Open Education Services

with Cloud Computing

Adapting Education Programs to Service Industry Needs

Professor Nicolae Tapus

Director of CS Department
University Politehnica of Bucharest

Engaging to build on a vision of cloud computing for education

Agenda

- Open education for a Smarter Planet
- The transformative potential of cloud computing
- The Virtual Computing Laboratory Technology (VCL)
- The IBM Cloud Academy: a new ecosystem to set the agenda for cloud computing in education
- Benefits for education and next steps

Something meaningful is happening…

"Every human being, company, organization, city, nation, natural system and man-made system is becoming ***interconnected, instrumented and intelligent.*** *This is leading to new savings and efficiency—but perhaps as important, new possibilities for progress."*

The world is flatter.

The world is smaller.

The world is getting smarter.

Because it can.

Because it must.

Because we want it to.

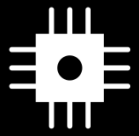
smarter planet

Smarter is a **vision** of how the world works — how every person, business, organization, government, natural system, and man-made system interacts.

Each interaction represents a chance to do something **better**, more efficiently, more productively.

But more than that, as the systems of the planet become smart, we have a chance to open up meaningful new **possibilities** for progress.

smarter planet



Our world is becoming

INSTRUMENTED

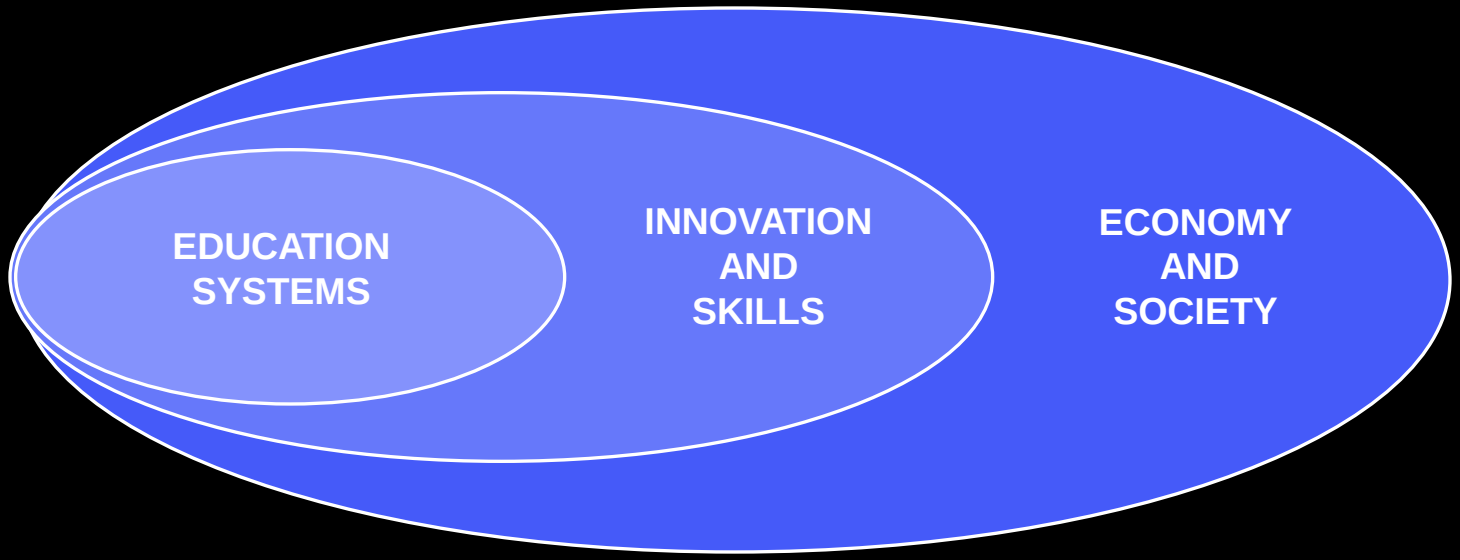
Our world is becoming

INTERCONNECTED

Virtually all things, processes and ways of working are becoming

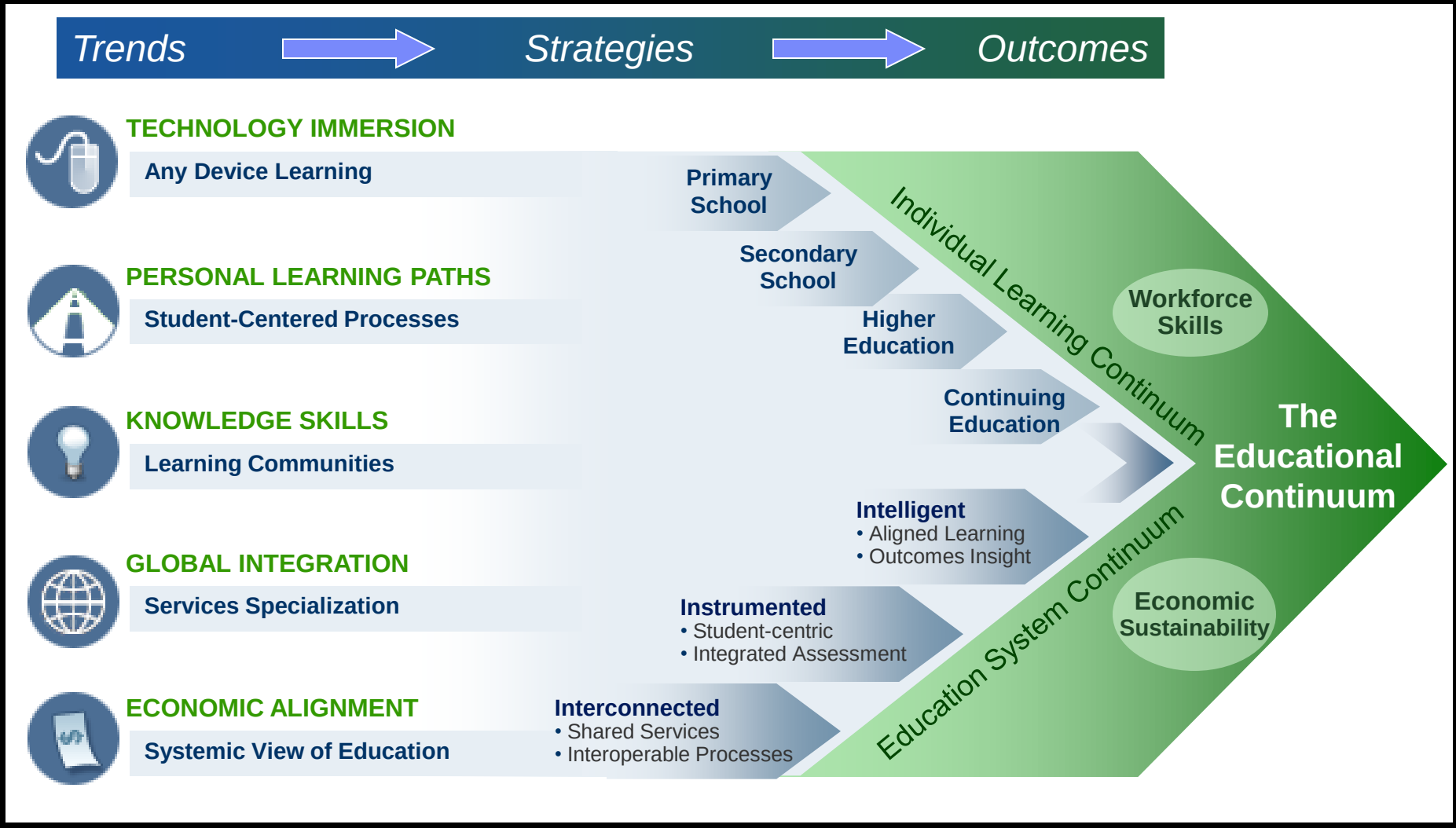
INTELLIGENT

Education for a smarter planet



By investing in education,
the positive impact will be felt far beyond the classroom

The Educational Continuum in the 21st Century



Cloud Computing provides the infrastructure for transformation

Smarter Classroom

Enabling student success and skills

Smart Administration

Optimizing educational systems

Innovation in Research

Accelerating innovation

Cloud Computing

Consumer Devices | ***Emerging Technologies*** | Open Platforms

Enabling Strategies

Interoperable Processes | Aligned Data | Shared Services

Cloud Computing

Resources scale to demand

ELASTICLY SCALABLE

Pooled, managed IT resources

VIRTUALIZED

Automated access to desired services

RAPIDLY PROVISIONED

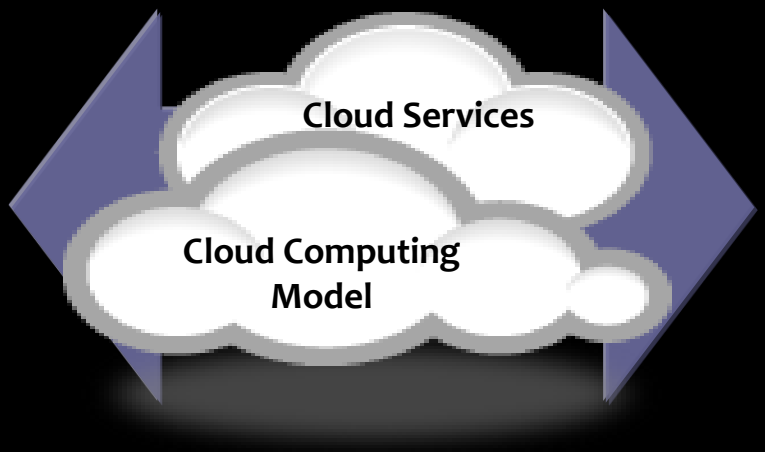
Pay by consumption

FLEXIBLE PRICING

Cloud Computing in Education
Considerations for Implementation on Private or Public Clouds

Private …

- Institution owned – managed by institutions or services provider
- Access defined by institution



Public …

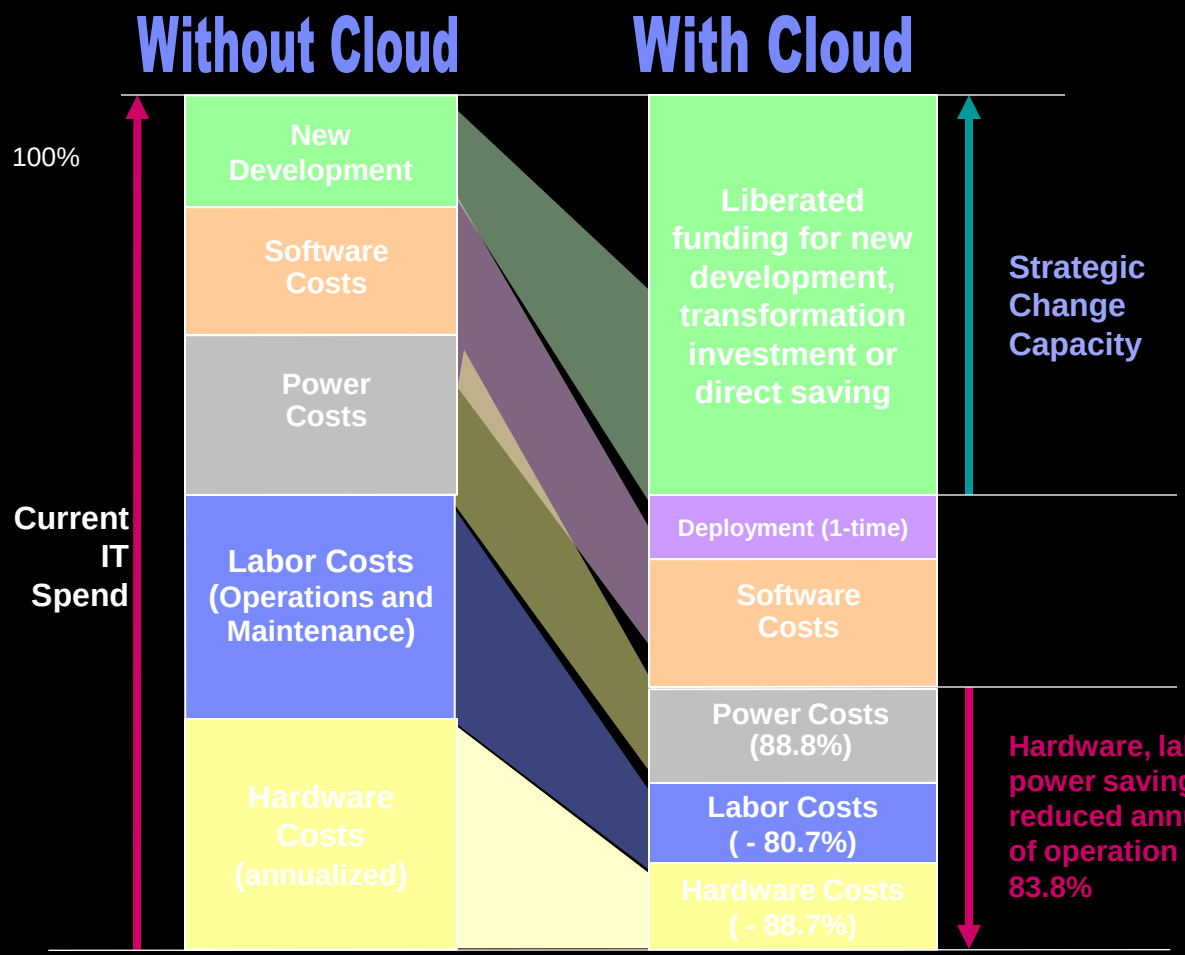
- Standardized services on the public provider's cloud
- Access by subscription

Considerations …

- Workload type, readiness
- Security, privacy, resiliency, accessibility
- Self-service
- Standardization

GOVERNANCE

The Experience with Cloud Deployment



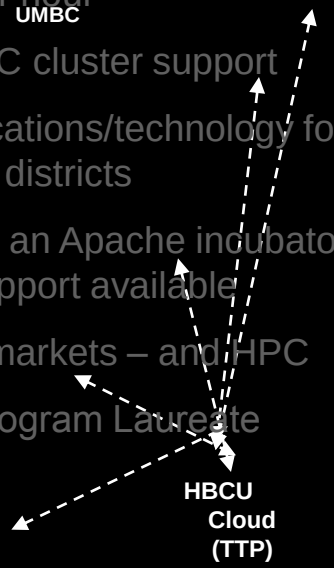
- ***Business Case Results***
- ***Annual savings: $3.3M (84%) $3.9M to $0.6M***

- Payback Period: 73 days
- Net Present Value (NPV): $7.5M
- Internal Rate of Return (IRR): 496%
- Return On Investment (ROI): 1039%

Note: 3-Year Depreciation Period with 10% Discount Rate

The Virtual Computing Laboratory (VCL)

- NC State University and IBM developed an open source cloud computing solution optimized for education and research, the Virtual Computing Lab or VCL .
- In production for 6 years, so extremely stable
- Nearly 3,000 severs and 600 images
- 80,000 sessions served in Spring ‘09 alone
- 24x7 availability, low TCO, cents per hour
- Client/server virtualization - and HPC cluster support
- Provides access to advanced applications/technology for even the most impoverished school districts
- An open source solution that is now an Apache incubator project available to all, with GBS support available
- Ideal solution for K-12 & emerging markets – and HPC
- ’07 & ‘09 Computerworld Honors Program Laureate



VCL production site: http://vcl.ncsu.edu (above)

VCL Apache project: http://incubator.apache.org/projects/vcl.html

The Virtual Computing Laboratory technology (VCL)

Features

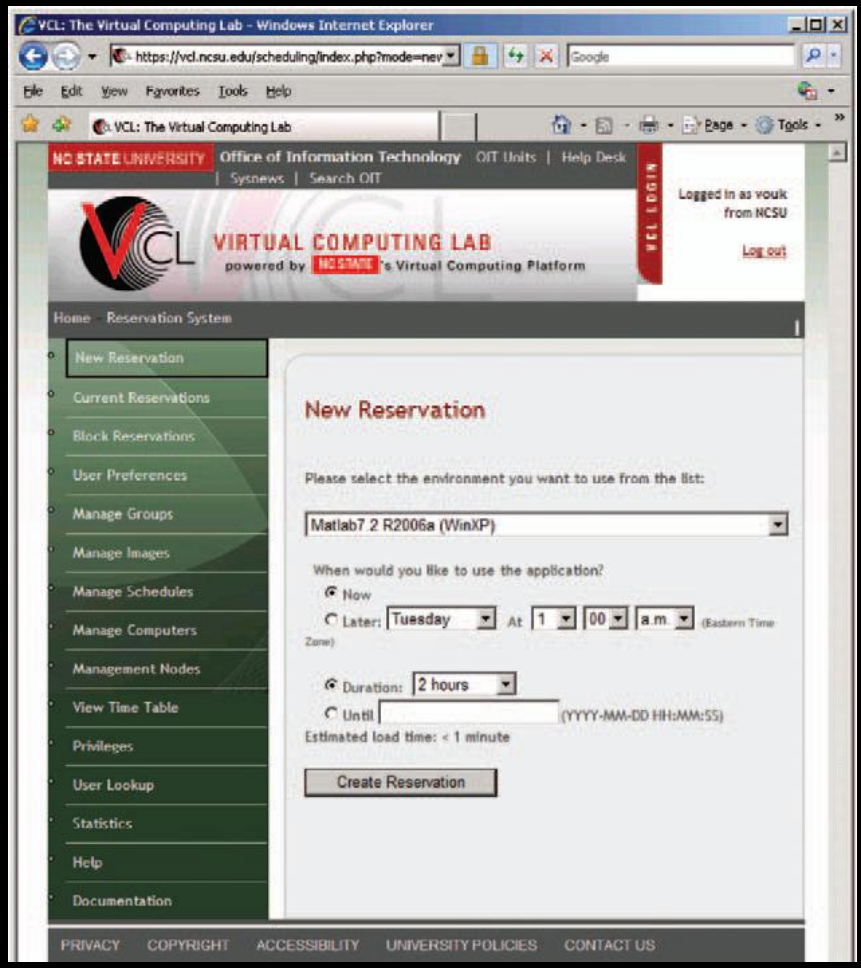
- VCL is an open-source implementation of a secure *production-level*, *on-demand service-oriented* technology for wide-area access to solutions based on real and virtualized resources, including computational, storage, networking and software resources
- VCL usage: to implement distributed reconfigurable data centres & computational services for educational institutions
- VCL can deliver complex homogenous or heterogeneous (virtual) clouds based on a mix of resource architectures [*ensembles*, *mainframe servers* – IBM system z & p platforms, *hybrid clouds*]

Benefit for higher education

- Small distributed data centers and laboratories are becoming increasingly expensive to provision, support and maintain on their own in educational environments
- Growing power and cooling needs (approaching acquisition costs)
- Large centers are becoming more powerful, sophisticated, expensive to build; need on high-capacity network infrastructure to connect end users
- Flexible VCL capabilities (offerings):
  - Infrastructure as a service [IaaS]
  - Platform as a service [PaaS]
  - Software as a service [SaaS]
  - Cloud as a service [CaaS]

VCL services

- Key concept: easy-to-use, cost-efficient and versatile services
- Baseline service: provisioning of *bare-metal* and *virtualized resources* i.e. a suite of on-demand & scheduled IaaS-type services, resources and functionalities
- Extended services: PaaS, SaaS
- Easy-to-use and friendly Web interface
- New Reservation: select an environment of interest (e.g. a MATLAB single-server image); the image is loaded for the requested time on:
  - Implicit auto assigned resources;
  - An explicit set of resources (tightly coupled cluster of nodes for HPC experiment)
- VCL also has a network-oriented (service) API allowing remote applications, middleware & OSs to access the same functionalities through a publishable service.



Bare metal: the OS and application stack ("image") are loaded straight onto the hardware without any software layer between image and hardware

VCL architecture: 7 major groups of subsystems

1. End-user access interface (Web-based and API-based subsystem)
2. Authentication service
3. VCL manager of user requests (includes a resource scheduler, auth., security, multi-site coord., performance monitoring, virtual network mngmt)
4. VCL database
5. Node manager of local installation resources & loads
6. Image repository
7. Computational, storage & network resources

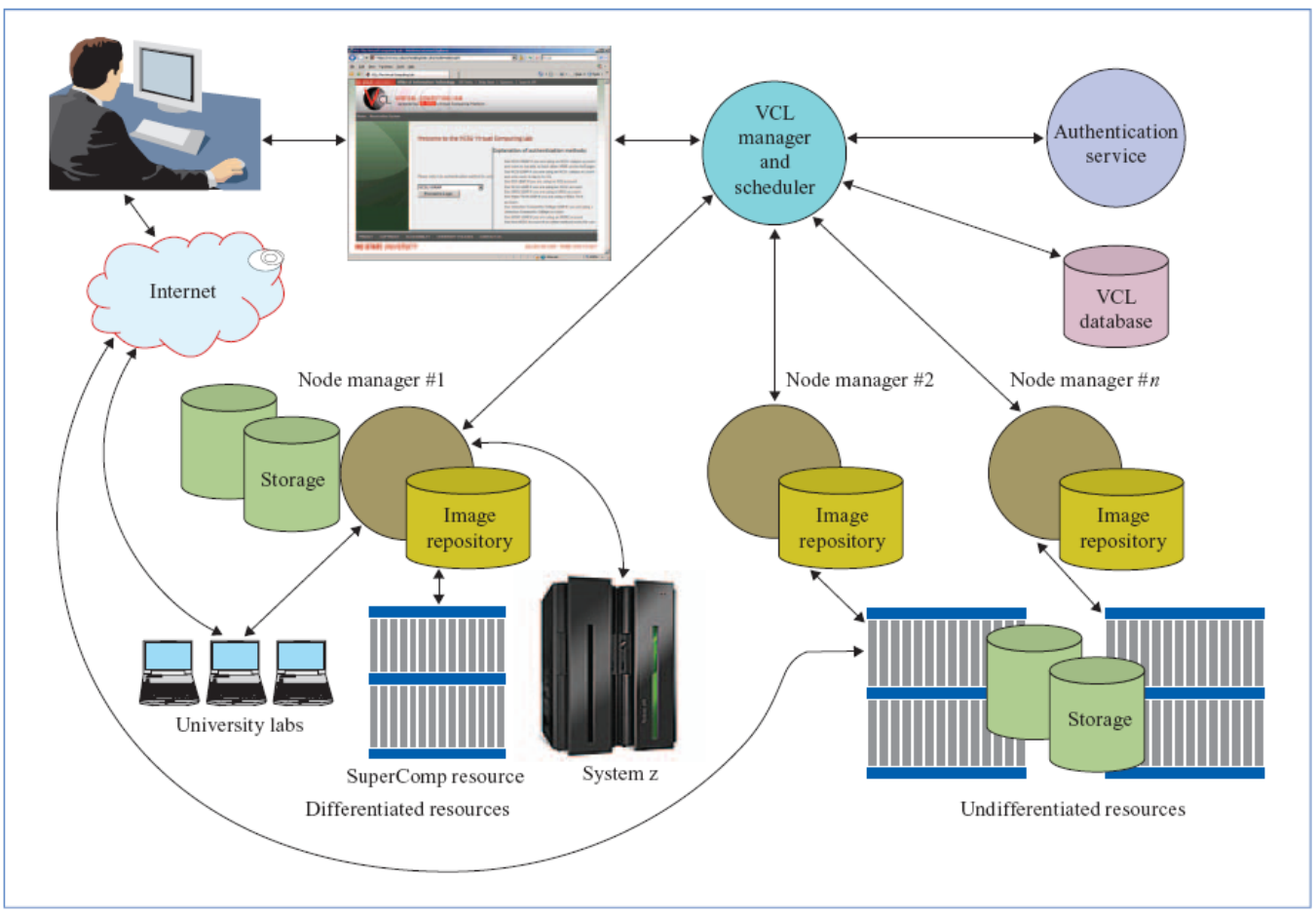
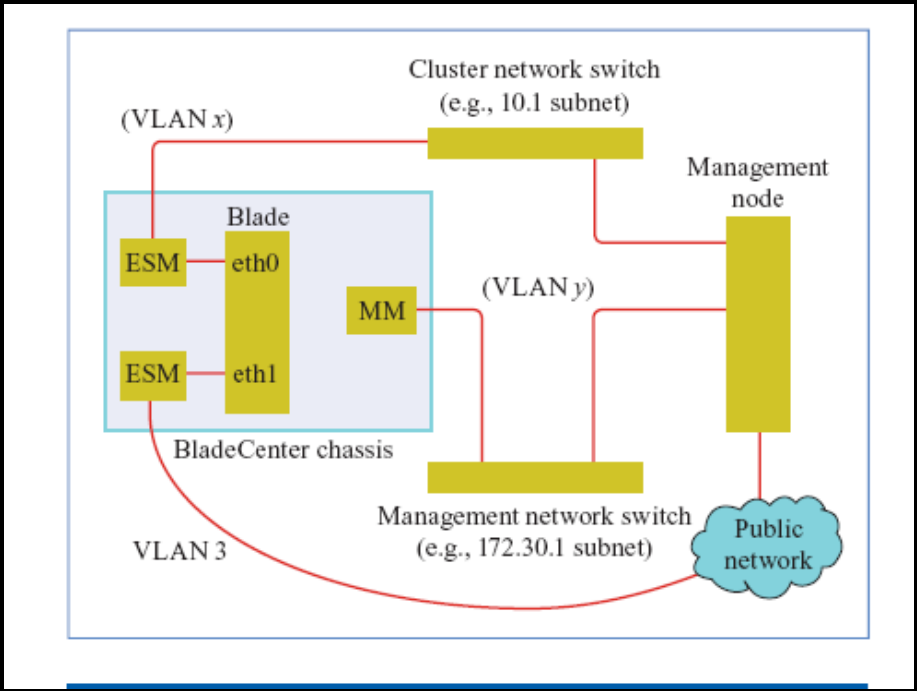


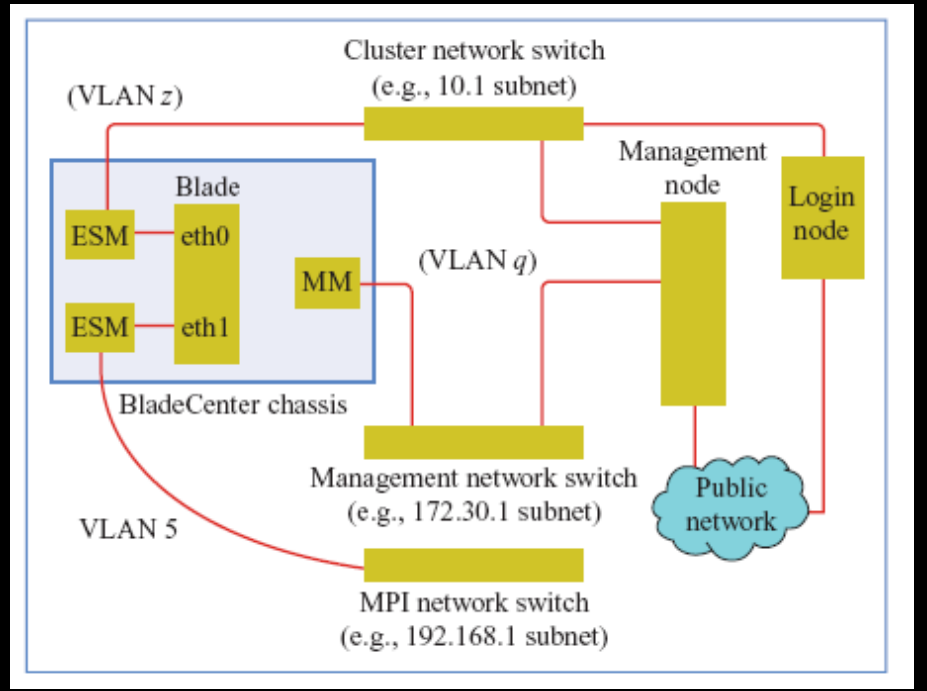
Image: a software stack incorporating any *baseline OS*, and if virtualization is needed for scalability, a *hypervisor layer*; any *desired middleware* or *application* that runs on that OS or on a hypervisor; and any *end-user appropriate access solution*

VCL architecture: basic VCL network configurations



1. Dual-use physical network configuration

Used for environments where seats and services are assigned individually or in synchronized groups, or when assigning or constructing an end-user image aggregate or environment where every node can be accessed from a public network



2. VCL high-performance computing physical network setup

Configuration with blades assigned to a tightly coupled HPC cluster environment or to a large overlay (virtual) cloud that has relatively centralized public access and computational management

Benefits of VCL

- VCL considerably increases utilization of resources (70%-80%)by allowing dynamic reallocation of excess undifferentiated resources to the purpose that is in need of additional capacity.
- Augmentation of laboratory desktop computing resources with HPC VCL services extends the life of the machines (by as much as 30%) since they do not have to be replaced as frequently.
- Gradual migration of HPC-grade blades to less demanding use over an 18- to 24-month period and extended use of blades (up to 5 years) increases capacity and return of investment.
- VCL reduces laboratory spaces.
- VCL considerably reduces the routine management effort for the undifferentiated resources through real-time resource monitoring, remote management of their states, and implementation of failover policies that make use of the redundancy in the resources.
- VCL allows very easy incorporation of new resources, both undifferentiated and differentiated
- VCL distributes the burden of image creation and management, often the most labour –intensive part of centralized IT management.
- VCL image methodology allows isolation of applications from each other (even providing the ability to allow multiple versions of the same application to be available).
- In VCL, scalability is achieved through a combination of multi-site multi-user service hosting, operating system and application virtualization using open-source and commercial products.
- VCL is “green” – most of its hardware is power conscious.

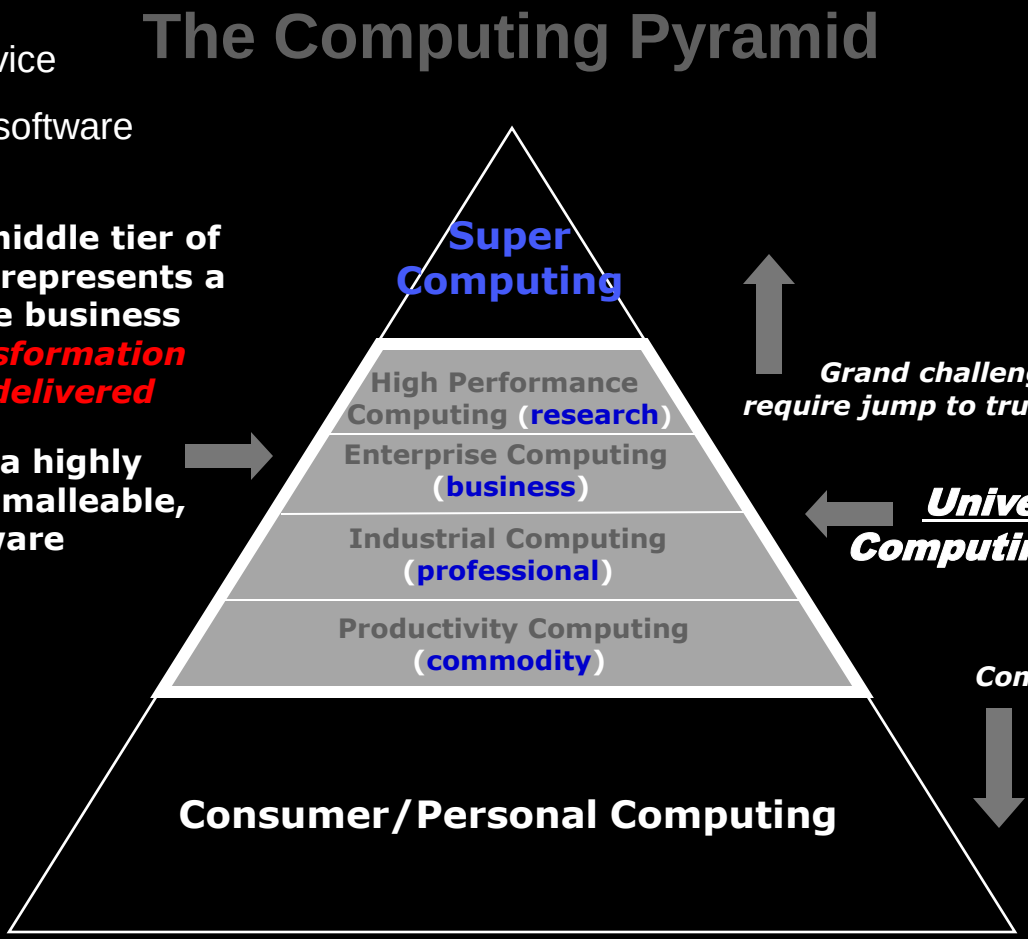
Advantages of VCL for higher education

An environment delivery service

Remote access to high-end software

VCL delivers entire middle tier of solutions. As such it represents a transformation in the business of education—*a transformation in how education is delivered*

Services delivered via highly uniform, extensible, malleable, & supportable hardware architecture



Advantages

- Student Owned Computing
- Distance Education
- Traditional Lab Model
- Shared Compute Resources
- Custom Compute Environments
- Continuous Cycles

Introducing the

IBM Cloud Academy

An ecosystem of leaders in designing and building cloud computing capabilities for students, institutions, and technology providers.

The IBM Cloud Academy is a forum for innovation for smarter classrooms, smarter administration, and research innovation.

The IBM Cloud Academy

Our vision

- Engaging with an ecosystem of thought leaders in cloud computing to share best practices, ideas, and technology
- Practicing what we preach – using cloud services to promote collaboration among the IBM Cloud Academy itself

Members will benefit from

- Access to thought leaders in the cloud computing arena, both from IBM and from other member institutions
- A technical community to share tools and technology to transform cloud projects
- Strategies to transform how technology can support educational initiatives on campuses and in schools around the globe

www.ibm.com/education/ibmcloudacademy

Academic Skills Cloud
Key Talking Points

Cloud Computing

- Cloud computing is an emerging style of computing whose foundation is the **delivery of services software** and **processing capacity** using **private or public networks**
- Cloud enables the ***dynamic availability of IT applications and infrastructure***, regardless of location

Academic Skills Cloud

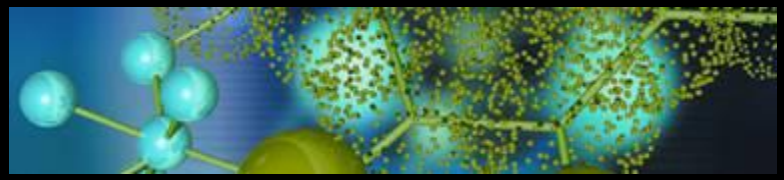
- IBM is announcing an Academic Skills Cloud project to **dynamically deliver provisioned virtual server images** of some of it's leading software for use by College/University Faculty to more easily teach IT related skills, that can be provisioned as services on the cloud.
- The goal is to **expedite the service delivery of software used to teach IT skills** at colleges/universities through a highly automated, highly virtualized, very dynamic, and flexible self service cloud environment.

Value Proposition

- IBM Academic Cloud, delivered by **IBM Development Test Cloud** delivers a broad portfolio of easy to consume, real-time provisioning and enterprise software services
- Reduces the necessity of faculty to conduct traditional and time consuming software download, installation, deployment and configuration routines to leverage our software for teaching purposes.
- Faster deployment of IBM development tools for use in classes.
- Increases faculty time focusing on teaching content, less time on logistics, and administration.
- Provides faculty and students participating in classes preconfigured virtual software images embodying best practices.

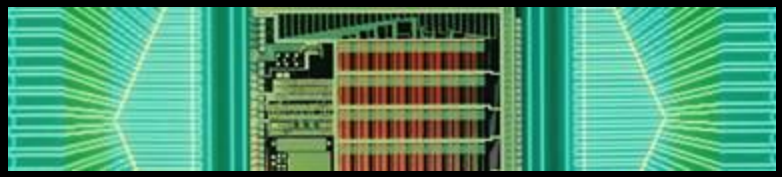
www.ibm.com/academicinitiative

IBM Cloud Academy participants will be able to:



Integrate IBM Cloud Technologies

Implement solutions for education based on IBM's world class cloud technology for private clouds and services from IBM's public cloud.



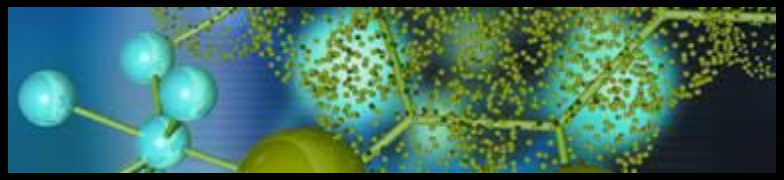
Innovate cloud services and technologies

Participate in the definition of emerging cloud technologies and implementations with IBM researchers, developers and partners

Collaborate with peers and developers

Work with colleagues from around the globe in an accessible cloud-based collaboration forum to share best practices, ideas, and insights

IBM Cloud Academy participants will be able to:



Integrate IBM Cloud Technologies

Implement solutions for education based on IBM's world class cloud technology for private clouds and services from IBM's public cloud.

PRIVATE CLOUD TECHNOLOGIES

Cloud "appliance" for Education

Server, storage virtualized hardware

- Virtual Computing Lab/ Virtual Computing Initiative
- Tivoli Software for Automation

PUBLIC CLOUD SERVICES

Desktop Cloud Services

Corporate Citizenship Projects

LotusLive for Administrative Collaboration

University Delivery Services for VCL

Items in red have
contractual agreements

IBM Cloud Academy participants will be able to:

Innovate cloud services and technologies

Participate in the definition of emerging cloud technologies and implementations with IBM researchers, developers and partners

- Accessibility for cloud services
- Faculty Awards
- Shared University Research grants
- Open Source Projects for cloud computing

Items in red have contractual agreements

New Cloud Offering for Academic Initiative Members

- **IBM Academic Skills Cloud**
  - Accelerate the teaching of IT skills of the future, and build skills for a smarter planet. Allow faculty members to access to customizable virtual machines in minutes
  - Showcase IBM's leading cloud offerings to future IT & Business leaders of tomorrow
  - Expedite the delivery of key IBM software for teaching purposes via a highly automated, highly virtualized, very dynamic, and flexible self service cloud environment.

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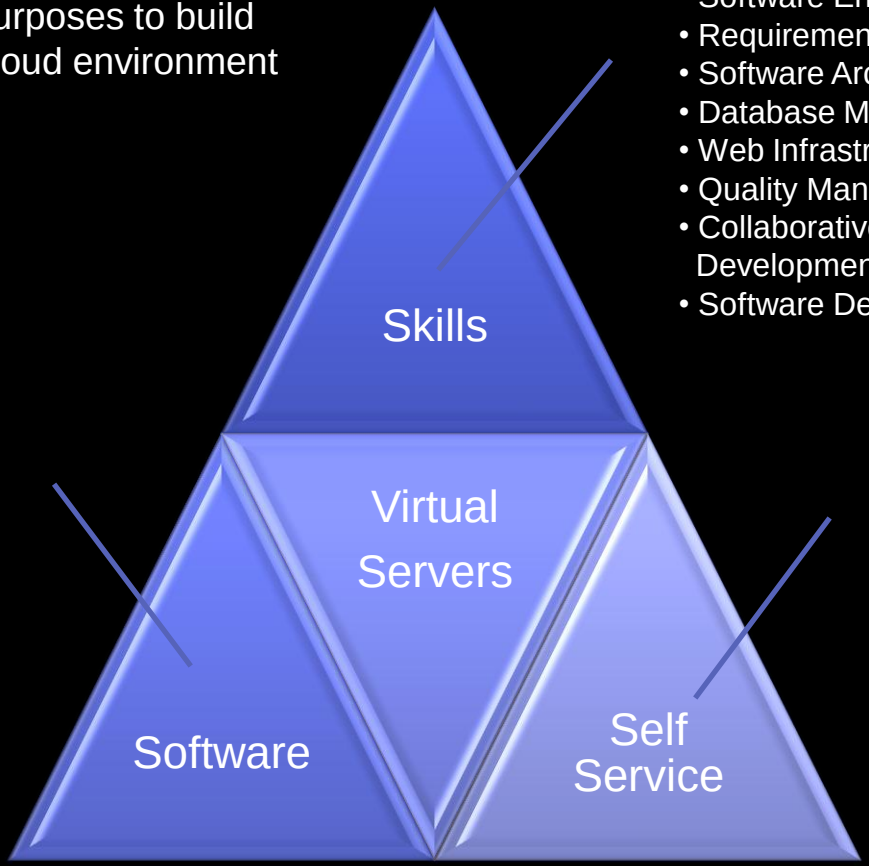
IBM Academic Skills Cloud

A ***self service cloud delivery model*** of key IBM software for teaching purposes to build skills via highly virtualized cloud environment

- Rational Requirements Composer
- Rational Asset Manager
- Rational Team Concert
- Rational Insight
- Rational Build Forge Agent
- Rational Application Developer
- Rational Build Forge
- Rational Asset Manager
- Rational Quality Manager
- Rational Software Architect
- WebSphere sMash
- WebSphere Application Server and Rational Agent Controller
- Informix Dynamic Server
- DB2 Express-C V9.7
- IDS 11.50.xC5 DE
- Lotus Turbo Forms
- SUSE Linux



- Web/J2EE Development
- Software Engineering
- Requirements Management
- Software Architecture
- Database Management
- Web Infrastructure
- Quality Management
- Collaborative Software Development
- Software Delivery Automation

- Image Library
- Self Provisioning
- Personalized Control
- Panel
- Community Forums
- Getting Started Guides
- Getting Started Demos

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Academic Skills Cloud

What images are available on IBM Academic Skills Cloud?

Academic Skills Cloud

Rational

- Rational Requirements Composer
- Rational Asset Manager 7.2.0.1
- Rational Team Concert
- Rational Insight
- Rational Build Forge Agent
- Rational Application Developer
- Rational Build Forge

- Rational Asset Manager
- Rational Quality Manager
- Rational Software Architect for WebSphere

WebSphere

- WebSphere sMash
- WebSphere Application Server and Rational Agent Controller

Information Management

- Informix Dynamic Server Developer Edition
- DB2 Express-C V9.7
- IDS 11.50.xC5 DE

Lotus

- Lotus Turbo Forms

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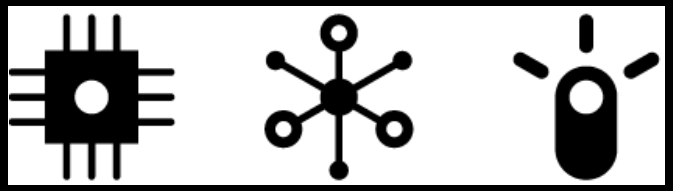
Putting it together…positioning guidance & context

IBM Cloud & Academic Initiative conversation roadmap

The world is changing



It's becoming increasingly instrumented, interconnected and intelligent

IBM views cloud computing as an emerging paradigm for delivering and consuming IT based services

New Cloud offerings, like IBM Development and Test Cloud present new opportunities to expedite service delivery of software used to teach IT skills at universities through a highly automated, highly virtualized, very dynamic, and flexible self service cloud environment.

Academic Initiative: partnering with faculty to build skills for a smarter planet

Academic Skills Cloud

Access to software & courseware via traditional download catalogs

www.ibm.com/academicinitiative

Cloud Computing is the mean for Smart Education

Q / A?