

HiPEAC – 13 years of successful networking High-Performance and Embedded Architecture and Compilation

September 8, 2017



This project has received funding from the European Union's Horizon2020 research and innovation programme under grant agreement no. 687698

High-Performance and Embedded Architecture and Compilation

HiPEAC's mission is to steer and increase the European research in the area of highperformance and embedded computing systems,

and stimulate cooperation betweena) academia and industry andb) computer architects and tool builders.



HiPEAC history





12 partners, 500 members, 96 associated members, 412 affiliated members and 875 affiliated PhD students from 350 institutions in 39 countries.

Membership is free of charge.

hipeac.net/members/stats/map



Membership per country





* * * * * * *

HiPEAC structure

Constituency Building

- HiPEAC Conference
- Computing Systems Weeks
- ACACES Summer School
- Collaboration Grants
- Concertation meetings Consultation Meetings

Result dissemination

Communications

Vision

Building

HiPEAC Vision

Impact Analysis

- Road show
- Awards

Community structuring

- Recruitment
- Industrial internships
- Industrial exhibition
- Industry talks
- Innovation stimulation

Management

- Coordination
- Financial management
- Membership management





Highly skilled candidates for specialist roles

"If you're looking for skilled PhD engineers in processor design, system architecture, compilers and tools, look in HiPEAC first, the best ones are there."

Christian Bertin, STMicroelectronics

- Recruitment portal and events
- Jobs shared via LinkedIn and Twitter
- PhD directory
- Pool of 800+ PhD students
- Internship programme supporting SMEs and larger businesses



Xavi Salazar, recruitment officer







Industrial internships



Industrial exhibition



Number of booths





Industrial talks

Industrial Session at the HiPEAC2016 Conference

• 17 booths + 71 industrial posters at the exhibition





Innovation Stimulation



Activities organised:

- Flipped knowledge transfer website
- Technology transfer awards
- Intense collaboration with Tetracom CSA
- Entrepreneurial courses during the ACACES summer school
- Entrepreneurial keynotes during the ACACES summer school
- Entrepreneurial new in the HiPEAC magazine
- Venture Capitalist Session organised during the Autumn Computing Systems Week by David Moloney, Movidius and Paul Murray, Atlantic Bridge Capital





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Innovation Europe

A single-board computer made in Europe

Cyber-physical systems meet supercomputing

In April, we saw another indicator of the booming UDOO X86 has the same pinout as an Anduino 101 and is 100% popularity of the DIY electronics scene, when the compactile with Anduino shields, sensors and accusions. It can Kickstarter campaign for the UDOO X86 board even run the Arduino integrated development environment smashed its € 100,000 target overnight. Thanks to directly from the main Intel quad core processor. The Adulto the EU-funded AXIOM (www.axiom-project.eu) and 101-comparable microcontrollar is based on Intel Curle, which Mont-Blanc (www.montblanc-project.eu) projects, a integrates 32-bit Quark SE system-on-chip, six-axis motion new and improved version of Barcelona sensors and Bluetooth low energy. Last but not lease, UDOO X86 Supercomputing Center's OmpSs parallel is open source and open hardware. programming model can be run on a cluster of UDOO X86, allowing hobbyists and professionals to craft their own supercomputer. The AXIOM team aims to create a single-board computer - a complete computer comprising microprocessor(s), memory, input/output and other features on one circuit board - which is designed and manufactured in Europe.

HiPEAC caught up with UDOO co-founder Maurizio Caporali (MC) of the University of Siena and Xavier Martorell (XM) of Barcelona Supercomputing Center to find out more.



What's so special about this new board?

MC: UDOO X86 is a unique single-board computer: it's both the world's most powerful maker board and a fully fledged Arduino But there's a 101. As a computer, UDOO X86 is a quantum leap forward it's a natura compared to regular single-board computers for makers, and its have program performance is comparable to most notebooks. It can drive up to for those sat three 4k screens - that is, screens with a horizontal resolution of program the around 4,000 pixels - simultaneously and runs Windows (including Windows 10), Android and Linux. It is 10 times more This is only p powerful than the Raspberry PI 3. Despite this incredible power, thrives aroun its Intel Quad Core 14nm 64-bit processors consume as little as an open sour 5-6W in energy, depending on the UDOO X86 model.



Processor on to 2 56CHr Up to SCB of RAM

- Drives up to three 4K monitors simultaneously
- Completely Anduino 101-Integrated
- Runs any XB6 Linux distribution, Windows and Android Multiple options for mass storage

Ability to start up processor through on-board microcontroller

Why are do-tr-yourself (DIY) electronics so popular? What are the benefits of making things open source?

MC: Hardware is becoming less expensive year by year, and people have started realizing that they can build their own stuff instead of buying it. Recently there's also been more focus on STEAM (science, sechnology, angineering, any and mathematics) fields. What we are wimessing is not just a bunch of hobbyises: it's a new industrial revolution, embodied by makers.





on 'Scale-out architecture for energy efficient servers & micro-servers' youtube.com/watch?v=2EnEKo...



7:32pm · 15 Feb 2017 · TweetDeck

OPEN TWITTER ANALYTICS

3 LIKES



roblem in the way of our







Video processing algorithms to boost edge and motion detection

HIPEAC



Researchers at the Czech Institute of Information Theory and Automation (UTIA) have demonstrated video processing algorithms for the Sundance EMC2 platform using the Xilinx system-on-chip (SDSoC) 2015.4 design environment.

Hardware accelerators used in the demonstration were found to achieve up to eight times faster edge detection and 50 times faster motion detection without a significant increase in power dissipation, hence significantly reducing energy consumption.



Three edge detection and three motion detection video processing designs were demonstrated on the Sundance EMC2 platform. The results for image processing will enhance embedded applications in security, medical imaging and unmanned vehicles.

HiPEAC @hipeac · 19 Nov 2018 The @KaleaoGlobal KMAX 'True Converged' platform in #HiPEACInfo 48 #energyefficiency #scalability #performance bit.lv/2fIFVvi



13 1

From TV, to railways to insects: enabling innovation at Embedded Computing Specialists

rgen Becker explain how it started and provide

st-hand insights into founding a tech company.

emmtrix

How has a start-up SME in the world of embedded systems made use of society and the economy's growing reliance on automation, smart devices and data? Philippe Manet and Bertrand Rousseau of Embedded Computing Specialists explain.



COMPANY: Embedded Computing Specialists SPRL MAIN BUSINESS: Expertise and solutions to accelerate R&D and enable innovation in embedded applications LOCATION: Brussels, Belgium WEBSITE: WWW.ecspec.com/

Embedded Computing Specialists (ECS) was founded in early 2013 by Philippe Manet and Bertrand Rousseau. We decided to launch the company after obtaining our Ph.D. in embedded computer architecture from Université Catholique de Louvain in Belgium. We have been part of the HIPEAC community since its beginning.

ECS offers a set of competences and solutions that accelerates



From research to business: the emmtrix story

an successful companies arise out of European How it all began

projects? The example of emmitrix Technologies The emmitrix spin-off is a product of excellent-rated research in would suggest so. Here, emmtrix founders the EU project ALMA (Algorithm parallelization for Mukicore Timo Stript, Frederik Riar and Professor Architectures), which set out to solve the programmability problems of embedded multicore systems. 'Computer architecture is becoming increasingly complex, meaning that systems need to be programmed by experts. ALMA developed technology to program embedded multicores based on the well-established, widely used Scilab (www.scilab.org) and MATLAB (http://bit.by/mathworks-MATLAB) languages. By supporting these languages, we enable seamless integration of our parallelization product Technol ogles emmatix Parallel Studio (ePS) into existing workflow processes

educe the risks and costs involved in ramming environments,' explains Timo

d during ALMA was successfully demonases, including ones in the relecommumage processing for Fraunhofer, an ch organization. Our test cases show ly parallelize applications for different says Timo. 'In addition, our tool chain of programming, saves critical developosts of parallel software development by



We have even worked in the agrobiological industry for a customer active in intensive microfarming. We designed a fully autonomous insect growth monitoring solution that allows them to automate and scale their production to the next level.

Since its beginning, the main goal of ECS has been to bring the best of scientific-level expertise and methodology in embedded systems and computer architecture to industry. We use the substantial experience that we acquired through our Ph.D. to build and conduct efficient R&D strategies. We make use of highmadalling has



Digitising Industry 1



SOFTWARE SECURITY TRANSFORMATION DEVOPS

BUSINESS PERSONAL TECH SCIENCE

More like this

European Commis

EMERGENT



.@hipeac co-organizer of 2day event, is doing a

great job in promoting #digitiseEU strategy and

Data Centre
HPC

DATA CENTRE

European Commission dangles €374m for low-power exascale research

Processors are going to be everywhere, so they should energy hogs

14 Nov 2016 at 07:28, Richard Chirgwin

Europe is trying to plant a flag in future chip development, slinging money towlow-power server silicon.

HIPEAC

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Video-What #digitalplatforms are needed to propel European industry into the future? @SandroDElia @DigIndEU explains



Sandro D'Elia on digital platforms HIPEAC project officer Sandro D'Elia, from the Technologies and Systems for Digitising Industry department at the European Commission, discusses the digital

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13 5



oject, which looks to push more digitis

evelop better software development er



Policy Corner

The 2017 call for proposals is coming

The next call for proposals "ICT-05-2017: Customised and low energy computing" will open in December, with a new topic on processor hardware which will be of interest to the HiPEAC community.

A few words of introduction: the overall strategy of the European Commission is to support jobs, growth and investment through digical technologies. European companies are strong in industrial markets like sylonics, health and sutomotive, and the relevant objective of the Horizon2020 Research and Innovation Programme is to develop the technologies that will be used in those sectors in the coming years.

> problem in these sectors is the nd complexity of software develop especially because it is still difficult e efficient programs for recent systhisocruras (heserogeneous, highly il). For this reason, the first version 2016-2017 Work Programme echnologies for digitizing industry, ig for hardware research: the EC will also at the edge of the network. ne project in the range of @6-10 to start the development of newin high-performance processors.

in objective is so get a substantial atio for high performance compu-"Something that will

change the market in

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comorrow's fastest supercomputers, but is extremely expensive and the timescales nents and toolboxes for low with low energy consumption, and criteria what the prototype should be (actual chip, and highly parallel computing"). like efficiency and space are relevant; in software simulator, hybrid hardwaremany cyber-physical systems and of many the important point is that the prototype It was possible to allocate extra applications requiring computing power should convince hardware experts that the objectives of the project have been achieved

The Work Programme sext does not

she market in the coming years.

For this reason, the call text asks for a the coming years" "working processpe". Developing and bith/ICT-05-2017



MOREINFORMATIO





HIPEAC

Europe
 Eur

8 hipeac.net

Tweeten naar

8 19 volgers die je kent

@hipeac Volgt jou



@hipeac













- Embedded World 2017
- DATE 2017
- ISC 2017
- DIF 2017
- ECSEL 2017
- EXDCI conference
- ICT Proposers day Budapest
- EFECS 2017





The Steering Committee of the HiPEAC Network of Excellence has awarded a



HiPEAC Paper Award

for the paper

Clearing the Clouds: A Study of Emerging Workloads on Modern Hardware

by M. Ferdman, A. Adileh, O. Kocberber, S. Volos, M. Alisafaee, D. Jevdjic, C. Kaynak, A.D. Popescu, A. Ailamaki and B. Falsafi

at International Conference on Architectural Support for Programming Languages and Operating Systems

The HiPEAC Award Coordinator

Prof. Koen De Bosschere





Conference	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
POPL	0	0	0	1	0	1	0	1	3	5
PLDI	1	1	1	1	4	1	1	4	2	2
ASPLOS	1	2	3	0	4	2	4	2	3	4
ISCA	2	2	2	2	5	5	9	9	7	6
HPCA	2	2	4	4	4	1	6	8	9	9
FCCM	2	6	6	2	11	8	9	11	8	8
DAC	5	4	8	7	16	19	25	20	19	19
MICRO	2	7	4	4	6	7	5	9	9	
TOTAL	15	24	28	21	50	44	59	64	60	(53)







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Marc Duranton

HIPEAC Vision 2017 HIGH PERFORMANCE AND EMBEDDED ARCHITECTURE AND COMPILATION

Editorial board:

Marc Duranton, Koen De Bosschere, Christian Gamrat, Jonas Maebe, Harm Munk, Olivier Zendra



HiPEAC Vision





HiPEAC vision 2017





Evolution of society





(Narrow) Artificial Intelligence everywhere

- Artificial Intelligence is changing the man-machine interaction natural interfaces, "intelligent" behavior
- The new systems should make intelligent and *trustable decisions*



Trust is key for critical applications



- Beyond predictability by design and beyond worstcase execution time (WCET)
- Capability to build trustable systems from untrusted components
- Mastering trustability for complex distributed
 stems, composed of black or grey boxes

Growing complexity of software and hardware







"And that's why we need a computer."





The Washington Post

Democracy Dies in Darkness

China has now eclipsed us in AI research

By Brian Fung October 13, 2016 🔤





Figure 1: Journal articles mentioning "deep learning" or "deep neural network", by nation.⁶²

(Office of Science and Technology Policy/The White House)







(Office of Science and Technology Policy/The White House)



Team/ algorithm	Date	Test error
Supervision	2012	15.3%
Clarifai	2013	11.7%
GoogLeNet	2014	6.66%
Microsoft	05/02/2015	4.94%
Google	02/03/2015	4.82%
Baidu/ Deep Image	10/05/2015	4.58%
Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences	10/12/2015 (the CNN has 152 layers)	3.57%
	Now	?



Figure 69: Further progress on ImageNet



speech recognition market

Posted Jun 11, 2016 by Daniel Faggella (@danfaggella)





Next Story

When Deep Speech 2 was first released in December 2015, Andrew Ng, the chief scientist at Baidu, described Deep Speech 2's test run as surpassing Google Speech API, wit.ai, Microsoft's Bing Speech, and Apple's Dictation by more than 10 percent in word error rate.

The system is capable of "hybrid speech," something that many Mandarin speakers use when they combine English and Mandarin.

According to Baidu, as of February of this year, Deep Speech 2's most recently published error rate is at 3.7 percent for short phrases, while Google has a stated 8 percent word error rate as of about one year ago (to its credit, Google did reduce its error rate by 15 percent over the course of a year). Coates called Deep Speech 2's ability to transcribe some speech "basically superhuman," able to translate short queries more accurately than a native Mandarin Chinese speaker.









		Value (billion \$)	Turnover (billion \$)	Profit (billion \$)	Personnel	User/ Units sold (million)
Social notwork	Facebook	370.0	17.9	3.7	14,495	1130
Social Hetwork	Tencent	252.0	15.8	4.8	30,160	697
Webshap	Amazon	354.0	107.0	0.6	230,800	304
web shop	Alibaba	242.0	15.7	11.1	36,450	410
Coarch ongino	Alphabet	539.0	73.6	15.8	66,575	1000
search engine	Baidu	64.0	10.6	5.3	41,467	667
Missahla -	Twitter	12.6	2.2	0.5	3,900	313
MICIODIOg	Weibo	9.8	0.5	0.3	6,400	282
Tavi	Uber	68.0	0.5	-1.0	6,700	8
IdXI	Didi Chuxing	33.8			6,000	250
Electric car	Tesla	29.7	4.1	-0.9	14,000	0.080
	BYD	21.5	11.6	0.4	200,000	0.120
Smartphone	Apple	595-7	231.3	53.4	110,000	1000
	Huawei		60.8	5.6	176,000	290

Figure 173: Vital statistics of leading global technology companies





How some U.S. universities are 'failing' cybersecurity

Posted in Education & Training by NCI at Excelsior on April 15, 2016



U.S. universities not prioritizing cybersecurity

CloudPassage, a cloud security company based in California, recently examined 122 United States colleges and universities with the leading computer and information science programs, a list it accumulated from rankings made by U.S. News & World Report, Business Insider and QS World.

"As cyberthreats become more aggressive and intelligent, so must the IT pros who handle them." It looked at what courses were offered in cybersecurity and what the requirements were for students to major in computer science or information assurance. And the findings suggested that America's higher education systems are not giving students the training and skills they need to properly fulfill cybersecurity roles. In fact, of the top 10 programs ranked by US News & World Report, it was found that not one of them required students to take a course in cybersecurity to graduate.

This demonstrates an obvious lag in college curriculums keeping pace with the rapidly evolving needs of cybersecurity and indicates that institutions of higher education in the U.S. can and should be doing more to adapt to the growing challenges and complexities of IT today.





Figure 147: Highly cited scientific publications by sector, 2010 Source: European Commission







Graduates in the field of computing per thousand population aged 25-34, 2013 and compound annual growth, 2007-2013







Analysing the success stories of FP7 projects in computing systems



50

Christophe Toulemonde

Project Impact Position





	From	То	EC Cont	ribution	EC Contribution By partner
	9/1/2011	10/31/2014	2 820 (€ 00,00	470 000,00 €
Consortium					
Partners	Number	Rating	Average	Maximum	Lead
	6	M			DE
Repartition	Large Enterprise	SME	Univ	ersity	Research Org.
	0	4		2	0
Category	Rank	Rating	Average	Maximum	Estimation
Team					Out of 40 projects
Team	6	м	55	160	83
Extended Team	N/A	-	64	181	115
Contributions					Out of 40 projects
Publications	31	****	40	135	12
Activities	6	****	68	147	116
Exploitable		ياد ياد ياد	44	22	22
Foregrounds	1	****	11	32	32
IP Rights	3	****	1	4	3
Start-up	6	*	0	3	0
Direct Jobs	n/a	∧	1	17	not estimated
ETE	1/4	***	11	40	40
EOSS	2	****	11	40	40
Category	Rank	Rating	Average	Maximum	Evaluation
Survey					Out of 44 surveys
Number of answ	vers received	6	5.4	-	-
Global	1	****	2.86	-	3,43
Organisation	2	****	3.17	-	3,83
Community	2	****	2.97	-	3,67
Business	2	****	2.63	-	3,50
Academia	10	****	3.23	-	3,50
Society	7	****	2.31	-	2,67
Contributions	* * * *	Excellent	*)	* *	Good
& Surveys	* *	Fair)	¥	Limited
	\diamond	Not estimated			
Partners	XL	Extra Large	1	L	Large
& Team	М	Medium		S	Small

Recommendations

ABOUT THE SURVEY

- Create a short questionnaire
- · Completed by every project participant
- at the end of the project or after three months
- Add a specific questionnaire to the coordinator right at the end of the project and one a year later.

ABOUT FINAL REPORTS

- Ask projects to provide the Excel files they used to publish the reports.
- Prepare guidance to project coordinators on how to fill in some sections of the report so as to increase homogeneity of the results.
- Ask for specific data (e.g. categorize Open source).
- Provide methodology to explain how to estimate certain figures (e.g. FTE).
- Gather data points from other sources of information (e.g. Project proposals, Reviews).
- Add request for certain data (e.g. TRL).

ABOUT PARTICIPANTS

• Ask for the name, role, and contact information of each project participant.

ABOUT DATA VALUE

- Subjectivity of Data : Include inputs from all participants as well as external stakeholders such as the Project Officer, reviewers, and ideally some experts.
- Uniformity of Data. Compare the score of the project with the average score of all projects
- Incompleteness of Data: Guidelines on how to evaluate certain aspects of the projects such as jobs and FTE.
- Time dependency of Data. A control point at the end of the project and one a year later
- Relevance of Data. Collect specific data according to the project type

ABOUT DOMAIN EXPERTISE

- Self-evaluation by Project Officer
 - evaluate how the project answered the EC objectives of the work programme
 - evaluate project on the five criteria
- Self-evaluation by project reviewers
 - Quality of the foregrounds, analysing the value
- Project Scientific Coordinator: One year after evaluation
 - Metrics such as FTE, PhD, jobs, patents...
 - TRL evolution



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2017 Conference January 23-25, 2017, Stockholm, Sweden



Home Call for Papers Workshops and Tutorials Venue and travel





The HiPEAC conference is the premier European forum for experts in computer architecture, programming models, compilers and operating systems for embedded and general-purpose systems.



Conference key figures



Progress indicators	HiPEAC 2011	HiPEAC 2012	HiPEAC 2013	HiPEAC 2014	HiPEAC 2015	HiPEAC 2016	HiPEAC 2017
# submitted papers	85	117	102	133	148	167	168
# accepted papers	20	37	43	39	38	37	34
# workshop/tutorials	7/2	17/9	24/10	23/6	30/4	32/9	34/11
# participants	190	523	506	533	631	650	550





Computing Systems weeks



European Network on High Performance and Embedded Architecture and Compilation





CSW Zagreb, April 27-28, 2017

About

Programme

Venues & Accommodation Attendees

2



Computing Systems weeks

Location	Date	Number of participants	Number of thematic sessions	
Göteborg	April 12	140	8	
Ghent	Oct 2012	206	12	
Paris	May 2013	136	7	
Tallinn	Oct 2013	104	10	
Barcelona	May 2014	398	7	
Athens	Oct 2014	211	13	
Oslo	May 2015	290	10	
Milano	Sept 2015	136	7	
Porto	April 16	118	9	
Dublin	Nov 2016	259	9	
Zagreb	Apr 2017	137	7	
Stuttgart	Oct 2017			





Thirteenth International Summer School on Advanced Computer Architecture and Compilation for High-Performance and Embedded Systems

9-15 July 2017, Fiuggi, Italy

Computer performance has increased by over 1,000-fold in the past three decades. This astonishing growth has fuelled major innovations across all aspects of society. New advances in drug discovery and diagnosis, product design and manufacturing, transportation and energy, scientific and environmental modelling, social networking and entertainment, financial analysis, all depend on continued increases in computer system

Early registration deadline March 31 2017

performance. Computing systems are so fundamental to today's society that they represent a basic resource, and form a strategic foundation for many of our most powerful and versatile tools and developments. Maintaining rapid growth in computing performance is key for tackling the societal challenges shaping Europe and assuring our global competitiveness in the future.



	Number of applicants	Number of participants	Participants from industry	Number of posters
ACACES 2012	283	203	17	83
ACACES 2013	241	151	13	68
ACACES 2014	238	172	21	76
ACACES 2015	241	188	15	89
ACACES 2016	275	187	16	81
ACACES 2017	231	179	15	76





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HiPEAC5 structure

- HiPEAC Conference
- ACACES summer school
- Computing systems weeks
- Stimulating collaboration
- HiPEAC Jobs

Connecting the communities

Dissemination

- Communications
- Road show
- Awards
- Website

Growing the communities

- Membership management
- Growing the industrial community
- Growing the innovation community
- Growing the stakeholder community
 - Growing the new member states membership

Management

Consultation meetings HiPEAC Vision 2019

Roadmapping

Disseminating the HiPEAC Vision

- Project management
- Financial management
- Industrial advisory board

To join, simply email <u>membership@hipeac.net</u>





Rainer Leupers



