

# Real World Clojure

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# 1 Overview

Real World Clojure

file:~/src/software-passion/Clojure-glyph.svg

My journey in using Clojure for a client that is developing a multiplayer game server hosting service.

## 1.1 Overview: Topics to cover

Press **f9** to see the list of topics

## 1.2 What is that presentation tool?

Emacs!

This is **org-tree-slide** from <https://github.com/takaxp/org-tree-slide>

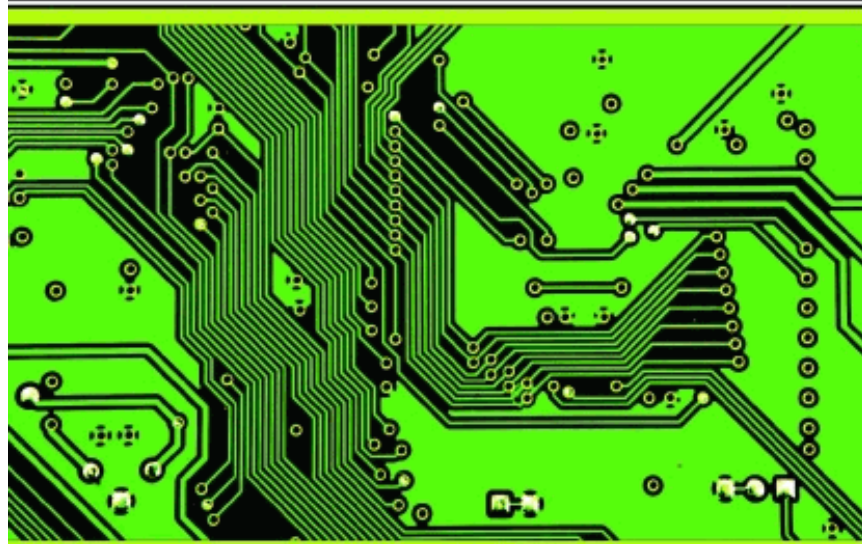
For more on org mode see <http://orgmode.org/org.html>

Yes I will share my “slides” on my website <http://tmarble.info9.net>

**A GNU MANUAL**

# **The Org Mode 7 Reference Manual**

**Organize your life with GNU Emacs**



**Carsten Dominik and others**

**PUBLISHED BY NETWORK THEORY LTD**

### 1.3 Tack!

My great grandmother immigrated to the USA from Sweden around 1900



## 2 Background

### 2.1 About Tom

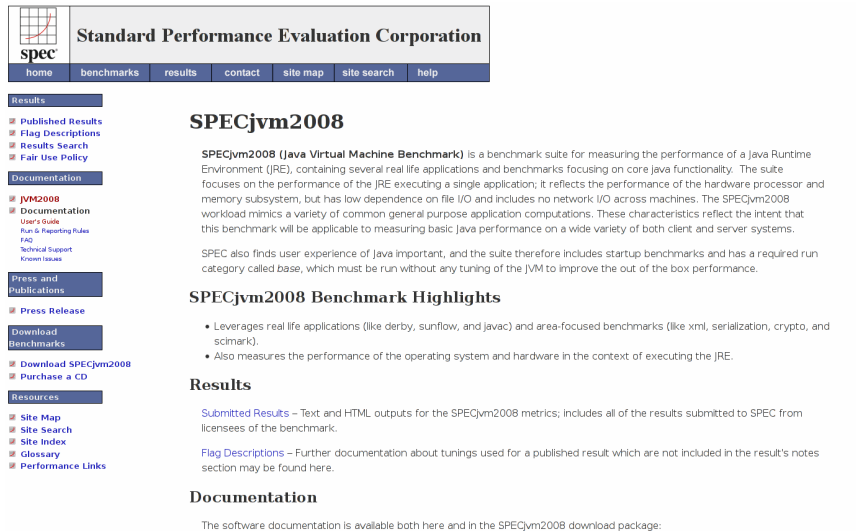


tmarble

2.1.1 Sun: technical presales during the dot.com era



## 2.1.2 Sun: Java Performance



The screenshot shows the SPEC website interface. At the top left is the SPEC logo, a grid with a red line graph. To its right is the text "Standard Performance Evaluation Corporation". Below this is a navigation bar with links: home, benchmarks, results, contact, site map, site search, and help. A left sidebar contains several menu categories: Results (with sub-links: Published Results, Flag Descriptions, Results Search, Fair Use Policy), Documentation (with sub-links: JHM2000, Documentation, User's Guide, Run & Reporting Rules, FAQ, Technical Support, Known Issues), Press and Publications (with sub-link: Press Release), Download Benchmarks (with sub-links: Download SPECjvm2008, Purchase a CD), and Resources (with sub-links: Site Map, Site Search, Site Index, Glossary, Performance Links). The main content area features the heading "SPECjvm2008" followed by a paragraph describing the benchmark suite. Below this is a section titled "SPECjvm2008 Benchmark Highlights" with a bulleted list. Further down are sections for "Results" and "Documentation".

**Standard Performance Evaluation Corporation**

home benchmarks results contact site map site search help

**Results**

- Published Results
- Flag Descriptions
- Results Search
- Fair Use Policy

**Documentation**

- JHM2000
- Documentation
- User's Guide
- Run & Reporting Rules
- FAQ
- Technical Support
- Known Issues

**Press and Publications**

- Press Release

**Download Benchmarks**

- Download SPECjvm2008
- Purchase a CD

**Resources**

- Site Map
- Site Search
- Site Index
- Glossary
- Performance Links

### SPECjvm2008

**SPECjvm2008 (Java Virtual Machine Benchmark)** is a benchmark suite for measuring the performance of a Java Runtime Environment (JRE), containing several real life applications and benchmarks focusing on core Java functionality. The suite focuses on the performance of the JRE executing a single application; it reflects the performance of the hardware processor and memory subsystem, but has low dependence on file I/O and includes no network I/O across machines. The SPECjvm2008 workload mimics a variety of common general purpose application computations. These characteristics reflect the intent that this benchmark will be applicable to measuring basic Java performance on a wide variety of both client and server systems.

SPEC also finds user experience of Java important, and the suite therefore includes startup benchmarks and has a required run category called base, which must be run without any tuning of the JVM to improve the out of the box performance.

### SPECjvm2008 Benchmark Highlights

- Leverages real life applications (like derby, sunflow, and javac) and area-focused benchmarks (like xml, serialization, crypto, and schmark).
- Also measures the performance of the operating system and hardware in the context of executing the JRE.

### Results

**Submitted Results** – Text and HTML outputs for the SPECjvm2008 metrics; includes all of the results submitted to SPEC from licensees of the benchmark.

**Flag Descriptions** – Further documentation about tunings used for a published result which are not included in the result's notes section may be found here.

### Documentation

The software documentation is available both here and in the SPECjvm2008 download package:

## 2.1.3 Sun: DLJ

Early 2006: DLJ with Debian and Canonical (Ubuntu)



Java ▾ Solaris ▾ Communities ▾ About Sun ▾ How to Buy ▾ My Sun Connection ▾ Cart ▾ United States | Worldwide

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» Press Release Finder » Week in Review

**Sun Recasts Java Licensing for GNU/Linux and OpenSolaris Communities**  
**Historic Collaboration Makes Java Technology Broadly Available On Leading Open Source Platforms**

**SAN FRANCISCO, CALIF. JAVAONE CONFERENCE, May 16, 2006** Sun Microsystems, Inc. (Nasdaq: **SUNW**), the creator and leading advocate of Java technology, today announced that **Java Platform, Standard Edition (Java SE) 5 is now available for redistribution by GNU/Linux and OpenSolaris operating system distributors under the new Operating System Distributor's License for Java (also known as the "Distro License for Java" or DLJ).**

Developed in consultation with, and for use by, the various GNU/Linux communities, the new license allows distributors to ship Sun's Java SE 5.0 Java Development Kit (JDK) and Java Runtime Environment (JRE) as installable packages for their operating systems.

The open source development community is demonstrating enthusiastic support of this announcement. Several project teams are expected to announce plans to redistribute the JDK, packaged for use with their operating systems, including the Ubuntu, Gentoo and Debian distributions of GNU/Linux, NexentaOS, a hybrid operating system with an OpenSolaris kernel and GNU applications and both the Schillix and BeleniX versions of OpenSolaris. These popular open source distributions will help make the Java platform a foundation of innovation for open source development.

"This new license shows that Sun and the Java technology world care about GNU/Linux and open source platforms and are willing to put aside philosophical differences and get down to business," said Mark Shuttleworth, founder and sponsor of the Ubuntu GNU/Linux distribution, the most-downloaded GNU/Linux in the world for the last eight months. "This eliminates one of the biggest roadblocks to wider use of the Java platform on free and open source operating system platforms and makes Java technology a more attractive foundation on which to build new projects and innovations."

"We are really pleased to see Sun's increasing involvement in the free software community, from the opening of the Solaris Operating System source and now the re-licensing of Java technology to be compatible with GNU/Linux distributions, and are looking forward to building stronger ties with the Sun community in the future", said Anthony Towns, Debian Project Leader.

Sun is also opening a new community project on Java.net (<https://jdk-distros.dev.java.net>) to serve as a clearinghouse of information and best practices for delivering compatibly packaged JDK bundles on GNU/Linux and OpenSolaris.

The DLJ leaves communities free to define the packaging, installation and support for the JDK within their distribution, creating new opportunities to add value for both developers and users, while maintaining Java's "write once, run anywhere" compatibility promise. One well-known effort to repackage Sun's JDK for GNU/Linux distributions, the Blackdown Project (<http://www.blackdown.org>), has generously agreed to join the new jdk-distros project on java.net and contribute their Debian packaging code to this initiative.

**Press Contacts**  
 Sun Microsystems, Inc.  
 Jacki DeCoster  
 (415) 294-4482  
[jacki.decoaster@sun.com](mailto:jacki.decoaster@sun.com)

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 Sun Global Communications  
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### 2.1.4 Sun: OpenJDK

JavaOne 2006: Rich Green announces that Sun will open source Java Core Strategy Team

- How organize community governance
- Copyright, Patent and Trademark licensing
- Infrastructure tools
- Pick license

First OpenJDK Ambassador (I went to a lot of conferences)

- FOSDEM

- FISL
- OSCON



ApacheCon 2006: Sun unBOF/Party  
Copyright 2006 Ted Leung: <https://secure.flickr.com/photos/twleung/268116213/>

### 2.1.5 Left Sun to do a startup



### 2.1.6 But

The global financial meltdown of 2008 happened (etc.)

Didn't work out :(

And so I... got into consulting!

### 2.1.7 Consulting

Cybersecurity

Probabilistic Model Verification (Electrical Engineering)

Software for Smart Grid + Renewable Energy

Clojure

### 2.1.8 Tom and Debian

Using Linux since 1996

Using Debian since 2003

Helped Debian Java Packaging Team since DLJ in 2006

World with Debian and Oracle on meshing Jigsaw with **apt**



### 2.1.9 FOSDEM

Java track

- Oracle
- Distros
- Developers
- Users

Legal Issues Track

- Organized by Karen Sandler, Bradley Kuhn, Richard Fontana and myself
- Check out the Wiki <http://info9.net/wiki/fosdem/LegalIssuesDevRoom/>
- Check out the oggcast <http://faif.us/>

## 2.2 About my client

The client

- Developing a multiplayer game server hosting service

- Comprised of very young developers
- Is in stealth mode (sorry!)

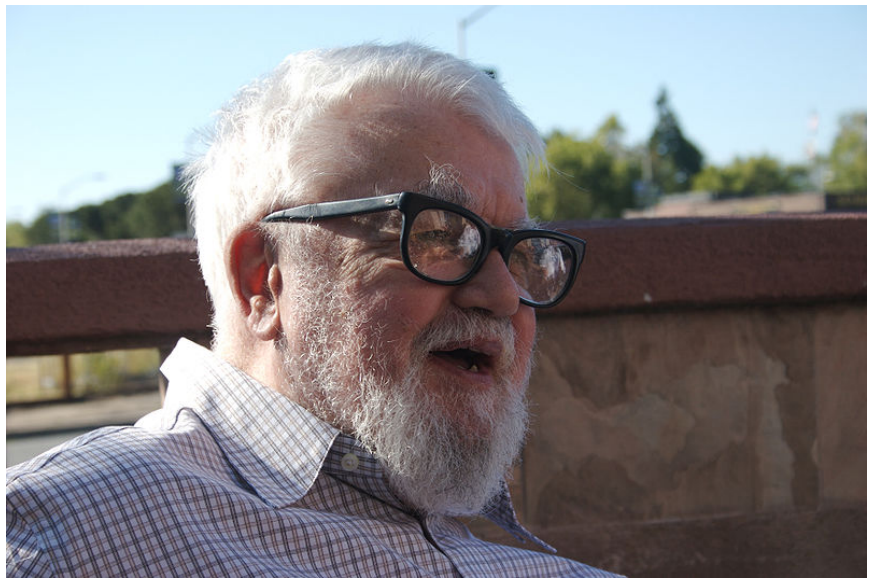
I have been given the authority to

- Make significant choices about architecture
- Green light to open source generic bits

(this is why i like consulting :)

I'm not the only one (especially in Nordic countries)!

### 3 Why Lisp?



John McCarthy is old school:

#### 3.1 homoiconic

##### code is data

List

```
(def mylist '(1 2 3))
```

Function

```
(defn myadd [a b] (+ a b))
```

Clojure is defined in terms of the evaluation of data structures and not in terms of the syntax of character streams/files.

## 3.2 macros: code transformations at compile time

Macros offer hooks for syntactic abstraction and there is very little syntax.

```
(defmacro and ([] true) ([x] x) ([x & rest] `(let [and# ~x] (if and# (and
~@rest) and#))))
```

Allows code transformation **before** the reader does evaluation `defn` is a macro that makes defining functions a little simpler.

### 3.2.1 defining functions uses the `defn` macro

Clojure supports arity overloading in a single function object, self-reference, and variable-arity functions using `&`:

```
(defn argcount ([] 0) ([x] 1) ([x y] 2) ([x y & more] (+ (argcount x y)
(count more))))
-> #'user/argcount (argcount) -> 0 (argcount 1) -> 1 (argcount 1 2) ->
2 (argcount 1 2 3 4 5) -> 5
```

## 3.3 Very easy to work with code (because it's data)

LISP is the language of choice when writing Domain Specific Languages (DSL's).

- Mentioned by Theo (JRuby) and Morton (APL) today!

Example from ILC '09 at MIT

- Alex Fukunaga (Tokyo University) spoke on The Satisfiability Problem
- A DSL for SAT algorithms
- Used a biological evolution inspired algorithm

## 3.4 REPL

The Read Eval Print Loop

Interactive code development

Instead of just dump a stack trace and die on an error... you can edit data and functions (they look the same) and continue your program!

### 3.5 Lisp successes

Artificial Intelligence

Scientific Computing Lisp

SciCL augments Common Lisp with an extensive library of aggregate-wise (“AG-wise”) operations on arrays, providing the essential functionality of languages such as APL, Fortran 90, IDL and Matlab.

<http://www.signif.com/>

## 4 Why Clojure?

### 4.1 Many enterprise deployments already use Java

Clojure adds a jar to the CLASSPATH (lowers the barrier to customer approval)

Embraces the power of the JVM

```
(defn #Properties as-properties "Convert any seq of pairsto a java.util.Properties instance. Uses as-str to convert both keys and values into strings." {:tag Properties} [m] (let [p (Properties.)] (doseq [[kv] m] (.set p (str k) (str v))))))
```

Leverages the wealth of existing Java libraries

### 4.2 Need the benefits of LISP and

Need to deal with concurrency using native threads and locking.

Without the downsides of Java

- Skip the boilerplate (to not fetishize complexity)
- Multi-methods instead of the “Kingdom of Nouns (OOP)”
- Unmoderated mutation simply “has to go” (makes concurrency very difficult)

### 4.3 Functional Programming

Immutable data + first-class functions, supporting recursion

Dynamic polymorphism

Emphasizes recursive iteration instead of side-effect based looping

```
user> (let [my-vector [1 2 3 4] my-map {:fred "ethel"} my-list (list 4 3 2 1)] (list (conj my-vector 5) (assoc my-map :ricky "lucy") (conj my-list 5) my-vector my-map my-list)) -> ([1 2 3 4 5] {:ricky "lucy", :fred "ethel"} (5 4 3 2 1) [1 2 3 4] {:fred "ethel"} (4 3 2 1))
```

#### 4.4 Software Transactional Memory

Core data structures are immutable and can easily be shared between threads  
Mutation is possible using locks to avoid conflicts

- dosync, ref, set, alter, et al, supports sharing changing state between threads in a synchronous and coordinated manner.
- The agent system supports sharing changing state between threads in an asynchronous and independent manner.
- The atoms system supports sharing changing state between threads in a synchronous and independent manner.
- The dynamic var system supports isolating changing state within threads.

#### 4.5 No spec, one implementation

Disadvantages: All eggs in one basket

Advantages: Clojure works **everywhere** Innovation happens quickly  
Core data structures are extensible abstractions





## 4.6 Java

Embraces the power of the JVM

- Multiplatform
- Performance

Note: also runs on the CLR and on JavaScript (\*)

### 4.6.1 Java - multiplatform

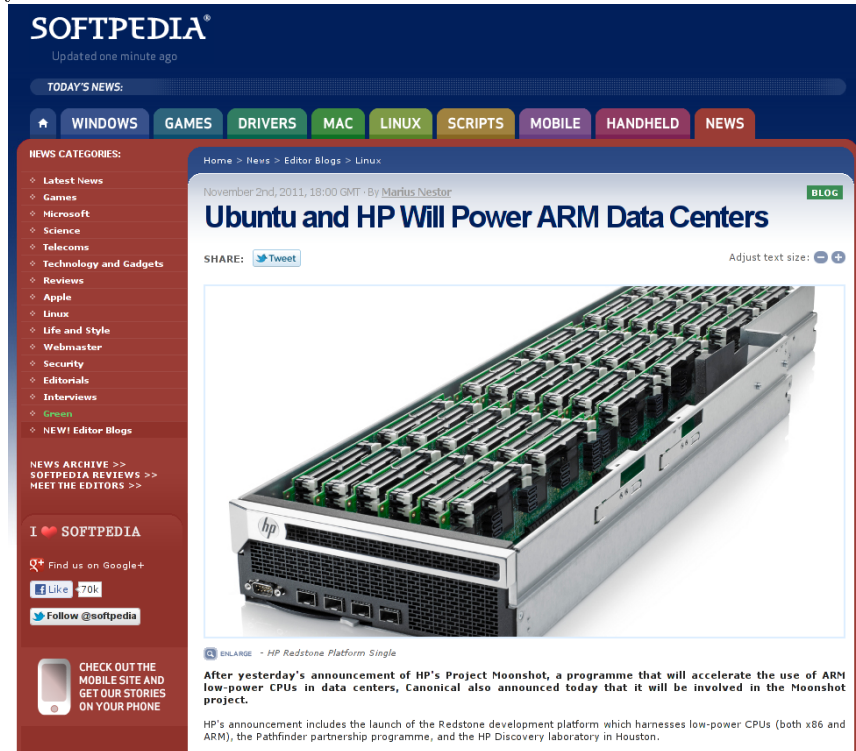
Sun originally wanted Java to enable customers to use SPARC

Today many Enterprises run on Intel architectures

But what about tomorrow?

#### 4.6.2 ARM looks very good for size, cost, heat

Maybe we will see ARM in the data center?



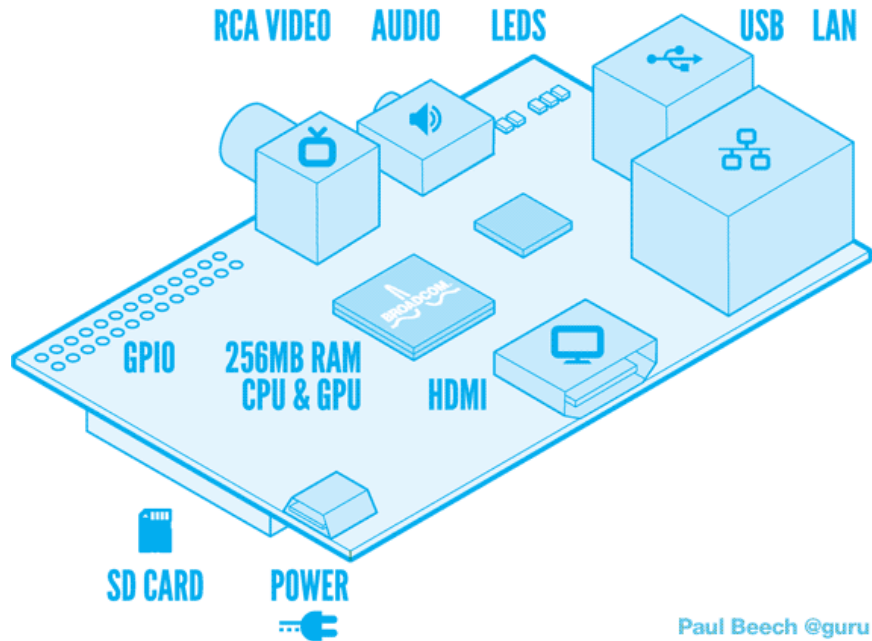
<http://news.softpedia.com/news/Ubuntu-and-HP-Will-Power-ARM-Data-Centers-231827.shtml>

#### 4.6.3 We are seeing ARM everywhere in embedded devices

Raspberry Pi = \$25

- SoC is a Broadcom BCM2835. This contains an ARM1176JZFS, with floating point, running at 700Mhz
- Videocore 4 GPU. The GPU is capable of BluRay quality playback, using H.264 at 40Mbits/s.
- It has a fast 3D core accessed using the supplied OpenGL ES2.0 and OpenVG libraries.
- 256 MB RAM
- One USB port

- (Model B adds a 2nd USB port, Ethernet)



<http://www.raspberrypi.org/>

#### 4.6.4 Java for the “Internet of Things”

##### Tiny ARM chip IPv6

**BBC NEWS**  
 BBC Home > BBC News > Technology  
 Menu

**Arm's latest processors aim to stretch internet's reach**  
 13 March 10 07:52 GMT

**ARM**

By Leo Kelion  
 Technology reporter

**Arm Holdings has unveiled what it describes as the "world's most energy-efficient microprocessor" design.**

The firm says that microcontrollers based on the "Flycatcher" architecture will pave the way for the "internet of things" - the spread of the net to a wider range of devices. It suggests that fridges and other white goods, medical equipment, energy meters, and home and office lighting will all benefit from the innovation.

Two firms have licensed the technology.

They are NXP Semiconductors and Freescale.

"It opens up all devices to the potential of being connected all the time," Freescale's Geoff Lees told the BBC.

"It's allowing us to provide connectivity everywhere. So anything from consumer appliances, MP3-music audio docks, kitchen equipment with displays right through to remote sensors in rain monitoring equipment or personal medical devices - an area where ultra-long battery life allied to high performance and safety is becoming more and more important."

**Smarter energy appliances**

The Cortex-M0+ architecture is designed to provide chip-makers with the means to build microcontrollers that require "ultra low power" but are capable of 32-bit processing. Arm says it went back to the drawing board to create the new processor cores which measure 1mm by 1mm in size.

It says the microcontrollers should draw around a third less energy than their predecessors, which only offered 8 and 16-bit capabilities.

It adds that its design has been created to be a low leakage part - meaning it consumes almost no power when it is in sleep mode. The firm says that means devices can offer wireless connectivity when paired with modern bluetooth or radio equipment, offering years of life from a single battery-pack rather than months.

Arm's director of embedded marketing Gary Atkinson says it could herald a new generation of smart energy systems.

"Every developed nation country has a graph showing electricity demand is going to outstrip supply at some point in the next 20 years unless we do something different," he said.

"What we need to do is something called design response - where all the devices on the network can make a decision as to whether or not to come on in order to smooth out peaks and troughs in electricity demand.

"So you should add connectivity to things like fridges, washing machines, freezers and dishwashers. If the wider electricity network is being very heavily used and if the element in your dishwasher could go off for two or three minutes to alleviate that - well then that would make a big difference."

#### 4.6.5 Java as assembly language

For these reasons Clojure is one of many vibrant, alternative languages on the JVM which include:

- JRuby
- Scala
- Jython
- IKVM.NET
- Gosu
- Smalltalk
- JavaScript

#### 4.7 Bleeding Edge OpenJDK features

NOT yet truly being used by Clojure

##### 4.7.1 Fork/Join

Bring Doug Lea's Fork/Join framework into Clojure

Primary example **pmap**

- using the shortest map/reduce tutorial ever
- WAIT, Morton did this in one line in APL :)  
user> (def mylist '(1 2 3 4 5 6)) #'user/mylist user> (map even? mylist) (false true false true false true) user> (reduce 'or (map even? mylist)) true

David Liebke: "From Concurrency to Parallelism" <http://incanter.org/downloads/fjclj.pdf>

##### 4.7.2 Tail Call Optimization

Save space on the stack:

```
call factorial (3) call fact (3 1) call fact (2 3) call fact (1 6) call fact (0 6) return 6 return 6 return 6 return 6 return 6
```

```
call factorial (3) call fact (3 1) replace arguments with (2 3), jump to "fact" replace arguments with (1 6), jump to "fact" replace arguments with (0 6), jump to "fact" return 6 return 6
```

NOTE: Clojure does have **recur** and **trampoline** but the JVM itself lacks a generic optimization for TCO (but there is an older patch in the MVLM repo).

[https://en.wikipedia.org/wiki/Tail\\_call](https://en.wikipedia.org/wiki/Tail_call)

### 4.7.3 Invoke Dynamic

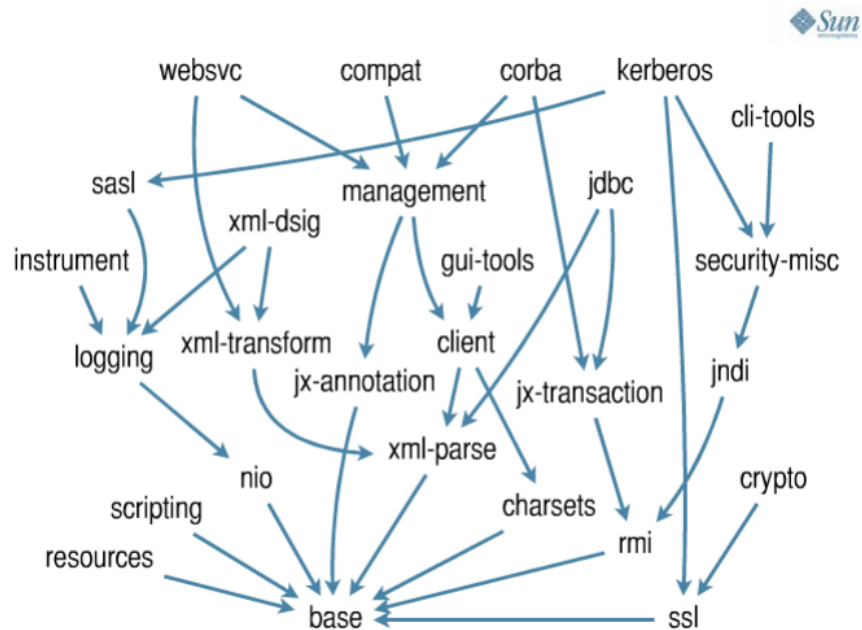
JSR 292

Enables the HotSpot VM to **see** into your “JVM Language” code and optimize it!

Why Clojure Doesn't Need Invokedynamic (Unless You Want It to be More Awesome) <http://blog.headius.com/2011/10/why-clojure-doesnt-need-invokedynamic.html>

### 4.7.4 Modularization (Jigsaw)

Better startup time  
Finer grained dependencies  
Smaller footprint (embedded)



## 5 The Tools I am using

### 5.1 Maven

Finding dependencies: `mvn dependency:tree -DoutputFile=dependency.txt`

```
my-website:my-website:jar:0.1.0-SNAPSHOT +- org.clojure:clojure:jar:1.3.0:compile
noir:noir:jar:1.2.2-SNAPSHOT:compile +- compojure:compojure:jar:1.0.0-
RC2:compile
```

```
    +- org.clojure:core.incubator:jar:0.1.0:compile
    +- org.clojure:tools.macro:jar:0.1.0:compile
    +- clout:clout:jar:1.0.0:compile
      ring:ring-core:jar:1.0.1:compile
    +- commons-io:commons-io:jar:1.4:compile
    +- commons-fileupload:commons-fileupload:jar:1.2.1:compile
      javax.servlet:servlet-api:jar:2.5:compile
+- org.clojure:tools.namespace:jar:0.1.0:compile
    org.clojure:java.classpath:jar:0.1.0:compile
+- clj-json:clj-json:jar:0.4.3:compile
    org.codehaus.jackson:jackson-core-asl:jar:1.5.0:compile
+- ring:ring:jar:1.0.1:compile
+- ring:ring-devel:jar:1.0.1:compile
    ns-tracker:ns-tracker:jar:0.1.1:compile
+- ring:ring-jetty-adapter:jar:1.0.1:compile
    +- org.mortbay.jetty:jetty:jar:6.1.25:compile
      org.mortbay.jetty:jetty-util:jar:6.1.25:compile
ring:ring-servlet:jar:1.0.1:compile
+- hiccup:hiccup:jar:0.3.7:compile +- clj-stacktrace:clj-stacktrace:jar:0.2.3:compile
+- ring-reload-modified:ring-reload-modified:jar:0.1.1:compile +- net.java.dev.jets3t:jets3t:jar:0.8.1:compile
    +- commons-codec:commons-codec:jar:1.3:compile
    +- commons-logging:commons-logging:jar:1.1.1:compile
    +- commons-httpclient:commons-httpclient:jar:3.1:compile
      com.jamesmurty.utils:java-xmlbuilder:jar:0.4:compile
org.mindrot:jbcrypt:jar:0.3m:compile
```

## 5.2 Leiningen

Leiningen is awesome <https://github.com/technomancy/leiningen>

Use the REPL **swank-clojure** <https://github.com/technomancy/swank-clojure>

Get... \$ lein plugin install swank-clojure 1.4.0 \$ lein plugin install lein-localrepo 0.3 \$ lein plugin install lein-noir 1.2.1

lein localrepo help

Public Repos: <http://clojars.org/>

Private Repos: <https://github.com/technomancy/s3-wagon-private>

Lein directly from git: <https://github.com/tobyhede/lein-git-deps>

## 5.3 Redis

Amazing NoSQL Database: <http://redis.io>

With a Clojure binding! <https://github.com/mmcgrana/clj-redis>

Redis utterly killed it in 2010 – check out the growth in developer conversation <http://www.redmonk.com/jgovernor/2012/03/15/redis-utterly-killed-it-in-2010-check-out-the-growth-in-share-of-developer-conversation/>

## 5.4 Jenkins

Continuous Integration Server: <http://jenkins-ci.org/>

Amazing Plugins: <https://wiki.jenkins-ci.org/display/JENKINS/Plugins>

The ones that I use:

- Trac Publisher
- Dependency Graph Viewer
- IM
- Pathignore (essential for big git repo)
- SSH Slaves
- Thin Backup
- Build Result Trigger

Fun ones

- Gravatar
- Emotional Jenkins

KK slides from February at MonkiGras in London <http://www.slideshare.net/kohsuke/building-developer-community>

## 5.5 Using Jenkins

Git push triggers Jenkins Updates the one (master) workspace Projects started based on updated paths

Java Client

- Builds on Linux
- Triggers native Mac OS X build on Mac slave
- Triggers native Windows build on Windows slave

Deploying Noir application

- shuts down dev website
- updates code
- restarts website

## 5.6 Trac

<http://trac.edgewall.org/>

- Tickets (bugs, tasks), Reports, Browse code, Timeline, Wiki
- Can now use git (yeah!)
- Integration with Jenkins <http://trac-hacks.org/wiki/XmlRpcPlugin>

## 5.7 Noir

Let's talk about Noir <http://webnoir.org>

# 6 Why Open Source Matters

Free as in Free Beer

Free as in Free Speech

Knowing the shape of the solutions: Ease of integration

No marketing: just code (extra credit: build in tests and Jenkins)

Fewer bugs (recent Coverity study)

Education, credentials and employment



- Employers **will** google you
- Many directly ask for pointers to FLOSS contributions

## 6.1 Where are you going to deploy that code?

The “cloud”.

Are you really going to deploy to Windows?

- you have to name your machines #FAIL
- you have to Remote Desktop in and click-to-admin #FAIL
- no anticipated downtime until 2016 :)

You can't deploy to Mac OS X

- X Serve died a long time ago

You want to deploy to Linux

- Cost effective
- Legal
- More reliable
- More automatable

## 6.2 permissive vs. restrictive licensing

BSD (MIT AL2) vs. GPL (MPL)

Permissive is necessary, but sometimes not enough to hold a community together.

Jeremy Allison: Why Samba Switched to GPLv3 2011 Linux Collaboration Summit <http://faif.us/cast/2011/may/10/0x0F/>

NOTE: proprietary (dual) licensing with contributor license agreements is now considered harmful

### 6.3 Open Source and Web Services

What if you want to build a strong community around a web service?

In the “cloud” the GPL is just like BSD.

The answer? The AGPL (Afero General Public License)

From the FSF The GNU Affero General Public License is a modified version of the ordinary GNU GPL version 3. It has one added requirement: if you run the program on a server and let other users communicate with it there, your server must also allow them to download the source code corresponding to the program that it’s running.

What? I’m going to build a business on AGPL? Is that CRAZY?

It is being done now: <http://status.net> “Enterprise Social Software is OPEN for business.”

### 6.4 Where is the value?

Productivity!

Right Now

- Hardware is effectively free
- The best software in life is Free
- Savoir Faire (brainpower) is expensive
- Data are like diamonds: they vary in clarity, quality and value

New business models need to maximize productivity around managing and improving quality of data.

(NOTE: China doesn’t care about intellectual property anyway)

### 6.5 Why Debian

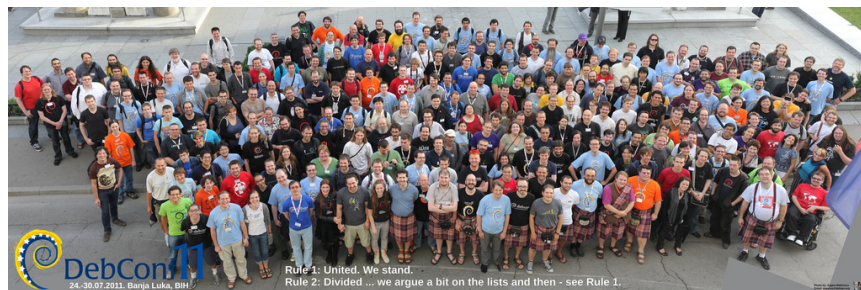
Commitment to quality and building everything from source

Package inter-dependencies are core to the system

- Windows needs Maven, Gems, cygwin, etc.
- Mac needs MacPorts, etc.

Very predictable, easy to administer & automate, secure, stable

One of the two major Linux families (.deb and .rpm) and the foundation of many derivatives (e.g. Ubuntu)



<http://wiki.debconf.org/wiki/DebConf11/Pictures/GroupPhoto>

## 7 Challenges and Next Steps

### 7.1 The state of Clojure Contrib (is a challenge)

“Modularization of Contrib”

<http://dev.clojure.org/display/doc/Clojure+Contrib>

Wait, why isn't there a `project.clj` (for lein)?

- officially must use `mvn` (!) (`lein` originally could not deploy to remote `mvn` repos)

The idea is that everything that hasn't been modularized yet is supposedly either low quality or in low demand

Using `clojars`: change `groupId` to highlight it's non-canonical

Also it's tricky to find out what the **real** disposition of stuff is.. I wanted `java-utils` (moved to `clojure.java.io`)

### 7.2 My client will expand capacity from private to public cloud

Expand service from customer hosted into EC2 With auto provisioning of resources (up/down)

### 7.3 Websockets

jQuery Atmosphere Jetty Noir

Fully bi-directional pipes (no more AJAX polling)!

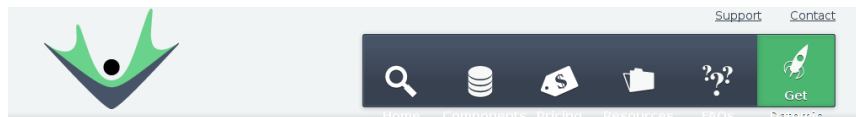
### 7.4 Redis binding change

`clj-redis` / `Jedis` / Apache connection library

- missing functionality
- times out

My be replaced with redis-clojure

## 7.5 Keeping an eye on Datomic



### *About Datomic*

As a long-time consumer of ISAM, relational, object and other databases, Rich Hickey has shared the pain points of developers in dealing with databases. With a new perspective, informed by the principles of functional programming, and hardware advances that have happened since relational, client-server databases were invented, he decided to design a new kind of database. Looking around the landscape, he saw that modern database and key-store developers were making tradeoffs they might not have to; sacrificing queries, joins and ACID transactions in pursuit of flexibility, scalability and speed. He thought there was a better way; Datomic is that way. In 2010, Rich and Relevance partnered to bring his vision to life. Stuart Halloway, already a committer on Clojure and a colleague of Rich's, led the charge on the Relevance side, not only coming on as a programmer to the project but managing a team of other contributors from within Relevance to help Rich get from design to product.

## 7.6 Keeping an eye on ClojureScript One

ClojureScript ClojureScript One ClojureScript One + the remote REPL + browser testing + no CSS reloads

Connect With Your Creation Through a Real-Time Editor <http://www.webmonkey.com/2012/03/with-your-creation-through-a-real-time-editor/> <http://www.chris-granger.com/2012/02/20/overtone-and-clojurescript/>

## 7.7 Experiment with exposing bleeding edge JVM features in the Clojure

It only takes about 30 min to build the JDK on an 8 core machine  
Tighter Debian Clojure packaging (Jigsaw)

## 8 Conclusion

LISP is incredibly powerful (don't be afraid of the parens)

Clojure is the best LISP now (because of the JVM)

Java means future proof for platforms in the cloud and the "Internet of Things".

Open Source isn't just free, it's key to a strong business model (and probably saving the planet).

Software "best practice" tools are available for Clojure now

There are **still** many optimizations waiting to be made

The #1 reason to use Clojure: productivity.

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Clojure: Copyright 2008-2012 Rich Hickey <http://clojure.org>

NOTE: Tom will code in Clojure / Jigsaw / Debian / ARM for food!  
<http://tmarble.info9.net>

## 9 Q/A + Live Hacking

file:~/src/software-passion

### 9.1 Command line processing and configuration files

tools.cli <https://github.com/clojure/tools.cli> awesome, right? connected to SSH agent (has at least one identity) tmarble@noir 102\$ lein search tools.cli  
== Results from central - Showing page 1 / 1 total [org.clojure/tools.cli "0.1.0"] [org.clojure/tools.cli "0.1.0"] tmarble@noir 103\$

### 9.2 Pretty Print HTML and XML

I created a future-contrib package: file:~/src/maas/clojure/future-contrib/project.clj

See file:~/src/maas/clojure/future-contrib/src/future\_contrib/core.clj

Demonstrate example with file:~/src/clojuremn/example.xml

### 9.3 redis2xml

Demonstrates command line processing and configuration files

see file:~/src/maas/clojure/redis2xml/project.clj

see: file:/.redis2xml

also try command line:

```
redis-cli -a NoOneWillEverGuess -n 3
```

```
./bin/redis2xml -v -n 3 -f -i ~/src/clojuremn/example.xml
```

## 9.4 Example Noir site

See file: `~/src/noir-examples/my-website`