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## The CC1 system – a solution for private cloud computing.

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In the multidisciplinary institutes the traditional way of computations is highly ineffective. A computer cluster dedicated to a single research group is typically exploited at a rather low level. The private cloud model enables various groups to share computing resources. It can boost the efficiency of the infrastructure usage by a large factor and at the same time reduce maintenance costs. The complete cloud computing system has been developed in the Institute of Nuclear Physics PAN, Cracow. It is based on the Python programming language and a low level virtualization toolkit – libvirt. The CC1 system provides resources within the Infrastructure as a Service (IaaS) model. The main features of the system are the following:

- custom web-based user interface,
- automatic creation of virtual clusters equipped with a preconfigured batch system,
- groups of users with the ability to share resources,
- permanent virtual storage volumes that can be mounted to a VM,
- distributed structure – a federation of clusters running as a uniform cloud,
- quota for user resources,
- monitoring and accounting.

Emphasis was put on the simplicity of user access, administrative tasks and installation procedure. The self-service access to the system is provided via the intuitive Web interface. The administration module contains a rich set of tools for user management and system configuration. Particular attention was paid to the preparation of the automatic installation procedure based on a standard package management system of Linux distributions. This way the system can be setup quickly within one hour and operated without the need of a deep understanding of the underlying cloud computing technology. One of the crucial features is easy creation of clusters of virtual machines equipped with a preconfigured batch system. This way the intensive calculations can be performed on demand without the need of time-consuming configuration of clusters. When finished, the resources can be released and made accessible to other users.

The stable system was put into operation at the beginning of 2012 and was extensively used for calculations by various research teams, in particular by HEP groups. The CC1 software is distributed under the Apache License 2.0. The web site of the project is located at <http://cc1.ifj.edu.pl>.

**Primary author:** WITEK, Mariusz (Polish Academy of Sciences (PL))

**Co-authors:** ZABINSKI, Bartlomiej Henryk (Polish Academy of Sciences (PL)); CHWASTOWSKI, Janusz (Polish Academy of Sciences (PL)); DANIELOWSKI, Krzysztof (Institute of Nuclear Physics PAN, Krakow, Poland); NABOZNY, Maciej (Institute of Nuclear Physics PAN, Krakow, Poland); ZDYBAL, Milosz (Institute of Nuclear Physics PAN, Krakow, Poland); GITULLAR, Oleksandr (Institute of Nuclear Physics PAN, Krakow, Poland); WOJCIK, Piotr (Institute of Nuclear Physics PAN, Krakow, Poland); GRZYMKOWSKI, Rafal Zbigniew (P); SOSNICKI, Tomasz (Institute of Nuclear Physics PAN, Krakow, Poland); WOJTON, Tomasz (Institute of Nuclear Physics PAN, Krakow, Poland); SOBOCINSKA, Zofia (Institute of Nuclear Physics PAN, Krakow, Poland)

**Presenter:** GRZYMKOWSKI, Rafal Zbigniew (P)

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