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LifeWatch - a Large-scale eScience Infrastructure to Assist in Understanding and Managing our Planet's Biodiversity

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Understanding and managing the complexity of the biodiversity system in relation to global changes concerning land use and climate change with their social and economic implications is crucial to mitigate species loss and biodiversity changes in general.

The sustainable development and exploitation of existing biodiversity resources require flexible and powerful infrastructures offering, on the one hand, the access to large-scale databases of observations and measures, to advanced analytical and modelling software, and to high performance computing environments and, on the other hand, the interlinkage of European scientific communities among each others and with national policies.

The European Strategy Forum on Research Infrastructures (ESFRI) selected the "LifeWatch e-science and technology infrastructure for biodiversity research" as a promising development to construct facilities to contribute to meet those challenges. LifeWatch collaborates with other selected initiatives (e.g. ICOS, ANAEE, NOHA, and LTER-Europa) to achieve the integration of the infrastructures at landscape and regional scales. This should result in a cooperating cluster of such infrastructures supporting an integrated approach for data capture and transmission, data management and harmonisation. Besides, facilities for exploration, forecasting, and presentation using heterogeneous and distributed data and tools should allow the interdisciplinary scientific research at any spatial and temporal scale.

LifeWatch is an example of a new generation of interoperable research infrastructures based on standards and a service-oriented architecture that allow for linkage with external resources and associated infrastructures. External data sources will be established data aggregators as the Global Biodiversity Information Facility (GBIF) for species occurrences and other EU Networks of Excellence like the Long-Term Ecological Research Network (LTER), GMES, and GEOSS for terrestrial monitoring, the MARBEF network for marine data, and the Consortium for European Taxonomic Facilities (CETAF) and its European Distributed Institute for Taxonomy (EDIT) for taxonomic data. But also "smaller" networks and "volunteer scientists" may send data (e.g. GPS supported species observations) to a LifeWatch repository. Autonomous operating wireless environmental sensors and other smart hand-held devices will contribute to increase data capture activities. In this way LifeWatch will directly underpin the development of GEOBON, the biodiversity component if GEOSS, the Global Earth observation System.

To overcome all major technical difficulties imposed by the variety of currently and future technologies, protocols, data formats, etc., LifeWatch will define and use common open interfaces. For this purpose, the LifeWatch Reference Model was developed during the preparatory phase specifying the service-oriented architecture underlying the ICT-infrastructure. The Reference Model identifies key requirements and key architectural concepts to support workflows for scientific in-silico experiments, tracking of provenance, and semantic enhancement, besides meeting the functional requirements mentioned before. It provides guidelines for the specification and implementation of services and information models, defining as well a number of generic services and models. Another key issue addressed by the Reference Model is that the cooperation of many developer teams residing in many European countries has to be organized to obtain compatible results in that conformance with the specifications and policies of the Reference Model will be required. The LifeWatch Reference Model is based on the ORCHESTRA Reference Model for geospatial-oriented architectures and services networks that provides a

generic framework and has been endorsed as best practice by the Open Geospatial Consortium (OGC).

The LifeWatch Infrastructure will allow (interdisciplinary) scientific researchers to collaborate by creating e-Laboratories or by composing e-Services which can be shared and jointly developed. For it a long-term vision for the LifeWatch Biodiversity Workbench Portal has been developed as a one-stop application for the LifeWatch infrastructure based on existing and emerging technologies. There the user can find all available resources such as data, workflows, tools, etc. and access LifeWatch applications that integrate different resource and provides key capabilities like resource discovery and visualisation, creation of workflows, creation and management of provenance, and the support of collaborative activities. While LifeWatch developers will construct components for solving generic LifeWatch tasks, users may add their own facilities to fulfil individual needs.

Examples for application of the LifeWatch Reference Model and the LifeWatch Biodiversity Workbench Portal will be given.