Bouncing signals off ceiling can rev up data centers

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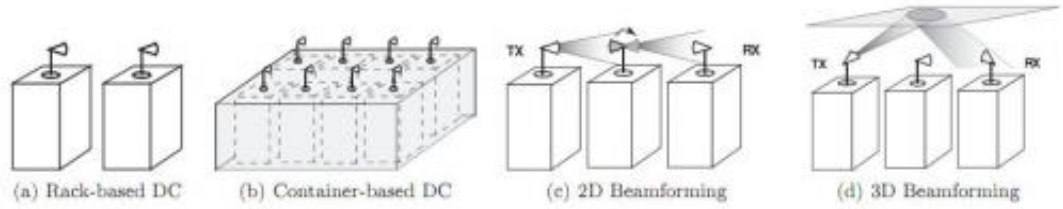

Radio transceivers are placed atop each rack (a) or container (b). Using 2D beamforming (c), transceivers communicate with neighboring racks directly, but forward traffic in multiple hops to non-neighboring racks. Using 3D beamforming (d), the ceiling reflects the signals from each sender to its desired receiver, avoiding multi-hop relays. Image credit: Weile Zhang et al, *3D Beamforming for Wireless Data Centers*

(PhysOrg.com) -- Researchers have a startlingly upbeat idea for data center managers coping with packed rooms, Internet traffic bursts, and high costs looming in having to reconfigure data center designs. The researchers find that data centers can use ceilings to bounce off data signals. Doing so enhances data transmission speeds by 30 percent.

What's more, compared to the cost and complexity of modifying data center architectures, they say their approach is a much more attractive option that can augment wired links with flexible wireless links in the 60 GHz band.

The team of researchers propose an approach in a short-range, rack-to-rack 60GHz wireless network setting. What they show is how bouncing 60 GHz wireless links off reflective ceilings can address link blockage and link interference.

Heather Zheng, an associate professor of computer science, worked with colleagues at the University of California, Santa Barbara, along with Lei Yang from Intel Labs in Oregon and Weile Zhang at Jiao Tong University in China.

In using a technique of angling the data stream upwards and bouncing it off the ceiling, signals can be transmitted from one area of a densely packed data center to another. Nodes send data to wherever needed regardless of location within a center. What is significant about this approach becomes apparent at peak traffic times, when wireless networks can switch on and provide an overflow for the wired network.

One of the key components in this ceiling approach is the use of metal plates, which the researchers say provided suitable reflection in their simulation of a 160-rack data center. Alternatively, the entire ceiling of the data center could be polished metal. In their studies the team mounted microwave reflectors on the ceiling. The reflectors behaved as specular mirrors to reflect the signals.

The reflectors can be flat metal plates; simple aluminum plates are sufficient. They placed electromagnetic absorbers on top of the racks to prevent local reflection and scattering around the receiving antenna. They note that such absorbers are widely available and maintenance-free.

Overall, they say that the importance of their study is that “We explore the design space, and show how bouncing 60 GHz wireless links off reflective ceilings can address both link blockage and link interference,

thus improving link range and number of current transmissions in the data center."

Also, one of the numerous advantages to their approach is what they categorize as easy rack movement and replacement. "Data center managers can upgrade or move racks without any physical constraints, and quickly calibrate the beam configuration based on rack locations."

To further exercise this approach, Zheng and team plan on building a prototype data center.

More information:
via TechnologyReview