

CS 563
Assignment Project Exam Help
Concurrent Programming
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Lecture 4: Message Passing (1)

Message Passing

- ❖ Abstract notions representing physical communication possibilities
- ❖ Many different names: message queues, pipes, mailboxes, ...
- ❖ Primitives:

send msg to dest

receive msg [from source]

Channel

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- ✧ Unbounded queue of messages

chan name(id1: type1; ...; idN: typeN)



field

Primitives

- ❖ `send name(expr1, ..., exprN)`
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 - ❖ Types and number of fields must match
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 - ❖ Effect:
 - ❖ Evaluate the expressions and produce a message M
 - ❖ Atomically append M to the end of the named channel
- ➡ send is nonblocking (asynchronous)

Primitives

- ✧ `receive name(var1, ..., varN)`

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- ✧ Again, types and number of fields must match
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- ✧ Effect: WeChat: cstutorcs

- ✧ Wait for a message on the named channel

- ✧ Atomically remove first message and put the fields of the message into the variables

➡ receive is blocking (synchronous)

Example

```
chan ch(int)
```

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```
process A:
```

```
    send ch(1)  
    send ch(2)
```

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```
process B:
```

```
    receive ch(x)  
    receive ch(y)
```

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- ▶ x will contain 1 and y will contain 2
- ▶ Order of messages from SAME source is the order of the sends

Example

```
chan ch1(int), ch2(int)
```

```
process A:      process B:
  send ch1(1)    receive ch1(x)
  send ch1(2)    receive ch1(y)

process C:      process D:
  send ch1(3)    receive ch2(u)
  send ch2(4)    receive ch2(v)
```

What is received now?

- x will get 1 or 3 and y will get 3 or 1
- u will get 2 or 4 and v will get 4 or 2

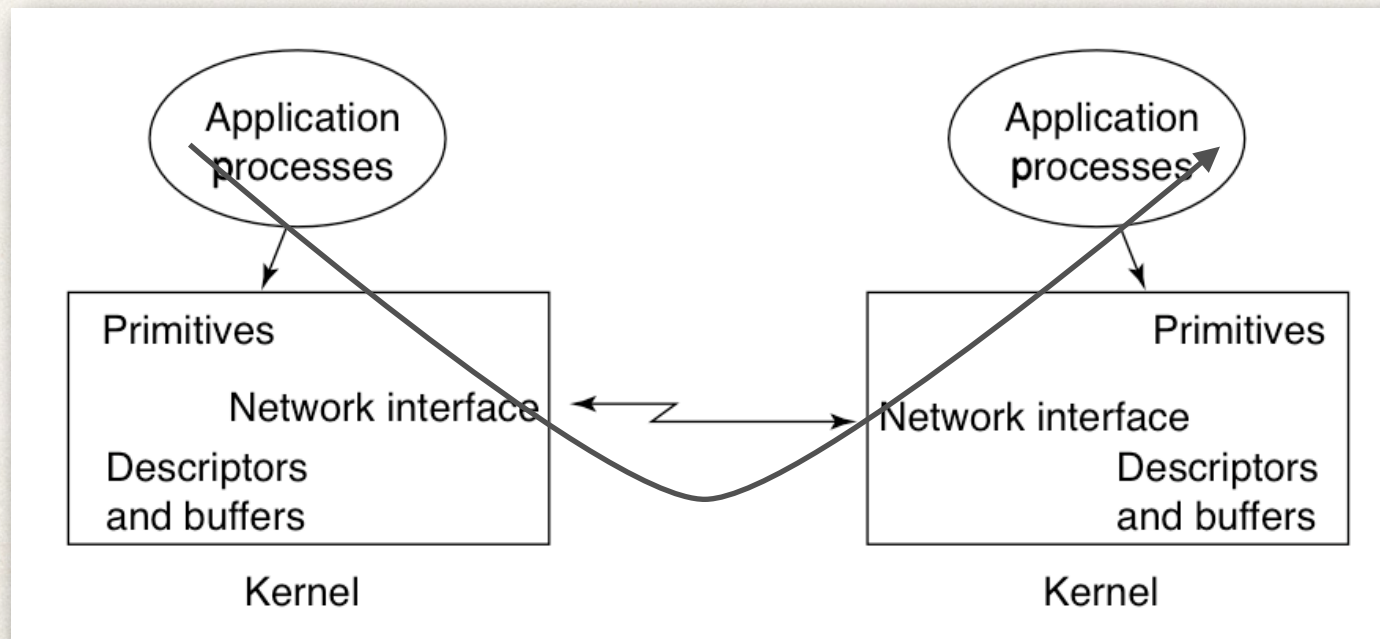
Implementation Sketch

With shared memory



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With distributed memory



Process Interaction Patterns

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- ❖ Filters: one way
- ❖ Client/Server: two way as master/slave
- ❖ Interacting peers: two way as peers

Filter Process to Assemble Characters

```
chan input(char), output(char [MAXLINE]);
process Char_to_Line {
    char line[MAXLINE]; int i = 0;
    while (true) {
        receive input(line[i]);
        while (line[i] != CR and i < MAXLINE) {
            # line[0:i-1] contains the last i input characters
            i = i+1;
            receive input(line[i]);
        }
        line[i] = EOL;
        send output(line);
        i = 0;
    }
}
```

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chan in1(int), in2(int), out(int);
process Merge {
 int v1, v2;
 receive in1(v1); # get first two input values
 receive in2(v2);
 # send smaller value to output channel and repeat
 while (v1 != EOS and v2 != EOS) {
 if (v1 <= v2)
 { send out(v1); receive in1(v1); }
 else # (v2 < v1)
 { send out(v2); receive in2(v2); }
 }
 # consume the rest of the non-empty input channel
 if (v1 == EOS)
 while (v2 != EOS)
 { send out(v2); receive in2(v2); }
 else # (v2 == EOS)
 while (v1 != EOS)
 { send out(v1); receive in1(v1); }
 # append a sentinel to the output channel
 send out(EOS);
}

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Merge Process and Sorting Network

