

Karl Perkins

K.A.Perkins@lboro.ac.uk

**Dept. of Computer Studies
Loughborough University**

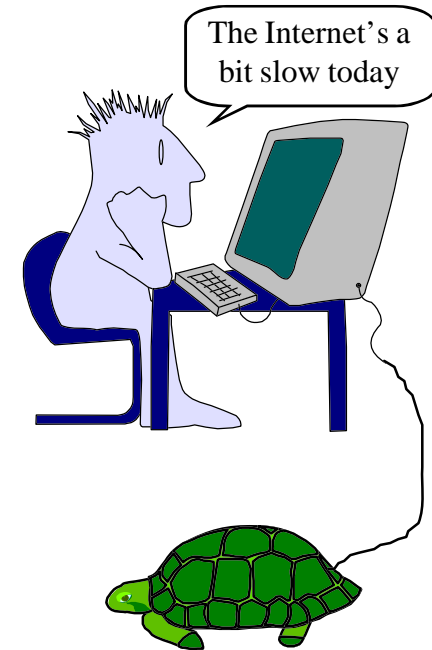
- Ph.D. Research Student
- Thesis Title: “Effective Management of Distributed Computation”
- Supervisor: Dr Colin Machin

Topics of Discussion

- The Internet's problems
- Market Trading, Telephone Systems, Intelligent Transportation Systems (ITS)
- Internet Users' Psychology
- Modeling Networks & Hosts
- Effective distribution schemes on the Internet:
What they should and should not be?

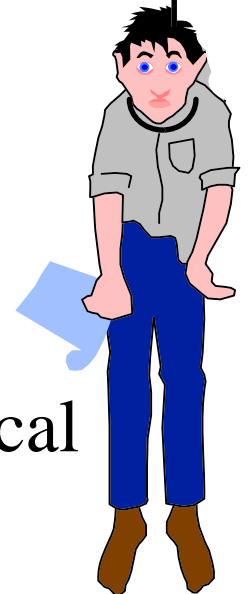
The Internet's problems

- “The Internet is slow and operating below its capacity”
- “It is going to get slower”
- Resources are not used effectively
 - ◆ Distribution is not used effectively
 - ◆ Scheduling can have no effect on average waiting times (*Kleinrock's conservation law*) assuming Poisson arrival procedure



Stock Markets, Telephones & Transportation Systems

- All are known to be chaotic systems when loaded (where solutions are sought)
- Telephones & Stock Markets: Determinism causes undesirable correlated activity (TV phone-ins & automatic trading)
- Transportation Systems: Humans are perceived as the problem
 - ◆ Draconian measures should work (but political suicide)



Internet Users' Psychology

- Evolve successful ideas (WWW) , unsuccessful die away (Gopher)
- Want the net to go faster & smarter
- Care about the performance of the whole, but don't see their own influence upon this (similar to car owners)
- Users' inverted point of view (me, me, me!)
 - ◆ Repeat reload of resources until they get what they want
- Can modeling have the answer?



Modeling Networks & Hosts (1)



- Hosts and Networks modeled using Queuing Theory (M/M/1 & M/M/n)
- Both assume messages/processes arrive and are serviced according to a Poisson distribution
- Measurement has shown on Ethernet that both *internal* and *external* traffic was described better by a self-similar (fractal) model
- Chaos on hosts? Who knows!

Modeling Networks & Hosts (2)

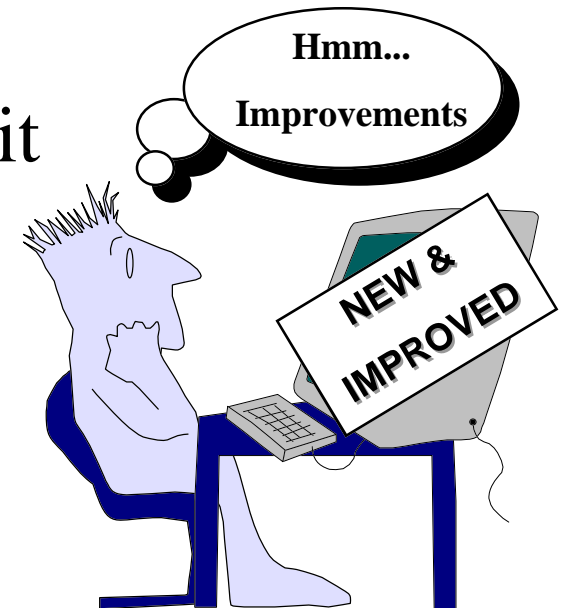
- Deterministic data network models: Chaos due to the underlying protocols and not just the irregularities of service demand
- Unified deterministic model of networks, hosts, messages & processes: ‘Desirable’ non-centralised distribution schemes are often bettered by random distribution schemes
- Do other complex systems have the answer?



Effective distribution schemes

What they should and should not be?

- Intuitive models are incorrect
- Evidence for chaos in many facets (network traffic, evolution of structure, host traffic) We should use it.
- Intuitive non-centralised distribution schemes do not work
- Scheduling might have some benefit
- Draconian measures will not work
 - ◆ Must be perceived improvements to the individual



What This Means

- Effective distribution on the Internet will not spontaneously evolve, it needs a hand
- Users are not to blame, they are the way forward to a solution
- The solution (if one exists) can only be found with better models of the Internet and a better understanding of the users' psychology

Next Steps

- How do we model the Internet?
- What do users expect?
- How can distribution use resources more effectively (*Resource discovery problem*)
- Is scheduling variant to average waiting times? (*Kleinrock's conservation law* might not apply)