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Author(s):	Leonardo Candela, George Kakaletis, Pasquale Pagano
Contributor(s):	Nicolas Bailly, Federico De Faveri, Anton Ellenbroek, Giulio Galiero, Pedro Goncalves, Jan Iwaszkiewicz, George Kakaletis, Jukka Klem, Lucio Lelii, Giorgos Papanikos, Fabio Simeoni, Rena Tsantouli
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SUMMARY

The realisation of a knowledge ecosystem requires the identification and deployment of a set of interoperability approaches and solutions making the interaction among the resources partaking to it feasible. The interoperability scenarios to be addressed depend on a set of factors including the type of resources involved, the kind of interaction to be realised, the technologies these resources have been implemented with. This deliverable describes a portfolio of standards (*de jure* or *de facto*), approaches and solutions that have been discussed and identified in the context of a working group operated by the D4Science-II project having as members representatives of the AquaMaps, D4Science, DRIVER, FAO, GENESI-DR and INSPIRE data infrastructures and resource providers. This working group surveyed the characteristics of the resources offered by each infrastructure as well as the standards and approaches put in place by them to “expose” their resources and simplify their consumption from third parties.

DELIVERABLE DOCUMENTATION

A knowledge ecosystem having a large and heterogeneous scope as the one envisioned by the D4Science-II project has strong requirements in terms of interoperability solutions and approaches that have to be put in place. Interoperability is among the most critical issues to be faced when building systems as “collections” of independently developed constituents (systems on its own) that should co-operate and rely on each other to accomplish larger tasks. Unfortunately, there is no single interoperability solution or approach that is powerful enough to serve the needs of this kind of system and the scenarios D4Science-II has been conceived for. The heterogeneity of the resources involved as well as of the scenarios to be served make the identification of a proper set of approaches very challenging. Moreover, the “openness” expected in the resulting ecosystem, i.e. the fact that the resources involved as well as the scenarios to be served is likely to evolve during the project lifetime and in the future, make this activity very demanding and ask for “wise” solutions. Because of these characteristics, a set of standards (*de jure* or *de facto*), approaches and solutions proved to be successful in well defined interoperability scenarios has to be carefully identified, implemented and deployed in the domain of the ecosystem.

This deliverable documents the procedure and the results of an activity conducted in the context of the D4Science-II NA4 “E-Infrastructures Interoperability: Requirements and Solutions” work package aiming at identifying best practices, methodologies, standards and approaches leading to interoperability solutions. The deliverable is of nature “Other” and it is planned to be regularly updated for the whole duration of the project. Because of this, it has been implemented through a set of dedicated wiki pages that are published in the context of the NA4 pages

https://networking.wiki.d4science-ii.research-infrastructures.eu/networking/index.php/NA4_Home

In particular, a set of pages dedicated to document per infrastructure results of the interoperability analysis have been produced. These pages have been produced by a dedicated working group having as members representatives of gCube the AquaMaps, D4Science, DRIVER, FAO, GENESI-DR and INSPIRE data infrastructures and resource providers. In addition to that **a wiki page documenting the proposed approaches and solutions** designed by the working group is published at

https://networking.wiki.d4science-ii.research-infrastructures.eu/networking/index.php/Interoperability_Solutions

This Wiki page is the *major achievement* of the whole activity. It documents the design of approaches and solutions dealing with resource discovery, data access and discovery, process execution as well as solutions dedicated to authentication and authorisation. These five cases actually represent a rich set of facilities enabling the interoperability. Resource discovery is the mechanism designed to make a *consumer*¹ aware of the existing resources as well as of their characteristics in a seamless way. Data access and discovery is the approach designed to provide a consumer with facilities for finding and fetching data conceptually residing in “*external*”² data sources. Process execution is the mechanism designed to support distributed processing by relying on “*external*” resources. Authentication and authorisation is the approach designed to make possible a consumer to “use” the target resource in accordance with the policies governing it. All

¹ Every interoperability scenario is characterised by a *consumer* willing to “use” a certain resource that is owned by another entity, the *provider*.

² The “external” qualification depends from the consumer perspective.

these approaches carefully describe the design principles as well as the resulting architectural components realising them.

REFERENCES

- [1] S. Heiler. *Semantic interoperability*. ACM Computing Survey, 27(2):271–273, 1995
- [2] C. Lagoze and H. Van de Sompel. *The open archives initiative: building a low-barrier inter- operability framework*. In Proceedings of the first ACM/IEEE-CS Joint Conference on Digital Libraries, pages 54–62. ACM Press, 2001
- [3] A. Paepcke, C.-C. K. Chang, T. Winograd, and H. García-Molina. *Interoperability for Digital Libraries Worldwide*. Communications of the ACM, 41(4):33–42, 1998.
- [4] J. Park and S. Ram. *Information Systems Interoperability: What Lies Beneath?* ACM Trans. Inf. Syst., 22(4):595–632, 2004.
- [5] P. Wegner. *Interoperability*. ACM Computing Survey, 28(1):285–287, 1996. 35.
- [6] G. Wiederhold. *Mediators in the Architecture of Future Information Systems*. Computer, 25(3):38–49, 1992
- [7] G. Wiederhold and M. Genesereth. *The conceptual basis for mediation services*. IEEE Expert: Intelligent Systems and Their Applications, 12(5):38–47, 1997