RP-SMARF: A Cloud-Based Platform for Research Collaboration on Smart Facilities Management

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EXTENDED ABSTRACT

The use of facilities with networked, embedded sensors, also known as "smart facilities", has been increasing as we approach the world of *Internet of Things* in which various sensor-equipped devices and systems are monitored and managed over networks. The Research Platform for Smart Facilities Management (RP-SMARF) is a cloud-based platform that allows researchers of smart facilities management techniques to access geographically dispersed computing and storage resources, data sets and tools which reside anywhere from anywhere without requiring that users package the data or software for distribution, maintain the software and provide remote support. RP-SMARF makes it easy for a researcher to invite other researchers to securely use his or her data or software tools which only need to run at the tool author's institution.

RP-SMARF is novel in its ability to unify disparate and distributed, privately-owned resources into a unified system for research collaboration. To the best of our knowledge this is the first cloud-based platform for supporting research collaboration in smart facilities management.

The two initial research projects using the RP-SMARF platform focus on (i) the management of smart structures such as sensor-equipped bridges and (i) the monitoring and management of smart aerospace machinery. Difficulties with sharing heterogeneous resources including data and software tools have been identified as significant impediments to research collaboration. RP-SMARF is designed to remove these impediments. With modest additional effort the RP-SMARF platform and services can be easily and quickly adapted to other research domains.

The key features of the platform are shown below.

Data Transfer: End-users can access any data on any repository and upload or download data as required. Data can also be easily transferred from any data repository or compute server to any other.

Metadata-based Searching: RP-SMARF allows metadata extraction tools to be associated with any dataset which then are run automatically to extract metadata from the dataset and then incorporate that metadata into the RP-SMARF system to allow effective searching using semantic web technology.

Simplified Tool Usage: RP-SMARF implements a Graphical User Interface (GUI) for tool setup which walks a user through the steps of configuring and running a tool on any dataset available in the RP-SMARF platform. Data selected for analysis is moved automatically to the compute node and results are automatically transferred to the specified data repository once the tool has finished running.

Support for Batch and Interactive Tools: "Batch" type tools process one or more data files specified by the user, producing output in files. "Interactive" type tools have a GUI, for example to visualize behavior described by the dataset specified. RP-SMARF supports the ability to run batch type tools as well as interactive type tools, allowing the user to interact with a Windows or Linux GUI-based tool via a web browser.

Streaming Data Transfer: The RP-SMARF system allows tool developers to feed real-time streaming data into any tool, remote or local, from a remote site allowing them to use remote equipment effectively.

Discovery Features: Elements in the system (e.g. tools and datasets) are organized into a hierarchy of communities. Users can then explore the elements which are associated with communities relevant to themselves and request access if required.

Authentication and Authorization: RP-SMARF authorizes users via the Canadian Access Federation using their host institutions' identity providers. Within RP-SMARF, resource and tool owners can authorize read, write and/or execute access to all data repositories and tools that they have contributed to the RP-SMARF platform.

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