TDI v7

Tivoli Directory Integrator v7

Workshop

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Version 1.1
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Directory Integration

- Meta-directory products
- The integration task
  - Extract data
  - Reformat
  - Enrich
  - Synchronise
  - Report
- Not just 'directories'

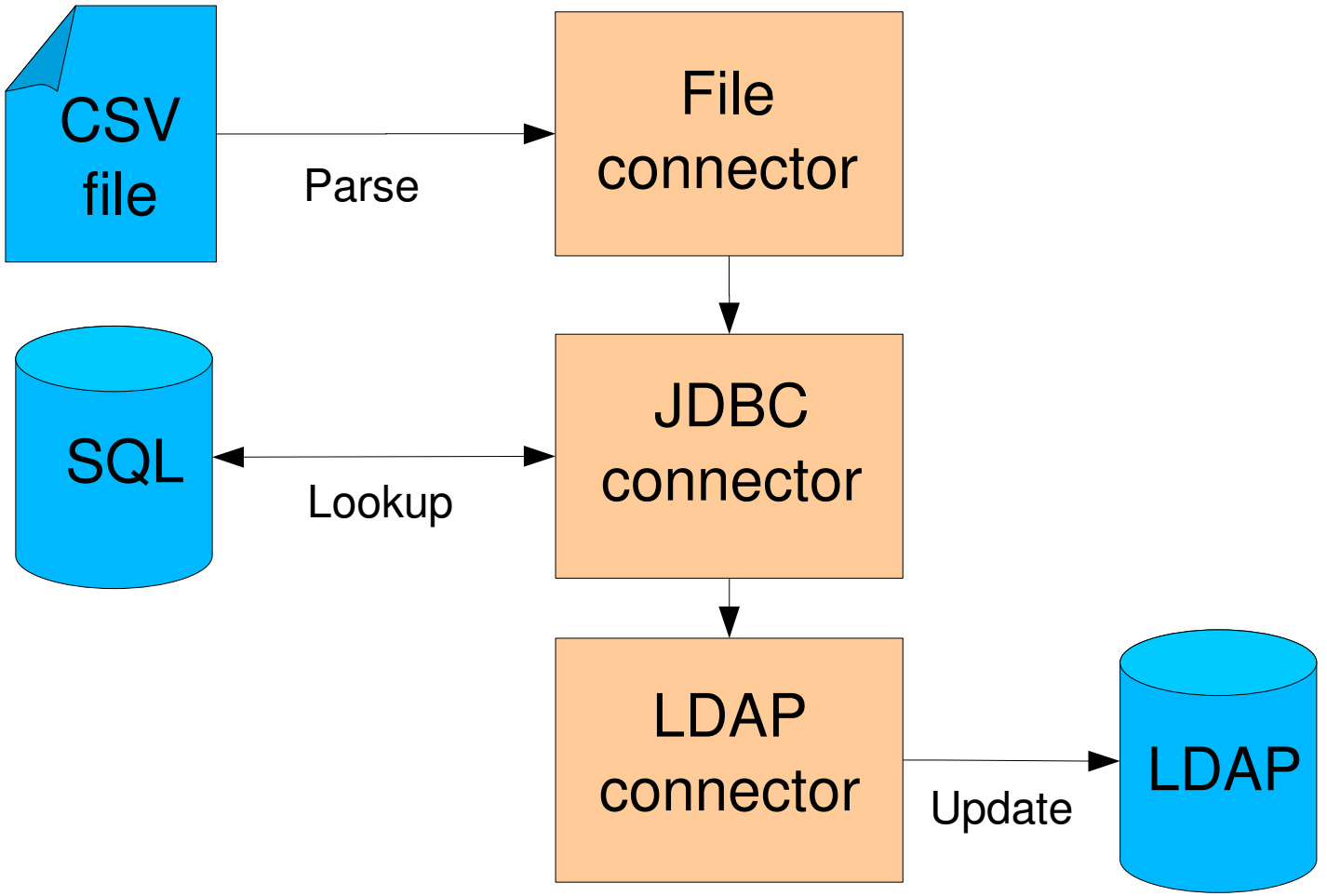
TDI Overview

- Toolkit – not 'solution' – choose your own architecture
- Data flows
  - Flow modelled by Assembly Line
  - Connectors for data stores
  - Maps and scripts for data conversion
- Multi platform (Java)
- Separate Config Editor and Runtime

TDI Data Model

- Process one entry at a time
- No fixed relationship between entries
- Entries are not named
- The Work Object – like an LDAP entry
  - Named attributes
  - Zero or more values per attribute
  - Values can be of any type

Assembly Line



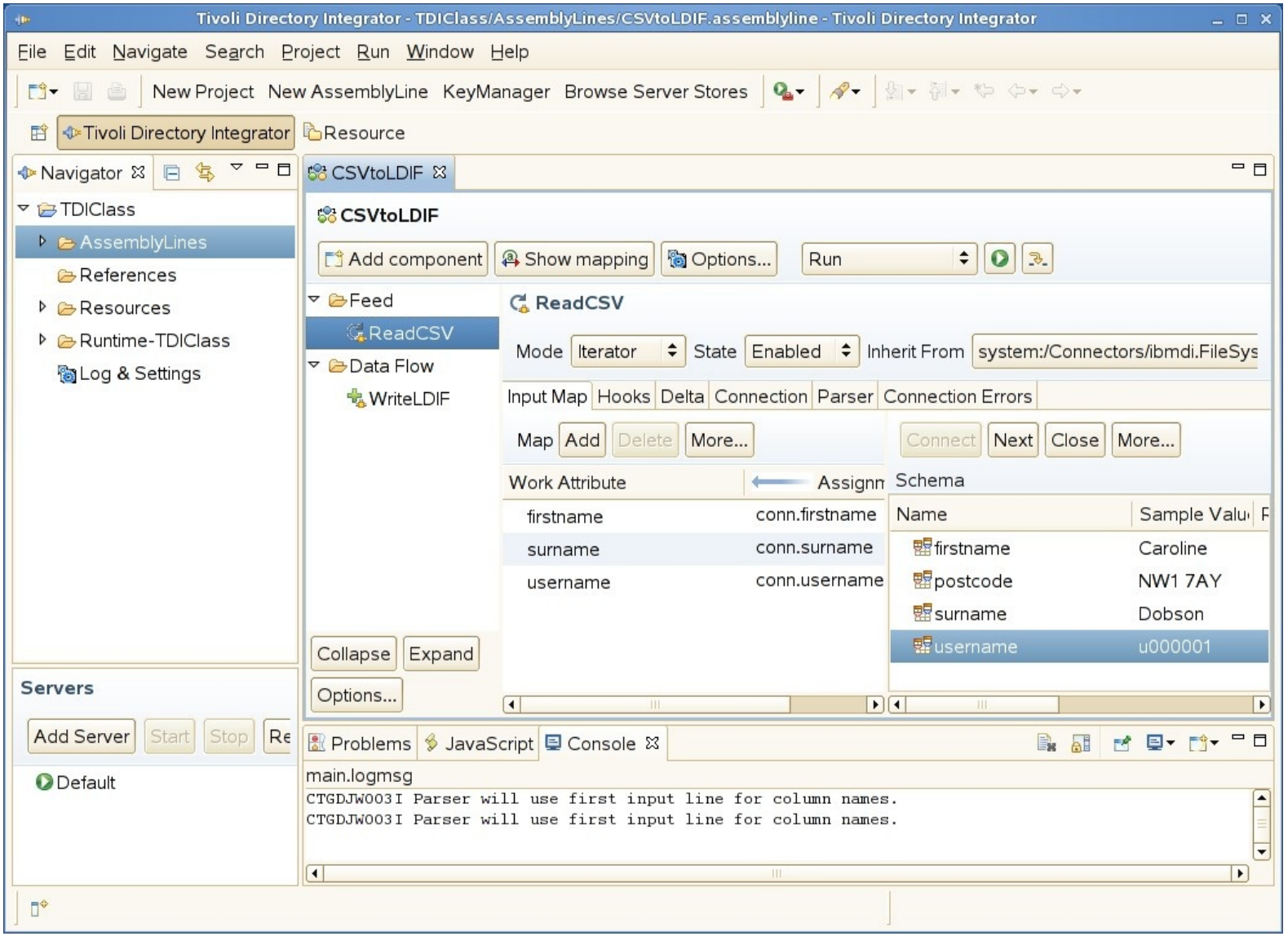
In the Toolbox

- Connectors
- Parsers
- Maps
- Scripts
- Loops
- Branches

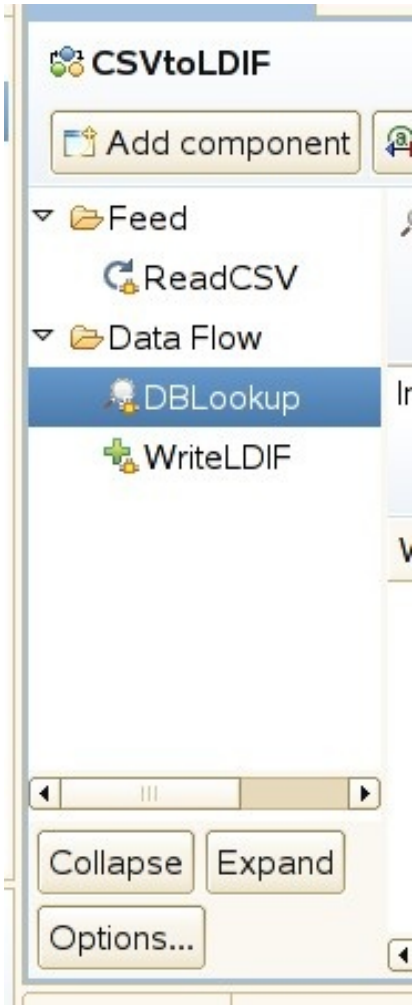
TDI Architecture

- Configuration Editor
  - Eclipse GUI
  - Works with code repositories
  - Drag-n-drop components
  - Extendable
  - Writes XML file for runtime
- Runtime
  - Small, multi-platform, extendable

The Config Editor

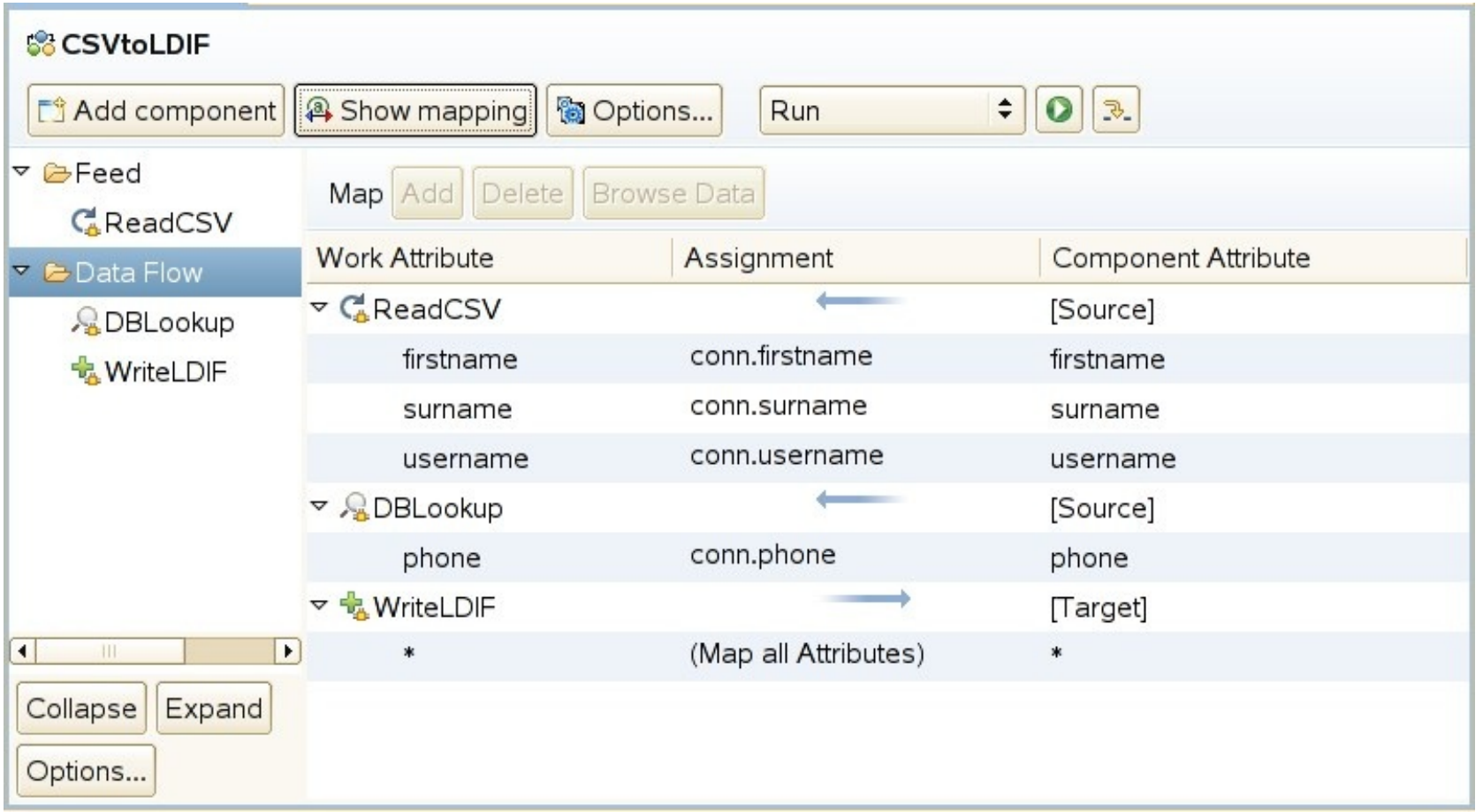


Assembly Line View



- Can expand items
- Drag things up and down
- Add and delete

Show Mapping



Installing TDI

- Installable components
- Code and Data areas
- Solution Directory
- Workspace Directory
- Differences between OS platforms
- Extras in the Identity Edition

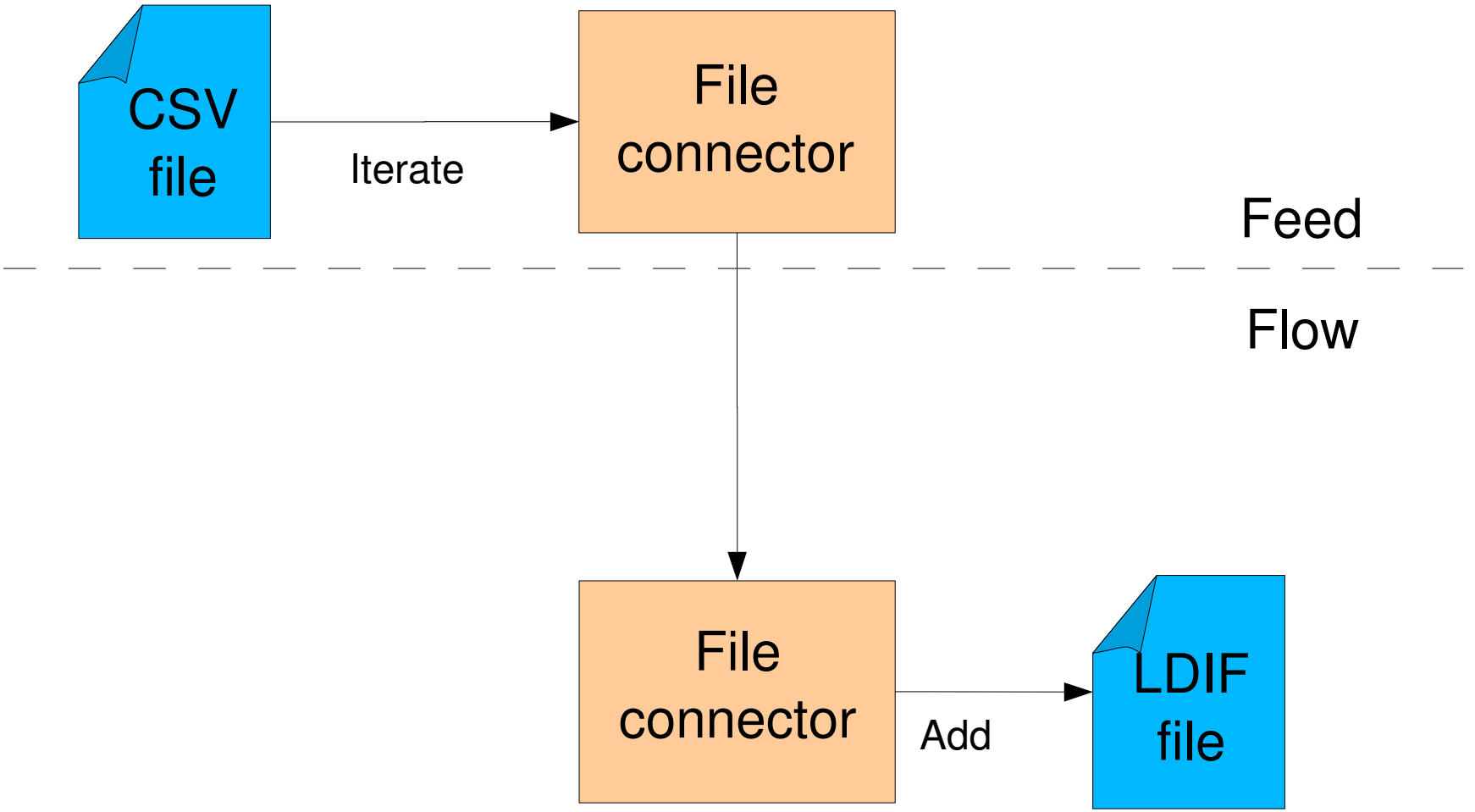
The workshop environment

- VMWare
- SuSE Linux: SLES 10 eval
- *student* account
- TDI v7.1 Identity Edition eval
- Datafiles
- MySQL database
- LDAP servers

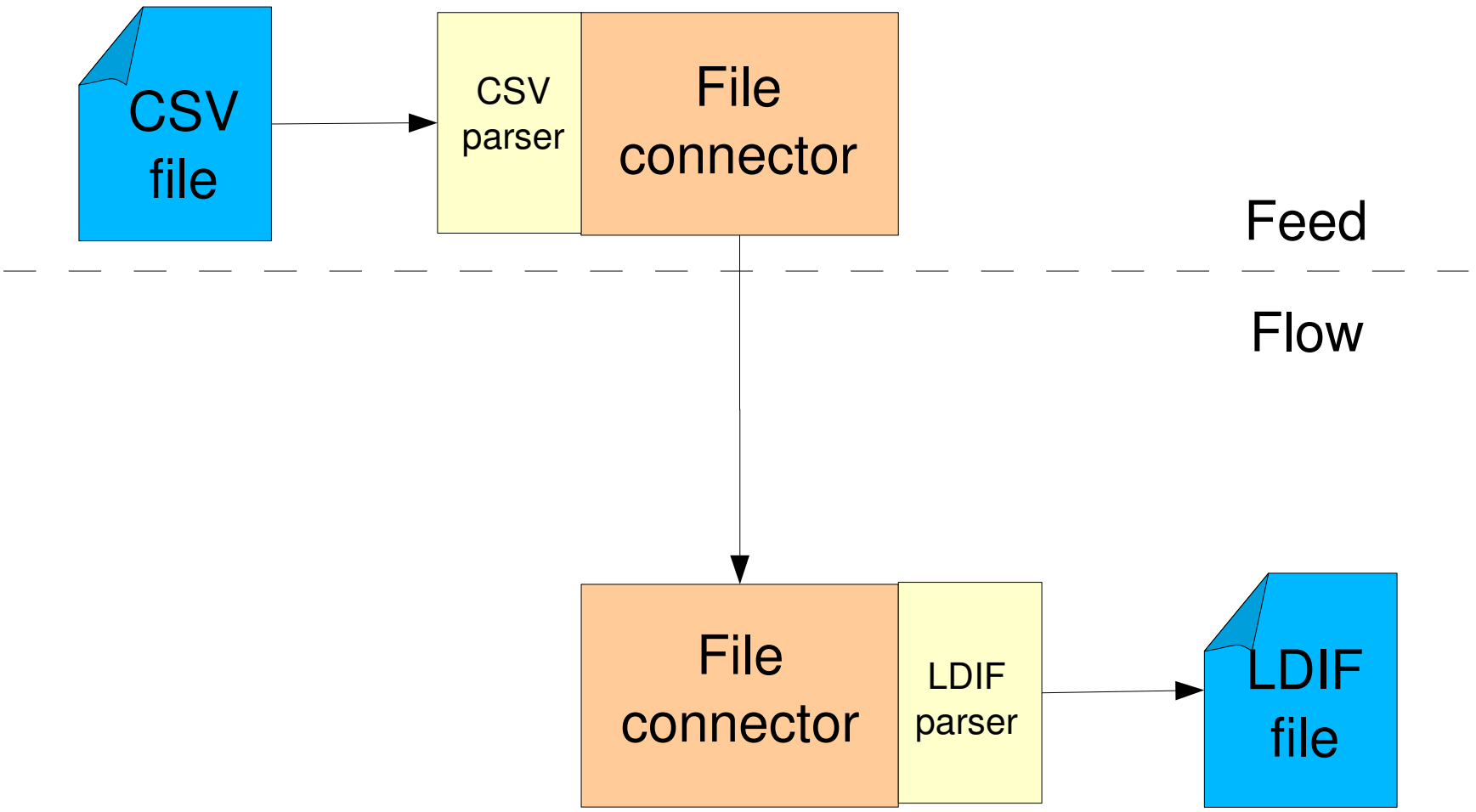
Exercises 1,2,3

- Login and explore
- Install TDI
- Start the Config Editor

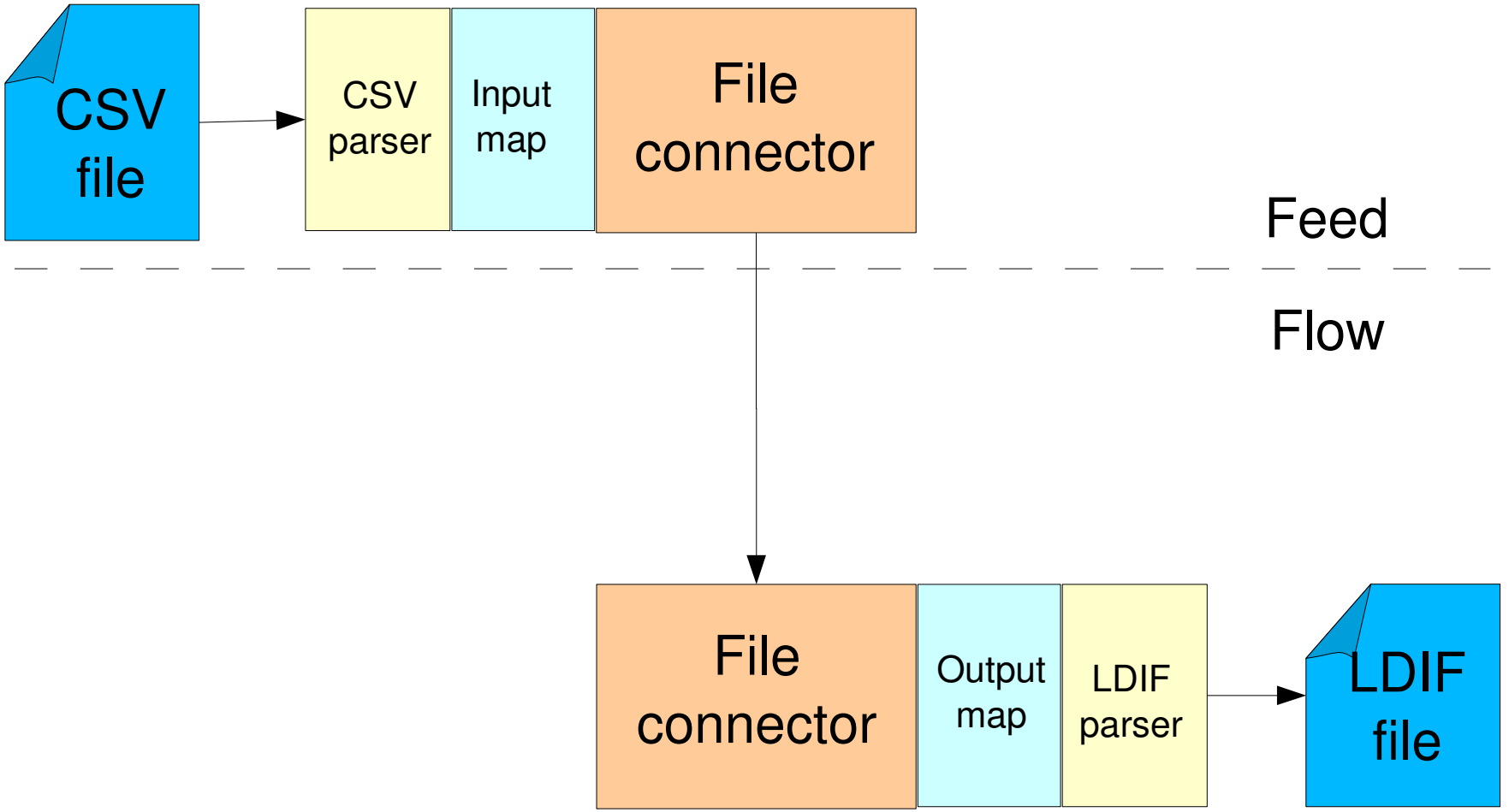
A Simple Assembly Line



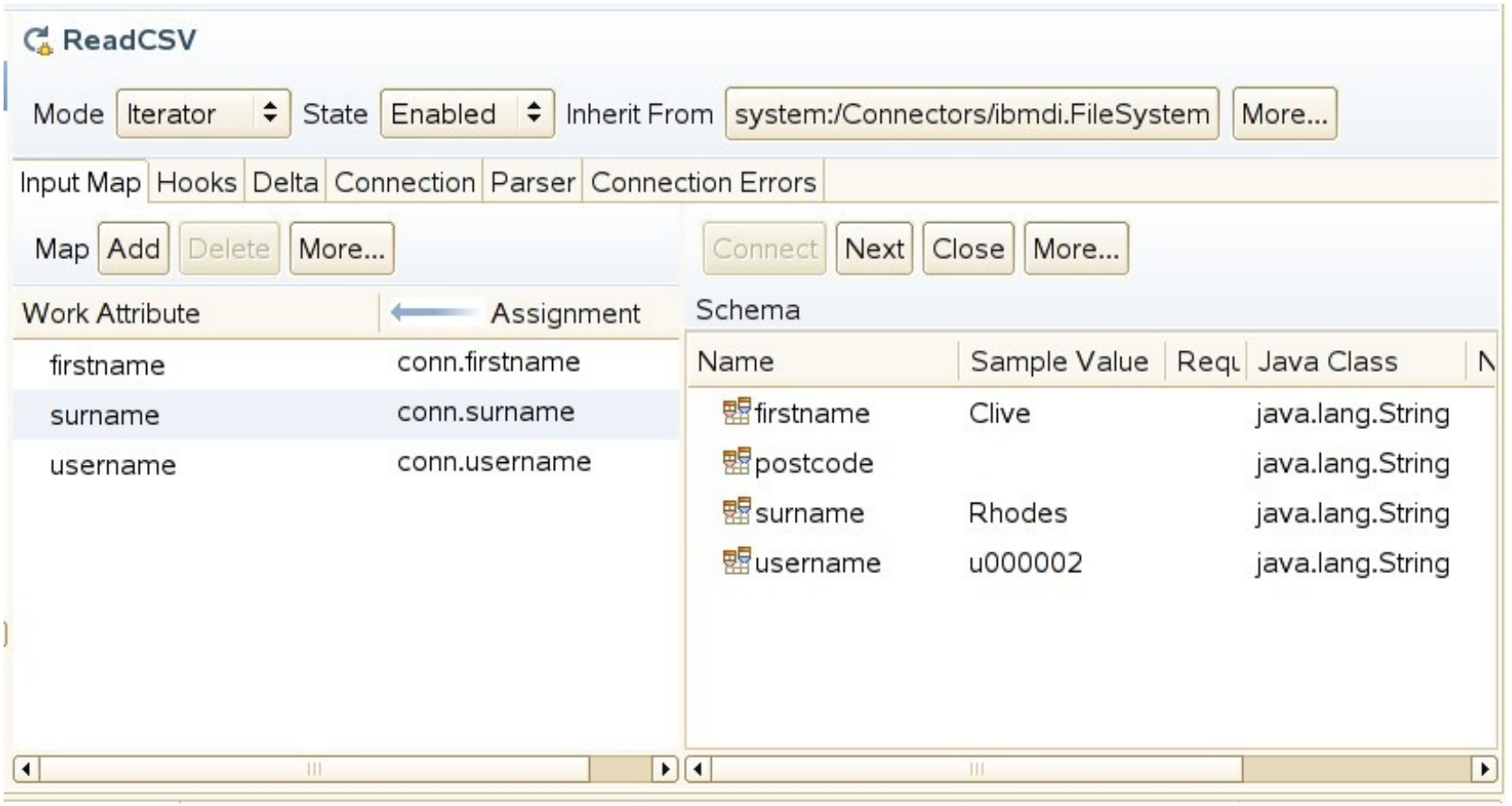
Parsers



Input and Output Maps



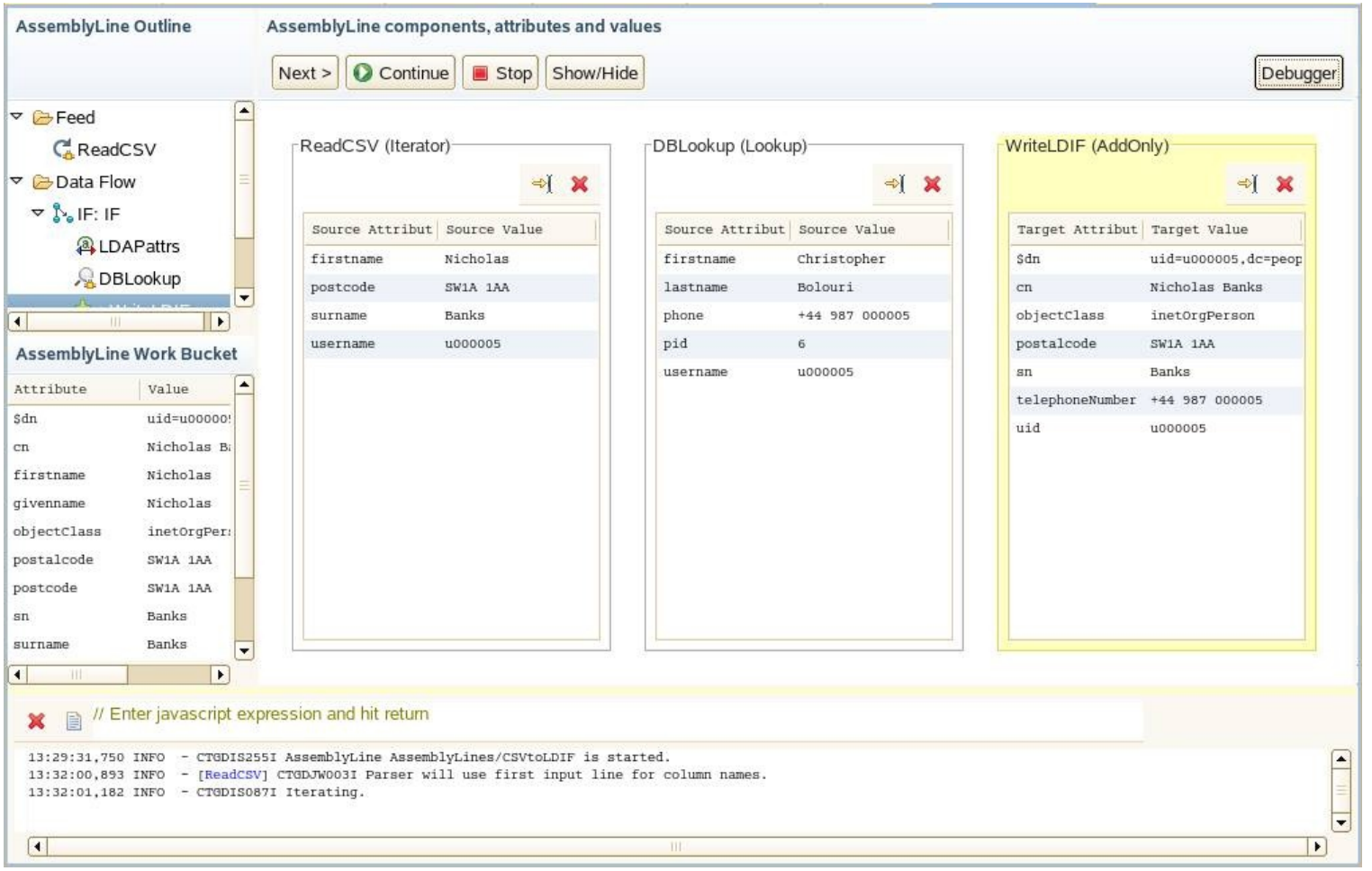
Input Map and Schema Discovery



Exercise 4

- Create an Assembly Line
- Read CSV file
- Write LDIF file

Data Stepper



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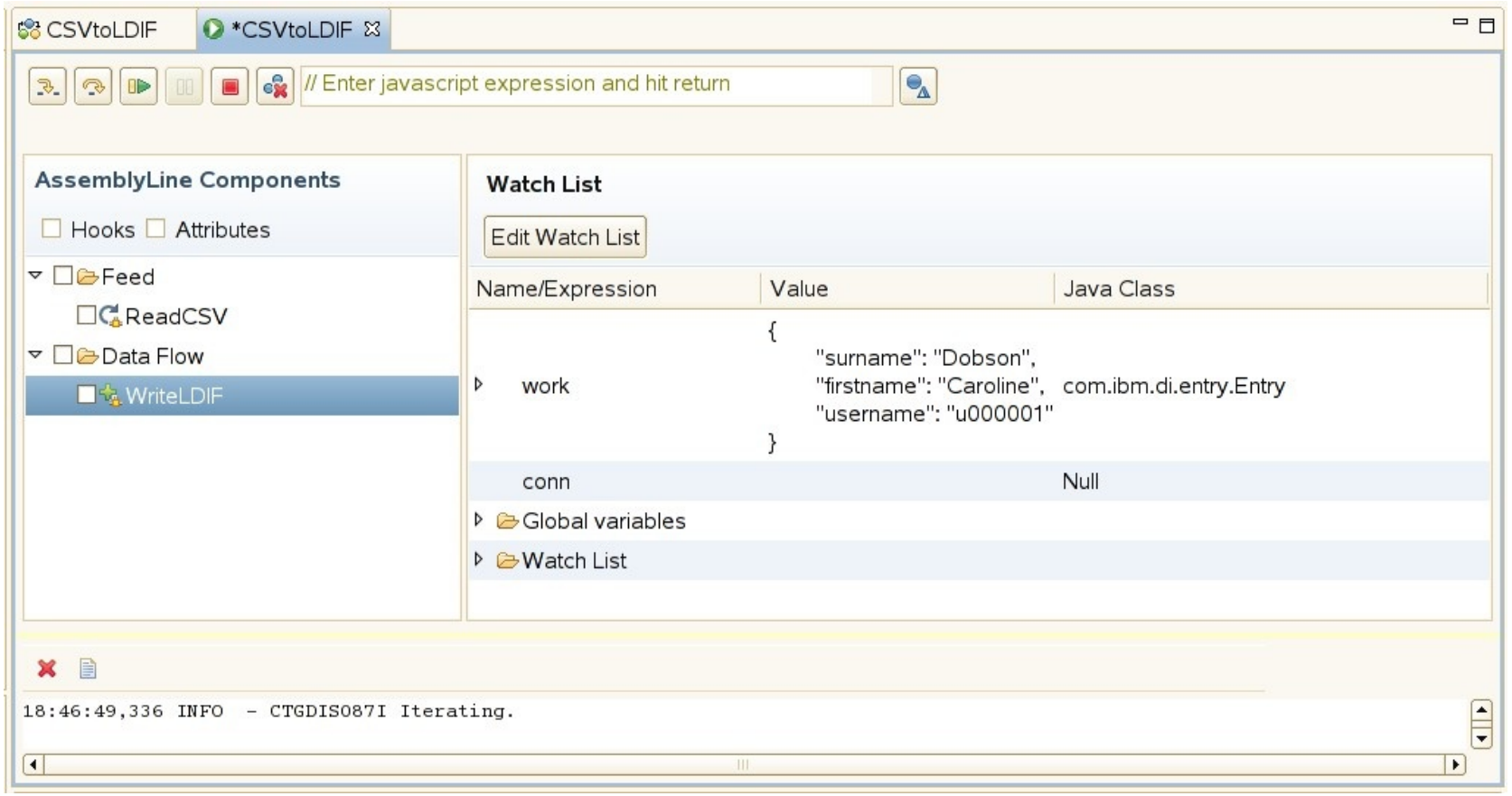
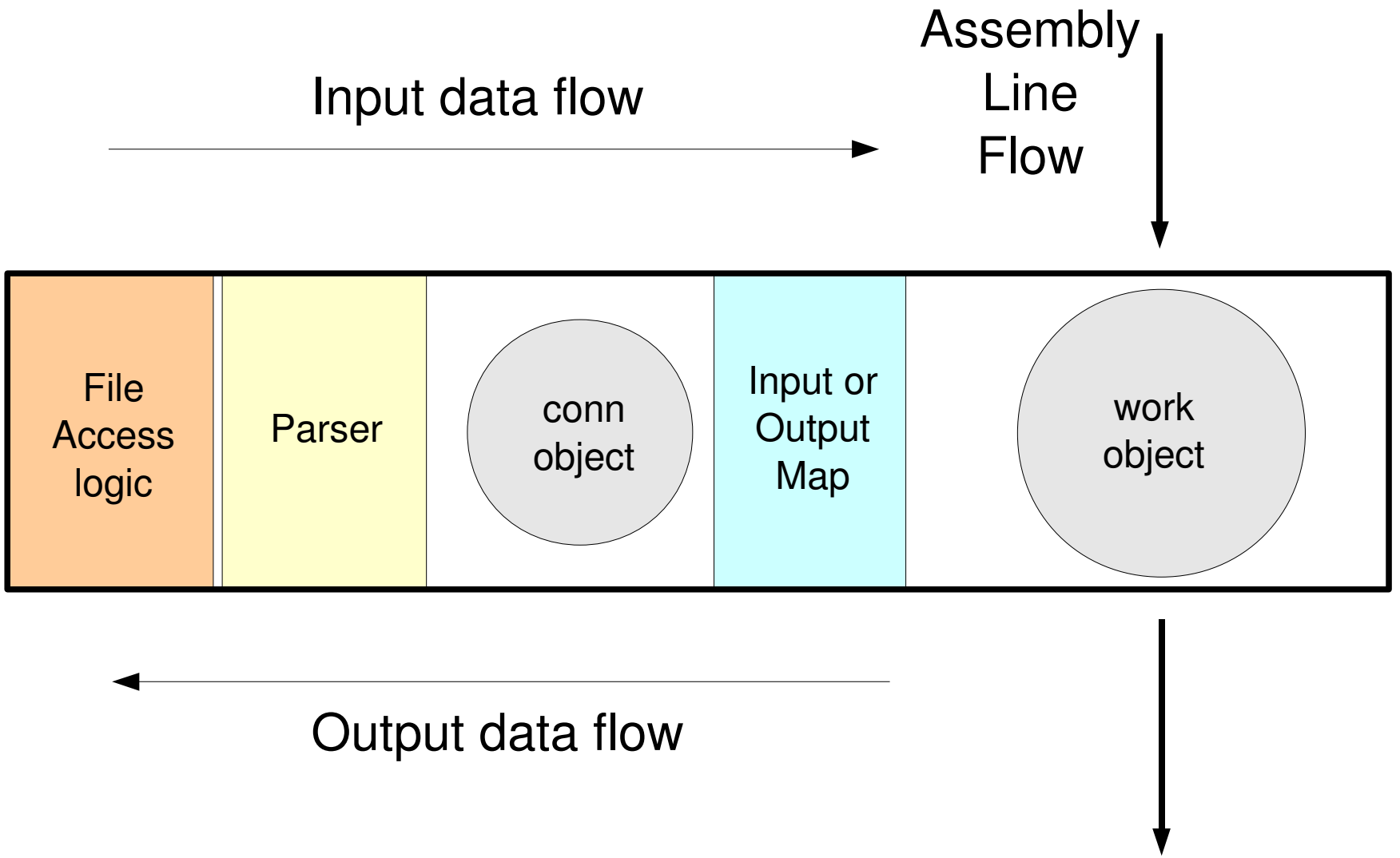
TDI Debugger



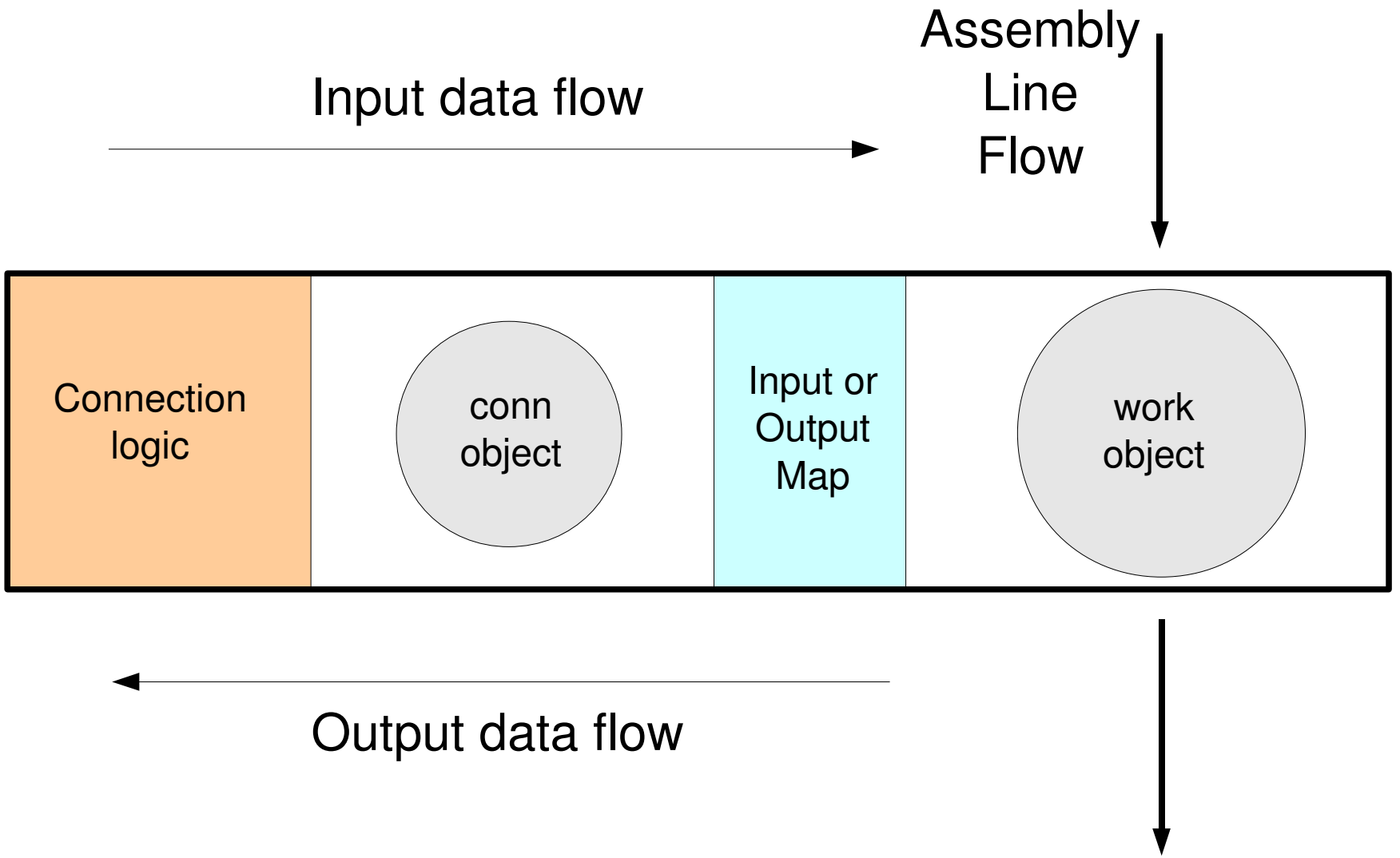
Exercise 5

- TDI Debugger

Inside a Filesystem Connector



Inside a Database Connector



Scripting in Maps

- Scripts can build new values

```
work.firstname + " " + work.surname
```

- Scripts can be:
  - Expressions (as above)
  - JavaScript code
  - Text with substitution

Script Editor

- Ctrl-space gives list of valid objects
- 'objname.' and wait – list of methods
- Syntax sensitive

Java + Script != JavaScript

- Beware of object types
- Java objects behave differently
- Mapping can be ambiguous
- Returned objects not always strings
- See Users Guide *Scripting* section
- Keep data as all-Java or all-JavaScript if possible

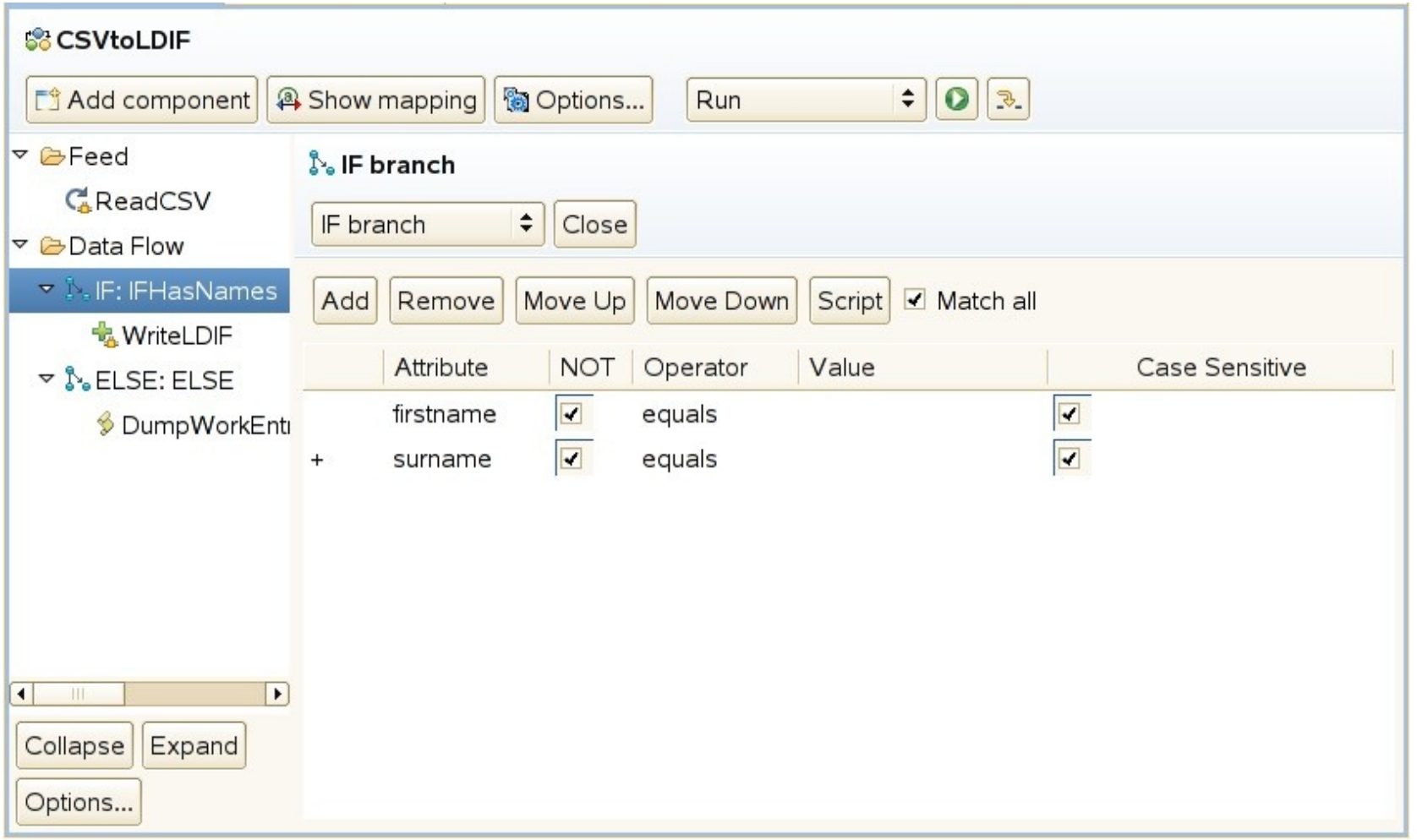
Null Behaviour

- Data fields are not always filled in
- They may not exist at all in some records
- The Null Behaviour setting defines what happens
- Settable at each level
  - Assembly Line
  - Map
  - Attribute

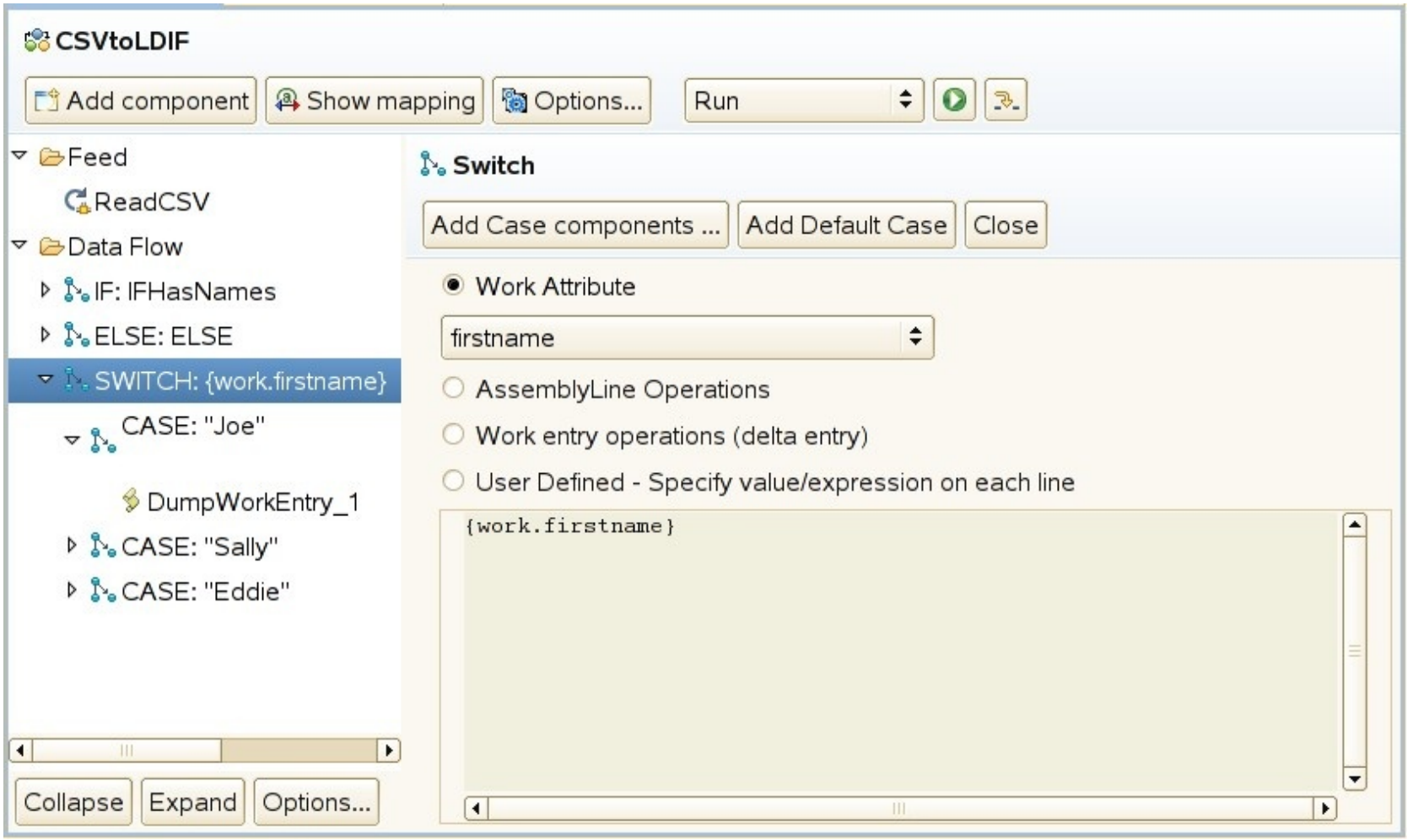
Exercise 6

- Attribute Maps
- Improve your LDIF output

Flow Control: IF-THEN-ELSE



Flow Control: Switch/Case



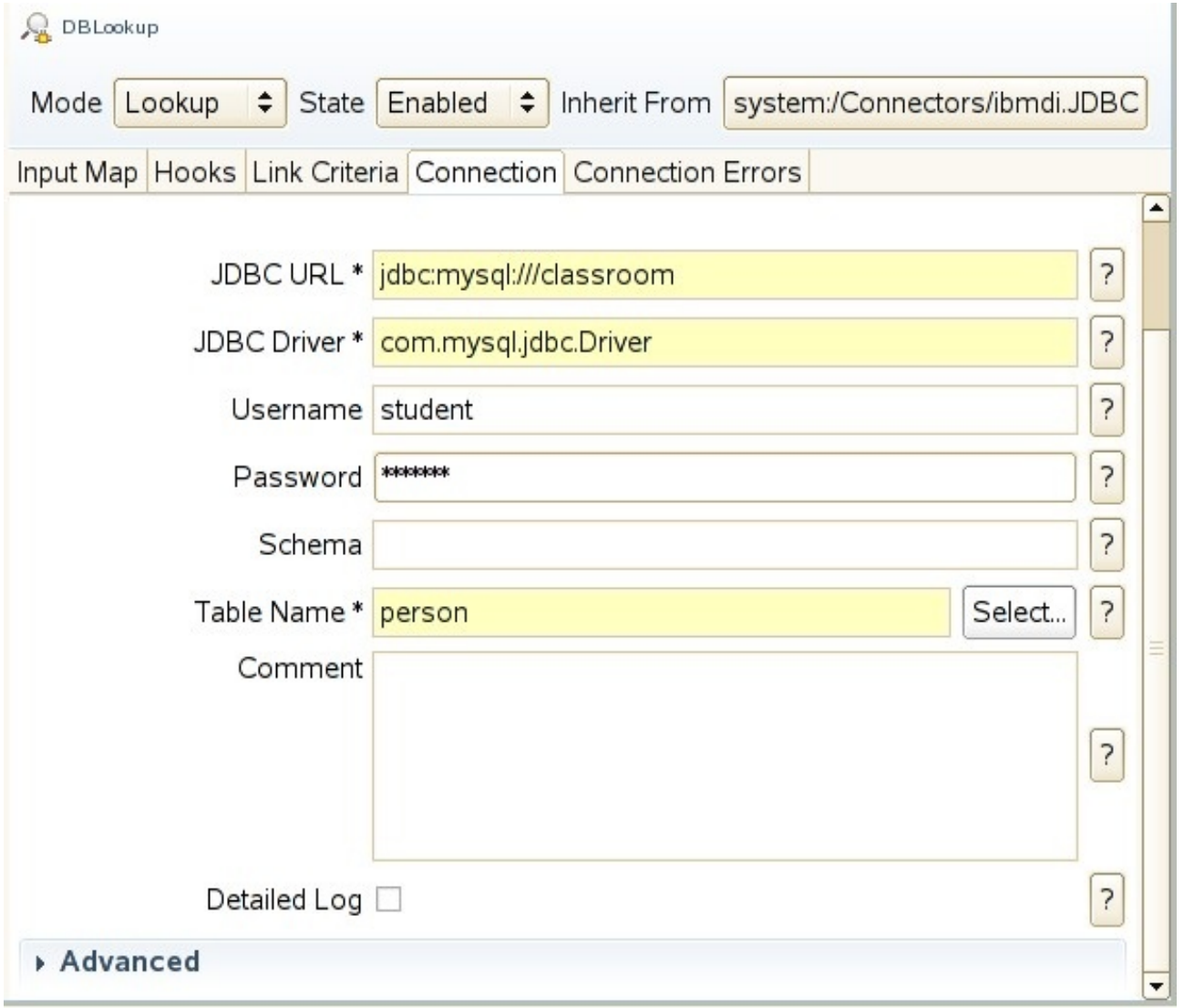
Exercise 7

- Use IF and ELSE
- Report entries with missing names

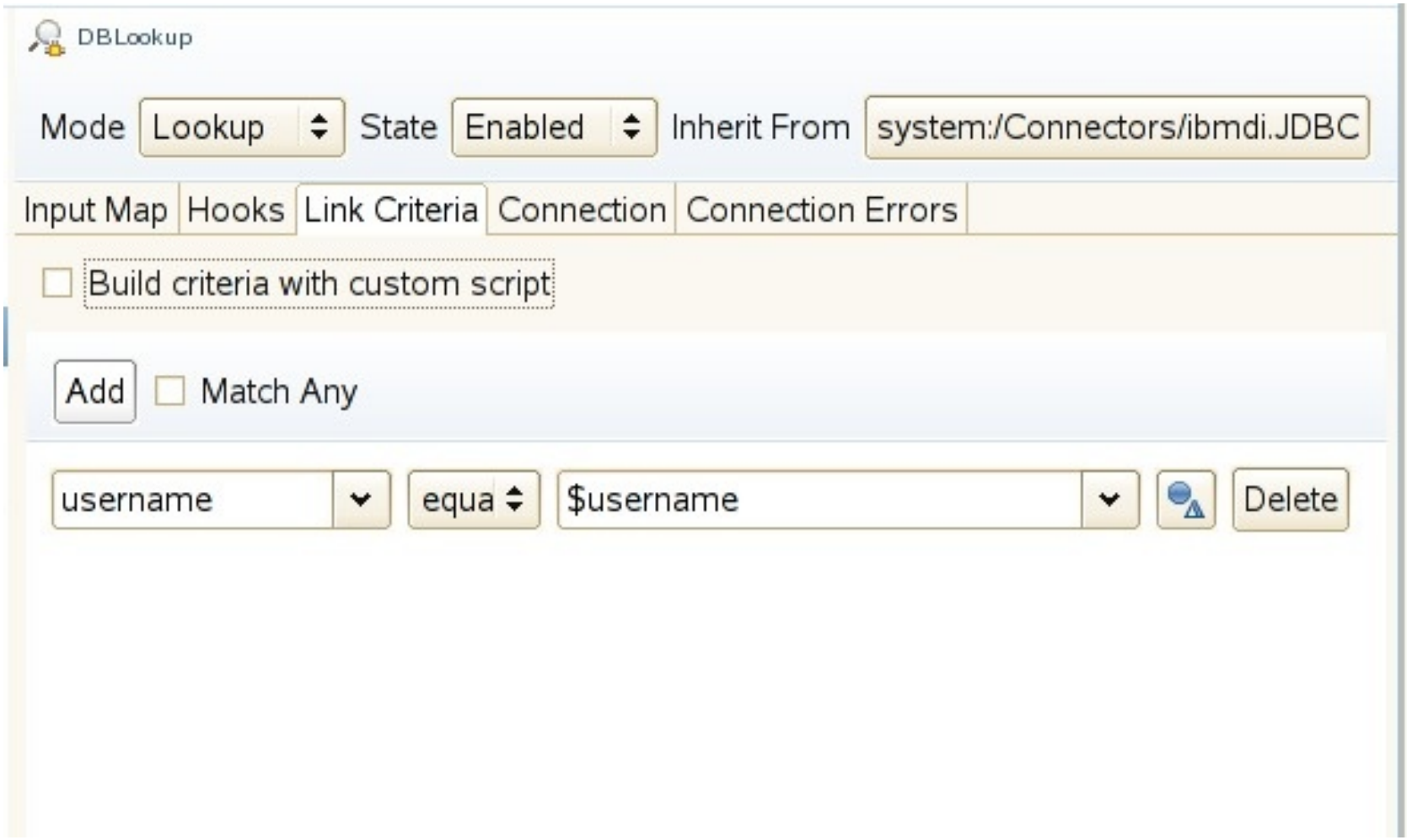
Database Lookups

- Connect to many different 'databases'
- SQL
- LDAP
- SOAP
- REST
- IMAP
- SNMP
- FTP...

JDBC Connector



Link Criteria



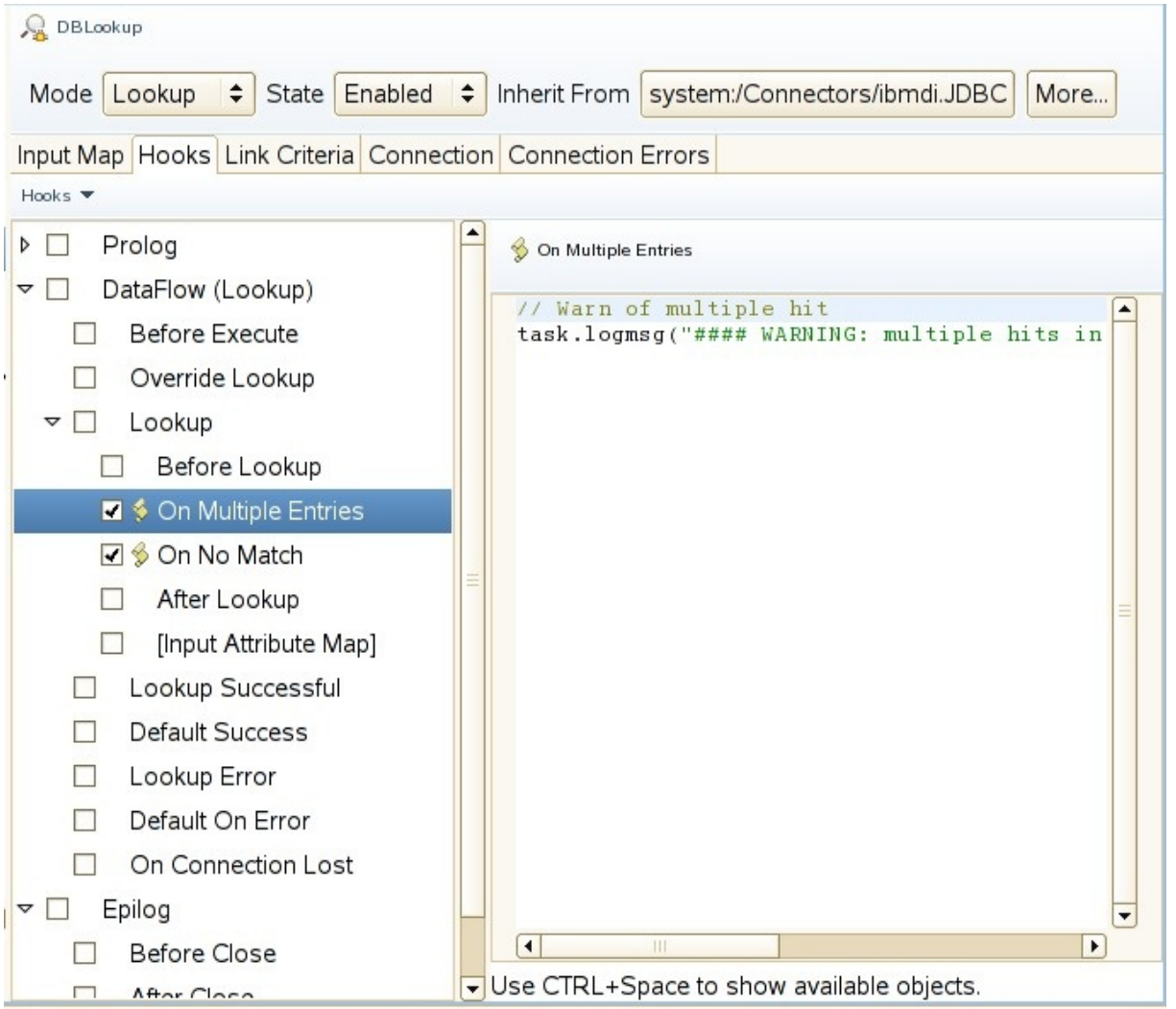
Exercise 8

- Configure JDBC for MySQL
- Lookup phone numbers in SQL database

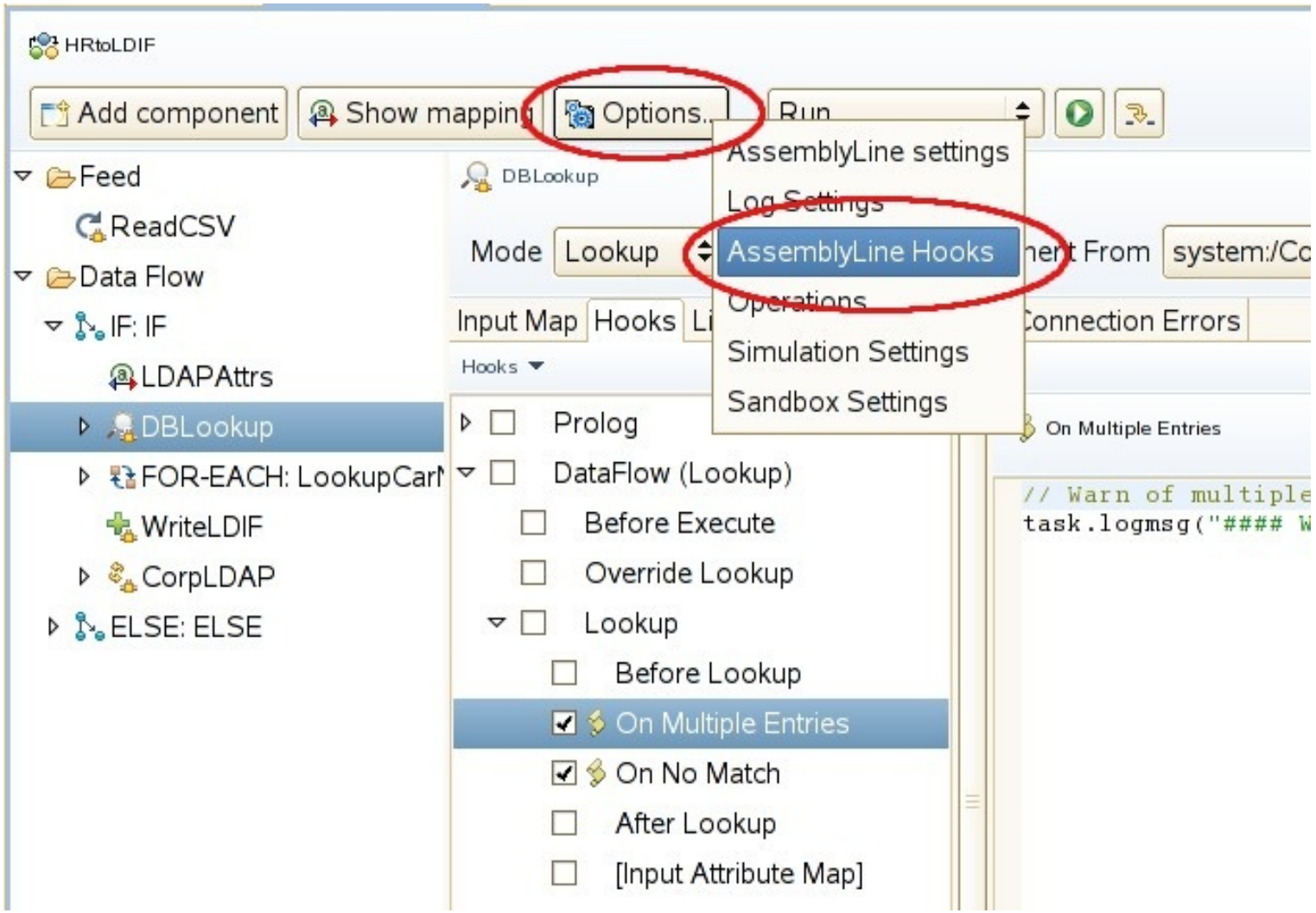
Hooks and Scripts

- Connector Hooks
- Assembly-Line hooks
- Using hooks for error handling
- Scripts to use in hooks
- Writing to the error log

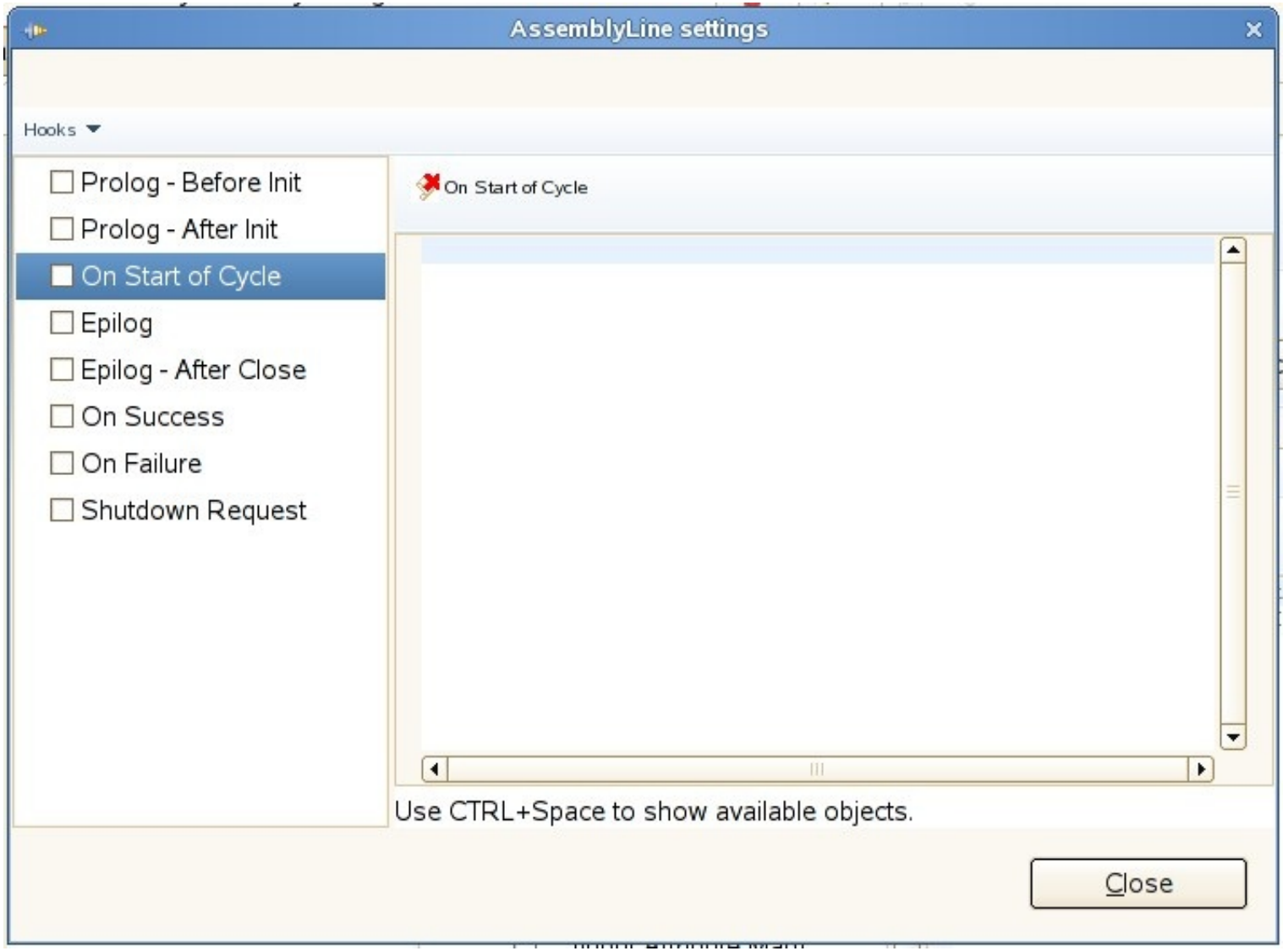
Connector Hooks



Assembly Line Hooks



Assembly Line Hooks



Which hook?

- Flowcharts
- Debugger

Available objects

- Ctrl-space in script editor
- Typically:
  - work
  - conn
  - error
  - system
  - task
  - All named components in AL

Exercise 9

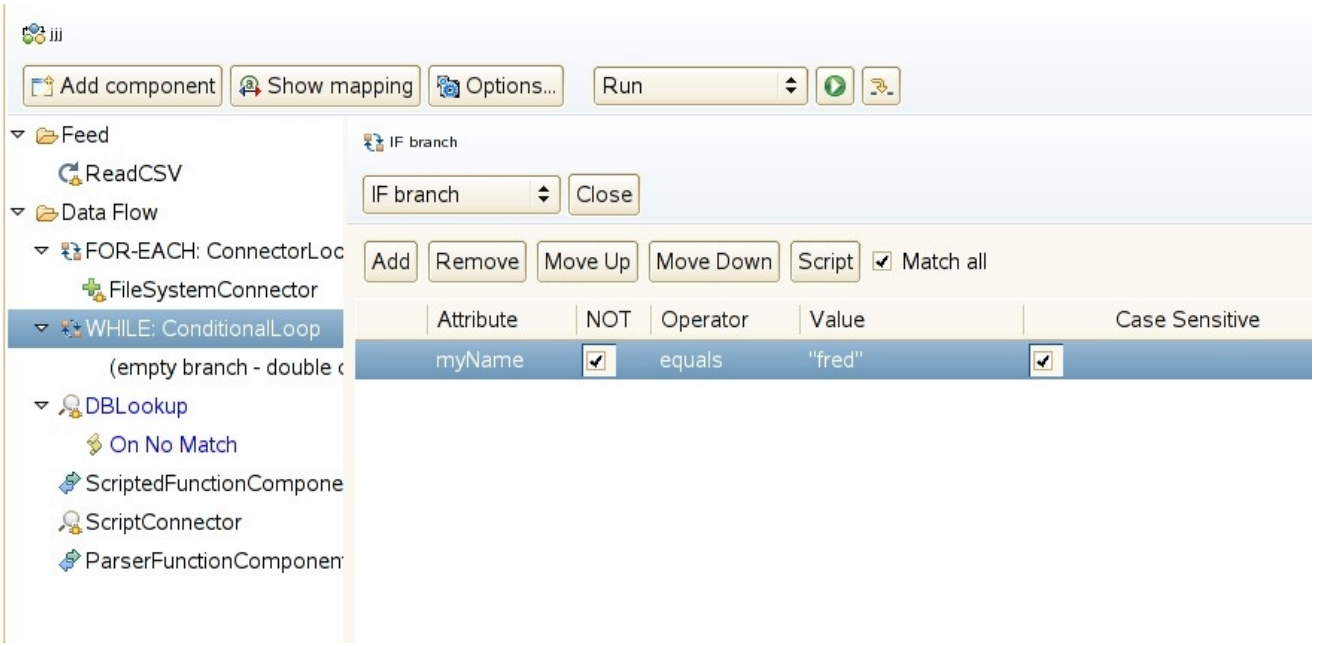
- Hooks and Scripts
- Basic error handling
- Missing Data
- Multiple hits

Loops

- Conditional loops
  - While <condition> do...
- Attribute-value loops
  - Handle each value separately
- Connector loops
  - Handle each entry of a multi-hit result

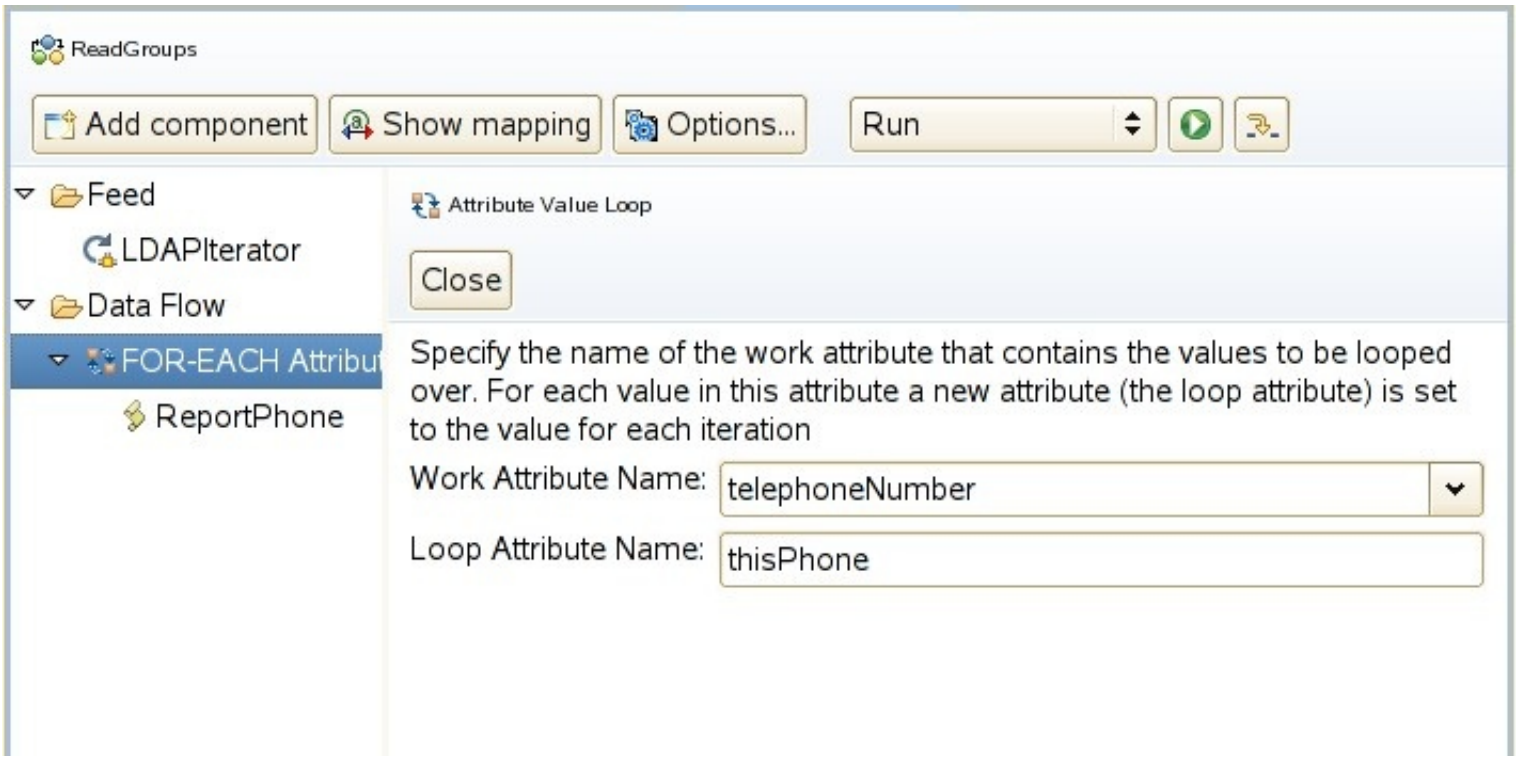
Conditional loops

- Loop continues while condition is true
- Condition set just like IF-THEN



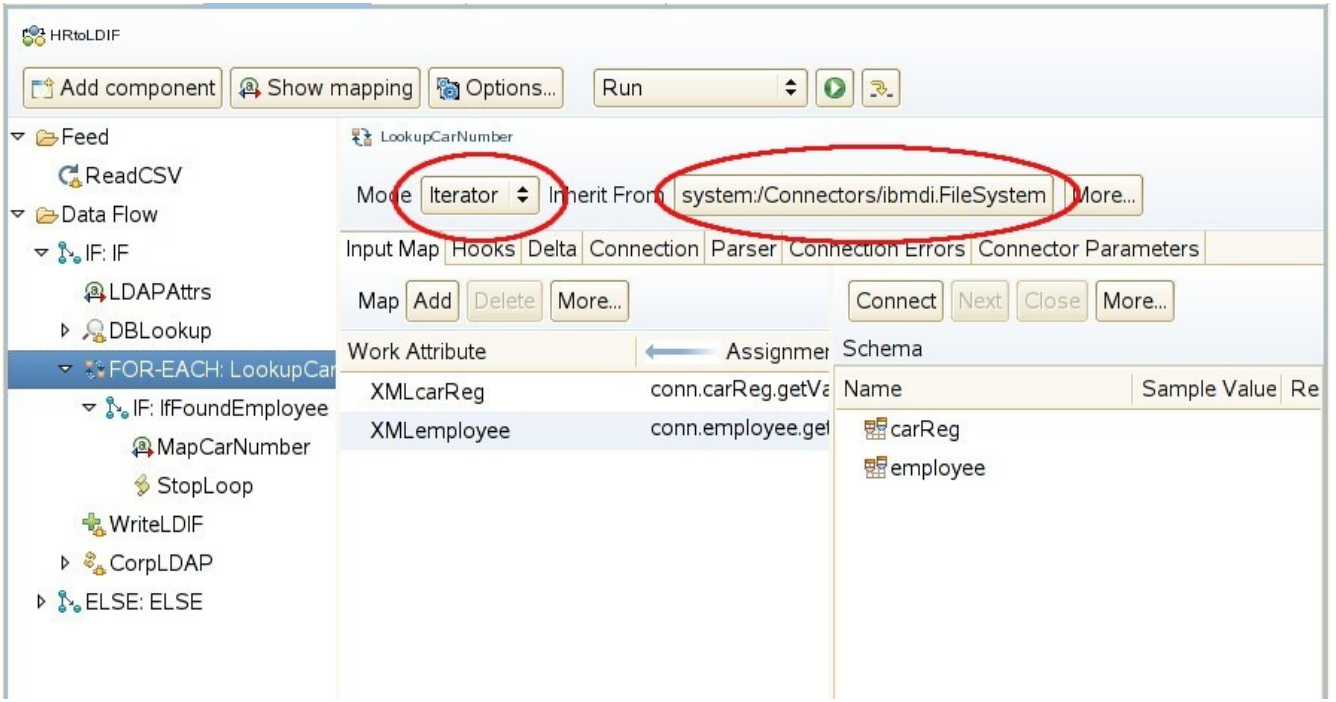
Attribute-Value loops

- Iterate through values of one attribute
  - e.g. Members of an LDAP group



Connector Loops

- Embedded connector in Lookup or Iterator mode
- Loops once for each entry returned



Exercise 10

- Connector loops
- Do lookup in XML file

Connector Modes

- Iterator
- Lookup
- AddOnly
- Delete
- Update
- Delta
- CallReply
- Server

Iterator Mode

- Read every entry in a data source
- Commonly used to process files
- Some (e.g. LDAP, JDBC) can select a subset of entries by configuration
- Normally used in the Feed section

Iterators with Delta Engine

- Detect changes in data sources
- Stores copy in TDI system store
- Issues tagged attributes in work object
  - Add
  - Delete
  - Modify
- Some connectors can use these tags (Delta Mode)
  - Efficient update with no pre-read

Lookup Mode

- Use attributes from the *work* object to search a data source: Link Criteria
- Import values from the data source into *work* attributes: Input Map
- Source is usually a database but can be almost anything

Add-Only Mode

- Adds one entry to a data source
- Often used to write files
- Output map only

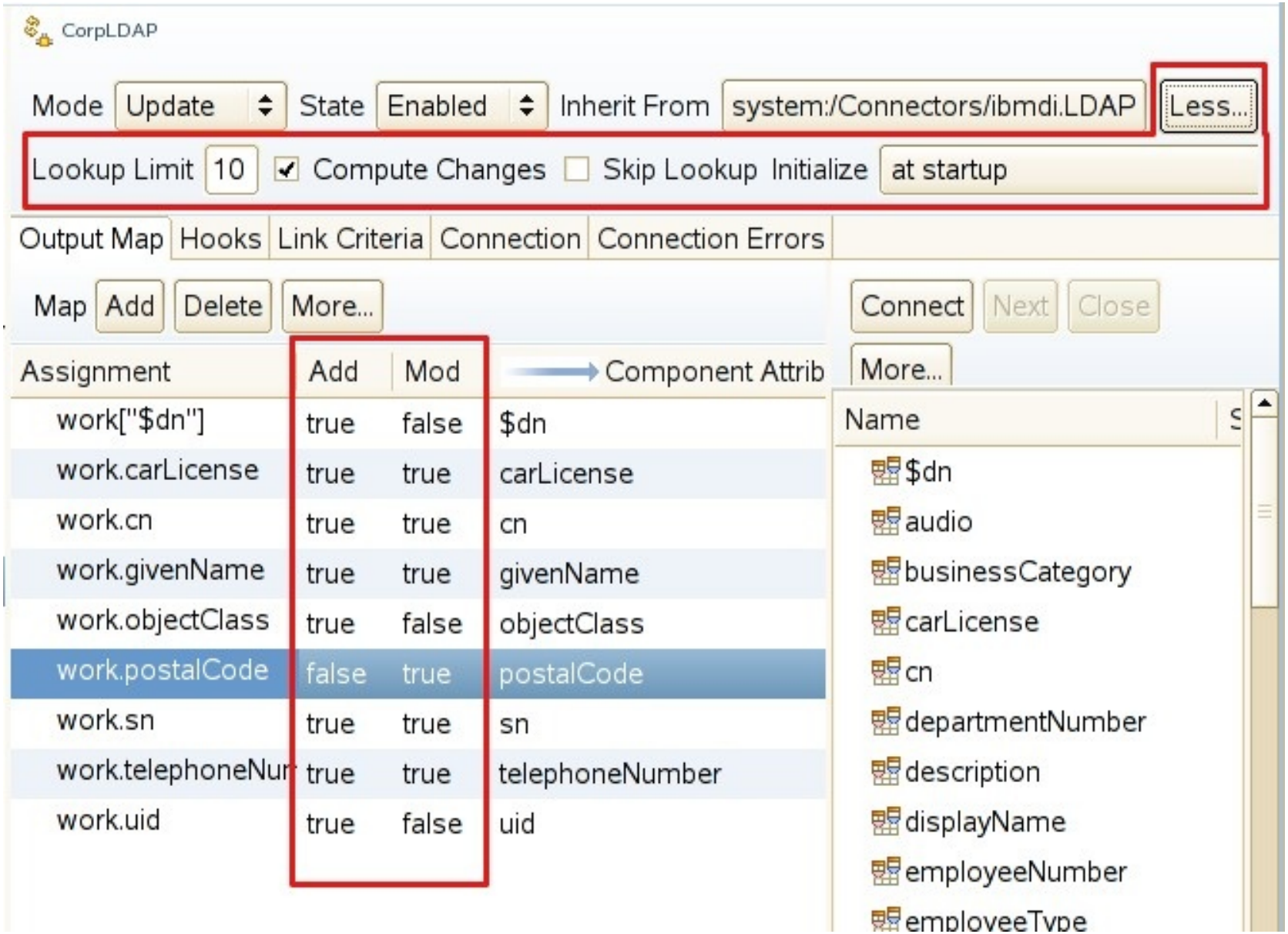
Delete Mode

- Delete a single entry from a database
- Use Link Criteria to choose the entry
- Has an input map
  - Used to return the contents of the deleted entry

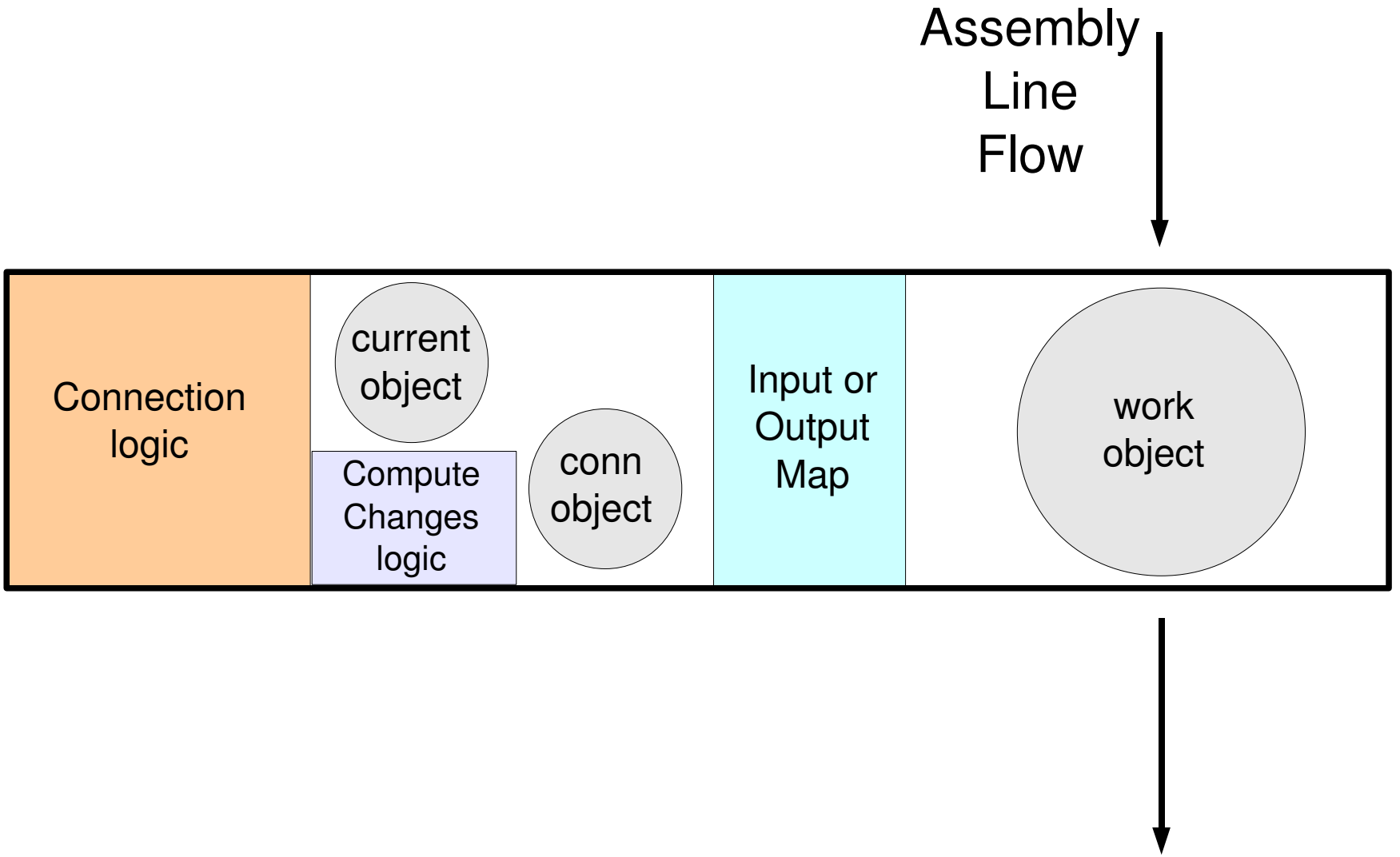
Update Mode

- Link criteria define entry to update
- If no entry found, adds one
- Separate control over attributes:
  - Updating
  - Adding
- Can override add or modify in hooks
- Compute changes option

Update Mode



Database Connector in Update



Delta Mode

- Like Update mode but uses Delta tags
- Can also process deletes
- Very efficient synchronisation when used with the Delta Engine
  - Take care! This only works if it is the *only* process updating the target data.

Call-Reply Mode

- Send one or more attributes to a remote service
- Receive one or more attributes back
- Similar to Lookup mode
- Has both input and output maps

Server Mode

- Server connectors listen for events
  - Incoming message
  - TCP connection
  - Clock tick
- Parse incoming data
- Build work object
- Create network response at end of AL

Server connectors available

- Axis2 web service server
- DSMLv2 SOAP server
- HTTP server
- LDAP server
- SNMP server
- TCP server
- Web service receiver server
- ... other server-like things

Exercise 11

- LDAP server
- Apache Directory Studio
- LDAP connector

TDI system store

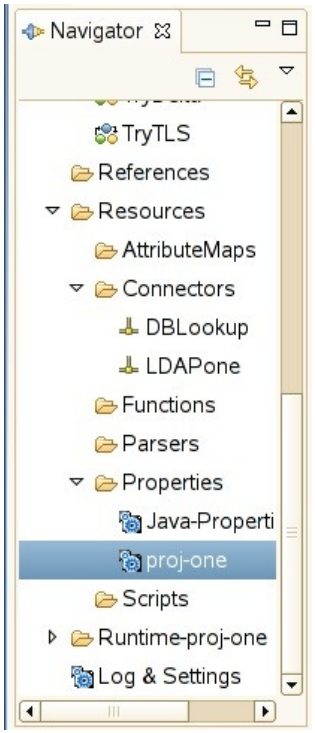
- Derby / Cloudscape database
- Embedded or Server mode
  - Embedded only usable by single process
  - Server mode now preferred
- Supports Delta Engine and other features
- Can be used from scripts

Queues

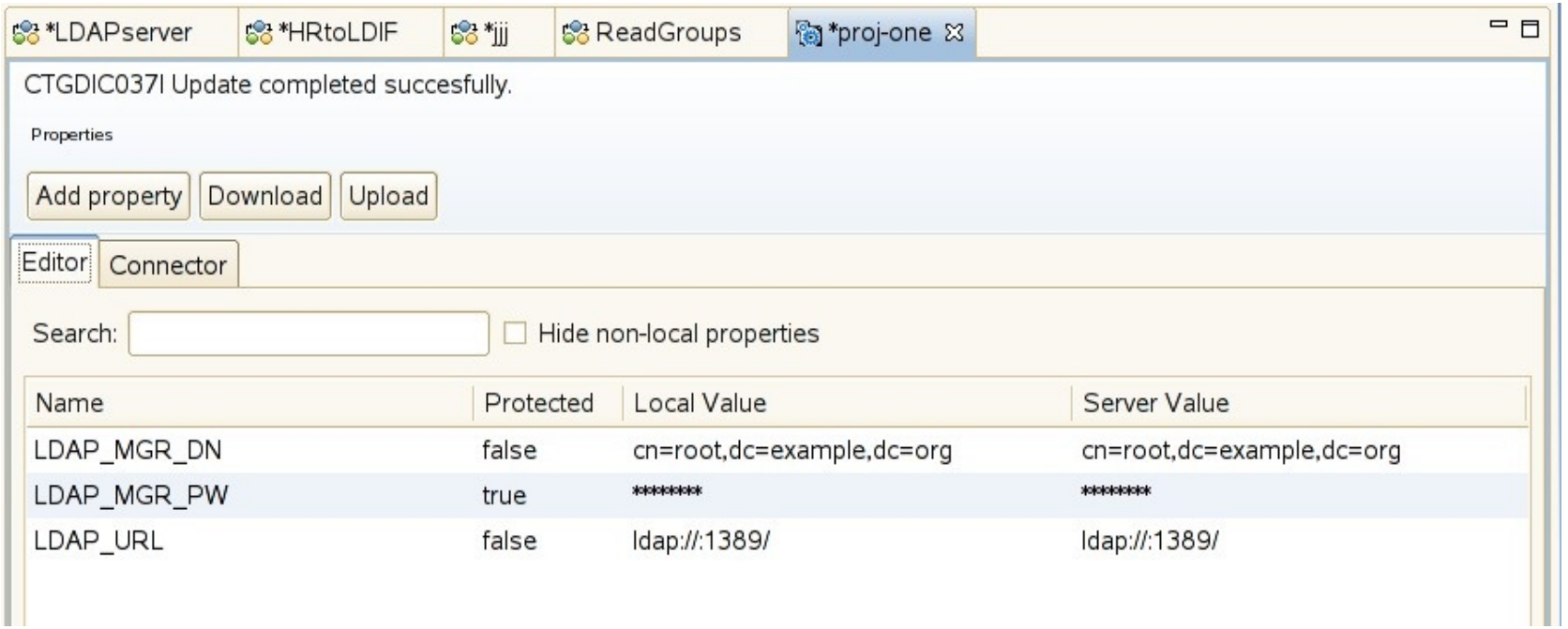
- General-purpose mechanism
- Memory queue
- System queue
- JMS
  - MQe etc

Property Stores

- Remove connection details from config
- Name-Value stores
- Multiple stores possible
- CE can upload to remote stores
- Properties can be protected (encrypted in file)



Edit Properties



Exercise 12

- Build a property store
- Use properties in LDAP configuration

Handling variable-size results

- Zero results may not be an error
- Multiple results may not be an error
  - OK to have multiple phone numbers
- Handle these cases with loops:
  - Connector loops when searching
  - Attribute-value loops when updating
- Scripts can add new values to attributes

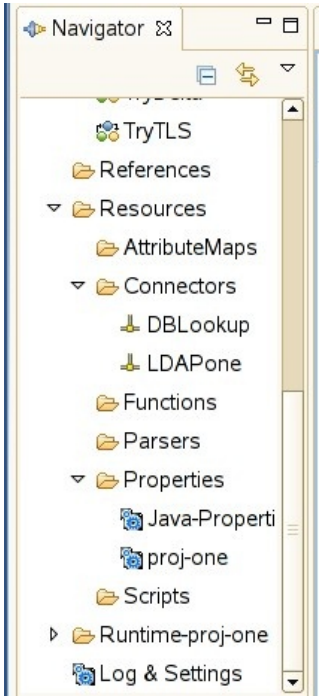
Building Attributes

- work.newAttribute(“telephoneNumber”)
- work.telephoneNumber.addValue(...)
- work.getString(“phone”)

Exercises 13 and 14

- Build multi-value attributes
- Build a web-server that answers white-pages queries

Building a Library



- Resources
  - Attribute Maps
  - Connectors
  - Functions
  - Parsers
  - Properties
  - Scripts
- Inheritance

Connector Re-Use

- Re-use within an AL
- Single connection to data source
- Lower resource usage
- May not mix operation types
- Inherits config
  - Items marked in blue

Connector Pooling

- Start with a connector in the library
- Enable Pooling (*Pool* tab)
- Set pool size
- TDI runtime maintains a pool of initialised connectors

Function Components

- Attribute Map
- Parser
- Assembly Line
- SOAP support
- Castor XML support
- Memory queue
- Send e-mail
- etc...

Scripted Components

- Write your own
  - Connector
  - Function
  - parser
- *Connection* tab has *Edit Script* button
  - First use provides template script

Exercise 15

- Delta mode

SSL and TLS

- Encryption
- Public-Key system
- Authentication

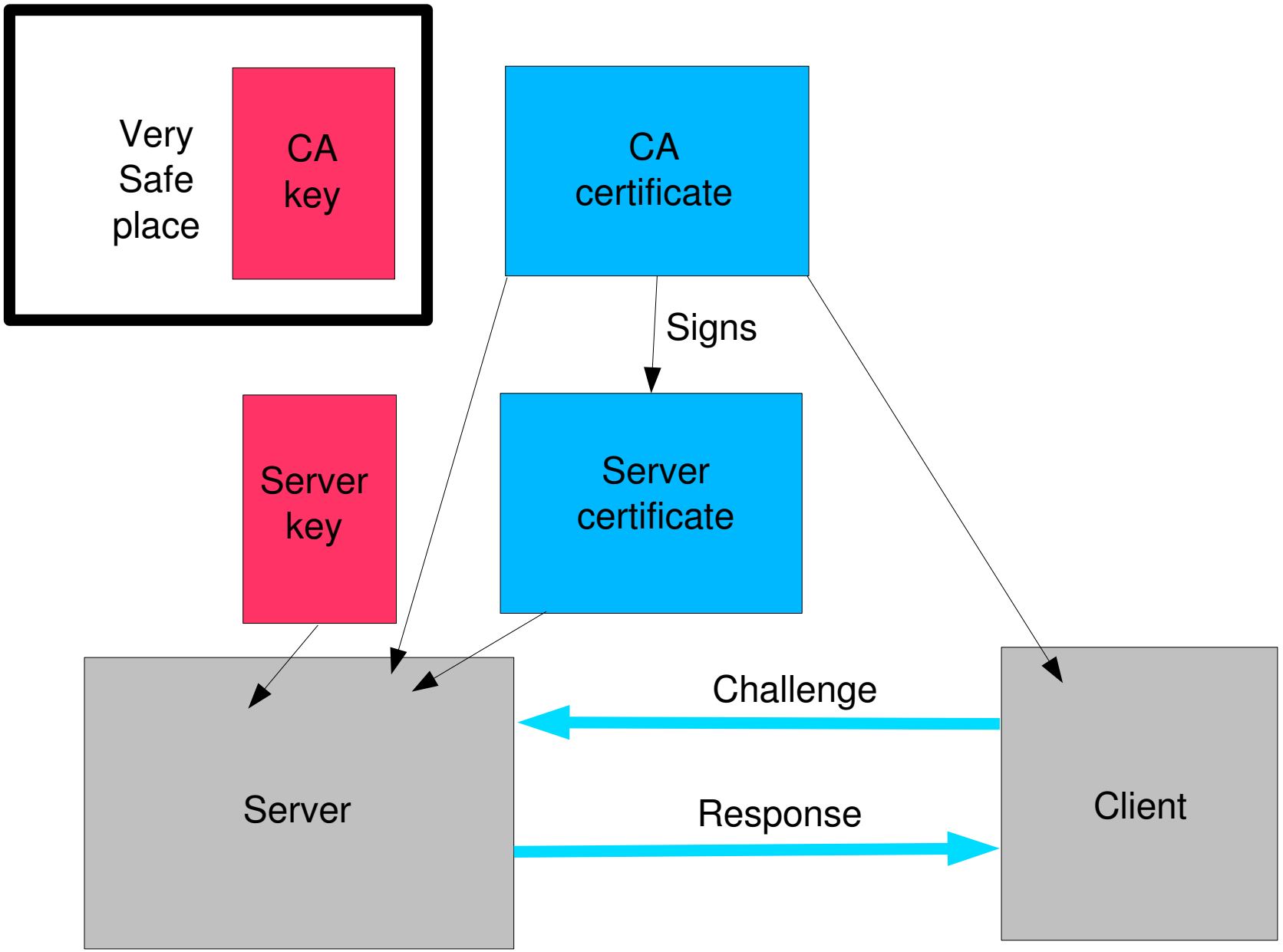
Public-key cryptosystems

- RSA, Diffie-Hellman etc
- One key to encrypt
- One key to decrypt
- Cannot derive one from the other
- Uses:
  - Key distribution
  - Zero-knowledge proof => authentication
  - Session-key generation

Certificates

- Use public-key system to sign data
  - Make a tamper-evident container
  - Bind a name to a key-pair => authentication
  - Use one certificate to sign others => Public Key Infrastructure
  - Certificate contains the public key => key distribution

Certificates for SSL/TLS



SSL or TLS

- SSL sets up encryption first
- TLS layers encryption into running protocol
- SSL needs new port number and also new IP address for each service
  - Deprecated
- Use TLS if possible
  - More hardened protocol

Exercise 16

- Use TLS with LDAP

Password Synchronisation

- Passwords not usually stored in clear
- Hash forms not usually cross-platform
- Password hashes often unobtainable
- Must *capture* plain-text passwords
  - At the point of use
  - When password is changed

Password Capture Plugins

- TDI supplies plugins for
  - Standalone Windows (XP and later)
  - Active Directory domains
  - Sun Directory Server
  - IBM Tivoli Directory Server
  - Lotus Domino
  - Unix/Linux PAM systems

Example Plugins

- Active Directory
  - DLL
  - Acts as a password-quality checker
  - Must be installed on all domain controllers
- Unix/Linux PAM
  - Shared Library
  - Configure into the normal PAM stack

Alternatives to the plugins

- Ordinary LDAP searches
  - If passwords stored in clear
  - If password hashes are usable
- Other capture mechanisms
  - Microsoft Services For Unix (SFU)
  - Password Hook: passwdhk.sourceforge.net

Password Storage

- Hold captured passwords securely
- LDAP
- JMS (MQe)
- Both can use SSL
- Passwords can be separately encrypted for transport (reversible)
  - AL must have access to the keys
  - Script needed for decryption

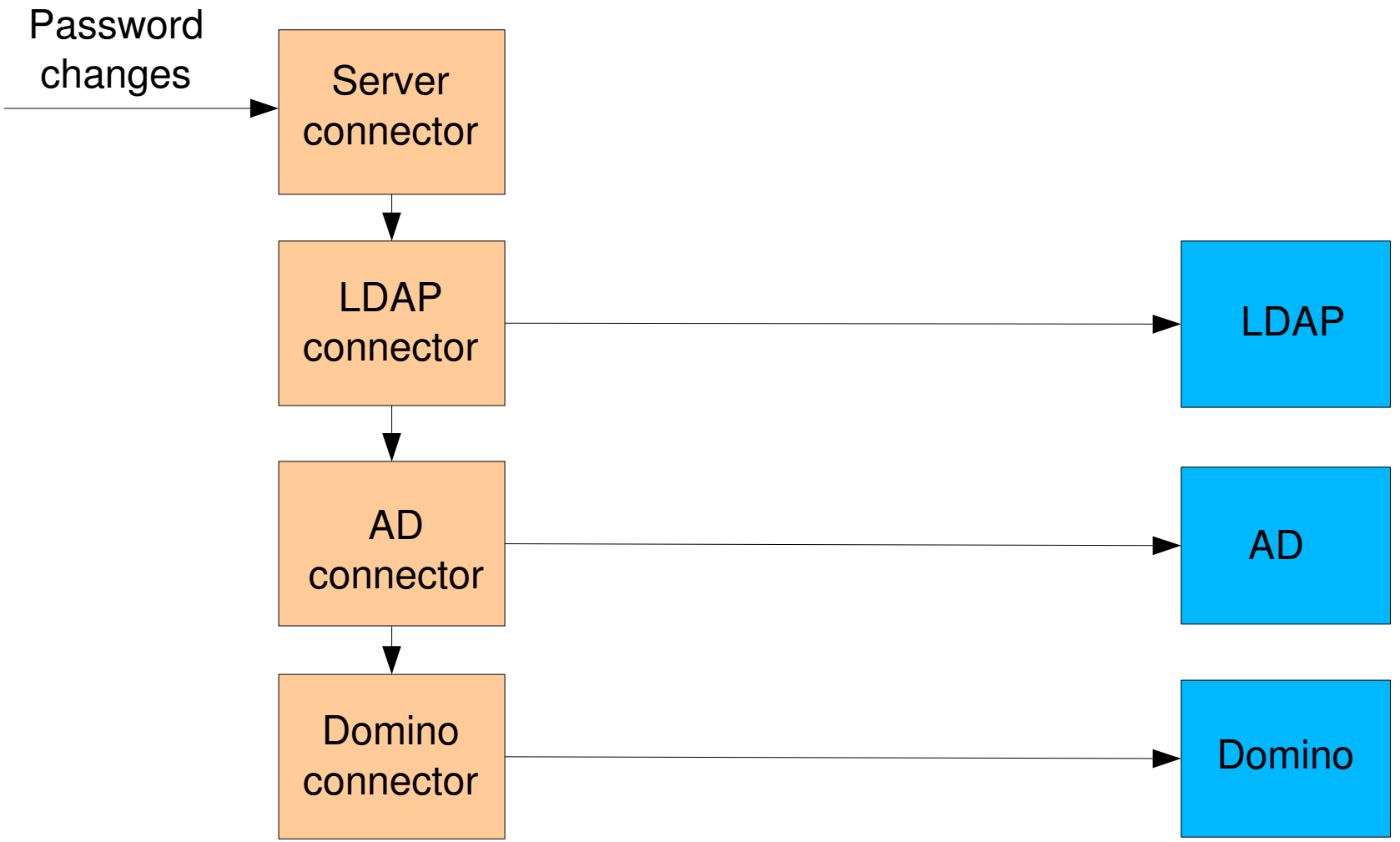
Robust Systems

- Good error-handling
- Not losing updates on error or crash
- Recover from connectivity problems
- Testable components
- Good architecture
  - Simple single-task ALs
  - Each data flow independent of others
  - Well-defined, replaceable ALs

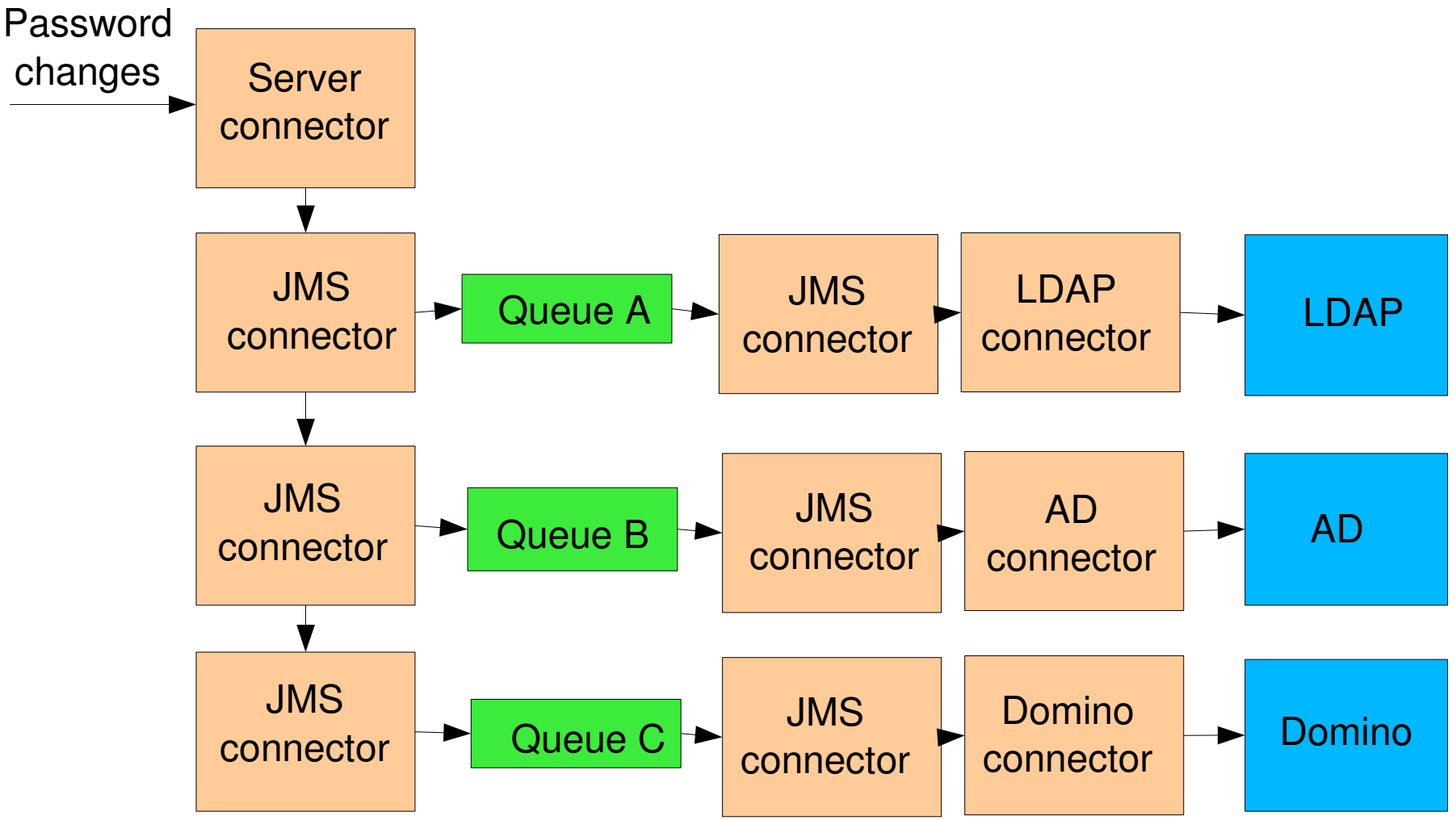
Error Handling

- Don't just crash
  - At least log a useful message
  - Try to recover
- Don't lose updates
  - Hold work-in-progress in persistent store
  - Write Idempotent assembly lines
  - Failure of one target must not prevent update of others
- Avoid massive damage
  - Set limits on critical changes

A risky assembly line



A safer approach



Reconnecting

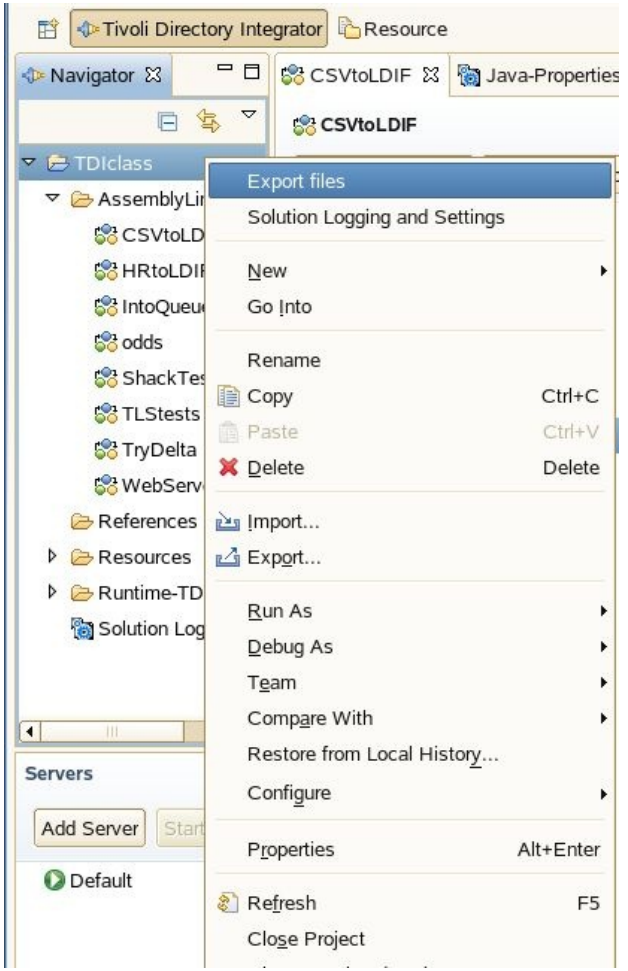
- *Connection errors* tab in connector
- Retry on:
  - Initial connection failure
  - Connection loss in operation
- Configure timeout and retry limit
- Beware: takes time, blocks error hooks

Going Into Production

- Export config files for runtime
- Property files
- Boot-time startup
- Scheduled tasks
- Logging
- Monitoring
  - AMC
  - Action Manager

Exporting the runtime config

- Right-click on the project
- Select *Export Files*
- Choose a directory
- Choose ALs to run



Starting the runtime server

- Installer adds lines to /etc/inittab on Unix-like systems: server runs as *root*
- Installer creates a system service on Windows: server runs as *System*
- Consider security!
  - Does the task *need* that much power?
- Consider command-line startup
  - ibmdisrv
  - tdisrvctl

Scheduling ALs

- Timer Connector
  - Feed a work object into an AL at certain times of day
  - Scheduling AL could call others
- Crontab
  - Invoke ALs from command-line

Monitoring TDI

- Build an AL to monitor the others
  - Report to enterprise console etc.
- AMC: Admin and Monitoring Console
  - Bundled with TDI
  - Can invoke “Health AL” and display result
- Action Manager
  - Automatic actions based on rules
- SNMP

Exercises 17 - 23

- Prepare for production
- AMC
- Report differences between data sources
- Account provisioning

Summary

- TDI structure
  - CE and Runtime
  - Assembly Lines, Connectors, etc
  - Scripts and hooks
  - Debugger
- Solution design

What have we missed?

- Many advanced topics
  - Creating re-usable TDI components
  - Access-control for runtime API
- Many types of connector
- Many types of parser
- Action Manager

Learning more

- TDI Users website:
  www.tdi-users.org
- Google Group:
  ibm.software.network.directory-integrator
- PDF manuals from IBM website