CSE 451: Operating Systems
Hard Lessons Learned

Windows
Pipes

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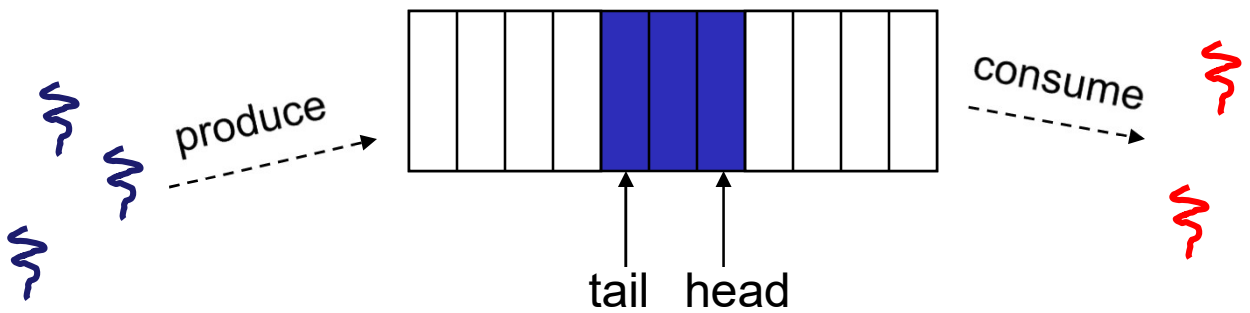
Not this pretty picture

- *AKA* “producer/consumer” problem
  - there is a circular buffer in memory with N entries (slots)
  - producer threads insert entries into it (one at a time)
  - consumer threads remove entries from it (one at a time)
- Threads are concurrent
  - so, we must use synchronization constructs to control access to shared variables describing buffer state



Windows NPFS

- 32 source files

aliassup.c	cleanup.c	close.c	create.c	createnp.c	datasup.c
deviosup.c	dir.c	dumpsup.c	eventsup.c	fileinfo.c	filobsup.c
flushbuf.c	fsctrl.c	nodetype.h	npdata.c	npdata.h	npinit.c
npprocs.h	npstruc.h	prefxsup.c	read.c	readsup.c	resrcsup.c
securesup.c	seinfo.c	statesup.c	strucsup.c	volinfo.c	waitsup.c
write.c	writesup.c				

- 20,000 lines of code (including comments)

- Integrated in the file system model, with added NtCreateNamedPipe() API

- Pipes can be Inbound, Outbound, or Full Duplex

Design considerations

- Named and unnamed pipes
- Message and byte streamed pipes
- How much data to buffer in the kernel
- Use of quotas to keep user from overusing kernel memory
- What if the user tries to write or read more data than is allowed in the pipe at any moment?

Naming Pipes

- Named and unnamed pipes

Message or byte streamed

- Message and byte streamed pipes
- Messages are easy to handle
- Byte streams have some behavior issues. How much to read on a byte stream pipe.

To buffer of not to buffer…

- How much data to buffer in the kernel
- Design Tradeoff

Quotas

- Use of quotas to keep user from overusing kernel memory
- How to handle situations when the user tries to write or read more data than is allowed in the pipe at any moment?

Other Pipe Considerations

- Needed to support the major file/directory operations, Get Info, Set Info, etc.
- Pipe States: Listening, Connected, Disconnected, Closing
- Who comes first, the Reader? Or the Writer? Is the pipe full of data or full of read requests?
- Delayed create until both sides do an open/create

More Pipe Considerations

- What happens when the writer closes the pipe? What about outstanding writes that are buffered in memory or still in the writer's memory?
- What happens when the reader closes the pipe?
- What happens if the readers asks for less than what's in the pipe? Or more?
- Peeking into a pipe?
- And a whole lot more…