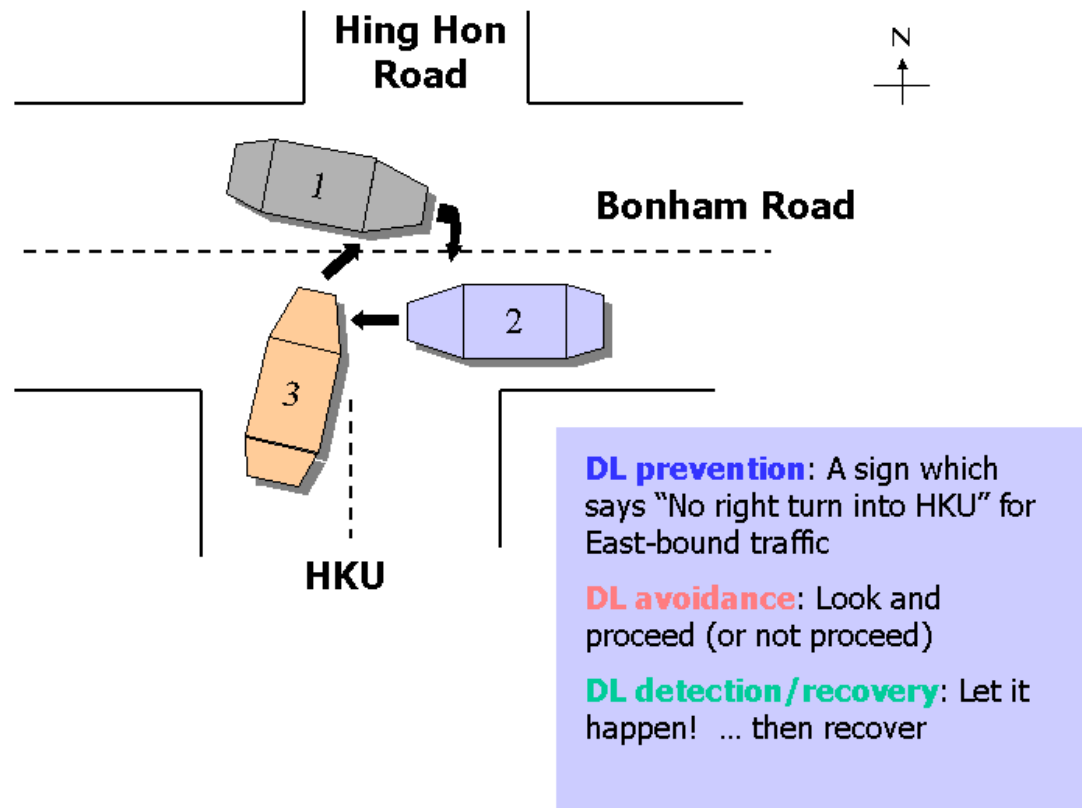


Deadlocks

- A deadlock occurs when two or more processes are waiting for an event that can only be generated by one of the waiting processes



Deadlock Characterization

- Resource allocation
 - Request => Use => Release
- Conditions
 - Mutual exclusion: resources cannot be shared
 - Hold and wait: a process holds some resources but needs a resource that is held by another process
 - No preemption: resources cannot be preempted
 - Circular wait: there must be a circular chain of processes, each of which is waiting for a resource held by the next in the chain

Deadlock Handling

- Prevention
 - Ensure that at least one of the conditions necessary to characterize a deadlock will never hold
- Detection and recovery
 - Allows deadlocks to occur
 - Detection algorithm is run periodically
 - Allocated resources X waiting processes
 - Recovery algorithm is run whenever a deadlock is detected
 - Process termination
 - Resource preemption (rollback)
- Practice
 - Too expensive, seldom used!