Automation of organizational and technical arrangements for scientific researches

A.B. Degtyarev[a], A.I. Ivashchenko[b], V.V. Korkhov[c], N.V. Yuzhanin[d]

Saint Petersburg State University, 7/9 Universitetskaya emb., St. Petersburg, 199034, Russia

E-mail: [a]deg@csa.ru, [b]aiivashchenko@cc.spbu.ru, [c]vladimir@csa.ru, [d]yuzhanin@cc.spbu.ru.

The article highlights the set of problems associated with automation of computing and informational support of scientific research, and offers a possible integrated solution based on the service desk system. The attention is focused on the common organizational and technical activities related to the lifecycle of scientific research, such as registration, accounting and technical support. A gracefully integrated software complex with the usage of universal web service is provided as a solution. Mentioned system binding tool allows automating the workflow of key applications and simplifying the staff decision-making problem. Achieved data relevance, reduction of human impact factor and man-hour costs are mentioned as a positive factor of integration solution.

Keywords: ITSM, Service Desk, Integration, Infrastructure, Computing Center.

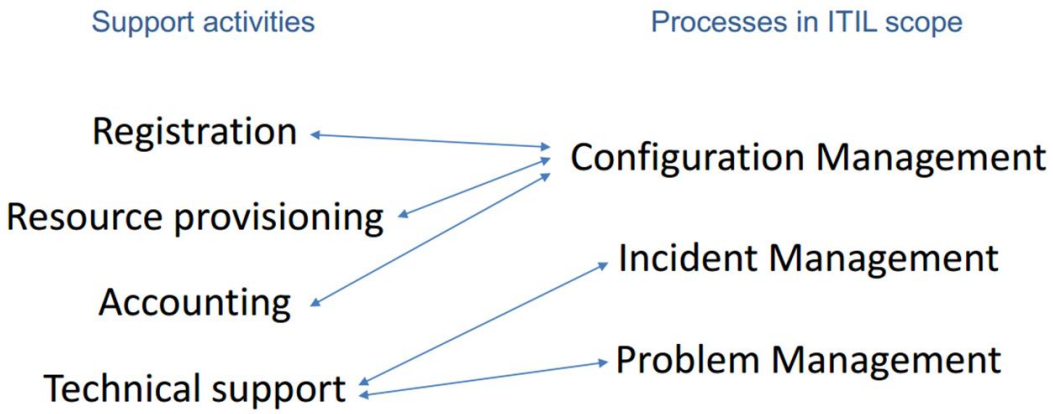
Research was carried out using computational resources provided by Resource Center "Computer Center of SPbU"(http://cc.spbu.ru/) and supported by grants of Russian Foundation for Basic Research (projects no. 16-07-01111, 16-07-00886, 16-07-01113) and Saint Petersburg State University (project no. 0.37.155.2014).

Introduction

Today's university computing center is a complex infrastructure with multiple interdependencies between its components no matter how large its scale is. Support of such infrastructure is absolutely non-trivial activity. A university specific in case of scientific researches is in variety of scientific problems that is a consequence of the variety of faculties, departments and laboratories. To provide IT services to all those users with different requirements the computing center is forced to support different resources and methodic of service. These requirements cause three basic problems opposed to high quality of service and user satisfaction: large amount of human tasks in processes of support, difficulties with construction of unified accounting system, and dependency of the data relevance from human impact factor. Solution of these contradictions is also complicated by strong limitations on financial and human resources that are inherent for governmental universities. In our case we tried to solve it with "low blood" solution represented with combination of informational and organizational solutions.

Main approach

As an approach to the construction of our solution we identified four basic activities in scientific research support mostly exposed to the problems mentioned before. Next step was in consideration of these activities in the scope of the ITIL processes these activities are related to (Pic.1). The ITIL scope was chosen because of its compliance to the standards of quality of IT services, and also because most of software solutions for IT service management is certified on compliance to this library of best practices.



Pic.1. Activities and processes of support

On the theoretical step we concluded that full automation of all these processes is unattainable because of university specific: center needs to support a lot of too different researches. That's why we found it necessary to combine information system and organizational solution. To simplify these organizational arrangements we decided to try auxiliary information system. The goal of the auxiliary system is to decrease the impact of human tasks on service quality. In our case it is expressed in decision support for the computing center staff.

On the other hand to keep all that subsystems united we must use some system with common objects and interface. In such case the service desk system seems like a best choice because of several reasons. First reason is a framework that provides a flow of documents for all necessary processes of support. But this flow mostly manual and this fact cannot satisfy the computing center staff. Second reason is in the fact that service desk has its own data store with basic object necessary for support

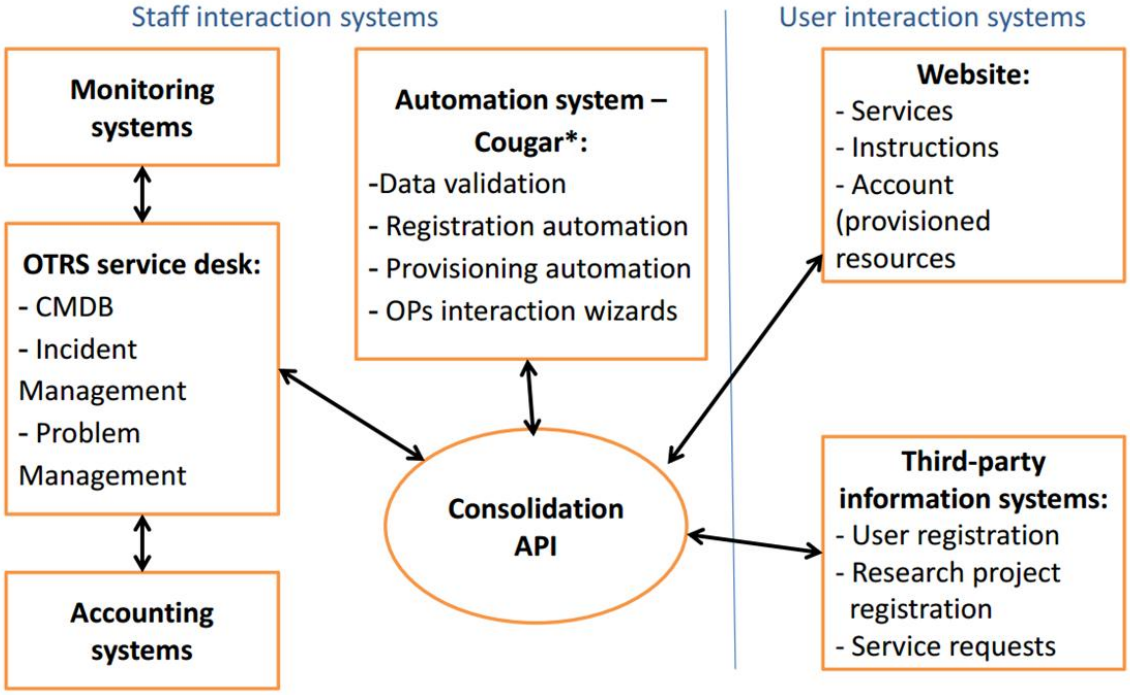
processes: tickets, FAQ notes, etc. Third reason is a web service API included in all widely known service desk frameworks.

Because of many additional systems we are planning to connect with service desk it must be customizable. That is why it must be open-source solution. And there is only one open-source service desk that meets all the requirements – the OTRS::ITSM service desk system. Its key features are fully customizable framework, included CMDB, web service API and automated report generator.

Next key element is usage of web services. It provides necessary integration of service desk and additional systems, and also the external information systems no matter higher or lower level they are. Web services are easy to use. But they have some disadvantages: different message formats and variety of data structures.

Problems and solutions

Main problem we met was unification of the system-to-system communication. To solve this problem the set of web service is used. Solution of this problem led us to develop some sort of consolidation API (Pic.2) to organize and automate the data exchange between information systems.



Pic.2. Structure of support system

Second significant problem was data control for error prevention. Some manipulations with the data in processes of research supports remained manual so the processed data must be checked before saving. This feature was included in our automation system we called Cougar. And this feature became one of factors of human impact factor limitation.

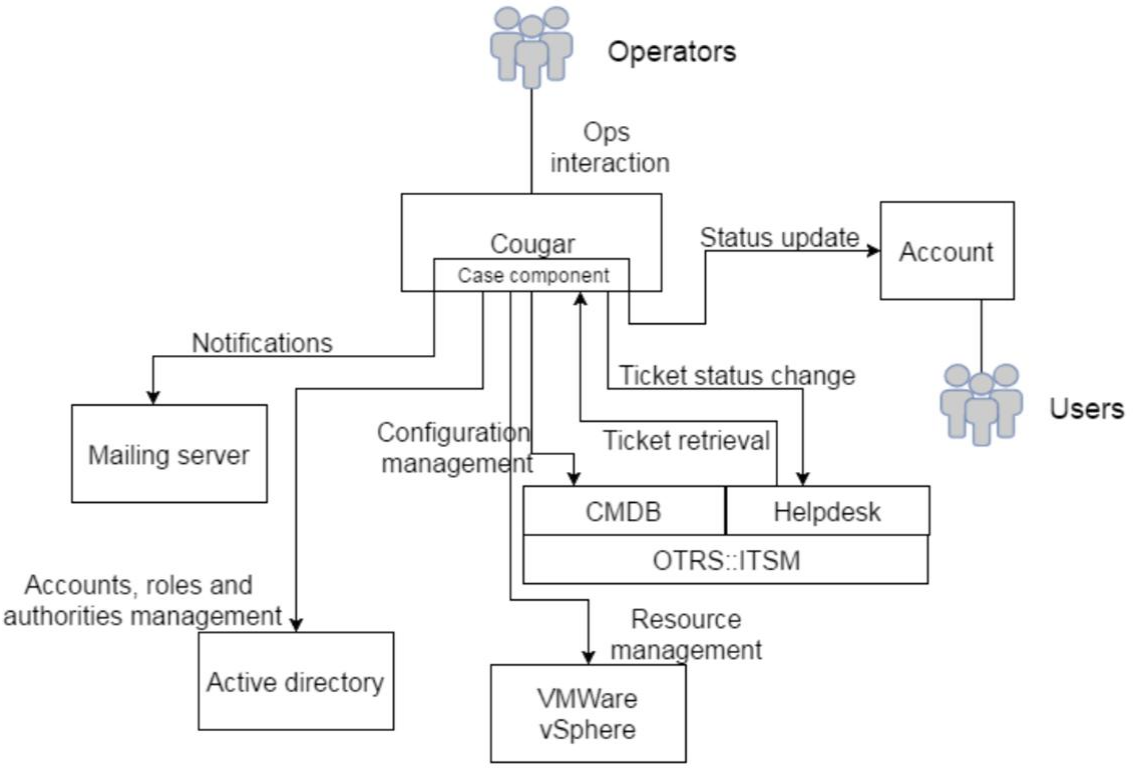
Automation complex

One of the challenges we met during dataflow has been built is an integration of various informational systems and services. This problem appears due to the fact that there is no complex and unified solution on the market, and we are even not talking about open source. The most flexible systems provide a basic functionality out of the box, like ticket management, workflow organization, automatic

call registration etc., but the case management for the common lifetime processes is an end user's responsibility. Commercial development of such case-based solutions is very expensive and due to that fact usually not available for university structures.

Keeping all that in a mind we have developed our own service, called "Cougar", which goal is to orchestrate our informational and infrastructural systems in the scope of HPC-based scientific project life cycle.

We realized it in the set of wizards for main processes of scientific research support. First step was the description of main support procedures and turning those descriptions in sets of rules. The wizards based on chains of those rules collected in a knowledge base. The system has a web-based UI with a support of mobile devices. It is very friendly for the operators and allows them to work with a system from any place where they have access to the web.



Pic.3. Cougar system interaction

Let's take a closer look for one of our common service scenarios, where the end user gets an access to cluster workload management system through virtual machine. This process includes the following steps: creation of user account, granting required permissions to the user, creation of virtual machine, sending a response to the ticket through service desk, logging everything to the CMDB. As you can see on Pic. 3, there are a lot of services involved, and staff should know how to interact with the whole stack, which also make a process of new employee acquirance quite painful and time consuming. Also, according to our stats, operators are often making mistakes, mostly with wrong input to the CMDB. Right now they are not happening just because ticket is parsed automatically and operator just need to check user input.

Conclusions

As a conclusion we can say that research led us to the creation of support system with automatic advisory that significantly simplified the decision making for the computing center operators during

the processes of research lifecycle support. Thanks to knowledge base and wizards for main processes this system reduced human impact factor and quantity of errors during operations with documents. Relevance of the data in data stores also got its profit because automatic system cannot “forget” to save, update, or delete necessary data.

Simplified report generation system became important acquirement for managers that reduced complexity and time cost of periodic report creation. Also part of automated reports became available for users and gave them an opportunity to evaluate their costs and efficiency during their research.

Perspectives

One of support problems was not solved completely – transport between the service desk system and the monitoring and accounting systems still realized without usage of web service API. Solution of this problem will be significant perspective work.

For the increase of service quality we want to automate the analysis of the users objectives, requests and QA surveys data and provision of recommendations for users about usage of our services. Such automation can reach two goals: to help in searching of optimal methodic to use in recent research and either to suggest the proper resources to achieve the objectives of future researches.

References

Black J., Draper C., Lococo T., Matar F., Ward C. An integration model for organizing IT service management // IBM Systems Journal. — 2007. — Vol. 46, No. 3. — P. 405–422.

Richardson L., Ruby S. RESTful Web Services. s.l. // O'Reilly. — 2007. — 454p.

Booth D., Haas H., McCabe F. Web Services Architecture. [Document] s.l. // W3C Working Group. — 2004.

Bogdanov A., Gaiduchok V., Gankevich I., Tipikin Yu., Yuzhanin N. The use of service desk to keep track of computational tasks on supercomputers // Transactions on Computational Science XXVII. — 2016. — P. 1–9.

Ezhakova T., Gaiduchok V., Yuzhanin N., Zolotarev V. Development of the Configuration Management system of the computer center and evaluation of its impact on the provision of IT services // Computational Science and Its Applications – ICCSA 2015. — 2015. — Part. IV. — P. 249–258.

Steinberg, R. ITIL Service Operation 2011 Edition (Best Management Practices) // London: The Stationery Office. — 2011. — 384p.