

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

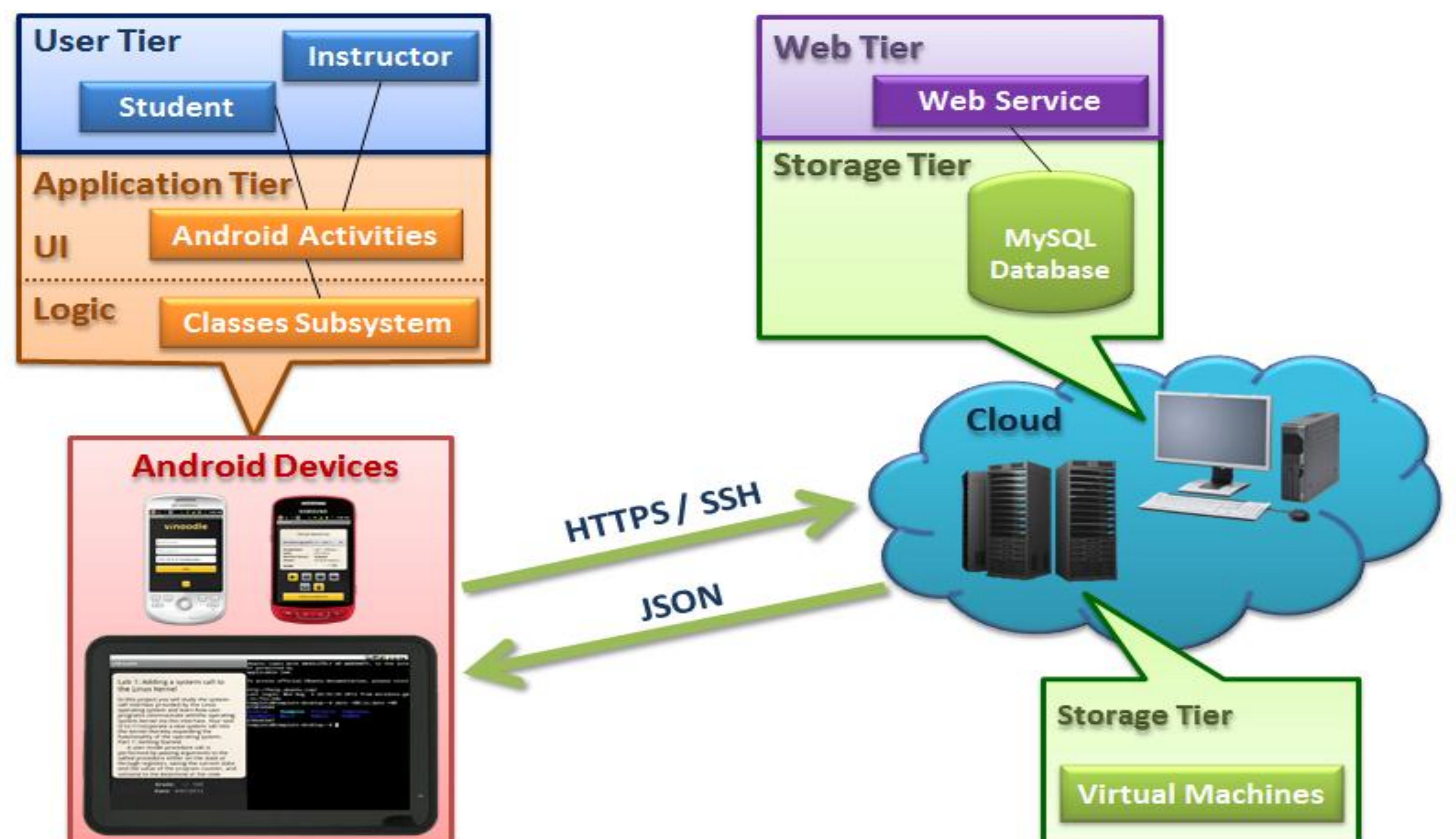
Proposed Solution: vMoodle

- **Front-end: Integration with online learning**
 - Allows instructors to create VM-based course materials (e.g., projects, demos) online
 - Create customized VM templates
 - 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

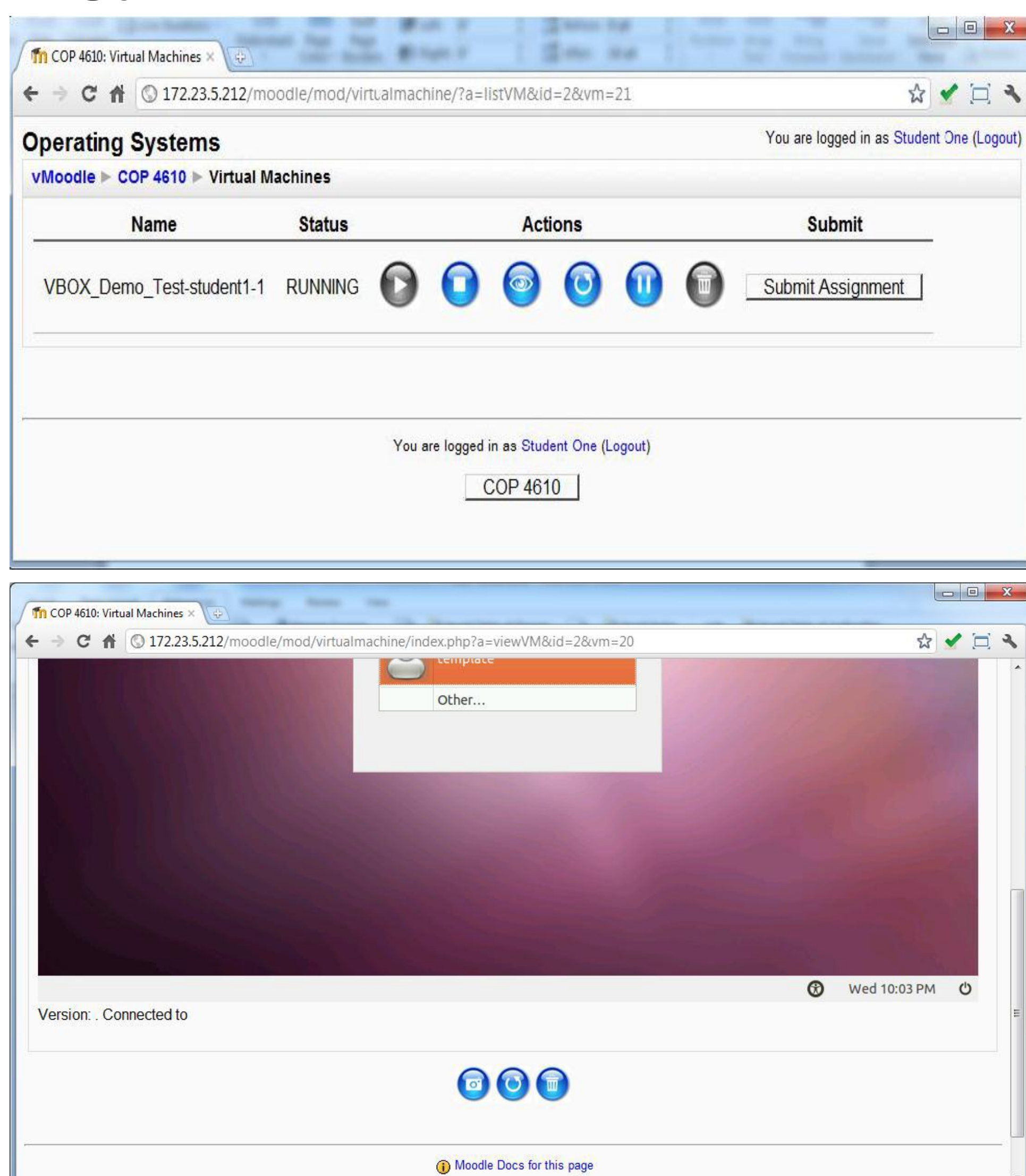
- **A native mobile app for vMoodle**
 - Allow instructors/students to access vMoodle at any time from anywhere
 - Exploit the increasing popularity and power of smart phones and tablets
 - A mobile-friendly user interface for smart phones and tablets
 - Allow fast access to VMs and other online course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



Interface

Web



Mobile



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