Cloud Computing and the IEEE

Doug Zuckerman
Conferences Track Leader
IEEE Cloud Computing Initiative

IEEE CLOUD COMPUTING

IEEE

Computing Waves

Arpanet

Mainframe

PC & Client Server

Web

Cloud

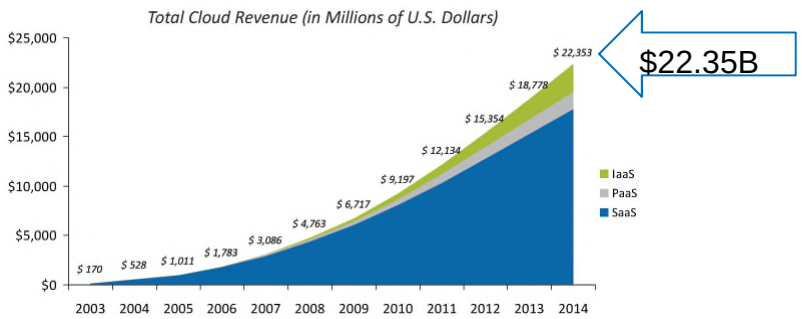
+Big Data

+Mobile

1960 1970 1980 1990 2000

Why should we care about cloud computing?

- ✓ It's big business
- ✓ It's creating new jobs



- ✓ Worldwide – governments have made cloud computing a priority
- ✓ It affects you, your family, your friends, everyone!

TARGET

amazon.com

Walmart
Save money. Live better.

iCloud

Networking, management, security, reliability, cost, mobility, power

IEEE

Cloud Computing Infrastructure and Management

Cloud computing technology contributes to network management across computing and telecommunications areas

- Cloud infrastructure and its management can be defined across multiple levels of service providers
- Unlike traditional implementations, cloud infrastructure services can be hosted across multiple distinct platforms and with different providers --- where software, hardware, network and data are “virtually” located and hopefully offers a limitless resource
- Migration to a cloud infrastructure does not necessarily involve accessing all the requirements in one traditional data center, but instead providing a more cost-effective set of services distributed across multiple providers in multiple locations

Cloud Computing and The IEEE

- The IEEE Cloud Computing Initiative (CCI) is uniquely qualified and positioned to play a leading role in the development of cloud computing globally and to help guide and shape its future
- IEEE has provided a venue for cloud-related activities for years
  - The Initiative has increased collaboration across multiple societies
- IEEE CCI is leading coordinated and collaborative effort on cloud opportunities across IEEE
  - "One IEEE"

IEEE Xplore® DIGITAL LIBRARY

the institute

EAB

MGA

IEEE computer society

IEEE PES Power & Energy Society®

IEEE Signal Processing Society

IEEE SYSTEMS COUNCIL

IEEE COMMUNICATIONS SOCIETY

ieee.tv Tune in to where technology lives.

IEEE VTS Vehicular Technology Society

IEEE Consumer Electronics Society

IEEE Computational Intelligence Society

Systems, Man, & Cybernetics Society

CSS IEEE Control Systems Society

ReliabilitySociety

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IEEE photonics SOCIETY Transforming science into technology®

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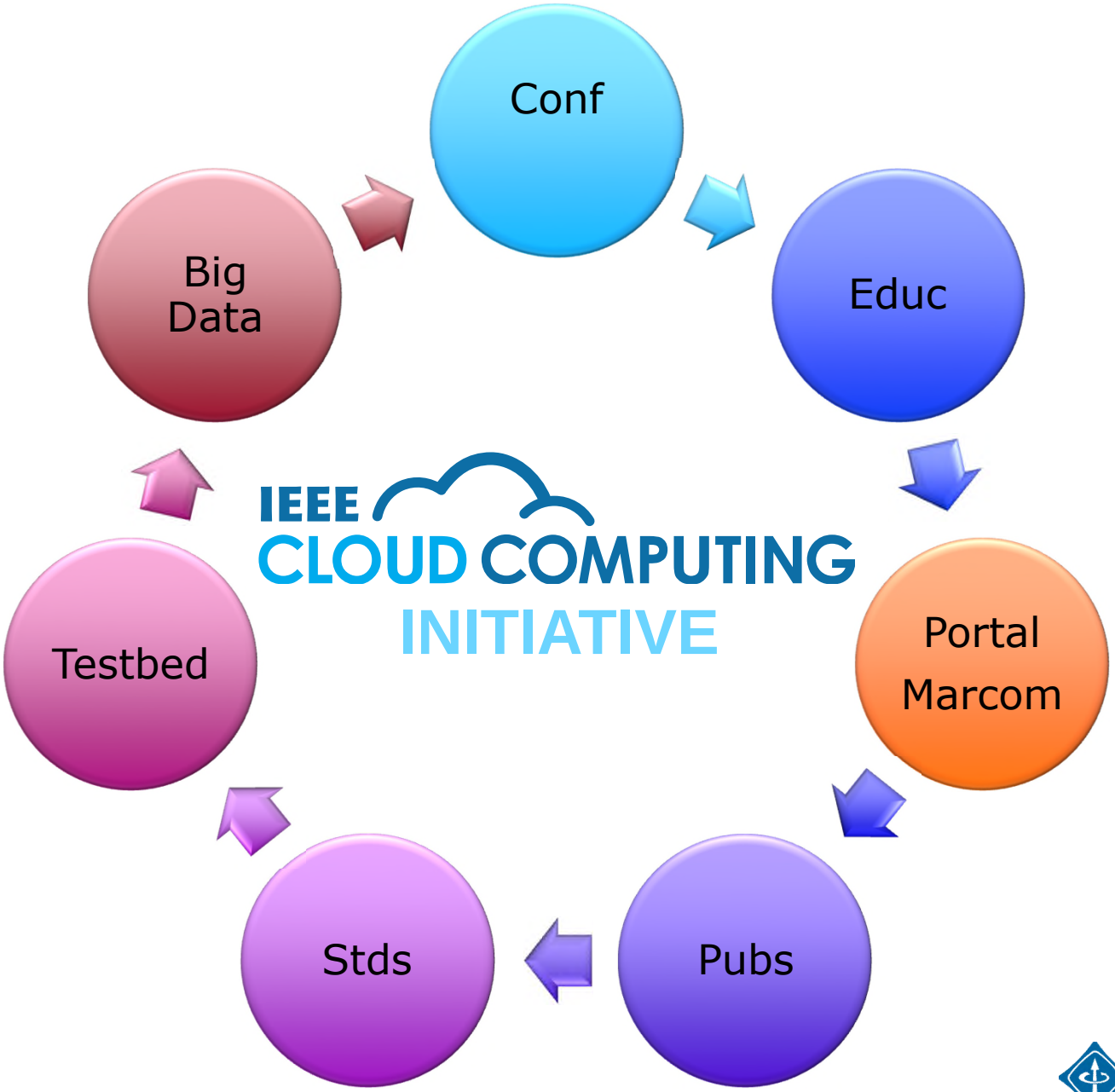
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Portal
Marcom
Pubs
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Testbed
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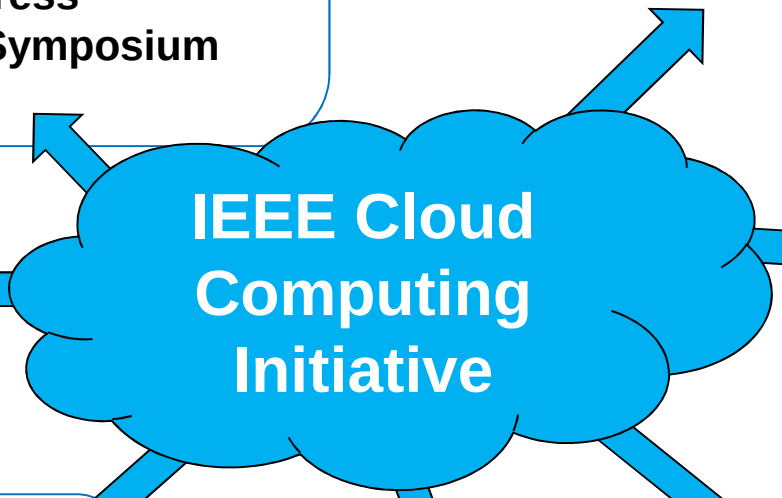
What is CCI doing?



Conferences Track
- IEEE Cloud Computing for Emerging Markets
- Asian Pacific Cloud Congress
- Latin America Cloud Congress
- European Cloud Congress
- North America Cloud Symposium
- World Forum

Intercloud Testbed Track
- Infrastructure environment for applications (P2302)
- Supports education, conferences, pubs

Web Portal Track
- Dedicated website
- Social media
- Video
- Articles
- Newsletter
- Blog

Publications Track
- Transactions
- Magazine
- Letters

Education Track
- eLearning modules
- Continuing education
- Video of conference talks, section/chapter talks

Big Data Track
- Transactions Pub
- Leadership

Standards Track
- P2301 Cloud portability, commonality
- P2302 Cloud to cloud interoperability

IEEE CLOUD COMPUTING

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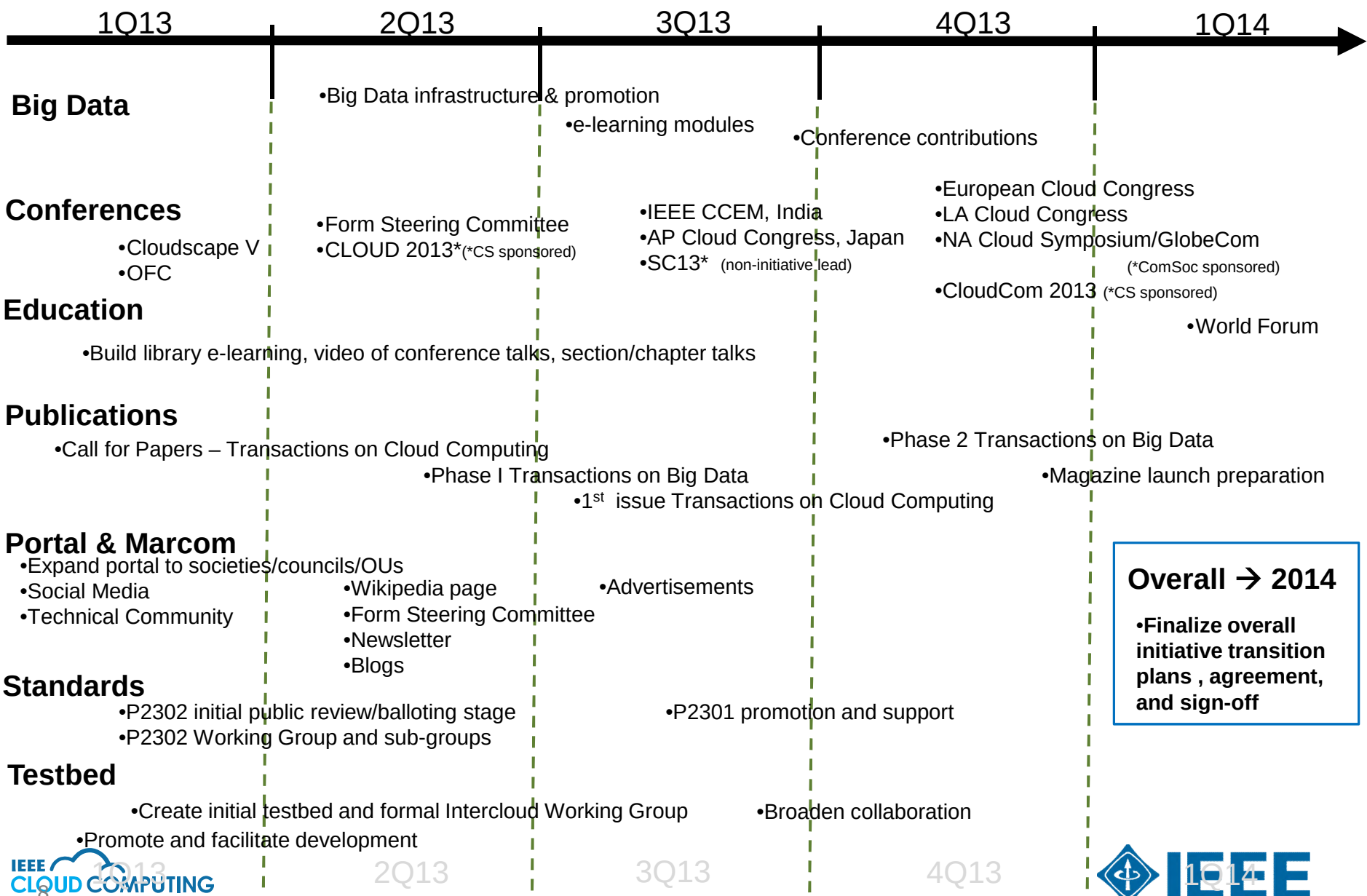
Project Milestones and Roadmap: 2013



IEEE Cloud Computing Conferences

Enable thought leaders, users, vendors, and interest groups opportunities to exchange knowledge and discuss cloud computing issues.

Asian Pacific Cloud Congress, 22-26 July 2013, Kyoto, Japan (compsac.cs.iastate.edu), associated with COMPSAC

Cloud Computing for Emerging Markets (CCEM), 16-18 October 2013, Bangalore, India (cloudcomputing.ieee.org/ccem)

Latin America Cloud Congress, 9-10 December 2013, Maceió-Alagoas, Brazil - LATINCLOUD (www.ieee-latincloud.org/2013)

European Cloud Congress, 2-5 December 2013, Bristol, UK (2013.cloudcom.org), associated with CloudCom

North America Cloud Congress, 9-13 December 2013, Atlanta, Georgia, US (www.ieee-globecom.org), co-located with GLOBECOM

Conferences cross-promoted across IEEE

IEEE CLOUD COMPUTING

IEEE Cloud Computing for Emerging Markets

16-18 October 2013 in Bangalore, India

IEEE

About | Program | Registration | Authors | Innovations Council | Speakers | Venue | Sponsors

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CCEM 2012 Photos

View All

Conference Overview

This second **IEEE International Conference on Cloud Computing for Emerging Markets (CCEM)** follows the highly successful launch of the first edition in 2012. The goal of the CCEM conference is to address the unique challenges and opportunities of cloud computing for emerging markets in a high quality event that brings together industry, government, and academic leaders in cloud computing from around the world, particularly from emerging markets.

Latest Information

CCEM early bird registration ends Saturday, 31 August!
Register now

Accepted Authors, please see final paper submission instructions
Author information

CCEM 2013 Hotel Reservation information now available
Reserve your room today

CCEM 2013 Sponsorship and Participation Opportunities
Download the brochure

Important Dates

19 April 2013: Sponsorship and Exhibit Proposals Due
17 June 2013: Final date for Paper Submissions, Demo Proposals and Tutorial Proposals; Tutorial Acceptance Notification
22 July 2013: Acceptance Notification of Papers/Demos
16 August 2013: Camera-ready papers, demo descriptions due
31 August 2013: Early registration deadline

Invited Talks

NEW "A Roadmap for Cloud Computing Innovation in India" white paper released by Dr. Sam Pitroda, Chairman of the National Innovation Council for India

Topics

- Cloud computing: overview, opportunities, issues, and challenges
- An emerging market view of cloud computing in government, public sectors
- Security and compliance issues in cloud computing and their implications in emerging markets
- Networking in the cloud computing era -- how emerging markets are changing the game
- Telcos as cloud providers -- opportunities and challenges in emerging markets
- Emerging standards in cloud computing

Keynote Speakers

Renu Budhiraja,
Sr. Director & HoD State Data Centers,
e-Governance Division, DeitY

Renu Budhiraja

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IEEE CLOUD COMPUTING

Register for CCEM2013

WELCOME TO IEEE LATINCLOUD 2013

The 2013 IEEE Latin America Conference on Cloud Computing and Communications (LatinCloud 2013) is the second edition of a conference that quickly has become the premier forum for discussions of recent advances in cloud computing and communications, virtualization, utility computing, grid computing, service-oriented architectures and software-defined networks for the datacenter in this world region". The Cloud Computing and communications paradigm has defined unprecedented business models, promoting on-demand computing resource allocation, elastic scaling, and elimination of up-front costs. Capitalizing on paradigms such as virtualization, utility computing, grid computing, and service oriented architectures, cloud computing and communications has already changed the way we compute and communicate.

We look forward to seeing you in Maceió!

Carlos Kamienski and Stenio Fernandes
General Co-chairs

Register for LATINCLOUD

Important Dates

- **Paper Submission:** Oct. 1st, 2013
- **Acceptance Notification:** Nov. 15th, 2013
- **Final Version:** Nov. 30th, 2013

IEEE Asia Pacific Cloud Computing Congress

14-17 November 2012 at Shenzhen Wuzhou Guest House

Attendance: 300

Peter Staecker presenting Spectrum in Chinese to Vice Mayor Chen Biao of Shenzhen

IEEE GLOBECOM 2013
GLOBAL COMMUNICATIONS CONFERENCE, EXHIBITION & INDUSTRY FORUM
ATLANTA, GA USA
9-13 DECEMBER 2013
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IEEE ComSoc Mentor Program

IEEE Cloud Computing Education

Dedicated to serving the education and training needs of members and non-members, the CCI Education Track will develop and offer IEEE's educational programs in cloud computing

Methodology supports:

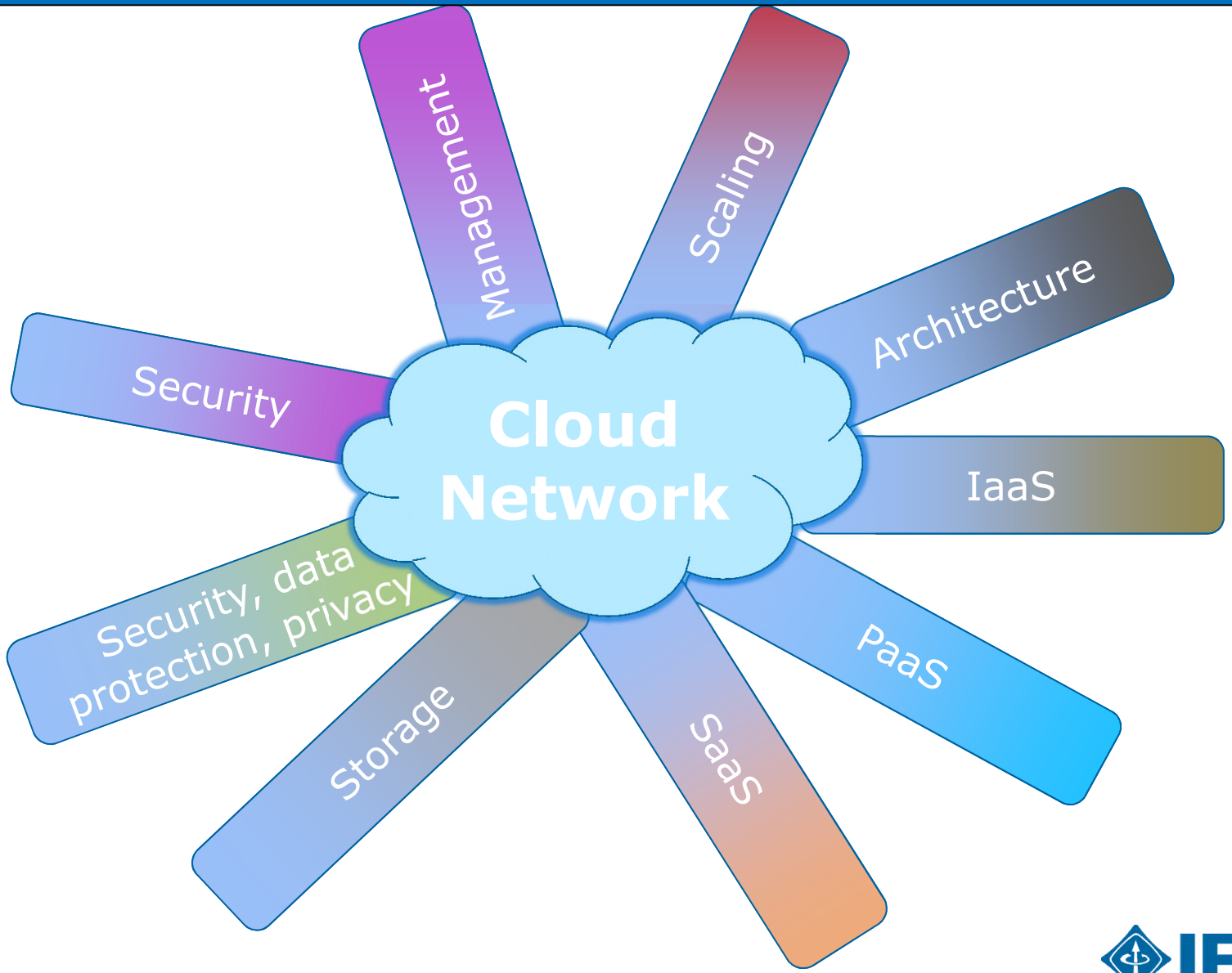
- eLearning course modules
- Continuing education
- Video of conference presentations, section/chapter talks

IEEE Cloud Computing Education

Providing a new and comprehensive curriculum through eLearning modules

1. A wider scope of technologies and important topics covered both in cloud Intermediate, Advanced, and Expert, including materials for developers
2. A stronger base on standardization and best practices – right up to expert knowledge at each level, from manager to developer
3. Is intended to achieve level of known certification programs in Cloud Computing
4. Has selected topics and level of coverage based on our experience of what is essential in mastering cloud technologies from initial involvement to current professional work and use of clouds

Cloud Network Topics



Sampler of eLearning Modules

Cloud Computing Definition, Reference Architecture, and General Use Cases

Cloud Scaling and Cloud Reliability. Cloud Computing Economics: Business and Operational models, Compliance

Servers, Physical Networking, Storage – Design Philosophy Alternatives

Identity and Trust Management in Clouds, Federated Access Control and Resource Management; SLA Management

Cloud Management Software (platform) (1): OpenStack™ , components, tools, configuration examples, design patterns

Cloud Management Software (platform) (2): OpenNebula (detailed overview, design patterns); Eucalyptus overview; VMware vCloud and Cloud Foundry™ (overview)

Custom and large scale Deployment, Management tools – Chef, Puppet , other tools

IEEE

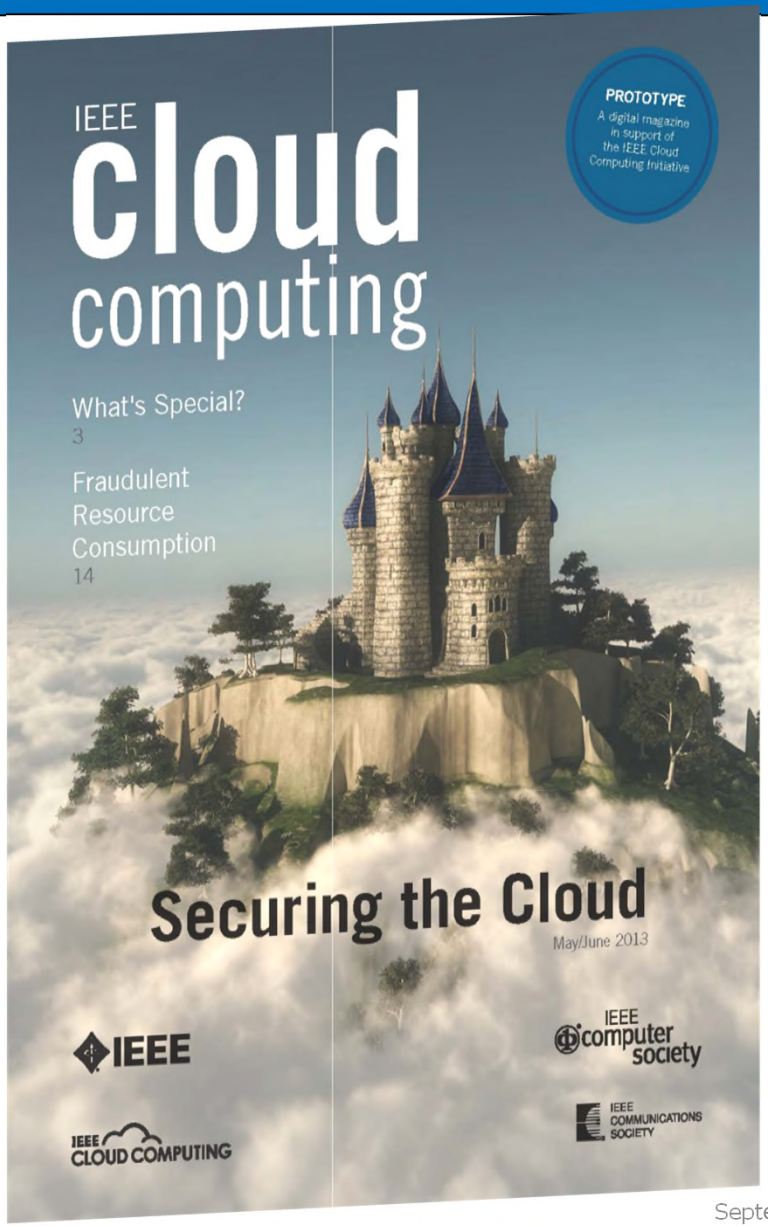
IEEE Cloud Computing Publications

Launching several new and very important publications on cloud computing and big data for both expert and lay audiences

- *IEEE Transactions on Cloud Computing*
  - Peer-reviewed engineering journal, call for papers now, launch in 2013
  - Include articles examining innovative research in cloud computing and the results of research in all areas of this broad field
  - Submissions ranging from algorithms and analytics to performance analysis, security and privacy, standards, theory, communications protocols, energy consumption, and applications for business and industry
- *IEEE Cloud Computing Magazine*
  - Broad topics of interest and targeted to the general public, will begin publishing 2014

- IEEE Transactions on Big Data
  - Planning to develop infrastructure and publishing paradigm to publish “big data” sets for access by researchers worldwide
  - Will offer, for example, access to big data being accumulated in research fields such as astronomy, meteorology, genomics, biology, social media, finance

Prototype Cloud Magazine



Guest Editor's Introduction

Cloud Computing: Transforming Information Technology

Jon Rokne • University of Calgary

The migration of information and processes to the cloud is transforming not only where computing is done but, fundamentally, how it is done. Cloud computing solves many conventional computing problems, including handling peak loads, installing software updates, and utilizing excess computing cycles, but the new technology has also created new challenges in data security, data ownership, transborder data storage, and the training of highly skilled cloud computing professionals. As more in the corporate and academic worlds invest in this technology, IT professionals' working environments are also changing dramatically.

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Taking Initiative

Recognizing that cloud computing is poised to be the dominant form of computing in the future, IEEE has funded a Cloud Computing Initiative (CCI) to coordinate its cloud-related activities. To that end, the IEEE CCI has established tracks for cloud computing standards, conferences, publications, and educational materials. The Cloud Computing Initiative portal site (http://cloudcomputing.ieee.org) presents information on all these topics.

The CCI publications track is tasked with developing a slate of cloud computing-related periodicals. To date, it has provided seed funding for two publications: *IEEE Transactions on Cloud Computing*, launched in 2013, and *IEEE Cloud Computing* magazine, which will be available in early 2014. These publications aim to provide a focused home for cloud-related research and feature articles so that cloud researchers can publish their most important work, informing other professionals of new developments in the field.

In this Issue

To highlight the IEEE CCI's activities and serve as a preliminary announcement of the cloud publications that will

Call for Papers Transactions on Cloud Computing

IEEE Cloud Computing Standards

IEEE leading the way on Cloud Computing standards:

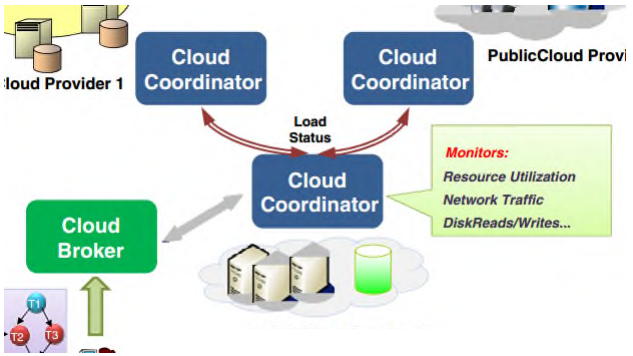
- IEEE P2301™ Cloud Portability, Commonality
  - Designed to provide an intuitive road map for application portability, management, and interoperability interfaces, as well as for file formats and operating conventions.

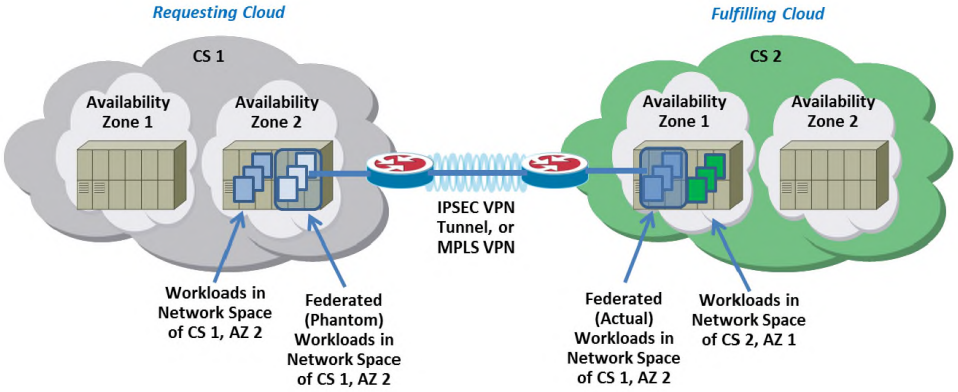
- IEEE P2302™ Cloud to Cloud Interoperability
  - Defining the topology, protocols, functionality, and governance required for cloud-to-cloud interoperability.
  - P2302 Working Draft, version 3 distributed
  - Six subgroups responsible for sections of the draft (led by organizations e.g. US Navy SPAWAR, Cisco, Intel etc.)
    - Intercloud Background, Concepts & Topology - Section 4
    - Intercloud Topology Elements - Section 5
    - XMPP based Collaboration Protocol - Sections 6.1 thru 6.5
    - Intercloud Security - Sections 6.6 thru 6.8
    - Ontology Definition - Sections 6.9
    - Decentralized Ontology Deployment - Sections 6.10

P2302 Standard Development

New Proposed Contributions:

- Cloud Coordinator (Gateway) and Cloud Exchange Details, *Buyya et al, University of Melbourne*
- Dynamic Trust Establishment Approach for Multi-provider Intercloud, *Demchenko et al, University of Amsterdam*
- CS Numbers for Autonomous Clouds with XMPP-URI-CS format, *Bernstein et al, IEEE*
- Workload Federation and Federated Storage Replication Mechanics, *Bernstein et al, IEEE*



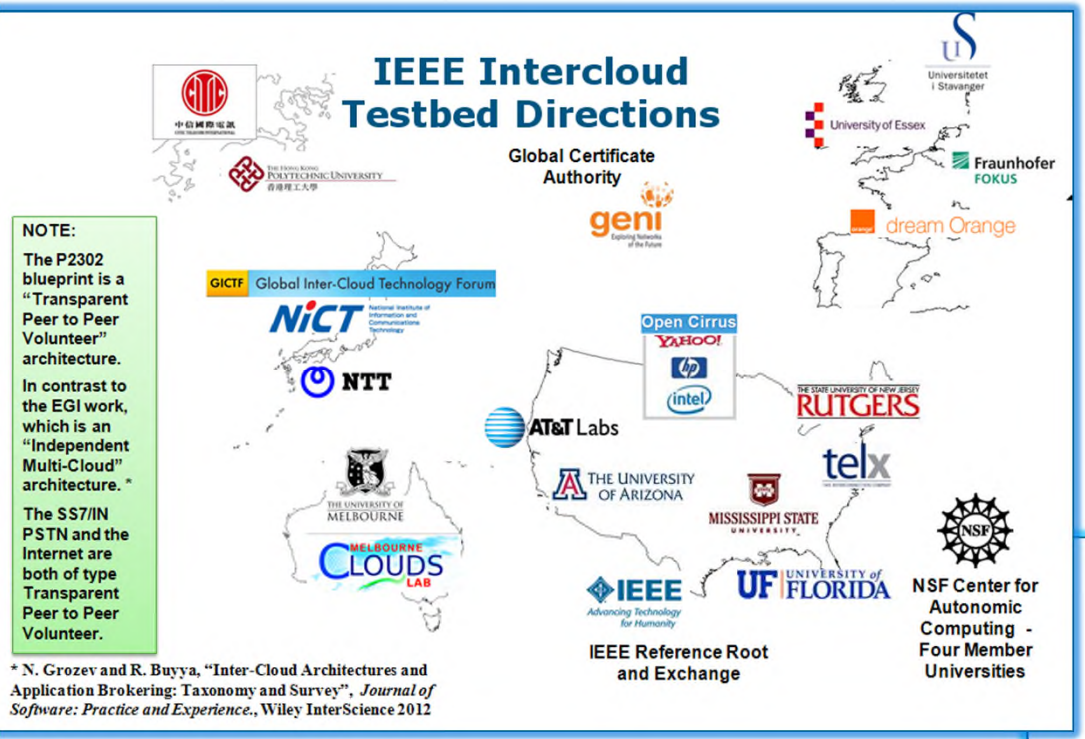


IEEE Cloud Computing Intercloud Testbed

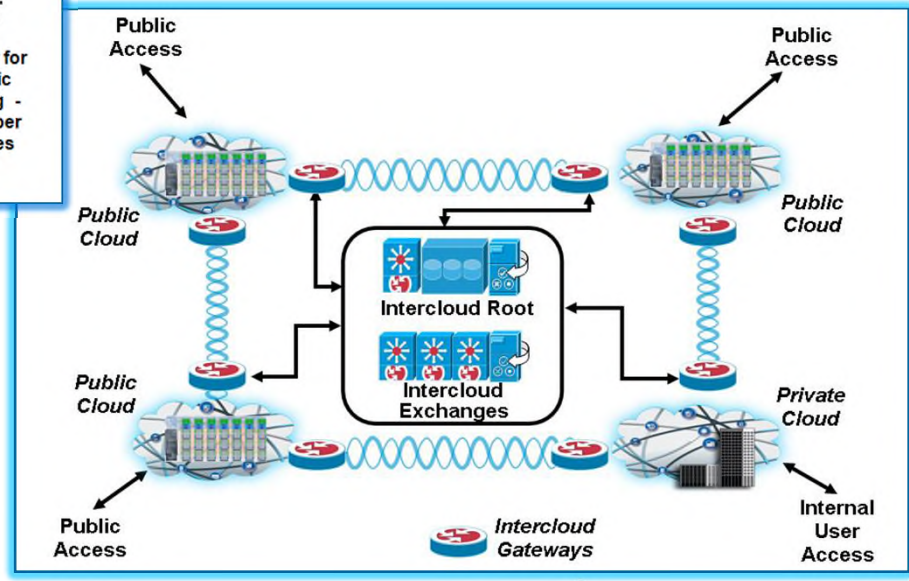
Methodology:

- As IEEE P2302 becomes standardized, the cloud computing ecosystem will need a standards-based cloud environment for creating and testing cloud-to-cloud protocols
- Vendors, service providers and application developers will also need a standards-based environment for experimenting with cloud-based products and services
- Executive committee formed
- Several partners secured and we're still open for more partnerships with companies, universities and research institutions around the world who have cloud computing resources to create the intercloud testbed environment

Intercloud Testbed



Map showing interested parties in the IEEE Intercloud Testbed and their location, including several Telco's



Reference Intercloud network topology and elements

What is the IEEE Intercloud Testbed Project?

- There are several Open Source and Standards projects in Cloud Computing
- The IEEE is working on an area which no other organization is tackling - that is "Intercloud"
- "Intercloud" is to Clouds as Internet is to Networks; a transparent, volunteer, peer-to-peer federation
- IEEE P2302 Working Group has been drafting a "Standard for Intercloud Interoperability and Federation" with such an architectural approach
- IEEE Intercloud Testbed is a companion effort to prototype, evolve, and make real this work

Organization of the IEEE Intercloud Testbed Project

- The Testbed is part of the IEEE Cloud Computing Initiative (CCI)
- The Testbed operates as a project of the IEEE "Industry Connections" program
- The Testbed is governed by an Executive Committee, including CCI and elected participant representatives
- The Executive Committee are overseen by the IEEE Cloud Computing Standards Committee (CCSC) and the IEEE-SA Board of Governors (BOG)
- Any company, university, or initiative can join with the approval of a Simple Majority of the EC

Governance of the IEEE Intercloud Testbed Project

- There is a V 1.0 of the IEEE Intercloud Testbed Industry Connections Activity Policies and Procedures
- This calls for a Six member Executive Committee. Three of these members are participants in the IEEE Cloud Computing Initiative

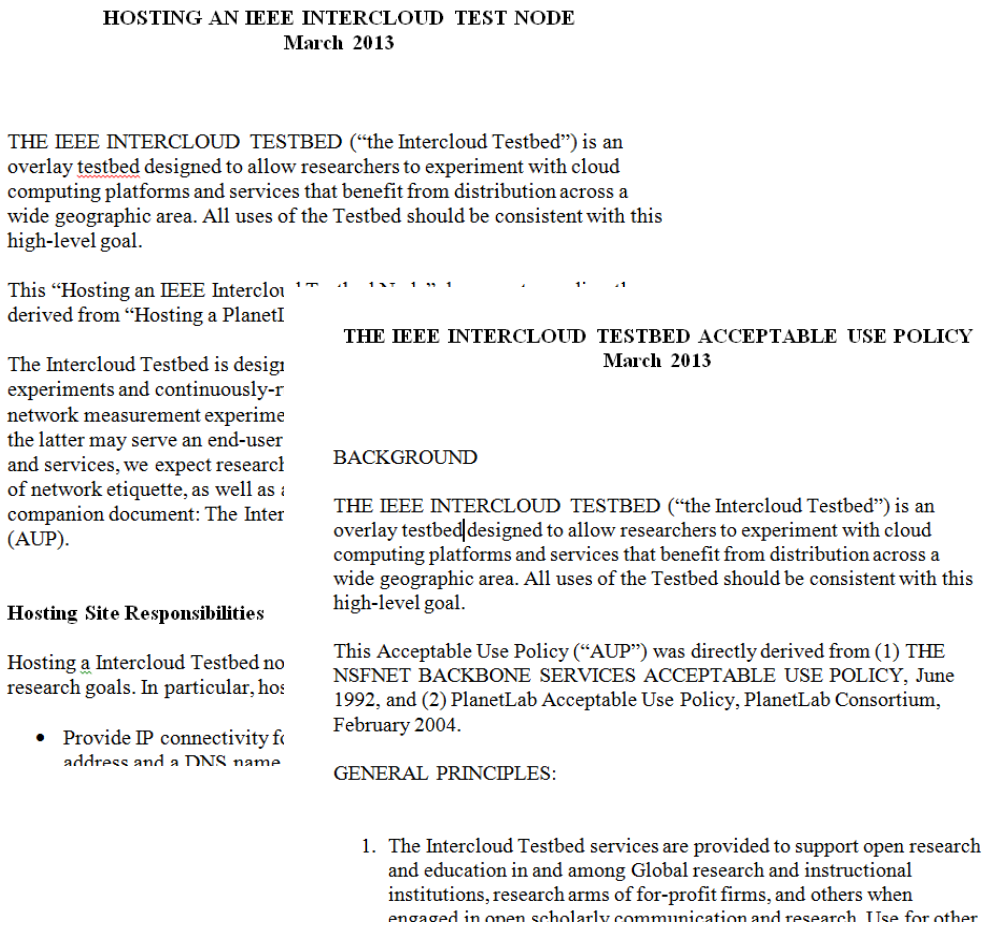
Prof. Michael Lightner **Chair, Dept. of Electrical and Computer Engineering, University of Colorado at Boulder**	**Mark Davis** **Founder and CTO Kitenga, a Dell Company**	**Prof. Jon Rokne** **Dept. of Computer Science** **The University of Calgary**

Three elected Executive Committee members

Joseph Weinman – Chair **SVP, Telx Group, Inc.**	**Henry Chan – Vice Chair** **The Hong Kong Polytechnic University Department of Computing**	**Kun Yang – Secretary** **University Of Essex**

New Governance Documents IEEE Intercloud Testbed Project

- The IEEE Intercloud Testbed Acceptable Use Policy
- Hosting an IEEE Intercloud Test Node



HOSTING AN IEEE INTERCLOUD TEST NODE
March 2013

THE IEEE INTERCLOUD TESTBED ("the Intercloud Testbed") is an overlay testbed designed to allow researchers to experiment with cloud computing platforms and services that benefit from distribution across a wide geographic area. All uses of the Testbed should be consistent with this high-level goal.

This "Hosting an IEEE Intercloud
derived from "Hosting a PlanetI

The Intercloud Testbed is desig
experiments and continuously-r
network measurement experime
the latter may serve an end-user
and services, we expect researcl
of network etiquette, as well as
companion document: The Inter
(AUP).

Hosting Site Responsibilities

Hosting a Intercloud Testbed no
research goals. In particular, hos

- Provide IP connectivity f
address and a DNS name

THE IEEE INTERCLOUD TESTBED ACCEPTABLE USE POLICY
March 2013

BACKGROUND

THE IEEE INTERCLOUD TESTBED ("the Intercloud Testbed") is an overlay testbed designed to allow researchers to experiment with cloud computing platforms and services that benefit from distribution across a wide geographic area. All uses of the Testbed should be consistent with this high-level goal.

This Acceptable Use Policy ("AUP") was directly derived from (1) THE NSFNET BACKBONE SERVICES ACCEPTABLE USE POLICY, June 1992, and (2) PlanetLab Acceptable Use Policy, PlanetLab Consortium, February 2004.

GENERAL PRINCIPLES:

1. The Intercloud Testbed services are provided to support open research and education in and among Global research and instructional institutions, research arms of for-profit firms, and others when engaged in open scholarly communication and research. Use for other

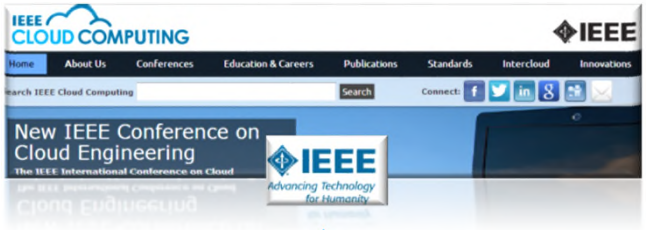
Participant Activities
IEEE Intercloud Testbed Project

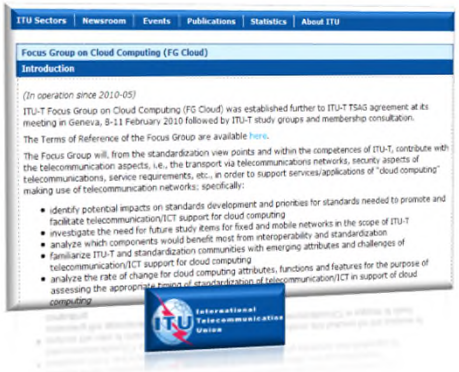
- Volunteer to re-use existing datacenter, cloud implementations, or construct a new cloud, of their choice, well-connected in a geography;
- Join the engineering project to code, test, re-engineer, and contribute to an open source implementation of the Intercloud protocol suite;
- Adapt protocols to the various cloud platforms and resource types in use in the Testbed;
- Connect to the reference Intercloud Root and Intercloud Exchange which IEEE are running;
- Explore the overall interoperability and applicability of the NSF GENI Project , in particular the trust and governance mechanisms of the GENI-ABAC project.

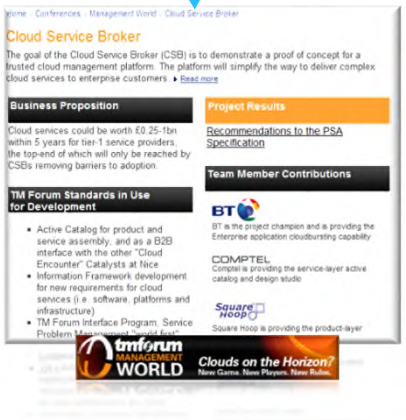
Participant Activities (continued)
IEEE Intercloud Testbed Project

- Experiment with cloud federation, further develop protocols, formats, and ontologies, explore topology issues for scalability;
- Feed results to the IEEE Standard project;
- Publish Papers on their research and implementation experience to constituencies;
- Create Reference Implementations of:
  - An Intercloud root cloud including naming, messaging, trust, audit, and semantic directory
  - An Intercloud exchange cloud
  - An Operational multi-cloud Intercloud protocol suite
  - Open Source projects of Reference Implementations, perhaps hosted with OpenStack Foundation.

Liaison Activities
IEEE Intercloud Testbed Project







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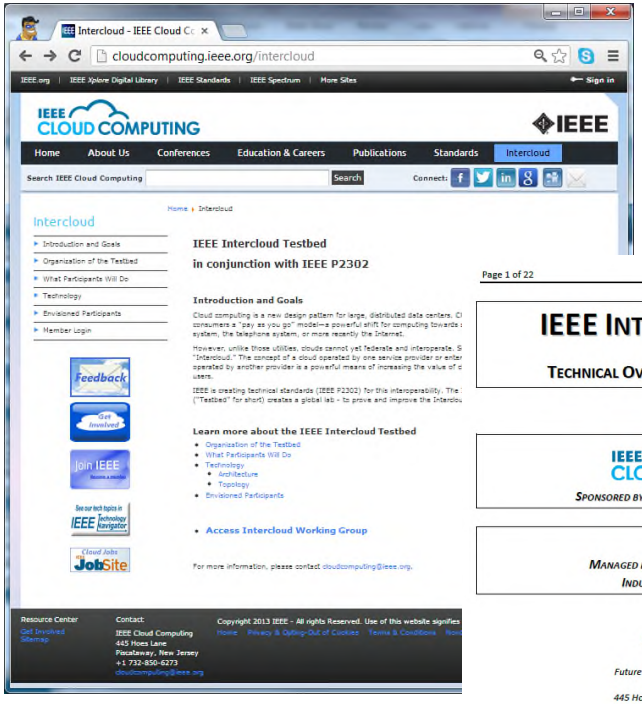
How we will work
IEEE Intercloud Testbed Project

Collaboration Site and Wiki
cloudcomputing.ieee.org/intercloud

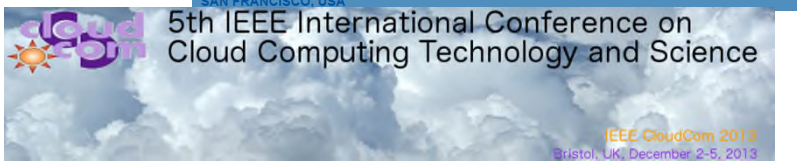


Engineering Plans

Conferences

IEEE CLOUD 2013
IEEE 6th International Conference on Cloud Computing
June 27-July 2, 2013, Santa Clara Marriott, CA, USA (Center of Silicon Valley)

2013 2ND IEEE INTERNATIONAL CONFERENCE ON CLOUD NETWORKING
IEEE CLOUDNET 2013
NOVEMBER 11-13, 2013
SAN FRANCISCO, USA



Your Labs!

IEEE

Engineering Plan
IEEE Intercloud Testbed Project

Engineering Plan Highlights:

- Topology
- Intercloud Gateway
- Intercloud Roots
  - Naming
  - Communications Substrate
  - Trust Infrastructure
  - Audit Trail
  - Semantic Resource Directory
- Intercloud Exchanges
- Sequence Diagram
- Protocols Summary
- Implementation Use Cases for Consuming Clouds
- Engineering Project Workpackages

IEEE INTERCLOUD TESTBED

RVIEW AND ENGINEERING PLAN

UD COMPUTING

HE IEEE CLOUD COMPUTING INITIATIVE

IEEE

THE IEEE STANDARDS ASSOCIATION

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Call for Participation
IEEE Intercloud Testbed Project

Participants, do you have a

- Cloud Lab,
- Cloud to turn to this effort,
- Place to Host,
- Infrastructure to re-purpose,
- Detailed Design and Specification ability,
- Programmers, Network Engineers,
- Project Management,
- Documentation,
- ?

IEEE Cloud Computing Web Portal

- Designed as the “go-to” Internet source for authoritative information on cloud computing
- To serve technology experts in cloud computing and others from industry, government, academia, and the general public

cloudcomputing.ieee.org

IEEE

Web Portals, Social Media, Branding

Portal Google Analytics

Over 39,000 visits since portal's launch 25 June 2012
~122,000 page views
Over 39,000 unique visitors

Facebook

>3,600

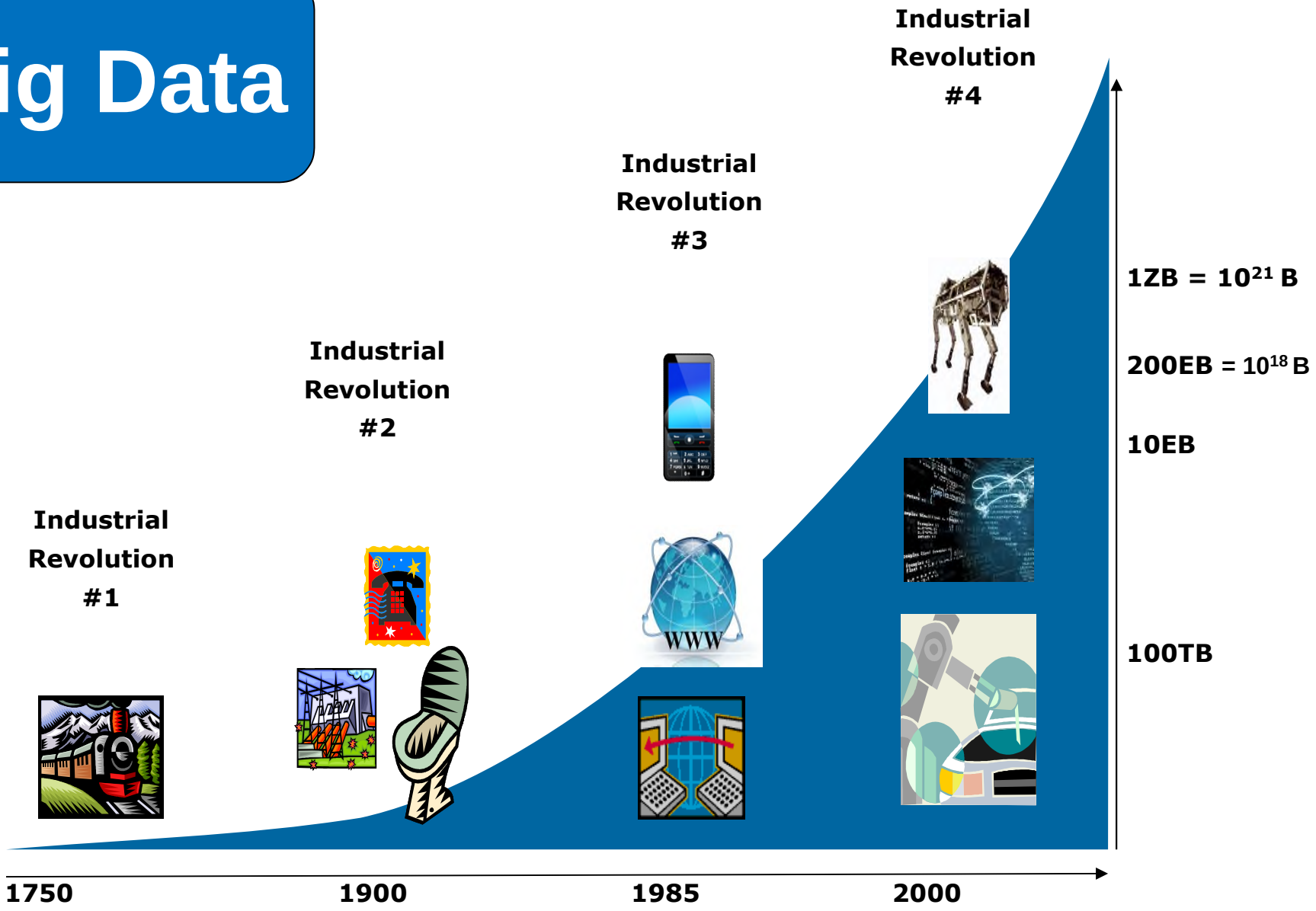
Twitter

>1,700 tweets
>160 following
> 600 followers

LinkedIn

>1,000 members

Big Data



R. J. Gordon: Is US economic growth over? Faltering innovation confronts the six headwinds. CEPR Policy Insight No 63

IEEE Big Data

Newest track - Area of intense interest and focus
Working on a new Transactions publication

Why big data?

- Area of intense interest and focus
- Next-generation compute technologies
- Data-driven future versus theory-driven
- Complexity of data types: structured, semi-structured, and unstructured
- Variety of data sources, use cases, and problems
- Data integration
- Intelligent systems that overcome the brittleness of specification of behavior

Software Defined Networking (SDN)

IEEE SDN Initiative

Mehmet Ulema, Manhattan College, USA - Contact
Nirant Amogh, Huawei, India
Raouf Boutaba, University of Waterloo, Canada
Cagatay Buyukkoc, AT&T Labs, USA
Alex Clemm, Cisco, USA
M.Can Vuran, University of Nebraska-Lincoln, USA
Linda Xie, University of North Carolina, Charlotte, USA
Antonio Mazalini, Telecom Italia, Italia, Initiative Chair, Working Group
Bobby Wong – Initiative Program Director

IEEE COMMUNICATIONS SOCIETY

IEEE

A Broader Vision for IEEE

SDN originally perceived to be a “Networking or Transport” specific technology --- can be used in all areas of networks

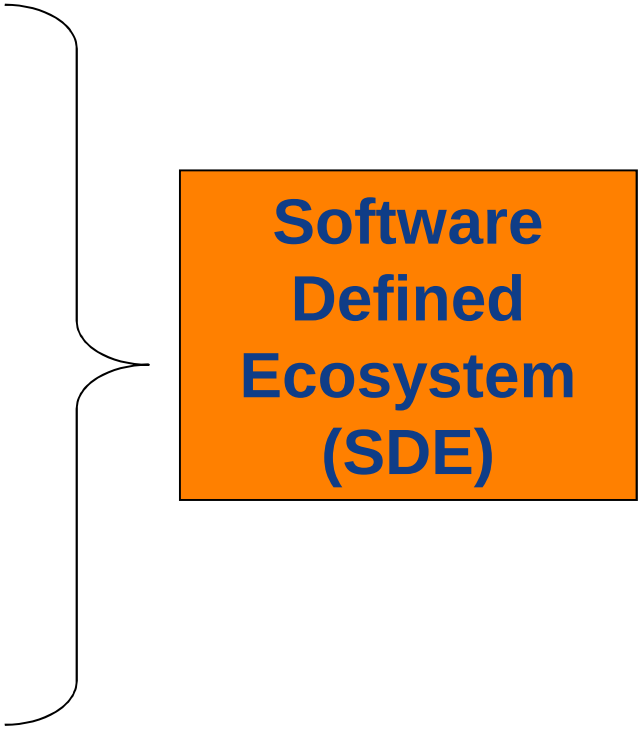
Broader vision encompasses the whole,
Information, Communications, Entertainment Technology (ICET)

Many existing and future technology goals can be realized using some general principles or characteristics:
Cognitive Networks, LTE-Adv, Self Organizing Networks, Cloud Computing, Compute & Storage, Smart Grids, Management, Virtualization, etc.

Software Defined Ecosystem

Technologies and applications where “Software Defined” concept are applicable to create an ecosystem

- Software Defined
  - Networks (SDN)
  - Service Providers (SDN-SP)
  - Antenna (SD-A)
  - Radio (SD-R)
  - Cloud (SDN-C)
  - Security (SDN-Sec)
  - Data Center (SD-DC)
  - Management (SD-NM)
  - Optical networks (SD-O)
  - Smart Grids (SD-SG)
  - Information Centric Networking (SD-ICN)



Key Aspects

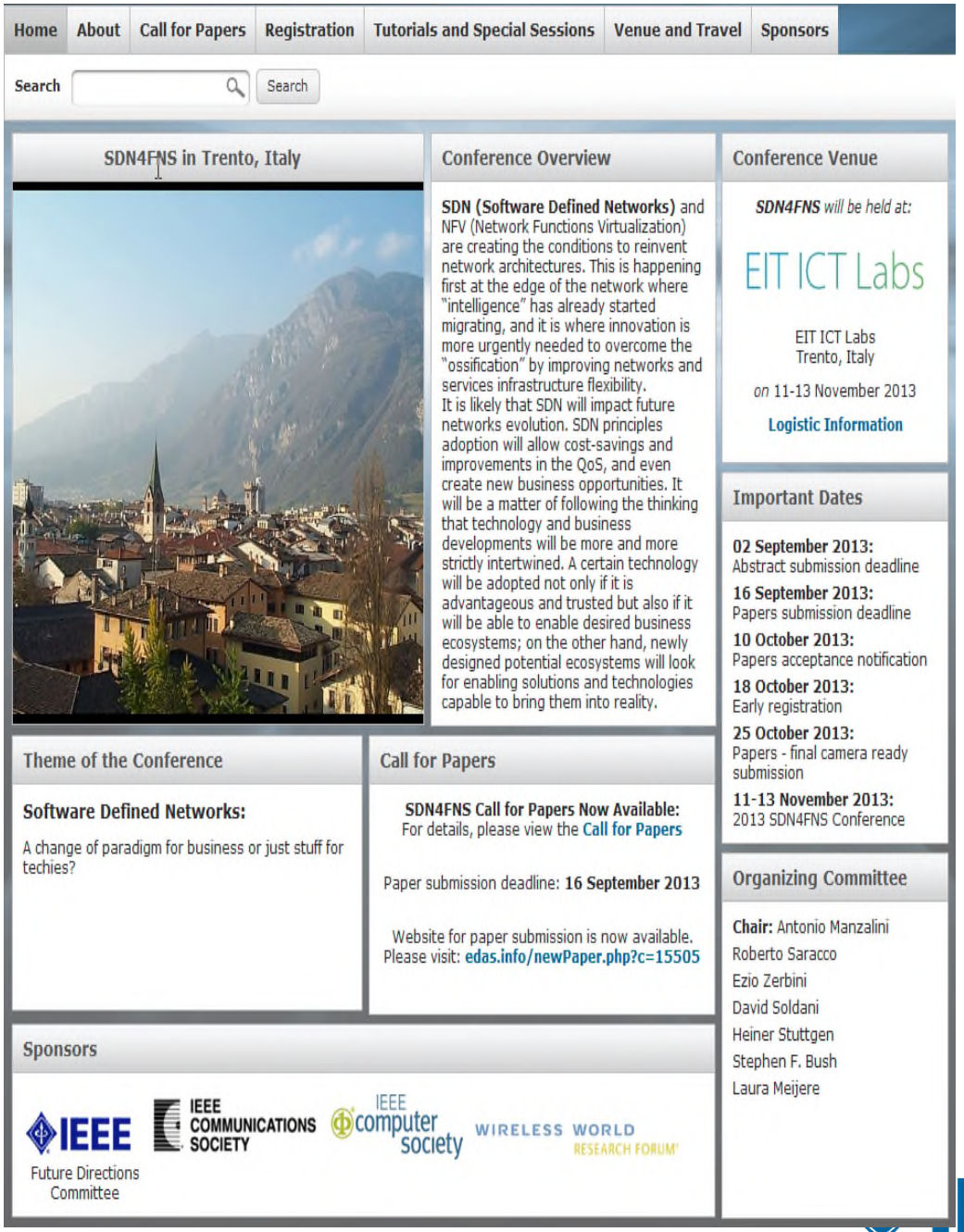
- Establish an IEEE wide initiative with a comprehensive program based on a broad vision of SDN
- Prioritized launch of products of services to utilize resources efficiently and to keep up and to lead
- Co-branding as much as possible
- Individual Areas highlights:
  - IEEE Magazine and a Transactions
  - Major conference, regional and topical conferences
  - Standards Committee on SDN to drive standardization
  - Tutorials, eCourses, training courses, webinars
  - Certification programs for people, devices, testbed
  - Web Portal for links to IEEE SDN programs, repository, publicity

2013 IEEE workshop on SDN4FNS

Call for Papers

2013 IEEE workshop on SDN4FNS

Conference Website



IEEE Cloud Computing – Contact us

Visit the Web Portal:

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IEEE CLOUD COMPUTING