calls to implement task switch

Task switching:

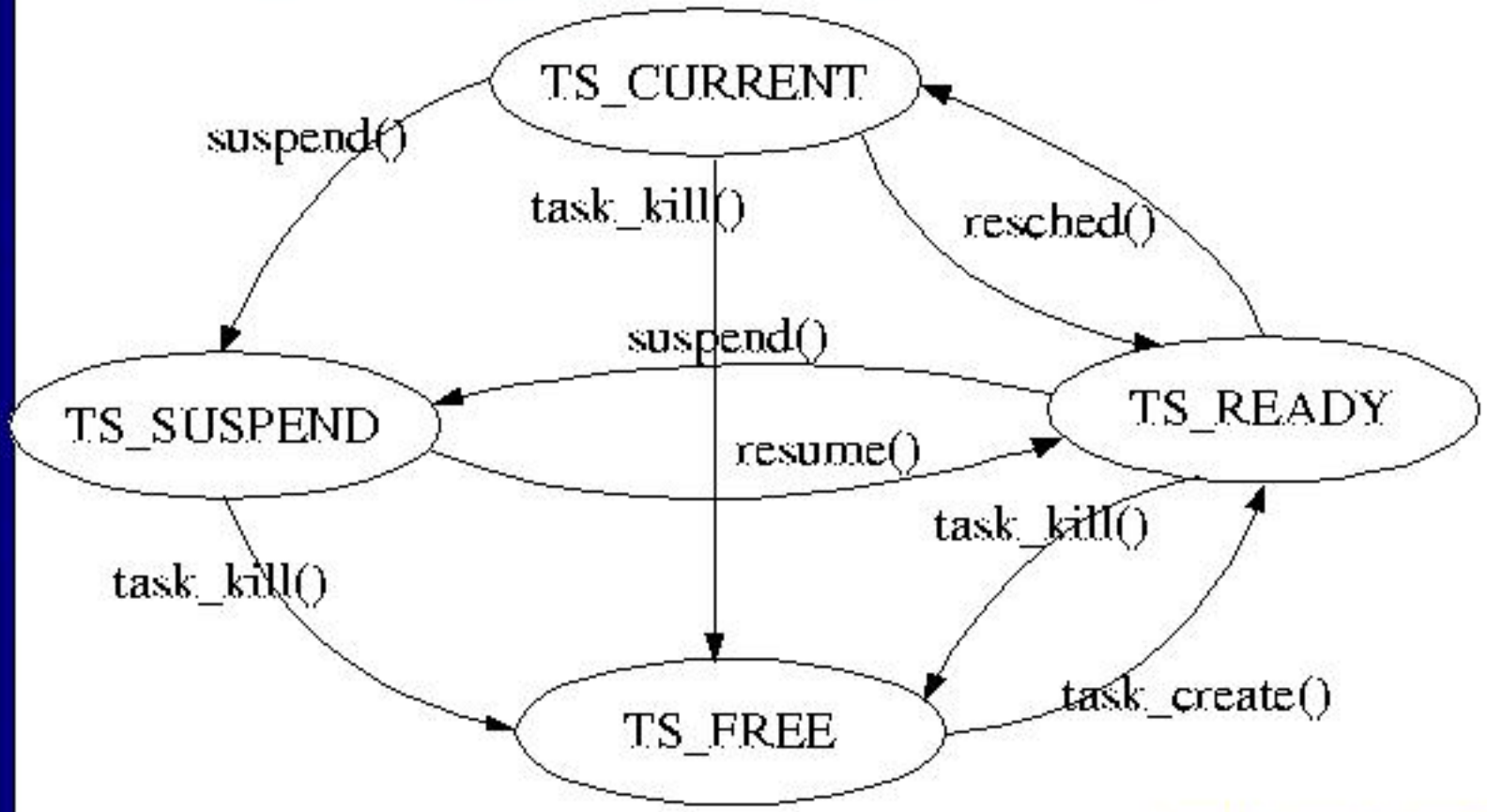
```
void task_switch(TCB * from, TCB * to)
{
   if(setjmp(from) == 0)
      tlongjmp(to, 1);
}
```

Priority- based Scheduling

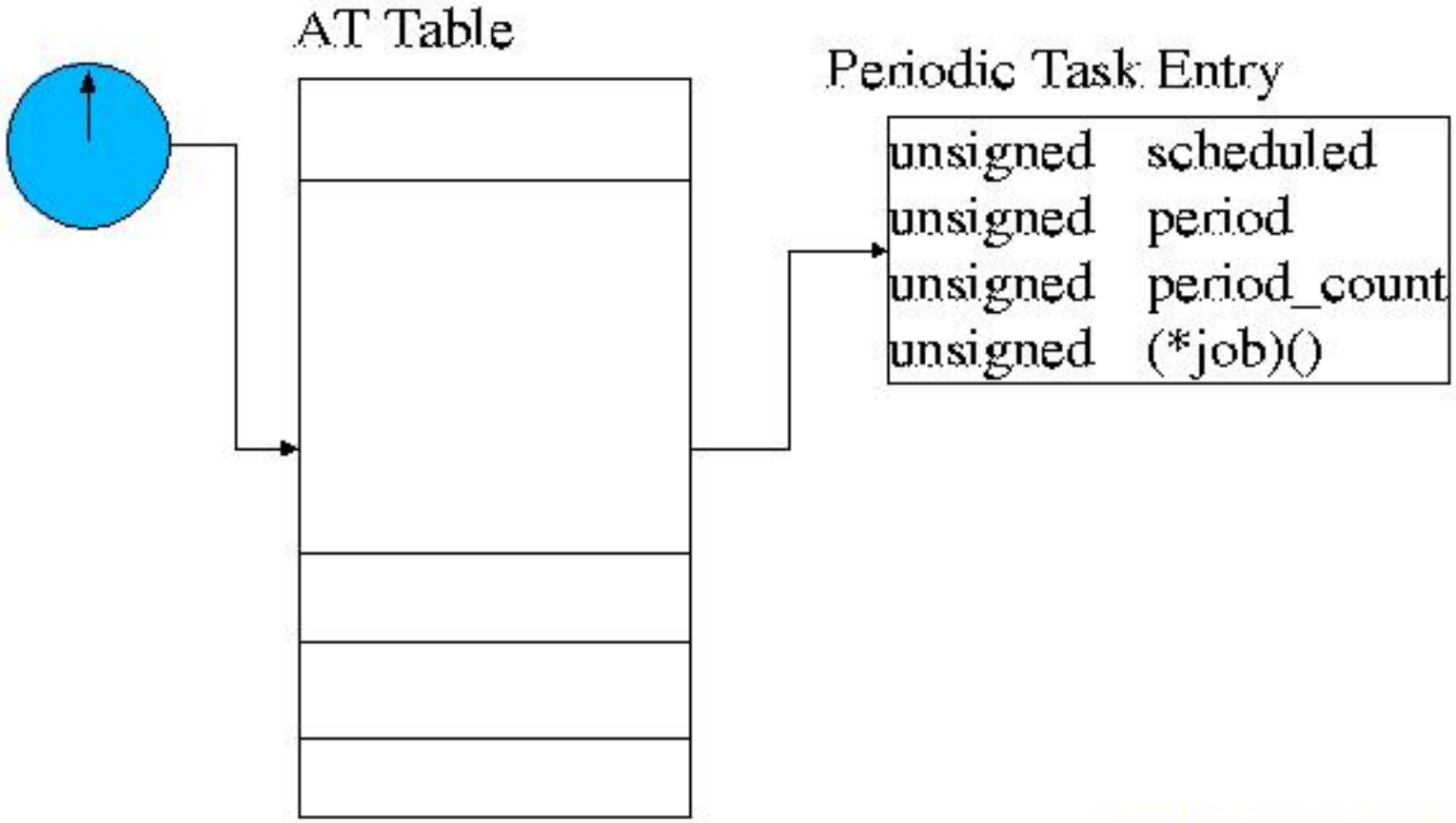


Use index mapping table to fast locate highest priority task

Task State Transition



Periodic Task Scheduling

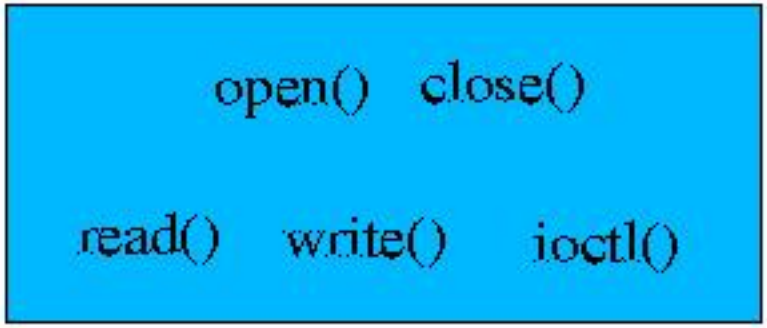


Device Drivers

- **Device Switch**
  Unified device driver interface
- **Blocking/Non- Blocking I/O**
  Efficiency and CPU utilization
- **Supported Devices**

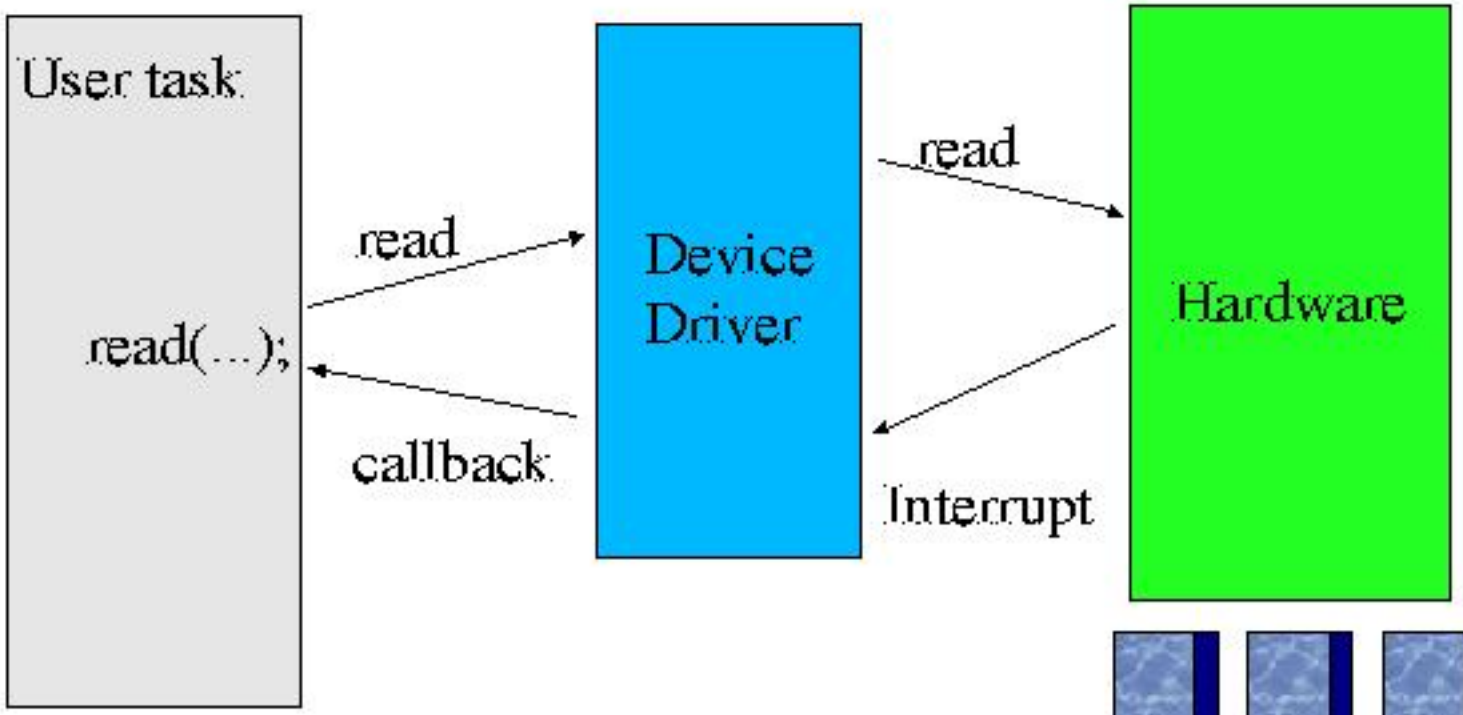
Device Switch

- Unified Device Driver Interface Device Switch:



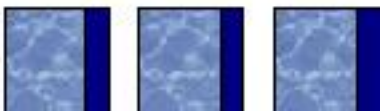
Blocking/Non- Blocking I/O

- Block/non- block mode



Supported Devices

- Supported devices
  1. Analog- to- digital convertor
  2. Capture unit
  3. General purpose timers
  4. PWM
  5. Serial communication with SECS- I
  6. Watch- dog



Inter Process Communication

- Counting Semaphore
- Message Pipe/Queue

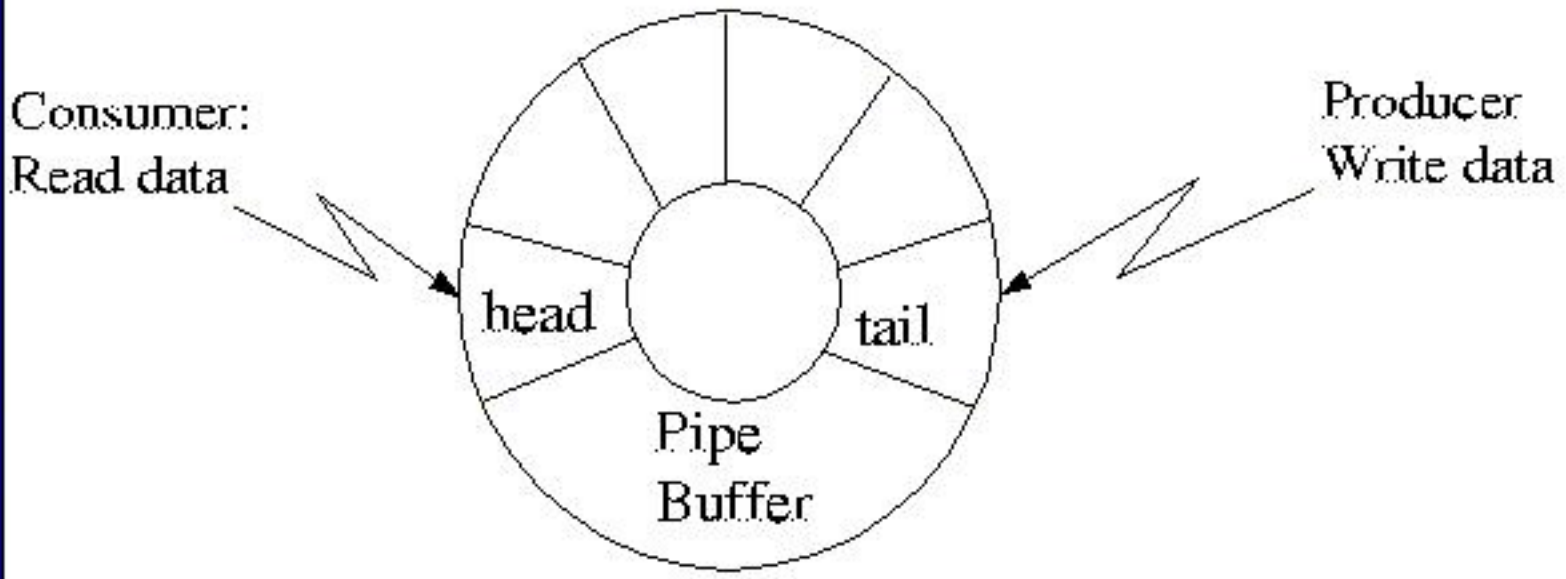
IPC - Semaphore

- Counting semaphore
  plus:

  1. Limited priority- based pending list

  2. Non- blocking pending

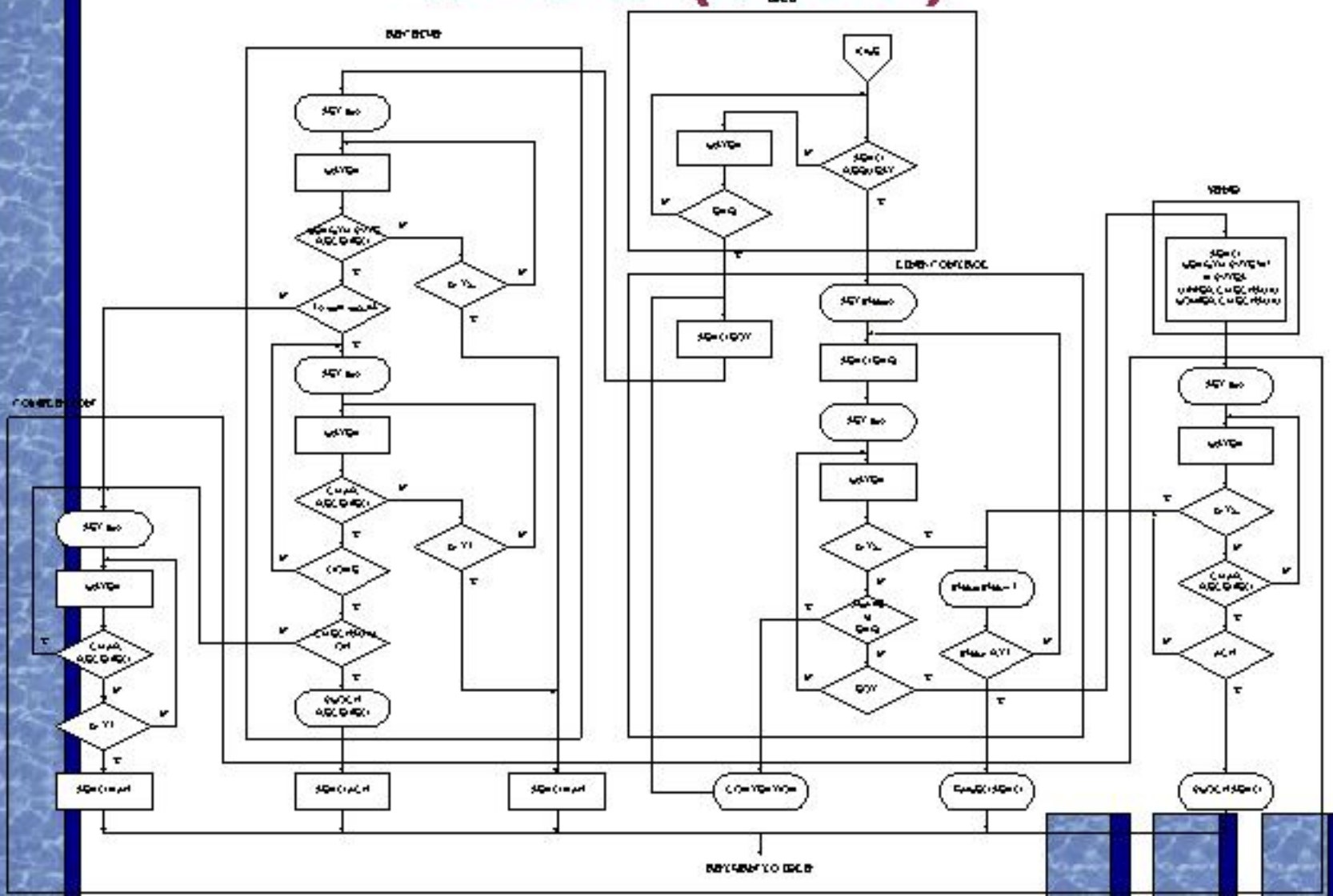
IPC - Message Pipe/Queue



SECS

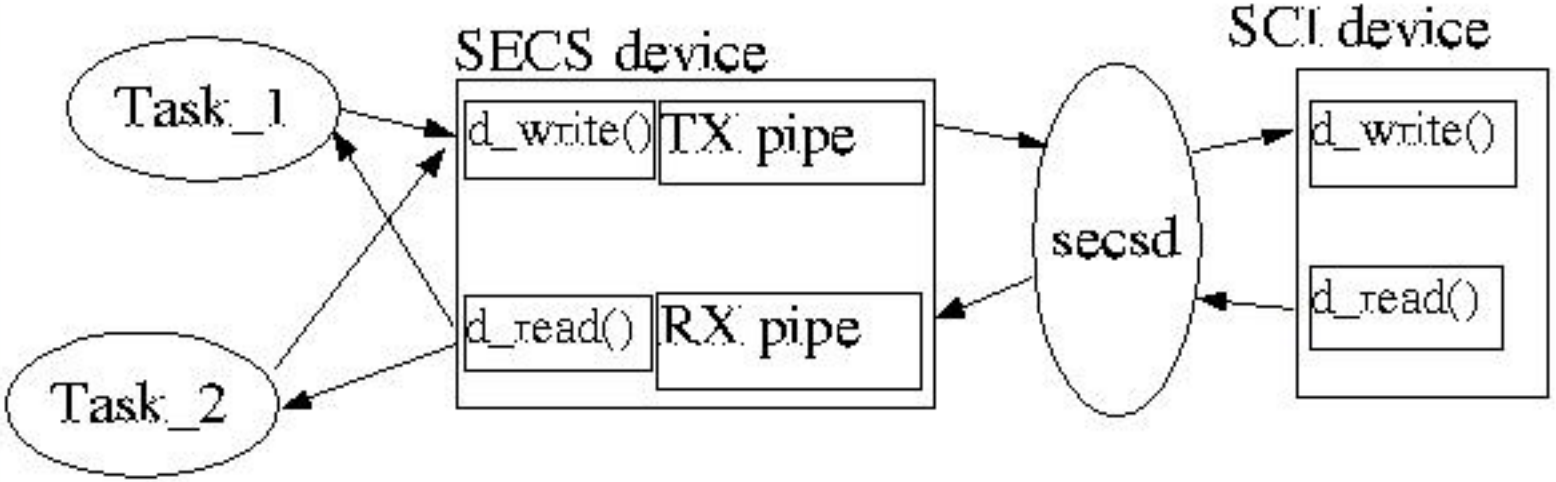
- Point- to- Point Communication
- Master/Slave Protocol

SECS (cont.)



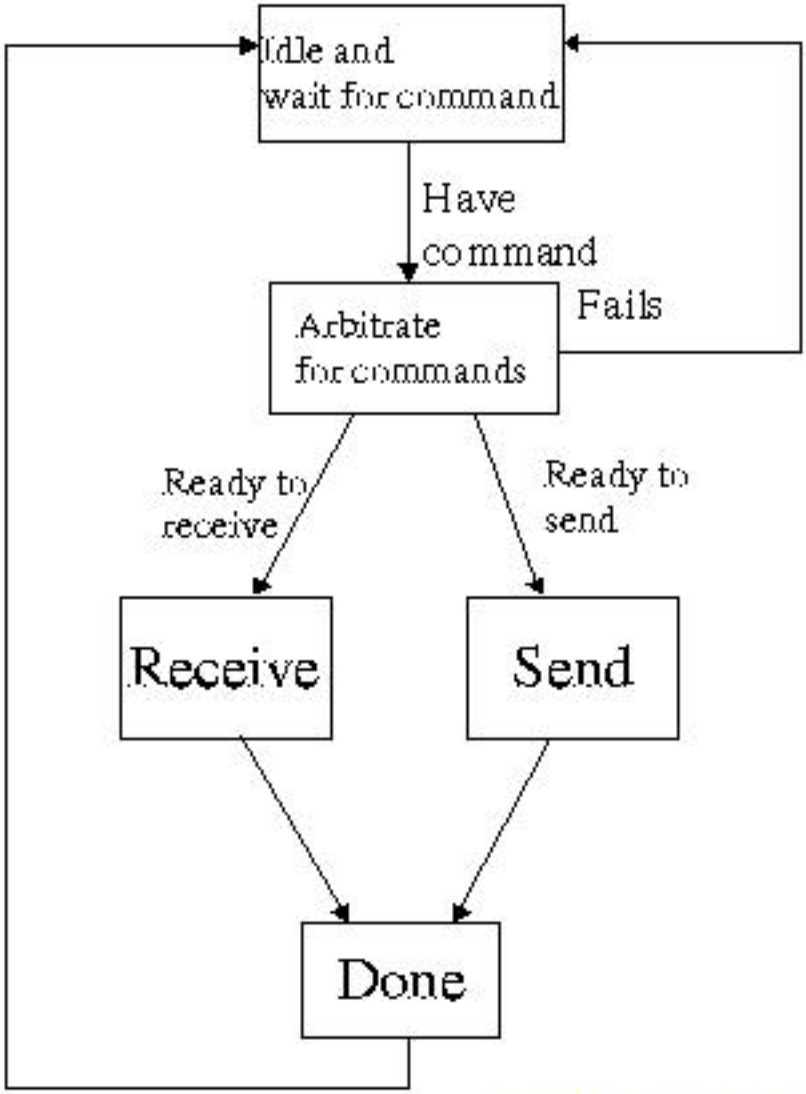
SECS (cont.)

Relation between Tasks, SECS virtual device and SECSd:



SECS (cont.)

SECSd Event Flow Chart:



Future Works

- Taunix Virtual File System
- System Call Library
- Installable Scheduling System
- Architecture Porting
- Going to GPL

Live Demo

Thank You Very Mush