Contents

1 Introduction **4**
- 1.1 What is virtualization? . . . 4
- 1.2 Need of virtualization in cloud computing . . . 4
- 1.3 Essential components of virtualization . . . 5
- 1.4 Types of virtualization . . . 5
- 1.5 Scope of this seminar . . . 7

2 Hypervisor/VMM **7**
- 2.1 What is hypervisor? . . . 7
- 2.2 Types of hypervisors . . . 8
- 2.3 Services offered by hypervisor . . . 8
- 2.4 Example hypervisors . . . 8

3 Possible usage requirement leading to improve hypervisor extensions **9**

4 Hypervisor services using guest state **10**
- 4.1 What is guest state? . . . 10
- 4.2 Techniques of collecting guest state . . . 10
- 4.3 Symbiotic virtualization . . . 11
  - 4.3.1 What is symbiotic virtualization? . . . 11
  - 4.3.2 Notable techniques . . . 11
  - 4.3.3 Implementing SymCall . . . 11
  - 4.3.4 Use cases of SymCall . . . 12
- 4.4 Preserving guest state for further analysis . . . 12
  - 4.4.1 Decoupling the execution from analysis . . . 13
  - 4.4.2 Analyzing execution trace . . . 13
  - 4.4.3 Use cases of analysis system . . . 15

5 Guest state replication **15**
- 5.1 VM cloning implementation . . . 16
  - 5.1.1 Design rationale . . . 16
  - 5.1.2 VM descriptor . . . 17
  - 5.1.3 Lazy state propagation . . . 17
  - 5.1.4 Avoidance heuristics . . . 17
  - 5.1.5 Multi cast distribution . . . 17
  - 5.1.6 Lock step detection . . . 17
  - 5.1.7 Virtual disk usage . . . 17
- 5.2 Selective cloning of VM . . . 17
  - 5.2.1 Micro elasticity . . . 18
  - 5.2.2 VM state coloring . . . 18
  - 5.2.3 Usefulness of coloring . . . 18
  - 5.2.4 Fractional footprint . . . 18
- 5.3 Stateful VM creation . . . 19
  - 5.3.1 VM substrate . . . 19
  - 5.3.2 Creation of VM from substrate . . . 19
- 5.4 The fine line of difference . . . 21

6 Conclusion **21**