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### A Mechanism to Improve the Reliability and Availability of Network Services

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**Abstract.** With a rapid growth of the Infrastructure as a Service (IaaS) market, it becomes more important for IaaS services to provide the work environment with high reliability and availability. Therefore, how to maintain TCP connections after the live migration, is a very important issue. Live migration is a process of moving a virtual machine (VM) from one physical host to another while the virtual machine is still running. In this research, we propose a new mechanism to keep clients' TCP sessions across live migration over Wide Area Networks (WANs), called Handover. By this mechanism, we expect to be realized faster and simultaneous migration. Through VM's IP address changed after live migration, Handover inserts an OUTPUT rule in the iptables to redirect the client's outgoing packets to the new IP address of the VM. In addition, we apply a fake three-way handshake mechanism to prevent the redirected traffic from being blocked by the NAT router, and ensure the redirected connection be recorded in NAT router's "current connections" table. The experimental results demonstrate that Handover is effective in varied network environments, and the overhead of this changeover process is less than 0.2 seconds. Furthermore, it may be integrated into a Distributed Denial of Service (DDoS) Defense System. By deploying the remaining parts of the DDoS defense system with Handover, we believe it could serve as a useful method to guard against DDoS attacks.

**Keywords:** virtual machine, three-way handshake, DDoS.

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### SHVC Tile-based 360 Video Streaming for Mobile VR

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**Abstract.** 360-degree video streaming for mobile virtual reality (VR) is emerging. However, the computational ability and bandwidth of mobile VR are limited when compared to those of tethered VR. To overcome these limits, this study proposes a new tile-based streaming method that transforms 360-degree videos to mobile VR using the scalability extension of HEVC (SHVC).

Video bitstreams generated by the proposed method consist of (i) an SHVC base layer (BL), which represents the entire 360-degree area and (ii) an SHVC enhancement layer (EL) with region of interest (ROI) tiles. By transmitting the BL and EL with ROI tiles, the proposed method helps reduce not only the computational complexity on the decoder side but also the network bandwidth.

The method involves modifying an SHVC encoder to support motion prediction between selected ROI (viewport) tiles and base layer. In addition, this paper proposes a method of sending selected ROI tiles in a single layer using HEVC encoder as well.

To build the proposed system, this research implemented the motion-constrained tile set (MCTS) method that is referencing only the upsampled BL and the prediction units in the tile located in same position. Besides, this research also implemented the EL tile parallel processing method optimized for asymmetric multicores with 35% improved decoding speed up.

**Keywords:** SHVC, tiles, 360 video streaming, mobile VR, motion-constrained tile set (MCTS), asymmetric multicores.

