SLOSH Provenance-Enabled Work Queue Framework

User Manual

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1. Introduction

The **S**ea, **L**ake and **O**verland **S**urges from **H**urricanes (SLOSH) model is a computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field, which drives the storm surge.

The SLOSH model consists of a set of physics equations which are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads, levees and other physical features.

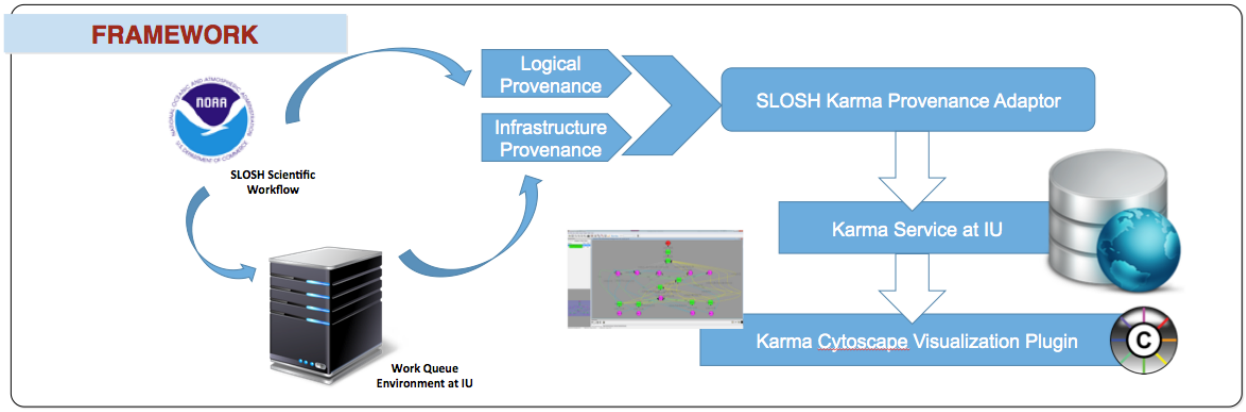
Work Queue is a framework for building large master-worker applications that span many computers including clusters, clouds, and grids. Work Queue applications are written in C, Perl, or Python using a simple API that allows users to define tasks, submit them to the queue, and wait for completion. Tasks are executed by a standard worker process that can run on any available machine. Each worker calls home to the master process, arranges for data transfer, and executes the tasks. The system handles a wide variety of failures, allowing for dynamically scalable and robust applications. Based on the Work Queue, we developed SLOSH on Work Queue framework to execute SLOSH scientific workflows in a highly distributed manner, which can handle massive scientific data input and multiple workflows.

SLOSH Karma is the provenance information collection tool that harvest provenance describing an experiment workflow from SLOSH on Work Queue framework, which is described above. The provenance data collected from the framework contains information including: application provenance describing how SLOSH modeling approaches are executed, metadata about input and output dataset and middleware provenance describing compute resource allocations and workload, etc. It can be used by researchers who need to create a global view of the SLOSH on Work Queue Framework on which they conduct their experiments.

2. Software Dependencies

2.1 Service dependencies

Figure 1 shows how SLOSH KARMA tool fits into SLOSH on Work Queue framework.



A SLOSH KARMA repository (KARMA server) is setup at Indiana University and available to users to process their experiment logs and to visualize the resulting annotated provenance graph.

2.2 Installation dependencies

The SLOSH Provenance-enable Work Queue Framework has the following dependencies:

1) Java Development Kit(JDK) V5 or later
   Available at: http://java.sun.com

2) KARMA Messaging Client Version 3.2.3 (for RabbitMQ karma Service Core configuration)
   Available at: http://sourceforge.net/projects/karmatool/files/v3.2.3/karma-v3.2.3-messaging-client-core.tar.gz/download

3) Apache Ant V1.6 or later
   Available at: http://ant.apache.org/

4) Cooperating Computing Tools (cctools)

   Available at: http://www3.nd.edu/~ccl/software/download.shtml

5) Python 2.7.6

   Available at: http://www.python.org/download/

3. Installing and Configuring the SLOSH on Work Queue Framework

1) Unzip the tar file:

Tar xvf SLOSHworkQueue.tar

2) Edit config/slosh.ini file:

vi config/slosh.ini

config/slosh.ini is used to configure the parameters about SLOSH on Work Queue framework such as input data and output data path, log path, etc.

workQueue_HOME	SLOSHworkQueue Directory
workQueue_TMP	Temp execution files path (deleted after execution)
trackFileSM	Track files summary file (default: hmi-total.txt)
noofTrackfile	Number of trk files as input of the SLOSH workflow
selectionCriteria	1 for top-down; 2 for bottom-top; 3 for random
outputFileName	Selected input trk files list (Default: selected-trackfiles.txt; Deleted after execution)
basinName	Selected input basin file
basinDirectoryName	Directory name for basin files
basinDirectoryPath	Directory path for basin files
trackFilePath	Track files directory path
sloshExecutablePath	SLOSH executable file path
tclExecutablePath	TCL script path(for merge phase)
outputPath	SLOSH modeling output path
mergePath	SLOSH merging output path
logPath	SLOSH and Work Queue logs output path
outputFile	Temp Work Queue execution file (deleted after execution)
noofWorkers	Number of Work Queue workers for execution

3) Edit slosh.makeflow file:

vi slosh.makeflow

config=	Path to slosh.ini file
workQueue_HOME	SLOSHworkQueue Directory
logPath	SLOSH and Work Queue logs output path

4. Installing and Configuring the SLOSH KARMA Adaptor

1) Unzip the tar file:

Tar xvf SLOSHKarma.tar

2) Edit the build.xml file:

vi build.xml

For tab <property name="karmaclient.dir" value="../KarmaClient"/>,

Please edit value to your local Karma Client path;

3) Build the SLOSH KARMA Adaptor:

ant build

4) Edit the Configuration File:

vi config.property

config.property is used to configure the connections from SLOSH KARMA Adaptor to SLOSH on Work Queue Framework and general workflow information such as time zone, etc..

master_log	Work Queue master node log path
worker_log	Work Queue worker nodes logs directory
merge_log	Work Queue merge phase log path
bsn_dir	SLOSH basin files directory
trk_dir	SLOSH track files directory
output_dir	SLOSH modeling output directory
merge_dir	SLOSH merging output directory
Karma_Properties	Karma properties file path
Log4j_Properties	Log4j properties file path
notification_dir	provenance notifications output directory
notification_delete	If delete notifications after sending to Karma server(on/off)
file_annotations	If capture input and output file

	metadata(on/off)
userDN	Specify user domain
Email	Specify user email
timeZone	Specify user time zone

5) Edit Shell-script

vi ./bin/SLOSHKarmaRun.sh

This shell script is used to invoke SLOSH KARMA adaptor to collect provenance information. Please edit the following lines to set up runtime environment.

JAVA_HOME	Your local JAVA home path
SLSOHKarma_HOME	Your local SLOSH KARMA Adaptor path
KarmaClient_HOME	Your local Karma Client Path

5. Viewing the Resulting Provenance Graph

To view a provenance graph enhanced with annotations from the SLOSH data, you can use the Karma Provenance Retrieval and Visualization Plug-ins (available at: http://pti.iu.edu/d2i/provenance_karma).

Instructions for installing the latest version of the Karma plug-ins for the Cytoscape visualization tool are also available at: http://pti.iu.edu/d2i/provenance_karma.