

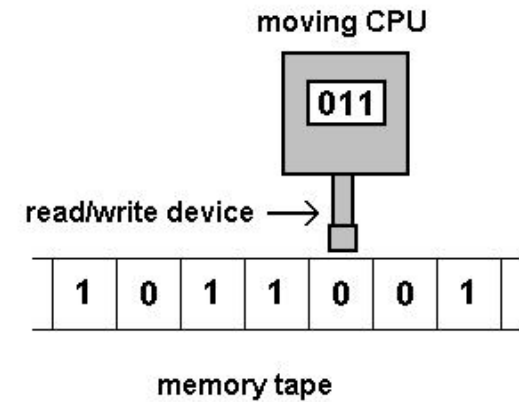
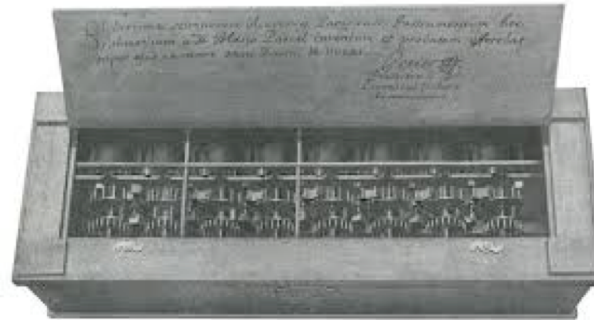
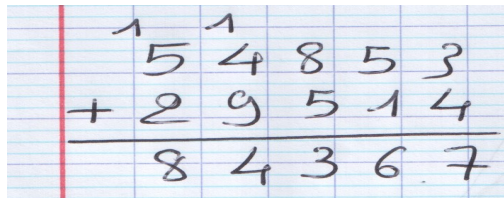
Distributed Computing

R. Guerraoui



The Quest for a Resilient Universal Computer

Universality



Algorithmi

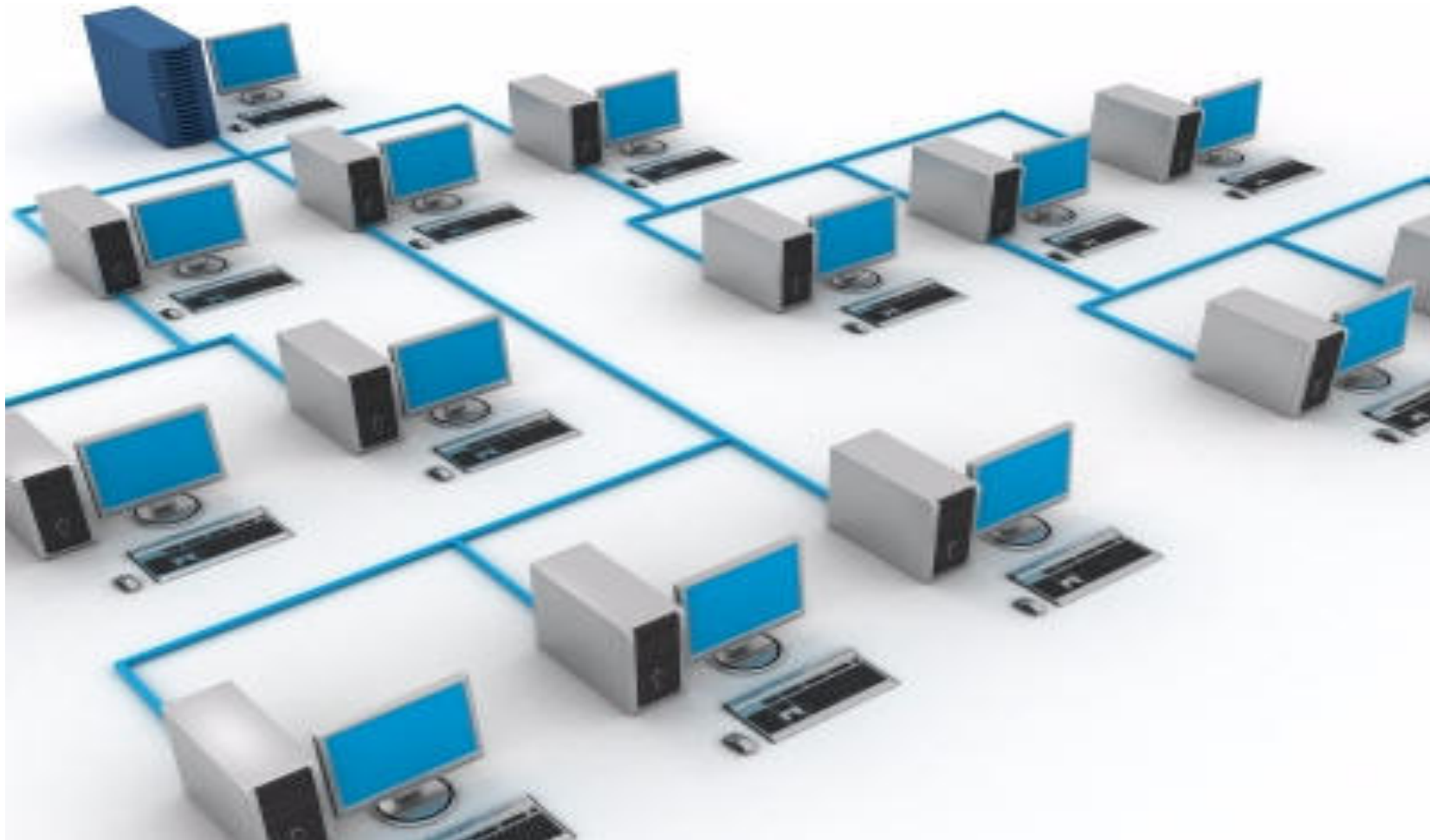


Pascal



Turing

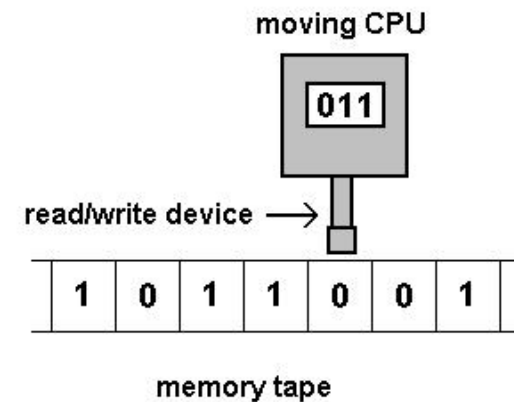
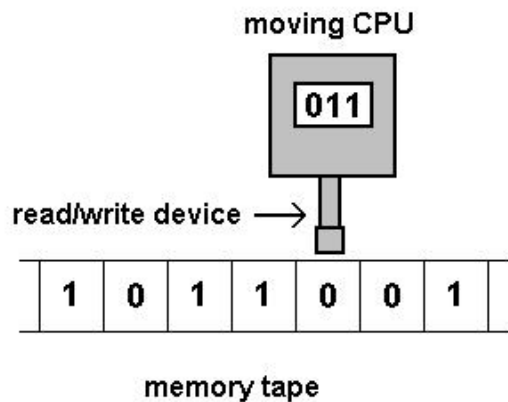
The Quest for a Resilient Universal Computer



Consensus Universality [L78]

Theorem: A network of computers can reliably emulate a universal machine iff they can solve consensus

Consensus



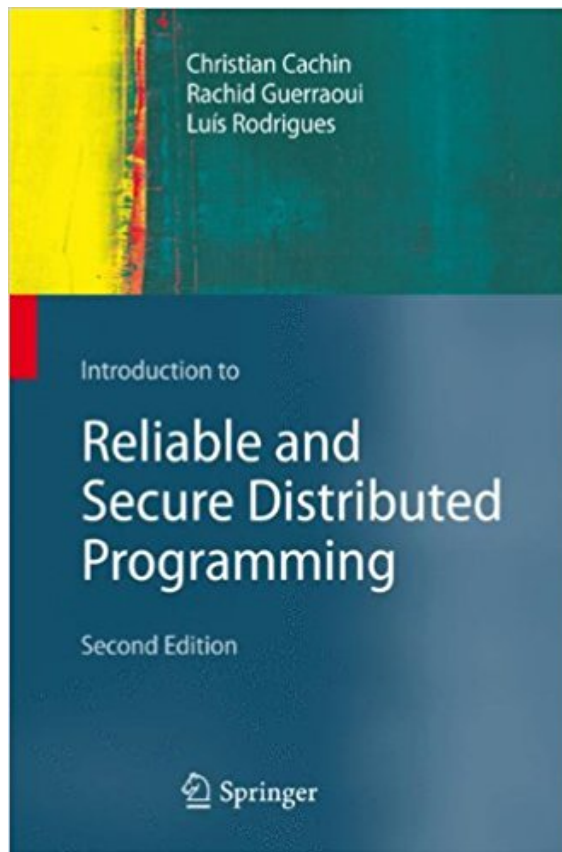
Two Big Questions

☛ **1. When can we solve consensus?**

☛ **Diagnostic of the infrastructure**

☛ **2. When can we circumvent consensus?**

☛ **Diagnostic of the problem**



ALGORITHMS FOR CONCURRENT SYSTEMS

Rachid Guerraoui
Petr Kuznetsov



1.1 RDMA

- Remote shared / protected memory
- Consensus with $2f+1$ and $f+1$ (vs $3f+1$ and $2f+1$) and 2 steps (vs 4 steps) –
- μ : SMR in $1\mu\text{s}$ / 1ms

[PODC, ASPLOS]



1.2 Synchrony

- What is the minimal amount of synchrony needed to solve consensus?
- What is the complexity of consensus given some synchrony

[DISC/PODC, OSDI]

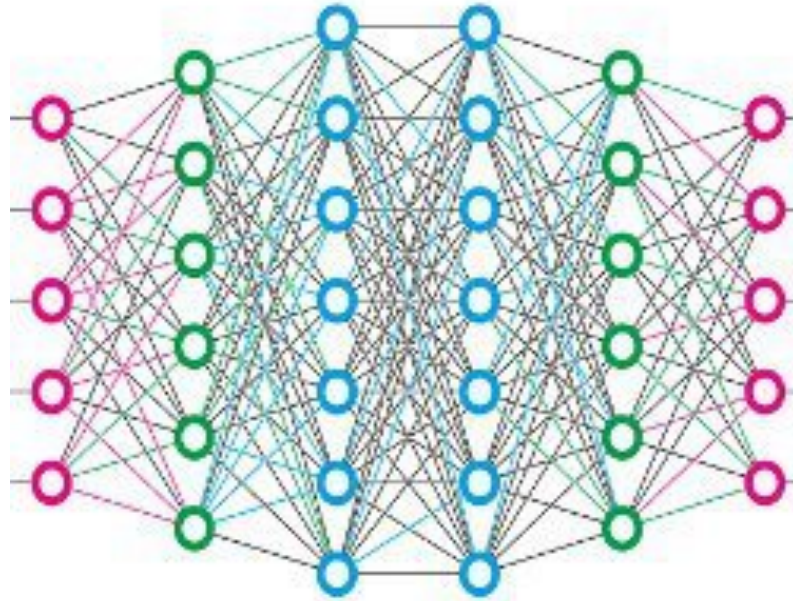
2.1 Does Asset Transfer need Consensus?



X000 implementations

[PODC/DISC, DSN]

2.2 Does Learning need Consensus?



[ICML, NeurIPS, ICLR, AISTATS]