

# Systems Research Group

Richard Mortier

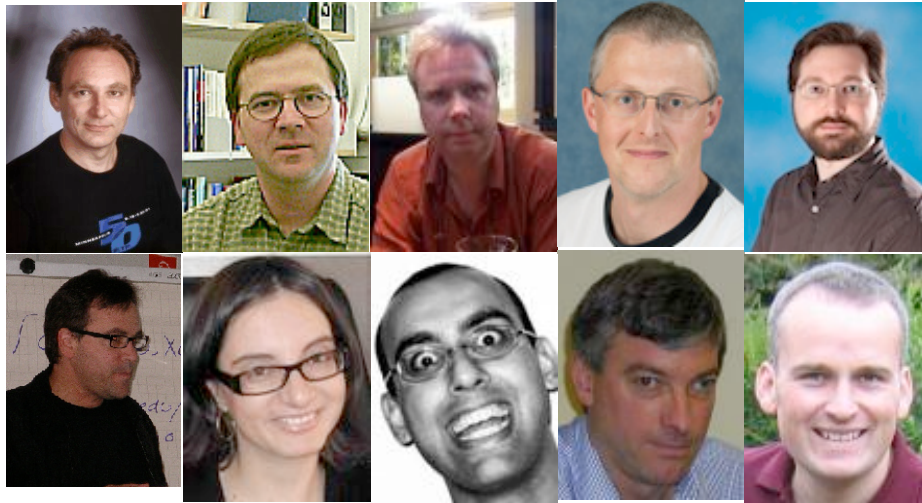
Networks & Operating Systems  
SRG, Computer Laboratory

# Welcome!

- I'm **Richard Mortier** of the **Systems Research Group (SRG)**
- We are legion
  - Well, quite big (10 Academics, 7 Researchers, 16+ PhD Students ... )
- We build better useful stuff
  - Strong focus on **building concrete artefacts** to **evaluate** in a **realistic environment**, and (hopefully!) **transition to deployment**
- We cover a lot of bases:
  - Networks, Operating Systems, Distributed Systems, Programming Languages, Databases, Modelling, Security, Hardware.
  - Significant industrial funding from Google, Microsoft, Facebook, ARM, Qualcomm, Samsung, Xilinx, British Telecom, etc...
  - Work with DTG, Security, Architecture, Theory, Programming Languages, ...

# Who Are We?

<http://www.cl.cam.ac.uk/research/srg/netos/people/>



Amir Chaudhry

Sarfraz Nawaz

Liang Wang

Noa Zilberman



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Thomas Gazagnas

Dimosthenis Pe

Eiko Yoneki

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Neelakandan  
Manihatty  
Bojan



Aisha  
El-Safty



Heidi  
Howard



Desi Hristova



Sheharbano  
Khattak



David Miller



Toby  
Moncaster



Myoung Jin  
Nam



Karthik  
Nilakant



Diana  
Andreea  
Popescu



Michael  
Schaarschmidt



Malte  
Schwarzkopf



Zafar Gilani



Malcolm  
Scott

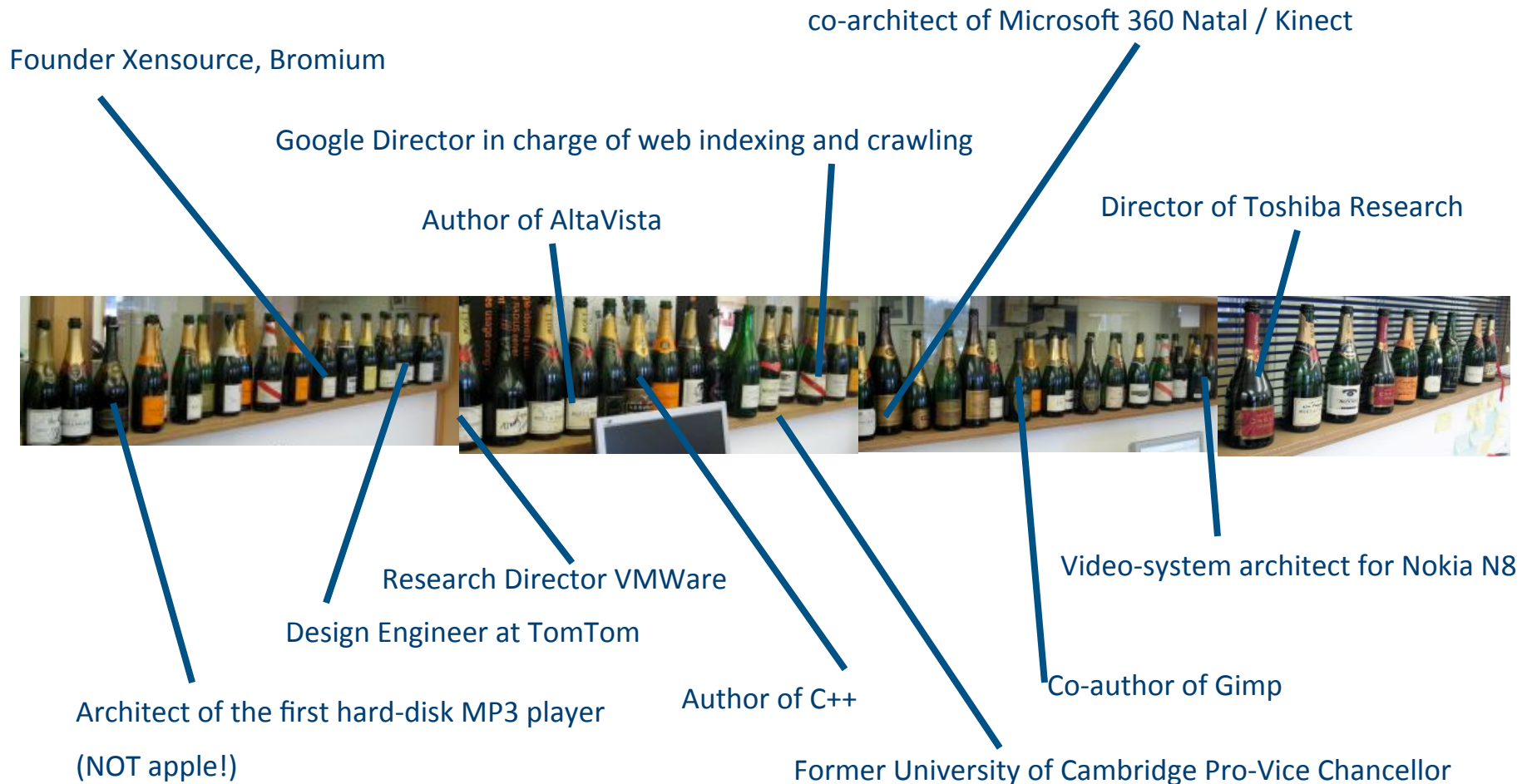


Bjoern A.  
Zeeb



Jingyun  
Zhang

# What Have We Done?



# Where Have We Gone?

...the ONLY qualification that guarantees a job here is a good systems PhD from Cambridge...

(Director of a **research** lab in Palo Alto)

You will find SRG PhDs in  
Microsoft, Google, Intel, Sun, AT&T, IBM,...  
AND founding a lot of other places too....

**Citrix Acquiring XenSource for \$500 Million**

August 15, 2007

**Globespan to buy Virata for \$1.3 billion to create  
DSL-chip powerhouse**

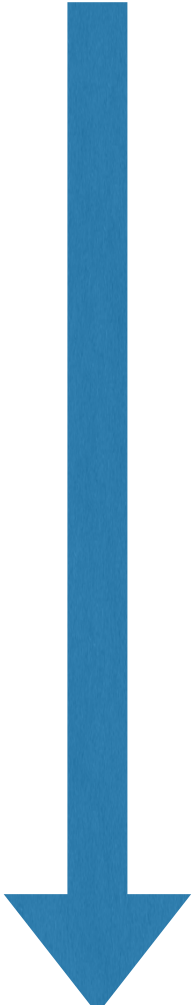
January 10, 2001

# Example: Xen Hypervisor



- Core technology that enables the cloud
  - Xen hypervisor fakes virtual computers on top of a real one
  - Developed in the SRG from 2002, commercialised 2005—2009, still actively worked on via open source (<http://www.xen.org>)
- Xen powers over >1 million physical servers and 100s of millions of virtual machines in worldwide cloud providers (Amazon, Rackspace, Oracle)
  - PhD students worked on specific parts of the original system, and used it as a base for their own research ideas
  - Acquired 2009 by Citrix for \$500M

# A Selection of SRG Projects



Area	Program
Hardware	INTERNET
Theory	Resilient Clouds (MRC)
Languages	REMS
Embedded	CADETS
	OCaml Labs
	Horizon
Privacy	Networks-as-a-Service
	User Centric Networking
Mobile	EmotionSense
Datacenter	Cloud Law
	Data Centric Systems
Legal	CHERI

# Getting Into the PhD Programme

- Two key steps to becoming a PhD candidate:
  - Getting an offer of admission
  - Finding funding for the **entire** program
- Getting an offer:
  - **Talk to other PhD students and faculty**
  - Your proposal doesn't map out all 3 years, but it needs to demonstrate the elements of research
  - Basing a research proposal on existing group projects can help, **but isn't necessary**



# Getting Funding

- Limited, highly competitive source of central funds
- You can self-fund, but this is expensive and you need to show evidence for all 3 years
- **Talk to faculty** about ongoing research projects
  - Be wary of constrained funding...  
...but sometimes it can't be helped

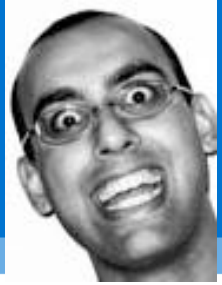
# Jon Crowcroft



## *Stuff*

- Hub of All Things: personal data business models  
<http://hubofallthings.org/>
- Cloud Legal: <http://www.claw-workshop.org/>
- Internet Science: <http://www.internet-science.eu/>
- Liquid Networking: <http://trilogy2.it.uc3m.es/>
- Energy Aware Networking:  
<http://www.internet-project.org.uk/>

# Anil Madhavapeddy [ sabbatical ]



## *Programming languages meets operating systems*

- OCaml Labs: <http://ocaml.io>
  - Real World Functional Programming
  - Maintaining the core OCaml compiler toolchain and ecosystem
  - Buildsystem tooling, Ctypes
- Unikernels
  - Mirage: Type-safe unikernel OS <https://mirage.io/>
  - Irmin: Branch-consistent git-like database library <http://github.com/mirage/irmin>
  - nqsb-TLS, Jitsu
- OPAM
  - Large scale package management and solving <http://opam.ocaml.org>
  - jsOPAM for web applications, Windows port

# Cecilia Mascolo



## *All aspects of mobile systems*

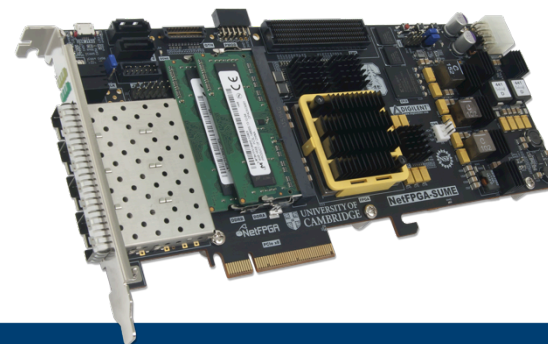
- Mobility Modelling with Data
  - Prediction models, complex network models, recommender systems
- Sensor Systems
  - Continuous sensing, new sensing modalities, sensing applications on wearables and phones
- Applications to health and behaviour monitoring generally

# Andrew Moore



## *Network software meets network hardware*

- One language for all network hardware, firmware, and software [www.naas-project.org](http://www.naas-project.org)
- Open Hardware and 100Gb/s Research Reality [www.netfpga.org](http://www.netfpga.org)
- Useful Measurements: Merging Cause and Effect [www.metrics-itn.eu](http://www.metrics-itn.eu)
- Datacenter heal thine self: Emulating 1 million machines <http://selena-project.github.io>
- SSICLOPS: secure (fast) clouds for everyone [www.ssiclops.net](http://www.ssiclops.net)
- ENDEAVOUR: exploring Software Defined Networking for Internet-wide switches

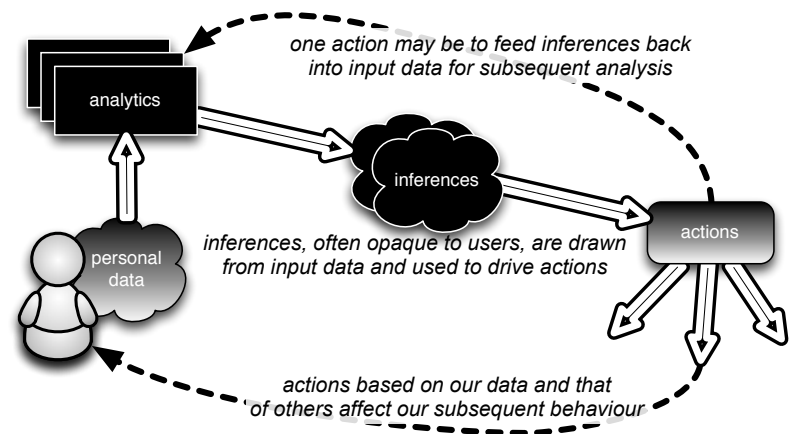


# Richard Mortier



## *Intersecting systems with HCI to make things better*

- **Homework** redesigned home network technologies  
<http://homenetworks.ac.uk>
- **User-Centric Networking** is rebuilding network technologies  
<http://usercentricnetworking.eu>
- **Human-Data Interaction** seeks to use these developments to put people at the centre of our data-driven world  
<http://hdiresearch.org>



# Robert Watson



## *OSs, ISAs, and program analysis/transformation for security, performance, and sometimes (pragmatic) correctness*

- Capsicum: POSIX + the capability-system ideal
  - POSIX + microkernels/capability systems → support application sandboxing
  - Started as FreeBSD sandboxing technology; Google has ported to Linux
- Network- and storage-stack specialisation for performance
  - Clean-slate network-stack and storage designs for performance
  - Microarchitecturally aware optimisation; 60+Gbps before we ran out of PCI buses
- CHERI: Revisiting RISC for the age of risk
  - Processor ISAs for security: fine-grained memory safety, compartmentalisation
  - FPGA prototypes / tech transition: time for systems software researchers!
- CADETS: DARPA new-start project on security via distributed tracing
  - Tracing distributed systems, LLVM-based program transformation
- PhD studentships available for multiple of the above projects

# Summary

- Work across all systems areas
  - Hardware up to cloud & mobile applications
- Work with wide range of industry
  - Microsoft, Google, Amazon, Facebook, etc
- Funded from many sources
  - EU, UK, US, industry, government
- We also welcome visitors!