BEL Framework V1.2 Getting Started Guide

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Introduction

This document will help you get started installing and using the BEL Framework V1. The BEL Framework distribution contains several applications and utilities that you can use to create, publish, and use scientific facts formatted using the Biological Expression Language (BEL).

The BEL Framework V1 includes the following components:

- BEL Workbench
- BEL Framework Compiler/Assembler
- BEL Framework Tools
- BEL Framework API, and
- BEL Framework Web API.

Version Changes

There are no version changes associated with this document.

System Requirements

The BEL Framework application is programmed in Java 1.6 and requires a Java runtime environment of 1.6 or better to run. The BEL Framework has been tested and verified on the following systems:

- Windows XP/SP2, 2gb RAM
- Windows 7/SP1, 4gb RAM
- OS/X 10.6, 2gb RAM
- Linux (various), 4gb RAM

Memory Requirements

The above system configurations should be used as guidelines however actual memory requirements will vary depending on the size of the largest BEL Document being compiled and the options selected during the augmentation phase (Phase III) of the compiler/assembler process.

Disk Space Requirements

The BEL Framework installation requires a small amount of disk space (< 100 mb). When running however, some components may create many intermediate files and database tables and can require access to a much larger amount of disk space.

A rule of thumb for estimating the disk space requirements is to ensure that 10 times the size of the input BEL Documents is available.

Installation

This section describes how to obtain and install the BEL Framework V1.2.

Preparing for Installation

To prepare for installing the BEL Framework you should ensure that the following requirements are met:

- You can connect to the Internet
- You have Java 1.6.x loaded on your computer.
- You have at least 1GB available disk space. This is not all needed for the installation but would be needed when you start to run some of the BEL Framework tools.
- You have at least 2GB memory installed and at least 1GB free.

To check the current version of java, open a command window and type

```
$java –version
```

If java is installed on your system it should print out the version of the runtime environment.

```
java version "1.6.0_24"
Java(TM) SE Runtime Environment (build 1.6.0_24-b07-334-10M3326)
Java HotSpot(TM) 64-Bit Server VM (build 19.1-b02-334, mixed mode)
```

Downloading

The BEL Framework is distributed as a single archive (zip) file that can be downloaded from the BEL Portal (http://www.belframework.org).

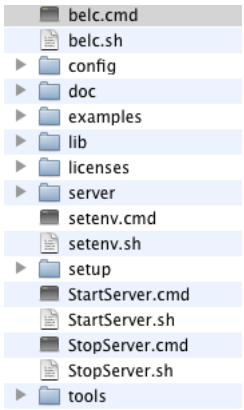
You will need to register and create an account on the BEL Portal and agree to the license in order to download the BEL Framework.

Installing

When the zip file has been downloaded you can simply un-compress the file. This will create a folder containing the BEL Framework distribution.

The Release Candidate version will unzip the contents to a folder named `BELFramework-1.0`.

The BEL Framework folder will contain a number of scripts and sub folders.



The BEL Framework is self-contained and can be moved to any location on your computer after it has been unzipped.

Understanding the BEL Framework Installation

The BEL Framework Installation contains several folders and utilities. The following table describes the top-level folder organization.

Item	Type	Description
belc.sh	Shell script	Shell script for running the Compiler/Assembler on Unix, OS/X and Linux systems.
belc.cmd	Windows Command File	Command file for running the Compiler/Assembler on Windows XP and Windows 7 systems.
config	Folder	Contains configuration files for the BEL Framework.
doc	Folder	Contains Java documentation for the BEL Framework API.
examples	Folder	Contains several example Java programs that illustrate using the BEL Framework API.
lib	Folder	Contains java libraries used by the BEL Framework tools.
licenses	Folder	Contains license agreements for the BEL Framework and third party components used by the BEL Framework tools.
server	Folder	Contains a copy of the Tomcat V6 that is used to run the BEL Workbench and BEL Framework Web API.
setenv.sh	Shell script	Shell script that is used to run the BEL Framework tools on Unix, OS/X and Linux systems.
Setup	Folder	Contains a set of subfolders one for each supported database. Each subfolder contains SQL DDL scripts for configuring the supported database.
setenv.cmd	Windows Command File	Windows Command File that is used to run the BEL Framework tools Windows XP and Windows 7 systems.
StartServer.sh	Shell script	Shell script that is used to start the Tomcat server on Unix, OS/X and Linux systems.
StopServer.sh	Shell script	Shell script that is used to stop the Tomcat server on Unix, OS/X and Linux systems.
StartServer.cmd	Windows Command File	Windows Command File that is used to start the Tomcat server on Windows XP and Windows 7 systems.
StopServer.cmd	Windows Command File	Windows Command File that is used to stop the Tomcat server on Windows XP and Windows 7 systems.
tools	Folder	Folder that contains additional utilities that are part of the BEL Framework distribution.

Getting Started

The BEL Framework tools are designed to work "out of the box". Once you have downloaded and unpacked the installation it should be ready to work. However, there are a few things you need to do first. This section will lead you through the steps necessary to get you started working with the BEL Framework tools.

Download Knowledge

First you need to find some knowledge in the form of BEL Documents to work against. The BEL Portal provides some publically available knowledge to get you started. You can download these BEL Documents from the `Downloads` section on the BEL Portal. You will need to register first and agree to the license agreement before you can download the content.

1. Download the small BEL Document named `small_corpus.bel` from the `Downloads` section on the BEL Portal This contains a small set of BEL Statements drawn from 57 PubMeds.
2. Create a folder on your computer and place the BEL document in it. For this tutorial, create a folder called `BELDocuments` on your computer and add the `small_corpus.bel` document to it.

Import a BEL Document

This version of the BEL Framework requires that the BEL Framework Document Store has been initialized before you can launch any of the server tools. To initialize the Document Store you must import a BEL Document.

To import a BEL Document:

1. Open a command window in the BEL Framework installation directory.
2. Run the DocStoreImport utility by entering the following command. This assumes that the BEL Document you downloaded is in a folder named `BELDocuments`.

```
./tools/DocstoreImport.sh --permissive [path]BELDocuments/small_corpus.bel
```

The `--permissive` switch allows the importer to continue to import even if there are any syntactic or semantic errors in the BEL Document.

The importer utility will create a local version of BEL Document Store database if it does not already exist and import the XBEL document after first performing syntax and semantic checks on the document and its contents.

```
$ ./tools/DocstoreImport.sh ~/Desktop/BELDocuments/small_corpus.bel

BEL Framework V1.0: BEL Document Import Utility
Copyright (c) 2011, Selventa. All Rights Reserved.


Validating BEL Document: ~/Desktop/BELDocuments/small_corpus.bel
```

3. If there were no errors, the Document Store database will be created and the BEL Document imported.

Start the BEL Framework Server

The BEL Framework server hosts the BEL Workbench and BEL Framework Web API applications. You must first start the server in order to access these applications.

Starting the Server

To start the BEL Framework Server:

1. Make sure you have at least one BEL Document imported to the Document Store.
2. Open a command window in the BEL Framework installation directory.
3. Run the StartServer script.

```
$ ./StartServer.sh
```

This will launch the Tomcat server that is provided with the distribution.

```
BEL Server successfully started at http://localhost:8080/
    BELWorkbench is available at http://localhost:8080/BELWorkbench
    WebAPI is available at http://localhost:8080/BELFrameworkWebAPI
```

Once the server has started, you will be able to access the BEL Workbench application.

Stopping the Server

Because the server has a live access to the Document Store database it is important that the server be correctly shutdown to avoid any possible corruption of the Document Store database.

To stop the server:

1. Open a command window in the BEL Framework installation directory.
2. Run the StopServer script.

```
$ ./StopServer.sh
```

This will terminate Tomcat server if it is running and gracefully shut down and database operations that are open.

```
Server is successfully stopped.
```

Once the server has been terminated, you will no longer be able to access the BEL Workbench application.

Access the BEL Workbench

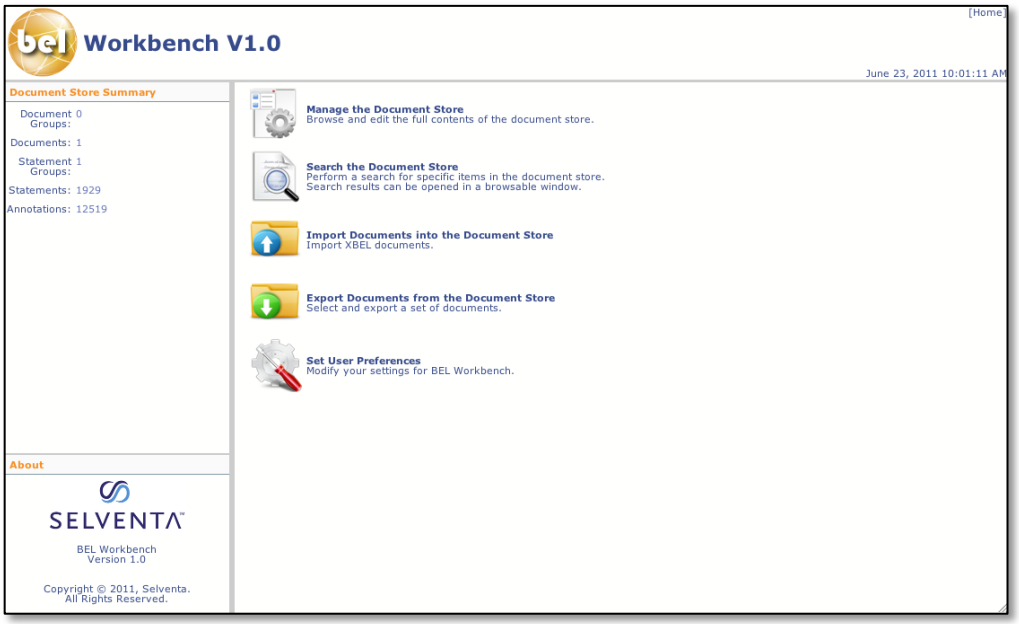
The BEL Workbench is a web-based application that allows you to create and manage BEL Documents in a Document Store. To access the BEL Workbench you must first start the BEL Framework server and then point a browser to the application end-point.

To access the BEL Workbench

1. Make sure you have at least one BEL Document imported to the Document Store.

2. Start the BEL Framework server.
3. Using a supported web browser, open a browser window and set the URL to

   `http://localhost:8080/BELWorkbench`
4. The BEL Workbench application will open in the browser.



Once the BEL Workbench is open you will be able to create new BEL Documents, edit existing BEL Documents.

Create a KAM

Knowledge Assembly Models (KAMs) are graphs representing biological networks that are compiled from one or more BEL Documents. KAMs are created by running the BEL Framework Compiler/Assembler utility.

To compile a BEL Document:

1. Ensure that one or more BEL Documents are available. You can compile documents stored on your or documents which are stored in a Document Store. This example will compile the `small_corpus.bel` document that has already been downloaded.
2. Open a command window in the BEL Framework installation directory.
3. Run the `belc.sh` script passing in the parameters to specify which BEL Documents to compile and the name of the KAM to create. This will start the multi-phase compiler/assembler and will create a KAM named `test`. We will use defaults for most of the operations but you can look at the BEL Framework Compiler/Assembler User Guide for a detailed description of all the command line options available.

```
$./belc.sh -f ~/Desktop/BELDocuments/small_corpus.bel -k test -d "Test KAM"
```

The compiler/assembler will start to run and provide a log of the phases and any warnings that are generated as the compiler works. The compiler will generate a lot of warnings from the nlp file.

```
BEL Framework V1.0: Compiler/Assembler
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    === Phase I: Compiling proto-networks ===
    Compiling 1 BEL Documents
        [WARNING]: SYMBOL WARNINGS in NLP Corpus Document (NLP Corpus
Document)
    reason: 98 invalid symbols
    symbol FGB, location http://download.belscripts.org/belframework/ns/mgi-
marker-symbols.belns

    (rows skipped)

[WARNING]: SEMANTIC FAILURE in NLP Corpus Document
    reason: 128 semantic warnings for document

    SEMANTIC WARNING in Parameter [namespace=Namespace [prefix=MGI,
resourceLocation=http://download.belscripts.org/belframework/ns/mgi-marker-
symbols.belns], value=CRP]
            reason: CRP does not exist in MGI:
http://download.belscripts.org/belframework/ns/mgi-marker-symbols.belns
    SEMANTIC WARNINGS
            reason: term failed semantic checks
            signature:
complexAbundance(F:biologicalProcess,F:proteinAbundance)moleculeAbundance
            function signatures: 2
                    the function argument is not valid for signature
complexAbundance(E:moleculeAbundance)moleculeAbundance
                    the function argument is not valid for signature
complexAbundance(F:abundance...)moleculeAbundance

    (rows skipped)

=== Phase Complete ===
    === Phase II: Merging proto-networks ===
    === Phase Complete ===
    === Phase III: Expansion and augmentation of composite network ===
    === Phase Complete ===
    === Phase IV: Exporting final network to the KAM Store ===
    === Phase Complete ===
```

Once the compiler has completed, the KAM will have been generated and available for use in the KAM Store.

Validate the KAM

The KAMs are designed for use only by the BEL Framework APIs. However there are several tools that can be used to check the KAM. The most useful tool for this version of the BEL Workbench is to export the KAM to XGMML so it can be visualized in Cytoscape or other similar applications.

Exporting the KAM to XGMML

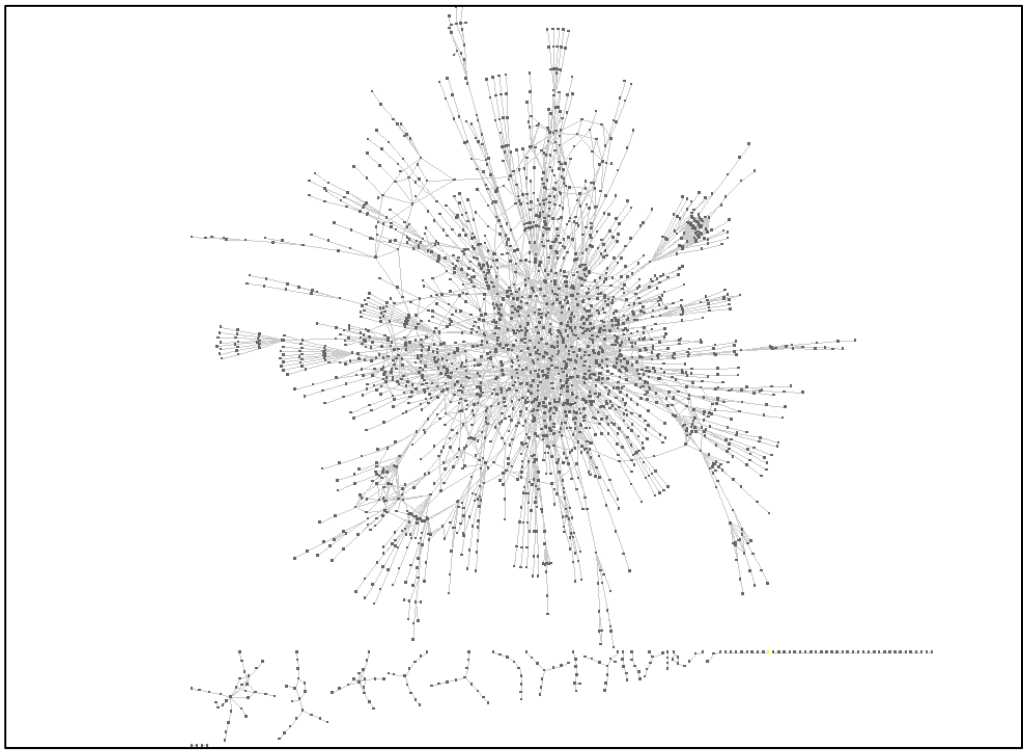
To compile a BEL Document:

1. Compile a KAM using the steps detailed above.
2. Open a command window in the BEL Framework installation directory.
3. Run the `KamExporter.sh` script passing in the parameters to specify which KAM to export and the file name to export it to. This will start the export utility.

```
$ ./tools/KamExporter.sh -k test -t XGMML -o test.xgmml
```

In this example the export utility will export the KAM named `test` to a file named `test.xgmml`.

Once the exporter has run, you should be able to launch Cytoscape and visualize the KAM.



Additional Information

This section provides additional information that might be helpful to you.

Obtaining Technical Support

Technical support is available by phone or email during normal business hours (8am to 5pm EST).

Email Support

Send an email to support@belframework.org. Please make sure to include your name, a phone number where you can be reached, and details about the issue.

Phone Support

Please call Selventa's technical support line at (617) 851-5273 during normal support hours.

Learning More About Selventa's Software and Services

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