GridUnesp Project and the Unesp Center for Scientific Computing

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RESEARCH ASSOCIATE /

CSC EXECUTIVE MANAGER

OSG All Hands Meeting 2018

University of Utah

unesp
UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"

State of São Paulo

- ❑ 34% of the Brazilian total GDP
- ❑ 45% of the Brazilian Science
- ❑ 39% of the Ph.D Graduates
- ❑ 3 State and 3 Federal Universities

São Paulo State University

- ❑ Among the TOP 10 Universities in Latin America (QS 2018)
- ❑ 34 Schools and Institutes in 24 cities over the State
- ❑ 35K+ undergrad students, 13K+ graduate students
- ❑ 180+ undergrad programs, 250+ graduate programs

Unesp Center for Scientific Computing

SPRACE

High Energy Physics Research/Engineering

CMS - CERN

Search for DM

Heavy Ion Collisions

WLCG Tier-2 cluster

Instrumentation

GridUnesp

General-Purpose HPC/HTC Facility

First Campus Grid in Latin America

Partnership with OSG

HPC for 400+ users

Openlab

Industry/University Cooperative Programs

Cloud Computing

Code Modernization

Machine Learning

SDN

São Paulo Research and Analysis Center

Fundamental Research in High Energy Physics

- ❑ Physics analysis: Beyond SM and Heavy Ion Collisions
- ❑ Data processing: CMS Tier-2 cluster (MoU: April/2009)
- ❑ Scientific instrumentation

Training and Education

- ❑ Promote expertise in advanced fields
  - ▪ Including High School teachers

Outreach

- ❑ Share the knowledge with society
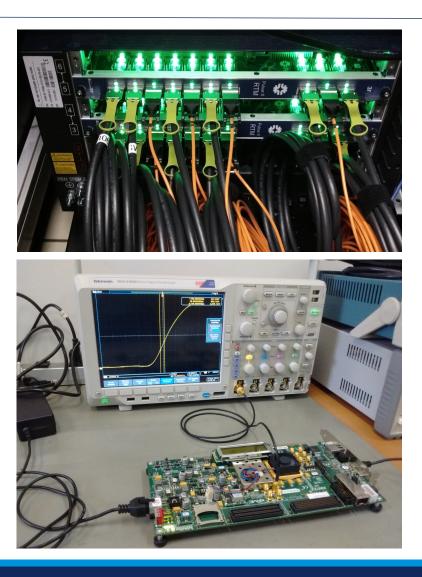 - ▪ Poster, web sites, game, Masterclass, etc.

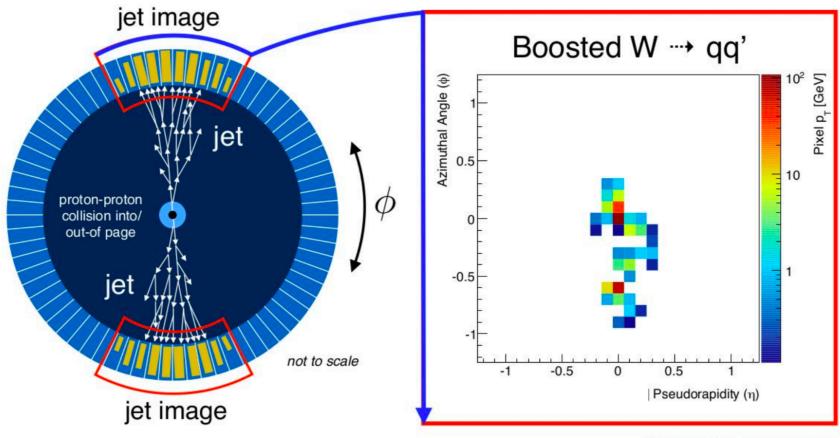# SPRACE Lab - CMS Level 1 Tracking Trigger

ATCA Setup

- ❑ ATCA COMTEL Chassis 100 G Full Mesh Backplane
- ❑ 2x Shelf Managers (ShM) + ATCA Switch F125
- ❑ 2x (Pulsar 2b board + RTM w/ 40x 10G QSFP+)
- ❑ 2 empty physical slots available for other blades

Lab Setup

- ❑ 3 Xilinx Kintex KC705 and 2 Zynq ZC702 boards
- ❑ 1GHz Scope, 240MHz FxGen, Power Supplies, etc
- ❑ Vivado, procuring ModelSim
- ❑ 2x FC7s boards (under negotiation)

Deep Learning for boosted jet classification in HEP

Ben Nachman, DS@HEP 2017

The GridUnesp Project

A production-quality, multi-campus Grid

- ❑ Spin-off of the SPRACE project
- ❑ Started in 2004 with a call for Scientific Proposals
- ❑ Financial support approved by FINEP by 2006
- ❑ Hardware acquisition process finished by 2008
- ❑ Partnership with OSG Consortium
- ❑ Operation started in October 2009
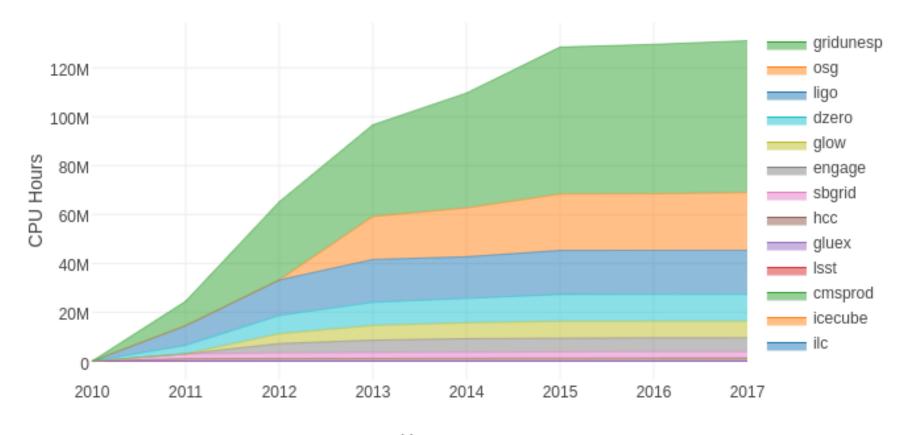- ❑ Upgrade: 2016 (=> 85 Tflops, 420 TB)

GridUnesp sites

- ❑ One central cluster (white)
- ❑ Six secondary clusters (green)
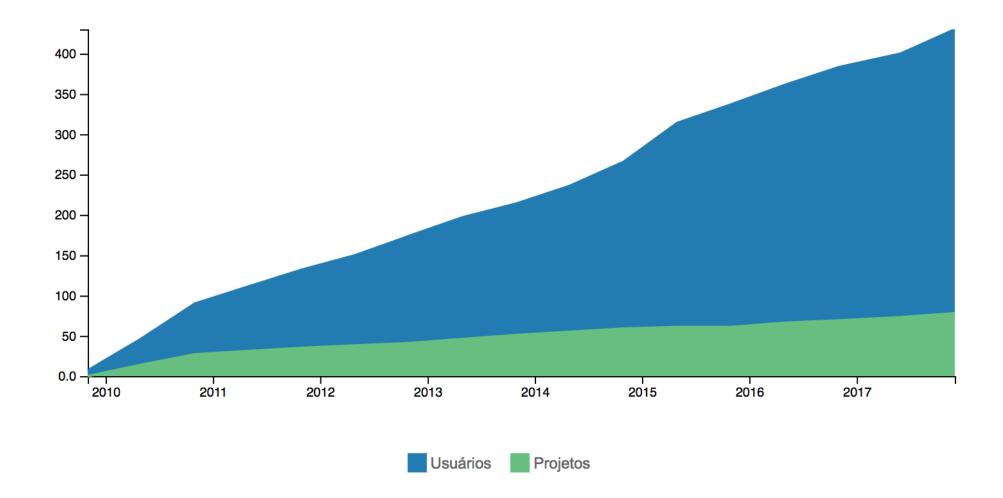- ❑ One extra secondary cluster should be deployed soon (orange)

GridUnesp - Cumulative CPU Hours

GridUnesp - Evolution of Projects and Users

Usuários   Projetos

GridUnesp - Certificate Authority

ANSP Grid CA

❑ Grid Certificate Authority for the State of São Paulo

- Initiative of Unesp CSC
- Managed by the Academic Network of São Paulo (ANSP)

Hardware Security Modules installed at CSC
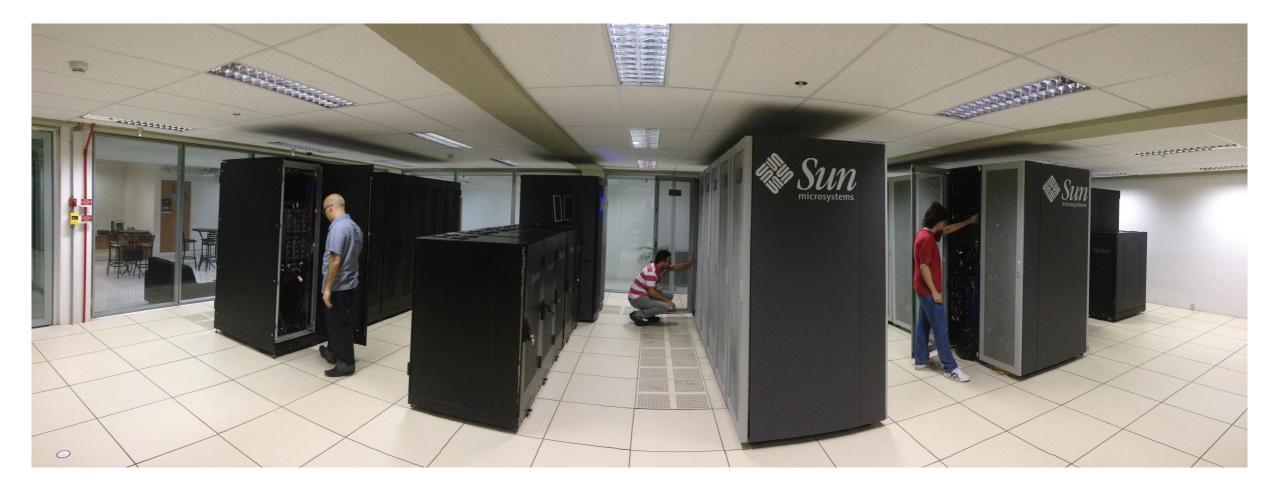
❑ Two Hardware Security Modules (HSM)

Accreditation

❑ Approved by

- TAGPMA in April 2012
- IGTF in August 2012

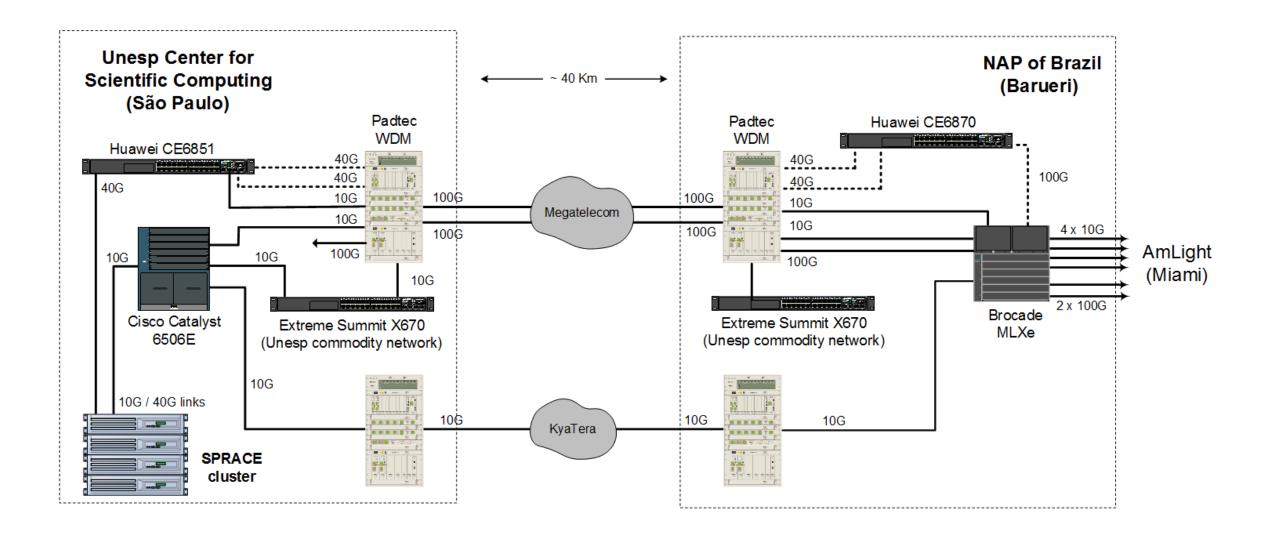❑ Included in TACAR (TERENA Academic CA Repository)

- October 2012

ASI- HSM AHX2

Unesp CSC - Datacenter

Unesp CSC - Network Infrastructure

Unesp CSC - Quick Facts

Hosting / Colocation

- GridUnesp: Central cluster
  - 85 TFlops & 420 TB
- BR-SP-SPRACE: WLCG Tier-2 Cluster
  - 15 TFlops & 1,500 TB
- Manycore Intel Xeon Phi Cluster
- Mirror of Unesp Administrative Systems
- Institutional Repository (Digital Library)

Certification Authority

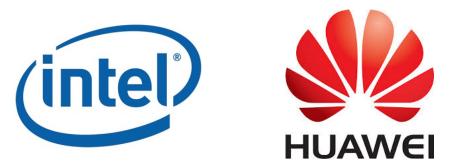- ANSP Grid CA

Network Infrastructure

- External Connections: 2x 40G, 1x 100 Gbps
- University Connection (UnespNet): 10 Gbps

Activities

- Scientific Processing (HTC, HPC)
- Technical Support
- LHC data analysis & processing
- High Performance Network
  - MegaTelecom & Telefonica links
- Technical Training
  - Intel 'Modern Code', Intel CoE for ML
- Outreach activities
  - International MasterClass on HEP
  - 250+ High School Students/year
- Innovative Projects with the Private Sector
  - R&D based on Tax Waiver Federal program
- Demonstration on HSN @ SC Conferences

Industry/University Cooperative Programs

Intel / Unesp R&D Projects

Manycore Testing Lab (2013)

- ❑ First manycore testing lab outside US
- ❑ First hands-on activities with Xeon Phi

Intel Parallel Computing Center

- ❑ Parallelization of Geant code
- ❑ Broad impact
  - ▪ HEP + Dosimetry + Radiation-hard electronics
- ❑ Goals
  - ▪ Develop GeantV: massive parallelism natively

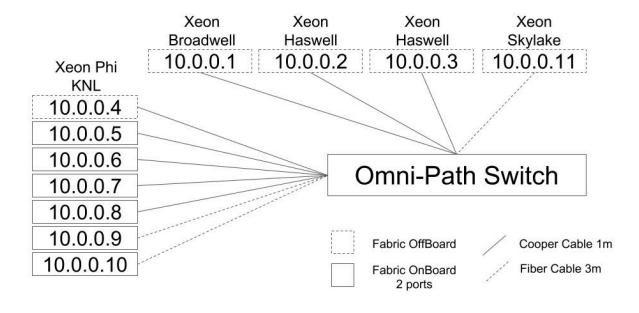## Intel Modern Code Program

- ❑ 1700+ students trained in 2 years
- ❑ 7 International training events
- ❑ 26 tutorials at Brazilian Institutions
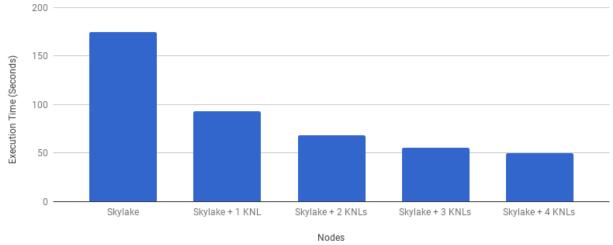
CoE in Machine Learning (2017)

- ❑ R&D, consulting, and training in ML
- ❑ High Energy Physics (boosted jets)
- ❑ SERPRO, DataPrev, Brazilian Financial Institutions, etc.
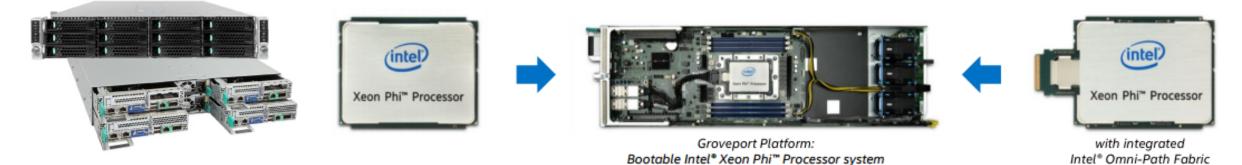
Intel /Unesp R&D Projects

Xeon Phi
KNL

Xeon Broadwell	Xeon Haswell	Xeon Haswell	Xeon Skylake
10.0.0.1	10.0.0.2	10.0.0.3	10.0.0.11

10.0.0.4
10.0.0.5
10.0.0.6
10.0.0.7
10.0.0.8
10.0.0.9
10.0.0.10

Omni-Path Switch

Fabric OffBoard   Cooper Cable 1m

Fabric OnBoard   Fiber Cable 3m
2 ports

N-Body Evaluation using Xeon - Xeon Phi and Omni-Path

Execution Time (Seconds)

Nodes: Skylake, Skylake + 1 KNL, Skylake + 2 KNLs, Skylake + 3 KNLs, Skylake + 4 KNLs

■ Execution Time (Seconds)

Xeon Phi™ Processor

Groveport Platform:
Bootable Intel® Xeon Phi™ Processor system

Xeon Phi™ Processor
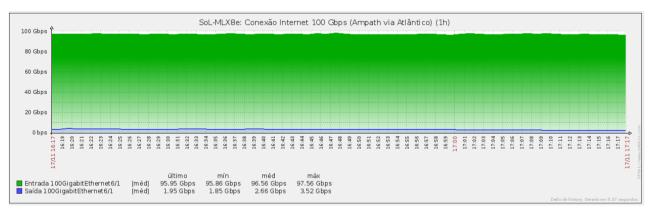
with integrated
Intel® Omni-Path Fabric

Huawei R&D Project

Development of a Software-Defined Networking (SDN) Controller

- ❑ Kytos: Open Source SDN Plataform
- ❑ Plug & Play, responsive web UI
- ❑ Scalable => NApss

Cloud-based testbed for exploring cloud-SDN integration

- ❑ Demonstrations at annual Supercomputing Conferences
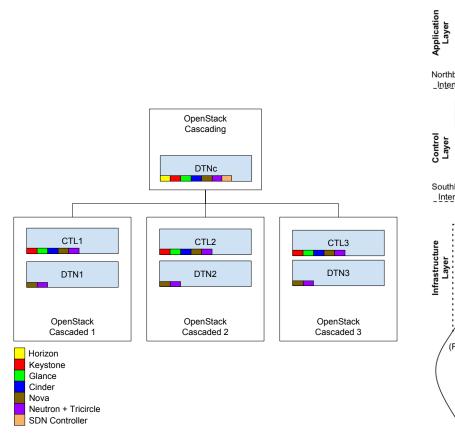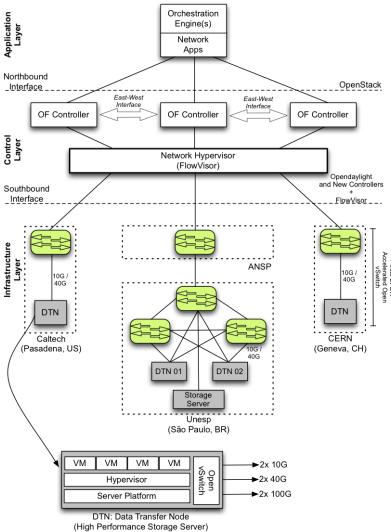- ❑ 2017: new record of data transmission between North-South Hemispheres

97.56 Gbps

Huawei R&D Project

Principal Investigator

Sérgio Novaes (UNESP)

SPRACE Researchers

Eduardo Gregores (UFABC)

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Thank You