

Blocking

(Mutex, Spinlock, Condition Variable)

“One stops, ALL stop.”

Philosophy: Pessimistic Control

Guarantee: None.

Depends on OS scheduler.

Risk: Deadlock, Priority Inversion ...

Blocking Synchronization

Lock-Free

(CAS-based Algorithms, Lock-Free Data Structures)

“System keeps moving.”

Philosophy: Optimistic Control

Guarantee: System-wide Progress.

At least one thread makes progress.

Risk: Starvation (Possible), Livelock ...

Wait-Free

(Wait-Free Algorithms, Bounded Data Structures)

“Everyone keeps moving.”

Philosophy: Deterministic Control

Guarantee: Thread-local Progress.

All threads complete in finite steps.

Non-Blocking Synchronization