

Program Modeling Concepts:

Lesson-8: MODELING USING

GRAPHS IN

MULTIPROCESSOR SYSTEMS

Application of Graphs

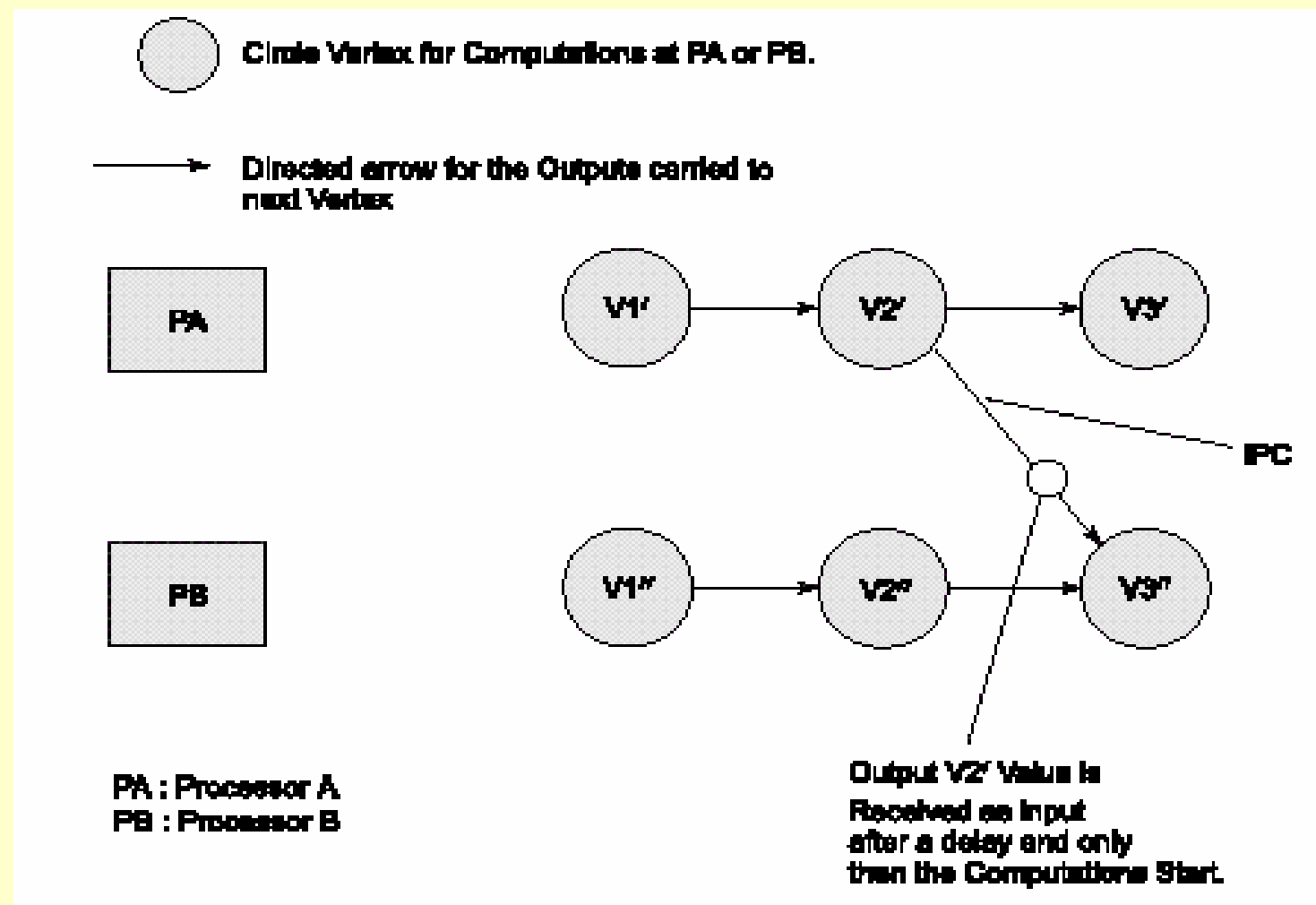
Multi-processor System Modeled as SDFGs unfolded into the APEGs and HSDFGs

When there is an indefinitely long data sequence, SDFG based modeling and the consequent unfolding into the HSDF and APEG graphs helps.

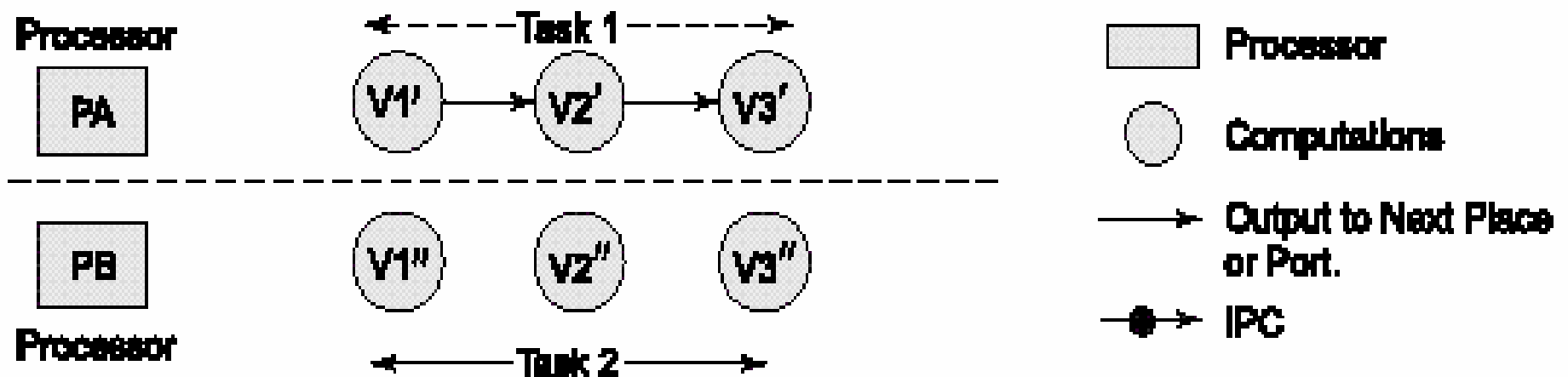
HSDFG

- HSDFG applied to the computations of a fast Fourier transform or for coding a voice data.
- An HSDF graph can also effectively model an IPC (Inter Processor Communication) graph.

Two-processor System Modeled as one APEG and one HSDFG with an IPC from PA to PB



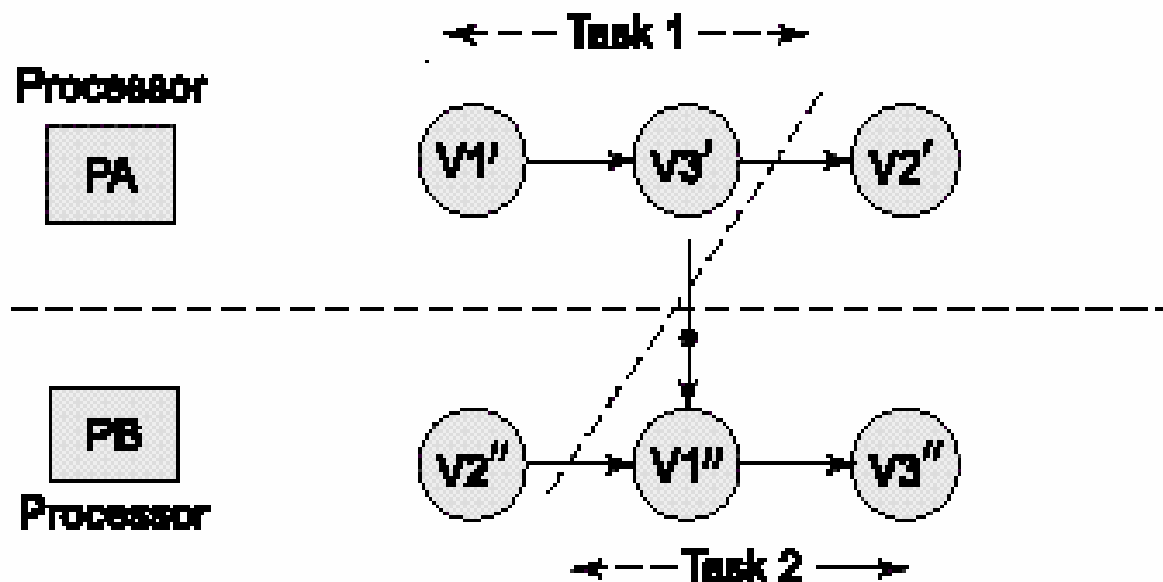
Each task of function Executing on an assigned processor



(V_1', V_2', V_3') and (V_1'', V_2'', V_3'') are different threads of the task 1 and task 2, respectively

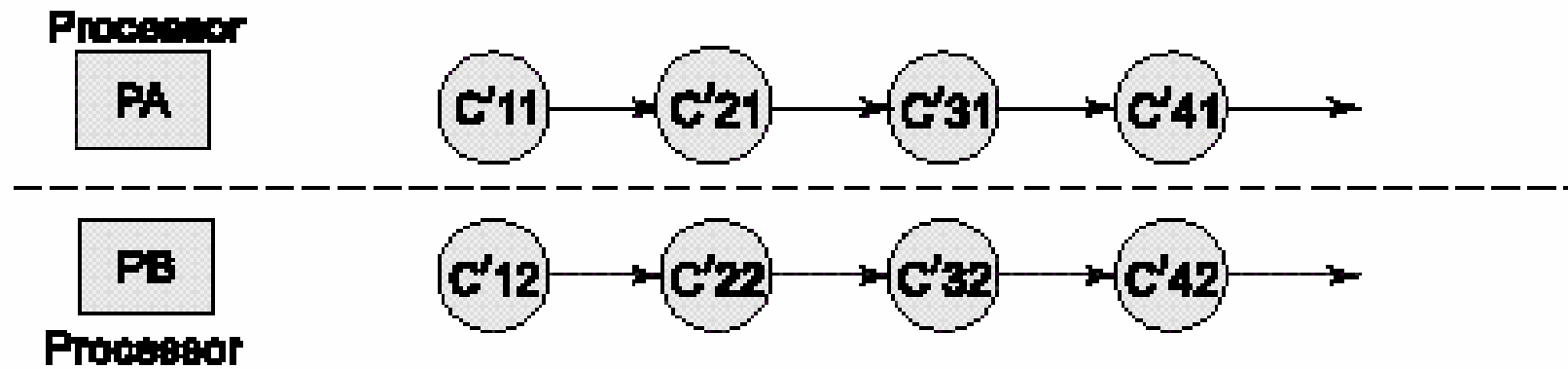
Each task or function executing on the different processors at the different periods

(V_1', V_2', V_3') and (V_1'', V_2'', V_3'') are different threads of the task 1 and task 2, respectively

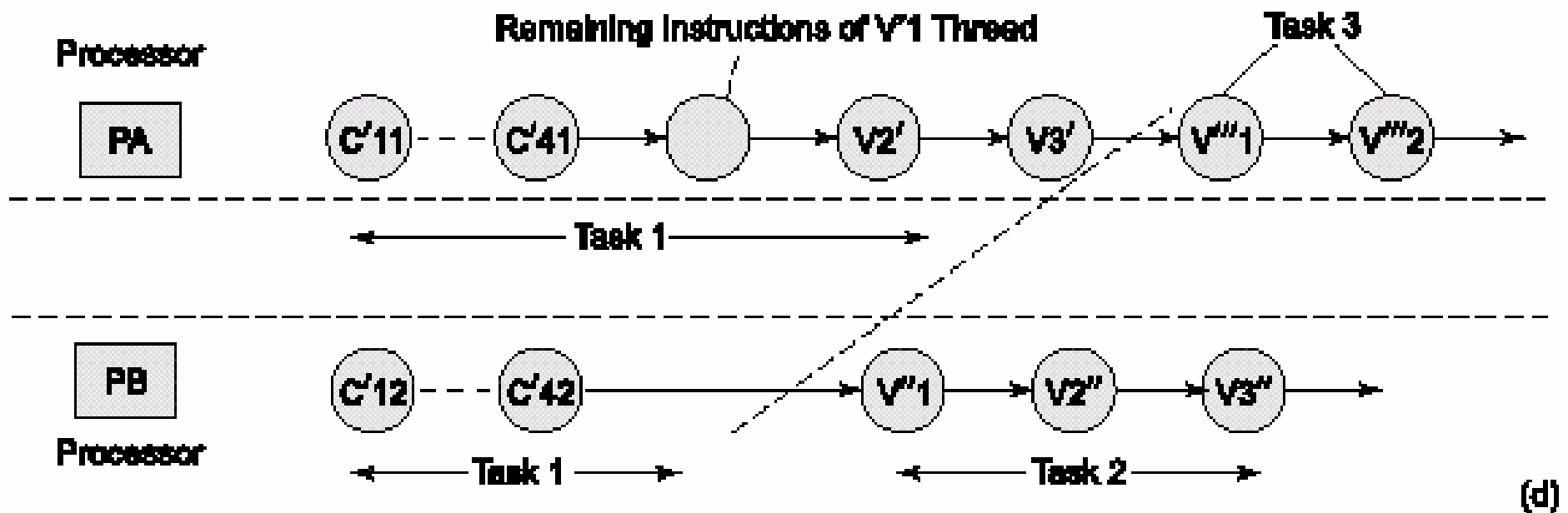


Instructions of Four Different Tasks Partitioned and Scheduled on Two processors

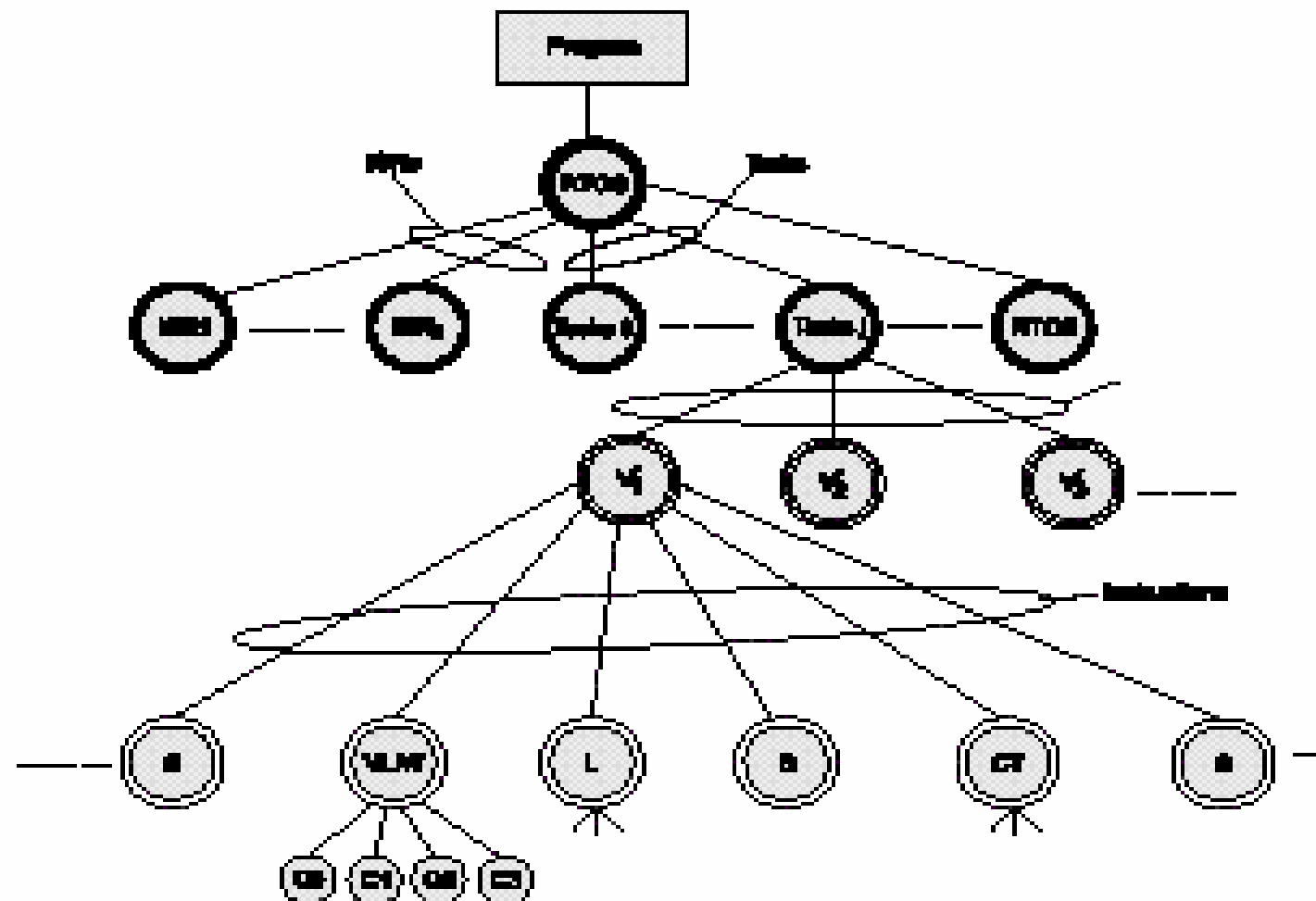
c'_{ij} is an instruction in V'_i to take i th column and j th row element of matrix A and bit with the Corresponding Element in B .



Instructions of Four Different Tasks Partitioned and Scheduled on Two processors differently in different periods



A model for partitioning all the processes running on the processors by HSDFGs and organisation of each vertex hierarchically as a tree of sub-graphs, each vertex having a nested controlling structure like a macro thread or task



P = Preface

L = Loop

VLW = Very Long Instruction Word

CT = Conditional Task

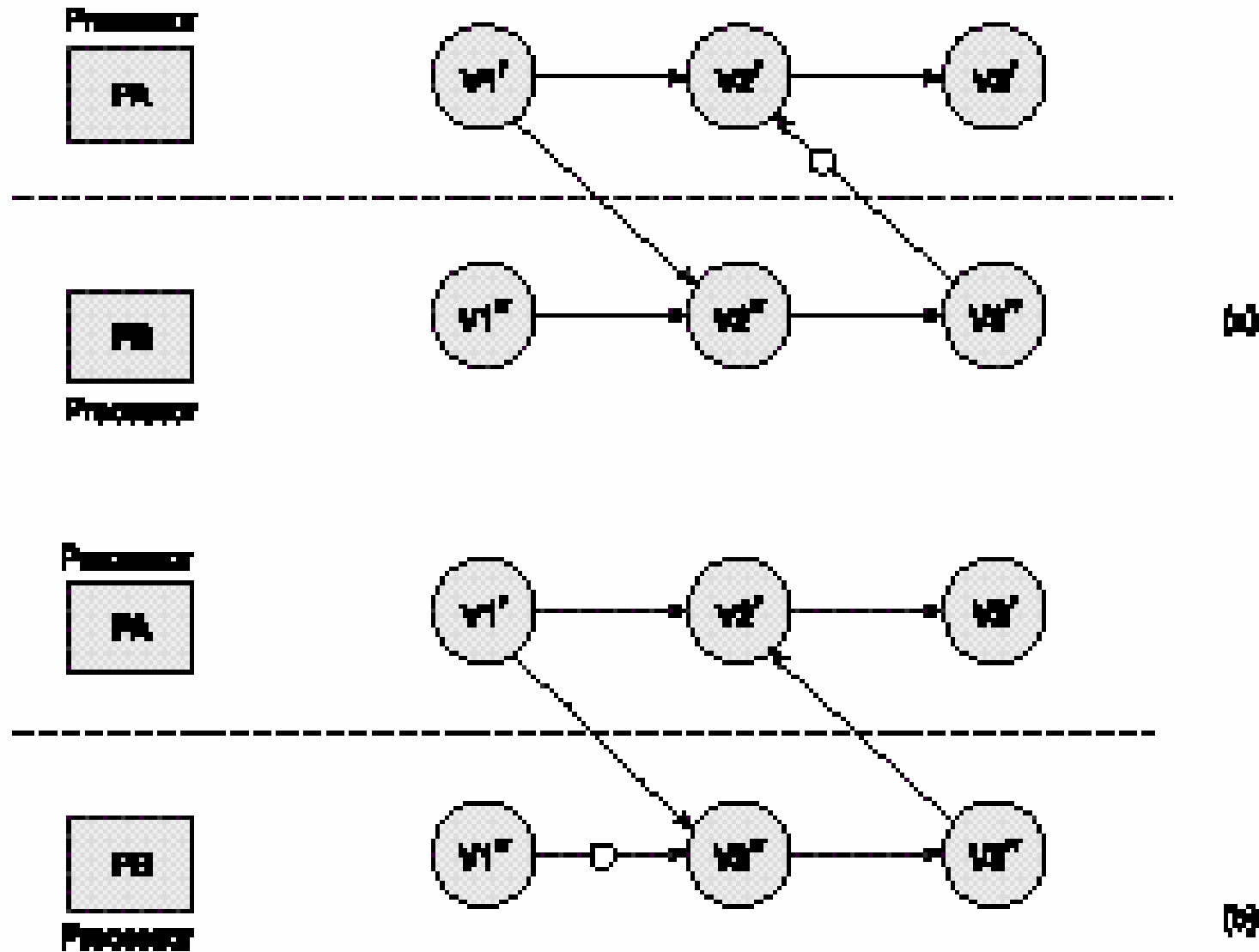
C1, C2 = Instruction Threads Operating on different data of the list.

↑ = Microtask

○ = Single, Double, Triple Circle and Vertical bar = Microtask, Microtask and Thread of a task.

When there are too many IPCs, total performance cost increases. This cost is reduced by appropriate re-synchronisation.

Re-synchronization



Summary

We learnt

- For Multiprocessor systems, use the models are used for partitioning, load balancing, scheduling, synchronisation and resynchronisation during the program flow on the multiple processors. This gives minimum total performance costs (processing delays).

End of Lesson 8 of Chapter 6