Readings and References

- Reading
  » Chapter 6, Section 6.7.2, *Operating System Concepts*, Silberschatz, Galvin, and Gagne

- Other References
  » Chapter 6, Performance Monitoring, *Windows 2000 Professional Resource Kit*, Microsoft

Dispatcher “database”

- Ready summary: 31 ... 0
- Idle summary: 31 ... 0

Thread State Transitions

- Transition between states: create thread, wait, select, dispatch, preempt, wait complete
- Timeline: history, reinitialize, terminate, place in ready queue, select, dispatch (context switch and run)
Ready, Running, Waiting

- Ready
  » ready to run if there is a processor available
  » there is a ready queue for each priority level
- Running
  » has been switched to and is running
- Waiting
  » waiting on an event (synchronize, I/O, etc)

Other States

- Initialized
  » On its way in the door
- Terminated
  » On its way out the door to history or recycle
- Standby
  » Ready and selected to run next
- Transition
  » Ready, but important parts are paged out

Windows 2000 Thread States

7 - Unknown
6 - Transition
5 - Wait (for something to complete)
4 - Terminated
3 - Standby (on-deck circle)
2 - Running (at bat)
1 - Ready (eligible to be selected)
0 - Initialized
Setting Thread Priorities

- Base priority
  » normally inherited from process default
  » can be explicitly set
- Current priority
  » starts out same as base
  » real time never changes
  » dynamic is boosted when appropriate for responsiveness

Priority boosting

- After I/O completion or event wait
  » you’ve waited for this data, now use it quick
- User response
  » Foreground thread after a wait or window thread wakeup for window event
- CPU starvation
  » found an aging thread on the ready queues
- The boost decays quickly over time
Quantum

- Thread Quantum is
  » indicator of the amount of time a thread can run before W2K checks whether another thread at the same priority should get to run
- Each thread has a current quantum value
  » a small integer that is decremented under various circumstances
  » not an actual length of time, just a number

Quantum value

- Thread quantum is initialized when thread is put on the ready queue
  » initial value of 6 on Windows 2K Professional
  » initial value of 36 on Windows 2K Server
- Quantum of running thread is decremented by 3 after system clock interrupt
  » so a W2K Pro thread can run for 2 clock intervals
  » a W2K Server thread can run for 12 clock intervals

Quantum is reset to initial value

- a thread moves to ready queue after quantum end
  » in other words, a thread is given another chunk of time to use after it has exhausted the first chunk
- a real-time thread is preempted and moves from running to ready or it moves from running to wait
  » the presumption is that you are doing a good job of explicitly managing priorities and access to the CPU when you are running real-time threads

Quantum changes

- Quantum is decremented
  » reduced quantum => less time remaining before thread has exhausted its time slice
  » reduced by 3 when the clock ticks
  » by 1 when dynamic thread executes a wait
- Quantum initial value may be boosted
  » “Optimize performance for applications”
  => boost initial quantum for foreground threads
Scheduling Scenarios

- Voluntary switch
  » thread calls a wait function of some sort
- Preemption
  » higher priority thread is ready to run
- Quantum end
  » the running thread exhausts its quantum

Voluntary Switch

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Dynamic - quantum unchanged
RT - quantum is reset to initial value

Preemption

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Quantum End

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