# DISTRIBUTED LOCKING PROTOCOLS – OVERVIEW

| | Single-Lock Manager | Primary Copy | Majority | Biased |
|---|---|---|---|---|
| **Deadlock Handling** | Centralized | Distributed | Distributed | Distributed |
| **Availability (*)** | global SPoF (central lock manager) | SPoF per data item $Q$ (primary copy of $Q$) | No SPoF ($\lfloor \frac{n}{2} \rfloor + 1$ replicas must be up) | Read: No SPoF Write: all $n$ replicas of $Q$ must be up |
| **Bottleneck** | Yes | No | No | No |
| **Supports Replicas** | Yes | Yes | Yes | Yes |
| **# of Messages** | Read: 2 Write: 2 Unlock: 1 | Read: 2 Write: 2 Unlock: 1 | Read/Write: $2\left(\lfloor \frac{n}{2} \rfloor + 1\right)$ Unlock: $\left(\lfloor \frac{n}{2} \rfloor + 1\right)$ | Read: 2 Write: $2n$ Unlock: Read: 1, Write: $n$ |
| **Read from Replicas** | Any | Any | Any | Any |
| **Write to Replicas** | All | All | All | All |

**SPoF** Single Point of Failure

**Q** data item to be locked / unlocked

**n** number of replicas for a data item $Q$

(*) The availability discussion is limited to lock requests only. Even if a lock is granted, depending on the replication policy it may not be possible to write. For example, the majority protocol grants a write lock if more than half of the replicas are available, but the replication policy may require writes to be executed on all replicas, which requires *all* replicas to be available.