Fostering Systems Research in Europe

A White Paper by EuroSys - the European Professional Society for Systems

European Chapter of ACM SIGOPS - the Special Interest Group on Operating Systems

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Outline

- Why are we here?
- Systems
- EuroSys
- Recommendations
  - For the Systems community
  - For department heads, deans, and presidents
  - For industry
- Concluding remarks

Why are we here?

- **Many important contributions in systems from Europe**
- **European systems research not as effective as possible (or necessary)**
- **Europe runs the risk to miss out on important developments**

Why are we here?

- Europe lately attractive for US-educated researchers
- European companies world leaders
  - Require Systems expertise
- Our plan:
  - Change limiting aspects of environment
  - Recommendations for
    - Systems community
    - Deans, department heads, presidents
    - Industry and policy makers

Systems

Union of

- **Operating systems**
- **Distributed systems**
- **Embedded/real time systems**
- **Pervasive systems**
- **Core tools (language runtime systems, networks, compilers)**

Systems research is the scientific study, analysis, modeling and engineering of effective software platforms

Systems in Computer Science

Many of our recommendations or findings also apply to other parts of CS

Special considerations:

- **Experimental science**
- **Long cycles**
  - **Design**
  - **Implementation**
  - **Evaluation**
  - **Publication**
- **Technology constraints**

Systems research

- **Systems a core computer science research area**
  - **Drives and builds upon results in many other parts of computer science:**
  - ❖ **Theory**
  - ❖ **Software Engineering**
  - ❖ **Information systems**
  - ❖ **Graphics**

- **Hypothesis: what's good for systems is good for computer science**

Systems research

- **Essential for many companies**
  - **Amazon, eBay, Google, HP, IBM, Iona, Microsoft, RedHat, Sun, Suse, Symbian, VMWare …**
  - **Airbus, Nokia, Philips, Siemens, STM, Thomson**
  - **Automotive industry**
  - **Financial industry**
- **Essential for society**
- **Hard research challenges remain**

Research challenges

- **Security**
- **Reliability**
- **Scale and diversity**
- **Data storage and filtering**
- **Managing complexity**
- **Sensor integration**

EuroSys

- **European professional society for Systems research**
- **Chapter of ACM SIGOPS (Special Interest Group on Operating Systems)**
- **European strengths**
- **European weaknesses**

European strengths

- **Important Systems contributions from Europe**
  - ***Not exclusive -- just a few examples***
  - **Xen virtual machine**
  - **MARS real-time operating system**
  - **L4 microkernel**
  - **Camille embedded OS**

- **Open source development**
  - **Linux started here …**
  - **So did the WWW**

European weaknesses

- **Short duration of Ph.D. program**
  - **Top US schools: 5-7 years**
  - **Many European universities: 3 years**
  - **Often no Ph.D. program**
    - **Ph.D. students vs. research assistants**
    - **Advanced classes**
- **Size of Systems group(s)**
  - **Isolation**
- **Funding constraints**
  - **Grant/contract 2-3 years vs. 4-6 year projects**
  - **Major conferences every 1.5 to 2 years**

European weaknesses

- **Industry relations**
  - **No Ph.D. student internships**
  - **Lack of Ph.D. employment**
  - **Limited cooperation with universities**
  - **Systems research inside industrial research labs**
  - **Sabbaticals of staff from industry in academia rare**

Recommendations - Systems community

- Get organized
- Improve student mobility
  - Internships in labs, other groups
- Networking
  - EuroSys 2006 conference - 170 attendees in Leuven
  - EuroSys 2007 conference in Lisbon
  - Senior workshops
- Enhance Ph.D. education
  - Authoring workshops
  - Database of assistantships/scholarships

Recommendations - institutions

- **Ph.D. programs**
  - **Combine (research) Master's with Ph.D. program**
  - **Be flexible w/ respect to length**
    - **Output oriented**
  - **Education of the next generation, not cheap labor for the chair**
    - **Fair payment**
    - **Appropriate classes (and exams), breadth**
  - **Thesis committees**
    - **3 to 4 members**
    - **External member(s)**
  - **Allow internships**

Recommendations - institutions

- **Faculty**
  - **Hire from the outside**
  - **Assistant professor model**
    - **Independent, principal investigator**
    - **Advisor of Ph.D. students**
    - **Attractive for the best talent**
  - **Realistic expectations**
    - **Building systems labor-intensive**
    - **Publications *one* way to disseminate knowledge**
    - **1 significant publication > 10 “write-only” papers**
    - **Teaching load < 15 hrs (preparation + contact hrs)**
  - **Tenure-track model**
    - **At least 6 years to establish record**

Recommendations - industry

- **Get involved**
- **Hire Ph.D.s**
  - **The right ones**
- **Offer internships**

Concluding remarks

- **Systems crucial for European industry, society and academia**
- **Long range and short range steps**
- **Become a member**
  - **Encourage your colleagues**
  - **Send your Systems faculty to EuroSys conferences and workshops**

www.eurosys.org