



## Networks of digital commons as enablers of Open Science

Christopher Atherton (), Peter Löwe (), and Léonie Schäfer ()

(1) GÉANT Association, United Kingdom (chris.atherton@geant.org), (2) Deutsches Institut für Wirtschaftsforschung, Germany (ploewe@diw.de), (3) Deutsches Forschungs Netz, Germany (schaefer@dfn.de)

The fabric of modern computer-driven science is composed of digital infrastructures and communication tools connecting individual scientists with their respective networks and communities. This enables networks of digital commons, which are intermeshed yet exist on varying levels of enabling technology. The services and infrastructure generated by underlying commons rooted in technologies (e.g. IT-network-infrastructure and data-repositories) are consumed by higher level commons which focus on specific scientific fields and applications, like scientific domains or software environments. The latter are often unaware and oblivious of the former, and also falsely assume that their working conditions are universally available globally. This is not the case, as the deeper commons have not achieved globally uniform coverage yet.

For example; GÉANT is a community of National Research and Education Networks (NRENs) providing a telecommunications commons across Europe, with international connectivity around the world. Its mission is to boost science globally. To do that GÉANT helps other world regions to establish National and Regional research and education networks, by providing advice, guidance, and expertise. This global telecommunications commons, solely for the use of and designed specifically for the unique demands of research and education, is largely transparent to the average researcher. Based on these fundamental telecommunication commons, higher level commons like eduroam and eduGAIN are provided to foster the scientific discussion process. However, without these infrastructure commons the latest research in geoinformatics and remote sensing would be limited to those with the largest budgets, who can afford to transport huge datasets. That being said, the global NREN commons does not interconnect every country, there are still nations which do not yet have an NREN.

This submission provides an integrated overview of the current state of dependencies among multi-level scientific commons, their current global distribution/availability and the remaining challenges towards an evenly distributed global digital research environment. For this the commons-related terminologies and patterns (Ostrom-principles) which were developed by economic research about digital and non-digital commons are applied to a reference case connecting the European research network commons, infrastructure commons like digital libraries and repositories, and scientific societies and software communities as a fabric of Open Science in geospatial. It is hypothesised; As NREN commons continue to grow and don't yet cover all nations, those "missing" NRENs stand for environmental/geospatial measurements and data which are still unknown, as well as the missing human potential to address new scientific questions.