Message Exchange between Independent Implementations of Servers in the Nexus-PORTAL-DOORS System

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Abstract. To search and summarize research on biomedical questions, reasoning agents require access to high-quality semantic markup. The Nexus-PORTAL-DOORS v1.0 API and message exchange format empower organizations to manage and share their own collections of lexical metadata and RDF descriptions of knowledge resources. In this systems demonstration, NPDS servers built on Microsoft's .NET framework distribute records to NPDS servers built on the MEAN solution stack for caching and distribution to clients.

Keywords: Nexus-PORTAL-DOORS System, semantic web, metadata management, distributed system, interoperability, knowledge engineering

1 The Nexus-PORTAL-DOORS System

Meta-analysis offers a potential solution to the problem of underpowered studies in neuroscience [1]. Semantic web technologies could facilitate meta-analysis, given adequate semantic markup, but must overcome the hazards of centralized repositories and of isolated silos [3]. To address these issues, Brain Health Alliance (BHA) is developing the Nexus-PORTAL-DOORS System (NPDS) for distributed metadata management. In this demonstration, we present NPDS specification version 1.0 and message exchange between servers implementing it in different solution stacks.

NPDS specifies a REST API and message exchange format by which diverse servers and clients can share metadata records about resources [4]. The API provides paths to request a record by URI or search a collection of records [5]. The message exchange format details correct usage of the required and permitted fields of a record from a DOORS directory (RDF description and resource location fields), PORTAL registry (other lexical metadata fields), or Nexus diristry (both) [5]. NPDS supports distributed storage using the Hierarchically Distributed Mobile Metadata architectural style [4]. A primary server maintains a master version of each record, which it may distribute to clients or secondary servers as requested [4]. This master version serves as the authoritative record by which to judge the integrity of cached copies, while the secondary

servers share the request load. A secondary server answers requests for a record with its cached copy if the copy has not exceeded its time-to-live. Otherwise, it retrieves, caches, and forwards a new copy from the primary server [4].

2 Microsoft and MEAN Stack Implementations

BHA first implemented PORTAL-DOORS v0.5 on Windows Server in C# in 2008 and continually updates this software as NPDS develops [6]. It stores records in Microsoft SQL Server, distributing complex fields across multiple tables and collecting them into a single object according to an Object-Relational Model. Live, public instances of this implementation include the biomedical Nexus diristries ManRay (nuclear medicine and radiotracers), BrainWatch (neuroscience and the brain), and SOLOMON (onset type in dementing neurodegenerative diseases) [7]. In this demonstration, these operate as primary servers.
In 2017, BHA has developed separate NPDS server software written in TypeScript v2.5 and transpiled to ECMAScript 5 to run in Node.js v4.5. As of 2017-10-11, Node.js does not fully ECMAScript 6. This implementation embeds complete serialized records in each MongoDB (v2.2) document for fast retrieval. It uses Express v4.15 to map NPDS API routes to controller method calls. To facilitate querying, the server extracts fields from XML NPDS records and adds them to the encapsulating MongoDB document with xml-js v1.5, a Node.js module that losslessly parses XML documents to JavaScript objects. Unit tests written with the Test Anything Protocol Engine v4.6 testing framework validate each module. In this demonstration, the MEAN stack NPDS servers function as secondary servers, though they implement the complete NPDS specification and can also serve as primary or stand-alone servers.

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