HETEROGENEOUS SYSTEM ARCHITECTURE

A NEW COMPUTE PLATFORM INFRASTRUCTURE

EDITED BY
WEN-MEI W. HWU

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Lei Shi

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Heterogeneous System Architecture Wen-mei W. Hwu,2015-11-20 Heterogeneous Systems Architecture a new compute platform infrastructure presents a next generation hardware platform and associated software that allows processors of different types to work efficiently and cooperatively in shared memory from a single source program HSA also defines a virtual ISA for parallel routines or kernels which is vendor and ISA independent thus enabling single source programs to execute across any HSA compliant heterogeneous processer from those used in smartphones to supercomputers The book begins with an overview of the evolution of heterogeneous parallel processing associated problems and how they are overcome with HSA Later chapters provide a deeper perspective on topics such as the runtime memory model queuing context switching the architected queuing language simulators and tool chains Finally three real world examples are presented which provide an early demonstration of how HSA can deliver significantly higher performance thru C based applications Contributing authors are HSA Foundation members who are experts from both academia and industry Some of these distinguished authors are listed here in alphabetical order Yeh Ching Chung Benedict R Gaster Juan G mez Luna Derek Hower Lee Howes Shih Hao HungThomas B Jablin David Kaeli Phil Rogers Ben Sander I Jui Ray Sung Provides clear and concise explanations of key HSA concepts and fundamentals by expert HSA Specification contributors Explains how performance bound programming algorithms and application types can be significantly optimized by utilizing HSA hardware and software features Presents HSA simply clearly and concisely without reading the detailed HSA Specification documents Demonstrates ideal mapping of processing resources from CPUs to many other heterogeneous processors that comply with HSA Specifications *InfoWorld* ,1998-03-02 InfoWorld is targeted to Senior IT professionals Content is segmented into Channels and Topic Centers InfoWorld also celebrates people companies and projects Heterogeneous Computing Architectures Olivier Terzo,Karim Djemame,Alberto Scionti,Clara Pezuela,2019-09-10 Heterogeneous Computing Architectures Challenges and Vision provides an updated vision of the state of the art of heterogeneous computing systems covering all the aspects related to their design from the architecture and programming models to hardware software integration and orchestration to real time and security requirements The transitions from multicore processors GPU computing and Cloud computing are not separate trends but aspects of a single trend mainstream computers from desktop to smartphones are being permanently transformed into heterogeneous supercomputer clusters The reader will get an organic perspective of modern heterogeneous systems and their future evolution **An Open-Source Research Platform for Heterogeneous Systems on Chip** Andreas Dominic Kurth,2022-10-05 Heterogeneous systems on chip HeSoCs combine general purpose feature rich multi core host processors with domain specific programmable many core accelerators PMCAs to unite versatility with energy efficiency and peak performance By virtue of their heterogeneity HeSoCs hold the promise of increasing performance and energy efficiency compared to homogeneous multiprocessors because applications can be

executed on hardware that is designed for them However this heterogeneity also increases system complexity substantially This thesis presents the first research platform for HeSoCs where all components from accelerator cores to application programming interface are available under permissive open source licenses We begin by identifying the hardware and software components that are required in HeSoCs and by designing a representative hardware and software architecture We then design implement and evaluate four critical HeSoC components that have not been discussed in research at the level required for an open source implementation First we present a modular topology agnostic high performance on chip communication platform which adheres to a state of the art industry standard protocol We show that the platform can be used to build high bandwidth e g 2 5 GHz and 1024 bit data width end to end communication fabrics with high degrees of concurrency e g up to 256 independent concurrent transactions Second we present a modular and efficient solution for implementing atomic memory operations in highly scalable many core processors which demonstrates near optimal linear throughput scaling for various synthetic and real world workloads and requires only 0 5 kGE per core Third we present a hardware software solution for shared virtual memory that avoids the majority of translation lookaside buffer misses with prefetching supports parallel burst transfers without additional buffers and can be scaled with the workload and number of parallel processors Our work improves accelerator performance for memory intensive kernels by up to 4 Fourth we present a software toolchain for mixed data model heterogeneous compilation and OpenMP offloading Our work enables transparent memory sharing between a 64 bit host processor and a 32 bit accelerator at overheads below 0 7 % compared to 32 bit only execution Finally we combine our contributions to a research platform for state of the art HeSoCs and demonstrate its performance and flexibility **Automatically Migrating Sequential Applications to Heterogeneous System Architecture** □□□,2018 Scalable Applications on Heterogeneous System Architectures Robert Dietrich,2019

Handbook of Heterogeneous Networking ,2018 Here is all the practical hands on information you need to build manage and maintain a heterogeneous computing environment with hardware software and network equipment from a number of different vendors Packed with real world case studies and proven techniques for integrating disparate platforms operating systems and servers Handbook of Heterogeneous Computing is a one stop non nonsense guide that shows you how to port and develop applications in a heterogeneous environment manage desktops data access communications and security in a heterogeneous environment and build distributed heterogeneous systems What is best for your installation Should you standardize on the Windows environment for both production applications and office applications Should you adopt the Windows NT workstation as a standard desktop and use Windows NT as the network operating system Handbook of Heterogeneous Computing details the advantages and disadvantages of these and other approaches The book also explains the arts of porting and developing applications in a heterogeneous environment using Java CGI Perl and other tools how to build interfaces with mainframe legacy systems how to use CORBA to integrate distributed database systems while at the

same time managing database gateways and interoperability how to manage interlan switching multicast networking structures SNA LAN integration and all aspects of enterprise networks and how to use Kerberos firewalls PGP RSA public keys and other tools to assure security in heterogeneous environments Heterogeneous computing is here to stay It is therefore up to corporate end users to make competing products fit into their environments efficiently effectively and economically Handbook of Heterogeneous Computing gives you t Provided by publisher Distributed Systems--architecture and Implementation Butler W. Lampson,Manfred Paul,H. J. Siegert,1983 **Programming Models' Support for Heterogeneous Architecture** Wei Wu,2017 Accelerator enhanced computing platforms have drawn a lot of attention due to their massive peak computational capacity Heterogeneous systems equipped with accelerators such as GPUs have become the most prominent components of High Performance Computing HPC systems Even at the node level the significant heterogeneity of CPU and GPU i e hardware and memory space differences leads to challenges for fully exploiting such complex architectures Extending outside the node scope only escalate such challenges Conventional programming models such as data flow and message passing have been widely adopted in HPC communities When moving towards heterogeneous systems the lack of GPU integration causes such programming models to struggle in handling the heterogeneity of different computing units leading to sub optimal performance and drastic decrease in developer productivity To bridge the gap between underlying heterogeneous architectures and current programming paradigms we propose to extend such programming paradigms with architecture awareness optimization Two programming models are used to demonstrate the impact of heterogeneous architecture awareness The PaRSEC task based runtime an adopter of the data flow model provides opportunities for overlapping communications with computations and minimizing data movements as well as dynamically adapting the work granularity to the capability of the hardware To fulfill the demand of an efficient and portable Message Passing Interface MPI implementation to communicate GPU data a GPU aware design is presented based on the Open MPI infrastructure supporting efficient point to point and collective communications of GPU residential data for both contiguous and non contiguous memory layouts by leveraging GPU network topology and hardware capabilities such as GPUDirect The tight integration of GPU support in a widely used programming environment free the developers from manually move data into out of host memory before after relying on MPI routines for communications allowing them to focus instead on algorithmic optimizations Experimental results have confirmed that supported by such a tight and transparent integration conventional programming models can once again take advantage of the state of the art hardware and exhibit performance at the levels expected by the underlying hardware capabilities A Language for Characterizing Heterogeneous Systems Judith D. Schlesinger,Institute for Defense Analyses,1994 Abstract Currently available taxonomies and models are inadequate for the task of describing complex computer systems and heterogeneous networks of machines We seek a method to describe higher level structural and semantic features of architectures for use in a variety of program

transformation and performance analysis tools We present a language adl to describe the architecture of a system or network of systems in such a way as to be used by other software tools Architectural Transformations in Network Services and Distributed Systems Andriy Luntovskyy,Josef Spillner,2017-03-23 With the given work we decided to help not only the readers but ourselves as the professionals who actively involved in the networking branch with understanding the trends that have developed in recent two decades in distributed systems and networks Important architecture transformations of distributed systems have been examined The examples of new architectural solutions are discussed *A New System Architecture for Heterogeneous Compute Units* Nils Asmussen,2019 Distributed Systems-Architecture and Implementation ,1981 **Architecture Design and Mapping Flow Development for FPGA-accelerated Heterogeneous Computing Systems** Hao Liang,2017

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