Common Lisp : An Introduction

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What we will cover

- What is Common Lisp?
- History
- Getting Started
- Ecosystem Overview
- Basic Language Overview
- Questions

What we will NOT cover

- Macros
- CLOS
- MetaObject Protocol
- Gray Streams
- Packages
- Conditions
- LOOP

What is Common Lisp?

- Direct Descendent of LISP, invented by John McCarthy in 1958
- multi-paradigm language
  - procedural programming
  - functional programming
  - object-oriented programming
  - generic programming
  - can extend Lisp to embrace new paradigms (via macros)
- Functional Programming dominant paradigm (i.e. most code will utilize FP in some way)
- Interpreted as well as compiled language

```
(defun compose (&rest fns) (if fns #'(lambda (&rest args) (let ((fn
(car (last fns))) (rest-fns (butlast fns))) (reduce #'funcall rest-fns
```

- Commercial
  - Allegro CL (Franz Inc.)
  - LispWorks
  - mocl (compiles to iOS and Android)
- Open Source
  - Armed Bear Common Lisp (ABCL): runs on JVM
  - SBCL (Steel Bank Common Lisp)
    - forked from CMUCL with some added fixes and extensions
    - available on all major platforms
  - CMUCL
  - Clozure CL
    - good Objective-C interoperability
  - ECL
  - Clasp (LLVM)

A Brief History

- Late 1970s
  - Different Lisps available for different computer architectures
    - S-1 Lisp (for Mark II SuperComputer)
    - MACLisp (from Project MAC not Macintosh) and it's derivatives (NIL, BBN Lisp, etc.)
    - InterLisp (started BBN, expanded later Xerox PARC)
    - many others
  - Each Lisp expanded on the original Lisp 1.5 implementation and MACLisp just a little differently
  - Each Lisp provided additional features (Parallel Programming, abstractions to implement OO, etc.)

A Brief History

- 1981: Start of Standardization
  - instigated by DARPA to create a single community Lisp standard
  - took almost 13 years to standardize (ANSI standard official in 1994)
    - CLtL (written by Guy Steele for example)
    - first published in 1984, republished in 1989 (with new additions)

Why is this history necessary?

- CL spec classical example of design by committee
- CL was a "consolidation effort"
  - A lot of compromises were made for reasons:
    - backwards compatibility
    - systems migration (different OSes, architectures)
    - political appeasement
- Consequences
  - Certain pieces of what is considered "Standard Common Lisp" are not part of ANSI Spec
    - MOP, Gray Streams, Regular Expressions
  - Platform extensions covers aspects not covered by ANSI or defacto

Getting Started

There are several ways of getting started:

- downloading a Lisp (SBCL, CCL, etc.)
  - Follow the appropriate Lisp Compiler's website on how to best install the distro
  - **Suggestion**: use SBCL unless you have a good reason to try other distros
- downloading and installing Quicklisp
  - located at `https://www.quicklisp.org/beta/`
  - single file download
  - Just load into your REPL, and follow the instructions

Getting Started (cont'd)

- Choosing a Text Editor
  - Use whatever makes you comfortable when you're first learning the language
- Recommendation: learn Emacs for Lisp Development
  - SLIME: Superior Lisp Interaction Mode for Emacs
    - makes Emacs into an IDE for Lisp Development
    - provides nice integrated debugger, inspector, and other nice to have tools
    - works across multiple lisps

Roswell

- Utility to keep track and maintain multiple lisps
- Supported on all Major Operating Systems
  - Linux (via linuxbrew)
  - Mac OS X (via Homebrew)
  - Windows (installer available on Roswell wiki (`https://github.com/roswell/roswell/wiki`) in the Installation Section
- Best way to get up and running with a lisp
- Best way to maintain and keep track of multiple lisps installed

Quicklisp

- De facto Package Manager for Common Lisp
- Nice curated set of libraries
- Installed by default when using Roswell with different lisp implementations

Every Common Lisp System consists of 4 main layers:

- ANSI Common Lisp
- De facto standards
- Platform Extensions
- Third Party Libraries

ANSI Common Lisp

- the standardized foundation
- EVERY CL compiler implements this standard (at least)

Defacto standards

- libraries that aren't part of the standard but most major implementations implement
- MOP, Gray streams, CFFI, ASDF, etc.

Platform Extensions

- Threading
- Extensible Sequences
- Extensions to leverage processor-specific instructions (VOPs)
- MOP extensions
- Tooling
  - Profilers
  - Advanced Debuggers

Third-Party Libraries

- User Interface Libraries (Qtool, CommonQt, McCLIM, LTK)
- Web Frameworks (Caveman2, ningle, Weblocks, etc.)
- Async and Parallel APIs (lparallel, cl-async, bordeaux-threads, etc.)
- and many more!

Language Overview

Recommendations

- prefer defparameter over defvar
  - defparameter always assigns value to symbol
  - defvar only assigns value once to symbol upon first initialization
  - if using defvar and need to change value of binding using SETF not defvar
- prefer use of lexical environments under normal development
  - few cases where special variables are an exception, but advanced topic

Recommendations

- functional programming by default
  - leads to cleaner, modular, composable code
  - leads into dealing with generic programming (at least in Common Lisp)

Book Recommendations

Introductory Books

- Practical Common Lisp by Peter Siebel
- ANSI Common Lisp by Paul Graham
- Land of Lisp by Conrad Barski

Learning about Macros:

- On Lisp by Paul Graham
- Let over Lambda by Doug Hoyte

Book Recommendations

Additional Resources

- Common Lisp Recipes by Edi Weitz (published 2015)

Questions??