Design Vision

Update on common vision for microelectronics design

- Andrew Brown
  - University of Southampton
- Steve Furber
  - University of Manchester
- Roger Woods
  - Queen's University Belfast

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Chronology

- 5/2002 DesignCentre
  - (Southampton, Manchester, Imperial, Sheffield)
- 11/2002 Wade report
  - (Specialist advisor: Steve Furber)
- 8/2004 Gang of Two
  - (Southampton, Imperial)
- 11/2004 EPSRC/UKpsc
  - (Southampton, Manchester, EPSRC, NMI)
- 11/2004 IEE meeting
  - (Steve Furber)
- 11/2004 IEE SoC meeting
  - (Bashir Al-Hashimi, Roger Woods)
- 2/2005 Design Vision meeting
  - (Royal Acad Eng)
- 2/2005 EPSRC Interconnections meeting
- 7/2005 EPSRC Network grant
  - (Andrew Brown, Steve Furber, Roger Woods)

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...and a lot more meetings later...

So far, we have

- µGC1: Batteries not included
- µGC2: Silicon meets life
- µGC3: Moore for less
- µGC4: Building brains

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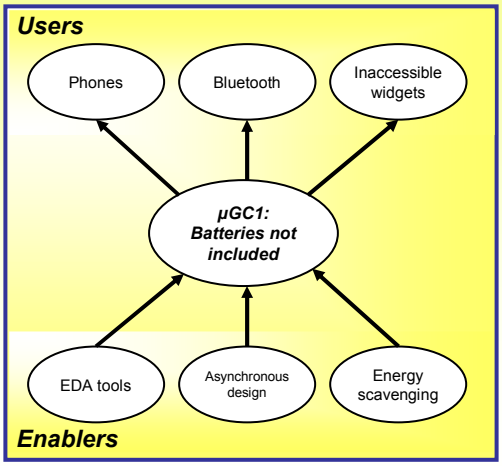
µGC1: Batteries not included



Minimising energy

Inaccessible widgets:

- Strain sensors inside concrete structures
- Pressure sensors inside tyres
- Crack detectors inside turbine blades

Enablers

- New EDA synthesis design optimisers
- Asynchronous design:- intrinsically lower rms power
- Energy scavenging:

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µGC1: Update

- "Next generation energy harvesting electronic systems", EPSRC Large Grant proposal (Southampton, Imperial, Bristol, and Newcastle) submitted via responsive mode in Nov.07.
  - 4 reviews, late March 08.
  - Invited by EPSRC for interview (22nd April).
- Dec. 07 meeting in Southampton to discuss a proposal addressing the impact of process variations on power and performance through system level approach*.
  - Imperial, Bristol, Manchester, and Newcastle.
  - Led by Newcastle, aim to submit proposal late summer 08

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µGC1:Update

- EKTN work shop planned on 16th July 08 in Southampton to interact with companies on Grand Challenges
  - Imperial, Queen's Belfast, Newcastle, Southampton, and Glasgow agreed to present
  - Waiting to hear from Edinburgh and Manchester
  - Others?

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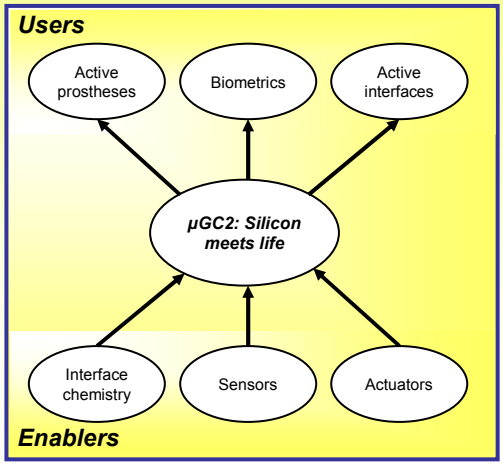
µGC2: Silicon meets life



Interface electronics to biology

Users include:

- Active prostheses
- Biometrics
- Active interfaces

Enablers

- Interface chemistry
- Sensors:
  - Chemical, electronic...
  - Sensitivity vectors
  - Reversibility/Reproducibility
- Actuators
  - Efficiency/Waste disposal

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µGC2: Update

- First uGC2 meeting (Manchester, 14/03/07)
  - Short presentations by P. Dudek, A. Brown, A.Allen & S.Roy.
  - Focused on clarifying the definition of the challenge, its scope and research themes - clearly multi-disciplinary
  - Concerns regarding the public understanding and perception of the topic were also raised.
  - New collaborative foothill projects formed basis of Grand Challenges brochure.
  - Discussions between Glasgow, Manchester, Stirling and Imperial, led to the development of a new research proposal on ion-sensing technology for neural and cellular interfacing
- Attendees: P.Dudek, S.Carey, P.Hicks, G.Chester, L.Smith, D. Cumming, C.Millar, K.Maharatna, A.Brown, P.Degenaar, Il Song Han, J. Nunez-Yanez, E.Regan, F. Claeyssens

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µGC2: Update

- Second uGC2 meeting (Manchester, 19/10/07)
  - Focused on activities of the “Silicon meets Life” challenge
  - Presentations by I.Philips and B.Adamson presented industry/KTN’s ideas respectively, for supporting the challenge,.
  - Research activities and foothill projects.
    - Research projects already under way (B.Adamson, C.Walti, G.Chester, P.Degenaar)
    - Summary of open research questions (L.Smith),
    - Outline of a new collaborative project proposal that originated from the uGC2 group (D.Cumming).
    - R.Petersen presented the topic of in-vivo neural recordings and interfacing to brain cells from a neuroscientists point of view.
  - Attendees: P. Dudek, S. Carey, R. Petersen, G. Chester, L. Smith, D. Cumming, C. Bouganis, P. Degenaar, C. Walti, X. Guo, D. Dearing, B. Adamson, I. Philips.

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µGC2: Update

- **Further meetings**
  - Manchester, 19/01/07 (K.Maharatna, G.Chester, C.Bouganis, S.Carey, P.Dudek). The scope of the challenge and research project were discussed. Bad weather hampered attendance.
  - Glasgow, 16/05/07 (David Cumming, Leslie Smith, Patrick Degenaar, Piotr Dudek). This was the working meeting of the Ionophysiology proposal group. Grant proposal was discussed.
  - EKTN meeting planned!

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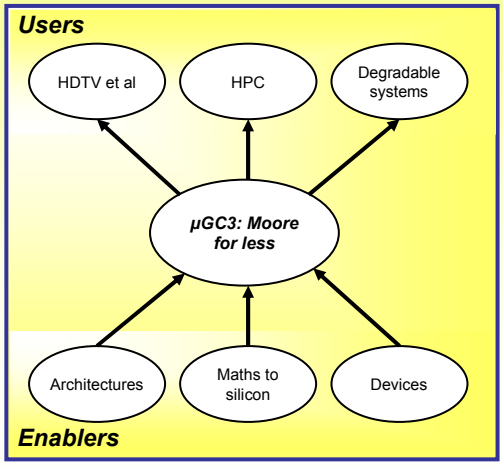
µGC3: Moore for less



Performance driven design for next generation chip technology

- HDTV:
- High performance Computing
- Degradable systems

Enablers

- Architectures: massively multithreaded computation engines
- Maths to silicon: huge spectrum of different EDA tools
- Devices:

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µGC3: Update

- Two meetings were held at Cambridge (Jan, Oct 2007)
- First meeting involved:
  - Reviewing uGC3 objectives and foothill projects generated from the September Loughborough Uni. meeting.
  - Prior to meeting - generation of potential research challenges/think about possible project outlines.
  - Identified key research areas, possible research projects, flagship projects, expertise and some ideas for collaboration.
  - Peter Cheung, Oswaldo Caderas, Sakir Sezer,Graham Megson, George Constantinedes, Gianluca Tempesti, Peter Sedcole, Alex Bestrov, Vassilios Chouliaras, Ian Watson, Peter Wilson, Simon Moore

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µGC3: Update

- Second meeting focussed on identifying consortia/ underpinning technological projects Thoughts:
  - High performance FPGA farm - potentially significant project to raise the capability of UK Universities in global research?
  - 3 specific research areas identified:
    - Synthesis for nano CMOS (Southampton/Reading to lead)
    - Reliable Technology on Unreliable Platforms (Southampton/York/Glasgow/Surrey/Bristol)
    - Delivering Moore's law though parallel computer architecture (Cambridge/Manchester/Imperial)
- Each consortium to develop an EPSRC Proposal - theme (2) has draft proposal and plan and looks to finalise submission to EPSRC in 2008.

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µGC3: Update

- Other smaller consortia and proposals proposed.
- 2nd meeting attendees: Andrew Brown, Andy Tyrrell, Aris Efthymiou, Cade Wells, Campbell Millar, Chris Bailey, George Constantinides, Gianluca Tempesti, Graham Magson, Ian Watson, Marcelo Cintra, Mark Zwolinski, Mike Freeman, Peter Wilson, Robert Mullins, Simon Davidson, Simon Moore, Tanya Vladimirova, Taskin Kocak.
- Cambridge hosting a meeting 30th Sept for EKTN Speakers include: Marcelo Cintra (Edinburgh), George Constantinides, Ian Watson (Manchester), Krsztian Flautner (director of research at ARM), Simon Moore.

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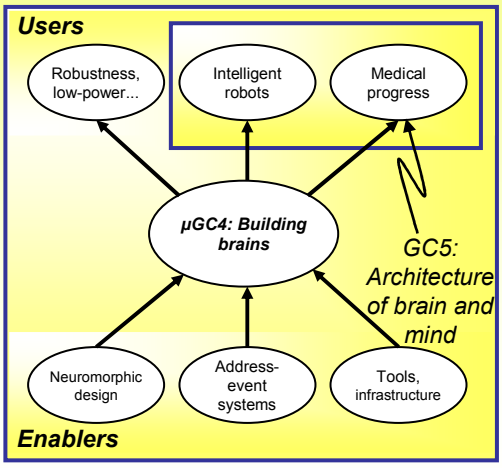
µGC4: Building brains



- Massive hardware acceleration of biological-inspired design
  - Robustness:
  - Intelligent robots:
    - Emergent behaviour
  - Medical progress

Enablers

- Neuromorphic design
- Address-event systems
- All aspects of electronic design
  - Tools

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µGC4: Update

- First uGC4 EPSRC grant EP/F033516/1 "**Modular Neural Simulation with Reconfigurable Hardware**" M Shanahan (PI), W Luk (Co-I)
- Steve Hall organising a Neural Hardware Workshop in Edinburgh on 19 Sept. http://essderc.iop.org/workshops.html

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Concluding remarks

- Presentation highlights the considerable activity across the community in developing, scoping challenges and targeting future proposals.
- Strong community ethos with challenge to target multi-disciplinary approach (except for uGC2 and probably uGC4)
- Major effort to link with EKTN (see March meeting!)
- Hard to keep up with progress - clear need to document this