

An i2b2 Plugin for Installing Ontologies

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Introduction

Informatics for Integrating Biology and the Bedside (i2b2) is a widely used clinical data warehouse platform that enables users to query biomedical data using query ontologies¹. The ontologies consist of hierarchically organized concept codes, descriptive terms, and other information². In federated networks such as the Evolve to Next-Gen ACT (ENACT) network, i2b2 is widely used, and interoperability is enabled by a common ontology, such as the ACT ontology, which is installed at each site². To facilitate the distribution and deployment of ontologies, particularly across a large number of sites, we created the OntologyStore i2b2 plugin that enables easy downloading and installation of ontologies from a cloud-based library. This plugin simplifies the process and alleviates the tedium of manually importing ontologies into i2b2 database tables.

Description

The OntologyStore follows the i2b2 design pattern, with a cell (back-end) that supports a client-side plugin (front-end)³. The OntologyStore cell's functions are to retrieve a list of available ontologies from an Amazon Simple Storage Service (AWS S3) library, parse the json ontology description files to determine the location of the ontologies and related files, download the ontologies to a local system, and import the downloaded ontologies into an i2b2 database. The OntologyStore plugin provides a graphical user interface for viewing a list of available ontologies, selecting ontologies, and downloading and/or installing selected ontologies (see Figure 1).

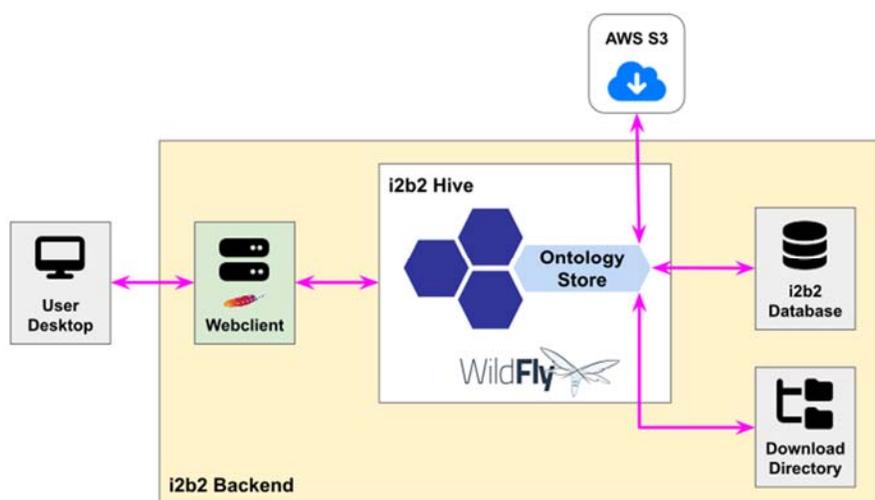


Figure 1. Architecture of the OntologyStore plugin.

includes domain ontologies, ontology indexes and adapter mapping files. The library cleanly separates each ontology into a package containing the components required to build an operational ontology that include files containing information for metadata, concept_dimension, table_access and schemes tables in i2b2. The plugin creates the necessary tables in the i2b2 database and populates the TABLE ACCESS, SCHEMES, and CONCEPT DIMENSION tables with the necessary data. The user-friendly interface provides ample feedback throughout the process and includes built-in guide rails to ensure that the user has appropriate privileges to install or overwrite existing ontologies.

Conclusion

Manually importing ontologies into i2b2 database tables can be cumbersome since several tables must be updated. With a single click, the OntologyStore plugin enables ontologies to be downloaded from the cloud and installed in the i2b2 platform. We plan to perform usability testing before deploying the plugin on the ENACT network for distributing the ACT ontologies that include ontologies for demographics, diagnoses, procedures, medications, laboratory test results, visit characteristics and COVID.

References

1. Murphy SN, Weber G, Mendis M, Gainer V, Chueh HC, Churchill S, et al. Serving the enterprise and beyond with informatics for integrating biology and the bedside (i2b2). JAMIA. 2010 Apr;17(2):124–30.
2. Visweswaran S, Becich MJ, D'Itri VS, Sendro ER, MacFadden D, Anderson NR, Allen KA, Ranganathan D, Murphy SN, Morrato EH, Pincus HA, Toto R, Firestein GS, Nadler LM, Reis SE. Accrual to Clinical Trials (ACT): a Clinical and Translational Science Award Consortium network. JAMIA Open. 2018 Oct; 1(2):147-152.
3. https://www.i2b2.org/software/projects/ontologymgmt/Ontology_Design_15.pdf (page 4)



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INTRODUCTION

Informatics for Integrating Biology and the Bedside (i2b2) is a widely used clinical data warehouse platform that enables users to query biomedical data using query ontologies¹. The ontologies consist of hierarchically organized concept codes, descriptive terms, and other information².

In federated networks such as the Evolve to Next-Gen ACT (ENACT) network, i2b2 is widely used, and interoperability is enabled by a common ontology, such as the ACT ontology, which is installed at each site³. To facilitate the distribution and deployment of ontologies, particularly across large number of sites, we created an i2b2 plugin, called OntologyStore, that enables easy downloading and installation of ontologies from a cloud-based library. This plugin simplifies the process and alleviates the tedium of manually importing ontologies into i2b2 database tables.

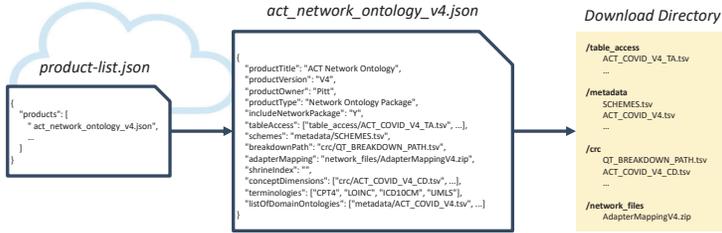


Figure 2- Ontology Description JSON File

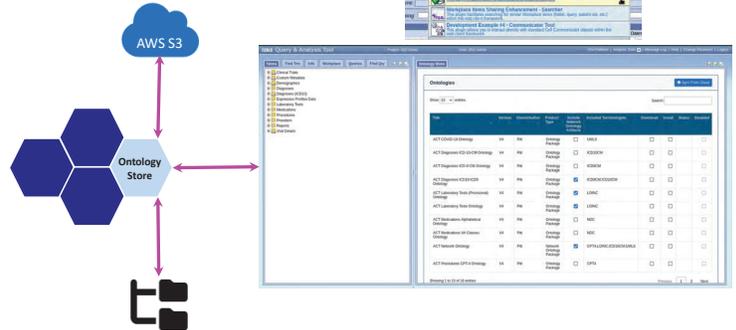


Figure 1 – OntologyStore Design

DESCRIPTION

The OntologyStore follows the i2b2 design pattern (see Figure 1), with a cell (back-end) that supports a client-side plugin (front-end)³.

The OntologyStore cell's functions are to retrieve a list of available ontologies (product-list.json) from an Amazon Simple Storage Service (AWS S3) library, parse the ontology description files (json files listed in the product-list.json) to determine the location of the ontologies and related files, download the ontologies to a local system, and import the downloaded ontologies into an i2b2 database (see Figure 2).

The OntologyStore plugin provides a graphical user interface for viewing a list of available ontologies from the cloud and for selecting ontologies for downloading and installing (see Figure 3).

Ontologies in the cloud library may include a single domain ontology (e.g., a diagnoses or procedures ontology), a collection of ontologies for multiple domains, such as the ACT ontology, or a network ontology, such as the SHRINE network ontology, which includes domain ontologies, ontology indexes and adapter mapping files.

The library cleanly separates each ontology into a package containing the components required to build an operational ontology that include files containing information for metadata, concept_dimension, table_access and schemas tables in i2b2. The plugin creates the necessary tables in the i2b2 database and populates the TABLE ACCESS, SCHEMES, and CONCEPT DIMENSION tables with the necessary data.

The user-friendly interface provides ample feedback throughout the process and includes built-in guide rails to ensure that the user has appropriate privileges to download and install ontologies.

CONCLUSION

Manually importing ontologies into i2b2 database tables can be cumbersome since several tables must be updated.

With a single click of a button, the OntologyStore plugin enables ontologies to be downloaded from the cloud and installed in the i2b2 platform. We plan to perform usability testing before deploying the plugin on the ENACT network for distributing the ACT ontologies that include ontologies for demographics, diagnoses, procedures, medications, laboratory test results, visit characteristics and COVID.

NEXT STEPS

- Improve the ontology download time by combining multiple files into a single file and compressing it to reduce download size.
- Add checksum to ontology packing to verify the integrity of a file.
- Group ontologies that have already been downloaded and installed into separate table.

BIBLIOGRAPHY

- Murphy SN, Weber G, Mendis M, Gainer V, Chueh HC, Churchill S, et al. Serving the enterprise and beyond with informatics for integrating biology and the bedside (i2b2). JAMIA. 2010 Apr;17(2):124-30.
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- https://www.i2b2.org/software/projects/ontologygmt/Ontology_Design_15.pdf (page 4)

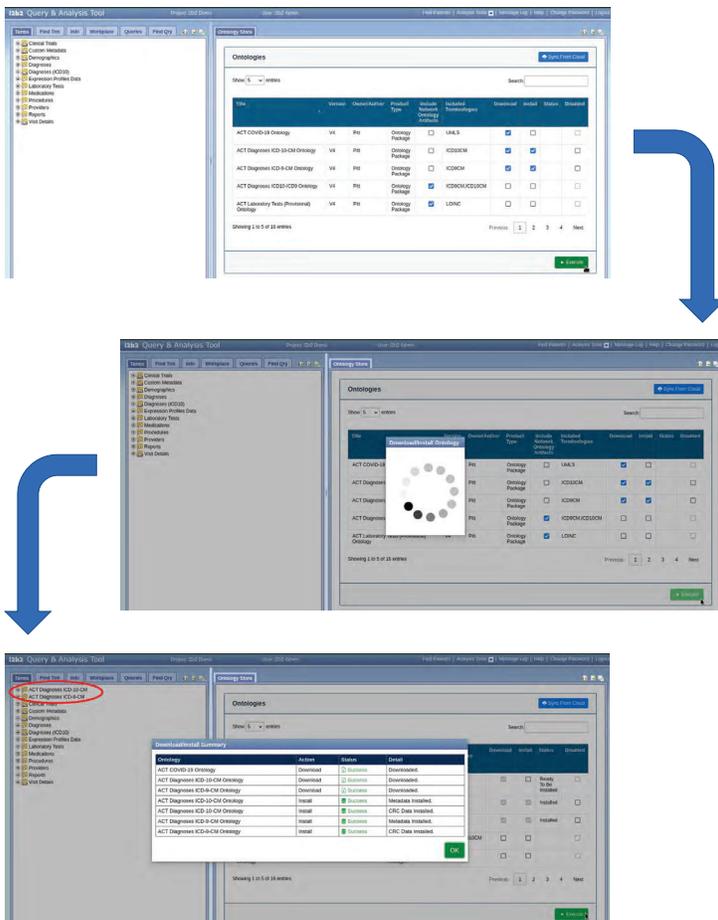


Figure 3- Process for Downloading and Installing Ontologies