CANARY Webinar: Connecting CANARY to Data Sources

CANARY Webinar #2

August 12, 2009

Sponsored by: U.S. EPA and Sandia National Laboratories

CANARY was developed through an InterAgency Agreement between the U.S. Environmental Protection Agency and Sandia National Laboratories. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Webinar Outline

- Background and resources
- CANARY run modes
- Generic database configuration
- EDDIES database configuration
- Q&A

CANARY Webinars

- Purpose of webinars is to answer all users' questions about CANARY.
  - Only mechanism for customer support
- Today's webinar focuses on how to connect CANARY to databases.
- First webinar focused on general overview and demonstration of CANARY.
  - You can find the first webinar presentation at: https://software.sandia.gov/trac/canary/downloader/download/category/6
- Next webinar topic based on your questions and feedback.

CANARY Resources

- The User Manual can be found at this site:
  http://www.epa.gov/nhsrc/water/teva.html

- The software can be downloaded under the Binaries section at:
  https://software.sandia.gov/trac/canary/downloader
  The first time CANARY is installed, you must download and run the full "setup-#.#.#.exe" file. Further updates can be installed by downloading and running the "update-#.#.#.#.exe" file.

- The source code can be found at:
  https://software.sandia.gov/trac/canary/downloader

- Software bugs and feature requests should be reported at:
  https://software.sandia.gov/trac/canary/newticket

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CANARY RUN MODES

On-line Run Mode Comparison

“EDDIES” mode

- Requires an “EDDIES” control mode
- Requires the use of an EDDIES database
- Parameters (SCADA signals and algorithms) must be defined both in EDDIES and in CANARY
- EDDIES handles I/O between EDS tool and the SCADA/HMI system

“RealTime” mode

- Requires “Internal” control mode
- Can use any database
- Connection to SCADA system must be set up manually
- Interpretation of CANARY results by SCADA system must be done by the SCADA/HMI contractor or database administrator

CANARY Configuration File

Input Tables

Output Tables

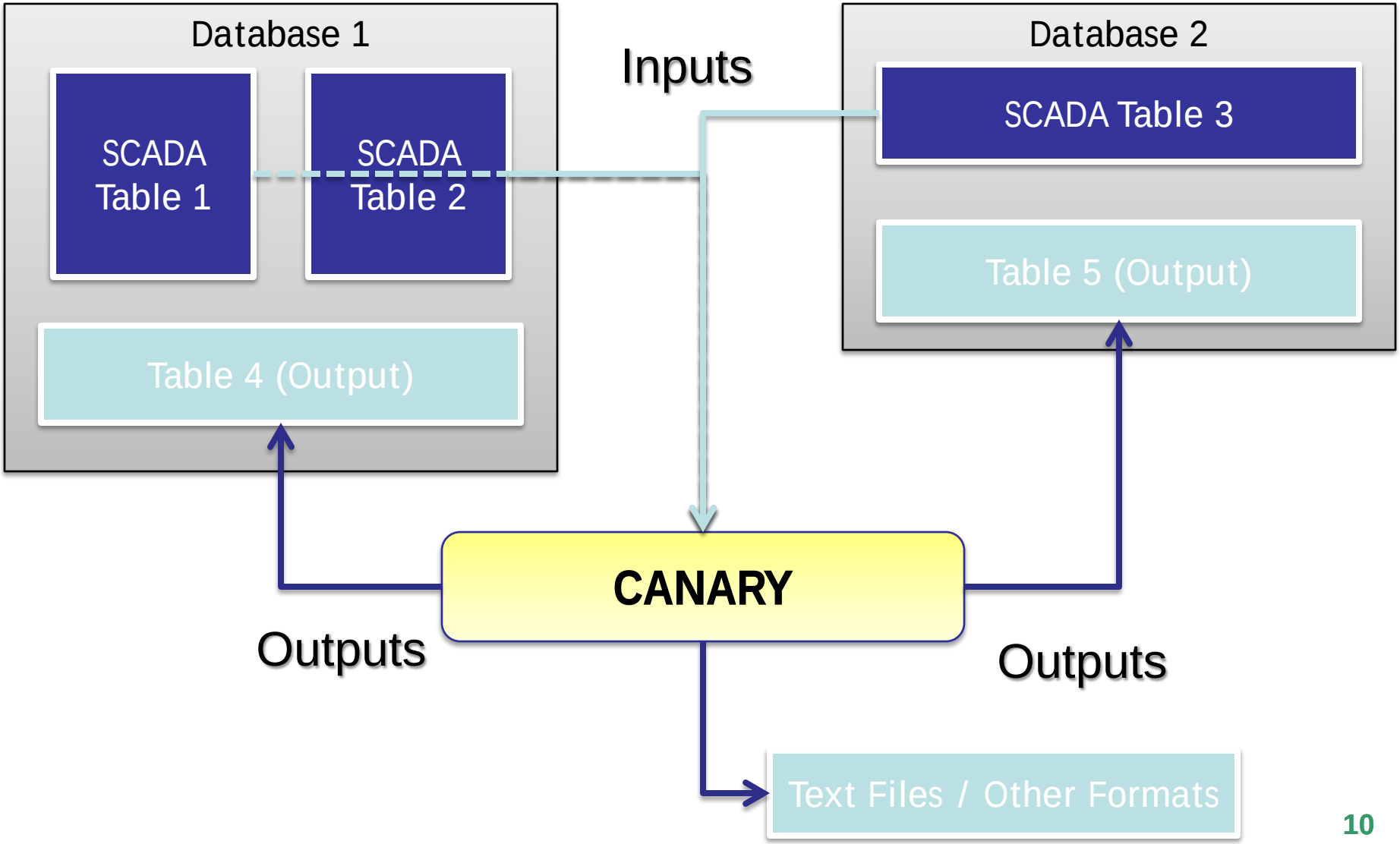
GENERIC DATABASE CONFIGURATION

Generic Databases

- Database connections are accomplished using Java connectors
  - All the major database vendors provide free Java connection drivers for their software
  - Installing the driver is usually as simple as unzipping a file into a directory, and including the location of the driver in CANARY's configuration file

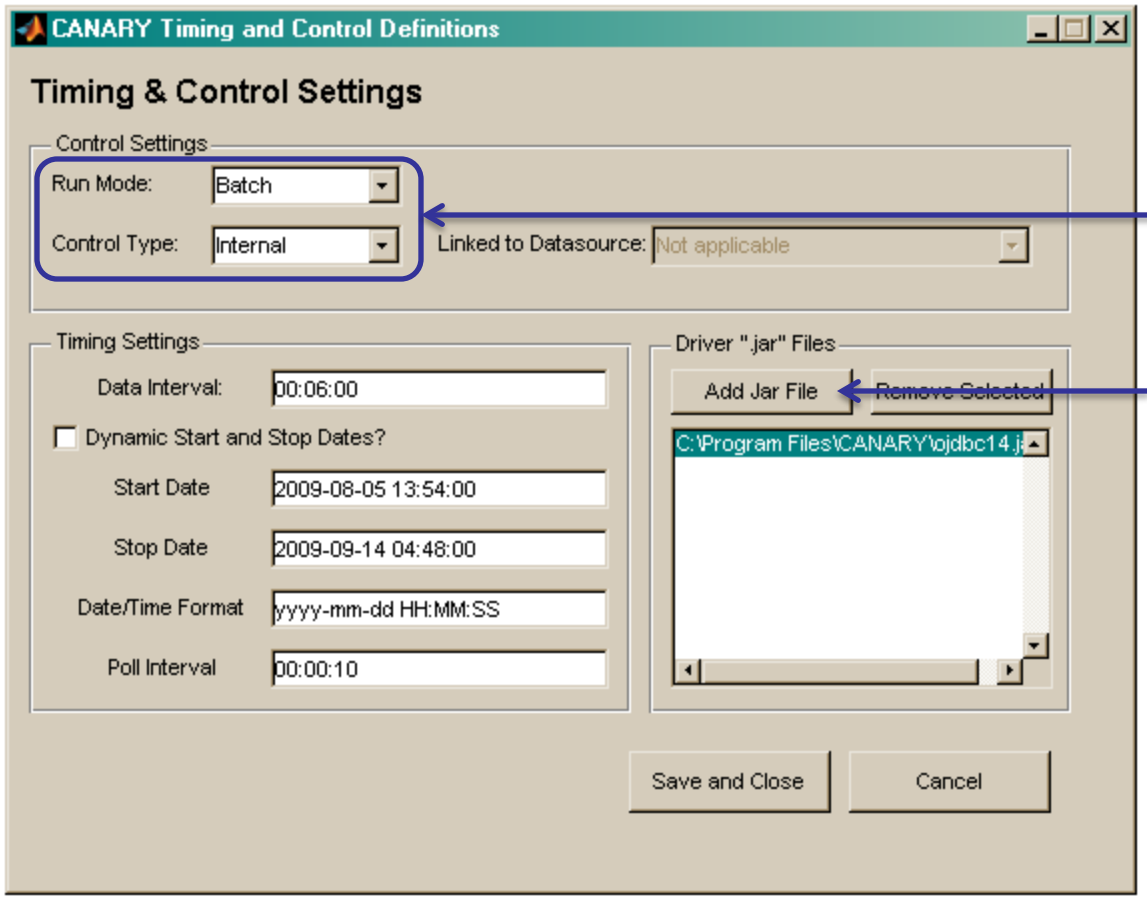
- The database will need to have a username and password that CANARY can use
  - Adding a separate CANARY user allows the SCADA database administrator (DBA) to set specific permissions for CANARY, such as permission to only read the SCADA tables but write to a CANARY table

Generic Database/CANARY Interaction



Generic Database Configuration

- To configure the driver, use the "Timing and Control Definitions" page in the CANARY configuration editor

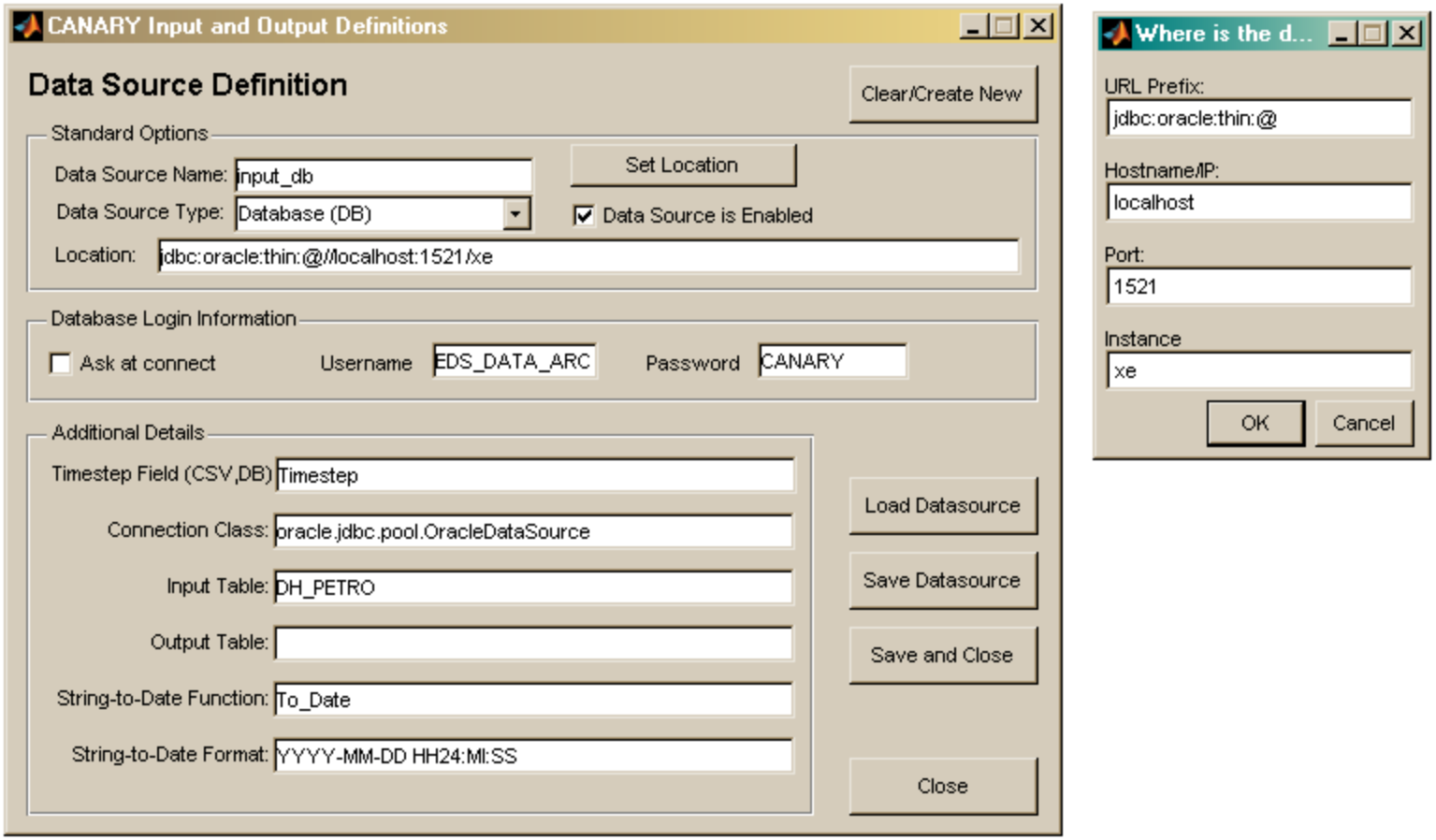


Make sure the run-mode is "**Batch**" or "**RealTime**" with a control type of "**Internal**"

Add the .jar file that came with the JDBC driver download for your database

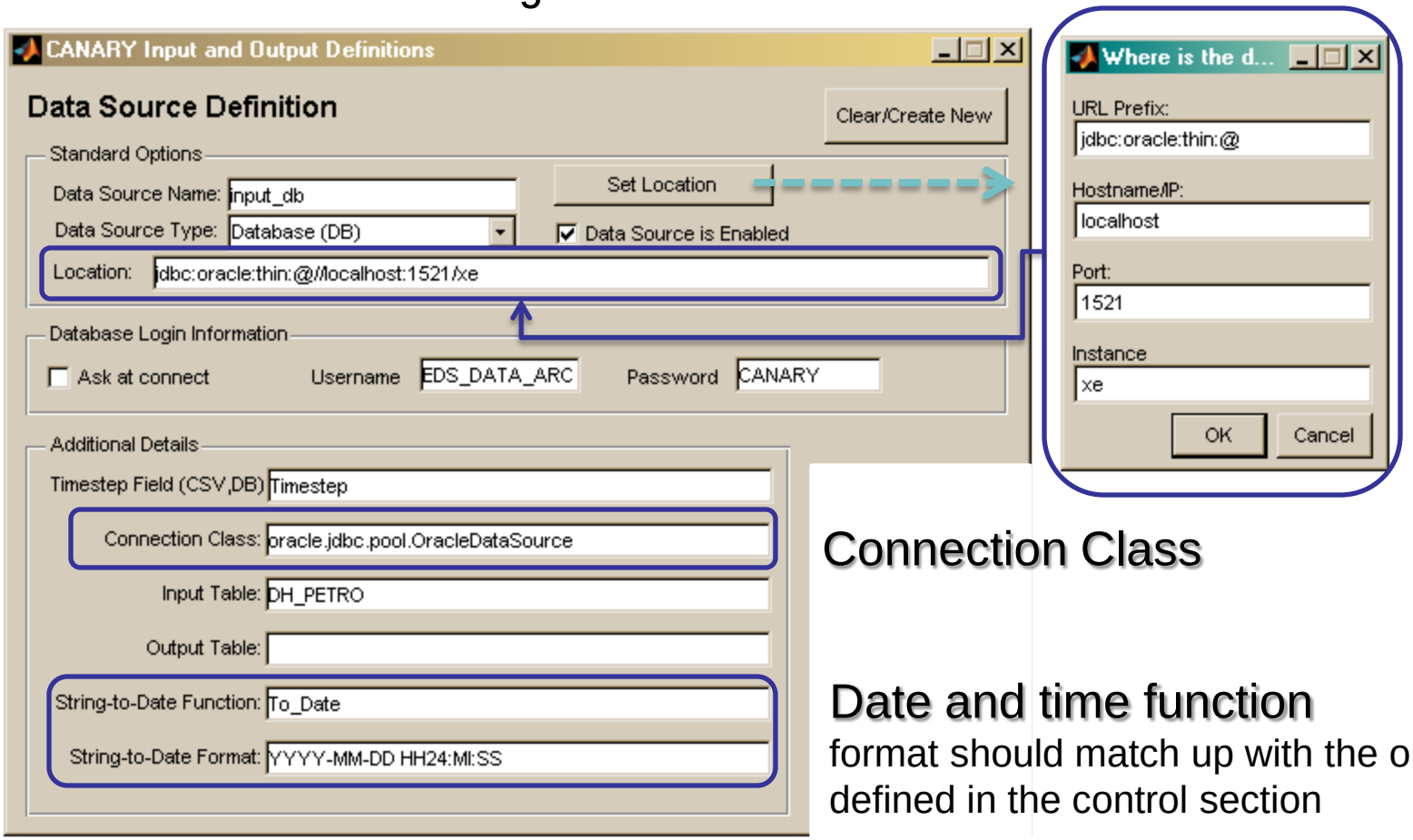
Generic Database Configuration

- The following is a graphic of the CANARY configuration editor screen setting up CANARY to use a generic database



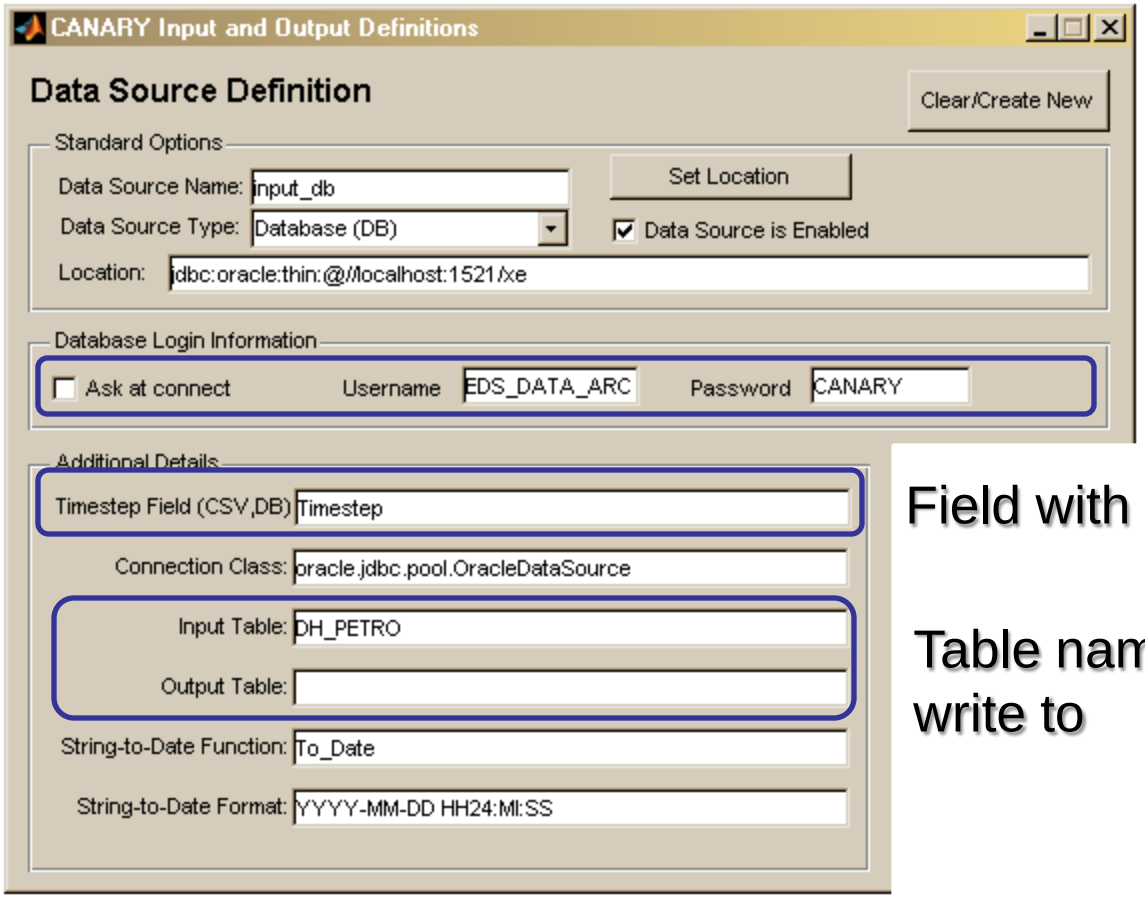
Generic Database Configuration

- The JDBC driver downloaded from the database vendor will specify how to set the following items:



Generic Database Configuration

- Your SCADA database administrator will specify the following:



User ID and password

Field with time stamp info

Table names to read from or write to

Generic Database Inputs

- CANARY reads from tables that are set up in the following manner, where the SCADA tags are mapped to field names

ID	TIME_STEP	C_TURB_VAL	C_CL2_VAL	C_PH_VAL	C_COND_VAL	C_TOC_A_VAL	C_TOC_B_VAL	C_TEMP_VAL	C_PRES_OP
1	03/13/2008 00:00:00	.406	.58	8.164	358.505	.647	888	23.012	16.323
2	03/13/2008 00:02:00	.409	.58	8.202	359.26801	.623	880	23.158	16.323
3	03/13/2008 00:04:00	.407	.58	8.17	359.26801	.621	880	23.121	16.323
4	03/13/2008 00:06:00	.408	.58	8.152	359.077	.609	885	22.46	16.296
5	03/13/2008 00:08:00	.409	.58	8.144	359.26801	.611	885	23.212	16.285
6	03/13/2008 00:10:00	.408	.58	8.168	358.505	.603	880	23.178	16.285
7	03/13/2008 00:12:00	.407	.58	8.197	359.26801	.608	880	23.238	16.285
8	03/13/2008 00:14:00	.406	.58	8.192	359.26801	.589	880	23.149	16.259
9	03/13/2008 00:16:00	.409	.58	8.147	358.505	.599	880	22.549	16.248
10	03/13/2008 00:18:00	.41	.58	8.153	358.505	.6	896	23.255	16.247
11	03/13/2008 00:20:00	.409	.58	8.157	359.26801	.602	896	23.287	16.247
12	03/13/2008 00:22:00	.406	.58	8.198	359.26801	.596	883	23.198	16.244

Generic Database Outputs

- Below is a screenshot showing the structure of the CANARY generic output table. If a table of the appropriate name does not exist, CANARY will try to create one.
  - TIME_STEP and LOCATION_ID form the primary index key
  - DETECTION_INDICATOR is the event code from CANARY
  - DETECTION_PROBABILITY is the [0..1] probability of an event
  - ANALYSIS_COMMENTS contains error text or warnings
  - CONTRIBUTING_PARAMETERS contains a list of outlying signals

```
1 SELECT * FROM _canary_output c;
```

TIME_STEP	LOCATION_ID	DETECTION_INDICATOR	DETECTION_PROBABILITY	ANALYSIS_COMMENTS	CONTRIBUTING_PARAMETERS
2009-08-06 10:52:00	TANK	2	0	Starting up by filling window	NULL
2009-08-06 10:54:00	TANK	2	0	Insufficient history, unable to predict	NULL

CANARY Configuration File

Input Table

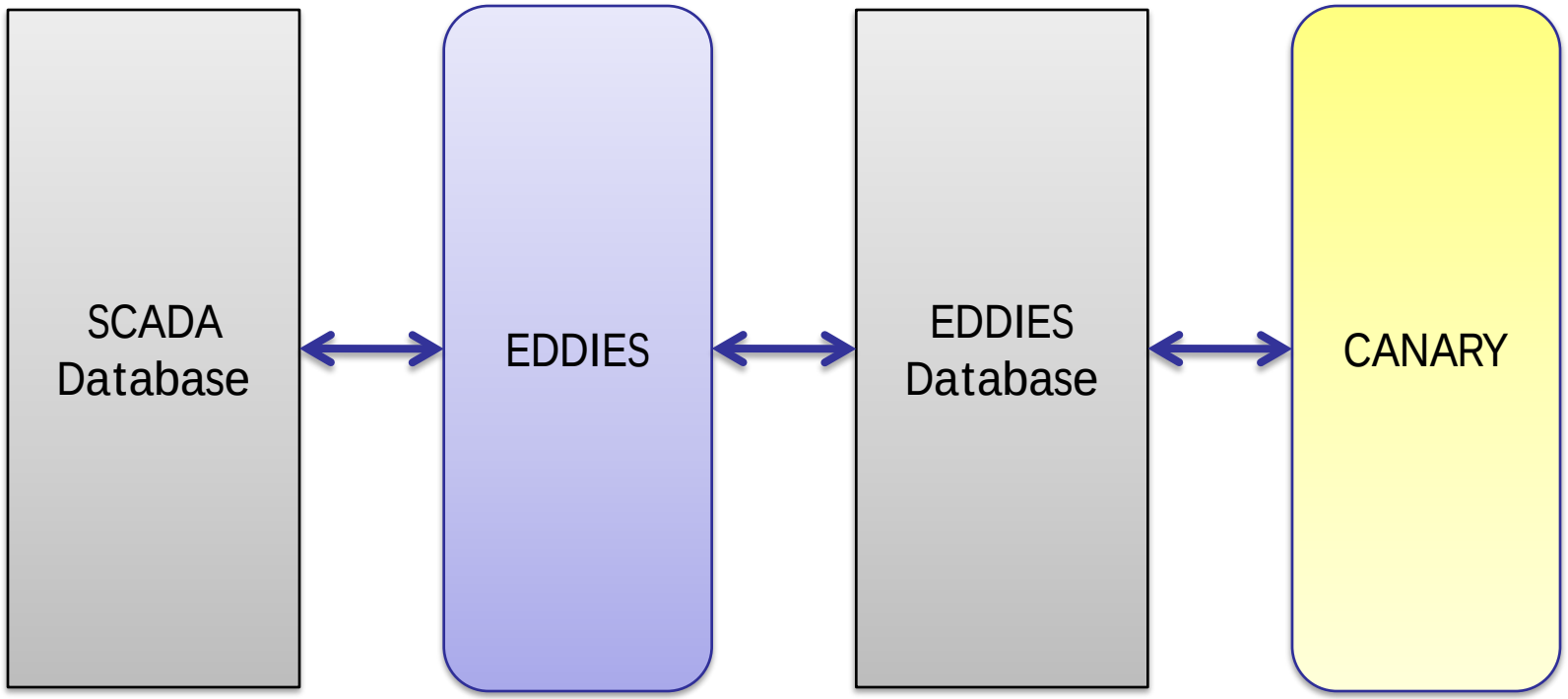
Output Table

Extending the Database

EDDIES DATABASE CONFIGURATION

EDDIES/CANARY Interaction

- The EPA's EDDIES software uses a separate database to insulate CANARY from the SCADA database.



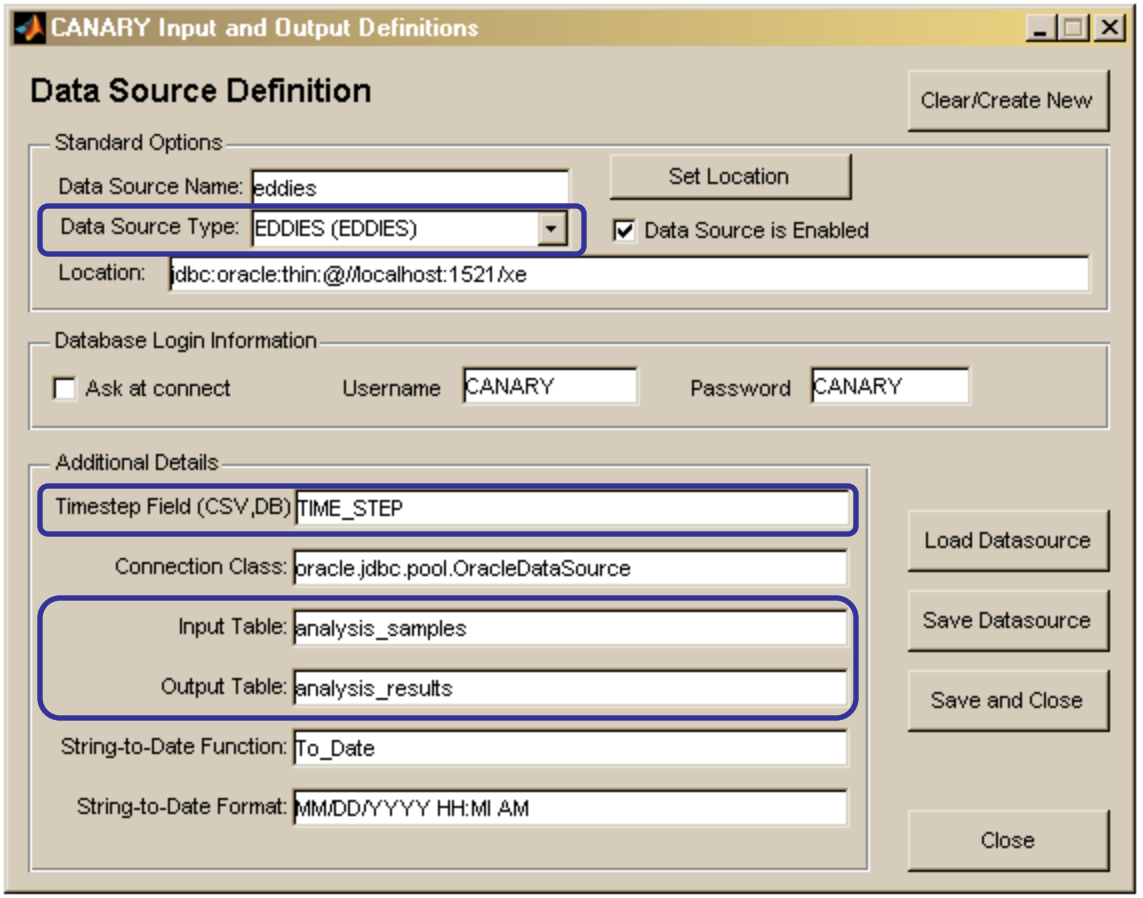
EDDIES/CANARY Configuration

- To configure CANARY to use EDDIES, there are a few changes that have to be made in the “Input & Output” configuration page

The data source type must be “EDDIES”

The time step field is “TIME_STEP”

The tables are named “ANALYSIS_SAMPLES” and “ANALYSIS_RESULTS”

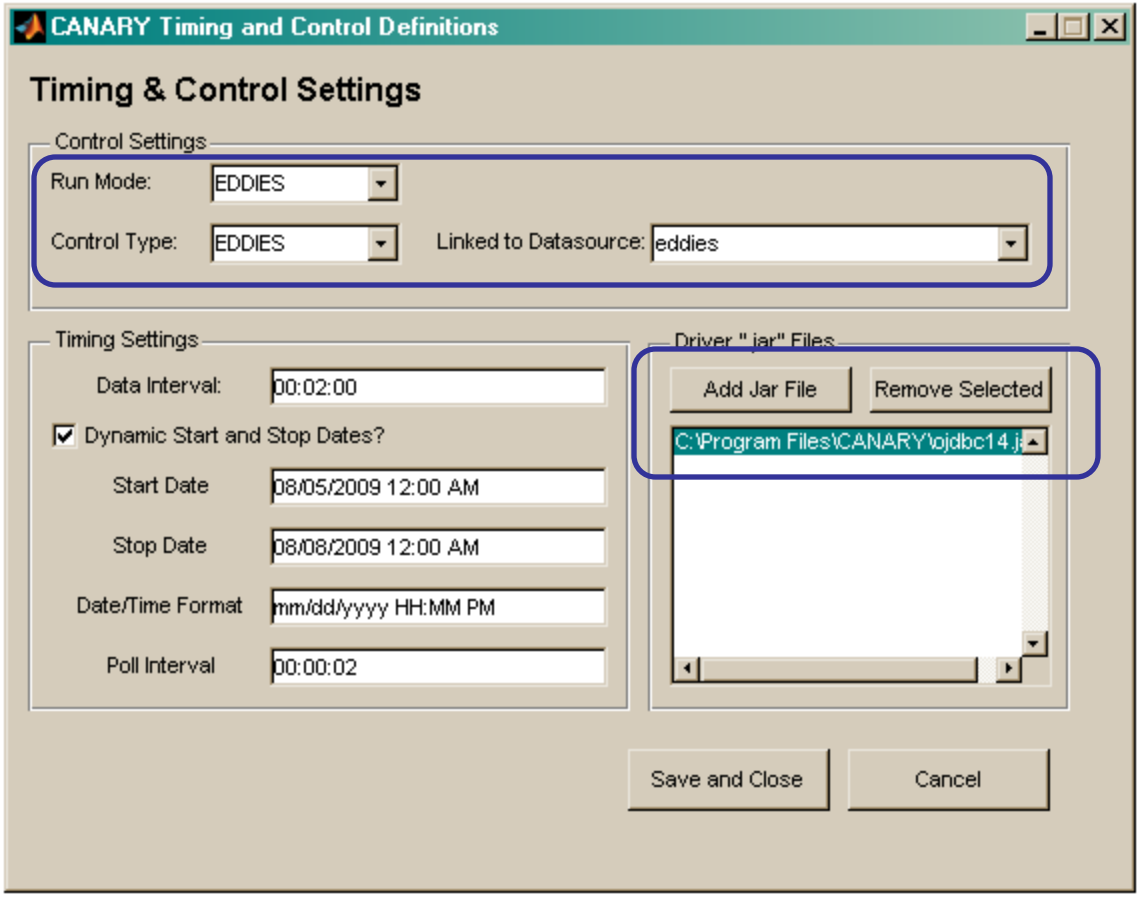


EDDIES/CANARY Configuration

- In CANARY's "Timing & Control Settings" page, the following must be correct:

Make sure that the run-mode is "EDDIES" and that the control type is also "EDDIES" and linked to the data source you created earlier

Don't forget to add the .jar file



EDDIES Inputs

- EDDIES uses an input format similar to the generic output table for input variables.
  - Each row in the table represents a single value for a single SCADA tag
  - EDDIES defines that a specific table (ANALYSIS_SAMPLES) be used

TIME_STEP	PARAMETER_ID		SAMPLE_VALUE	SAMPLE_QUALITY	EVENT_STATUS	RECEIPT_TIME
31-MAR-08	DST_CWS_	_H2OxYSI_COND_V	293	Normal	0	-
31-MAR-08	DST_CWS_	_H2OxYSI_ORPx_V	693	Normal	0	-
31-MAR-08	DST_CWS_	_H2OxYSI_TEMP_V	10.2	Normal	0	-
31-MAR-08	DST_CWS_	_H2OxYSI_TURB_V	0.08	Normal	0	-
31-MAR-08	DST_CWS_	_MON_UPSxON_ALM	1	Normal	0	-
31-MAR-08	DST_CWS_	_MONxSCAN_TOCx_ALM	0	Normal	0	-
31-MAR-08	DST_CWS_	_MONxSIEV_TOCx_ALM	1	Normal	0	-
31-MAR-08	DST_CWS_	_MONxUSF_CL2x_ALM	0	Normal	0	-

EDDIES Inputs

- If CANARY needs to connect to a database that is set up like the EDDIES input tables, it is possible to configure an "EDDIES" type data source for a non-EDDIES system
  - This allows CANARY to read an EDDIES style table in a generic "RealTime" mode
  - The table name *can* be changed
  - The field names *cannot* be changed, so the format must be exactly like the EDDIES table
- **However**,
  - Your DBA may be able to set up a view that will convert an existing table into something with the EDDIES field names without having to change the SCADA database or duplicate data

EDDIES Outputs

- The EDDIES output table is roughly the same as the generic database output table. However, the EDDIES database schema defines two stored procedures to add data to the tables.
  - CANARY must use the stored procedures to output to an "EDDIES" formatted data source
  - EDDIES stores the results in the "ANALYSIS_RESULTS" table
  - EDDIES stores the "Contributing Parameters" in a separate table, called "PARAMETER_TYPE_RESULTS"
  - All the tables should be created during EDDIES setup

The CANARY FAQ is available at
https://software.sandia.gov/trac/canary

Answers to today's questions will be added soon

Q & A

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