

The Raft Consensus Algorithm



Quick Links

Raft paper (raft.pdf)

raft-dev mailing list (<https://groups.google.com/forum/#!forum/raft-dev>)

Raft implementations

What is Raft?

Raft is a consensus algorithm that is designed to be easy to understand. It's equivalent to Paxos in fault-tolerance and performance. The difference is that it's decomposed into relatively independent subproblems, and it cleanly addresses all major pieces needed for practical systems. We hope Raft will make consensus available to a wider audience, and that this wider audience will be able to develop a variety of higher quality consensus-based systems than are available today.

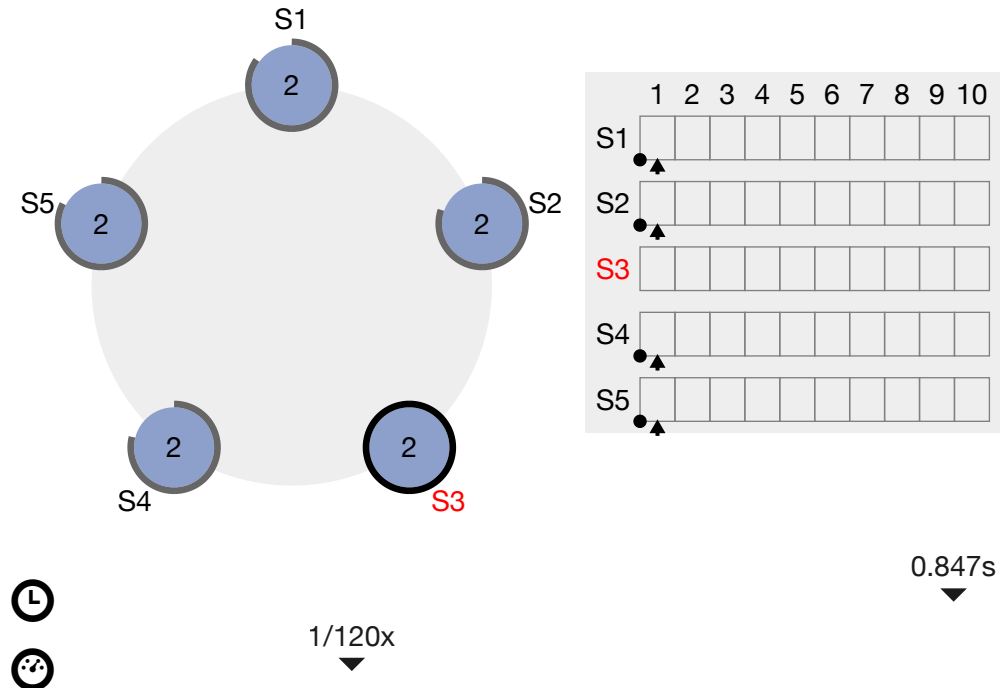
Hold on—what is consensus?

Consensus is a fundamental problem in fault-tolerant distributed systems. Consensus involves multiple servers agreeing on values. Once they reach a decision on a value, that decision is final. Typical consensus algorithms make progress when any majority of their servers is available; for example, a cluster of 5 servers can continue to operate even if 2 servers fail. If more servers fail, they stop making progress (but will never return an incorrect result).

Consensus typically arises in the context of replicated state machines, a general approach to building fault-tolerant systems. Each server has a state machine and a log. The state machine is the component that we want to make fault-tolerant, such as a hash table. It will appear to clients that they are interacting with a single, reliable state machine, even if a minority of the servers in the cluster fail. Each state machine takes as input commands from its log. In our hash table example, the log would include commands like *set x to 3*. A consensus algorithm is used to agree on the commands in the servers' logs. The consensus algorithm must ensure that if any state machine applies *set x to 3* as the n^{th} command, no other state machine will ever apply a different n^{th} command. As a result, each state machine processes the same series of commands and thus produces the same series of results and arrives at the same series of states.

Raft Visualization

Here's a Raft cluster running in your browser. You can interact with it to see Raft in action. Five servers are shown on the left, and their logs are shown on the right. We hope to create a screencast soon to explain what's going on. This visualization (RaftScope (<https://github.com/ongardie/raftscope>)) is still pretty rough around the edges; pull requests would be very welcome.



The Secret Lives of Data (<http://thesecretlivesofdata.com/raft/>) is a different visualization of Raft. It's more guided and less interactive, so it may be a gentler starting point.

Publications

This is "the Raft paper", which describes Raft in detail: In Search of an Understandable Consensus Algorithm (Extended Version) (raft.pdf) by Diego Ongaro (<https://twitter.com/ongardie>) and John Ousterhout (<http://www.stanford.edu/~ouster/>). A slightly shorter version of this paper received a Best Paper Award at the 2014 USENIX Annual Technical Conference (<https://www.usenix.org/conference/atc14/technical-sessions/presentation/ongaro>).

Diego Ongaro's Ph.D. dissertation (<https://github.com/ongardie/dissertation#readme>) expands on the content of the paper in much more detail, and it includes a simpler cluster membership change algorithm.

More Raft-related papers:

- Doug Woos, James R. Wilcox, Steve Anton, Zachary Tatlock, Michael D. Ernst, and Thomas Anderson.
Planning for Change in a Formal Verification of the Raft Consensus Protocol (<http://verdi.uwplse.org/>).
Certified Programs and Proofs (CPP), January 2016.
- James R. Wilcox, Doug Woos, Pavel Panchekha, Zachary Tatlock, Xi Wang, Michael D. Ernst, and Thomas Anderson.
Verdi: A Framework for Implementing and Verifying Distributed Systems (<http://verdi.uwplse.org/>).
Programming Language Design and Implementation (PLDI), June 2015.
- Hugues Evrard and Frédéric Lang.
Automatic Distributed Code Generation from Formal Models of Asynchronous Concurrent Processes (<https://hal.inria.fr/hal-01086522>).
Parallel, Distributed, and Network-Based Processing (PDP), March 2015.
- Heidi Howard (<https://twitter.com/heidiann360>), Malte Schwarzkopf, Anil Madhavapeddy, and Jon Crowcroft.
Raft Refloated: Do We Have Consensus? (<http://www.cl.cam.ac.uk/~ms705/pub/papers/2015-osr-raft.pdf>).
SIGOPS Operating Systems Review, January 2015.
- Heidi Howard.
ARC: Analysis of Raft Consensus (<http://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-857.html>).
University of Cambridge, Computer Laboratory, UCAM-CL-TR-857, July 2014.

Talks

These talks serve as good introductions to Raft:

Talk on Raft at CS@Illinois Distinguished Lecture Series (<https://cs.illinois.edu/news/distinguished-lecture-series-dr-john-ousterhout>) by John Ousterhout (<http://www.stanford.edu/~ouster/>), August 2016:

Video YouTube (<https://youtu.be/vYp4LYbnnW8>)

Slides PDF (<slides/uiuc2016.pdf>) with RaftScope visualization (<raftscope/index.html>)



Talk on Raft and its TLA+ spec as part of Dr. TLA+ Series (<https://github.com/tlaplus/DrTLAPlus>) by Jin Li (<https://research.microsoft.com/en-us/um/people/jin/>), July 2016:

Video YouTube (<https://www.youtube.com/watch?v=6Kwx8zfGW0Y>)

Slides SlideShare (<http://www.slideshare.net/DrTlaplusSeries/dr-tla-series-raft-jin-li>)



Talk on Raft at Build Stuff 2015 (<http://buildstuff.it/>) by Diego Ongaro (<https://twitter.com/ongardie>), November 2015:

Video InfoQ (<https://www.infoq.com/presentations/raft-consensus-algorithm>)

HTML (<https://ongardie.github.io/raft-talk-archive/2015/buildstuff/>) PDF

Slides (<slides/buildstuff2015.pdf>) with RaftScope visualization

(<https://ongardie.github.io/raft-talk-archive/2015/buildstuff/raftscope-replay/>)



Talks on Rust, Raft, and distributed systems at Rust Bay Area Meetup (<http://www.meetup.com/Rust-Bay-Area/events/219696985/>) by Yvonne Coady (<http://webhome.cs.uvic.ca/~ycoady/>), Diego Ongaro

(<https://twitter.com/ongardie>), Andrew Hobden (<https://twitter.com/andrewhobden>), Dan Burkert (<https://github.com/danburkert>), and Alex Newman (<https://twitter.com/posix4e>), August 2015:

Video Air Mozilla (<https://air.mozilla.org/bay-area-rust-meetup-august-2015/>)

Slides Diego: PDF (<slides/rustdiego2015.pdf>) with RaftScope visualization (<raftscope-replay/index.html>)



Talk on Raft at CoreOS Fest 2015 (<https://coreos.com/fest/>) by Diego Ongaro (<https://twitter.com/ongardie>), May 2015:

Video YouTube (https://youtu.be/6bBggO6KN_k)

Slides PDF (<slides/coreosfest2015.pdf>) with RaftScope visualization (<raftscope-replay/index.html>)



Talk on Raft at Sourcegraph meetup (<http://www.meetup.com/Sourcegraph-Hacker-Meetup/events/221199291/>) by Diego Ongaro (<https://twitter.com/ongardie>), April 2015:

Video YouTube (<https://youtu.be/2dfSOFqOhOU>)

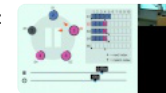
Slides PDF (<slides/sourcegraph2015.pdf>) with RaftScope visualization (<raftscope-replay/index.html>)



Talk on Raft at LinkedIn by Diego Ongaro (<https://twitter.com/ongardie>), September 2014:

Video YouTube (<http://youtu.be/LAqyTyNUYSY>)

Slides PDF (<slides/linkedin2014.pdf>) PPTX (<slides/linkedin2014.pptx>) with RaftScope visualization (<raftscope-replay/index.html>)



Talk on Raft at USI 2014 (<http://www.usievents.com/en>) and /dev/summer 2014 (<http://devcycles.net/summer/sessions/index.php?session=3>) by Arnaud Bailly (<https://twitter.com/abailly>), July 2014:

Video YouTube (<https://www.youtube.com/watch?v=eRDq2Fr6grY>) (French)

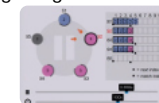
Slides Speaker Deck (<https://speakerdeck.com/abailly/the-raft-protocol-distributed-consensus-for-dummies>) (English)



Talk on Raft at 2014 USENIX Annual Technical Conference (<https://www.usenix.org/conference/atc14/technical-sessions/presentation/ongaro>) by Diego Ongaro (<https://twitter.com/ongardie>), June 2014:

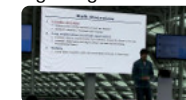
Video USENIX (<https://www.usenix.org/conference/atc14/technical-sessions/presentation/ongaro>)





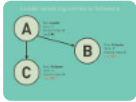

Slides RaftScope visualization (<raftscope-replay/index.html>)



Talk on Raft at CraftConf 2014 (<http://craft-conf.com/2014/#speakers/DiegoOngaro>) by Diego Ongaro (<https://twitter.com/ongardie>), April 2014:

Video Ustream (<http://www.ustream.tv/recorded/46672856>)



Slides	PDF (slides/craftconf2014.pdf) PPTX (slides/craftconf2014.pptx)	
Talk on Raft at Rubyconf 2013 (http://rubyconf.org/program#patrick-van-stee) by Patrick Van Stee (https://twitter.com/vanstee), November 2013:		
Video	YouTube (http://youtu.be/IsPxxZ2lsWw)	
Slides	Speaker Deck (https://speakerdeck.com/vanstee/raft-consensus-for-rubyists)	
Talk on Raft at RICON West 2013 (http://ricon.io/west.html) by Diego Ongaro (https://twitter.com/ongardie), October 2013:		
Video	YouTube (http://youtu.be/06cTPHi-3_8)	
Slides	PDF (slides/riconwest2013.pdf) PPTX (slides/riconwest2013.pptx)	
Talk on Raft at Strange Loop 2013 (https://thestrangeloop.com/sessions/raft-the-understandable-distributed-protocol) by Ben Johnson (https://twitter.com/benbjohnson), September 2013:		
Video	InfoQ (http://www.infoq.com/presentations/raft)	
Slides	Speaker Deck (https://speakerdeck.com/benbjohnson/raft-the-understandable-distributed-consensus-protocol)	
Talk on Raft and Rafter (https://github.com/andrewjstone/rafter) at the Erlang NYC Meetup (http://www.meetup.com/Erlang-NYC/events/131394712/) by Tom Santero (https://twitter.com/tsantero) and Andrew Stone (https://twitter.com/andrew_j_stone), August 2013:		
Video	Vimeo (http://vimeo.com/71635670)	
Slides	Speaker Deck (https://speakerdeck.com/tsantero/consensus-raft-and-rafter)	
Talk on Raft (venue unknown) by Patrick Van Stee (https://twitter.com/vanstee), July 2013:		
Slides	Speaker Deck (https://speakerdeck.com/vanstee/consensus-an-introduction-to-raft)	
Lecture for the Raft User Study (https://ongardie.net/static/raft/userstudy/) by John Ousterhout (http://www.stanford.edu/~ouster/), March 2013:		
Video	YouTube (http://youtu.be/YbZ3zDzDnrw) MP4 (http://raftuserstudy.s3-website-us-west-1.amazonaws.com/raft.mp4)	
Slides	PDF (slides/raftuserstudy2013.pdf) PPTX (slides/raftuserstudy2013.pptx)	

Courses teaching Raft

This is a list of courses that include lectures or programming assignments on Raft. This might be useful for other instructors and for online learners looking for materials. If you know of additional courses, please submit a pull request (<https://github.com/raft/raft.github.io>) or an issue to update it.

- Northeastern University (<https://khoury.northeastern.edu/>), CS 3700: Networks and Distributed Systems (<https://cbw.sh/3700/>), Christo Wilson (<https://cbw.sh/>), Long Lu (<https://khoury.northeastern.edu/people/long-lu/>). Includes an assignment to build a replicated key-value store based on the Raft protocol. (Fall 2018, ...)
- Rose-Hulman Institute of Technology (<http://www.rose-hulman.edu/>), CS 403: Programming Language Paradigms (<http://files.hewner.com/classes/csse403/>), Buffalo Hewner (<http://hewner.com>). Includes Raft programming assignment in Erlang (assignments (<http://files.hewner.com/classes/csse403/HomeworkCode/ErlangRaft/>)). (Winter 2017, ...)
- Princeton University (<https://www.cs.princeton.edu/>), COS-418: Distributed Systems (<https://www.cs.princeton.edu/courses/archive/fall16/cos418/>), Mike Freedman (<http://www.cs.princeton.edu/~mfreed/>) and Kyle Jamieson (<http://www.cs.princeton.edu/~kylej/>). Includes lecture on Raft (<https://www.cs.princeton.edu/courses/archive/fall16/cos418/docs/L8-consensus-2.pdf>) (PPTX (<https://www.cs.princeton.edu/courses/archive/fall16/cos418/docs/L8-consensus-2.pptx>)) and programming assignments (<https://www.cs.princeton.edu/courses/archive/fall16/cos418/assignments.html>) to build a Raft-based key-value store. (Fall 2016, ...)
- University of Washington (<https://www.cs.washington.edu/>), CSE 452: Distributed Systems (<https://courses.cs.washington.edu/courses/cse452/16wi/>), Tom Anderson (<https://www.cs.washington.edu/people/faculty/tom>). Includes lecture on Raft (<https://courses.cs.washington.edu/courses/cse452/16wi/calendar/calendar.html>), though they call it Paxos. (Winter 2016, ...)
- University of Colorado, Boulder (<http://www.cs.colorado.edu/>), CSCI 5673: Distributed Systems (<http://www.cs.colorado.edu/~mishras/courses/csci5673/Fall15/>), Shivakant Mishra (<http://www.cs.colorado.edu/~mishras/>). Includes assignment to download a Raft implementation and build a fault-tolerant data structure with it. (Fall 2015, ...)
- University of Utah (<http://www.cs.utah.edu/>), CS 6963: Distributed Systems (<http://www.cs.utah.edu/~stutsman/cs6963/>), Ryan Stutsman (<http://www.cs.utah.edu/~stutsman/>) (@rstutsman (<https://twitter.com/rstutsman>)). Will include something about Raft (TBD). (Fall 2015, ...)
- San Jose State University (<http://info.sjsu.edu/web-dbggen/catalog/departments/CMPE.html>), CMPE 275 Enterprise Application Development (<http://info.sjsu.edu/web-dbggen/catalog/courses/CMPE275.html>), John Gash (<https://cmpe.sjsu.edu/profile/john-gash>). Includes project to make a distributed filesystem (<https://github.com/deepmehtait/Distributed-file-system-server-with-RAFT>) using Raft. (Spring 2015, ...)
- Brown (<http://cs.brown.edu/>), CS 138: Distributed Computer Systems (<http://cs.brown.edu/courses/csci1380/>), Tom Doeppner (<https://www.cs.brown.edu/~twd/>), Rodrigo Fonseca (<https://www.cs.brown.edu/~rfonseca/>) (@rodrigo_fonseca (https://twitter.com/rodrigo_fonseca)). Includes Raft programming assignment in Go. (Spring 2015, ...)
- MIT (<https://www.csail.mit.edu/>), 6.824: Distributed Systems (<http://nil.csail.mit.edu/6.824/2015/index.html>), Robert Morris (<http://pdos.csail.mit.edu/~rtm/>). Includes lecture on Raft (lecture notes (<http://nil.csail.mit.edu/6.824/2015/notes/l-raft.txt>)). See Jon Gjengset (<https://twitter.com/Jonhoo>)'s posts for instructors (<https://thesquareplanet.com/blog/instructors-guide-to-raft/>) and students (<https://thesquareplanet.com/blog/students-guide-to-raft/>). (Spring 2015, ...)
- University of San Francisco (<http://cs.usfca.edu/>), CS 636: Graduate Operating Systems (<http://cs636.cs.usfca.edu/home>), Greg Benson (<http://benson.cs.usfca.edu/>) (@gregorydbenson (<https://twitter.com/gregorydbenson>)). Includes lecture on Raft. (Spring 2015, ...)
- Harvard (<http://www.eecs.harvard.edu/>), CS 261: Research Topics in Operating Systems (<http://www.eecs.harvard.edu/cs261/>), Margo Seltzer (<http://www.eecs.harvard.edu/margo>). Includes lecture on Raft (lecture notes (<http://www.eecs.harvard.edu/cs261/notes/ongara-2014.html>)). (Fall 2014, ...)
- University of Houston (<http://www2.cs.uh.edu/>), COSC 6360: Operating Systems (<http://www2.cs.uh.edu/~paris/6360/resources.htm>), Jehan-François Pâris (<http://www2.cs.uh.edu/~paris/>)

- (@jehanfrancois (<https://twitter.com/jehanfrancois>)). Includes lecture on Raft (PPT (<http://www2.cs.uh.edu/~paris/6360/PowerPoint/Raft.ppt>)). (Fall 2014, ...)
- Stanford (<https://cs.stanford.edu/>), CS 244b: Distributed Systems (<http://www.scs.stanford.edu/14au-cs244b/>), Dawson Engler (<http://web.stanford.edu/~engler/>), David Mazières (<http://www.scs.stanford.edu/~dm/>) (@dmazieres (<https://twitter.com/dmazieres>)). Included guest lecture on Raft by Diego Ongaro. Several students chose to work on Raft-based final projects (<http://www.scs.stanford.edu/14au-cs244b/labs/presentations.html>). (Fall 2014)
 - NUST-SEECs (<http://seecs.nust.edu.pk/>), CS 332: Distributed Computing, Tahir Azim (@TahirAzim (<https://twitter.com/TahirAzim>)). Includes lecture on Raft based on user study materials (tweet (<https://twitter.com/TahirAzim/status/527363109678112768>)). (Fall 2014, ...)
 - Duke (<http://www.cs.duke.edu/>), CPS 512: Distributed Systems (<http://db.cs.duke.edu/courses/compsci512/spring15/>), Bruce Maggs (<http://www.cs.duke.edu/~bmm/>). Includes guest lecture on Raft (PPTX (<http://db.cs.duke.edu/courses/compsci512/spring15/lectures/raft-guest.pptx>)) by Landon Cox (<http://www.cs.duke.edu/~lpcox/>) (@lpcox (<https://twitter.com/lpcox>)). (Spring 2014, Spring 2015, ...)
 - IIT Bombay (<http://www.cse.iitb.ac.in/>), CS 733: Cloud Computing (<http://www.cse.iitb.ac.in/page134?course=CS+733>), Sriram Srinivasan (<https://github.com/sriram-srinivasan>). Includes Raft programming assignment in Go (assignments (<https://github.com/dushyant89/CS-733>)). (Spring 2014, Spring 2015, ...)

Where can I ask questions?

The best place to ask questions about Raft and its implementations is the raft-dev Google group (<https://groups.google.com/forum/#!forum/raft-dev>). Some of the implementations also have their own mailing lists; check their READMEs.

Where can I get Raft?

There are many implementations of Raft available in various stages of development. This table lists the implementations we know about with source code available. The most popular and/or recently updated implementations are towards the top. This information will inevitably get out of date; please submit a pull request (<https://github.com/raft/raft.github.io>) or an issue to update it.

Name	Primary Authors	Language	License	Leader Election Log Replicat
etcd/raft (https://github.com/coreos/etcd)	Blake Mizerany, Xiang Li and Yicheng Qin	Go	Apache 2.0	Yes
TiKV (https://github.com/pingcap/tikv)	Jay (https://github.com/BusyJay), ngaut (https://github.com/ngaut), siddontang (https://twitter.com/siddontang), tiancaiamao (https://github.com/tiancaiamao).	Rust	Apache2	Yes

Name	Primary Authors	Language	License	Leader Election Log Replicat
hashicorp/raft (https://github.com/hashicorp/raft)	Armon Dadgar (https://twitter.com/armon) (hashicorp)	Go	MPL-2.0	Yes
dragonboat (https://github.com/lni/dragonboat)	Lei Ni (https://github.com/lni)	Go	Apache2	Yes
RethinkDB/clustering (https://github.com/rethinkdb/rethinkdb)		C++	AGPL	Yes
hazelcast-raft (https://github.com/hazelcast/hazelcast/tree/master/hazelcast/src/main/java/com/hazelcast/cp/internal/raft)	Mehmet Dogan (https://github.com/mdogan), Ensar Basri Kahveci (https://github.com/metanet)	Java	Apache 2.0	Yes
willemt/raft (https://github.com/willemt/raft)	Willem-Hendrik Thiant (https://twitter.com/willemt)	C	BSD	Yes
braft (https://github.com/brpc/braft)	Zhangyi Chen, Yao Wang	C++	Apache 2.0	Yes
SOFAJRaft (https://github.com/alipay/sofa-jraft)	Boyan (https://github.com/killme2008), Jiachun (https://github.com/fengjiachun).	Java	Apache2.0	Yes
Ra (https://github.com/rabbitmq/ra)	Team RabbitMQ (https://twitter.com/rabbitmq)	erlang	ASL2 / MPL1.1	Yes
go-raft (https://github.com/goraft/raft)	Ben Johnson (https://twitter.com/benbjohnson)(Sky) and Xiang Li (https://twitter.com/xiangli0227) (CMU, CoreOS)	Go	MIT	Yes
raftos (https://github.com/zhebrak/raftos)	Alexander Zhebrak (https://github.com/zhebrak/)	Python	MIT	Yes
Kudu (https://github.com/apache/incubator-kudu)	David Alves (https://twitter.com/dribeiroalves), Todd Lipcon (https://twitter.com/tlipcon), Mike Percy (https://twitter.com/mike_percy)	C++	Apache2	Yes

Name	Primary Authors	Language	License	Leader Election Log Replicat
OpenDaylight (https://github.com/opendaylight/controller)	Moiz Raja, Kamal Rameshan, Robert Varga (Cisco), Tom Pantelis (Brocade)	Java	Eclipse	Yes
canonical/raft (https://github.com/canonical/raft)	Free Ekanayaka (https://github.com/freeekanayaka/) (Canonical)	C	Apache2.0	Yes
LogCabin (https://github.com/logcabin/logcabin)	Diego Ongaro (https://twitter.com/ongardie) (Stanford)	C++	ISC	Yes
simpleRaft (https://github.com/streed/simpleRaft)	Sean Reed	Python	MIT	
bakwc/PySyncObj (https://github.com/bakwc/PySyncObj)	Filipp Ozinov	Python	MIT	Yes
Zatt (https://github.com/simonacca/zatt)	Simon Accascina	Python	AGPL	Yes
jgroups-raft (https://github.com/belaban/jgroups-raft)	Bela Ban	Java	Apache2	Yes
peterbourgon/raft (https://github.com/peterbourgon/raft)	Peter Bourgon (https://twitter.com/peterbourgon) (SoundCloud)	Go	Simplified BSD	Yes
Qihoo360/raft (https://github.com/Qihoo360/floyd)	ZongzhiChen (https://github.com/baotiao), AnAnZhao (https://github.com/flabby)KangWang (https://github.com/CatKang)	C++	GPL3	Yes
ckite (https://github.com/pablosmedina/ckite)	Pablo Medina (https://twitter.com/pablosmedina)	Scala	Apache2	Yes
akka-raft (https://github.com/ktoso/akka-raft)	Konrad Malawski (https://twitter.com/ktosopl)	Scala	Apache2	Yes
liferaft (https://github.com/unshiftio/liferaft)	Arnout Kazemier (https://twitter.com/3rdEden)	Javascript	MIT	
jraft (https://github.com/andy-yx-chen/jraft)	Andy Chen	Java	Apache2	Yes

Name	Primary Authors	Language	License	Leader Election Log Replicat
kanaka/raft.js (https://github.com/kanaka/raft.js)	Joel Martin (https://twitter.com/bus_kanaka)	Javascript	MPL-2.0	Yes
hoverbear/raft (https://github.com/Hoverbear/raft)	Andrew Hobden (https://twitter.com/andrewhobden), Dan Burkert	Rust	MIT	Yes
Juno (https://github.com/buckie/juno) (BFT variant of Raft)	Brian Schroeder (http://twitter.com/bschroed), Libby Kent (https://github.com/libby), Stuart Popejoy (https://twitter.com/SirLensALot), Will Martino (http://github.com/buckie).	Haskell	BSD	
rafter (https://github.com/andrewjstone/rafter)	Andrew Stone (https://twitter.com/andrew_j_stone) (Basho)	Erlang	Apache2	
zraft_lib (https://github.com/dreyk/zraft_lib)	Gunin Alexander	Erlang	Apache2	yes
verdi-raft (https://github.com/uwplse/verdi-raft)	James Wilcox, Doug Woos, Pavel Panchekha, Zach Tatlock, Xi Wang, Mike Ernst, and Tom Anderson (University of Washington)	Coq	BSD	Yes
Ratis (https://github.com/hortonworks/ratis)		Java	Apache2	
copycat (https://github.com/atomix/copycat)	Jordan Halterman (https://twitter.com/definekuujo)	Java	Apache2	Yes
.NEXT Raft (https://github.com/sakno/dotNext/tree/master/src/cluster/)	Roman Sakno (https://github.com/sakno/)	C#	MIT	Yes
ocaml-raft (https://github.com/heidi-ann/ocaml-raft)	Heidi Howard (https://twitter.com/heidiann360) (Cambridge)	OCaml	MIT	Yes
skiff (https://github.com/pgte/skiff-algorithm)	Pedro Teixeira (https://twitter.com/pgte)	Javascript	ISC	Yes

Name	Primary Authors	Language	License	Leader Election Log Replicate
harryw/raft (https://github.com/harryw/raft)	Harry Wilkinson (https://twitter.com/harwilk)	Ruby	MIT	
Permazen (https://github.com/permazen/permazen)/RaftKVDatabase (http://permazen.github.io/permazen/site/apidocs/index.html?io/permazen/kv/raft/RaftKVDatabase.html)	Archie Cobbs	Java	Apache2	Yes
kontiki (https://github.com/NicolasT/kontiki)	Nicolas Trangez (https://twitter.com/eikke)	Haskell	BSD	Some
srned/Prez (https://github.com/srned/Prez)	Sureshkumar Nedunchezian	C	BSD	Yes
floss (https://github.com/celluloid/floss)	Alexander Flatter (https://twitter.com/aflatter)	Ruby	MIT	
py-raft (https://github.com/kurin/py-raft)	Toby Burress	Python	public domain	Lacking persistence
raft-clj (https://github.com/saebryn/raft)	John Weaver	Clojure	Eclipse	
whitewater (https://github.com/amidvidy/whitewater)	Adam Midvidy (https://twitter.com/amidvidy), Anh Mai, Karoun Kasraie, Sanketh Katta (Berkeley)	Bloom	MIT	Some correctness issues
ScaleCube Raft Leader Election (https://github.com/scalecube/raft-leader-election)	ScaleCube	Java	Apache 2.0	Yes
allengeorge/libraft (https://github.com/allengeorge/libraft)	Allen George (https://twitter.com/allenageorge)	Java	BSD	Yes
Raft-php (https://github.com/Waqee/Raft-php)	Waqee Khalid (https://twitter.com/WaqeeKhalid)	PHP	MIT	Yes
xraft (https://github.com/xnnyygn/xraft)	XnnYygn (https://twitter.com/XY8080)	Java	MIT	Yes
raft-kotlin (https://github.com/AChepurnoi/raft-kotlin)	Sasha Chepurnoi (https://github.com/AChepurnoi)	Kotlin	MIT	Yes
Gondola (https://github.com/yahoo/gondola)	Patrick Chan, Wei-Cheng Pan	Java	New BSD	Yes

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RaftCore (https://github.com/guille/RaftCore)	Guillermo Rodríguez (https://github.com/guille)	C#	MIT	Yes
NRaft (https://github.com/devatwork/NRaft)	Bert Willems (Premotion)	C#	MIT	
gaggle (https://github.com/ben-ng/gaggle)	Ben Ng (https://twitter.com/_benng)	Javascript	MIT	Yes
barge (https://github.com/mgodave/barge)	Dave Rusek (https://twitter.com/davidjrusek)	Java	Apache2	Yes
noeleo/raft (https://github.com/noeleo/raft)	Noel Moldvai, Rohit Turumella, Josh Muhlfelder, James Butkovic (Berkeley)	Bloom	Simplified BSD	Lacking persisten
tetrapods/raft (https://github.com/tetrapods/raft)	Aaron Davidson (https://twitter.com/artichikin)	Java	Apache2	Yes
dupdob/RAFTiNG (https://github.com/dupdob/RAFTiNG)	Cyrille Dupuydauby	C#	Apache2	
dataleading/easyRaft (https://github.com/dataleading/easyRaft)	Shanliang Shen (https://github.com/dataleading/)	Java	Apache2.0	Yes
lite-raft (https://github.com/nackstein/lite-raft)	Luigi Tarenga	Shell	MIT	Yes
aioraft (https://github.com/lisael/aioraft)	lisael	Python	AGPL	Lacking persisten
rafute (https://github.com/mururu/rafute)	Yuki Ito (https://twitter.com/mururururu)	Elixir	MIT	Yes
xingyif/raft (https://github.com/xingyif/raft)	Yifan Xing	Python	Apache 2.0	Yes
chicm/CmRaft (https://github.com/chicm/CmRaft)	Cheng Min Chi	Java	Apache2	Yes
archie/raft (https://github.com/archie/raft)	Marcus Ljungblad (https://twitter.com/mljungblad)	Scala		Some

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Flotten (https://github.com/haf/Flotten)	Henrik Feldt (https://twitter.com/henrikfeldt) (Jayway)	F#	MIT	Some
Cornerstone (https://github.com/andy-yx-chen/cornerstone)	Andy Chen	C++	Apache2	Yes
Vesper (https://github.com/Oaklight/Vesper)	Nicola Manzini (https://github.com/nmanzini), Peng Ding (https://github.com/Oaklight).	Python	MIT	Yes
melee (https://github.com/wayoutmind/melee)	Fredrick Galoso (https://twitter.com/wayoutmind)	Clojure	Eclipse	
C5 replicator (https://github.com/cloud-software-foundation/c5-replicator/)	Ryan Rawson (https://twitter.com/ryanobjc), Alex Newman (https://twitter.com/posix4e), and Josh Greenberg (https://github.com/joshua-g/)	Java	Apache2	Yes
RSM (https://github.com/opaugam/rsm)	Olivier Paugam (https://github.com/opaugam)	Rust	MIT	Yes
Chillaxd (https://github.com/ylamgarchal/chillaxd)	Yassine Lamgarchal	Python	Apache2	Yes
pontoon (https://github.com/mreiferson/pontoon)	Matt Reiferson (https://twitter.com/imsnakes)	Go		
Riff (https://github.com/aaronp/riff)	Aaron Pritzlaff (https://github.com/aaronp)	Scala	Apache2	Yes
IvanProdaiko94/raft-protocol-implementation (https://github.com/IvanProdaiko94/raft-protocol-implementation)	Ivan Prodaiko (https://github.com/IvanProdaiko94/)	Go	MIT	Yes
Raft-JVM (https://github.com/tkellogg/Raft-JVM)	Tim Kellogg (https://twitter.com/kellogh) (Alteryx)	Java		No
dannycoates/raft-core (https://github.com/dannycoates/raft-core)	Danny Coates (https://twitter.com/antiserf)	Javascript	BSD	
cppa-raft (https://github.com/echaozh/cppa-raft)	Zhang Yichao	C++	MIT	Partial

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graft (https://github.com/dev-urandom/graft)	Ben Mills (https://twitter.com/benemills) and William Dix (https://twitter.com/williamjdix) (Braintree)	Go		Partial
huntlabs/hunt-raft (https://github.com/huntlabs/hunt-raft)	huntlabs	D	Apache2	Yes
meatcompute/raft-consensus (https://github.com/meatcompute/raft-consensus)	Mikaela Patella (https://twitter.com/meatcomputer)	Clojure	Eclipse	
RaftShop (https://github.com/methk/RaftShop)	Matteo Berti (https://github.com/methk), Arnaldo Cesco (https://gitlab.com/annopaolo), Salvatore Fiorilla (https://github.com/Salvo000)	Jolie	LGPL	Yes
mruby-flotte (https://github.com/ascaridol/mruby-flotte)	Hendrik (https://twitter.com/Asmod4n)	mruby	Apache2	Yes
dinghy (https://github.com/trevorbernard/dinghy)	Trevor Bernard (https://twitter.com/trevorbernard) (UserEvents)	Clojure	Apache2	
giraft (https://github.com/vanstee/giraft)	Patrick Van Stee (https://twitter.com/vanstee)	Ruby	MIT	
yora (https://github.com/huy/yora)	Huy Le (https://twitter.com/lehuy20)	Ruby	MIT	Yes
r4j (https://github.com/kaarelk/r4j)	Kaarel Kann	Java	Apache2	Yes
huckleberry (https://github.com/cannedprimates/huckleberry)	Jakob Sievers (https://twitter.com/cannedprimates)	Erlang		
zodiac-prime (https://github.com/evanphx/zodiac-prime)	Evan Phoenix (https://twitter.com/evanphx) (LivingSocial)	Ruby	MIT	
rodriguezvalencia/rafting (https://github.com/rodriguezvalencia/rafting)	Sergio Rodriguez	Clojure	MIT	Partial

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Raft4WS (https://github.com/filipecampos/raft4ws)	Filipe Campos	Java	Apache2	Yes
fxsjy/Ins (https://github.com/fxsjy/ins)	Junyi Sun	C++	BSD	Yes
draft (https://github.com/vanstee/draft)	Patrick Van Stee (https://twitter.com/vanstee)	Elixir		
rafterl (https://github.com/ericmoritz/rafterl)	Eric Moritz (https://twitter.com/ericmoritz)	Erlang		
fsraft (https://github.com/kjnilsson/fsraft)	Karl-Johan Nilsson (https://twitter.com/kjnilsson)	F#	public domain	
bspolley/raft (https://github.com/bspolley/raft)	Alex Kaiser, Brennan Polley, Helen Weng (Berkeley)	Bloom		Some
seaturtles (https://github.com/lionelbarrow/seaturtles)	Lionel Barrow (https://twitter.com/LionelBarrow) (Braintree)	Go		
drpicox/uoc-raft-2013p (https://github.com/drpicox/uoc-raft-2013p)	David Rodenas (https://twitter.com/drpicox)	Java	GPL3	
scalaraft (https://github.com/stepist/scalaraft)	Kim Je Min	Scala	Apache2	
pvilas/raft (https://github.com/pvilas/raft)	Pere Vilas (https://twitter.com/perevilas)	Java		
chelan (https://github.com/burma-shave/chelan)	Eric Jutrzenska (https://twitter.com/burma5have)	Scala		Yes
jalvaro/raft (https://github.com/jalvaro/raft)	Jordi Alvaro	Java		
cb372/raft (https://github.com/cb372/raft)	Chris Birchall (https://twitter.com/cbirchall)	Scala		
jpathy/raft (https://bitbucket.org/jpathy/raft)	Jiten Pathy	Go	WTFPL	

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viile/raft (https://github.com/viile/raftDlang.git)	viile	D	MIT	Yes
d-raft (https://github.com/dengoswei/d-raft.git)	Dengos Wei	C++	Apache2	Yes
raft-angular (https://github.com/dushyant89/raft-angular.git)	Dushyant Sabharwal	Angular 4	MIT	Yes
raft-java (https://github.com/wenweihu86/raft-java.git)	Wenwei Hu	Java	Apache2	Yes
Theseus (https://github.com/eloquentlabs/Theseus)	Eloquent Labs (https://www.eloquent.ai/) (Keenon Werling (https://github.com/keenon), Gabor Angeli (https://github.com/gangeli), et al.)	Java	MIT	Yes

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