# Homework 3

Understanding communications
performance issues using models
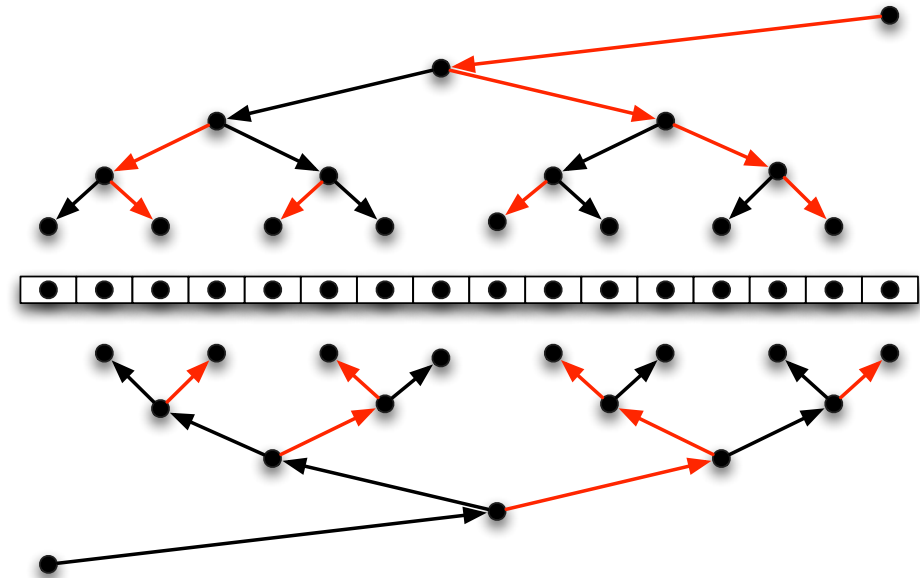
Return by Feb 8 2012

Broadcast

- A broadcast communication is a rooted communication pattern where an instance of a data will be transferred into multiple others data

- Such a communication pattern can be implemented using several communication patterns, each one exhibiting different properties.

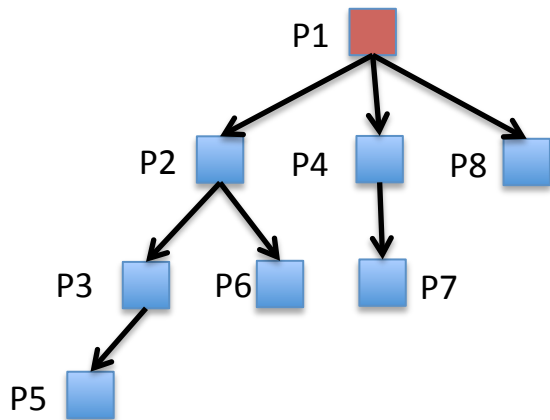- Let's take 3 patterns: a chain, a binomial tree and a two binary tree (depicted on the next page).

P1 ■
P2 ■
P3 ■
P4 ■
→
P1 ■
P2 ■
P3 ■
P4 ■
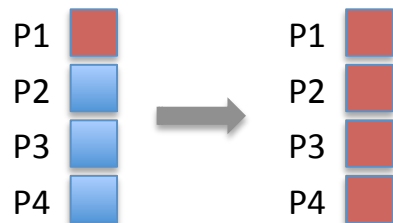
Few collective topologies

Chain

P1 P2 P3 P4

Two binary tree

Binomial tree

P1
P2 P4 P8
P3 P6 P7
P5

Two-tree algorithms for full bandwidth broadcast, reduction and scan
Peter Sandersa, , Jochen Specka, , Jesper Larsson Träff
http://www.sciencedirect.com/science/article/pii/S0167819109000957

- **1: Using the LogP/LogGP model evaluate the cost of a simple broadcast over each of the previous 3 topologies.**
  - Consider a fixed number of participants and two types of message (small and very large*). Order the three topologies based on the performance of the broadcast algorithm
- **2: Consider a pipelined approach to the broadcast operation, where the original message is split in several size-identical fragments, and to broadcast of the fragments is pipelined.**
  - Consider again a fixed number of participants and two types of messages (small and very large*). Order the three topologies based on the performance of the broadcast algorithm.
  - Consider now the case of an intermediate message and vary the number of participants. Answer the previous question again.

* relationship between the number of potential fragments and the number of participants

Extra question

- The reduction operation is somehow the opposite of the broadcast. Originally each participant has a piece of the data, at the end of root will have a composition of the data from all participants.

- There is a major difference compared with the broadcast (in addition to the change of direction of the flow of data), which is the extra operation done at each node.

  – Considering this extra operation, model and evaluate the cost of a reduce call (answer the same questions from the previous slide).