



## 4.3

- Recall: Standard algorithms for all-to-all broadcast on a ring and a hypercube give the following times:
  - $T_{ring}=(t_s+t_w m)(p-1)$  and  $T_{cube}=t_s \log p + t_w m(p-1)$
  - with the assumption that there is no congestion. If  $t_s=100t_w$  we have  $T_{ring}=(100+m)(p-1)t_w$  and  $T_{cube}=(100 \log p + m(p-1))t_w$ .
- On a ring, the standard algorithm gives  $T_a=T_{ring}$  and the hypercube algorithm suffers from congestion (ratio of bisection width= $p/4$ , we take dimension $\geq 2$ ) for all communications except the one that corresponds to the dimension of the ring. We have a correction factor  $f=p(\log p-1)/4 \log p$ . For the hypercube we have  $T_b=fT_{cube}$
- If we look at the ratio  $T_a/T_b$  we see that for large messages the ring algorithm is better and for small messages, *depending on  $p$* , the hypercube algorithm may be better.

$$\frac{T_a}{T_b} = \frac{100(p-1) + m(p-1) * 4}{(100 \log p + m(p-1)) * p}$$