Chapter 7

- System Model – typical assumptions underlying the study of distributed deadlock detection
  - Only reusable resources, only exclusive access, single copy of resource in system.
- Besides deadlocks due to resources, we can have communication deadlocks
- Strategies
  - Prevention – can cause further problems. Consider one shot allocation where resources and requesters are on different sites.
  - Avoidance – global state needs to be maintained, safe state checks need to be mutually exclusive.

Detection

- Issues
  - Detection
    - Deadlocks should be detected in finite time.
    - No false positives (phantom deadlocks)
      - Realize that states are not coherent.
  - Resolution
    - Clean up the information upon rollback.
- Control Organizations
    - Centralized
    - Distributed
    - Hierarchical

Distributed Deadlock Detection

- Basic Centralized.
  - All requests and release messages are sent to a designated site, which maintains a global WF Graph
  - Problems – bottleneck, single POF, phantom deadlocks
- Ho-Ramamoorthy 2 Phase
  - Each site maintains a status table – resources locked and resources being waited upon. The central site periodically requests this table, constructs a global WFG, and searches for cycles. If a cycle is found, it requests the tables again, and constructs WFG from those transactions that are common to both tables. If a cycle is still detected, then a deadlock is declared.

- Ho-Ramamoorthy 1 phase
  - Each site maintains 2 tables, one for resources (transactions that have locked a resource) and one for process status (resources locked/waited). These tables requested periodially by central site, and WFG constructed using those entries in the resource table which have corresponding entry in process table.

- Distributed Algorithms
  - Path pushing: WFG constructed by disseminating dependency sequences
  - Edge chasing: process sends out probes. A blocked process receiving probes circulates it along its outgoing dependency edges
  - Diffusion: queries are diffused (sucessively propagated) and reflected
  - Global State Detection

Obermack's Algo.

- Path pushing approach deals with transactions. Each transaction may have sub transactions, but they execute sequentially. Transactions are totally ordered.
- Each site waits for deadlock related information (paths) from other sites. It abstracts the nonlocal portion of the WFG with a single node called EX.
- It combines this with its own WFG. It then detects cycles and breaks those which do not contain EX.
- For all cycles involving EX, the string indicating the cycle (EX-T1-T2-EX) is sent to all sites which have subtransactions of T2 waiting to recv a message from the subtransaction of T2 at this site.
- Problem – this algorithm can detect phantom deadlocks. Needs n(n-1)/2 messages of O(n) size and detects in linear time.