COMPUTING SYSTEMS RESEARCH AT NEWCASTLE

Brian Randell

Department of Computing Science
University of Newcastle upon Tyne, UK

May 1999

The Department

- The Department's origins date from 1957
- It currently has an academic faculty of nearly thirty, and a similar number of post-doctoral research associates
- Research is in the main concerned with computer systems - both hardware and software; the style of research ranges from the experimental to the theoretical.
- The Department is one of just five of the approx. 100 CS Departments to receive an "outstanding" grading in each national research grading exercise so far

Main Research Groups

- Dependability
- Distributed Systems
- Parallelism
- Theoretical Computing Science
- VLSI Design

Dependability

- The term dependability subsumes such topics as reliability, availability, safety and security - and the Group has close links with the Distributed Systems Group.
- (In fact the Department coordinates Cabernet, the ESPRIT Network of Excellence whose remit covers both Distributed Systems and Systems Dependability.)
- Dependability research at Newcastle goes back to about 1970, and has been growing ever since, funded by EPSRC, MoD, ESPRIT and industry.
- The majority of the department's dependability-related research now takes place within the Centre for Software Reliability (CSR), and its BAe-sponsored Dependable Computing Systems Centre

Distributed Systems

- The Group undertakes long-term research on the underlying principles of designing and implementing large scale distributed computing systems.
- The group was principal contractor on the ESPRIT Basic Research Project on this topic, BROADCAST, which ran from July 1989 to August 1995
- It now co-ordinates the C3DS ESPRIT Long Term Research Project
- The group works closely with UK IT industry. Currently, research is being funded by EPSRC, GPT, HP, BT, Nortel and BNR
- A spin-off company, Arjuna Solutions Ltd, has just been set up to exploit the group's work

Parallelism

- Primary interests of this group concern
  - languages, tools and algorithms for the efficient utilisation of parallel systems
  - both numerical and non-numerical computation
- The Centre for High Perfomance Computing and Networking has been set up to house:
  - a prototype APP system (13 high performance workstations interconnected by an ATM network)
  - an ICL Goldrush (a parallel database server with 8 dual-processor SPARCs and 120Gbytes of disk storage
- An EPSRC Project is now under way, with Manchester, on Parallel O-O Databases

Theoretical Computing Science

- A major area of research is the theoretical treatment of concurrent distributed systems
- The main work is on Petri net theory and obtaining structural and behaviour compositionality via its integration with process algebra approaches
- (This has been in connection with ESPRIT Basic Research projects, DEMON and CALIBAN, involving 13 European centres of Petri net theory)
- Other research is on semantic models for safety analysis techniques (the COPERNICUS ISAT project) and on formal modelling for secure system components (the ESSI-funded ConForm project)

VLSI Design

- This group works very closely with colleagues in the Department of Electrical and Electronic Engineering, on several EPSRC-funded projects.
- Since developing the STRICT VLSI design system, the group's most recent work has centred on developing methods and software tools for designing asynchronous systems and circuits
- (STRICT - Strongly Typed Recursive Integrated CircuiTs) is a complete high level language VLSI design system.)
- Work in the EPSRC-funded project ASAP has produced models and methods for synthesis and verification of asynchronous circuits based on Petri nets and Signal Transition Graphs.

The European Dimension

- The Department directs the Cabernet Network of Excellence on Distributed Computing System Architectures
- It also leads the DeVa (recently completed), C3DS, and ISAT projects, the ESSI ENCRESS network of technology transfer clubs.
- The Department has in fact, since first becoming involved with ESPRIT in 1989, achieved an exceptional success rate, of over 65%, in bids for European-funded research projects.
- We have been closely involved in planning the European Dependability Initiative, and EU/US collaboration on dependability

In Summary

- The range of computing science research topics at Newcastle is wide but, continuing a tradition of many years, the main emphasis is on “systems” research, covering both hardware and software topics.
- Our aim has been to identify topics of broad and continuing applicability, avoiding the traps of working on topics which relate to only a narrow area of application, or which do not take adequate cognizance of the continuing rapid developments in electronic component technology.
- In practice, funding successes (and failures) influence our detailed program of work - but not, as far as it can be avoided, our overall aims and research style