CERN ICT Technologies

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Software

- Open Source
  - INDICO
  - INVENIO
  - KiCad
  - ROOT
  - GEANT4
  - CRISTAL
  - CernVM-FS
- Other
  - FLUKA
  - C2MON
  - RadSHIP

INDICO

Description:

Collaboration tool, event organization, archival, etc. Web-based, multi-platform, conference lifecycle and agenda management system. Integration with videoconf services.

Web site:

http://indico.github.io/ (see video clip https://cernbox.cern.ch/public.php?service=files&t=6276a6470db5f79c2fa30867e3b1281e&download)

http://indico-software.org

Strong points:

- Web-based, fully flexible platform
- Suitable for entire event lifecycle, from pre- to post- conference management
- Multi-platform compatibility (Windows, Mac, Linux)
- Flexible plugins system to integrate the software seamlessly to the corporate/institutional environment

Applications:

- Event Management; full life-cycle
- Corporate and institutional event data management and archiving
- Professional collaboration hub

IP status: GPL v.3

Examples: Over 200 installations that we know worldwide. One company providing support services

INVENIO

Description:

Integrated digital library and repository system. Software suite for building and managing an autonomous digital library systems.

Web site:

http://invenio-software.org/

Strong points:

- Navigable collection tree. Docs organized in collections
- Powerful search engine. Combined metadata, fulltext & citation search
- Flexible metadata – Std format (MARC)
  - Handling articles, books, theses, photos, videos, museum objects and more

Applications:

- Digital library server
- Institutional document repository
- Multimedia document archive
- Administrative document management

Limitations:

- Complexity
- Large document repositories (>10K recodes)

IP status: GPL v.2

Examples: Very wide use in the scientific world. TIND – CERN spinoff. Support services: https://tind.io/ Cloud service too.

BlogForEver project.

KiCad

Description:

OS Electronic Design Automation tool for the creation of professional schematics and printed circuit boards up to 32 copper layers with additional technical layers. KiCad runs on Windows, Linux and Apple OS X and is released under open-source licence. KiCad is a mature EDA software tool under continuous development.

Web site:

http://www.kicad-pcb.org

Strong points:

- dynamic and growing user community contributing regularly
- Rich set of open-source libraries including 3D Models
- Three step approach in PCB design via independent interconnected modules.
- All KiCad files are in ASCII. Facilitates manual manipulation and scripting. No vendor lock in.
- Extensive documentation

Applications:

- PCB design
- Educational tool to teach electronics

Limitations:

- Stable version not out yet but very soon (Sept-Oct 15)
- Under continuous development

IP status: GPL v.2

Examples: Opportunities in PCB design combined with the Open hardware repository where open designs can be found.

Support service

ROOT

Description:

General purpose framework to analyse very large amounts of data in a extremely efficient way. Data is defined as objects. Direct access to attributes of data objects. Very powerful visualization tools including histograms in any number of dimensions, curve fitting, parallel coordinates etc. Easy to set up an analysis system that can query data interactively or in batch mode.

Web site:

https://root.cern.ch

Strong points:

- query databases in parallel on clusters of workstations or many-core machines
- Very fast response. Can handle very large amounts of data
- Many external libraries available. Open system easily extendable

Applications:

- Data Analysis in various fields. Examples are: Scientific, Finance, Medicine, etc

Limitations:

- Complexity

IP status: LGPL

Examples:

ROOT is being used in may industries, from auto crash testing, insurance fraud detection, financial analysis (hedge fund) etc. Any big data application.

Offer data analytics services to a specific industry sector.

GEANT4

Description:

Geant4 is a toolkit for simulating the passage of particles through matter. Geant4 covers all relevant physics processes, electromagnetic, hadronic, decay, optical, for long and short lived particles, for energy range spanning from tens of eV to TeV scale. The transport of low energy neutrons down to thermal energies can also be handled. Monte Carlo simulation software.

Web site: https://cern.ch/geant4

Strong points:

- query databases in parallel on clusters of workstations or many-core machines
- Very fast response. Can handle very large amounts of data
- Many external libraries available. Open system easily extendable
- Fully OO, Runs on Linux, Mac, Windows (32/64) and parallel architectures.

Applications:

- Radiotherapy
- Assessment of radiation damage to the electronics. Cosmic rays
- Dosimetry, Biological damage studies
- Radiation shielding

Limitations:

- Complexity

IP status: OS based on the EGEE licence (permissive)

Examples: Tomographic emission (GATE), DNA damage assessment (G4DNA), Radiation treatment (G4NAMU)

CRISTAL

Description:

CRISTAL is a distributed data management, description-driven system to manage data and process information for business process life cycle management. It provides a radically new strategy to implement new or to adapt existing business process systems in real time. Based on a meta-data approach, CRISTAL enables the tracking of product and process evolution in distributed environments all over the product life cycle. Business systems in many application domains can be defined, configured and instantiated to support the complete process lifecycle suitable for any evolving business process execution.

Web site: https://proj-cristal.web.cern.ch/proj-cristal/

Strong points:

- CRISTAL is a description-driven system, which means that the data structures and workflow-driven behaviour of the business objects in the system can be reconfigured at any time
- building a system that could change and evolve over time, and still be in place ten years later
- Dynamic and real time business process configuration during process execution. Can track systems that change and evolve over time, and still be in place many years later
- Tracking of multiple product and process systems in one business system.
- Compliant with highly distributed IT landscapes.
- Scalable to large and complex production systems

Applications:

- Business process management and business application monitoring

IP status: LGPL

Examples: Existing licence to Technoledge (Personnel, order management, CRM, ERP, BPM). Licensed to M1i, similar applications

CernVM-FS

Description:

It is a web-based, global, and versioning file system optimized for software distribution. The file system content is installed on a central web server from where it can be mirrored and cached by other web servers and web proxies. File system clients download data and meta-data on demand and cache them locally. Data integrity and authenticity is ensured by cryptographic hashes and digital signatures. CernVM-FS is used, among others, by the LHC experiments for the distribution of 100 million files and directories of LHC experiment software onto tens of thousands of nodes distributed worldwide

Web site: http://cernvm.cern.ch

Strong points:

- Various Linux distributions (x86, AMD64, ARM) & Mac OS X (client) supported
- Global-scale open source file system optimized for software distribution.
- Data transport via standard HTTP protocol.
- Data integrity secured by cryptographic hashes and digital signatures.
- File system level versioning.
- Transparent data compression/decompression and file chunking.
- Capability to hot patch the file system client.
- Capability to work in offline mode providing that all required files are cached.

Applications:

- Large-scale distributed computing, big data processing. Volunteer computing services for companies, monetization of sleeping resources etc

IP status: Not yet defined but OS licence

Examples:

V early stage. Volunteer computing projects. Security application etc

FLUKA

Description:

FLUKA (Fluctuating Cascade) is a general purpose tool for calculations of particle transport and interactions with matter.

FLUKA is a MonteCarlo simulation software that can simulate with high accuracy the interaction and propagation in matter of about 60 different articles, from 1 keV to thousands of TeV, neutrinos, muons of any energy, hadrons of energies up to 20 TeV and all the corresponding antiparticles.

FLUKA can handle even very complex geometries. It has been designed to track correctly also charged particles (even in the presence of magnetic or electric fields). It is also possible to describe a complex geometry in terms of "voxels" (tiny parallelepipeds forming a 3-dimensional space) especially useful when translating a CT scan of a human body into a dosimetry phantom.

Web site: http://www.fluka.org

Strong points:

- Sound and modern physical models. high level of reliability. Predictability where no experimental data are directly available
- A friendly user interface is available, as well as a 3D visualisation too
- Continuous development & improvement of models. User support is provided through the web site and a dedicated mailing list
- Courses for beginners and for advanced users are regularly organised

Limitations: Linux only but can be used on Mac & Windows via a VM

Applications:

- Proton and electron accelerator shielding to target design, calorimetry, activation, dosimetry, detector design, Accelerator Driven Systems, cosmic rays, neutrino physics, radiotherapy etc

IP status: CERN & INFN proprietary licence

Examples:

Particle therapy treatment plans, design of medical (particle therapy) hw, shielding applications, nuclear industry simulation consultancy services, etc.

C2MON

Description:

C2Mon is the CERN Control and Monitoring Platform, a SCADA system used to monitor complex CERN infrastructure, such as HVAC, Access, Safety etc, developed by GS/ASE. It is based on more than 10 years of experience with the previous Technical Infrastructure Monitoring systems at CERN. It is a Java application which handles a very large number of alarms in an intelligent way via a sophisticated filtering mechanism in order to provide meaningful dashboards and alarms to human operators so that they can take appropriate action.

Web site: http://c2mon.web.cern.ch

Strong points:

- Sophisticated filtering & alarm mechanism resulting from years of CERN experience
- Many different dashboards providing sophisticated monitoring capabilities(>200 synoptic views)
- Easy to integrate additional systems that need to be monitored and create new monitoring views
- Full Java application using Oracle as a repository but can use HSQL or MySQL

Applications:

- Any large and complex control & monitoring environment. From factory to healthcare

IP status: Not yet defined. We are working on this. Early stage.

Examples:

Health care example.

RADSHIP

Description:

RADShip is a comprehensive software package that efficiently manages all aspects of shipping radioactive materials, except for the calculations for classifying the material. It fulfils, and in many areas exceeds, the IAEA Specific Safety Requirements SSR-6 [3] that states that “a management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of the Regulations, as identified in paragraph 106, to ensure compliance with the relevant provisions of these Regulations {…}”.

Web site:

Strong points:

- Web application uses a local database back-end that ensures full data security and control.
- Automatic mechanism simplifies tasks, prevents errors and enhances users’ experience.
- Locking mechanism minimizes errors and fully meets regulatory requirements.
- Quality assurance and tracking system. All transactions and interactions with the application are time and name stamped.
- Automatic generation of regulatory shipping documents minimizes errors and improves efficiency.
- The application is easy to customize and adapt to most software environments.

Applications:

- Radiation protection
- Management of transport of dangerous goods

IP status: CERN proprietary licence

Examples:

Radioactive material shipping agency (healthcare, academic , national authorities). Possibility to extend it to chemical risks too.

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Questions ?