The 13th KIPS International Conference on Ubiquitous Information Technologies and Applications (CUTE 2018) & The 10th International Conference on Computer Science and its Applications (CSA 2018)

December 17-19, 2018
Kuala Lumpur, Malaysia

Organized by

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Service integration methodology for convergence service in science and technology

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Abstract. To facilitate the open science in research lifecycle, reconstructing individual services into modular and independent function blocks that can be reusable and interoperable. Over the years, more REST based web services have been deployed in the enterprise application that is integrated with services from different sources with existing functionality over HTTP. This results in an increasing interoperability and supporting seamless integration compared to traditional web services. Despite this trend, there are still no standards or guidelines about how to develop a RESTful web service for S&T knowledge infrastructure. In this paper we introduce the methodology for service integration for modelling conceptual architecture and understand the practices on the portal composed of services of convergence of S&T. In the research lifecycle, S&T services are used to support resource activities from developing ideas to sharing to proliferating research results.

Keywords: service integration, convergence service, knowledge infrastructure, web services, research lifecycle

1 Introduction

In a new science research way represented as data intensive paradigm, open science drives an innovative approach to the scientific process based on cooperative work and new ways of convergence knowledge by using digital technologies and new collaborative tools. It is about extending the principles of openness to the entire research lifecycle. It can reduce the barriers for sharing any kind of output, resources, methods or tools, at any stage of the research process [1, 2].

To facilitate the open science in research lifecycle, reconstructing individual services into modular and independent function blocks that can be reusable and interoperable. The vision of a service integration for the convergence service of S&T(Science and Technology) knowledge infrastructure is to seamlessly access computing resources and the research results including artifacts digitally enabled

scholars, researchers, and engineers participating in multidisciplinary collaborations in the open science way. The integrated portal with convergence services can provide a systematic and interconnected S&T knowledge infrastructure including NTIS, NDSL, COREEN, etc.

Over the years, more REST based web services have been deployed in the enterprise application that is integrated with services from different sources with existing functionality over HTTP. This results in an increasing interoperability and supporting seamless integration compared to traditional web services. Despite this trend, there are still no standards or guidelines about how to develop a RESTful web service for S&T knowledge infrastructure. In this paper we introduce the methodology for service integration for modelling conceptual architecture and understand the practices on the portal composed of services of convergence of S&T. In the research lifecycle, S&T services are used to support resource activities from developing ideas to sharing to proliferating research results.

2 Related works

Increasingly, scientific breakthroughs represented as Fourth Paradigm of science have been driving by on-demanding and federated computing resources that help researchers manipulate and explore massive data [2, 4]. But upcoming infrastructure technologies such as cloud computing and multicore processors provide the specific solutions in pre-processing and post-processing the large dataset as well as their tradition computing resources and tools. For example, particle physics has been used to analyze the world's largest datasets by using Hadoop distribution and Spark [2, 3, 5]. Nation-wide research involves many different stages and activities from developing ideas to proliferating those research results.

Service-oriented architecture (SOA) presents a fundamental shift in dealing with the difficulties of building an enterprise information system composed of diverse services involved in research lifecycle for many S&T research areas [6-7]. It promotes loose coupling between software components so that they can be reused. Applications in SOA are built based on independent services. As the extension of SOA, the microservice architectural style is an approach to developing a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms, often an HTTP resource API. Cloud computing and SOA can be pursued that cloud computing's platform and storage service offerings can provide a value-added supporting for SOA efforts as an integration technology.

3 The proposed service integration methodology

3.1 Integration modelling for convergence services

In the enterprise modelling for a convergence service in S&T knowledge infrastructure, we propose the service concept plays a central role. A service is defined as a unit of functionality that an entity (such as a system, organization, or

department) makes available to its environment, and which has some value for certain entities in the service users.

Service orientation approach typically leads to a layered view of enterprise architecture models, where the service concept is one of the main linking points between the different layers. Service layers with service made available to higher layers are interleaved with implementation layers that realize the services. Within a layer, there may be internal services, services of supporting applications that are used by the end-user applications. In Fig. 1, each service has specific user and user groups. Two or more services can be integrated into convergence service as business services in integrated portal.

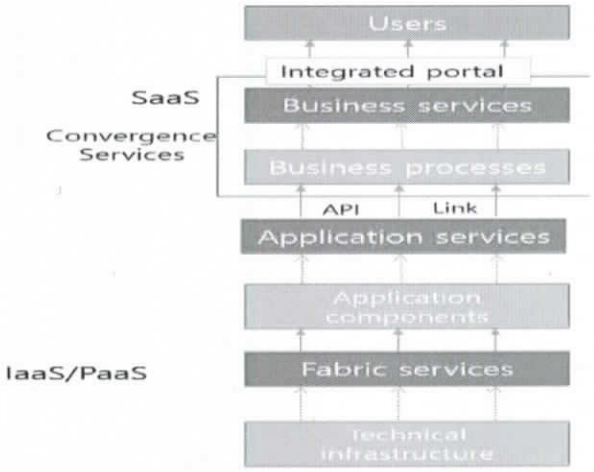

Fig 1. Layer view for convergence service

With these observations, we decide that modelling enterprise architecture should focus on inter application-domain relation. It provides a metadata for integration by allowing the creation of models that showing how the implementation layers make use of services of other layers located in lower layers, and realization relations, showing how services are realized in an implementation layer. Hierarchical layers are used to separate the business of users, the service, and the gateway. The interaction between layers will most likely be a client-server relation. There is no enforced coherence of central shared data. Working on integration emphasizes the interoperability of services in distributed information systems.

3.2 The design guideline for a convergence service

Researchers, funding agencies, and publishers are increasingly concerned with matters of scientific reproducibility. Especially the need for integration of services is getting important to users who is working for convergence studies in the research community. New information architectures enable new approaches to publishing and accessing valuable data and programs. SOA allows for the reuse of existing assets where new services can be created from an existing IT infrastructure of systems. In

other words, it enables businesses to leverage existing investments by allowing them to reuse existing applications and promises interoperability between heterogeneous applications and technologies.

In this reason, SOA is a good way to handle the complexity of enterprise software environment has been increased. We can build the convergence service by referring the specification of well-designed services and putting together them in bottom-up manner. We apply the cloud-based delivery model for supporting standards interface like REST via light-weight client. In a SOA environment, a service is composed with the operations that the service supports; defining the protocol used to invoke those operations over the Internet; and operating a server to process incoming requests.

1) **(Loose coupling)** To meet the loose coupling requirement of an enterprise application, the application should communicate a data service mediator with different access mechanisms, synchronous RPC and pub/sub based asynchronous communication. To reduce coupling between applications, we use callback in which the subscriber is asked to supply a reference to a function with a certain signature, which is called later. The publisher of the event knows nothing about the module that is called, so there's no dependency. This communication mechanism is also reduced dependencies between two entities.
2) **(Interoperability)** To meet the interoperability needs of applications, we consider data is formatted as XML. To reformat the data from data service mediator to the end-user application, we design the proxy to transform the result of a query for different formats.
3) **(Seamless integration)** As data sizes increase, and researchers rely on a distributed large scale of dataset and publication, data storage, and compute resources, these challenges are likely to become barriers. Hence it is important to support stakeholders for a scientific research that we construct a software architecture for integrating seamlessly separate service in KISTI. We consider applying LISI model for measuring the integration level.
4) **(Flexible service pool)** The complete set of services for all resource types forms a service pool which provides uniform access to data stored in the underlying information system.
5) **(Performance)** Handing component interactions can be the dominant factor in user-perceived performance and network efficiency. To manage web services, it needs to monitor quality of them periodically or aperiodically when changing their status like availability, performance and security policy. To meet the performance needs of applications, we consider an optimized binary data format and a data caching.
6) **(Scalability)** simplifies component implementation, reduces the complexity of connector semantics, improves the effectiveness of performance tuning, allowing to support large numbers of components and interactions among components.
7) **(Cross-domain accessibility)** it allows to provision users and accounts to REST-based endpoints that the CA API Gateway supports. Identity and Access management (IAM) describes the management of individual identities, their authentication, authorization, roles and privileges within or across system and enterprise boundaries It needs for enterprise or cross-network identity

management, which reduces the development time for web service connectors.

4. Conclusion

In forth paradigm era, scientific methods to analyze and organize data are required to handle large-scale datasets for scientific discovery by on-demanding computing resources. Hence, these methods also need to support effective S&T knowledge infrastructure in research life cycle. We applied the practices on the portal composed of services and identified and analyzed requirements for integrating diverse individual services for the logical design of RESTful web services in the S&T knowledge infrastructure.

Acknowledgements. This Research was supported by the Korea Institute of Science and Technology Information(KISTI) in 2018

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Message from the CUTE 2018 General Chairs

On behalf of the organizing committees, it is our pleasure to welcome you to the 13th International Conference on Ubiquitous Information Technologies and Applications (CUTE 2018), will be held in Kuala Lumpur, Malaysia on December 17-19, 2018.

This conference provides an international forum for the presentation and showcase of recent advances on various aspects of ubiquitous computing. It will reflect the state-of-the-art of the computational methods, involving theory, algorithm, numerical simulation, error and uncertainty analysis and/or novel application of new processing techniques in engineering, science, and other disciplines related to ubiquitous computing.

The papers included in the proceedings cover the following topics: Ubiquitous Communication and Networking, Ubiquitous Software Technology, Ubiquitous Systems and Applications, Ubiquitous Security, Privacy and Trust. Accepted papers highlight new trends and challenges in the field of ubiquitous computing technologies. We hope you will find these results useful and inspiring for your future research.

We would like to express our sincere thanks to Steering Committees: James J. Park (SeoulTech, Korea), Doo-Soon Park (SoonChunHyang University, Korea), Young-Sik Jeong (Dongguk University, Korea), Hsiao-Hsi Wang (Providence University, Taiwan), Laurence T. Yang (St.Francis Xavier University, Canada), Hai Jin (Huangzhong University of Science and Technology, China), Chan-Hyun Youn (KAIST, Korea), Jianhua Ma (Hosei University, Japan), Mingyi Guo (Shanghai Jiao Tong University, China), Weijia Jia (City University of Hong Kong, Hong Kong). We would also like to express our cordial thanks to the Program Chairs & Program Committee members for their valuable efforts in the review process, which helped us to guarantee the highest quality of the selected papers for the conference.

Finally, we would thank all the authors for their valuable contributions and the other participants of this conference. The conference would not have been possible without their support. Thanks are also due to the many experts who contributed to making the event a success.

CUTE 2018 General Chairs

Yi Pan, Georgia State University, USA
Sanghoon Kim, Hankyong National University, Korea
Luis Javier Garcia Villalba, Universidad Complutense de Madrid, Spain

Message from the CUTE 2018 Program Chairs

Welcome to the 13th International Conference on Ubiquitous Information Technologies and Applications (CUTE 2018), will be held in Kuala Lumpur, Malaysia on December 17-19, 2018.

The purpose of the CUTE 2018 conference is to promote discussion and interaction among academics, researchers and professionals in the field of ubiquitous computing technologies. This year the value, breadth, and depth of the CUTE 2018 conference continues to strengthen and grow in importance for both the academic and industrial communities. This strength is evidenced this year by having the highest number of submissions made to the conference.

For CUTE 2018, we received a lot of paper submissions from various countries. Out of these, after a rigorous peer review process, we accepted only high-quality papers for CUTE 2018 proceeding, published by the Springer. All submitted papers have undergone blind reviews by at least two reviewers from the technical program committee, which consists of leading researchers around the globe. Without their hard work, achieving such a high-quality proceeding would not have been possible. We take this opportunity to thank them for their great support and cooperation.

Finally, we would like to thank all of you for your participation in our conference, and also thank all the authors, reviewers, and organizing committee members. Thank you and enjoy the conference!

CUTE 2018 Program Chairs

Muhammad Khurram Khan, King Saud University, Kingdom of Saudi Arabia
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