THE VMATRIX: A BACKWARD-COMPATIBLE SOLUTION FOR IMPROVING THE INTERACTIVITY, SCALABILITY, AND RELIABILITY OF INTERNET APPLICATIONS

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Currently, most Internet services are pre-allocated to servers statically; which leads to sluggish interactivity, low availability, limited scalability, and delay fairness issues.

In this thesis, we present a novel architecture that solves these issues without requiring significant code changes (i.e., backward-compatible). This architecture is called the vMatrix, and it is an overlay network of virtual machine monitors (VMMs). A VMM encapsulates the state of the machine in a virtual machine file, which could then be migrated and activated on any real machine running the VMM software.

We identified three challenging Internet problems that previous solutions failed to address in a backward-compatible way. We then implemented a prototype of the vMatrix and studied it in detail as a solution for these three challenges:

Dynamic Content Distribution: Moving services closer to the Internet edge, thus reducing latency and rendering such services more interactive and available for end users.

Server Switching: Sharing a pool of servers between more than one service, thus leveraging the benefits of statistical multiplexing to reduce overall hardware requirements for running a group of distinct Internet services.

Equi-ping Game Server Placement: Placing game servers at optimized equi-ping locations to improve the fairness of multi-player first-person-shooter games by reducing the delay differential between participating players.

We also demonstrate additional side benefits, including on-demand replication for absorbing flash crowds (in case of a newsworthy event like a major catastrophe) and faster recovery times for improved overall reliability.

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