CERN COMPUTER NEWSLETTER

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Contents

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CINBAD keeps an eye on the CERN network

The CINBAD (CERN Investigation of Network Behaviour and Anomaly Detection) project was launched in 2007 as a collaboration between CERN openlab, IT-CS and HP ProCurve Networking. The project's aim is to understand the behaviour of large computer networks in the context of high-performance computing and campus installations such as those at CERN. The goals are to detect traffic anomalies in such systems, perform trend analysis, automatically take counter measures and provide post-mortem analysis facilities.

CERN's network

CERN's campus network has more than 50 000 active user devices interconnected by 10 000 km of cables and fibres, with more than 2500 switches and routers. The potential 4.8 Tbps throughput within the network core and 140 Gbps connectivity to external networks offers countless possibilities to different network applications. The bandwidth of modern networks is growing much faster than the performance of the latest processors. This fact combined with the CERN specific configuration and topology makes network behaviour analysis a very challenging and daunting task.

CINBAD in a nutshell

The CINBAD project addresses many aspects associated with the CERN network. First, it provides facilities for a better understanding and improved maintenance of the CERN network infrastructure. This includes analysing various network statistics and trends, traffic flows and protocol distributions. Other factors that might have an impact on the current network status or influence its evolution are also studied, such as connectivity, bottleneck and performance issues.

When we have learnt and understood the network behaviour, CINBAD can help to identify various abnormalities and determine their causes. Because there are many factors that can be used to describe the network status, anomaly definition is also very domain specific and includes network infrastructure misuse, violation of a local network security policy and device misconfiguration. In addition, the expected network behaviour never remains static because it can vary with the time of day, the number of users connected and network services deployed. As a consequence, anomalies are not easy to detect.

Network sniffing

To acquire knowledge about the network status and behaviour, CINBAD collects and analyses data from numerous sources. Alarms from different network monitoring systems, logs from network services like Domain Name System (DNS), Dynamic Host Configuration Protocol (DHCP), user feedback, etc – all of these constitute a solid base of information. A naive approach might be to look at all of the packets flying over the CERN network. However, if we did this we would need to analyse even more data than the LHC could generate. The LHC data are only a subset of the total data crossing via these links.

CINBAD overcomes this issue by applying statistical analysis and using sFlow, a technology for monitoring high-speed switched networks that provides randomly sampled packets from the network traffic. The information that we collect is based on the traffic from around 1000 switches and routers and gives a representative sample of the CERN network traffic with more than 3 Terabytes of data per month. The multistage collection system was designed and implemented in consultation with experts from the LHC experiments and Oracle, to benefit from their data-analysis and storage experience. The system has now been up and running for more than a year (figure 1).

Network operation enhancements

The field of network monitoring and planning can greatly benefit from the CINBAD activities. We provide tools and data that simplify the operation and problem-diagnosing process. In addition, our statistics help in understanding the network evolution and design.

Editorial

A very basic piece of information that is of interest for network operations is knowledge about the host's activity. CINBAD is able to provide detailed statistics about the traffic sent and received by a given host, it facilitates inference about the nature of the traffic on a given outlet/port and can thus identify the connected machine. This information could also be used to diagnose routing problems by looking at all of the packets outbound or inbound to a particular host.

CINBAD is also able to provide information about the traffic at CERN. The sampled data collected by the project are sufficient to obtain the switching/routing/transport protocol information as well as gaining information about the application data. This provides valuable input for an understanding of the current network behaviour. Here the CINBAD team uses descriptive statistics. The potential set of metrics that we can provide to characterize the traffic at CERN is very extensive and specific needs are currently being discussed. For example, we can enumerate protocol-type distributions, packet size distributions, etc. Depending on the requirements, these statistics can be tailored even further.

Top n-list is another form of network summary that might be of interest. Such lists would allow the identification of the most popular application servers, either inside or outside CERN. Although this information might be available on each individual CERN server, CINBAD provides the possibility to collect these statistics for all servers of a given type, whether or not they are centrally managed by the IT Department. This information may be of value to both network engineers and application-server administrators.

These statistics can also be useful for network design and provisioning. The CINBAD project can provide valuable information about the nature of the traffic on the links. These statistics can also be used to detect the trunks with potential bottlenecks. This information can be compared with the service-level agreements that specify the conditions for link usage, enabling appropriate corrective actions to be taken.

With all of these improvements, CINBAD offers a comprehensive system to facilitate day-to-day operations, diagnose network problems and extend our understanding of network evolution and design. The CINBAD team is currently working in close collaboration with IT-CS on a visualization model of this information that is suitable for network operation and troubleshooting.

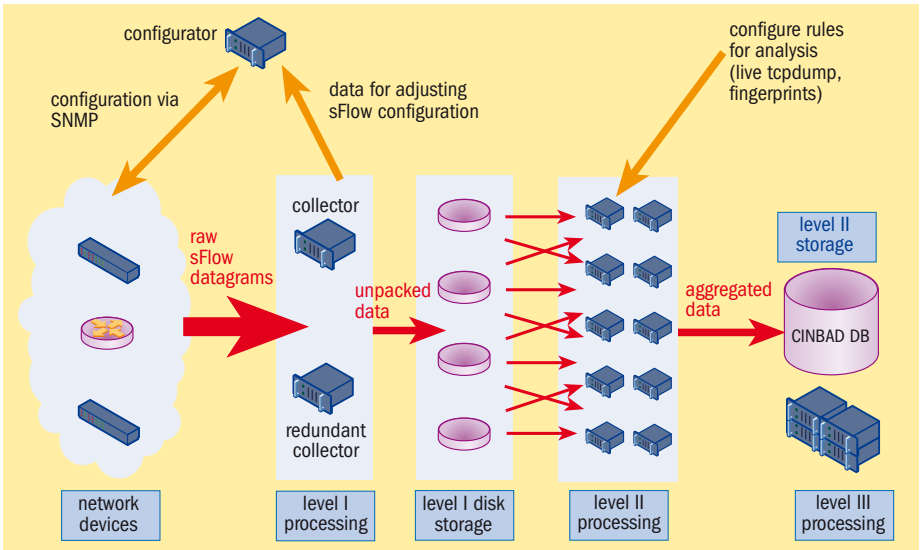


Fig. 1. The CINBAD sFlow data collector receives and processes the CERN network traffic.

Security enhancements

Security is another area that benefits from the CINBAD project. The only safe computer is a dead computer, or at least one disconnected from the network (if no-one can get to it, no-one can harm it). Nowadays, we cannot avoid communicating with others and therefore we expose our machine to outside threats. Although CERN centrally managed desktops have up-to-date anti-virus software and firewalls, this does not guarantee that our machines and data are shielded from attacks. These tools are usually designed to detect known patterns (signatures) and there are also other machines (unmanaged desktops, PDAs, etc) connected to the CERN network that might be less protected.

Currently, detailed analysis is only performed at critical points on the network (firewall and gates between network domains). The CINBAD team has been investigating various data-analysis approaches that could overcome this limitation. These studies can be categorized into two main domains: statistical and signature-based analysis. The former depends on detecting deviations from normal network behaviour while the latter uses existing problem signatures and matches them against the current state of the network.

The signature-based approach has numerous practical applications, for example SNORT (an open-source intrusion-detection system). The CINBAD team has successfully ported SNORT and adapted various rules to work with sampled data. It seems to perform well and provides a low false-positive rate. However, the system is blind and can yield false negatives in cases of unknown anomalies.

This problem can be addressed by the statistical approach. Expected network activity can be established by specifying the allowed patterns in certain parts of the network. While this method works well for a DNS or web server that can only be contacted on a given protocol port number, for more general purposes this approach would not scale.

A second approach is to build various network profiles by learning from the past. The selection of robust metrics that are resistant to data randomness plays an important role in characterizing the expected network behaviour. Once these normal profiles are well established, the statistical approach can detect new and unknown anomalies.

The CINBAD project combines the statistical approach with the signature-based analysis to benefit from the synergy of the two techniques. While the latter provides the detection system with a fast and reliable detection rate, the former is used to detect the unknown anomalies and to produce new signatures. The CINBAD team constantly monitors both the campus and internet traffic using this method. This has already led to the identification of various anomalies, e.g. DNS abuse, p2p applications, rogue DHCP servers, worms, trojans, unauthorized wireless base stations, etc. Some of these findings have resulted in refinements to current security policies.

The future

The CINBAD project offers many opportunities to improve CERN's network operation, and it also provides a unique opportunity for the CERN Computer Security Team to identify (and protect against) incidents that might not be seen otherwise. It also enables other groups concerned with varying network applications, such as web services and mail servers, to understand their behaviour.

Useful links

The CINBAD project: http://cern.ch/openlab-cinbad
CERN openlab: http://cern.ch/openlab

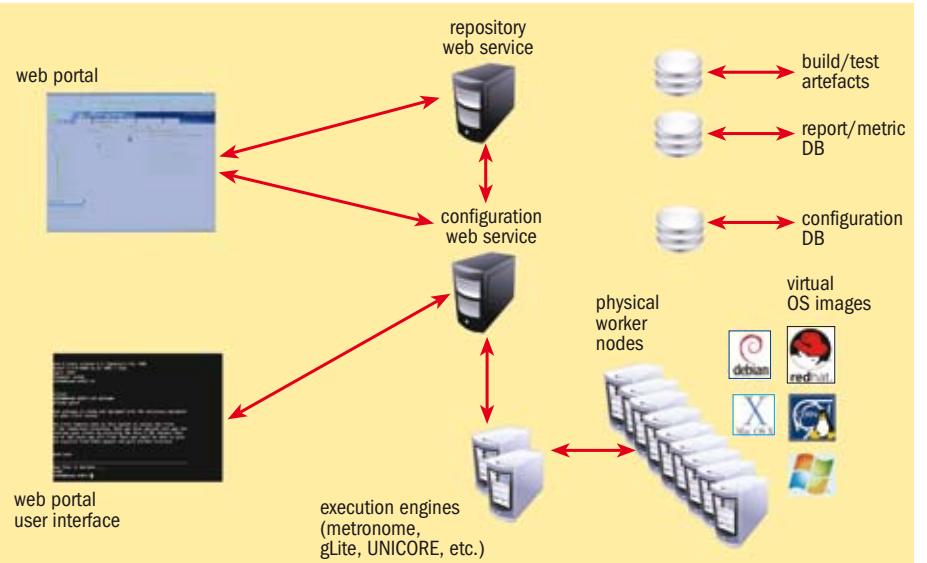
Milosz Hulbój and Ryszard Jurga, IT-CS (CERN openlab)

ETICS 2 offers guidance to software professionals

Software professionals have been known to describe the task of building, configuring and integrating new software in as little as two words: "nightmare activity".

However, with E-infrastructure for Testing, Integration and Configuration of Software Phase 2 – or ETICS 2 – they have an all-in-one solution that helps to configure and build software, and at the same time check its quality. As the result of three years of project activities, this system provides tools and resources to build and test runs, thereby simplifying complex and often repetitive activities.

"By automating many day-to-day tasks, ETICS 2 supports software professionals to obtain higher-quality software, a shorter time to market, a lower risk on schedule and reduced project costs," said Alberto Di Meglio, ETICS 2 project manager at CERN.



The ETICS 2 project is run according to the guidelines laid down in the Consortium and European Commission Grant Agreement. Image courtesy of ETICS 2.

ETICS 2 advantages

The ETICS 2 system exploits Grid software and distributed computing infrastructures. It is highly customizable, multi-platform and independent from any build or test tool. Project data and results from daily, nightly and continuous builds and tests can be viewed and edited through a rich web application.

The system's Automated-Quality Certification Model, known as A-QCM, provides a way to automatically evaluate and certify aspects such as functionality, reliability, maintainability and portability of any kind of software, while following current ISO software-quality guidelines.

Continuous refinements have been a hallmark of ETICS 2, thanks to collaboration with its users, which include organizations such as EGEE and D4Science. The ETICS 2 team is now working together with members of EGI, such as UNICORE, ARC and gLite, to enhance ETICS interoperability testing features. ETICS 2 is also developing a new functionality to design and run complex tests over distributed networks, a feature that is rare to find even in high-end commercial test management applications.

The ETICS 2 system user community now includes 35 projects that are using or evaluating its services.

"A-QCM trial certifications are now starting and whoever is interested in issuing their software with one can contact our support team at etics-support@cern.ch," said Jorgen Boegh, a senior consultant from Engineering Ingegneria Informatica S.p.A., responsible for the quality-certification model.

On 21–23 October, ETICS 2 testing and quality-verification features will be shown at the Q&ATEST conference in Bilbao, Spain, during a hands-on tutorial session.

Meanwhile, users can download the software from the ETICS 2 website.

Useful links

ETICS 2 website: http://cern.ch/etics
Q&ATEST conference: www.qatest.org/

Isabel Matranga, Engineering Ingegneria Informatica S.p.A., ETICS 2

• This article was published online in iSGTW on 27 May (www.isgtw.org/?pid=1001819).

The deadline for submissions to the next issue of CNL is

16 October

Please e-mail your contributions to cnl.editor@cern.ch

CERN welcomes 13 Intel ISEF pre-college winners

At the end of June, CERN hosted the visit of 13 pre-college students who won "Best of Category" awards at the Intel International Science and Engineering Fair this spring in Reno, US. The young students spent four days at CERN, visiting the Large Hadron Collider (LHC) facility and enjoying a range of presentations.

The Intel International Science and Engineering Fair (Intel ISEF) is the world's largest international pre-college science competition and annually provides a forum for more than 1500 high-school students from more than 50 countries to showcase their independent research. The Intel ISEF organizer – Society for Science and the Public – partners with Intel, along with dozens of other corporate, academic, government and science-focused sponsors. The partners provide support and awards each year. The Intel ISEF encourages students to tackle challenging scientific questions, using authentic research practices. In fact, despite their young age, the 13 students were already well acquainted with science.

The students won Best of Category awards in fields as diverse as cellular and molecular biology, computer science, Earth and planetary science, electrical and mechanical engineering, environmental management, microbiology, medicine and health, and materials and bioengineering. In physics and astronomy, Nilesh Tripuraneni did research on "a relativistic generalization of the Navier-Stokes equations to quark-gluon plasmas".

The 13 students in the CMS cavern with Jim Virdee and Wolfgang von Rüden during their visit. Image courtesy of Michael Hoch.

Thomas H Osburg, director of Europe corporate affairs for Intel Corporation, was present at CERN to meet the students and to discuss education activities. He stated that: "Supporting tomorrow's innovators is a priority for both Intel and CERN, and I am glad that this co-operation complements what we do jointly in research and technology."

Prior to their visit, the students already had contact with CERN through Jim Virdee, CMS experiment spokesperson, who attended the Intel ISEF in Reno this year and gave the keynote speech at its Grand Opening Ceremony. Wolfgang von Rüden, head of CERN openlab, who accompanied the students during their stay at CERN, explained: "When Craig Barrett visited CERN in January we talked about ISEF. I proposed a visit to CERN as an additional prize to some of the best students, which Craig immediately accepted. We were very impressed by the highly competent students and their interaction with us. We enjoyed the visit as much as they did."

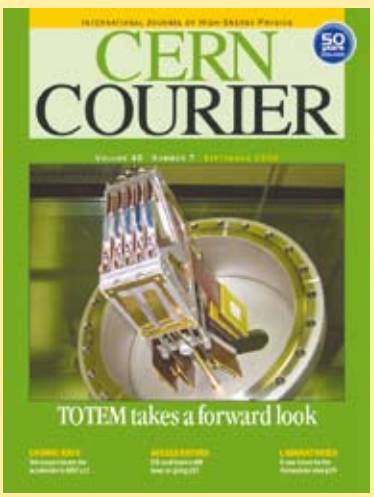
Since the start of CERN openlab in January 2003, Intel and CERN have not only been collaborating on scientific projects but also on educational activities. Every year, young IT students participate in the CERN openlab Summer Student Programme to work on the joint projects and attend lectures given by CERN experts and openlab partners. Workshops on advanced topics are also jointly organized to disseminate the knowledge created through these projects.

Useful links

Visit programme: http://indico.cern.ch/conferenceDisplay.py?confId=62155
CERN openlab news: http://cern.ch/openlab-news
More information about the winners and the organization: www.intel.com/education/ISEF/ and www.societyforscience.org/ISEF/

Mélissa Le Jeune, IT-DI (CERN openlab)

Look out for the September issue of CERN Courier, featuring the story of the Gargamelle experiment.



Computer team advises reviewing your security now and frequently

The start-up of the LHC is foreseen to take place in the autumn and CERN will be in the public spotlight again. This increases the necessity to be vigilant with respect to computer security and the defacement of an experiment's webpage last September shows that we should be particularly attentive. Attackers are permanently probing CERN and so we must all do the maximum to reduce future risks.

Security is a hierarchical responsibility and requires us to balance the allocation of resources between making systems work and making them secure. All of us, whether users, developers, system experts, administrators or managers, are responsible for securing our computing assets. These include computers, software applications, documents, accounts and passwords. There is no "silver bullet" for securing systems, it can only be achieved by a painstaking search for all possible vulnerabilities followed by their mitigation. Additional advice on particular topics can be obtained from the relevant IT groups or members of the security team, but here we include a basic list of items to be considered by all CERN computer users.

- Review access rights to your computers and documents (InDiCo, EDMS, TWiki, etc), as well as files and directories on AFS, DFS and local disks. Don't give write access if read access is sufficient and limit access only to those who need it.
- Protect websites. Very few should be publicly accessible and those that are should not reveal details of system architecture and design, computer configurations or source code.
- Ensure that accounts have been closed for individuals who have left.
- Reduce the number of service accounts where possible.
- Harden computers by removing unnecessary applications, disable unneeded services such as for web, FTP, etc, use automated update and patching services as well as up-to-date anti-virus software for PCs (but also for embedded devices like oscilloscopes), upgrade Scientific Linux CERN from SLC3 to SLC5, use local firewalls to block both incoming and outgoing traffic that is not expected.
- Protect private SSH keys.
- For experiment networks, review central firewall openings and whether devices need to be trusted or exposed.

Further information about how to improve computer security can be found on the internet at http://cern.ch/security/ and www.isseg.eu. These websites include material on risk analysis, training and recommendations for general users, developers and system administrators. As well as the many security awareness presentations that are available, training courses can also be found on writing secure code and secure web applications (see http://cern.ch/security/training).

CERN Computer Security Team, e-mail computer.security@cern.ch

EGEE-III project is on track for EGI transition

In late June, as part of the first EGEE-III review, an EC-appointed review panel listened to two days of presentations about the state and direction of the project and followed the live demonstrations of applications and software developments.

The large scale of the infrastructure, the scope of the engagement with a diverse user community and a successful comprehensive training programme were commended by the review panel. The progress made on interoperability, the adoption of OGF standards in production grids, IPv6 support and the better balance between middleware development, testing and deployment were also noted.

The panel commended the project for planning in advance for the transition to the European Grid Initiative (EGI). All of the suggested changes to the Description of Work for transitioning to EGI during the next year – as well as the deliverables and milestones – were approved.

While the full details of how EGI will come in are still being finalized, this endorsement gives the project added confidence that it is headed in the right direction to meet its goals. The most important of which is to work with the projects coming after EGEE to ensure that there is a smooth, continued support of the infrastructure into EGI. The project is rated as having made "good to excellent progress" (the top rating available) and 19 recommendations were made, which will be the subject of a dedicated face-to-face meeting of the activity managers in early September.

An important checkpoint in preparing for EGI will be the EGEE'09 conference in Barcelona on 21–25 September. Many of the activities will be using the meeting to report on their progress in implementing the changes needed for the transition to EGI and planning the activity for the final six months of the project. The community will also be elaborating details of the EC projects that will be submitted to continue the work started within EGEE.

After this event we will have a clearer picture of which NGIs will be contributing to the infrastructure and who will be providing the critical EGI services. The Specialized Support Centres will have established their links with their European-wide community stakeholders and the support they will be obtaining from interested NGIs. The middleware consortia will also be able to present their view as to how European middleware will evolve in the EGI era.

Useful links

EGEE-III first review: http://indico.cern.ch/conferenceDisplay.py?confId=53198
EGI: http://web.eu-egi.eu/

Danielle Venton, IT-EGE

If you want to be informed by e-mail when a new CNL is available, subscribe to the mailing list cern-cnl-info. You can do this from the CERN CNL website at http://cern.ch/cnl.

Scientists demonstrate the role of CMS in computing Grid

The LHC@FNAL Remote Operations Centre at Fermilab is located on the first floor of Wilson Hall. Image courtesy of Fermilab.

Last autumn's unplanned shutdown of the Large Hadron Collider (LHC) was a disappointment for physicists around the world. But for organizers of the computing Grid supporting the collider's detectors, it was an opportunity to keep working hard. For the first two weeks of June, instead of flooding the Grid with data from actual particle collisions, experiment collaborators at CERN and remote computing sites in Europe, Asia, and North America joined up to test the ability of the collider's Worldwide LHC Computing Grid (WLCG) to record, transfer and analyse simulated data in a step-by-step "production demonstration".

Scientists conducted a series of challenges, collectively called the Scale Test of the Experimental Program 2009 (STEP09). All four LHC experiments participated in the test. For example, at the CMS experiment, they first tested the archiving of older recorded data from CERN to CMS' seven Tier 1 computing sites. There, scientists checked the Tier 1 central processing power as they shuttled data to Tier 2 sites. Finally, they challenged the full physics analysis capacity of the Tier 2 sites. On 15 June, as the curtains closed on STEP09, Oliver Gutsche, a Fermilab physicist who was one of those participating in the effort for the CMS experiment, declared the overall performance "very good".

While the CMS portion of this Grid – like the rest of the WLCG – was ready to take data last September, says Gutsche, the test "gave us an opportunity to test parts that could not be tested on the previous schedule". It also showed how the system will function under simultaneous demands from the LHC's three other detectors.

A primary STEP09 goal was testing the tape systems at CERN and Tier 1 computing centres. When the LHC is operating, computers at CERN will need to record – "write to tape" – at least 15 Petabytes of data per year. Thanks to this run-through, Gutsche said: "We are confident that CERN could write to tape at the speeds needed", when data from collisions begin pouring in.

Another key goal was gauging the analysis capabilities of Tier 2 computing centres. CMS aimed to employ 50% of the Grid's analytical power and while only an ongoing study can prove that it succeeded, Gutsche says that the prognosis looks good. During STEP09's 13-day run, Tier 2 centres performed more than 900 000 analysis jobs. However, the test revealed that there is room for improvement.

Making a good thing better

Operators at CERN and the remote computing sites were forced to work long hours, particularly in the pre-staging process. But their efforts revealed principles that will ease the future automation of these procedures. "Sites are happy because we stressed them and they learned how to run more efficiently," said Gutsche. "Now they have ideas for what they can improve."

Echoing this observation was Ian Fisk, a CMS collaborator at Fermilab. "We wanted to show that we could run on 'non-hero-mode'," he said. "We want to finish a test saying, 'That was easy. We could run for a year at that level.'"

Jamie Shiers of CERN, who organized the computing tests, including STEP09, said: "Many of the Tier 1s, and the Tier 0, sustained a load that was artificially high – certainly higher than early data taking – with generally smooth and sustainable operations. But a few sites did not and this has triggered us to undertake a perhaps overdue analysis of the root causes with a clear desire to fix and retest. We saw significant progress since a year ago."

Shiers added: "For Tier 2s, the results were more variable: Monte Carlo production is clearly a largely solved problem. As for analysis, some sites – even very large ones – did extremely well, while others did not. Once again, we need to understand the root causes and fix them. In some cases, this may be hard: there has been a feeling for quite some time that the external network bandwidth for at least some sites is not large enough and that the internal bandwidth all the way to the data is also too small. Most likely they will need major configuration changes."

Starting in July, CMS scientists have been using the Grid to analyse cosmic ray data, which stream into the detector even when the accelerator is off. When the LHC turns on – in November, says CERN's director-general – the real challenge will begin.

Useful links

WLCG: http://cern.ch/LCG/
CMS FNAL Remote Operations Centre: www.uscms.org/roc

Rachel Carr, Fermilab, for iSGTW

- This article was published online in iSGTW on 8 July.

Indico's new face goes live

Indico has become a ubiquitous application at CERN, hosting (at the time of writing) almost 80 000 events and more than 300 000 contributions. It is a precious tool that allows users to benefit from a common platform that goes beyond a simple agenda system, and encompasses a complete event lifecycle-management tool.

In spite of its uniqueness and rich feature set, Indico has not escaped the effects of time: it was conceived at the beginning of this decade, based on the web technology available at the time, and was not really focused on user-friendliness or intuitiveness. In 2007, at the peak of the social web revolution, the differences between state-of-the-art web applications and the likes of Indico became evident. Criticisms centred on the complexity of the tool and the excessive number of mouse clicks required to perform any operation. In addition, the overall look and feel of the application was a little dated.

To address these problems, a series of studies was conducted. In the first phase, Indico was evaluated against the usability guidelines and best practices; and in the second phase, user feedback was carefully analysed, so that particular cases could be identified and user expectations addressed.

New Indico is now online

We are proud to announce that the new Indico is ready for use, albeit in beta form, at http://indicobeta.cern.ch. As with any new interface, users will need to familiarize themselves with it. However, we feel that people will find this investment worthwhile. Most should find it intuitive and simple because we have reused existing concepts and practices that have become de facto standards on the web.

Internationalization

Nowadays, internationalization is an essential feature for all web applications. With a large community of non-English-speaking users, the availability of different languages is a request that needs to be filled. The new Indico interface offers internationalization and a French translation is already available (other languages will follow). The tools that are being used allow other people to contribute and to easily translate the interface to any conceivable language. This important improvement will meet the demands of several educational institutions around the world. Figure 1 demonstrates that it is easy to switch languages in Indico and shows the final result after switching to French.

Fig. 1. A French translation of Indico is already available and other languages will follow.

Fig. 2. The event-creation form.

Fig. 5. The grey box at the bottom can be clicked to display the full list of events.

Simplified event creation

With the old Indico interface, a user would need to browse to the correct category and select the kind of event before creating an event. Now things are much easier. The "Create event" option is available everywhere, and the creation form (figure 2) is much simpler. It is a two-step process that involves choosing a target category and filling in some basic information about the event (an option to toggle to some "advanced" parameters is also available). The target category can be selected using an interactive category-browsing widget but if the operation is performed within a specific category, then this will be taken as default.

Inline editing

Lots of modern web applications make use of a technique called "inline editing", which allows the user to change information directly without having to switch to a modification view/form. We decided to give it a try with Indico and the results have so far been very positive. Inline editing is currently available from the "General settings" page (figure 3). For now, users can still use the old style to edit event data, but this will be discontinued if feedback remains positive.

Fig. 3. Inline editing, in editing mode.

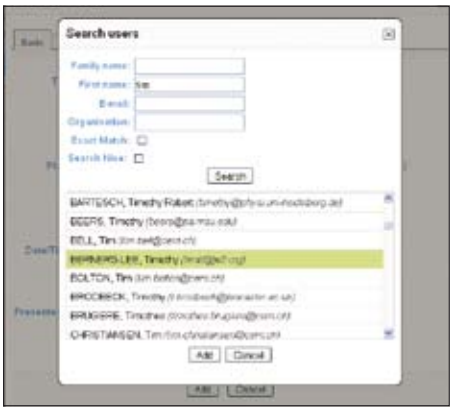


Fig. 4. The new user search dialog.

Pop-up dialog boxes

One of the cornerstones of the new Indico interface is the idea that simple operations should not require a lot of page transitions. To achieve this goal, we have replaced some of the "auxiliary" forms with pop-up dialog boxes, reducing page transitions. Various operations such as "adding minutes", "uploading files" and "searching for users" (figure 4) have been greatly simplified by this new approach.

Shorter event list

The list of events inside a category can be quite long, for example in the case of long-standing periodic meetings. To make it easier and faster for the user, we have

Fig. 6. Category search suggestion box.

limited the number of events displayed to only the current month, and if there is space, its neighbours (figure 5). If other events are required, simply click on "Show them" and the display will be updated.

Improved category search

Searching for a particular event or category used to be a tedious task. Searching for a category was not possible and meant that the user had to browse through the categories to reach the required target. To solve this issue, we have introduced an "auto-suggest" feature in the search box (figure 6), which suggests category names matching the text input so far. Both the mouse and the arrow keys can be used to select the desired category.

New graphical conference timetable

The brand new timetable display interface is a groundbreaking feature (figure 7). It was completely rewritten from scratch, with flexibility and user-friendliness in mind. It now allows the user to browse the sessions and contributions in a graphical way that can be filtered by session and room. All of the information and functionality that was available in the old interface remains accessible, but in a simpler, more intuitive way. In management mode, the timetable view has been improved as well, and research is currently in progress to make drag and drop possible.

Customizable conference portals

Over the years, we have often been asked for more layout flexibility. In particular, many conference organizers did not want to use the default Indico layout. They would choose to create a "general site" for the conference and then link to the Indico page. From our perspective this was a great loss for both parties. It was possible for event managers to create custom pages with Indico before, but this feature was rarely used. We believe that by providing an additional level of customization, the new Indico conference site will better meet user's expectations. Indico now allows the conference organizers to upload their own Cascading Style Sheet files, making it possible to customize the look and feel of the pages. Some default templates are also available (figure 8).

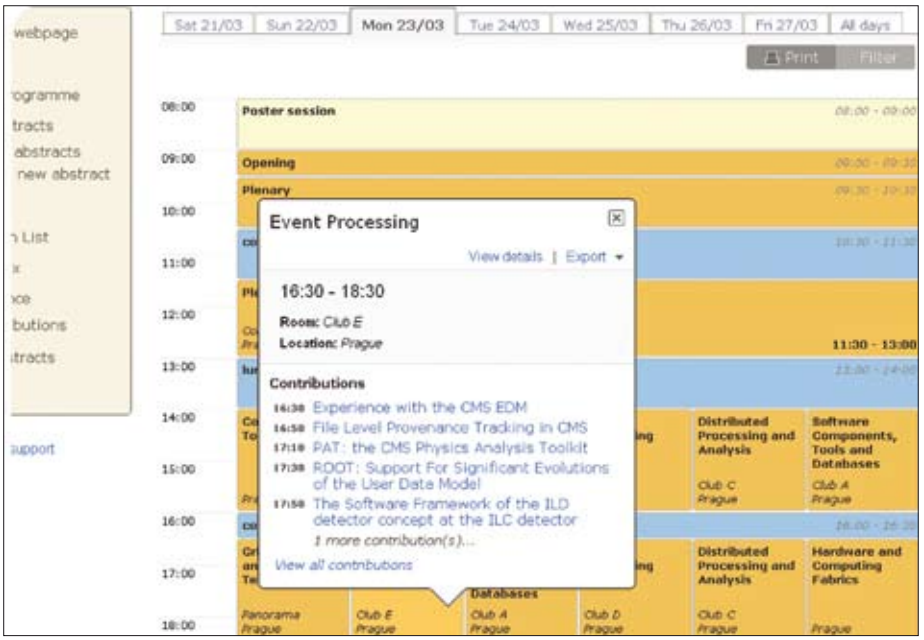


Fig. 7. The new timetable display interface. The pop-up contains extra information.

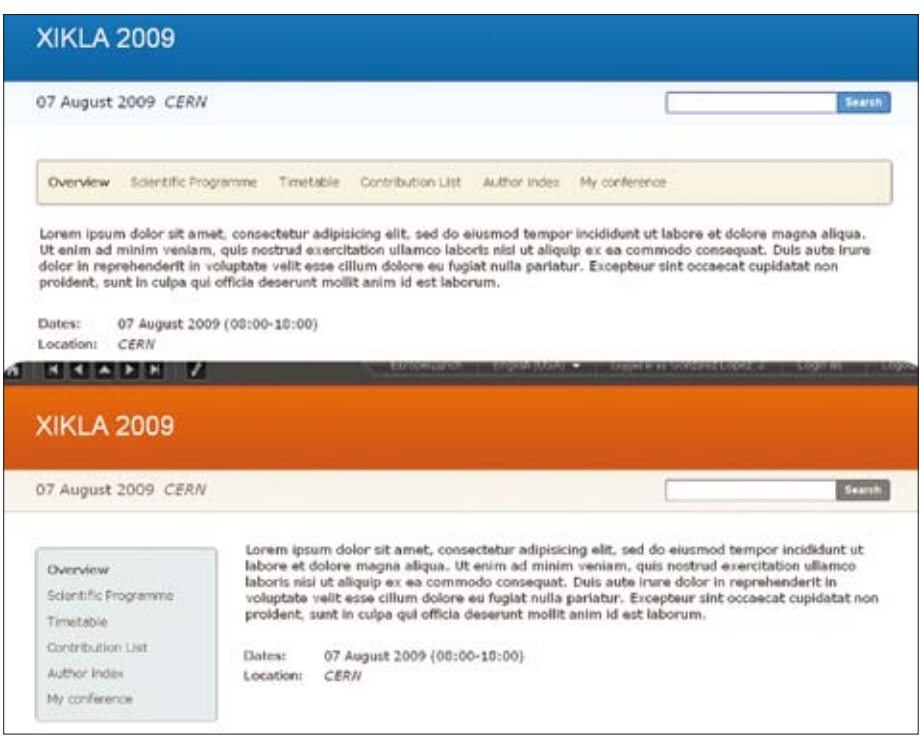


Fig. 8. Examples of the default templates. Styles and element positions can be changed.

Conclusions

The modifications to Indico are the result of two years of work and go from simple changes to the web interface to rethinking processes and operations deep in the core of Indico. We have put a lot of dedication and thought into this new interface, trying to make it as simple to use as current web technology allows. We hope that you feel as enthusiastic about it as we do. Send any feedback to indico-team@cern.ch.

Useful links

Indico beta: http://indicobeta.cern.ch/
CHEP'09 presentation "Indico Central – Events Organisation, Ergonomics and Collaboration Tools Integration": http://cdsweb.cern.ch/record/1177417

José Benito Gonzalez and José Pedro Ferreira, IT-UDS, on behalf of the Indico team

CERN updates Wi-Fi network

Wi-Fi, a well known trademark for certified products based on the IEEE 802.11 standards, has become a widely used technology. The recent rise in the use of laptops, PDAs and other devices operating wirelessly has further increased the demand for Wi-Fi connectivity. It is an adequate solution for staying connected outside the office in places such as conference rooms and libraries, but also in hallways, cafeterias and open spaces.

IT-CS operates more than 500 wireless base stations around CERN, mainly in public areas. This is progressively being improved.

With the successive improvements to 802.11 technology and its increased popularity, some believe that Wireless Local Area Networks (LANs) can replace classical wired LANs. Is this the case?

Wi-Fi technology is designed to extend the wired network by providing wireless connectivity but it suffers from a certain number of limitations because it is impossible to master the communications medium, i.e. the air. Therefore, one weakness will come from the way in which the radio waves propagate.

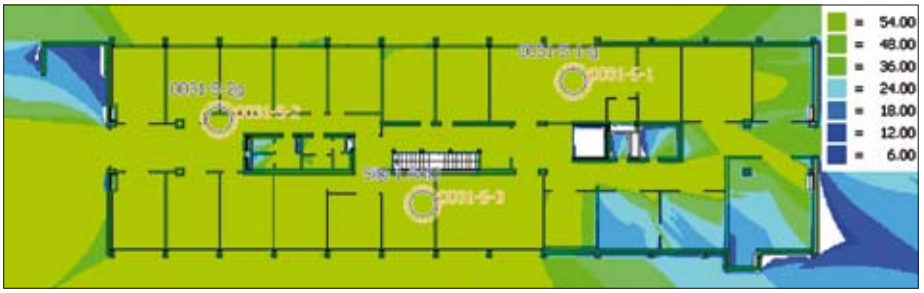


Fig. 1. The data rate in Building 31-S when the access points work on three independent channels. The maximum rate is achievable in most of the floor with no coverage hole.

Fig. 2. The maximum data rate when the access points work on the same channel, creating large interference areas (white) where connectivity is unstable or impossible.

Table 1. IEEE standards

IEEE standards	*Maximum physical rate (Mbps)*	*Maximum typical throughput (Mbps)*	*Release date*
802.11a	54	23	1999
802.11b	11	4.3	1999
802.11g	54	23	2003
802.11n (draft)	450	140	expected late 2009

Radio-frequency obstacles and interferences

As for mobile telephony (e.g. GSM) or other radio technologies, no radio frequency (RF) coverage can be perfect. As such, during their propagation, radio waves are affected by several phenomena such as reflection, refraction, diffraction or absorption, which will distort the original wave pattern. When dealing with indoor environments, like the CERN buildings, the effects are even worse due to the high number of obstacles such as walls, ceilings, doors and cabinets.

Moreover, this coverage evolves due to changes in the surrounding environment, such as opening of doors and movement of elevators or furniture. When planning RF deployments, we attempt to optimize wireless coverage, but this coverage is not homogeneous around the access points and potentially degraded areas will appear at some places. As a consequence, the Wi-Fi client will decrease its data rate to reduce the bit error ratio and preserve the quality of the connection as far as possible.

Because Wi-Fi uses radio waves on unlicensed bands, the transmission is likely to interact and be disturbed by other sources operating at the same frequency, such as microwave ovens and cordless phones. However, IEEE 802.11 devices may also interfere with each other, e.g. stations connected to the same radio cell facing the hidden node issue. But the most disastrous impact on the RF quality is caused by co-channel interferences coming from neighbouring access points, working on the same channel or overlapping ones (a particular problem with the 802.11b/g where only three channels are usable). Adding more base stations is not a solution because in most cases this will degrade the communication even further.

Wi-Fi performance

The connection data rate indicated on a wireless device corresponds to the nominal bandwidth of the physical layer. This is different from the payload throughput available for transferring data. Before transmitting any payload packet, a complex mechanism takes place to establish and manage the wireless communication. This consumes a lot of time and dramatically increases the transport overhead. Consequently, the available payload throughput is reduced by more than 50%.

Table 1 shows the most common IEEE 802.11 standards and their typical rates.

The 802.11a/b/g/n standards are half-duplex, which means that a device can either transmit or receive data, but not at the same time. In the Wi-Fi world, the bandwidth is shared in an unfair way between all of the clients in the same area. Serious performance degradation can be observed due to reduced available throughput and an increase in latency and jitter.

In Wi-Fi communications, many factors reduce the expected performance of wireless connections, e.g. location, interference, station density and limitations in the technology. Wi-Fi does provide mobility and will continue to be deployed at CERN as technology advances are made. However, the CERN wired infrastructure remains better in terms of performance and reliability. Consequently, you are strongly recommended to use wired connections in offices where possible to benefit from network rates up to 1 Gbps. If all of the plugs are in use at a location, it is possible to connect several computers to the same socket using a FANOUT, available from the CERN Stores (SCEM: 80.02.08.030.0).

Useful link

Wi-Fi site: http://cern.ch/wireless

Sebastien Ceuterickx, IT-CS

Prague hosts CHEP conference

The old city of Prague blends with its modern aspects to provide a suitable setting for CHEP'09. Image courtesy of CHEP'09 organizers.

The CHEP series of conferences, held every 18 months, covers the wide field of computing in high-energy and nuclear physics. CHEP'09 was the 17th meeting and attracted 615 attendees from 41 countries. It was held on 23–27 March in Prague. The conference was co-organized by CESNET, Charles University in Prague – Faculty of Mathematics and Physics, Czech Technical University, the Institute of Physics and the Nuclear Physics Institute. Throughout the week some 560 papers and posters were presented. As usual, given the CHEP tradition of devoting the morning sessions to plenary talks and limiting the number of afternoon parallel sessions to around six or seven, the organizers found themselves short of capacity for oral presentations. This time 500 offers were received for 200 programme slots with the rest being shown as posters, split into three full-day sessions of around 100 each day. The morning coffee break was lengthened to permit the attendees to browse the posters and discuss them with the authors.

Given the timing of the event, a large number of the presentations related to computing for the LHC experiments but there was also a healthy number of contributions from experiments taking place elsewhere in the world, including the US labs BNL, Fermilab and SLAC (where BaBar is still analysing its data although the experiment has stopped data-taking), KEK in Japan and DESY in Germany.

The conference was preceded by a Worldwide LHC Computing Grid (WLCG) workshop, which was summarized by Harry Renshall (CERN). There was a good mix of Tier 0, Tier 1 and Tier 2 representatives. It started with a review of each experiment's plans, all of which include more stress testing in some form before the restart of the LHC. EGEE to EGI transition is an issue, as is the lack of a winter shutdown in the LHC plans. The workshop summary was that ongoing emphasis should be put on stability, preparing for a 44-week run and continuing the good work on data analysis.

Sergio Bertolucci, CERN director for research and scientific computing, gave the opening talk of the conference, reviewing the LHC start-up and initial running, the steps being taken for the repairs after the incident of 19 September and how to avoid any repetition, and the plans for the restart. He compared the work being done currently at Fermilab and how CERN will learn from this in the Higgs search. Les Robertson (CERN), who led the WLCG project through the first six years of its life, discussed how we got here and what's next. A very simple grid was first presented at CHEP in Padova in 2000 and he labelled the 2000s as the decade of the Grid. Thanks to the development and adoption of standards, grids have developed and matured, and an increasing number of sciences and industrial applications have made use of them. But Robertson thinks that we should now be looking at locating Grid centres where energy is cheap, using virtualization to share processing power better and starting to look at clouds.

The theme of using clouds came up several times later in the meeting, for example the Belle experiment at KEK is experimenting with the use of clouds for Monte Carlo simulations in its planning for SuperBelle; and the STAR experiment at BNL (Brookhaven) is also considering using clouds for Monte Carlo production. Another of Robertson's suggestions for future work – virtualization – was one of the most common topics throughout the week in terms of contributions. Different uses of it cropped up time and again in multiple streams.

Among the other notable plenary talks was that by Neil Geddes (STFC, Rutherford Laboratory) who asked "can WLCG deliver?" and deduced that it can, and it does, but that there are many challenges left to face. Kors Bos (ATLAS) compared the different approaches to computing across the LHC experiments, pointing out similarities and differences. Ruth Pordes (Fermilab), executive director of the Open Science Grid (OSG), described work happening in the

US with regard to evolving grids, making them easier to use and more accessible to a wider audience.

The conference had a number of commercial sponsors, in particular IBM, Intel and Sun Microsystems, and part of the Wednesday morning was devoted to speakers from these firms. IBM used its slot to describe a machine that it says offers cooler, denser and more-efficient computing power. Intel focused on an effort to get more computing for less energy, noting work done under the openlab partnership with CERN. Intel hopes to partially address this by increasing computing energy efficiency (denser packaging, more cores, more parallelism) because they realize that power is constraining growth in every part of computing. The Sun speaker presented some ideas on building state-of-the-art data centres. He claims that raised floors are dead – he proposed "containers" or a similar pod architecture that has built-in cooling and a modular structure connecting to overhead hot-pluggable busways. Another issue is to build "green" centres and he quoted solar farms in Abu Dhabi and a scheme to use free ocean cooling for floating ship-based computing centres.

It is impossible to summarize the seven streams of material presented in the afternoon sessions but some highlights deserve to be mentioned. The CERN-developed Indico conference tool was presented and statistics showed that it has been adopted by more than 40 institutes and manages material for an impressive 80 000 events. The summary of the 44 Grid middleware talks and 76 poster presentations was that production grids are here, Grid middleware is usable, standards are evolving but have a long way to go, and network bandwidth use seems to keep pace with technology. From the Distributed Processing and Analysis stream of talks came the message that a lot of work has been done on user-analysis tools since the last CHEP, with some commonalities between the LHC experiments. Data management and access protocols for analysis are a major concern and the storage fabric is expected to be stressed when the LHC starts running.

Dario Barberis (ATLAS) presented the conference summary. He had searched for the most common words in the 500 submitted abstracts and the winner was "data", sometimes linked with "access", "management" or "analysis". He noted that users want simple access to data so we need to provide easy-to-use tools to hide the complexity of the Grid. Of course "grid" was another of the most common words but the word "cloud" did not appear in the top-100 although it was much discussed in plenary and parallel talks. For Barberis, a major theme was performance, at all levels from individual software codes to global Grid performance. He felt that networking is a neglected but important topic (for example, the famous digital divide and end-to-end access times). His conclusion was that performance will be a major area of work in the future and a topic at the next CHEP in Taipei on 17–22 October 2010.

Useful links

CHEP'09 trip report: http://cdsweb.cern.ch/record/1173073?ln=en
CHEP'09 programme including presentations: http://indico.cern.ch/conferenceTimeTable.py?confId=35523

Alan Silverman, IT-DI

• A version of this article was published in *CERN Courier*, July 2009.

Workshop identifies steps to reap benefits from multicore and virtualization technologies

Driven by advances in two of its research and development projects (Parallelization of Software Frameworks to Exploit Multicore Processors and Portable Analysis Environment using Virtualization Technology) CERN organized a workshop on 24–26 June about adapting applications and computing services to multicore and virtualization technologies. The workshop brought together experts from industry, developers using these technologies and IT service providers at CERN. It provided an understanding of what can be achieved and identified a set of actions required for physics applications to further exploit multicore and virtualization technologies.

The workshop was structured into sessions on technology, application requirements, computing services and Grid services. Although they had a CERN focus, presentations and discussions were enhanced by contributions from representatives of institutes elsewhere in Europe and from North America.

From a technology viewpoint, the number of cores per machine will continue to increase in the near future and the challenge becomes implementing software in ways that can efficiently exploit them. The increased number of cores per machine has helped to drive the rapid adoption of virtualization. In addition to its benefits for resource consolidation, virtualization creates opportunities for a more flexible approach to offering computing services. Both technologies are rapidly maturing, particularly in terms of performance and management tools. Physics applications can benefit from these advances but computing services need to adapt to support them.

Application requirements were presented in terms of the promising experience so far using multicore and virtualization together with requests for support beyond test environments. As expressed by Paolo Calafiura: "ATLAS is ready to transition from prototypes to production." The presentations on IT and Grid services completed the picture with information about available and planned services.

From the fruitful discussions that ensued, the follow-up actions below were identified. These, together with increased understanding and collaboration, represent the results of the workshop.

Actions at CERN:

• provide infrastructure in CERN's computer centre for the preparation of CernVM images and the Virtual Organization's application software delivery to them. CernVM images are generated by tools of the CernVM project, http://cern.ch/CernVM, which provides a virtual software appliance for developing and running LHC data analysis.
• include the capability to run CernVM images in CERN's virtualized batch initiative.
• test scheduling options for parallel jobs in mixed workload environments.

Actions requiring Grid-wide collaboration:

• establish procedures for creating images that can be trusted and run at Grid sites. This is needed for Virtual Organizations to be able to run their images at Grid sites.
• investigate scenarios for reducing the need for public IPv4 addresses on Worker Nodes. Virtualization is increasing IP address usage and given the IPv4 address limitations (www.ipv6actnow.org) public IPv4 addresses need to be used wisely.
• deploy multicore performance and monitoring tools (e.g. KSM, PERFMON) at CERN and at other Grid sites.
• provide input to initiatives for running multicore jobs Grid-wide, e.g. EGEE's MPI (Message Passing Interface) Working Group recommendations.

Interoperability with clouds:

• prototype a solution to run Grid jobs on cloud resources.

Further information can be obtained from the slides and an executive summary of the workshop, which are linked from the agenda page: http://indico.cern.ch/conferenceDisplay.py?confId=56353.

Denise Heagerty, IT-FIO

HEPiX event arrives in Sweden

More than 250 sites from all over the world provide computing services for the particle-physics community, for example in the framework of the Worldwide LHC Computing Grid (WLCG) project. Many sites are facing the same challenges and problems, so why not share insights and solutions? That's the idea behind HEPiX, an informal organization that holds workshop-style meetings twice a year.

The spring 2009 meeting was hosted by Umeå University in Sweden on 25–29 May. Umeå is a town on the Baltic coast, only 350 km south of the Arctic Circle.

Academia is very important in Umeå: little more than 100 000 people live in the town and the two universities have almost 30 000 students. The Scandinavian countries contribute a special Tier 1 to LCG – it is distributed among a number of sites, one of which is Umeå.

Some 100 attendees registered, surpassing the expectations of the HEPiX board and the local organizing committee, led by Mattias Wadenstein. There were more than 50 scheduled presentations, organized in tracks covering virtualization, storage and file systems, operating systems and applications, security and networking, and data centres. Full details are available from Indico: http://indico.cern.ch/conferenceDisplay.py?confId=45282.

Virtualization

This track attracted the most interest. Although forward-looking presentations on the technology and vague usage ideas were still around, they were complemented by reports concerning production experience and benchmarking. This showed that virtualization has matured. For example, it is being used in production facilities to provide high-availability services, a large and highly flexible test facility for software testing, the possibility to run experiment-specific images, etc. Security concerns were also discussed. Detailed comparisons showed the strengths and weaknesses of popular hypervisors, such as XEN, KVM, VMware and HyperV, and demonstrated that under certain circumstances virtual machines can even perform better than physical ones. The track then focused on computing clouds, mentioning both commercial and academic solutions including first cost estimates and the significant security aspects. A full Grid site has already been successfully run on a commercial cloud.

Storage and file systems

Storage was a central theme. The session provided an overview of the HEPiX file system Working Group activities as well as presentations targeted at specific technologies. The Working Group results included measurements of their standard benchmark with the General Parallel File System (GPFS) for clusters, complementing earlier results with Lustre, AFS and other file systems. The AFS performance is rather poor for large files, but can be considerably improved by object extensions – the AFS client accesses the object store directly rather than through a single, bottleneck AFS server. CERN presentations were on Internet Small Computer System Interface (iSCSI) storage and Lustre evaluation.

Operating systems and applications

The presentations and discussions covered Scientific Linux (SL): the end of SL4 support (confirmed for October 2010), the status of SL5 and prospects for SL6. Addressing the need to support new hardware and provide more up-to-date releases of desktop software, FNAL is now offering FermiLinux Short Term Support, currently based on Fedora 10. Another talk described an alternative approach to pack Grid software for the most popular Linux distributions. Further presentations reported experience with Puppets (a configuration manager), Dovecot (an smtp mail server), OpenSharedroot (a tool to share a root file system across machines for high availability) and Slurm (a resource manager).

Security and networking

Talks described the CERN tools for detecting abnormal network behaviour, an SMS-based system to provide users with a one-time password required on top of the standard username/password combination for ssh access, and new requirements at FNAL when connecting to its network (an automatic software inventory is compulsory).

Data centres

This session saw two contrasting talks: one from a site that is launching a project to build a new data centre (they are full of optimism and faith) and one from a site that has just finished building a centre (their degree of optimism is quite a bit lower).

Conclusion

The meeting offered a broad spectrum of presentations, which led to intense discussions during the breaks. New opportunities for commonalities and collaborations were identified, and existing partnerships received a boost. The next meetings are scheduled for 26–30 October at LBNL in Berkeley, spring 2010 in Lisbon and autumn 2010 in the US.

Useful link

HEPiX website: www.hepix.org

Helge Meinhard, IT-FIO

Calendar

September

27 September – 2 October, **13th European Conference on Digital Libraries**
Corfu, Greece
www.ecdl2009.eu/

October

6–10, **2nd International Conference of Security of Information and Networks (SIN'09)**
Gazimagusa, North Cyprus
www.sinconf.org/

8–9, **European Computer Science Summit (ECSS 2009)**
Paris, France
www.informatics-europe.org/ECSS09/

12–13, **3rd International Symposium on Intelligent Distributed Computing (IDC 2009)**
Ayia Napa, Cyprus
www.idc2009.cs.ucy.ac.cy/

12–14, **Cracow '09 Grid Workshop (CGW'09)**
Krakow, Poland
www.cyfronet.krakow.pl/cgw09/

12–16, **12th International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS 2009)**
Kobe, Japan
http://icalepcs2009.spring8.or.jp/

12–16, **Open Grid Forum (OGF27)**
Banff, Canada
www.ogf.org/OGF27/

12–17, **First INFN International School on "Architectures, tools and methodologies for developing efficient large scale scientific computing applications" (ESC09)**
Bertinoro, Italy
http://web.infn.it/esc09/

13–16, **17th IEEE International Conference on Network Protocols (ICNP)**
Princeton, US
www.ieee-icnp.org/2009

21–23, **8th International Conference on Software QA and Testing on Embedded Systems (QA&TEST 2009)**
Bilbao, Spain
www.qatest.org/en/registration/registration.php

21–23, **eChallenges e-2009 Conference**
Istanbul, Turkey
www.echallenges.org/e2009/

27–29, **Third National Meeting of Security Industry (ENISE III)**
León, Spain
www.enisa.europa.eu/