Thread Model for Work Unit

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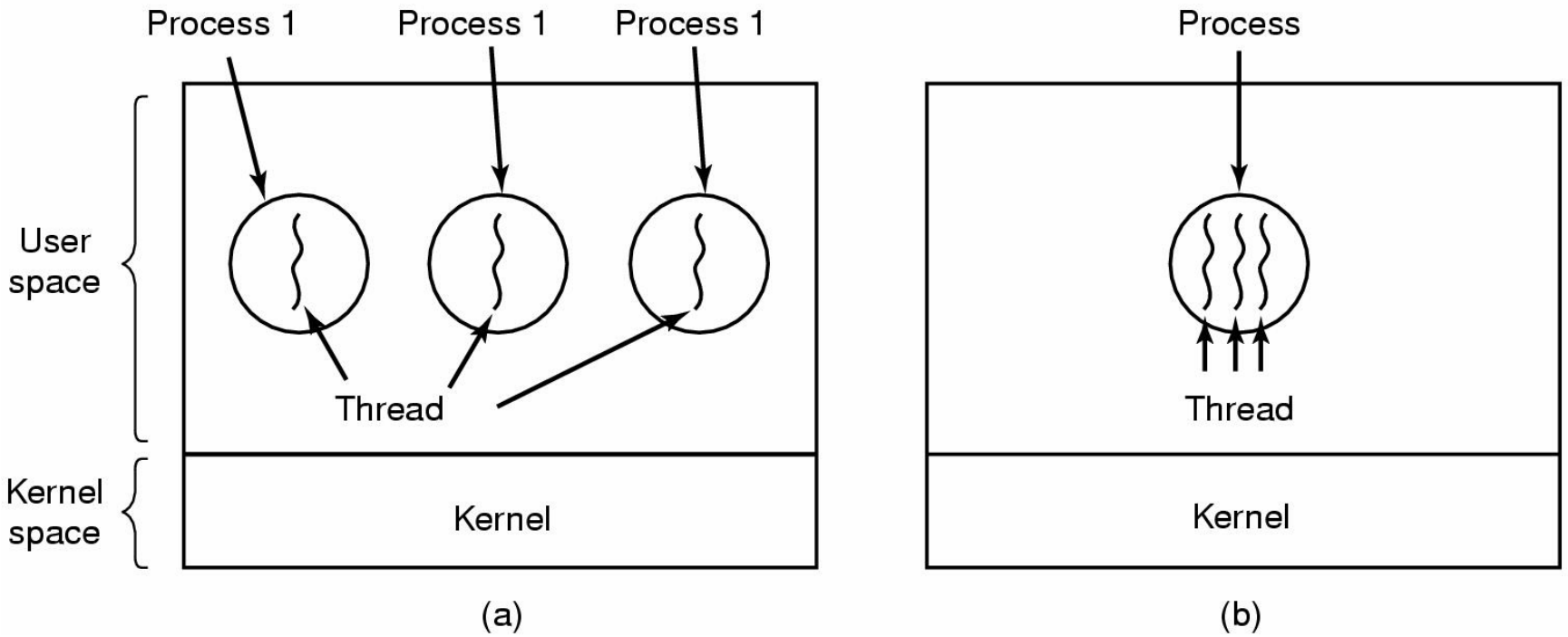
Modified version slides provided
by A. Tennenbaum's Text

The Thread Model



(a) Three processes each with one thread

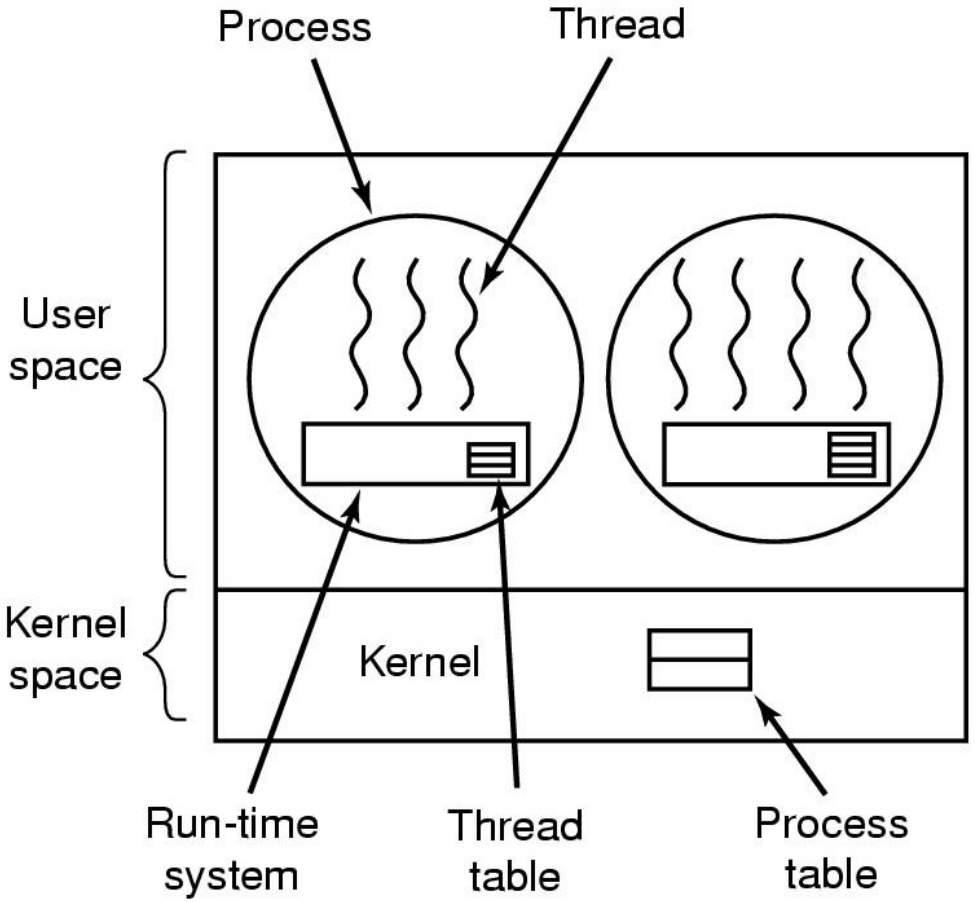
(b) One process with three threads

Per process vs per thread items

Per process items	**Per thread items**
Address space	Program counter
Global variables	Registers
Open files	Stack
Child processes	State
Pending alarms	
Signals and signal handlers	
Accounting information	

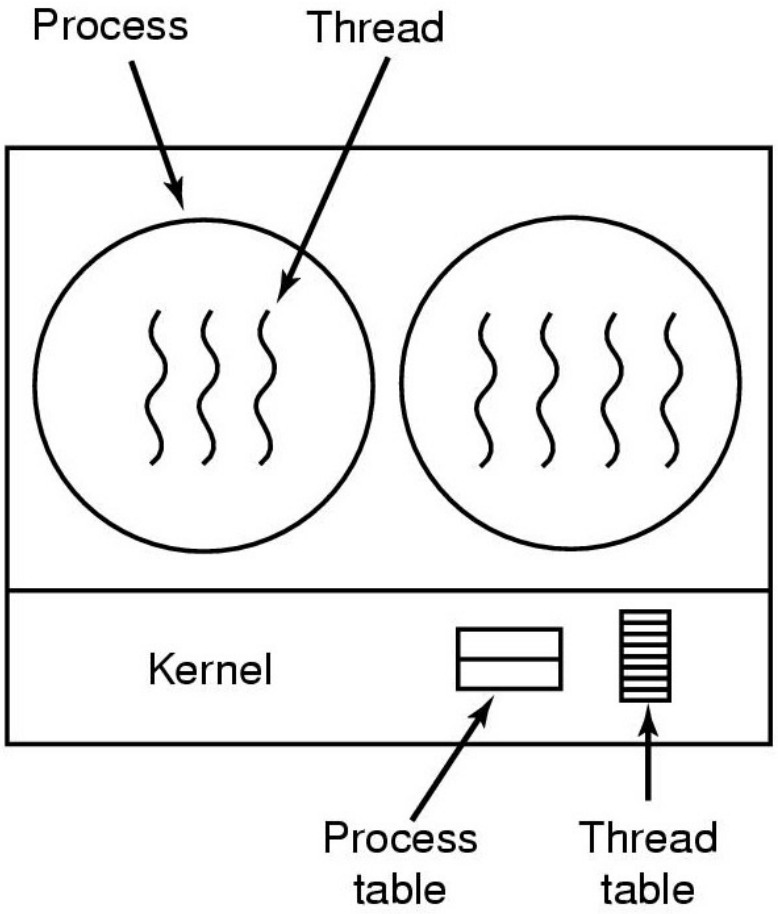
- Items shared by all threads in a process
- Items private to each thread

Implementing Threads in User Space



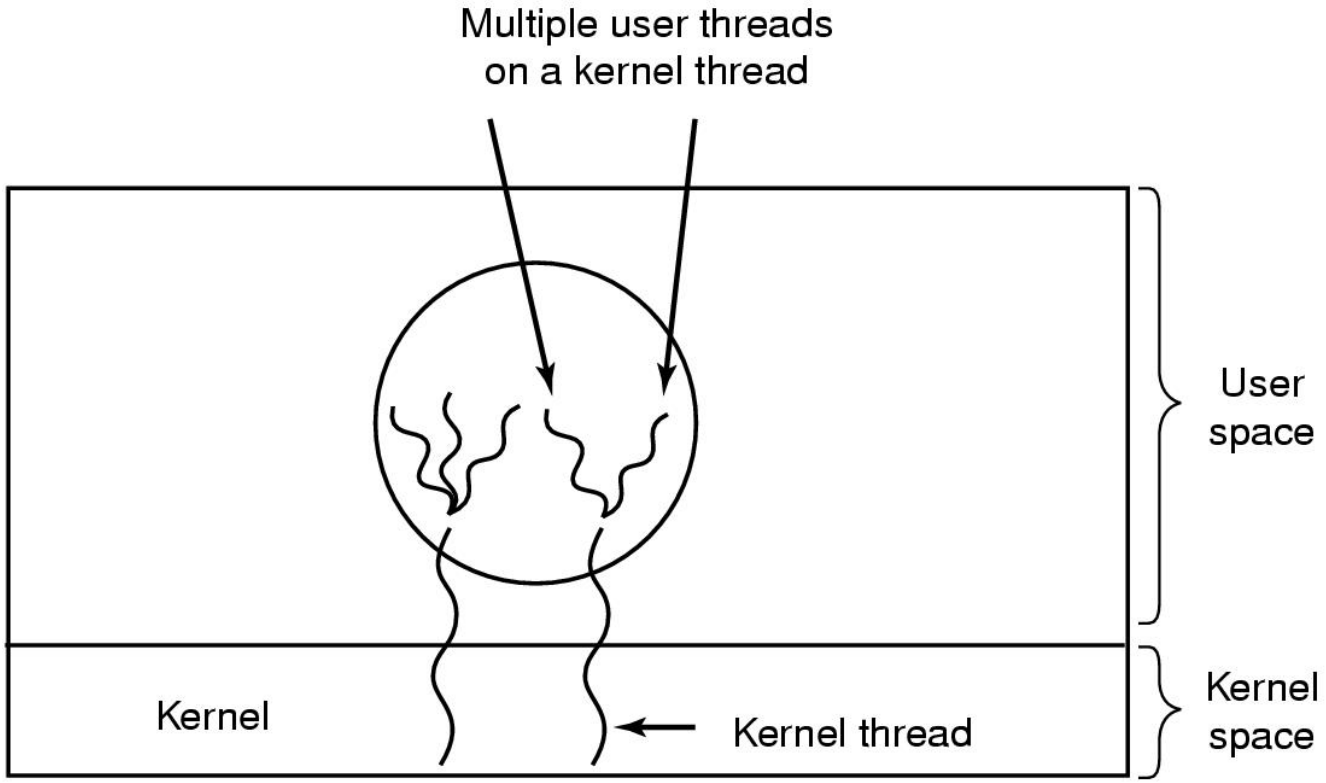
A user-level threads package

Implementing Threads in the Kernel



A threads package managed by the kernel

Hybrid Implementations

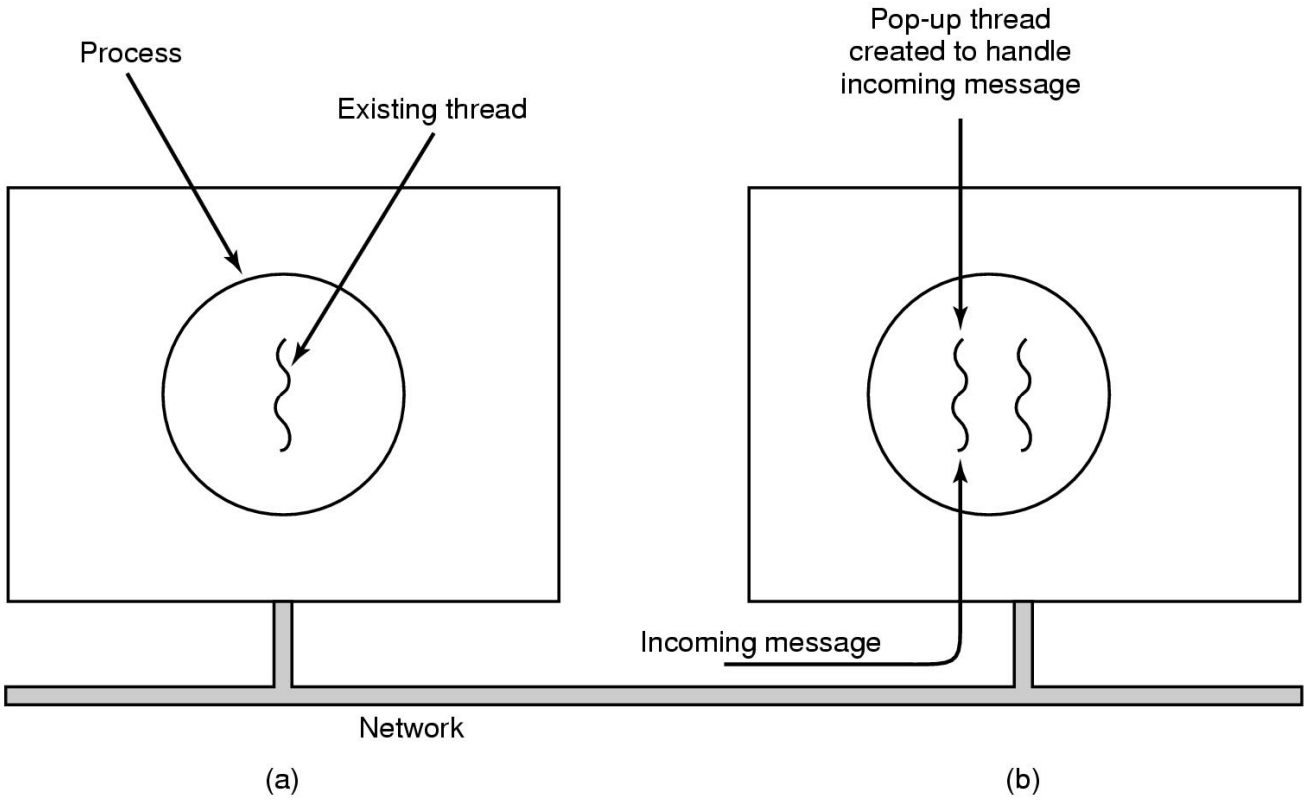


Multiplexing user-level threads onto kernel- level threads

Scheduler Activations

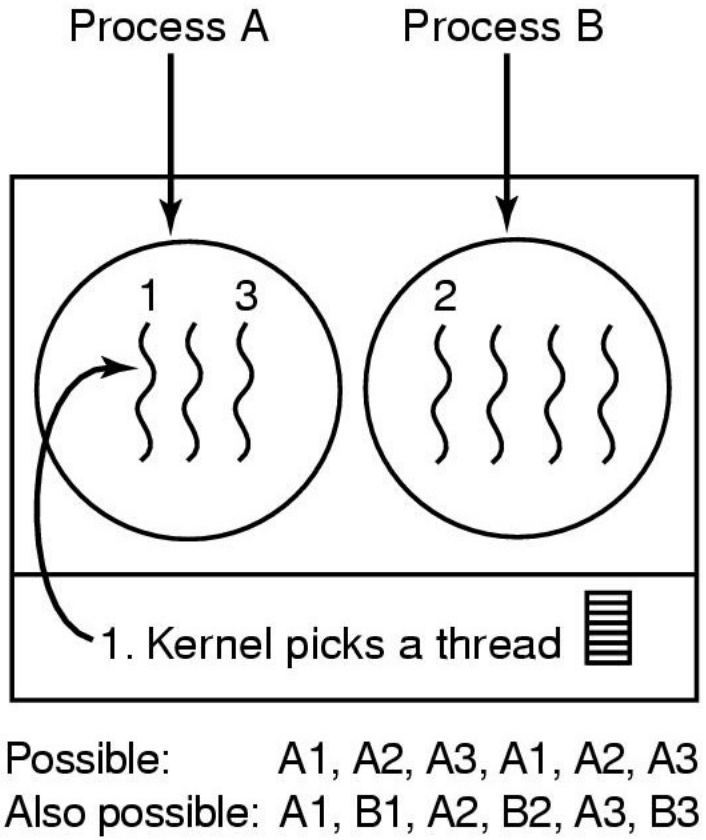
- Goal – mimic functionality of kernel threads
  - gain performance of user space threads
- Avoids unnecessary user/kernel transitions
- Kernel assigns virtual processors to each process
  - lets runtime system allocate threads to processors
- Problem:
  Fundamental reliance on kernel (lower layer)
  calling procedures in user space (higher layer)

Pop-Up Threads



- Creation of a new thread when message arrives
  (a) before message arrives
  (b) after message arrives
- Thread pools

Thread Scheduling (2)



Possible scheduling of kernel-level threads

- 50-msec process quantum
- threads run 5 msec/CPU burst