Systems Research Group

Jon Crowcroft
Welcome!

- I’m Jon Crowcroft 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, Environment, Health, …
  - Significant industrial funding from Google, Microsoft, Facebook, ARM, Qualcomm, Samsung, Xilinx, British Telecom, Huawei, etc…
  - Work with DTG, Security, Architecture, Theory, Programming Languages, …
Who Are We?

http://www.cl.cam.ac.uk/research/srg/netos/people/
What Have We Done?

- Founder Xensource, Bromium
- Google Director in charge of web indexing and crawling
- Author of AltaVista
- Director of Toshiba Research
- Co-author of Gimp
- Video-system architect for Nokia N8
- Architect of the first hard-disk MP3 player (NOT apple!)
- Research Director VMWare
- Author of C++
- Former University of Cambridge Pro-Vice Chancellor
…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 Amazon, Microsoft, Google, Intel, Sun, AT&T, IBM,… AND founding a lot of other places too. Also, MIT, Berkeley, Yale, HKUST, Helsinki Uni

**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
A Selection of SRG Projects

<table>
<thead>
<tr>
<th>Area</th>
<th>Program</th>
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<tbody>
<tr>
<td>Hardware</td>
<td>INTERNET</td>
</tr>
<tr>
<td>Theory</td>
<td>Resilient Clouds (MRC)</td>
</tr>
<tr>
<td>Languages</td>
<td>REMS</td>
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<tr>
<td>Embedded</td>
<td>CADETS</td>
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<td>Privacy</td>
<td>OCaml Labs</td>
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<tr>
<td>Mobile</td>
<td>Horizon</td>
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<td>Datacenter</td>
<td>Networks-as-a-Service</td>
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<td>Legal</td>
<td>User Centric Networking</td>
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<td>EmotionSense</td>
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<td>Cloud Law</td>
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<td>Data Centric Systems</td>
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<td>CHERI</td>
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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/
Eva Kalyvianaki


Design and management of next generation, large-scale applications in the Cloud. Addressing the complexity of modern systems with mathematical reasoning.

- Optimised resource management:
  - Integrating novel distributed optimisation techniques in large-scale management problems
- Federated data center resource management:
  - Integrating novel federated processing algorithms in low-level resource management in virtualized data centers
Computer science to promote a sustainable future

- Reducing the carbon footprint of existing energy systems
  - HVAC, transportation, building lighting, transmission grid
- Optimal sizing and operation of solar PV and storage
- Systems for forest conservation and restoration
  - Using mobile phones to measure trunk diameter in forest plots
  - Estimating reforestation rate in the Amazon from earth observation
- Creating trust in carbon credits using blockchains and earth observation
  - Cambridge Centre for Carbon Credit

https://svr-sk818-web.cl.cam.ac.uk/keshav/wiki/index.php/Working_on
Programming languages meets operating systems

- OCaml Labs: [http://ocaml.io](http://ocaml.io)
  - Real World Functional Programming
  - Maintaining the core OCaml compiler toolchain and ecosystem
  - Buildsyste tooling, Ctypes

- Unikernels
  - Mirage: Type-safe unikernel OS [https://mirage.io/](https://mirage.io/)
  - nqsb-TLS, Jitsu

- OPAM
  - Large scale package management and solving [http://opam.ocaml.org](http://opam.ocaml.org)
  - jsOPAM for web applications, Windows port
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
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](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
Intersecting systems with HCI to make things better

- **Homework** redesigned home network technologies [http://homenetworks.ac.uk](http://homenetworks.ac.uk)
- **User-Centric Networking** is rebuilding network technologies [http://usercentricnetworking.eu](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](http://hdiresearch.org)
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!