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PIONEER OF MODERN DATACENTER DESIGN RECEIVES ECKERT-MAUCHLY AWARD

Google's Luiz Barroso Recognized as Visionary Architect of Warehouse-Scale Computing

New York, NY, **June 3, 2020** – ACM, the Association for Computing Machinery, and the IEEE Computer Society have named Luiz André Barroso, Vice President of Engineering at Google, recipient of the 2020 Eckert-Mauchly Award for pioneering the design of warehouse-scale computing and driving it from concept to industry. Today's datacenters contain hundreds of thousands of servers and millions of disk drives, and make possible the most prevalent applications used by the public today, including cloud computing, powerful search engines, and internet services.

Barroso is widely recognized as the foremost architect of the design of these new ultra-scale datacenters. The cornerstone of his architectural vision was to think of a system holistically, weaving together the individual compute, storage, and networking components into an overall design across large-scale distributed systems.

Barroso has been a thought leader in the field, writing seminal papers and books which reconsidered every aspect of data center and system design. At the same time, he has also guided industry efforts in this area. He was the lead architect of Google's first custom-built data centers and has been the primary technical leader steering the development of Google's computing infrastructure for much of the last two decades. This work has been replicated by other large companies. Virtually all the hardware architectures that power today's internet services and cloud computing systems feature elements introduced by Barroso and his team at Google.

Warehouse-scale computing

Barroso proposed the idea that a datacenter should be designed as a single, massive warehouse-scale computer, popularizing the phrase "the datacenter is the computer." The workloads of these computers are internet services that run on thousands of CPUs across high-bandwidth networks and require specialized storage systems. Barroso's designs paired inexpensive hardware with powerful distributed systems software to dramatically change system design. When Barroso's designs were introduced in the mid-2000s, they garnered a new term: "hyperscale datacenters." Those designs were attractive not only because they could manage the mushrooming workloads from internet services and cloud computing, but because they also reduced hardware and operating costs. By 2022, the hyperscale datacenter market is expected to grow to more than $80 billion annually.

Hyperscale system architecture

Barroso and his colleagues at Google were the first to abandon traditional server products and work directly with commodity component manufacturers to build low-end servers that were specifically optimized for the efficiency and scalability needs of internet services. In his well-cited *IEEE Micro* paper, "Web Search for a Planet," he and his co-authors Jeffrey Dean and Urs Hölzle described the hardware requirements for emerging web services, arguing for designs that used modular hardware coupled with simple robust software. This approach helped dramatically drive down complexity to make systems less expensive to buy and build, easier to maintain, and more adaptable to rapidly-changing workloads.

Energy efficiency

In one of his most influential papers, which has been cited more than 2,300 times, "The Case for Energy-Proportional Computing," Barroso (with co-author Urs Hölzle) called for a new approach to achieving energy efficiency, where the energy used would be roughly proportional to the utilization of the systems in question. The paper's key ideas resulted in significant energy efficiencies when computers were operating below peak capacity. It has been documented that standard servers circa 2006 used 70% peak power even when nearly idle, whereas since 2012, after Barroso's ideas on energy proportionality had been implemented throughout the industry, a standard server consumed only a small fraction of its peak power at idle.

Other key contributions by Barroso include co-leading the Piranha chip project at DEC Western Research. Piranha was one of the first multicore processor architectures proposing multiple "wimpy" cores, and many of Piranha's designs have since been adopted in today's commercial processors. Barroso's book, *The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines*, (co-authored with Urs Hölzle and Parthasarathy Ranganathan) is widely accepted as the authoritative textbook in the field.

Barroso will be formally recognized with the ACM-IEEE CS Eckert-Mauchly Award today during the ACM/IEEE International Symposium on Computer Architecture (ISCA), which is being held virtually May 29 – June 3, 2020.

About the ACM-IEEE CS Eckert-Mauchly Award

ACM and IEEE Computer Society co-sponsor the Eckert-Mauchly Award, which was initiated in 1979. It recognizes contributions to computer and digital systems architecture and comes with a $5,000 prize. The award was named for John Presper Eckert and John William Mauchly, who collaborated on the design and construction of the Electronic Numerical Integrator and Computer (ENIAC), the pioneering large-scale electronic computing machine, which was completed in 1947.

About ACM

ACM, the Association for Computing Machinery is the world's largest educational and scientific computing society, uniting computing educators, researchers and professionals to inspire dialogue, share resources and address the field's challenges. ACM strengthens the computing profession's collective voice through strong leadership, promotion of the highest standards, and recognition of technical excellence. ACM supports the professional growth of its members by providing opportunities for life-long learning, career development, and professional networking.

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