

# Researchers propose method to balance user experience and cloud cost

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For an online gamer, lag is the worst. The gamer watches, telling the avatar to move to avoid another player's attack, but the avatar does nothing. Then, suddenly, the avatar does all of the commands, rapid fire. It was listening, it just took too long for the commands to process.

Researchers at the New Jersey Institute of Technology (NJIT) have now developed a method to help avoid this aggravating issue. They published their results in *IEEE/CAA Journal of Automatica Sinica*, a joint publication of the IEEE and the Chinese Association of Automation.

According to Dr. Qiang Fan from the Department of Electrical and Computer Engineering at NJIT, the problem comes down to something called end-to-end delay. This is the time it takes for information to be transmitted from a source to a destination across a network, such as a gamer's directions to the avatar actually acting, but it can go beyond the irritation of game delay.

"End-to-end delay is a significant metric for service performance," Fan said. "A long end-to-end delay

is unbearable for various delay-sensitive applications, such as autonomous vehicles, augmented reality and virtual reality."

In autonomous vehicles, it's a critical problem. A delay between the source and the destination could result in an accident.

To address this issue, Fan and Nirwan Ansari, co-author and Distinguished Professor of Electrical and Computer Engineering at NJIT, proposed a fix using cloudlets. These are basically tiny versions of the cloud.

"The cloud is a centralized [data center](#) that offloads users' tasks via the Internet," Fan said, noting that this usually expedites the commands while reducing the amount of energy users consume in processing. "However, the cloud is usually remotely located and far away from its users."

In comparison, cloudlets live on the edge of a user's network and only address commands from the designated user or users, depending how many are within the network. They can significantly improve a network's service performance for a limited number of users, but they can be costly if more are needed

Each cloudlet must be hosted by a server, a considerable expense. If the cloudlet serves more than one user, the expense per user drops, but the end-to-end delay length can increase.

Fan and Ansari aimed to find a balance between cost and acceptable [delay](#). They developed an algorithm that assesses how the location and capacity of each cloudlet can best handle user requests to achieve an optimal balance.

"The proposed cloudlet placement scheme has jointly considered the deployment cost and service performance," Fan said, referring to the outcome of the researchers' simulations. "Cloudlet providers

can flexibly balance cost and performance by adjusting their deployment plans based on their practical requirements."

**More information:** Qiang Fan et al, On cost aware cloudlet placement for mobile edge computing, *IEEE/CAA Journal of Automatica Sinica* (2019). DOI: [10.1109/JAS.2019.1911564](https://doi.org/10.1109/JAS.2019.1911564)

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