PICO SwitchOn workshop

Jan 8, 2015

Jason Liu
Florida International University

- **Academic position:**

  Associate Professor
  School of Computing and Information Sciences
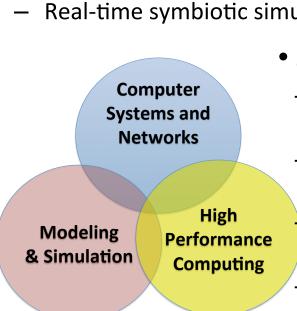 Florida International University (FIU)
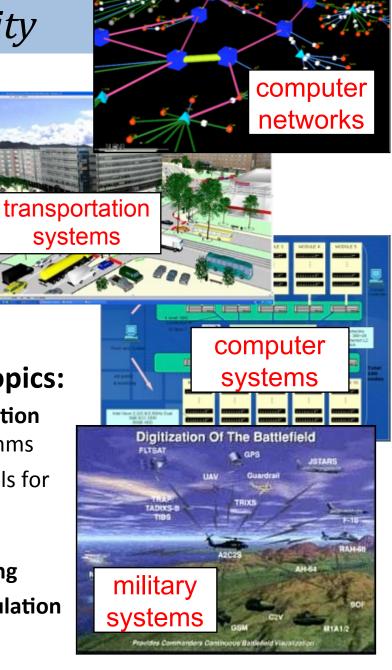
- **General research interests:**
  - Parallel discrete-event simulation
  - High-performance simulation modeling
  - Simulation of large-scale complex systems
  - Real-time symbiotic simulation and emulation

- **Specific research topics:**
  - Efficient **parallel simulation** synchronization algorithms
  - **Scalable simulation** tools for HPC platforms
  - Large-scale **network simulation and modeling**
  - Network **real-time simulation and emulation**

Computer Systems and Networks

Modeling & Simulation

High Performance Computing

computer networks

transportation systems
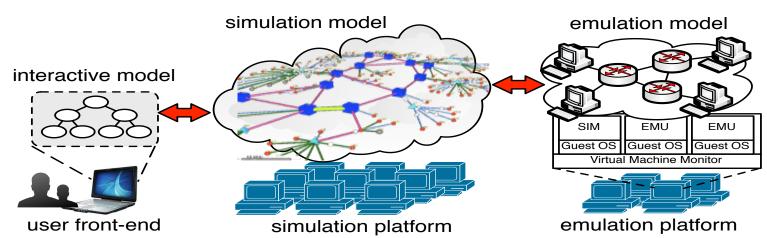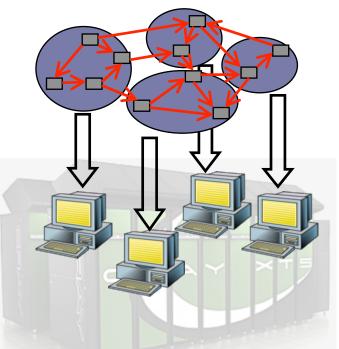
computer systems

military systems

Future Internet Research

- **Future Internet testbed development**

- **Big & fast network simulation**
  - Parallel network simulators on HPC platforms (SSFNet, PRIME)
  - Network scale to hundreds of millions and more
  - Realistic and efficient multi-scale traffic modeling

- **Hybrid network experimentation**
  - PrimoGENI Constellation Project (GENI)
  - Enable hybrid experiments with simulated and emulated components on GENI
  - Apply parallel simulation to enable large-scale experiments in real time
  - Interact with network applications running on virtual machines

interactive model · simulation model · emulation model

user front-end · simulation platform · emulation platform

Brazil Collaboration on Future Internet Research

- Ongoing collaborations with Prof. Cesar Marcondes (UFSCar, São Carlos, SP, Brazil)

- **#1 "Mininet conflux"** – an SDN testbed
  - Objective: hybrid at-scale OpenFlow network experiments
  - Interoperable simulation and emulation of OpenFlow
  - High-fidelity, high-performance, large-scale network traffic modeling through symbiotic network simulation

- **#2** OpenFlow-based fine-grain congestion control mechanisms for large-scale enterprise networks and data centers

- **#3** Fluid-based traffic modeling for efficient traffic characterization

Personal stuff:
- *Classic literature, poetry, history, classical music, piano*
- *New year resolution: Français*

weibo.com/u/2927121691

Dr. Julio Ibarra

SwitchOn Co-Principal Investigator

As the Assistant Vice President for Technology Augmented Research at FIU, Dr. Julio Ibarra is responsible for furthering the mission of the Center for Internet Augmented Research and Assessment (CIARA) – to contribute to the pace and the quality of research at FIU through the application of advanced Cyberinfrastructure. He is responsible for strategic planning and development of advanced research networking services, including the development and management of the AMPATH International Exchange Point for Research and Education networks, in Miami, Florida. He holds B.S. and M.S. in Computer Science from FIU, and Ph.D. in Telematics and Information Technology from Twente University.

Research & Personal Interests

- Current research interests are Software-Defined Networking, and IT Service Management
- Wine making, tasting and sharing
- Physical fitness and healthy living

Dr. Heidi Morgan

Director of Center for Augmented Research and Assessment (CIARA)

Heidi L. Morgan is the Director at Florida International University's CIARA, where she facilitates high-performance next generation Research & Education (R&E) networking initiatives and other related cyberinfrastructure, such as cloud computing, to higher education and research institutions in the U.S., Latin America, and the Caribbean.

Current NSF Support:
Award# ACI-0963053, $7,744,790.00, 2010-2015, IRNC-ProNet: Americas Lightpaths: Increasing the Rate of Discovery and Enhancing Education across the Americas.

Award# IIA-1129076, $4,224,324.00, 2010 – 2015, PIRE: Training and Workshops in Data Intensive Computing Using The Open Science Data Cloud

Award# ACI-1246185, $500,000.00, 2012-2014, CC-NIE Network Infrastructure: FlowSurge: Supporting Science Data Flows Towards Discovery, Innovation and Education

Award# CNS-1443285, $200,000.00, 2014-2015, RES IN NETWORKING TECH & SYS: EAGER: SwitchOn - Exploring and Strengthening US-Brazil Collaborations in Future Internet Research

Other Research & Social Interests

- e-Science Collaborations and Educational Outreach (e.g. Astronomy, High Energy Physics)
- Providing extraordinary opportunities for grad students!

Luis Lopez

Research Scientist USP

Prof. Lopez holds PhD in Mathematical Physics. Currently he is a professor at USP (Medicine School, University of São Paulo) and at FIU (Florida International University – Miami, USA). He is also the NARA Coordinator (Center for Advanced Networking Applications) of USP and Principal Investigator of the Project ANSP (Academic Network at São Paulo), funded by FAPESP (Foundation for Research Support of the State of São Paulo) and NSF (National Science Foundation).

Prof. Dr. Alessandro Anzaloni
1- Description of who you are

- Title : Prof. Dr. Alessandro Anzaloni

- Position at ITA (Instituto Tecnológico de Aeronaútica): since May 2014 retired as full professor from the Department of Telecommunication-ITA. Still collaborating, advising Master and PhD thesis and managing joint projects with other Universities.

- History: ITA was founded in the early 1950s, with parteciption of M.I.T. professors. Since then ITA has been one of Brazil's most important institutes of engeneering.

2- Research interest and main results.

Research interests:

- Aeronautical Communication
- Wireless Communication
- SDN/SMART GRID

Main results:

- SynFlight: A Disruption –Aware Programmed Transmission approach for Air-Ground Networks.IEEE Latin American Transactions Vol.2, December 2014.

- Kalman Filtering: Estimate of the Number of Active Queues in an 802.11e EDCA WLAN. Computer Communication Vol. 39, February 15, 2014.

- An Application using Openflow for fault tolerant multicast in Energy substations.Graduation project at ITA.December 2014.

3- Current and potential USA Collaborations.

- At the moment only exists the possibility to develop a collaboration with M.I.T in the area of wireless communication.

4-Themes that best fit for USA.

SDN in SMART GRID

- SMART GRID needs a complex networking between a vast number of entities (sensor, smart meters, renewable distributed energy resources, supervisory control and data acquisition systems).

- SDN offers more dynamic interaction between applications and network (ease of configuration and management)

Cloud (Elasticity)

Cloud (Elasticity - Fault)
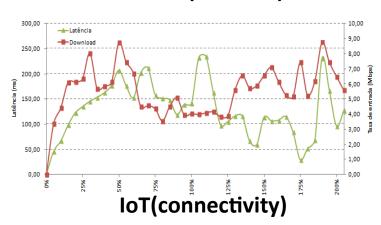
SDN (reconfiguration)
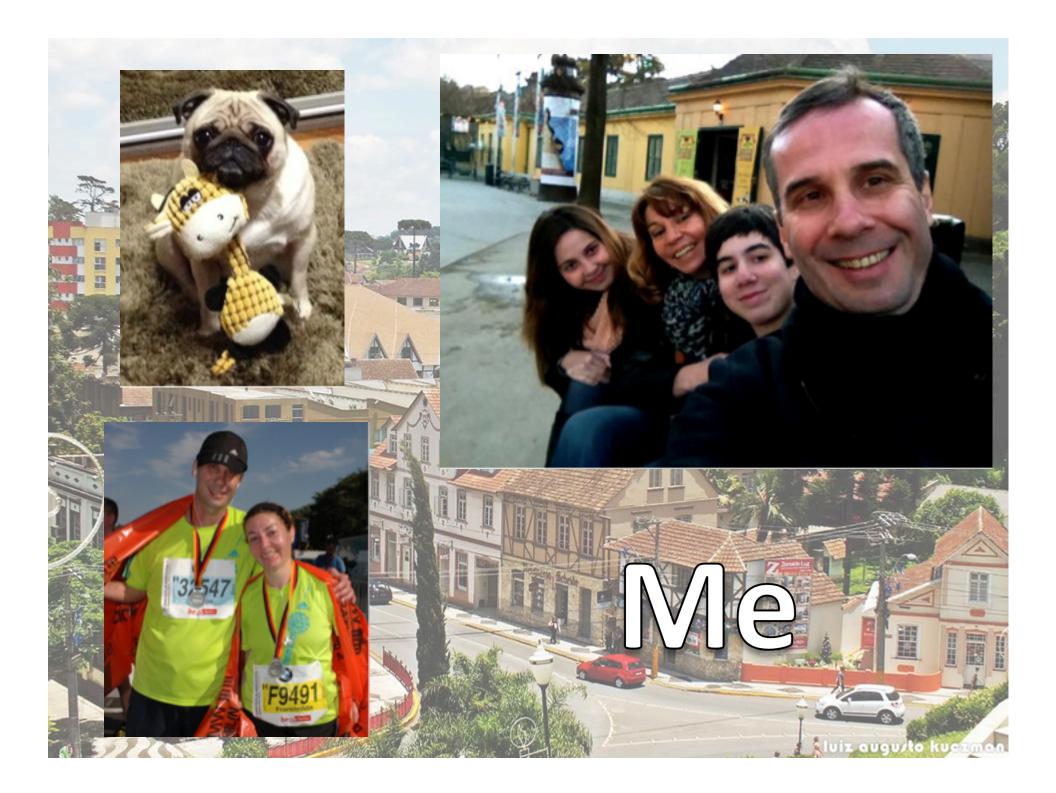
NFV (creation)

OSN (influence)

IoT(connectivity)

Me

luiz augusto kuczman
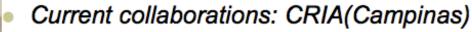
José A. B. Fortes

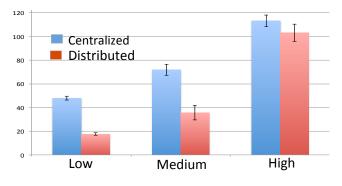- *Professor and AT&T Eminent Scholar Director, Advanced Computing and Information Systems (ACIS) Laboratory, University of Florida*

- Research interests: Cyberinfrastructure, Distributed/autonomic/cloud/software-defined computing systems

- *Current collaborations: CRIA(Campinas)*

- *Themes for US-Brazil collaboration*
  - *Biodiversity*
  - *Transnational IT systems*
  - *Multi-cloud computing*

- Personal information
  - Grand-daughter (American father/Brazilian mother)

Advanced Computing and Information Systems laboratory · UNIVERSITY OF FLORIDA
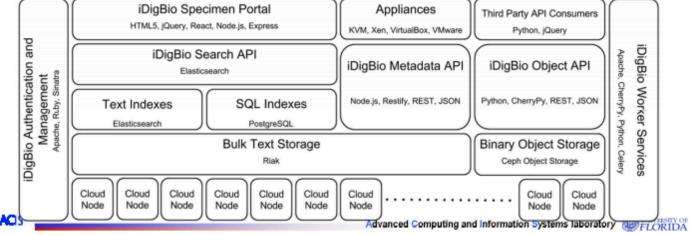
eScience Cyberinfrastructure (iDigBio)

Integrated Digitized Biocollections (iDigBio) is the US resource for digitized information about natural history collections

	iDigBio Specimen Portal	Appliances	Third Party API Consumers	
iDigBio Authentication and Management	HTML5, jQuery, React, Node.js, Express	KVM, Xen, VirtualBox, VMware	Python, jQuery	iDigBio Worker Services
	iDigBio Search API	iDigBio Metadata API	iDigBio Object API	
	Elasticsearch	Node.js, Restify, REST, JSON	Python, CherryPy, REST, JSON	
	Text Indexes / SQL Indexes			
	Elasticsearch / PostgreSQL			
	Bulk Text Storage — Riak		Binary Object Storage — Ceph Object Storage	
	Cloud Node ... Cloud Node			

Advanced Computing and Information Systems Laboratory

Software-defined Systems

Multicloud Hadoop-based BLAST

Virtual Cluster

Ethernet

UC

PU

UF

ViNe Download Server

1. ViNe-enable sites
2. Configure ViNe VRs
3. Instantiate BLAST VMs
4. Contextualize
   a. Retrieve VM information
   b. ViNe-enable VMs
   c. Configure Hadoop

- **Virtual Networking**
- **Fault-tolerant Map Reduce**

Communications-aware job scheduling in hybrid SDN datacenters

Malathi Veeraraghavan[1], Nelson Fonseca[2], Andrea Fumagalli[3]
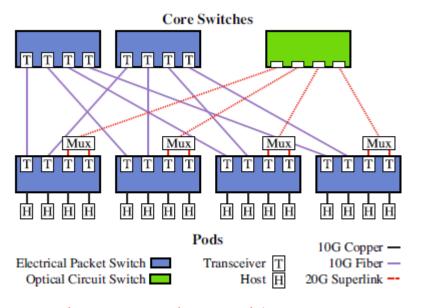
1 University of Virginia (UVA), Charlottesville, VA 22904, USA

2 The University of Campinas, Campinas, Brazil

3 The Univ. of Texas at Dallas, Dallas, TX 75080, USA

Shoulders of giants:
- Hybrid optical-packet networks for datacenters
  - Energy savings of optical switches
- Hadoop scheduling and SDN controller
- Digital Sub-Carrier Multiplexing (DSCM)
- Dynamic Inter-Domain L2 path service across OpenFlow networks with an SDN controller

Helios: Hybrid optical/packet network
(cannot connect all rack pairs
via circuits simultaneously)

Digital subcarriers: energy-efficient
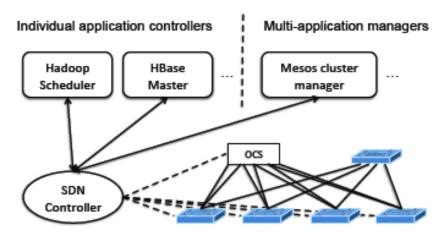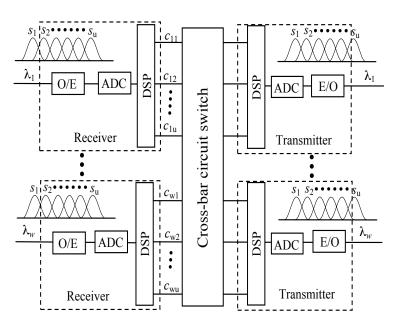sub-wavelength multiplexing technique
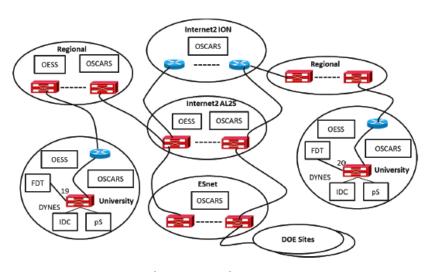
Figure 1: Integrated network control for big data applications

G. Wang et al., HotSDN 2012; Setup dynamic circuits
based on computers assigned by Hadoop scheduler

Inter-domain dynamic L2 service
with OpenFlow controllers

Resources/expertise

- Univ. of Virginia (UVA)
  - Acquisition and analysis of Hadoop logs (Data analysis)
  - Use of Hadoop MapReduce on UVA cluster
  - Experiments with dynamic inter-domain L2 path service
  - Test integrated Hadoop scheduler-SDN controller on GENI clusters: ProtoGENI and ExoGENI
- State Univ. of Campinas
  - Hadoop scheduling
  - Integration with SDN controller
  - Lab cloud: 13 PCs running vSwitch (OpenFlow and SDN)
  - Simulations: ns3
- The Univ. of Texas at Dallas
  - Simulations of Digital SubCarrier Multiplexer Network
  - Simulation platform: P2A (Physical to Application; GMPLS)

Cesar Marcondes – UFSCar – São Carlos, SP, Brazil

São Carlos Cathedral

MSc in CS at Federal University of Rio de Janeiro Brazil
   Advisor: Paulo Aguiar (UCLA 1988)
   VoIP Service
PhD in CS at University of California Los Angeles
   Advisor: Mario Gerla (UCLA 1976)
   TCP Expert – TCP Evaluation – TCP Design
   Real Time Estimations based on Measurement
Professor at Federal University of Sao Carlos
Visiting Professor at Florida International University
   Host: Jason Liu

São Carlos – SP
"Center" of SP

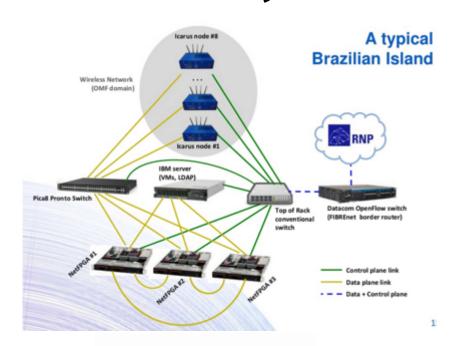TAM Aviation Museum

Prior Collaboration Projects

- **3 Funded Research Projects**
  - FIBRE (2011-2014)
    - Future Internet (OpenFlow)
  - STIC/AMSUD (2012-2014)
    - DTN
    - Streaming Processing
  - Neutron Design for DATACOM (2014)
    - New Cloud Computing Abstractions and NFV integration
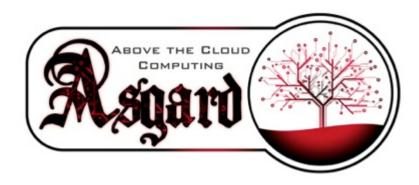
In 2013/2014
CTO UFSCar
2 University Projects
   UFSCar Network Backbone
   UFSCar Private Cloud

Research Group

ABOVE THE CLOUD COMPUTING

Asgard

- 8 Master Students
- 6 Undergrad Students
- 3 PhD Student
- Areas of Research:
  - SDN/NFV
  - Cloud Computing
  - Streaming Computing
  - Future Internet
  - Congestion Control
  - Distributed Computing Scalability
  - Delay Tolerant Networks
  - Testbeds

Recent Work (*)

- Map Constrained Mobility Influence in DTN Protocols
- CastFlow – Rethinking Multicast in SDN
- Data Mining and C4.5 Decision Trees to Improve VANET Bus Networks
- MapReduce Parameter Optimization
- Energy-Aware Datacenter
- SDN Testbeds
- NFV Tutorial @ Integrated Network and Service Management (IM 2015)

Collaboration with FIU – **joint papers** with Liu's research group and other FIU researchers
  Large scale simulation
  Automatic Experimental Design
  Hybrid simulation and emulation
  OpenFlow and SDN simulation

* Published Work on : ICSA'13, ISCC'12, ISCC'13, SBRC'14, IM' 15

Norival Figueira

- Intro
    - Ph.D. in Computer Science from the University of California, San Diego (UCSD)
    - Currently a distinguished member of the Office of the CTO at Brocade
        - Working on product strategy and technology vision in SDN/NFV areas
    - Previously, led the development of OpenFlow on Brocade routers (MLXe, CES/CER)
        - Spearheaded Brocade OpenFlow development in 2010
    - Accredited with the issuance of 16 US patents in networking technology

- Areas of interest
    - SDN/OpenFlow, Network Function Virtualization (NFV), Policy-based Orchestration and Control

- Related publications
    - IEEE ICNC 2015 (Feb 2015): "SDN Multi-Domain Orchestration and Control: Challenges and Innovative Future Directions"
    - IEEE ICNC 2015 (Feb 2015): "Analysis of Data Center SDN Controller Architectures: Technology and Business Impacts"
    - draft-norival-nfvrg-nfv-policy-arch: "Policy Architecture and Framework for NFV and Cloud Services"
    - draft-krishnan-nfvrg-policy-based-rm-nfviaas: "NFVIaaS Architectural Framework for Policy Based Resource Placement and Scheduling"
    - draft-krishnan-nfvrg-real-time-analytics-orch: "NFV Real-time Analytics and Orchestration: Use Cases and Architectural Framework"

Presentation on Jan 9th

- Agenda
  - Brocade OpenFlow-enabled products
  - Brocade Vyatta Controller
  - Brocade Applications
    - Traffic Explorer
    - Volumetric Traffic Management

Parallel and Distributed Computing Systems

Hermes Senger

Computer Science Department
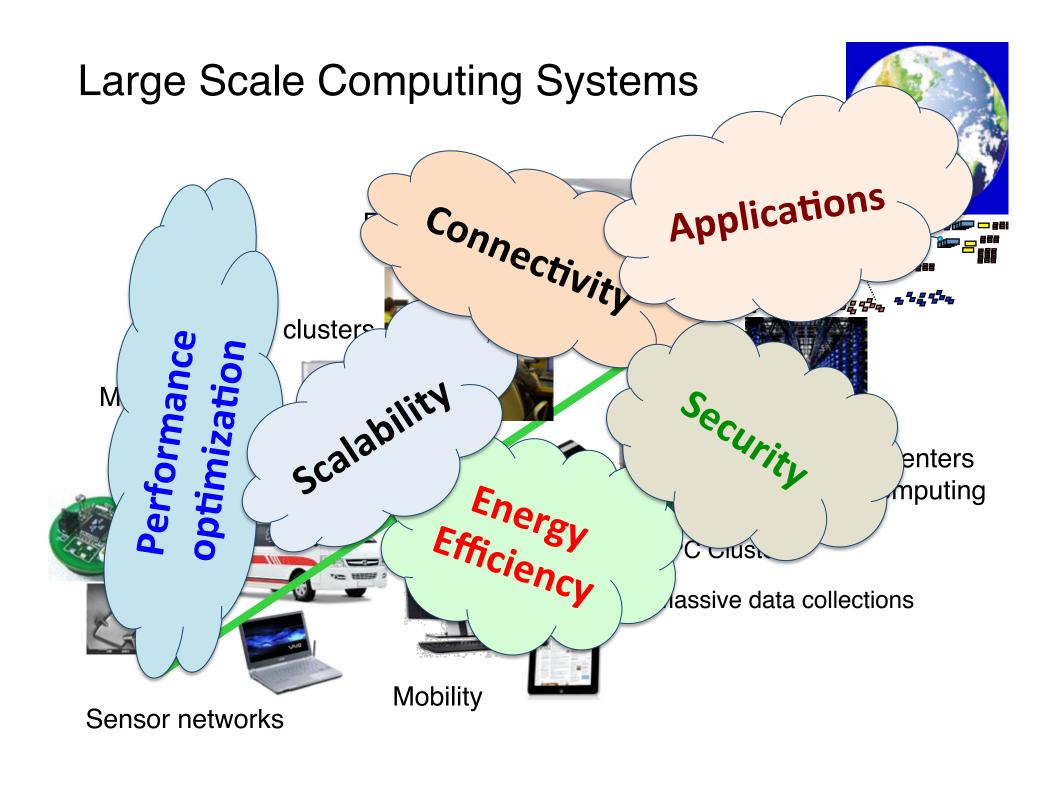
UFSCar – Federal University of São Carlos – Brazil

http://www2.dc.ufscar.br/~hermes/index-en.html

email: hermes@dc.ufscar.br

Large Scale Computing Systems

Desktop Grids

SMPs, clusters

Multicore

Large datacenters
& cloud computing

HPC Clusters

Massive data collections

Mobility

Sensor networks

Large Scale Computing Systems

Connectivity

Applications

clusters

Performance optimization

Scalability

M

Security

Energy Efficiency

enters
mputing

C Clusters

assive data collections

Mobility

Sensor networks

Current Research Topics

- Parallel Computing Models:
  - e.g., Embarrassingly parallel, BSP, MapReduce
  - Stream Processing (DAG)
  - Scalability analysis
- Hybrid Distributed Computing
  - e.g., desktop grids + cloud, etc.
  - Heterogeneity
  - Scalability
  - Energy efficiency
- Distributed Computing Platforms
  - Hadoop, Spark, Storm, Seep, etc.
  - Elasticity
  - Capacity planning
  - Fault Tolerance
  - Stream Processing on cloud environments

- MANETs/VANETs
  - Opportunistic Routing & Connectivity
  - Dynamic structure of mobile networks
  - Discovery of traffic patterns in time
  - Communication & Apps. for disasters scenarios
- Energy efficiency
  - Modeling energy consumption
  - Software sensors for energy consumption
  - Improving energy efficiency
- SDN/NFV
  - Parallel computing (e.g., multicore, GPU, FPGA) to implement high complexity networkvirtualized functions
  - virtualization technologies for NFV
- Applications:
  - Genome assembly (de Novo) methods

Michael Stanton
Diretor of R&D at RNP
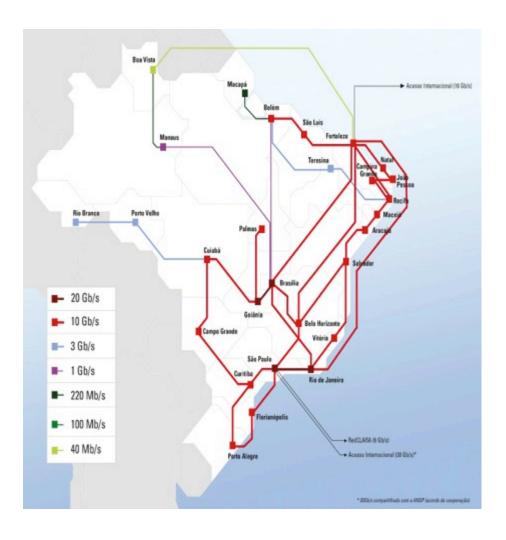
RNP is the Brazilian R&E network provider, created in 1989 and maintained by the Brazilian federal government to provide Internet and other related services to the national R&E community

Website: www.rnp.br/en

Current network:

- More than 1200 campi connected
- 62% of upstate campi connected at 100M or 1G.
- Owned fiber metro networks in 40 cities.
- Current intercontinental connectivity: 45G shared with the São Paulo state network (ANSP).

R&D at RNP

The R&D directorate carries has two main functions:

- Contributing to discussions and decisions about long-term infrastructure projects for national and international connectivity and support resources

- Supervision and execution of R&D projects of interest to RNP.

Go to http://www.rnp.br/en and click on "Research and Development" for a drop-down menu of our R&D projects

- **Public Notice**
- **Working Groups**
- **Advanced Internet**
- **Future Internet**
- **Experimentation Networks**
- **eScience and eArts**
- **CTIC**

Working groups

- RNP works in partnership with the Brazilian scientific community through the Working Groups program, launched in 2002, using the model of open innovation.
- Through an annual call for projects, research groups can submit proposals for new services and products in the areas of networks and distributed applications, potentially of interest to RNP users.
- Successful proposals, known as Working Groups (GTs) are financed for 1 or more years.
- Starting in 2002, more than 90 projects have been supported, and many of their results have been adopted as products or services by RNP.

Advanced Internet

- Beginning in 2008, this initiative has sought to develop facilities for the RNP network beyond the traditional IP-routed network.
- The facilities developed include:
  - Hybrid packet-circuit network (Cipó)
  - Advanced performance monitoring (perfSonar / Monipê)
  - High-performance campus networks (Science DMZ)
  - Hi-res videowalls for collaboration (SAGE)
- Several of these are still in the prototype/experimental phase

RNP

Future Internet / Testbed networks

The network as a testbed:

- Planet-Lab, since 2005 – software and operation provided internationally
    - www.planet-lab.org
- FIBRE, since 2011 – Future Internet testbed using software and operation developed in collaboration with Brazilian and European groups (see talk by Antonio Abelém)
    - www.fibre.org.br

e-Science and e-Arts

e-Sci: Support for (usually international) scientific collaborations in various domain sciences, notably:

- Space research (includes weather/climate studies)
- High-energy Physics
- Biodiversity
- Astrophysics/Astronomy

e-Arts: international collaborations in various areas including:

- Performing arts (music, ballet)
- Cinema and UHD video (medical apps)
- Super UHD (8K) TV transmission of sporting events

- Network resources often obtained through the GLIF community (www.glif.is)

RNP

Some Links to articles on Infrastructure and R&D

- Infrastructure
  - RNP: a brief look at the Brazilian NREN (slides and article)
    - http://tnc2010.terena.org/schedule/presentations/show/11/
  - Brazilian experience of connecting at 100 Mb/s and 1 Gb/s universities and research institutions in the interior of the country (article)
    - www.ubuntunet.net/sites/default/files/grizendi.pdf
  - Use of Subfluvial Optical Cable in a Region Without Land-Based Infrastructure – a Project to Deploy Advanced Communications in the Amazon Region (article)
    - www.ubuntunet.net/sites/default/files/grizend.pdf

- R&D
  - Ten years of creating advanced services in collaboration with the research community (slides and article)
    - https://tnc2013.terena.org/core/presentation/57
  - MonIPÊ Service enabling perfSONAR deployment in Brazil (slides and article)
    - https://tnc2014.terena.org/core/presentation/67
  - A Software-Based Solution for Distributing and Displaying UHD Video Content over Packet Networks with Applications to Telemedicine and Culture (article)
    - http://www.ubuntunet.net/sites/default/files/ciuffol.pdf
  - Interoperable Multi Conferencing Technology as a Basis for an Open, Global Web Conferencing Network (article)
    - http://www.ubuntunet.net/sites/default/files/roeslerv.pdf

RNP
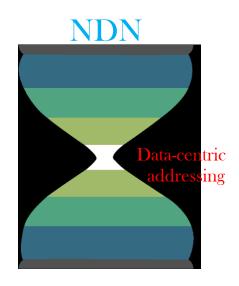
Named Data Networking (NDN)
Christos Papadopoulos
Colorado State University
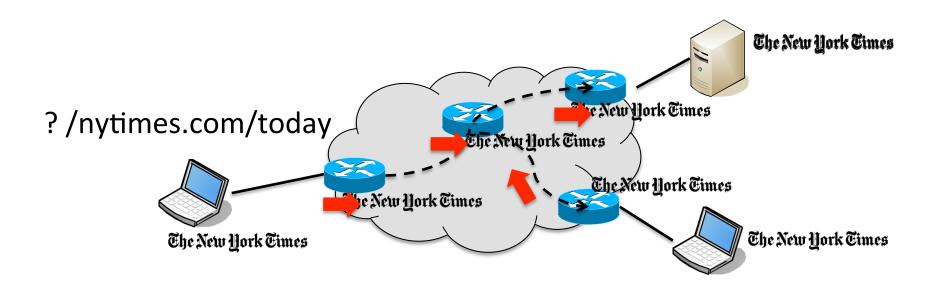
- Name-based network architecture
- Users care about the data, not where it is
  - NDN focuses on the **What**, not the **Where**
- Security is fragile if we only secure the path
  - NDN secures the **Data**, not the **Container**
- Real deployment:
  - http://ndnmap.arl.wustl.edu/
  - Come join the testbed

http://named-data.net/

NDN Operation

? /nytimes.com/today
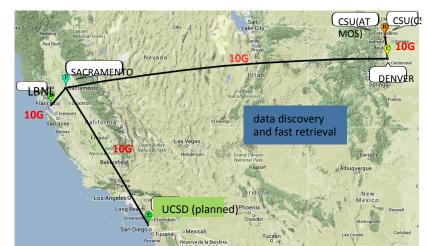
- Requests routed on content prefixes
- Date follows "breadcrumbs"
- Data is cached in the network as it flows along
- Content from anywhere: not just the publisher

37
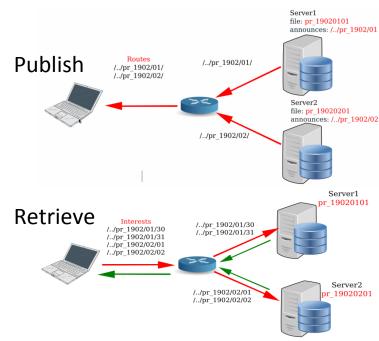
Supporting Climate Applications over NDN

- **Need**: climate and other big data applications have overwhelmed existing networking and data management solutions
  - Data size and diversity
  - Naming, discovery, retrieval, sharing, etc.
- **Approach**: migrate workflows to NDN
  - Name based rather than host based paradigm
  - Easy migration: automatically translate existing ad-hoc names to structured NDN names
 - Evaluate over state-of-the-art NDN testbed deployed in partnership with ESnet
- **Benefit**: vastly simplified application and networking environment
  - Robustness and speed: in-network caching, efficient content distribution, automatic failover, security, etc.
  - Simplified management: highly structured, standardized naming across application domains
  - Trivial publishing, grouping and discovery
- **Related approaches**: CDNs, cloud systems, web apps
  - Highly complex
  - Ad hoc, fragile solutions (e.g., DNS manipulation and redirection)

#13410999: NSF CC-NIE Integration award

SwitchON Workshop
Miami, Jan. 8-9, 2015

Prof. Christian Esteve Rothenberg

Department of Computer Engineering and Industrial Automation (DCA)

Faculty of Electrical and Computer Engineering (FEEC)

University of Campinas (UNICAMP)

About: Christian Esteve Rothenberg

- Assistant Professor (tenure track) at FEEC/UNICAMP (since 201

  - Leading the INTRIG lab at DCA/FEEC/UNICAMP
    **INTRIG: Information & Networking Technologies Research & Innovat
    Group**

  - Currently, supervising 6 PhD, 5 MSc candidates, and 4 undergrad students

- PhD in Electrical and Computer Engineering (FEEC/UNICAMP, 2010),
  MSc in Electrical Eng and Information Technlogy (Darmstadt University, 2006),
  Telecommunication Eng (Universidad Politécnica de Madrid, 2004)

  - Visiting researcher at Ericsson Research Nomadic Lab, Jorvas, Finland, 2008,
    participated in EU Publish/Subscribe Internet Routing Paradigm (PSIRP).

- Research Scientist at CPqD R&D Center in Telecommunication (2010-2013)

  - Technical Lead of SDN activities in the Converged Networking Division

- ONF Research Associate (since Apr/2013)

Research Interests and Main Goals & Results

- RouteFlow (hybrid IP-SDN)

- softswitch13

- libfluid (ONF Driver)

- SDN-2-SDN Peering

- MD2-NFV (Multi-Domain Distributed)

- VNF-a-a-S

Software Defined Networking

Information Centric Networking
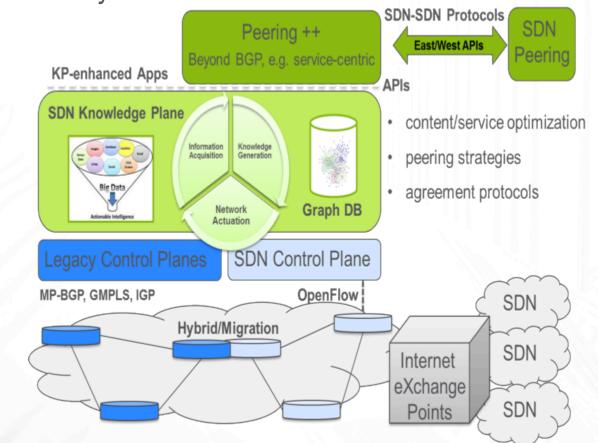
Network Functions Virtualization

- Mini-CCNx

- Wireless CCN

- LIPSIN (in-packet Bloom filters)

- 10G VNF

- Multi-Core Architectures

Ongoing research project:
Advanced Peering with a Software-Defined Knowledge Plane

- Duration: 24 months (Started in May/2014)

- Funded by Ericsson
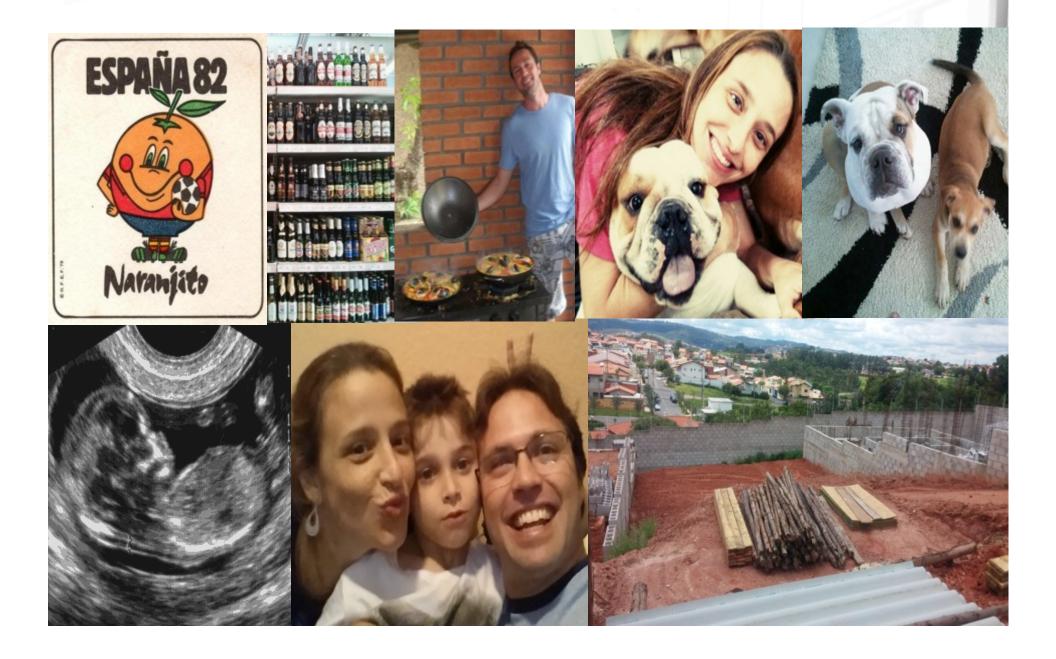
Current US-Brazilian collaborations

- Ericsson Research in San Jose

  - Attila Takacs. "Advanced Peering with a Software-Defined Knowledge Plane"

- UC Santa Cruz (UCSC)

  - Prof. Katia Obraczka. "Software-Defined Internetworking Framework"

- ESnet / Lawrence Berkeley National Laboratory

  - Inder Monga. RouteFlow & Software Defined Exchanges

- NSF Named Data Networking (NDN)

  - Prof. Lan Wang (Memphis Univ.). Mini-NDN

  - http://redmine.named-data.net/projects/mini-ndn

- Open Networking Foundation (ONF)

  - Research Associates. Open Source Developments (libfluid driver, ofsoftswitch, routeflow)

Personal Information

- One of the six public universities of the Brazilian state of São Paulo, together with USP, UNICAMP, UFABC, UFSCar, UNIFESP
- It is part of the state's higher education system
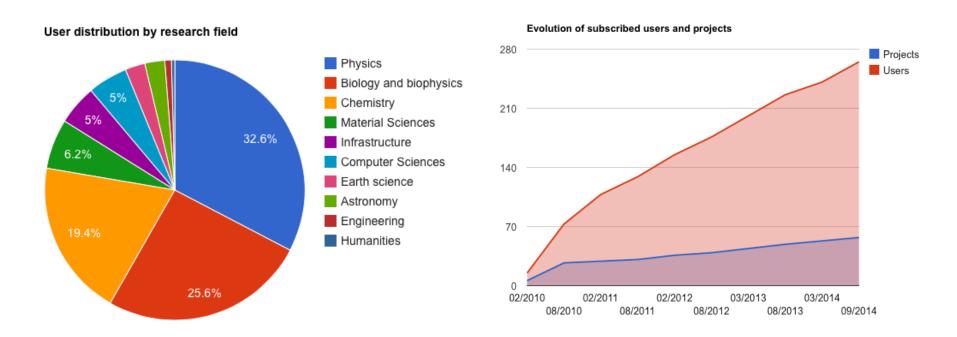
The SPRACE Project

- São Paulo Research and Analysis Center
  - Funded by FAPESP
  - Timeline
    - ❏ 2004 – Started processing DZero/Fermilab data
    - ❏ 2005 – Open Science Grid official site
    - ❏ 2006 – CMS/CERN association
    - ❏ 2008 – LHC First Beam
    - ❏ 2009 – WLCG MoU signed by FAPESP: official Tier-2 facility
    - ❏ 2012 – Higgs Discovery

- BR-SP-SPRACE
  - Official WLCG Tier-2 class Latin America site
    - ❏ MoU signed between FAPESP and CERN - **20/April/2009**
  - One of the most available and reliable among all the WLCG sites
    - ❏ Processes physics analysis jobs and Monte Carlo simulation
    - ❏ Storage datasets for EXOTICA, HI, SUSY
    - ❏ Network connection: 10 Gbps & 40 Gbps R&D links

SPRACE

GridUNESP: Spin-off of SPRACE

- Multi-user, multi-campus (first campus Grid in Latin-America)
- 7 sites on different UNESP campi (spread over the state of São Paulo)
- Central cluster at UNESP CSC datacenter (together with SPRACE cluster)
- Scientific impact
  - 60+ scientific projects, 300+ users
  - 50+ journal papers; 20+ conference papers; 10+ theses/dissertations

User distribution by research field

Physics 32.6%
Biology and biophysics 25.6%
Chemistry 19.4%
Material Sciences 6.2%
Infrastructure 5%
Computer Sciences 5%
Earth science
Astronomy
Engineering
Humanities

Evolution of subscribed users and projects

Projects
Users
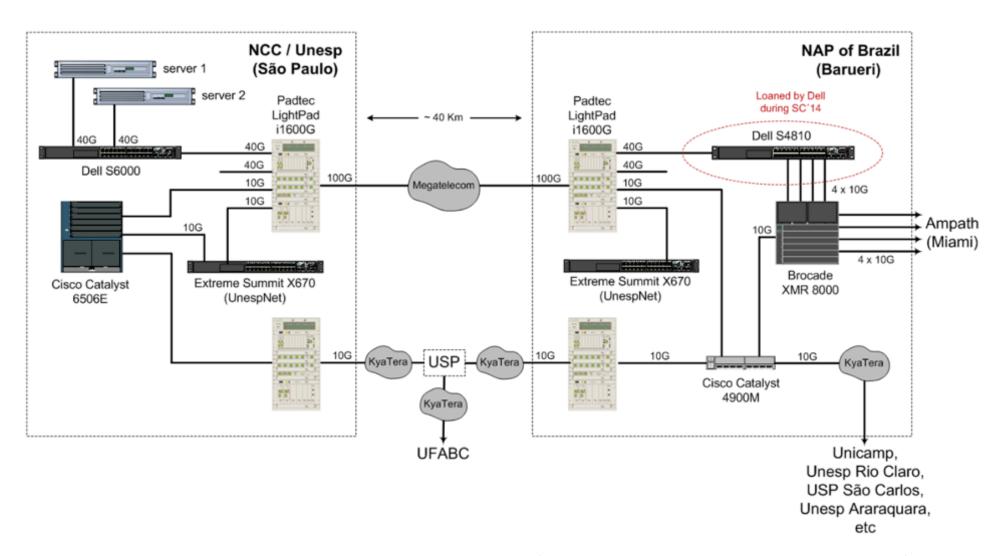
- **ANSP Grid CA**
  - Grid Certificate Authority for the State of São Paulo
    - ❑ Initiative of UNESP CSC
    - ❑ Managed by the Academic Network at São Paulo (ANSP)

- **Hardware collocated at CSC datacenter**
  - Two Hardware Security Modules (HSM)

- **Accreditation:**
  - Approved by
    - ❑ TAGPMA in April 2012
    - ❑ IGTF in August 2012
  - Included in TACAR (TERENA Academic CA Repository)
    - ❑ October 2012

ASI- HSM AHX2

Unesp CSC - Network infrastructure

SC'14: Dell S6000 switch + 100G lambda (client side: 2x 40G + 2x 10G ports)

Global Software-Defined Dynamic Circuits for Data Intensive Science
(PhEDEx – ANSE – PANDA - OpenDayLight)

R&D activities in Scientific Instrumentation

- SPRACE Lab: engineering team acquiring expertise in
  - System development with FPGAs, microcontrollers and microprocessors
  - Small particle detectors DAQ and trigger electronics
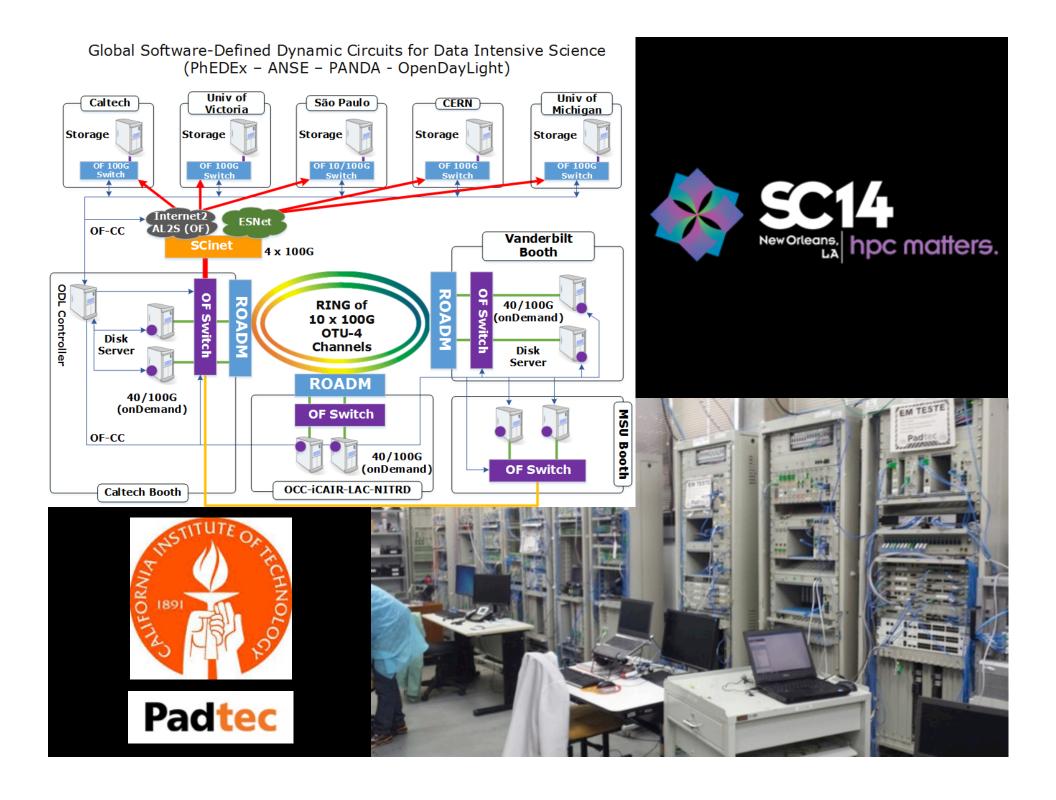 - Telecommunications and digital data transmission
- Ongoing activities
  - Two engineering students working at Fermilab (Oct/2014)
    - ❑ Help on the development of the CMS L1 Tracking Trigger (Pulsar IIb)
    - ❑ Acquire expertise in ATCA systems monitoring and control
  - Activities at the SPRACE Lab
    - ❑ System development & testing
    - ❑ IPMI development on custom and commercial IPMC modules
    - ❑ Search for partnerships with Brazilian industries
    - ❑ Participant researchers from UNESP, UNICAMP, UFRJ, UFABC
- Future activities
  - Modeling, simulation and emulation of Tracking-Trigger Systems
  - Massively parallel processing applied to HEP data acquisition systems (FPGA + Xeon Phi coprocessors)

Intel Parallel Computing Center

- **NCC/UNESP IPCC**
  - R&D efforts to adapt HEP software tools
  - Explore new manycore architectures
- **Main target**
  - Parallelization of Geant (GEometry ANd Tracking)
    - ❑ Essential simulation platform for HEP
    - ❑ Need to explore new manycore architectures
    - ❑ Requires long calculation times (Intel Xeon Phi)
    - ❑ Broad Impact: radiation-hard electronics, dosimetry
- **Work plan**
  - Associated to
    - ❑ CERN Geant-V development team
    - ❑ Fermilab Computing Division Division
  - Test vector-coprocessor prototypes in hybrid parallel systems
  - Analyze the performance of the Intel Xeon Phi coprocessors
  - Evaluate the redesign efforts to adopt the next generation of Intel manycore technology

Jeronimo A. Bezerra

AmLight Senior Network Engineer

AmLight Senior Network Engineer, responsible for the AmLight *Software Defined Network* (SDN) and all its applications, protocols and performance requirements.

MSc in Mechatronics and BS in Computer Science by the Federal University of Bahia/Brazil, Cisco CCIP, Juniper JNCIA and Linux LPIC-1 certified, Jeronimo Bezerra has been involved with academic networks for the last 12 year.
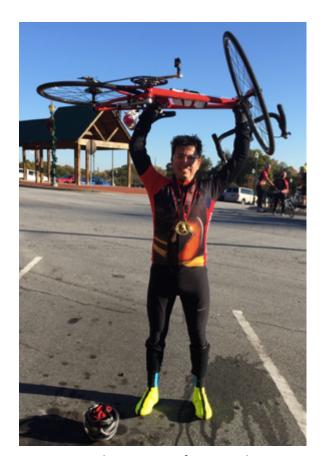
Other Research & Social Interests

- Interested in SDN + QoS, SDN + Troubleshooting and SDX subjects

- Pursing a Cisco CCIE certification by May
- Willing to start PhD at FIU this year

- Cycling (preparing for Titan Road 300)
- Triathlon (preparing for Ironman 2015 Miami)

Titan Road 300 2014 – After 300 miles

Future Internet Research, Experimentation and Innovation

Research Interests

- New network architectures that can bring to the core of the network intelligence that would enable an autonomic behavior capable of satisfying requirements provided by an entity with a smarter and efficient use of resources resources
- Reconfigurable software defined networks with cloud based network virtualized functions on current and future network architectures
- Mobility in heterogeneous networks
- Future novel user, sensor and content centric applications
- Mobile cyber physical systems and applications

Main Results

- **2011**
  - Proposal selected to experimentation at OFELIA testbed in a contest organized by MyFire EU project
  - Entity Title Model
- **2012**
  - EU FP7 OFELIA PARTNER - Extending and Deploying OFELIA in Brazil (EDOBRA)
    - Team: EPUSP (São Paulo Brazil), ITAV (Aveiro, Portugal) and UFU
    - Design of the Entity Title Architecture (ETArch) – Clean-slate SDN based network architecture that aims to satisfy different applications requirements such as multicast traffic, mobility, QoS and Security
    - Deployment of a OFELIA Island at Uberlândia, MG, Brazil
- **2013**
  - UFU became a FIBRE associated member
  - EDOBRA
    - Deployment of ETArch at OFELIA testbed
- **2014**
  - One of the EDOBRA results (Openflow + IEEE 802.21) was selected as an Academic demo for ONS2014
  - Best Paper at Advanced International Conference on Telecommunications (AICT) 2014
  - EU FP7 FI-WARE project partner - Brazilian Regional Centers For Future Internet Innovation (FIILAB)
    - Team: EPUSP) and UFU
    - Deployment of FI-Lab Nodes in Uberlândia, MG, Brazil and São Paulo at EPUSP
  - Funded projects by CAPES, CNPq, FAPEMIG and EU FP7
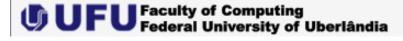
UFU Faculty of Computing
Federal University of Uberlândia

Prof. Flávio de Oliveira Silva, Ph.D.
flavio@ufu.br

Future Internet Research, Experimentation and Innovation

Potential US-Brazilian collaborations

- Software architecture design, development and validation
- Protocol specification, design and validation
- Experimentally driven research based on real use cases considering telecommunication service provider and smart cites based on public open data
- Beyond state-of-the-art research projects tied an innovation vision where some results can be deployed

Research, Funding and Industry Partners

Themes for US-Brazil research collaboration

- Future Internet Exchange Point (FIXP) that will enable the interconnection of different FI infrastructures currently bringing life the Future Internet
- Carrier grade SDN control layer that encompasses high availability, scalability, high performance, reliability, fault tolerance, security and manageability
- Reconfigurable convergent network architecture based on SDN, NVF and the Cloud for service providers, specially in the area of telecommunications
- Multi Protocol stack Future Internet architecture which would enable an *-centric internet based on plethora of different requirements

UFU Faculty of Computing Federal University of Uberlândia

Prof. Flávio de Oliveira Silva, Ph.D.
flavio@ufu.br

Aurisabel Fereira

Ampath SDN/Openflow Network Engineer

She participates in deployment of software and network operating system builds, working in coordination with development teams at Internet2, GENI, and Brazil's OpenFlow projects. She prepares user and technical documentation for use internally and disseminate to communities of interest on the use of OpenFlow/SDN. She provides required engineering assistance in the connection of OpenFlow/SDN research activities. She maintains, implements and coordinates operations of Controller and Openflow switches in Ampath.

Other Research & Social Interests

- Plan to do a Master in FIU
- Musical Theaters, Family, Orchids, Fine food & wine plus lots of exercise
- My Daughters

Tae kwon do

Swimmer

Pianist

Violinist

James H. Grace

AMPATH Senior Network Engineer

AMPATH Senior Network Engineer, responsible for operations and engineering of the AMPATH International Exchange Point, and for all service monitoring and metrics analysis.

MA in Econometrics from Florida International University

Other Research & Social Interests
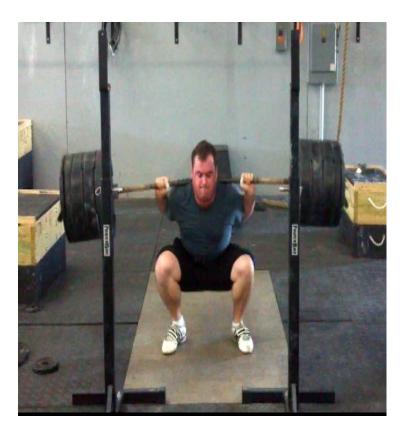
- Interested in SDN Metrics, Performance Monitoring, and Growth Forecasting

- Preparing for Ph.D Studies at FIU

- Weightlifting

- Hiking, Fishing, Hunting

250Kg (~551lbs) Squat

Jose F. de Rezende
UFRJ (Federal University of Rio de Janeiro)

SwitchON Workshop

Miami, Jan 8-9 2015

Jose F. de Rezende - UFRJ

COPPE
UFRJ

- **Research interests**
  - wireless networks
  - SDN
  - federation of testbeds

- **Current and potential US-Brazilian collaborations**
  - VirginiaTech (Luiz DaSilva)
  - my lab has a strong collaboration with UMass (Don Towsley/Kurose)

- **Themes for US-Brazil research collaboration**
  - 5G wireless networks & cognitive radios
  - Future Internet architectures

SwitchON Workshop 2015

Antonio "Guto" Rocha

Institute of Computing (IC)
Fluminense Federal University (UFF)
arocha@ic.uff.br
www.ic.uff.br/~arocha

Miami, Jan 8 2015

Research interests

- Performance Evaluation

- Network Measurement

- Next Generation Internet

- Network Science

- Security Systems

US-Brazilian collaborations

- Currently with Umass:
  (in Sabbatical Period)
    - Arun Venkataramani
    - Don F. Towsley

- Themes of interest for new collaborations:
    - Future Internet architectures
    - Network Measurement in New Internet Generation

SwitchON Miami Workshop

Andy Bavier

Princeton University

January 8-9, 2015

Since 2002: PlanetLab
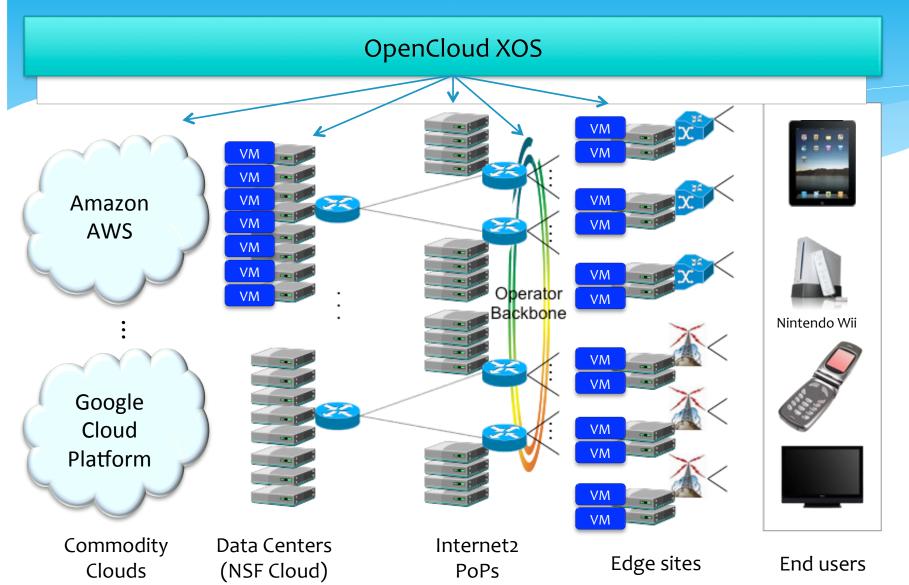
* 645 sites, 1335 nodes worldwide
* Brazil collaborators:
  * C3SL
  * Federal University of ABC
  * LARC – University of Sao Paulo
  * RNP – Ceara
  * RNP – Rio de Janeiro
  * RNP – Para
  * RNP – Rio Grande do Sul
  * Universidade Federal de Campina Grande
  * Universidade Federal de Minas Gerais

Next: OpenCloud

* Build and operate a logical Cloud
    * Support *long-running services*
    * Integrate with commodity clouds (e.g., EC2), research clouds (NSF Cloud), testbeds (GENI, PlanetLab)
    * Spans data centers, network PoPs, edge sites
* With a unifying architecture
    * Designed around *composable services*
    * Key principle: XaaS - Everything as a Service
* Leveraging open-source software
    * XOS, OpenStack, OpenVirteX (SDN)
* More info: http://opencloud.us

The Big Picture

OpenCloud XOS

Amazon AWS

⋮

Google Cloud Platform

Operator Backbone

Nintendo Wii

Commodity Clouds

Data Centers (NSF Cloud)

Internet2 PoPs

Edge sites

End users

Facilitating Auditability, Reliability, and Scalability in
Building Future Internet

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

Dr. Baek-Young Choi

Dr. Sejun Song

Dr. Edmundo MadeiraDr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in
Building Future Internet

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

X

UMKC

RESEARCH INTERESTS

- Resilient multilayer networks — architecture and design
- Cloud/data center networking
- Internet routing protocols
- Network design, optimization, performance and management
- Next generation networks

UFRGS
UNIVERSIDADE FEDERAL
DO RIO GRANDE DO SUL

Dr. Baek-Young Choi

Dr. Sejun Song

Dr. Edmundo Madeira Dr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in Building Future Internet

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

X

UMKC

UFRGS
UNIVERSIDADE FEDERAL
DO RIO GRANDE DO SUL

RESEARCH INTERESTS

- Cloud computing and software-defined networks
- Network algorithms and protocols
- Data storage and management systems
- Network traffic/performance/security: measurement, analysis and modeling

Dr. Baek-Young Choi   Dr. Sejun Song   Dr. Edmundo MadeiraDr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in
Building Future Internet

Research Teams

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

X

RESEARCH INTERESTS

- Software defined networks, cloud computing and data center networks
- Network systems security and fault-tolerance management
- Embedded real-time systems and controller area networks
- Mobile operating systems and mobile cloud computing
- Wireless/sensor networks
- Software systems quality assurance

Dr. Baek-Young Choi   Dr. Sejun Song

Dr. Edmundo Madeira   Dr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in Building Future Internet

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

UMKC

X

RESEARCH INTERESTS

- Management of network virtualization
- Web services and peer-to-peer (P2P)-based management
- Autonomic computing and self-*
- Visualization of network management information
- Management of Future Internet
- Network programability

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UNICAMP

Dr. Baek-Young Choi   Dr. Sejun Song   Dr. Edmundo MadeiraDr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in
Building Future Internet

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

RESEARCH INTERESTS

X

- Computer Networks
- Distributed System Management
- Distributed Systems
- Grid and Cloud Computing
- Mobility Aware Technologies
- Wireless Mesh Networks

UNICAMP

UFRGS
UNIVERSIDADE FEDERAL
DO RIO GRANDE DO SUL

Dr. Baek-Young Choi

Dr. Sejun Song

Dr. Edmundo Madeira Dr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in Building Future Internet

Research Teams

Dr. Deep Medhi

Dr. Lisandro Zambenedetti Granville

UMKC

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RESEARCH INTERESTS

My current research interests are: network, service, and application management; network virtualization; software-defined networking; cloud computing; security of large-scale distributed systems (*e.g.*, P2P); IT service management; and intrusion detection and prevention.

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UNIVERSIDADE FEDERAL
DO RIO GRANDE DO SUL

Dr. Baek-Young Choi   Dr. Sejun Song   Dr. Edmundo MadeiraDr. Luciano Paschoal Gaspary

Facilitating Auditability, Reliability, and Scalability in Building Future Internet

Current US-Brazilian Collaborations

Themes for US-Brazil research Collaboration

Facilitating Auditability, Reliability, and Scalability in
Building Future Internet

Current US-Brazilian Collaborations

Themes for US-Brazil research Collaboration

X

- Dr. Deep Medhi selected as a leading international research visitor under the Brazilian Science Mobility Program with the University of Campinas (UNICAMP), Brazil. Multiple visits (each of about five weeks) to UNICAMP, where he has collaborated with Dr. Edmundo Madeira and Dr. Nelson Fonseca.
- Dr. Deep Medhi visited the Federal University of Rio Grande de Sul (UFRGS), Brazil in July 2013 and July 2014, where he has initiated research collaboration with Dr. Lisandro Zambenedetti Granville and Dr. Luciano Paschoal Gaspary.
- The research areas of these collaborations span data center networking, multilayer networking, and resilient embedding in network virtualization and SDN.
- One of the current projects between UNICAMP and UMKC is to create an experimental testbed 'Hadoop in a Hybrid Cloud' that has also a component being installed at the GENI environment.

UMKC UFRGS UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL UNICAMP

Facilitating Auditability, Reliability, and Scalability in Building Future Internet

Current US-Brazilian Collaborations

Themes for US-Brazil research Collaboration

X

- Cloud Auditability: An efficient facility for storing and mining cloud event logs.
  - ✓ For deploying the practical cloud, an effective event tracking and recording facility is one of the most fundamental and inevitable components to ensure security, accountability, and auditability.
- Cyberinfrastructure Federation: It can be a new recipe for a pandemic disaster.
  - ✓ A new problem can be created when multiple CIs are federated. There is very little facility to perform the root cause analysis over the multiple federated environment.
- Software-Defined Networking (SDN) Scalability.
  - ✓ The abstractions toward the remote and centralized control tend to extend the legacy network management's inaccurate and unreliable problems into the control plane. SDN also imposes excessive control traffic overheads in order for the controller to acquire global network visibility.
- Software-Defined Networking (SDN) High Availability (HA).
  - ✓ SDN poses many critical challenges on the existing HA mechanisms to achieve the same HA Service Level Agreement (SLA) for services in SDN and NFV environments.

Architecture and Systems for Data Analytics and Intelligent Networking

Prof. Yan Luo
Dept of Electrical and Computer Engineering
University of Massachusetts Lowell
(*yan_luo@uml.edu* , *http://yanluo.github.io/*)

Research Theme:
Design architecture and systems to solve challenging issues in computing and networking

*Current Research Areas – **C.S.I.***
- CPU/GPU heterogeneous computing
- Software defined networking
- Intelligent embedded sensing

Heterogeneous processor
GPU/FPGA accelerators
Deep learning
…

SDN

Software defined network
Programmable flow classification
SD measurement
…

Embedded sensing,
Smartphone apps,
In-situ data processing
…

SwitchOn Participation

- Potential US-Brazilian collaborations
  - SDN for accelerating science discovery
  - Data analytics of network flows
  - Acceleration of deep learning algorithms
- Themes for US-Brazil research collaboration
  - Network big data
  - Network measurement
- About myself
  - Originally from China, Resident of US for 15 years
  - Speak English and Chinese
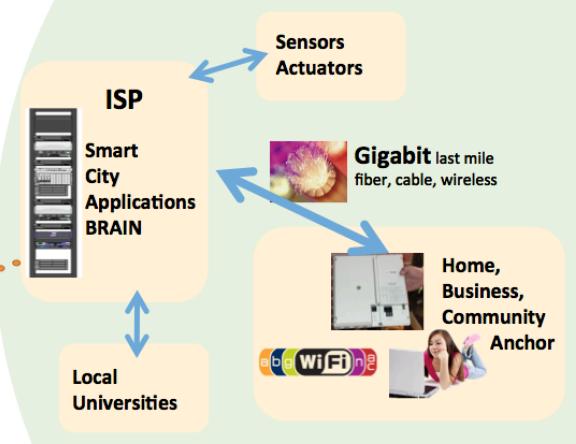 - Fan of classical music, love to play 8-ball pool

Current Partners

Public-private partnership

501(c)(3)

Data centers are power-hungry

U.S. data centers in 2013

91 billion kWh; 34 power plants (ea. 500MW); 17 more by 2020

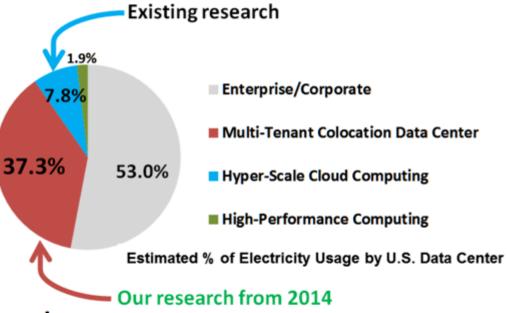Power the entire state of Washington

~ 10 billion USD

Source: Natural Resources Defense Council

My research

Existing research focuses on **Google**-type data centers

Operator has **full** control over servers and facilities

This is **not** true in multi-tenant colocation data centers...

Existing research

1.9%

7.8%

37.3%

53.0%

- Enterprise/Corporate
- Multi-Tenant Colocation Data Center
- Hyper-Scale Cloud Computing
- High-Performance Computing

Estimated % of Electricity Usage by U.S. Data Center

Our research from 2014
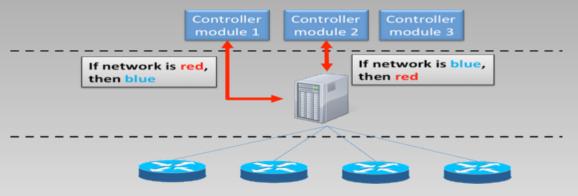
Xin Sun (assistant professor, FIU)

Xin Sun is currently an assistant professor in the School of Computing & information Sciences at Florida International University. His general research interest lies in networking and systems, and he has worked extensively in the areas of network design and management, cloud computing, and software-defined networking. He was a visiting researcher at IBM Watson research center from June to August in 2014. He received his Ph.D. in computer engineering from Purdue University, West Lafayette.

Xin Sun (assistant professor, FIU)

➢ **Overall direction: transforming network design from art to science**
- Thread 1: reasoning the joint effect of (potentially) conflicting objectives to check for compatibility.

- Thread 2: integrate the design of multiple elements with intrinsic interplay for optimality
- Special focus: network complexity
  - *Highly important (operating a network == mastering its complexity) --*
  - *-- but least explored (human error is #1 cause of outage & attacks)*
  - *Insights from this research can inform & guide the development of future Internet architectures --*
  - *-- by making complexity/manageability an explicit design knob*

Vasilka Chergarova

CIARA Coordinator

Florida International University

- Native from Bulgaria
- OSDC-PIRE Fellow 2011 Sao Paulo, Brazil
- Graduated with a BS in Computer Science from FIU
- MS Management of Information Systems FIU
- Interested in BigData analytics and data visualization
- Planning to start PhD in Medical IT

Interest

- Interested in Data, Data and Data mining
- Travel – I did travel for around 5-6 years
- Art (sculpture, painting, photography, art craft)
- Sport (from martial art to Zumba)

Russ Clark

SwitchON Workshop
2-minute madness

January 8-9, 2015

Research, Teaching and Operations

- School of Computer Science
  - Research in networking, especially SDN
  - Mobile Applications and Services
  - Teaching and Student Engagement
  - Entrepreneurship
- SoX – Southern Crossroads
  - Regional Network Operator

Best Fits for Collaboration

- ⦿ GENI
  - ● Experience from original campus trials through ongoing GENI rack support
- ⦿ SDX
  - ● Defining and deploying a Software Defined Exchange
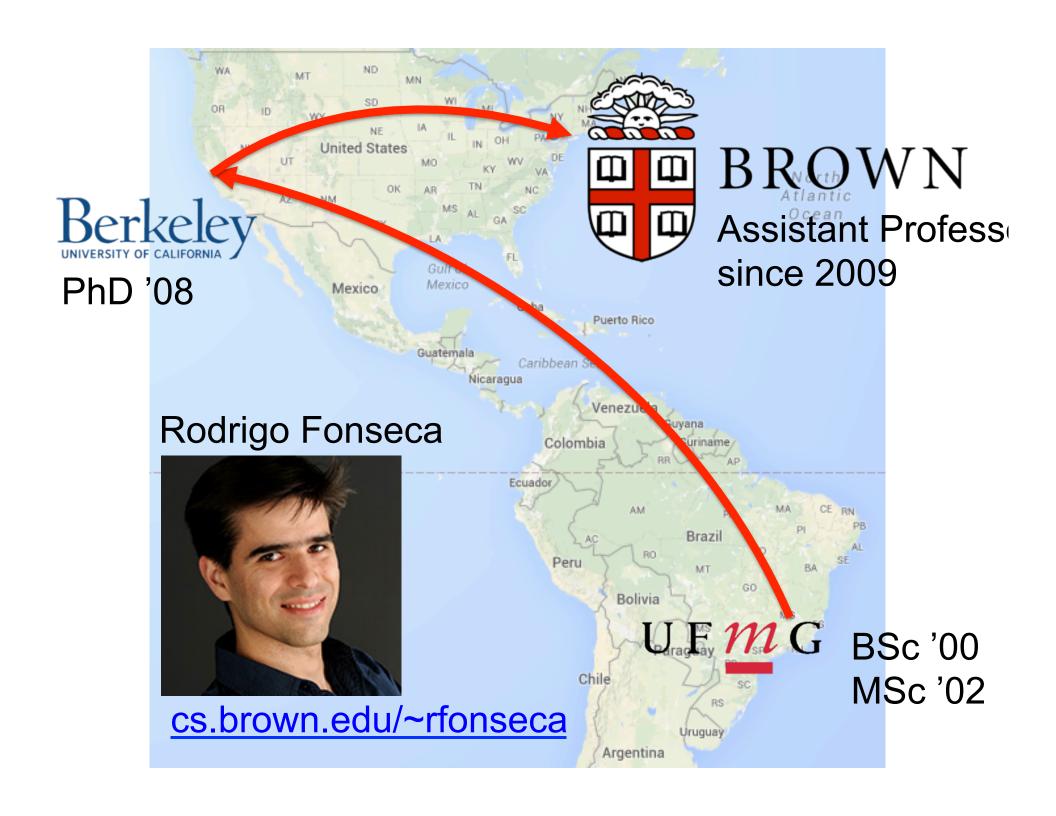 - ● Collaborators include Nick Feamster, Jen Rexford, Arpit Gupta, Laurent Vanbever

Research

- Networking, Operating Systems, Distributed Systems
  - SDNs
    - Participatory Networking ("user-level")
    - Migration to SDN
    - Debugging SDNs
  - Visibility into Distributed Systems
    - Causal tracing
    - Resource tracing and management

Participatory Networking

- End-user applications help configure the network
  - "User-level" API to SDNs
  - Requests, hints, queries about QoS, security, traffic, paths
  - Main problem: how to do this safely -> privilege delegation, conflict resolution
  - Examples:
    - SSHGuard to the edge of the network
    - Reservation for Video Conferencing/VoIP
    - Zookeeper vs Hbase traffic

http://pane.cs.brown.edu

Ferguson, Guha, Liang, Fonseca, and Krishnamurthi. **Participatory Networking: An API for Application Control in SDNs.** SIGCOMM 2013

NSF NeTS Award # 1320397

Resource-tracing in Distributed Systems

- Real-time action with global context
  - Across components, nodes
  - Pervasive per-workflow resource monitoring
  - Global, centralized policies

- Deployment
  - HBase, Yarn, MapReduce, HDFS, Zookeeper
  - Foreground and backgroun tasks
  - Global policies: DRF, Latency SLOs

Mace, Bodik, Musuvathi, Fonseca. **Retro: Targeted Resource Management in Multi-tenant Distributed Systems**. NSDI 2015, to appear

Muito obrigado :)

Rodrigo Fonseca

cs.brown.edu/~rfonseca

Inder Monga, Introduction

- Passionate about Networking and Innovation
  - Crossing the rope bridge between the 'new' and the 'conservative'

- Development Career
  - Router coder and IETF'er – Wellfleet Communications
    - ISDN, PPP, L2TP, IPSec
  - Intersection of Data and Optical networking – Nortel Networks
    - Integrated router with optics

- Telecom Bust

- Research career
  - Looking beyond the network
  - 17 patents granted

- Research Networking
  - Responsible for future networking strategy, research and experiments
  - High speed networking focus
  - Focus on the end-user

'Research' Interests and Results

- Future Internet Architectures
  - SDN
  - NDN
  - High-speed data transfer protocols
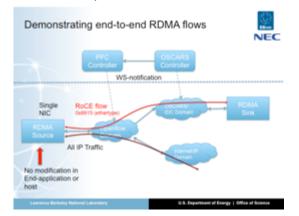 - Tempered by what's possible in the next 3 – 5 yrs

- Approach
  - break existing barriers – demonstrate its possible
    - 'Open' Collaboration
  - Get industry excited (if possible), so they can cater to R&E requirements
  - Push for cross-vendor standardization
  - Publish papers if time

- In addition
  - ONF Technical Leadership Council as Research Associate Lead
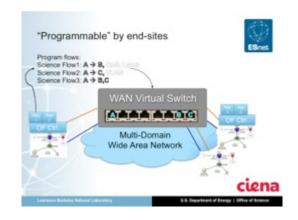 - New workshop and paper series on Manageability and Security of NFV/SDN (MASONS)

ESnet

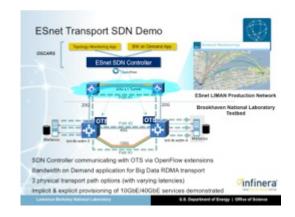# Last three years of SDN investigations
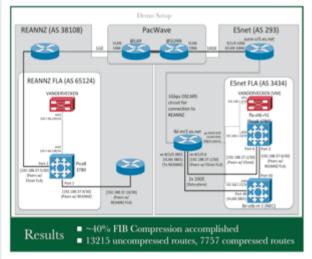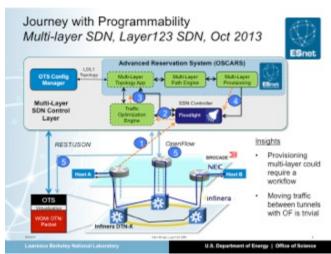
ONS 2011, SC 2011

SC 2012

December 2012

Treehouse w/REANNZ, Google

ONS March 2013

Layer 123 SDN, Nov 2013

SDN Workshop
'Operationalizing
SDN'
December 2013

ESnet

US-Brazil Collaboration

- RNP
  - OSCARS (MEICAN)
  - perfSONAR
  - GNA

- RouteFlow
  - CpQd / University of Campinas (Christian)
  - Ad-hoc but hope to grow this more

ESnet

Spectrum and Infrastructure Sharing in Future Wireless Networks

Luiz A. DaSilva

Professor of Telecommunications, Trinity College Dublin

Research Professor, Virginia Tech

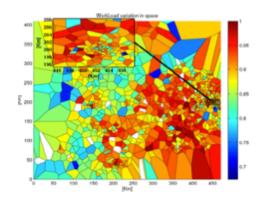(dasilval@tcd.ie)

Miami, FL, 8 January 2015

(PVE, UFRJ, 2015-2017)

Analysis of resource sharing in wireless networks

- spectrum sharing mechanisms

- game theoretic analysis

- heterogeneous networks and small cells

- infrastructure sharing and crowdsourced wireless access

- stochastic geometry

Experimentation in wireless networks

- cognitive and reconfigurable rado

- federated testbeds: US/Brasil/Europe (FIRE + GENI)

- open software architectures for prototyping of wireless solutions

- flexible protocol stacks

Current Call
Deniz Gurkan
03:17:25

Allen B. MacKenzie

In a sentence…

» I do interdisciplinary work at the interface between communications and networking in wireless systems.

Research Themes

» Game Theoretic Analysis of Wireless Communications and Networking

» Resource Allocation in Cognitive Networks

» Network Experimentation

Brief Bio

» Associate Professor in ECE at Virginia Tech

» Associate Director of Wireless @ VT, a research group of 15 core faculty

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Wireless @ *Virginia Tech*

Why I'm Here...

Future Interests

» I'm interested in new network architectures that enable better resource allocation.

» Topics of Interest Include

  » Programmable Wireless Networks (Close Ties to SDN)

  » Virtualized Wireless Networks (Also Close Ties to SDN)

  » Joint Optimization of Wired and Wireless Infrastructure Networks

Brazilian Collaborations

» Kleber Vieira Cardoso, a faculty member at Federal University of Goiás (UFG) will be visiting me for one year, beginning in February.

» Long time collaborator of Luiz DaSilva.

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Thank you!
Obrigado/a!