Virtual Machine based Online Learning System

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Introduction

- **Goal**: A novel educational system that seamlessly integrates virtual machine (VM) based education with convenient online learning environments
- **Background**
  - Web-based online learning environments (e.g., Moodle, WebCT, Blackboard)
  - Widely used by instructors/students to distribute/consume course materials
  - VMs (e.g., VMware, VirtualBox, Xen)
  - Self-contained educational modules
  - Can be deployed in clouds for high scalability and availability

Proposed Solution: vMoodle

- **Front-end: Integration with online learning**
  - Allows instructors to create VM-based course materials (e.g., projects, demos) online
  - Create customized VM demos
  - Assign VMs for course activities
  - Grade student copies of the VMs
  - Allows students to use VMs online
  - Create private clones of the VM templates
  - Conduct projects on the VMs
  - Submit VMs for instructors to grade
  - Support widely-used online learning systems (e.g., Moodle)

- **Back-end: Integration with cloud**
  - Support different VMs/clouds
  - Private data centers and clouds (e.g., VirtualBox)
  - Public clouds (e.g., Amazon EC2)
  - Efficient resource usage & good performance
  - Dynamic load balancing using live VM migration without disrupting users
  - Efficient VM storage using shared network storage
  - Instant VM creation using copy-on-write-based VM cloning

vMoodle Mobile

- A native mobile app for vMoodle
  - Allow instructors/students to access vMoodle at any time from anywhere
  - Exploit the increasing popularity and power of smartphones and tablets
  - A mobile-friendly user interface for smartphone and tablets
  - Allow fast access to VMs and other online course materials

- A prototype developed on Android mobile OS:
  - Support widely used touchscreen smart phones and tablets (e.g., Samsung Galaxy, HTC Nexus, LG Optimus)
  - Allow secure communication between mobile devices and vMoodle server using HTTPS
  - Allow SSH connection to VMs using the ConnectBot app

System Architecture

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Interface

- **Web**
  - Operating System: Ubuntu
  - Screen Resolution: 1920x1080
  - VM Hosting: Amazon EC2
  - Cloud: VirtualBox

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  - Cloud: VirtualBox

Conclusion and Future Work

- **Conclusions**
  - Successful integration of VMs with online learning environments, enabling convenient VM-based education
  - Cloud-based, highly scalable and available VM hosting
  - A user-friendly mobile app making the system extremely versatile and providing user access from anywhere at any time

- **Future work**
  - Soon to be deployed for production use by FIU instructors and students
  - Optimize resource management of vMoodle VMs in order to improve user experience
  - Integrate vMoodle with social networks (e.g., Facebook) in order to enhance instructor-student interactions