ITU CoE on IoT and Big Data and Statistics
The Abdus Salam International Centre for Theoretical Physics
(ICTP), Trieste, Italy

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Meeting of the ITU Center of Excellence (CoE)
Steering Committees for Europe and CIS Regions
Trieste, Italy,
19-20 November 2019

Overview

- Review of 2019 activities

- Lessons learnt

- 2020 Activities

Marketing strategy

- World-wide (emphasis on developing countries)
  - Established network of scientific/technical institutions
  - Community of professionals
  - Past participants

- Avenues:
  - mailing lists for
    - posters (paper & PDF)
    - Targeted electronic mails

Training strategy

- Target audience are professionals

- Participants are always treated as peers
  - Sustainable empowerment via hands-on with state-of-art.
  - Post-activity long term interactions

- Promote collaborative self-paced application of knowledge tailored to individual needs

2019 Activity 1
CODATA/RDA Research Data Science Summer School

- **Report summary**
  - **Dates: 12-16 August**
  - **Mode: Face to Face**
  - **Language: English**
  - **Cost: 500USD**
  - **Location: Trieste, Italy**
  - **Participants**
    - **ICTP sponsored participants = 35**
    - **ITU Academy = 1**
  - **Resource persons**
    - **18 lecturers/tutors**

- Overview

  This course focuses on building a range of data related skills and competence in data analysis techniques for participants from all disciplines and/or backgrounds. Topics to be covered include
  - Data visualization,
  - Machine Learning,
  - Artificial Neural Networks,
  - High Throughput Computing (HTC) and
  - Cloud Computing.

  The activity includes practical hands-on sessions on techniques and applications for large-scale data handling, analysis, visualization and modeling on a variety of compute infrastructure including high performance compute platforms/systems.

  Participants are expected to have a working knowledge of the Linux Operating System including using the command line environment as well as the basic level of programming in the R programming Language (via the Rstudio GUI). *Applicants who lack the expected background may arrive 1 week early and participate in a preparatory boot-camp activity aimed at developing R programming and Linux O.S. skills.*

August 2019						
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2019 Activity 2

CODATA/RDA Advanced workshop on IoT and Big-Data Analytics

- Report Summary
  - Dates: 19-23 August
  - Mode: Face to Face
  - Language: English
  - Cost: 500USD
  - Location: Trieste, Italy
  - Participants
    - ICTP sponsored = 12
    - ITU Academy = 0
  - Resource persons
    - 6 lecturers/tutors

August 2019						
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- Overview

The Internet of Things (IoT) and the real time data analytics promises many new technological innovations and business benefits. The success of any solution leveraging these technologies lies in the ability to process and analyze the vast amounts of data produced by the millions or even billions of embedded devices, sensors, appliances and other data-collecting systems in real time. It requires new processes and tools for collecting, storing and processing IoT big data. This workshop introduces the data and analytic flows with a specific focus on IoT and real-time processing of event/streaming data.

The workshop first defines IoT and why IoT data processing is very different from typical data analytics, with its unique requirements for big data and real-time processing. Using a hands-on approach with simulated data, participants will learn to build a messaging and data streaming system with Apache Spark and Kafka and perform a real-time analysis with IoT and streaming data.

By the end of the workshop, participants will have learned:

- The characteristics and requirements of IoT specific and streaming data
- How to build a data flow to connect an IoT system or device data to a Big Data platform in specific formats
- How to use Big dDta tools to process IoT and streaming data in distributed computing
- How to use machine learning algorithms to analyze data and extract intelligence.

Participants are expected to have a working knowledge of fundamentals of IoT Data collection from sensors, the Linux Operating System including using the command line environment, software installation and some programming experience in R, Java or Python (one of the three) is required.

2019 Activity 3

TECHNICAL ASPECTS OF WIRELSS SOLUTIONS FOR THE INTERNET OF THINGS (IoT)

- Report summary
  - Dates: 2-4 September
  - Mode: Face to Face
  - Language: English
  - Cost: 500USD
  - Location: Trieste, Italy
  - Participants
    - ICTP sponsored = 4
    - ITU Academy = 1
  - Resource persons
    - 1 lecturers/tutors

September 2019						
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- Overview

There is general consensus that IoT has enormous potential to deliver great impact on the economy and on society at large. Having a good grasp of the relevant technical aspects is a must for bringing this to fruition. This capacity building course aims to provide the audience with a better technical understanding of wireless solutions for IoT. Participants will be exposed to the general aspects of IoT networks and will then dive into specifics of LPWAN and cellular solutions tailored to IoT like LTE-M and NB-IoT. Practical examples of IoT wireless technologies will be demonstrated.

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2019 Activity 4
INTERNET OF THINGS (IoT) ENTREPRENEURSHIP

- Report summary
  - Dates: 6-8 November
  - Mode: Face to Face
  - Language: English
  - Cost: 500USD
  - Location: Trieste, Italy
  - Participants
    - ITU Academy = 0
  - Resource persons
    - 1 lecturers/tutors

November 2019						
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- Overview

The rise of Internet of Things (IoT) has many names, including The Next Industrial Revolution and Industry 4.0. As with any emerging technology, entrepreneurs worldwide are impatient to build IoT businesses. While every company's IoT product offerings will differ, there are some basic items that must be addressed in order to build a successful IoT business. This capacity building course will introduce the general entrepreneurship concepts and will then focus on IoT business models and user cases.

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2019 Activity 5

CODATA/RDA/ICTP/TWAS Research Data Science Summer School in West Africa

- **Report Summary**
  - **Dates: 18-22 November**
  - **Mode: Face to Face**
  - **Language: English**
  - **Cost: 300USD**
  - **Location: Abuja, Nigeria**
  - **Participants**
    - **ICTP sponsored = 0**
    - **ITU Adademy = 0**

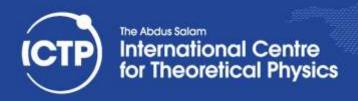| November 2019						
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- Overview

  This course focuses on building a range of data related skills and competence in data analysis techniques for participants from all disciplines and/or backgrounds. Topics to be covered include

  - Data visualization,
  - Machine Learning,
  - Artificial Neural Networks,
  - High Throughput Computing (HTC) and
  - Cloud Computing.

  The activity includes practical hands-on sessions on techniques and applications for large-scale data handling, analysis, visualization and modeling on a variety of compute infrastructure including high performance compute platforms/systems.

  Participants are expected to have a working knowledge of the Linux Operating System including using the command line environment as well as the basic level of programming in the R programming Language (via the Rstudio GUI). *Applicants who lack the expected background may arrive 1 week early and participate in a preparatory boot-camp activity aimed at developing R programming and Linux O.S. skills.*

Lessons learnt

- **Training strategy**
  - Joint activity with other partners
    - Successful but with few ITU academy participants
  - Dedicated only ITU academy activity
    - Growing number of participants
- **Recommendations**
  - Marketing within Europe:
    - Improving early targeted distribution of announcements (via ITU Academy) to professionals and corporate entities.

- **Other Region activity**
  - Challenges
    - Reaching direct agreements between CoE.
    - Differences in approaches to costing and payment.
    - National limitations on FOREX
  - Recommendations
    - Create a common inter-region framework based on ITU involvement:
      - Facilitate an enabling environment for all parties: ITU, CoEs, corporate participants, & individual participants.

2020 ACTIVITIES

2020 Activity 1
CODATA/RDA Research Data Science Summer School

- Information
    - Dates: 3-14 August
    - Mode: Face to Face
    - Language: English
    - Cost: 500USD
    - Location: Trieste, Italy

August 2020

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- Overview

  This course focuses on building a range of data related skills and competence in data analysis techniques for participants from all disciplines and/or backgrounds. Topics to be covered include
    - Introduction to Linux
    - Introduction to R
    - Introduction to Open Science
    - Data visualization,
    - Machine Learning,
    - Artificial Neural Networks,
    - High Throughput Computing (HTC) and
    - Cloud Computing.

  The activity includes practical hands-on sessions on techniques and applications for large-scale data handling, analysis, visualization and modeling on a variety of compute infrastructure including high performance compute platforms/systems.

  Participants are expected to have a working knowledge of the Linux Operating System including using the command line environment as well as the basic level of programming in the R programming Language (via the Rstudio GUI). *Applicants who lack the expected background may arrive 1 week early and participate in a preparatory boot-camp activity aimed at developing R programming and Linux O.S. skills.*

2020 Activity 2
CODATA/RDA Advanced Research Data Science workshops

- Information
  - Dates: 17-21 August
  - Mode: Face to Face
  - Language: English
  - Cost: 250USD
  - Location: Trieste, Italy

- Overview

Parallel hands-on (with real or simulated data) workshops covering domain specific applications of Data Science for Research work in five different domains of:

Bioinformatics: Covers building Machine Learning workflows using NGS Data. Topics include: Experimental design; Introduction to NGS data analysis; Machine Learning in NGS; and CWL.

IoT and Big Data Analytics: Covers big-data analytics, real-time streaming or processing and sentiment analytics for both general and IoT applications. Some coding would be presented in the Java Programming Language and involves introduction to BDA pipe-lines using Apache Spark, Kafka and Cassandra.

Climate Data Sciences: Covers on-line and cloud computing based data access, processing and visualisation tools for Climate Science, including the Copernicus climate data services platforms and the CMIP Earth System Grid.
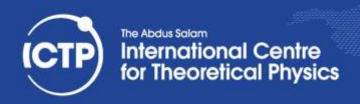
Computational Nuclear Engineering: Covers open-source tools and techniques (from basic to machine learning ones) for analyzing scientific big-data with focus on nuclear engineering applications.

Extreme sources of Data in High Energy Physics: Covers phenomenological, experimental and data-analysis aspects of the Standard Model; software development and tools for data analysis and reproducible science and sharing in particle physics.

By the end of each workshop, participants will have learned:
- The characteristic big-data analysis approach of scientific data in the domain
- How to use tools for handling and process data in specific formats
- How to perform data analysis on distributed computing environments
- Using machine learning algorithms to analyze data and extract intelligence.

Participants are expected to follow activities within a single domain for which they have either a background or working knowledge

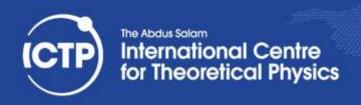| August 2020						
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2020 Activity 3
5G technologies for IoT

- Information
  - Dates: 28-30 September
  - Mode: Face to Face
  - Language: English
  - Cost: 300USD
  - Location: Trieste, Italy

- 5G technologies address a variety of applications in many fields, but those related with IoT are of particular interest given the great number of devices that are being connected.There is no doubt that 5G will play a pivotal role, both in massive and in critical applications.

- This capacity building course aims to provide the audience with an understanding of the 5G aspects relevant to IoT. Participants will be exposed to the general aspects of wireless networking with the particular requirements of machine type communications and will then dive into specifics of LTE-M and NB-IoT.

- Practical examples of 5G technologies for IoT will be demonstrated.

September 2020						
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2020 Activity 4
Applications of Satellite Based IoT Networks

- Information
  - Dates: 16-17 November
  - Mode: Face to Face
  - Language: English
  - Cost: 200USD
  - Location: Trieste, Italy

November 2020						
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- Satellite technology has an important role in driving the growth momentum behind the Internet of Things (IoT) and unlocking the promise of connected devices worldwide. Satellites serves as a key enabler for IoT applications across industries and across geographical borders.

- In this capacity building activity we will cover technologies of GEO (geostationary) satellites in C-, Ku- and Ka-band, new LEO (low earth orbit) or HEO (highly elliptical orbit) constellations, as well as the new developments in nanosatellites.

- As controlling the cost per device is of essence for the success of IoT applications, we will cover the sustainability issue of satellite-based IoT applications.