OSM
operating systems
+middleware

Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam

InstantLab 2.0 - A Platform for Operating System Experiments on Public Cloud Infrastructure

Prof. Dr. Andreas Polze / Christian Neuhaus
with Rehab Alnemr, Lysann Kessler, Frank Schlegel

Cloud Futures, Berkeley, May 7th 2012

InstantLab 2.0 –
It's about using Cloud for Teaching
(and not about teaching cloud)

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Microsoft IT Academy Program NEWS

Prepare your students with the 21st century technology **skills** they need for **successful** careers

Welcome to the April 2012 edition of the Microsoft IT Academy newsletter, a resource loaded with information intended to help program administrators and educators get the most out of their IT Academy memberships. If this newsletter was forwarded to you by a colleague, please feel free to subscribe today to receive future editions directly.

Feature Story

Help Your Students Make the Shift to Microsoft Cloud-Based Certifications

Teach 21st century technology skills and follow that education with Microsoft Certification to ensure your students validate what they've learned with a reliable and trusted benchmark. Microsoft technology certifications have recently evolved to include more cloud-based certifications, making them even more respected by hiring managers and increasing their value to your students. **Learn more about the reinvented certifications.**

Read about the reinvented certifications for the cloud on the Born to Learn website.
Read the full article »
Original Publication Date: 04/26/2012

What's New/Program Updates

Get the Windows 8 Consumer Preview

Windows 8 is Windows reimagined and reinvented from a solid core of Windows 7 speed, security, and reliability. Windows 8 offers an all new touch interface compatible with today's devices and uses less power to transfer data faster. Take advantage of this opportunity to try Windows 8 before it's available for sale. **Download the Windows 8 Consumer Preview today.**
Read the full article »
Original Publication Date: 04/26/2012

News for Administrators and Educators

April 2012

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Access Your Benefits
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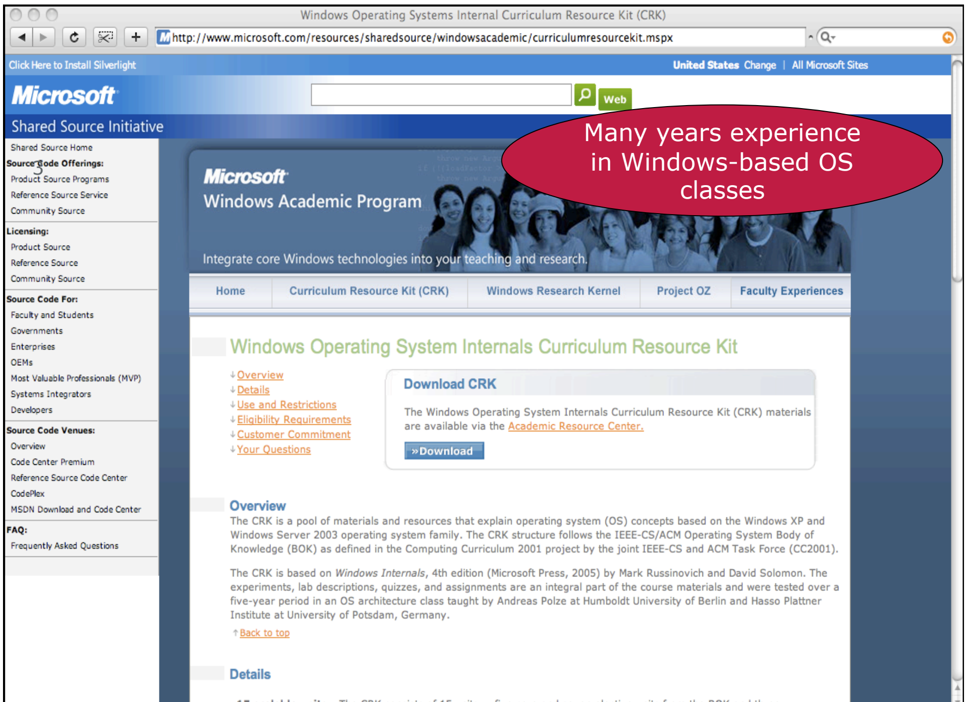

InstantLab 2.0 employs Windows Research Kernel (WRK)

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- Stripped down Windows Server 2003 sources
  - Only kernel itself, no drivers, GUI, user-mode components
  - Missing components: HAL, power management, plug-and-play
- Released in 2006
- Freely available to academic institutions
- Encouraged by license:
  - Modification
  - Publication (of excerpts)

Structuring Experiments: The UMK Approach

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- U-phase
  - Concentrate on OS concepts
  - Introduce OS interfaces
  - Systems programming
- M-phase
  - Observe concepts at run-time
  - Introduce monitoring tools
  - System measurements
- K-phase
  - Discuss kernel implementation
  - Introduce kernel source code (WRK/UNIX)
  - Kernel programming

The burden of running OS experiments

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- Teaching operating systems requires chances for hands-on experience and demonstrations on live systems
- Providing these experiments is hard:
  - Changes of the underlying hardware and software make it hard to reproduce results
  - Considerable set-up work is required

Solution →

InstantLab 2.0

InstantLab 2.0: Challenges & Solutions

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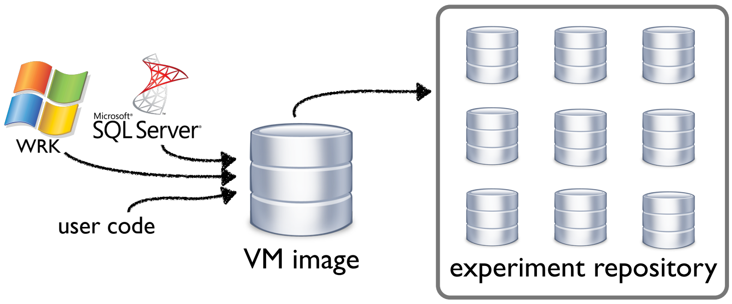
- **Problem #1:**
  - Changes of hardware and software make it hard to reproduce experiment results (after more than 5 years of WRK in class)
- **Solution:**
  - Run experiments in virtualized environments
  - Set of „canned" experiments available via MSDN AA



InstantLab 2.0: Challenges & Solutions

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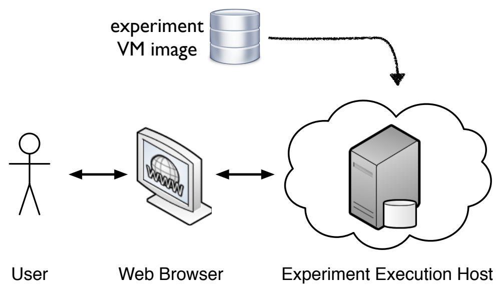
- **Problem #2:**
  - Users (lecturers/students) need to set up and maintean experiment environment
- **Solution:**
  - Experiment provisioning on cloud infrastructure
  - But: Which provider? Public/private?



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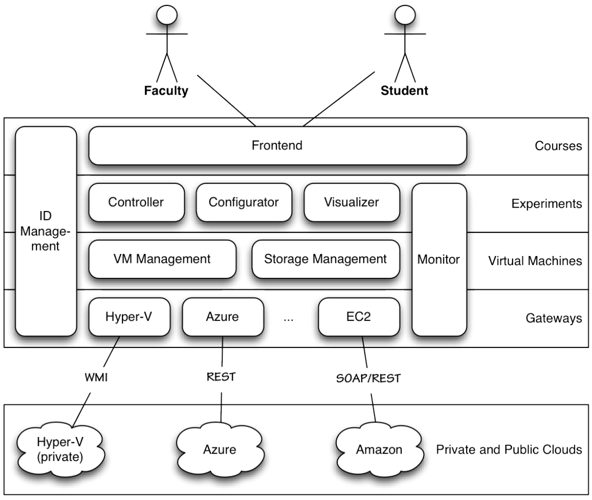
InstantLab 2.0: Architecture Overview

Everything in the cloud, flexible choice of providers



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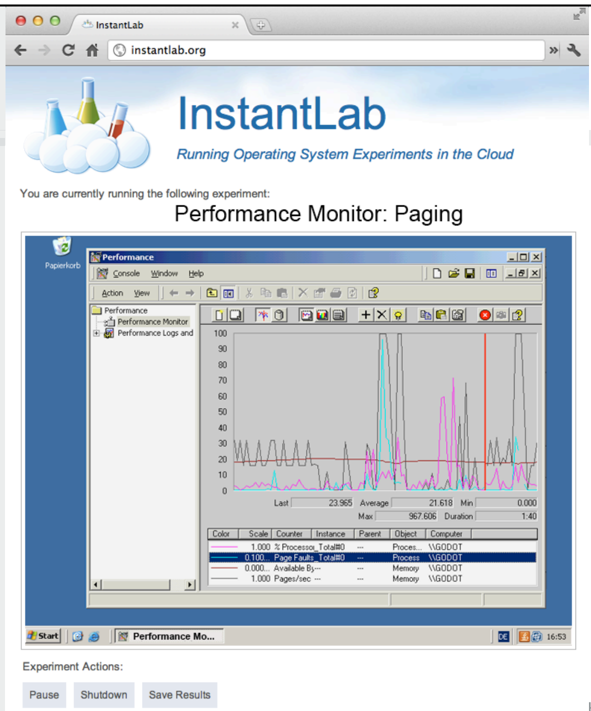

Browser-based access

- U/M experiments are easy
- K experiments are best run in private cloud
- User/Experiment management is big challenge

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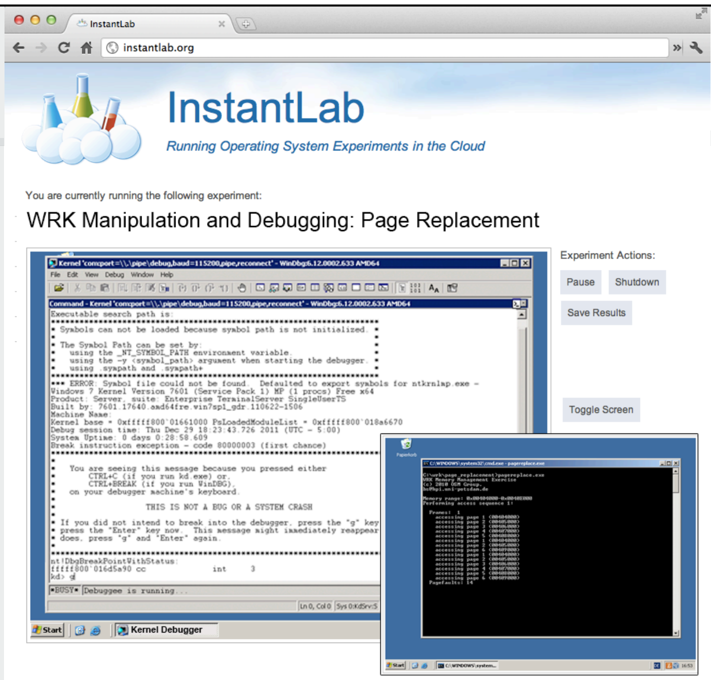

K experiment

with two interconnected VMs –

running kernel debugger and system under test

InstantLab 2.0: Demo Video

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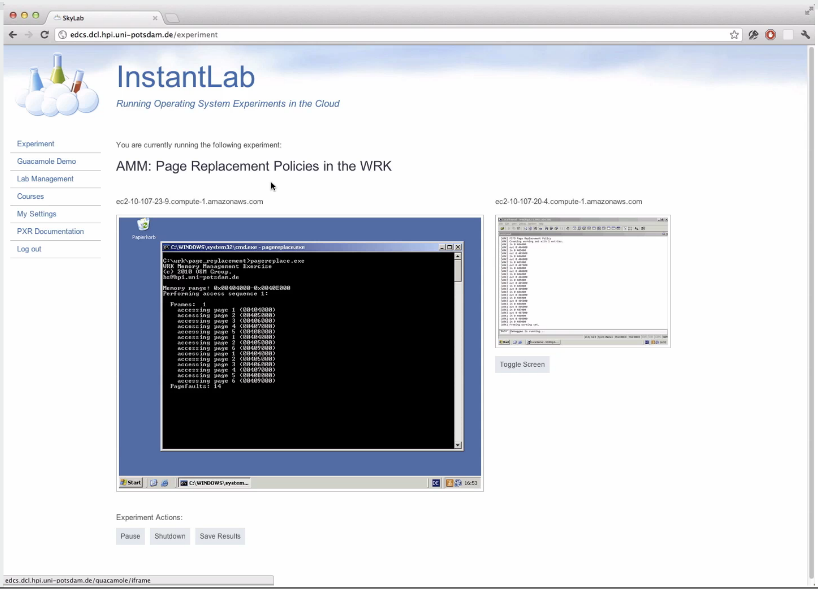

InstantLab 2.0: Making it public

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- So far: InstantLab acessible by invitation only
  - Our students (undergrad OS class)
  - A few connected schools
- The current trend: making teaching material available online

Microsoft Faculty Connection   STANFORD UNIVERSITY   iTunes U   IBM Academic Alliance

- **InstantLab 2.0:**
  Make experiment resources available to the public
  - Using public cloud infrastructure (easy)
  - On a self-service platform (tough)

InstantLab 2.0: Everything Self-Service

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- InstantLab „1.0": Limited group of known users
- InstantLab 2.0:
  - Potentially thousands of users
  - Users we don`t know nothing about!
- Problem:
  - How to manage and administer all these people?
  - How to decide who gets to use which resources
- Our Solution: A **self managed** version of InstantLab
  - Access control to resources based on **trust relationships**
  - **Fully-automatic provisioning** of experiments

How to distribute resources
(sponsors may be want to address certain target groups)

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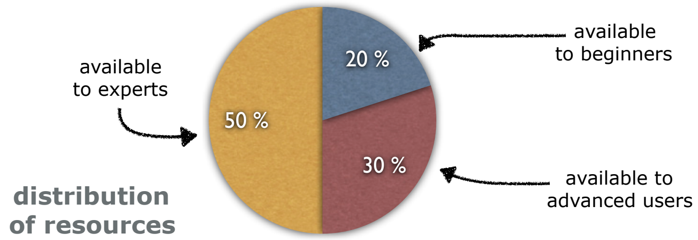
- Experiments on public cloud infrastructure consume resources and cost real money!
- Resources for a public teaching programme are limited
- Access control to experiment resources should
  - … foster earnest and competent users
  - … limit misuse and wasting of resources.



Reputation and Trust

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- How to rate a user as „beginner", „advanced" or „expert"?
- Behavior of user on the platform constitutes a user's reputation:
  - Evaluation of completed experiments
  - Community interactions
    (e.g. contribution to support forums)
  - Online lessons and quizzes
  - Referrals and recommendations
- Reputation, interpreted by one's own weighting and calculation scheme constitutes trust

Trust-based Access Control – the idea

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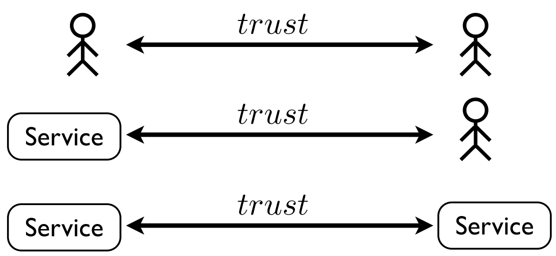
Trust:

- is real-valued: e.g. t = 0.73
- multi-dimensional:
  correct computation, reliability, benevolence
- can be applied between machine entities and humans



Building and Maintaining Trust Levels

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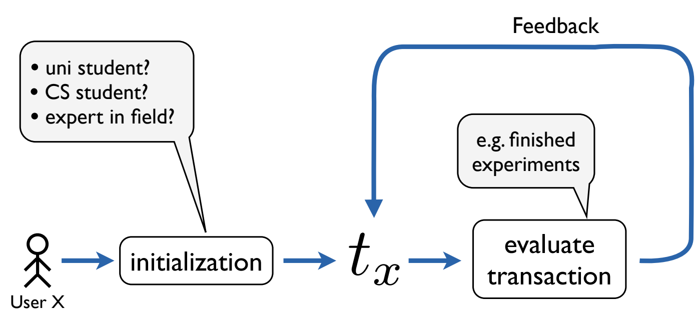
The trust value for every InstantLab users:

- … is set to an initial value.
- … is updated by transactions with this user.



Making Access Control Decisions

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- Access to experiment resources requires a certain level of trust

Experiment Repository	
Kind of Experiment	Req. Trust
user mode experiments	0.5
metering experiments	0.8
kernel experiments	0.95

requests access,
trust level 0,85

$$t \geq t_{min}$$

user mode: yes
metering: yes
kernel mode: no

Resource allocation – Trust revisited

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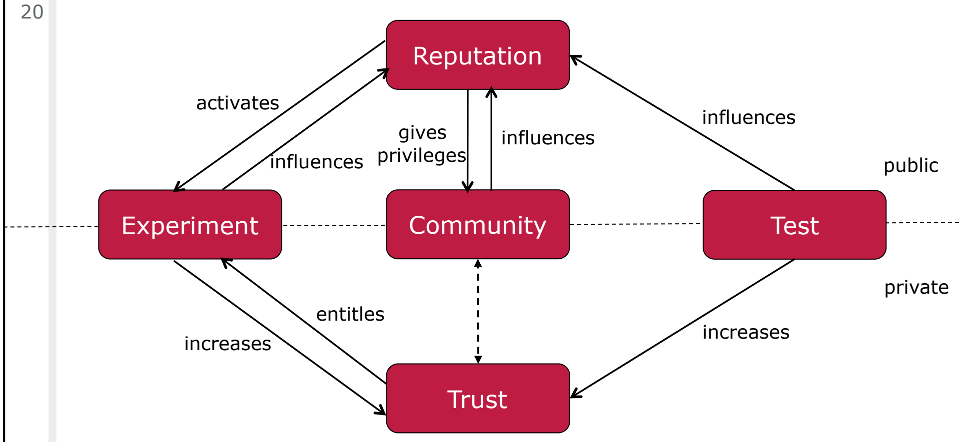

Our private cloud – OpenNebula

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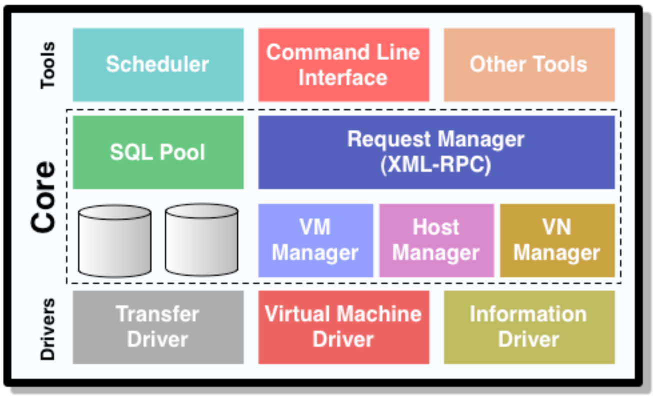
- Private + Public Cloud
  - C12G Labs, Microsoft, CERN
  - 4CaaSt, BonFIRE, **CERN**, CESGA, D-Grid Resource Center Ruhr, Deltacloud, RESERVOR, SARA, StratusLab



Authentication

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- OpenID
- OAuth
- Windows Live ID

Connecting with the Cloud

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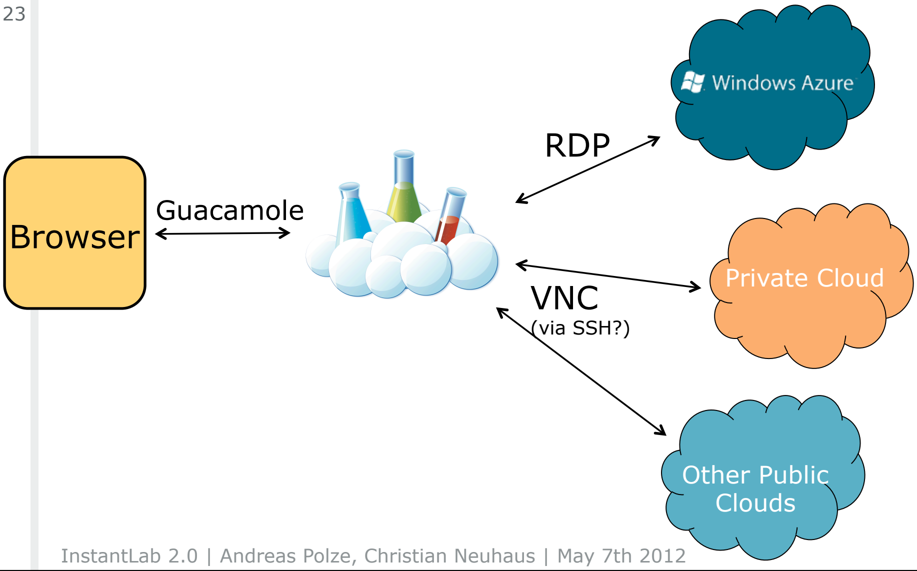

Future SOC Lab @ HPI – our private cloud

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- Vision was to establish an open research platform for tomorrow's IT landscape, start: June 2010
- Industry partners
  - Fujitsu
  - Hewlett-Packard
  - SAP
  - EMC
  - VMware
  - NetApp
  - Intel SCC

Testbed:
MultiCore MultiThreading Hardware,
huge memories, NehalemEX-based, GPU computing

HP ProLiant DL980 G6:
64 Cores, 1-2TB
Fujitsu Primergy RX600S:
32 Cores, 1TB

Application areas:
- **Large Databases**
- **Consolidation, Virtualization**
- **High-Performance Computing**

Steering commitee from industry and academia

The 1000 Core machine @ FutureSOC Lab

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Conclusions – InstantLab 2.0

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- Maintaining OS experiments for teaching is cumbersome
  - Virtualization may be the answer in provider side
  - Consumer still has to maintain experiment environment
- Putting experiments on the cloud lifts burden on consumer side

- Not all clouds are equal
  - In particular, none of the public clouds allows requesting co-located VMs or even worse – co-located physical machines
  - Need generic architecture for public/private clouds

- Everything has to be self-managed – otherwise it won't scale
  - Notion of Trust and Reputation is crucial
  - Adopt techniques established for social networks