

# Hubdrive: Enhancing HUBzero© for Offline Data Sharing

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HUBzero© is a framework for creating instances of virtual research environments and/or science gateways, so-called hubs under HUBzero©. The strategy behind HUBzero© started over two decades ago with nanoHUB filling the need for a framework enabling developers to integrate tools and simulations for nanotechnology easily in a web browser user interface. One of HUBzero©'s strategies since then is to extend the use of the framework for general use opening it up to a diversity of research domains and adding features for research and teaching in the framework. HUBzero@ applies cutting-edge and successful concepts and environments such as Jupyter, RStudio and shell environments in the user interface and give federated access to computing and data infrastructures.

Following the strategy of supporting cutting-edge concepts and embedding them into the framework, HUBzero© is always looking to streamline, simplify and remove barriers in doing collaborative research. To this end, HUBzero© is consistently evaluating new innovations as they appear on the technologic landscape.

One active element both from a technological perspective, but also on both a cultural and community standpoint is innovations in peer-to-peer (p2p) technologies. P2p technology allows computers (including desktops, mobiles, and laptops) to communicate directly without and intermediate server. This is extremely interesting not only from a privacy standpoint, but it also allows an additional level of resilience and natural pruning (the removal of incorrect or no longer relevant information) over traditional client-server architecture.

It has long been a requested feature by researchers using HUBzero© to simplify file and data sharing in a way that more naturally fits into a day-to-day workflow. HUBzero© recognized an opportunity to potentially fulfill this request via the leveraging of a decentralized data sharing network and protocol called "hypercore protocol" (formerly dat protocol). It allows files and folders to be accessible to any other peer with the proper read encryption keys, without having to upload the files or folders to a centralized server. HUBzero© can, of course, add additional resilience via "pinning services", effecting leveraging its own infrastructure as a participating peer as well, but it is not strictly necessary.

HUBzero© is working to integrate this functionality into its CMS system. HUBzero© projects are the means which researchers collaborate on the HUBzero© platform, providing an online location to gather and share resources, including datasets, images, PDFs, etc., to ultimately create publications with a title, abstract, authors and attached file assets content from the collaborative project. Ultimately submitting the publication via the publications component for an associated DOI (Digital Object Identifier).

Hubdrive is a downloadable executable application or app, and requires no formal technical expertise on behalf of the user. The Hubdrive p2p client application allows this collaboration to seamlessly fit into the researcher's workflow without having to visit the online website to manually upload files through a web form, but rather just save, drag, and modify files on a local desktop folder.

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