Master’s Thesis
Multi-criteria Placement of Geo-distributed Containers

Background
Container technology (e.g. Docker) has risen to great popularity for deploying modern distributed, service-oriented applications, especially microservices. Container orchestration frameworks, such as Kubernetes or Docker Swarm, facilitate the – otherwise tedious – deployment of large numbers of services running in containers across multiple environments. Schedulers, a component of these orchestrators, allow the user to specify various constraints with regard to the automated placement of containers.

Problem
Container schedulers must respect multiple criteria during placement decisions, e.g., resource utilization and already running containers. A geographically distributed setup, in addition, requires reasoning about user access and consequences regarding data placement - in summary: the topology of communication. This information can only be extracted at runtime, requiring an up-to-date view of cluster state.

Goals
The candidate is to analyze the ability of existing, open source scheduler implementations (e.g., for Kubernetes) to factor in topology information, such as geographic (co-)location of users, services and data, and runtime-measurements of performance metrics, e.g. latency. Requirements regarding data, scheduling time and other aspects, such as the ability to decentralize decision making are topics of interest, too. Also, a prototype implementation to investigate aspects quantitatively is possible and encouraged.

Required Skills:
• General understanding of challenges in distributed systems
• Basic knowledge of Container Technology (i.e. Docker)
• Basic ability to read and understand Golang code
• Good programming skills in a modern programming language, ability to work with HTTP APIs in that language

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Our Mission:
Our lectures cover fundamental methods and techniques in the areas of service computing, cloud computing, and enterprise computing. We like to engage students in hands-on building of distributed information systems and to take an interdisciplinary approach to evaluating such systems. Through a close mentoring of students, especially in our seminars, we aim to introduce students to our ongoing research and to excite them to do future studies and research with us.