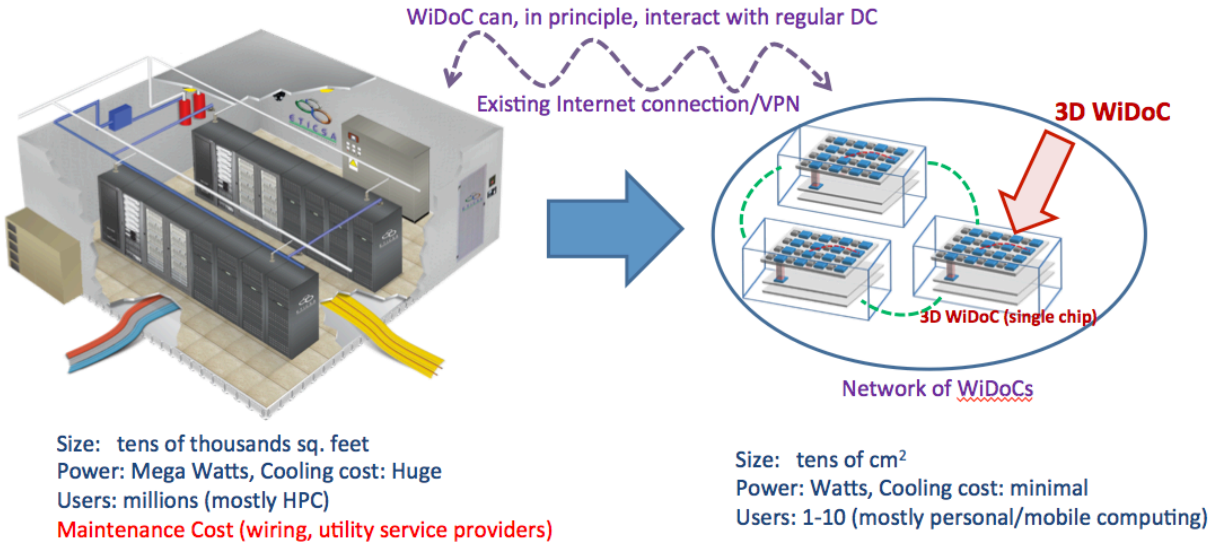
Datacenter-on-chip: Researchers target a new paradigm for big data computing

September 12 2016, by Radu Marculescu



From Data Centers to Wireless Datacenter on Chip (WiDoCs). Credit: Carnegie Mellon University Electrical and Computer Engineering

Diana Marculescu and Radu Marculescu have been awarded an NSF grant to develop a new paradigm for Big Data computing. Specifically, this project focuses on a new Datacenter-on-a-Chip (DoC) design consisting of thousands of cores that can run compute- and data-

intensive applications more efficiently compared to existing platforms.

Currently, data centers (DC) and high performance computing clusters are dominated by power, thermal, and area constraints. They occupy large spaces and necessitate sophisticated cooling mechanisms to sustain the required performance levels. The proposed new DoC design consists of thousands of cores that communicate via a new communication infrastructure, while provisioning the system resources for the necessary power, performance, and thermal trade-offs (Fig.1). From an intellectual perspective, this approach lies squarely at the intersection of two major trends in integrated systems design, namely low power and communication centric design.

"There are three goals in this project," explains Radu Marculescu. "We want to design small-world wireless architecture as a communication backbone for many core-enabled Wireless Datacenter on Chip (WiDoC), while establishing physical layer design methods for highly-integrated 3-D WiDoC suitable for low latency data communication. We hope to evaluate latency-power-thermal trade-offs for the proposed WiDoC platform by considering relevant big data applications."

The unique proposed research brings together highly novel and interdisciplinary concepts from network-on-chip (NoC), wireless and complex networks, communication circuits, and optimization techniques aimed at single chip solutions for achieving data center-scale performance. At the same time, this work will help to establish an interdisciplinary research-based curriculum for high performance many-core system design meant to increase the number of students attracted to this area of engineering.

"Our research will impact numerous areas," says Diana Marculescu. "Big data applications like social computing, life sciences, networking, and entertainment will benefit immensely from this new design paradigm

that aims at achieving server-scale performance from hand-held devices."

This is a joint project between Carnegie Mellon University and Washington State University. Preliminary results based on this work will be presented at the 2016 edition of Embedded Systems Week.

Provided by Carnegie Mellon University Electrical and Computer Engineering