Speckled Computing

Speckled Computing- A half-term Report

D.K. Arvind
Research Consortium in Speckled Computing
School of Informatics, University of Edinburgh
(dka@inf.ed.ac.uk)

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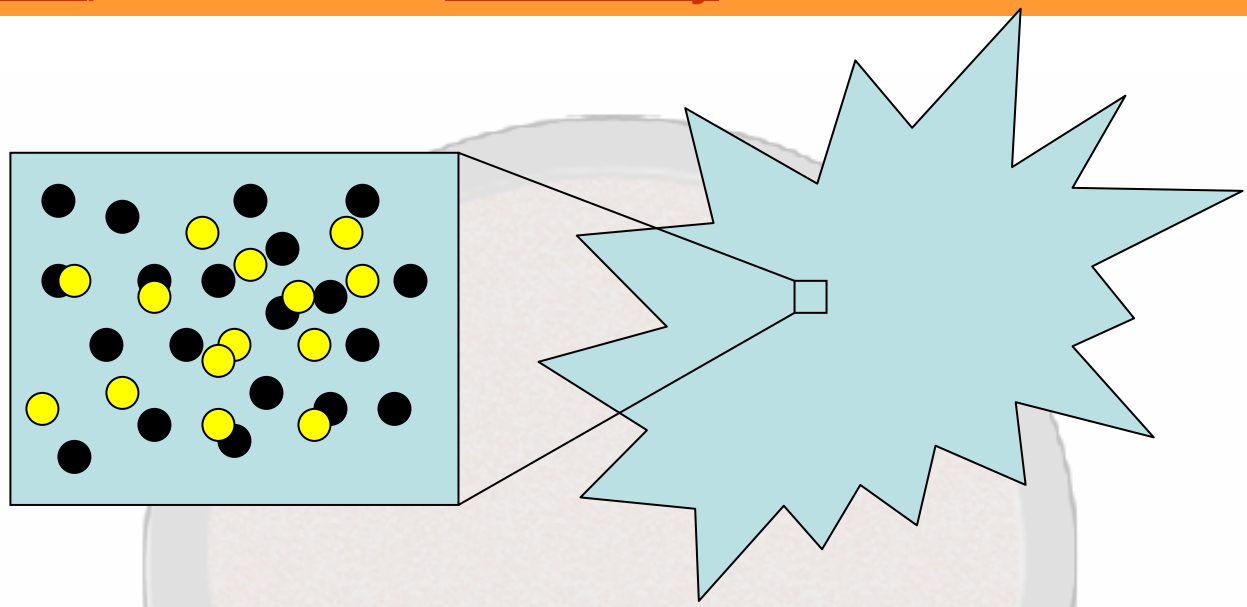
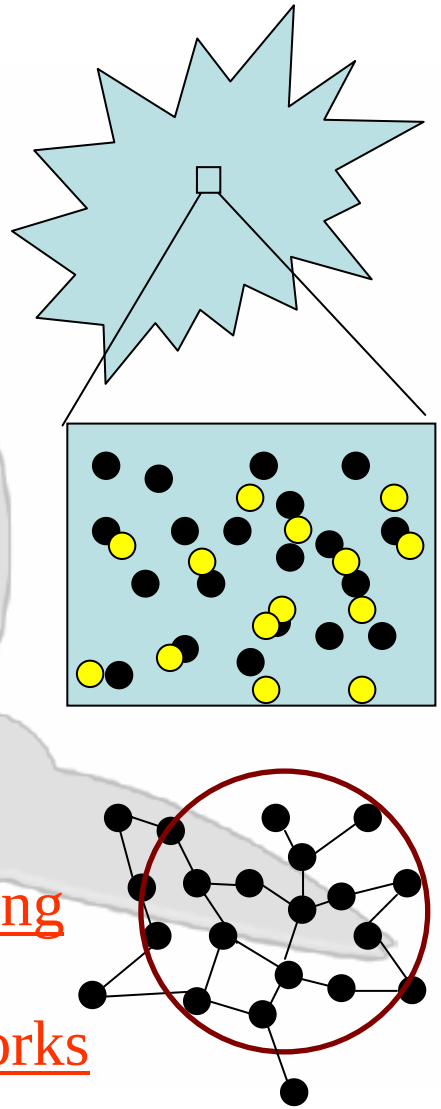
"To realise programmable semiconductor specks which can sense, compute, and network wirelessly."



- Specks communicate wirelessly over a few cms
- Size of a matchstick head (5X5X5mm) with limited power
- Specks bought by the weight: yellow specks - temperature sensor,
  black specks - pressure sensor
- Specks are assumed to be non-static and unreliable

Specknets and Speckled Computing

- Thousands of specks collaborate as dense programmable network – Specknet
- Sensory data processed collaboratively, and information extracted *in situ* – fine-grained distributed computation
- Encapsulation of sensing, processing and wireless networking in a single chip

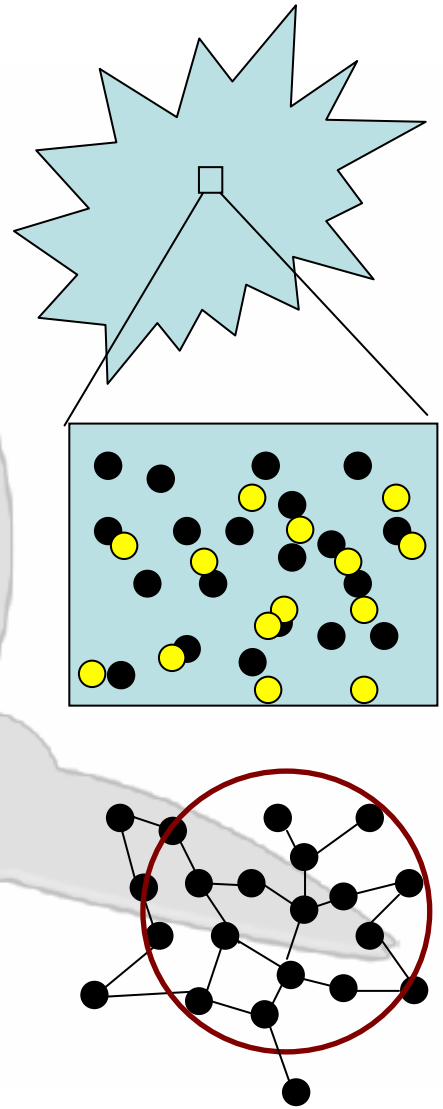


Enabler technology for truly ubiquitous computing

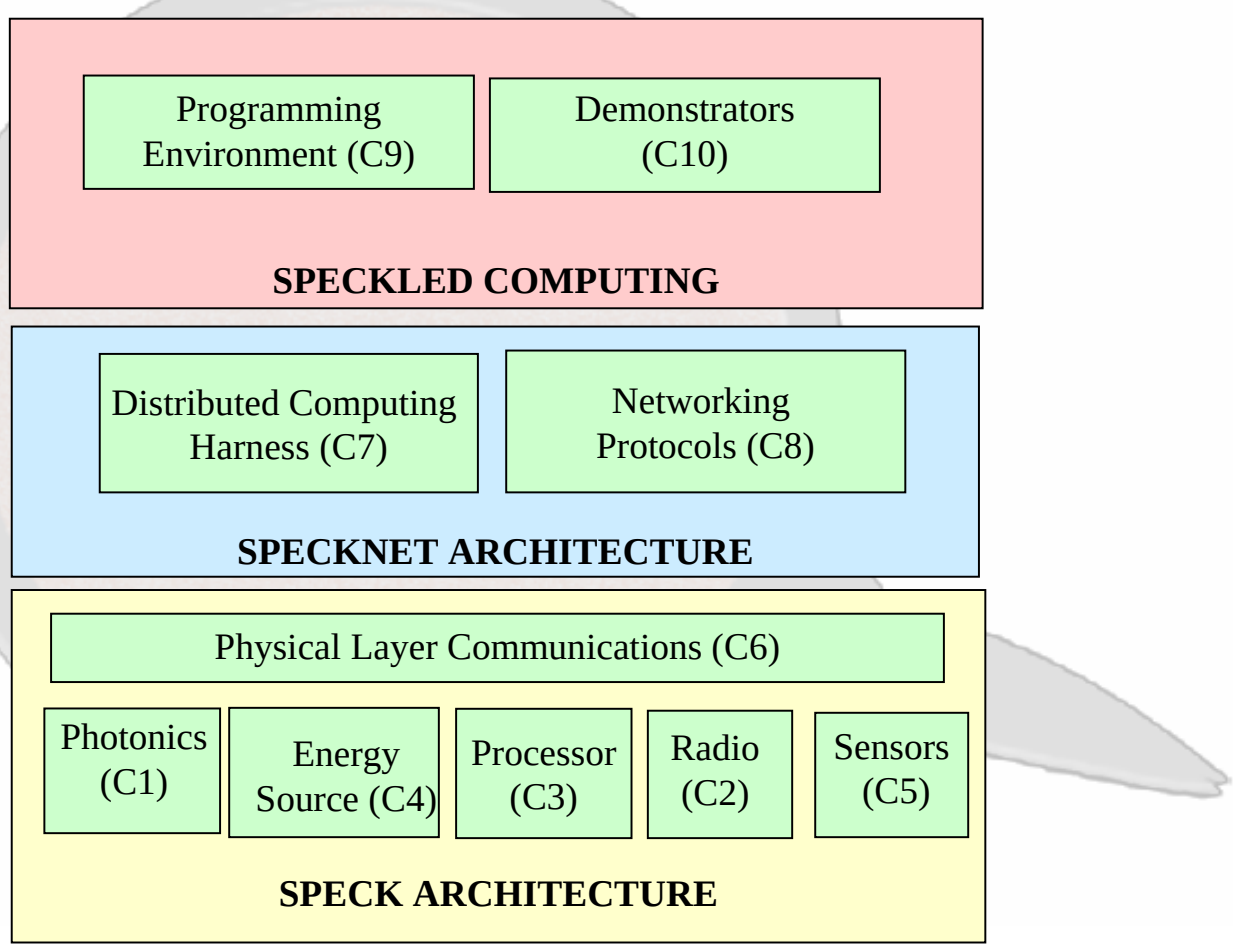
Speckled Computing looks beyond sensor networks

Specknets - Looking Beyond Traditional Sensor Networks

- Program-centric (specknets) v/s data-centric (sensor networks)
- Sparse (sensor networks) v/s Dense networks (specknets) – short range comms
- Mobility model – nodes in sensor networks are static. In contrast, specks are mobile
- Data transfer model – Source nodes transfer to sink nodes (sensor networks) v/s peer-to-peer model in specknets
- Control model - Decentralised, leaderless



Collaborative Technology Push



Research Topics

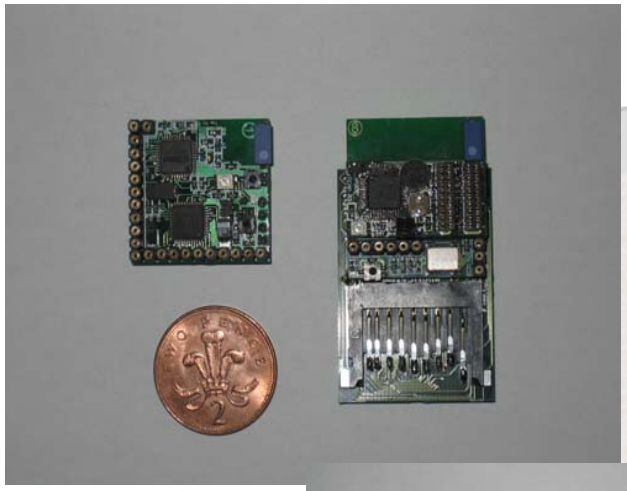
- Speck Architecture and System Level Integration
- Energy source: battery, renewable sources
- Resource-constrained network services for hubless, transient network of specks
- Programming environments for specknets
- Decentralised leaderless distributed algorithms for clustering, location determination, motion tracking
- HCI Issues and Applications development

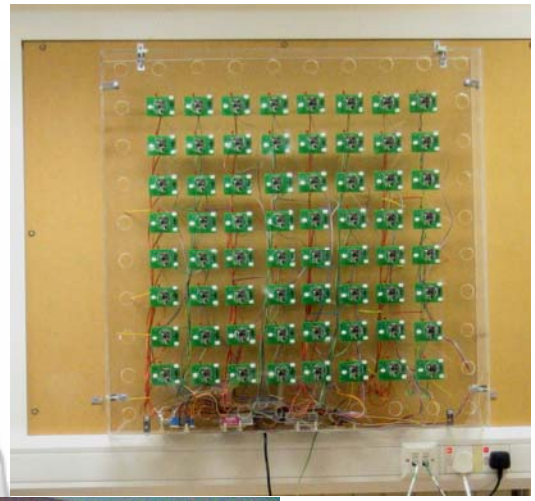
Speck Architecture and Integration

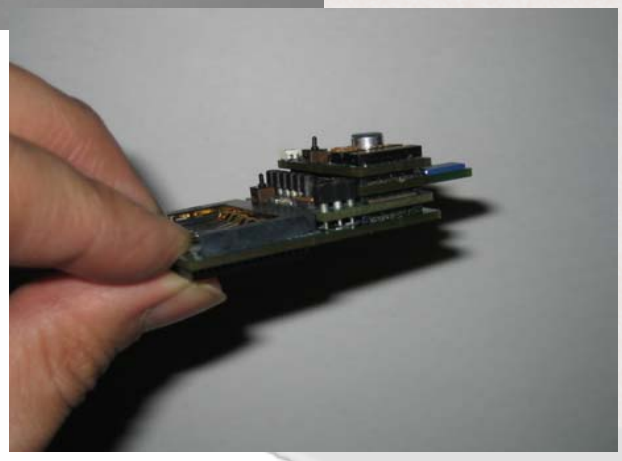
- Speck prototypes using OTS components
  - Prospeckz II
  - Prospeckz III
  - Perspeckz64
  - 5CubeOTS
  - Optical triangulation using ProspeckzII with dome of LEDs
- Bespoke 5Cube Design
  - Low power digital transceivers
  - ASIC design currently in fabrication
  - Prototype Radio Xceiver in III-V
  - Antenna design and characterisation
  - 5X5 MMIC transceiver
  - Liquid Crystal Optical Beam steering for VCSEL array

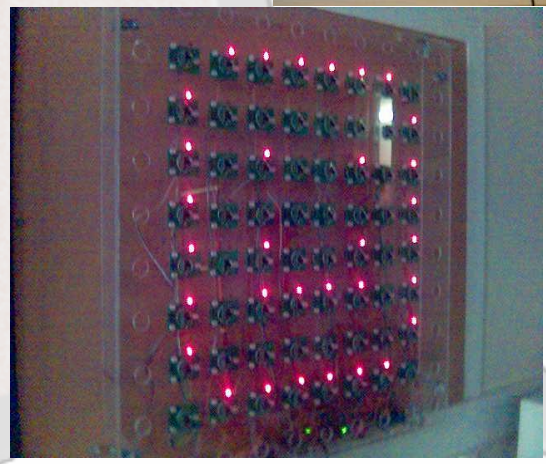
Prospeckz II/III

Perspeckz64









Specknet: Tangible Interfaces for Digital Media

- Everyday objects are applied with specks or *speckled*
- Objects sensitised *post hoc* both as computational resources and as props for interactions with the computational resources
- Pre-school education
  - Speckled toys, props and playmats
- Smart spaces in galleries and supermarkets

Funding Situation

- SHEFC grant – 2003-07 £ 1.3Million
  - 6 RAs, 13 PhD students
- EPSRC Basic Technology grant 2005 – 09 £3.8Million
  - 9 RAs, 4 Phd students, 6 support staff
- Proposal to European Framework Programme

Conclusions

- A unique, multidisciplinary consortium of computer scientists, electronic engineers, electro-chemists and physicists to provide an integrated technology push
- Guaranteed funding until 2010 – stable collaboration partner
- Seeking partners with applications to collaborate on demonstrator projects

Contact dka@inf.ed.ac.uk for more information