

Tcl Shell for Milkyway

Noel Strader
Interoperability Developer Forum
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Agenda

- **Overview of Tcl Addition**
- **Details of Tcl Shell**
- **Scheme/Tcl Interaction**
- **Information on CCI**

Synopsys Adds Tcl Shell to Milkyway

- Synopsys augments Milkyway Environment with Tcl shell capability
- Tcl is the common extension/scripting language for the Galaxy platform
- Both Tcl and Scheme are supported
- Tcl available in Milkyway Database Environment for MAPin later this year

Why Should You Care About Tcl?

- **Milkyway Database Environment with Tcl**
 - Provided to all MAPin participants
 - Provides procedural interface to database
 - Consistent with industry trend
- **MAPin Database C-API**
 - Not directly affected by Tcl addition
 - MDE provides R/W facility for standard formats
 - MDE Tcl shell allows easy checks

Why Adopt Synopsys Tcl for Milkyway?

- **Interactive**
 - Commands are executed as they are typed
 - Allows easy modification and debugging
- **Concise**
 - Simple structure e.g., “*do thing –option*”
 - One command serves many functions
- **Supports “collections”**
 - Directly operate on a set, e.g., “*get ports in**”
 - Don’t need explicit loops, e.g., “*foreach port*”

What Is Our Solution Plan for Tcl?

- **Tcl shell will be available in Astro, Milkyway, and JupiterXT in 2004.06**
- **Scheme is not going away**
 - **Existing command files still work**
 - **Can alternate between Scheme and Tcl**
- **Synopsys Tcl/CCI-style commands will be available for Milkyway, Astro, and JupiterXT – also available for MAPin**

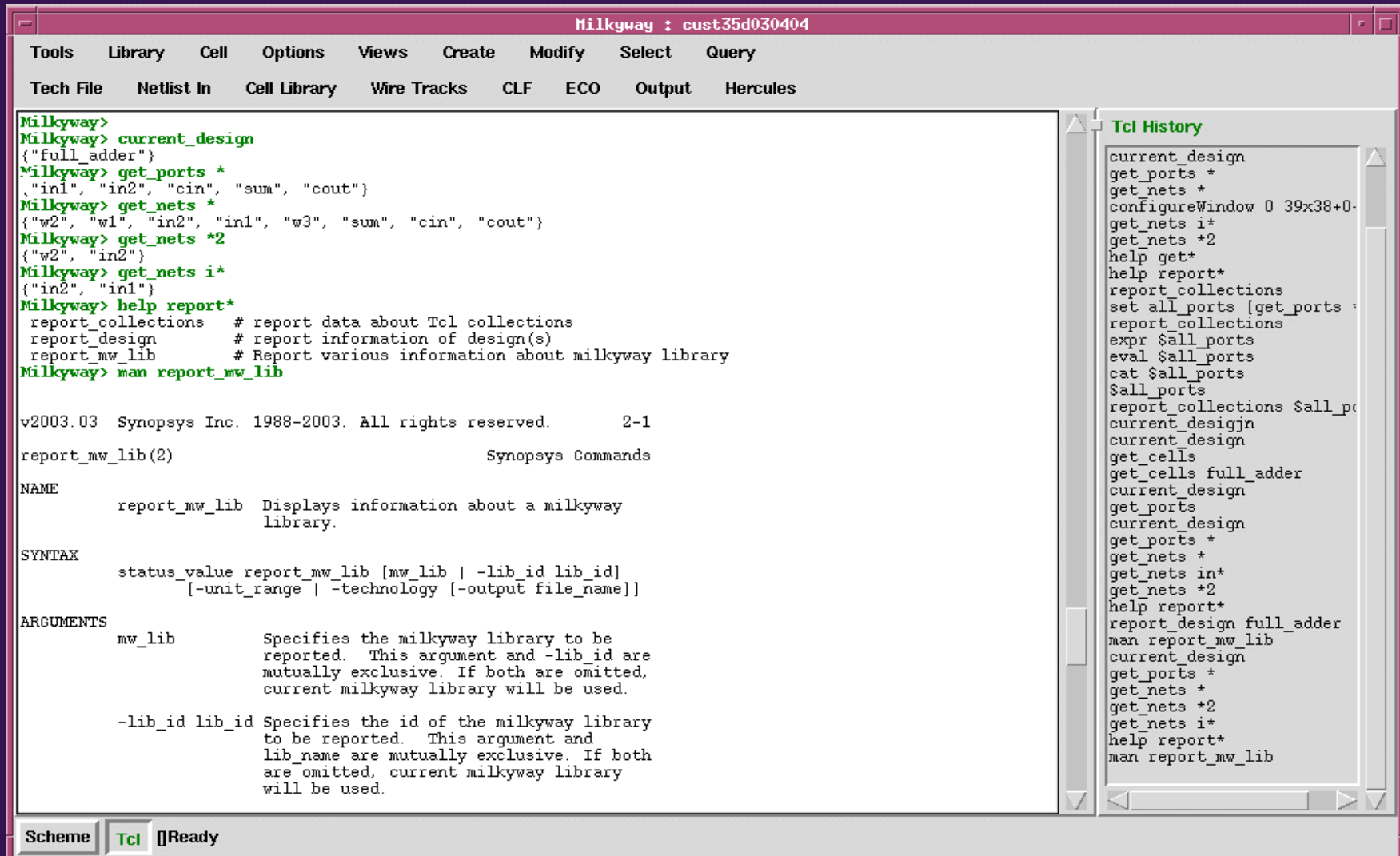
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How Do Users Get A Tcl Shell?

- **At start up**
 - User types 'Milkyway -tcl' to bring up Tcl shell
- **During a session**
 - Click a radio button at any time to switch
 - Type a short command in the Milkyway command window

What Does The Tcl Shell Look Like?



The screenshot shows the Milkyway Tcl shell interface. The window title is "Milkyway : cust35d030404". The menu bar includes Tools, Library, Cell, Options, Views, Create, Modify, Select, Query, Tech File, Netlist In, Cell Library, Wire Tracks, CLF, ECO, Output, and Hercules. The main window contains a Tcl shell prompt and the following commands and output:

```
Milkyway>
Milkyway> current_design
{"full_adder"}
Milkyway> get_ports *
{"in1", "in2", "cin", "sum", "cout"}
Milkyway> get_nets *
{"w2", "w1", "in2", "in1", "w3", "sum", "cin", "cout"}
Milkyway> get_nets *2
{"w2", "in2"}
Milkyway> get_nets i*
{"in2", "in1"}
Milkyway> help report*
report_collections # report data about Tcl collections
report_design      # report information of design(s)
report_mw_lib      # Report various information about milkyway library
Milkyway> man report_mw_lib

v2003.03 Synopsys Inc. 1988-2003. All rights reserved.      2-1
report_mw_lib(2)                                             Synopsys Commands

NAME
    report_mw_lib  Displays information about a milkyway
                  library.

SYNTAX
    status_value report_mw_lib [mw_lib | -lib_id lib_id]
                              [-unit_range | -technology [-output file_name]]

ARGUMENTS
    mw_lib          Specifies the milkyway library to be
                    reported. This argument and -lib_id are
                    mutually exclusive. If both are omitted,
                    current milkyway library will be used.

    -lib_id lib_id Specifies the id of the milkyway library
                    to be reported. This argument and
                    lib_name are mutually exclusive. If both
                    are omitted, current milkyway library
                    will be used.
```

The Tcl History panel on the right shows the following commands:

```
Tcl History
current design
get_ports *
get_nets *
configureWindow 0 39x38+0-
get_nets i*
get_nets *2
help get*
help report*
report_collections
set all_ports [get_ports *]
report_collections
expr $all_ports
eval $all_ports
cat $all_ports
$all_ports
report_collections $all_ports
current design
current design
get_cells
get_cells full_adder
current design
get_ports
current design
get_ports *
get_nets *
get_nets in*
get_nets *2
help report*
report_design full_adder
man report_mw_lib
current design
get_ports *
get_nets *
get_nets *2
get_nets i*
help report*
man report_mw_lib
```

At the bottom of the window, there are tabs for Scheme, Tcl (selected), and Ready.

Milkyway Tcl Commands for 2004.06

- **Over 70 new commands**
- **Milkyway object access commands**
 - open, create, get ...
- **Logical and physical editing**
 - connect, move, rotate ...
- **Attribute queries**
 - set, list, remove ...
- **Utilities command**
 - report, update ...

“Help” and “Man” for Tcl Shell

The screenshot shows the Milkyway Tcl Shell interface. The title bar reads "Milkyway : cust35d030404". The menu bar includes Tools, Library, Cell, Options, Views, Create, Modify, Select, and Query. Below the menu bar are several tool-specific buttons: Tech File, Netlist In, Cell Library, Wire Tracks, CLF, ECO, Output, and Hercules.

The main window displays a list of commands and their descriptions:

```
rotate_objects      # Rotates one or more objects
save_design         # Saves the design
set_attribute       # Set attribute data on the specified object
update_design       # Updates the specified design to make them consistent
update_movebound    # Modifies information for an existing movebound
update_mw_lib       # Update a milkyway library
```

The user has entered the following commands:

```
Milkyway> help report_design
report_design      # report information of design(s)
Milkyway> man report_design
```

The man page for `report_design(2)` is displayed, showing the following information:

```
v2003.03 Synopsys Inc. 1988-2003. All rights reserved.      2-1
report_design(2)                                           Synopsys Commands

NAME
    report_design  Displays contents of specified designs.

SYNTAX
    int report_design [design_list]

ARGUMENTS
    design_list    Specifies the designs to report. They
                  are specified by their names.

                  If not specified, current design will be
                  used.

DESCRIPTION
    Lists information about the contents of the design.

EXAMPLES
    The following is an example of a design report:

    mw_shell> report_design vend cell
    Library: /home/wllin/test/cell0per/design
```

On the right side of the window, there is a "Tcl History" panel showing a list of commands entered:

```
help
configureWindow 0 27
help milkyway
man report_desgin
man report_design
help milkyway
man report_design
help report_design
help milkyway
help report_design
man report_design
```

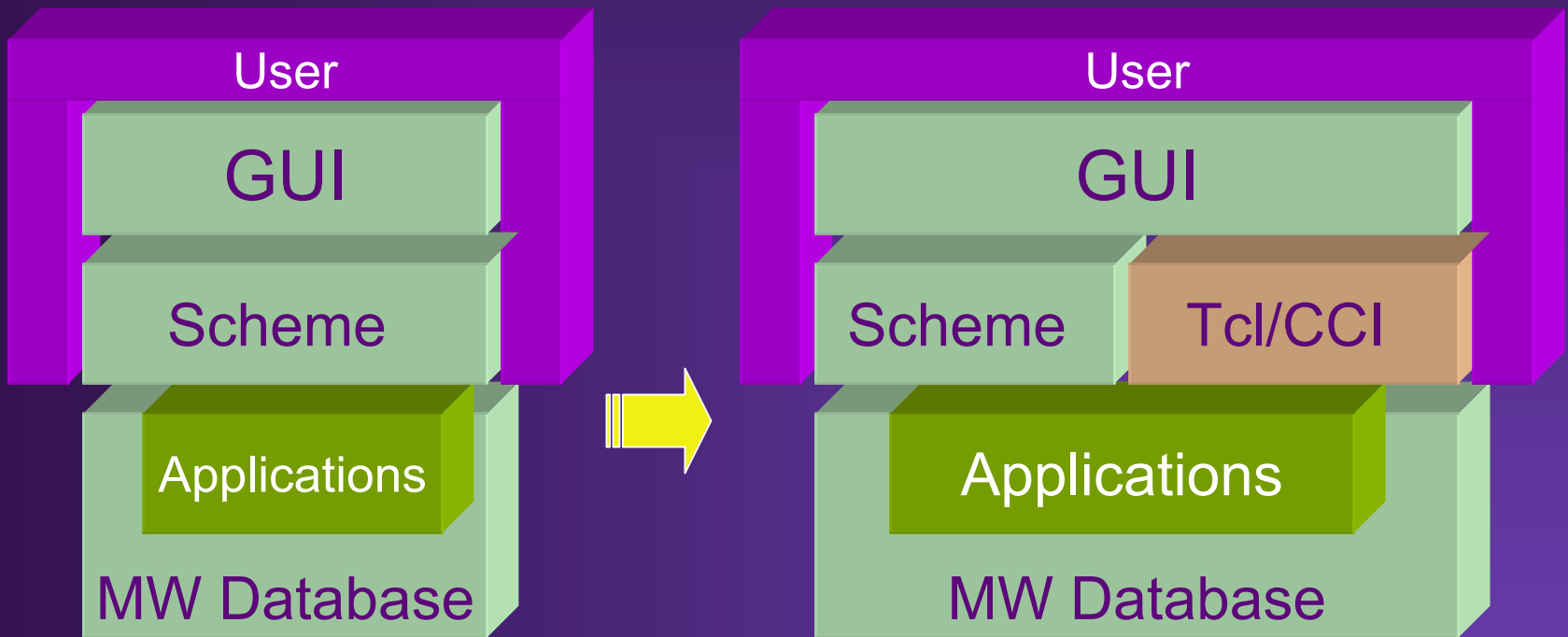
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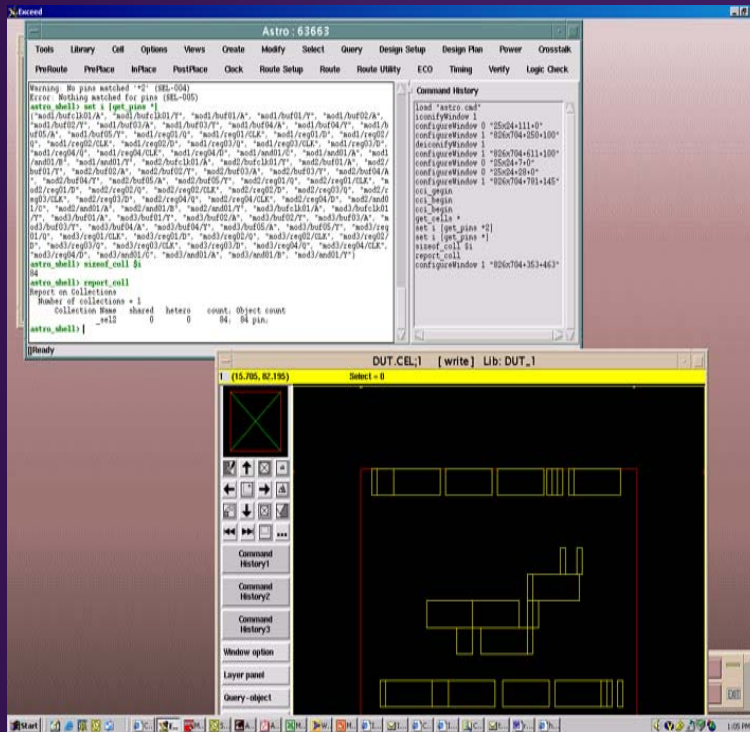
Current Milkyway User Interface

- **Scheme**
 - Milkyway has 1500+ Scheme commands
 - Scheme is the extension/scripting language
- **GUI**
 - Invokes Scheme commands under the hood
 - Scheme command logging file can be used for replay

Milkyway User Interface Structure



What About Today's Scheme Commands?



2004.06 Astro

- 1:1 mapping of existing Scheme commands to Tcl
 - Allows GUI compatibility and command replay
 - Begin/End “escapes” allow use of legacy Scheme replay files
- Minor syntax changes for mapped Scheme commands in Tcl shell

Scheme-Tcl Commands

- **Scheme commands registered directly in Tcl, not in CCI**
- **Provides backward compatibility**
- **1:1 Tcl commands not listed in Tcl “help” or Tcl “man” pages**
- **Scheme help continues for 1:1 commands (note: there are slight syntax changes)**

Interaction between Scheme and Tcl Modes

- **Command-line choice of Tcl or Scheme shell at start up**
- **Runtime switch between Tcl and Scheme modes**
- **Run single Scheme command under Tcl mode and vice versa**
- **Separate Tcl and Scheme logging files**

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What is Synopsys Tcl/CCI

- **Synopsys CCI**
 - Synopsys Common Command Interpreter
 - A layer with enhanced features on top of Tcl
 - Script language adopted by PC, DC, PT, FM etc.
- **Support collections of objects**
- **Allows command redirection**
 - e.g., `report_design > my_design.rpt`
- **Allows command abbreviation**
- **Provides utilities**
 - `man, help, history, !reuse ...`

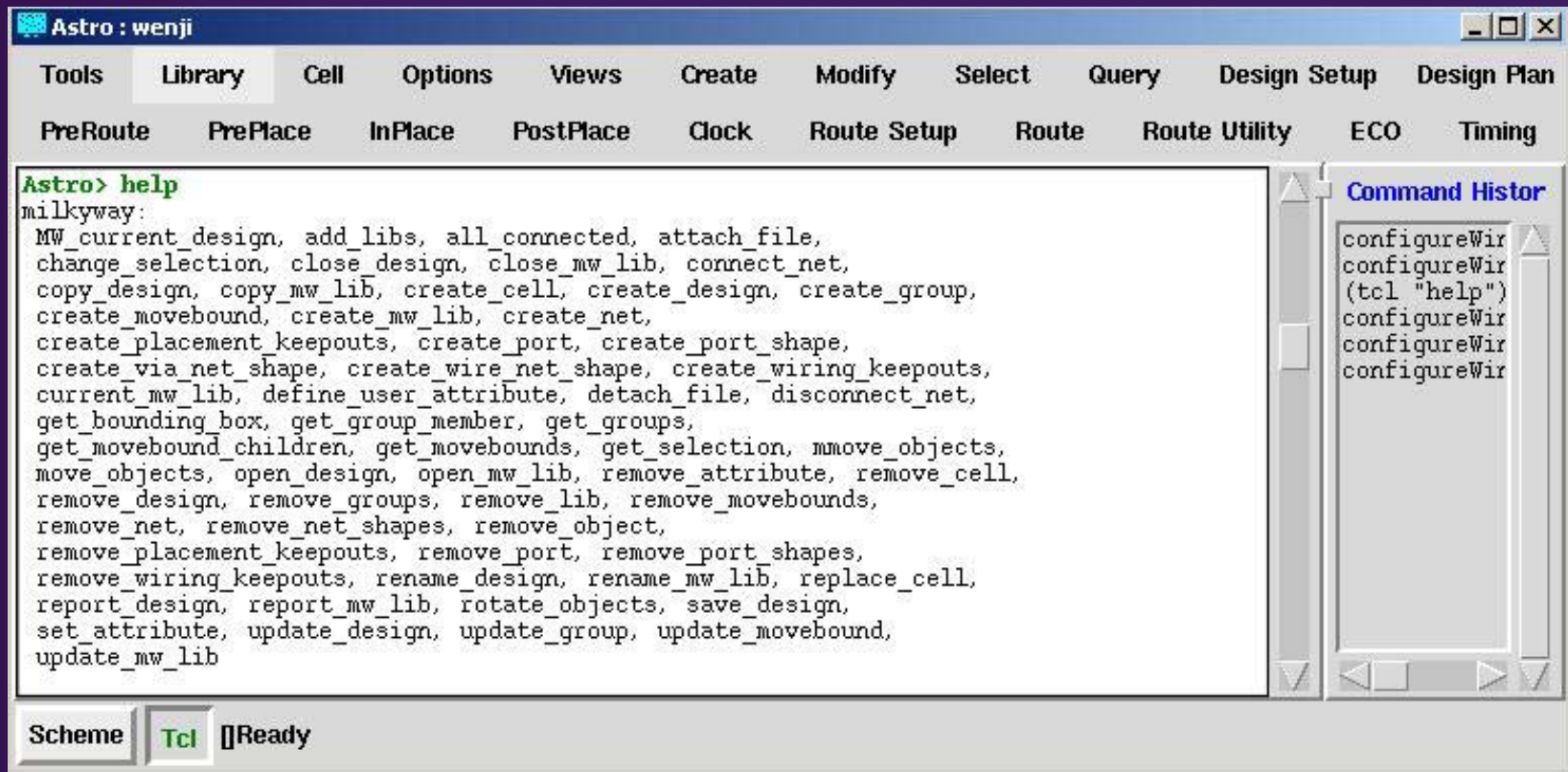
About Collections in Tcl/CCI

- A collection → a list of objects
- Can be assigned to variables and passed to commands as arguments
- Convenient and powerful to handle multiple homogeneous and heterogeneous objects
- Examples
 - `get_cells MYCELL*`
 - `set net_clct [get_nets A/B/C/*]`
`remove_nets $net_clct`
 - `query_objects -verbose [get_selection]`

About Collections in Tcl/CCI (cont'd)

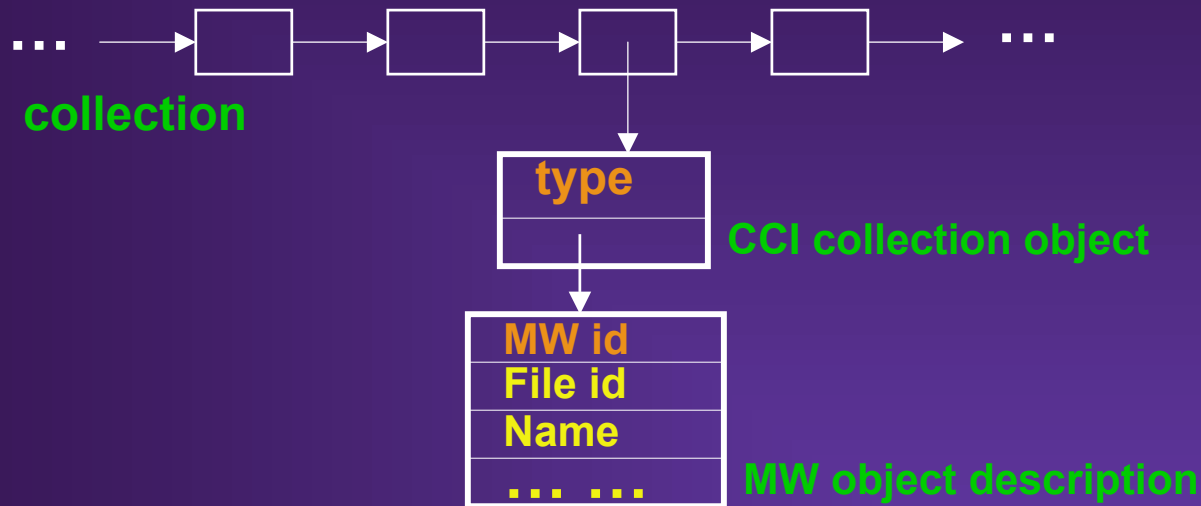
- **CCI utilities to manage collections**
 - **add_to_collection**
 - **copy_collection**
 - **foreach_in_collection**
 - **remove_from_collection**
 - **sort_collection**
 -
- **Automatic memory garbage collection**
- **Automatic translation mechanism between different classes of objects**

Milkyway Tcl/CCI Commands



Collections of Milkyway Objects

- CCI collection built based on Milkyway



- Referenced by object ID and name
 - Milkyway collection is a list of above objects
- Inherits Tcl/CCI collection features

Supported Objects in Collection

- **Logical objects**

- **Library**
- **Design**
- **Cell**
- **Port**
- **Pin**
- **Net**

- **Physical objects**

- **Movebound**
- **Keepout**
- **Port shape**
- **Net shape**
- **Bounding box**

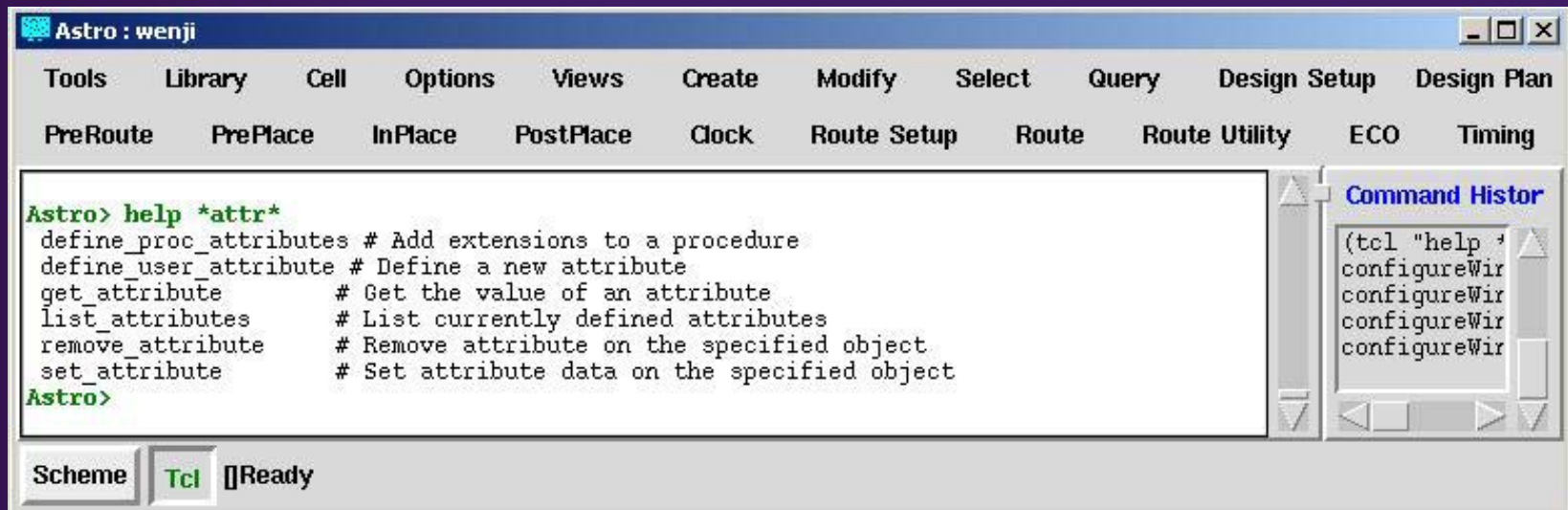
Collection Operations



Application Attributes of Milkyway Objects

- Application attributes are for products based on Milkyway
- Milkyway Tcl/CCI allows access of application attributes in user interface
- Mapped or derived from Milkyway object fields and properties
 - e.g., $\text{area} = \text{length} * \text{width}$

Attribute Operations



The screenshot shows the Astro Tcl console window. The title bar reads "Astro : wenji". The menu bar includes: Tools, Library, Cell, Options, Views, Create, Modify, Select, Query, Design Setup, Design Plan, PreRoute, PrePlace, InPlace, PostPlace, Clock, Route Setup, Route, Route Utility, ECO, and Timing. The main text area displays the following help text for attribute operations:

```
Astro> help *attr*
define_proc_attributes # Add extensions to a procedure
define_user_attribute # Define a new attribute
get_attribute          # Get the value of an attribute
list_attributes        # List currently defined attributes
remove_attribute       # Remove attribute on the specified object
set_attribute          # Set attribute data on the specified object
Astro>
```

On the right side, there is a "Command Histor" panel showing a list of commands: (tcl "help ", configureWir, configureWir, configureWir, and configureWir.

At the bottom of the window, there are tabs for "Scheme" and "Tcl", with "Ready" status indicators.

Summary

- **Milkyway Tcl/CCI is a common interface for Milkyway-based Galaxy products**
- **Tcl provides enhanced support to MAPin partners for both MDE and C-API use**
- **TC/CCI adds new command set with**
 - **Collection support**
 - **All other Tcl/CCI features**
 - **1500+ Scheme-Tcl commands**