INTERNET SYSTEMS CONSORTIUM
ANNUAL REPORT 2018

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(A DELAWARE NOT-FOR-PROFIT CORPORATION HEADQUARTERED IN CALIFORNIA)

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2018 was a very good year for ISC. We had increased stability in our core product, BIND 9, and saw continued success in Kea, our new implementation of DHCP. We have stayed focused on our key strengths: software development and the operation and growth of the F-Root system. In 2016, we implemented a change in the licensing for BIND 9 to the Mozilla Public License (MPL2), which makes a more powerful case for users to pay for support and/or an exception license to keep a competitive edge. In 2018, this continued to provide a strong and growing base of support customers. Currently, most ISC software is covered by the MPL 2.0 software license, which has been an important basis for financial support from a growing list of ISC customers around the world.

We were profitable in 2018, and used some of the upside to add six new staff members, beefing up the BIND and Kea teams and their support functions. We added a team member in China, in addition to new and existing employees throughout the US, the UK, France, Poland, the Czech Republic, Australia, and the Netherlands. ISC is truly a global company.

In 2018, ISC finished incubating the Digital Security Exchange as it spun off to become a viable organization on its own. We were able to act as a collector of charitable contributions, legal advisor, payroll provider, and health insurance partner as the small organization got off the ground. We enjoyed the process, and hope to help other fledgling organizations in the future.

It has been a good year at ISC and we look forward to many more.

Regards,

Jeff Osborn

May 2019
WHAT’S NEW AT ISC

It is not difficult to make the argument that developing open source software requires an unproven business model. We work to ensure that our offerings are standards-compliant, well-written and -documented, and patched quickly when security needs dictate. We try to keep up maintenance and add new features when we can.

Some of our most significant accomplishments this year included:

- New features added in both BIND 9 and Kea DHCP;
- Migration to GitLab for all our development projects; and
- Significant growth in our customer base.

More specific details about our 2018 achievements can be found in the following pages.
2018 FINANCIAL OVERVIEW

ISC’s revenues come primarily from support contracts for our software products. In 2018, two-thirds of our revenues came from our flagship product, BIND 9. Another 15% came from our DHCP offerings, the venerable ISC DHCP and the new package, Kea DHCP. Kea has a strong future, with revenues beginning in 2017 and growing strongly in 2018.

We gained 22 new support contracts and lost ten. As a result, ISC was able to add six new staff members: three new BIND 9 developers, a senior QA person, a systems and support engineer, and a documentation/communications person. This is a strong vote of confidence in our future, particularly for a company that runs as lean as ISC.
Revenues

ISC receives revenue primarily from support services for our software products. In 2018, 66% of ISC’s total revenue came from BIND 9, ISC DHCP represented 7%, and Kea DHCP totaled 8%. While BIND 9 remains our flagship product, Kea DHCP has become an increasingly important revenue source for us over the past two years.

The remaining 19% of the company’s 2018 revenues came from F-Root, the Internet Domain Survey, Hosted@ hosting services, SNS services, training, and donations.
Expenses

ISC's staff are leaders in their fields and represent the majority of the company's costs. Other than personnel, ISC's expenses include bandwidth, facilities, network and equipment depreciation, travel, taxes, utilities, and maintenance – and very little else. We are proud of the efficiency and cost-effectiveness of our operations.

Nearly three-quarters of ISC's staff are technical personnel in the software engineering, technical support, and network operations areas; the remaining employees fill sales, marketing, and general/administrative roles.

2018 Expenses by Service (Unaudited)
WHAT WE DO

Open Source for an Open Internet

Since the company’s founding in 1994, ISC’s employees have pursued the mantra of “open source for an open Internet,” and that work continued in 2018. We are proud of the refactoring work we have done on our flagship software package, BIND 9, and we were gratified to see the number of users of our Kea DHCP software grow significantly in 2018. As a non-profit, we receive most of our funding through customer support contracts, and our support business is strong.

ISC develops and distributes three open source Internet networking software packages: BIND 9, ISC DHCP, and Kea DHCP. BIND 9, ISC’s Domain Name System (DNS) software program, is widely used on the Internet by enterprises and service providers, offering a robust and stable platform on top of which organizations can build distributed computing systems. ISC DHCP implements the Dynamic Host Configuration Protocol for connection to an IP network, offering a complete solution for implementing DHCP servers, relay agents, and clients. ISC DHCP is a mature program with many features, but it can be cumbersome for operators to maintain. Kea DHCP is ISC’s intended replacement for ISC DHCP, and is designed for dynamic reconfiguration.

All of our open source software is freely available on our website. ISC’s work is supported by the sale of software support contracts, and by donations from users who want to see free open source maintained and extended for everyone.

In addition to our open source software, ISC also operates critical Internet infrastructure, in the form of the F-Root service, and offers DNS hosting services for selected non-profits. In addition, our staff contribute to various Internet governance and community initiatives, and ISC engineers have written or co-authored more than 85 of the technical standards (RFCs) that are essential to interoperability on the Internet.
Why Does an Open Internet Matter?

The concept of the Internet began in the early 1960s as the idea of globally connected computers able to communicate via packet switching. (Please see The Internet Society’s Brief History of the Internet for more details.) ARPANET was developed and designed as a joint project between the US Department of Defense, private entities, and universities as a way to research both how to connect computers and how best to take advantage of the connected possibilities.

In the 1990s, as commercial access to the Internet began to take off, more and more people saw the value of worldwide interconnectivity. The benefits are huge and obvious: improved access to people in remote areas, the ability to share vast amounts of knowledge, and cat videos, to name just a few. But there are also potential downsides: notably, privacy concerns. The concentration of information and personal data in the hands of a few giant companies is a serious issue, and many people are uncomfortable with the thought of those corporations having so much access to our lives.

ISC and other open source software companies provide an alternative that becomes more and more valuable with each passing year. We don’t make money by mining our users’ personal data and selling it; we make software that keeps the Internet open and accessible to everyone. And we truly appreciate the support of our customers who are willing to pay for us to continue our work.

The accelerated adoption of the new DNS over HTTPS specification (DoH) by large hosting providers has led to two trends that we think are bad for the open Internet. Hiding DNS traffic inside of HTTPS traffic breaks all of the existing security and network control mechanisms based on DNS, which have – until now – provided effective and efficient filtering for malware, phishing, and legally mandated content blocking. The second problem is that the adoption of DoH is driven by a few enormous content providers, further accelerating the centralization of control of Internet
traffic. While these content providers currently have impressive policies regarding individual privacy protections, the centralization is itself a threat. Once the Internet loses the capability of operating a distributed DNS, we will all be dependent on these hosting providers and their policies.

*Internet Systems Consortium, Inc. (ISC) is dedicated to developing software and offering services in support of the Internet infrastructure.*
OUR OFFERINGS

BIND 9

Ondřej Surý, our BIND 9 Development Director, drove a lot of changes in 2018, including ISC’s adoption of GitLab, BIND 9 refactoring, a new BIND release strategy, and termination of workarounds for legacy systems.

GitLab Migration

One of the most significant events for our BIND 9 team was the migration to GitLab, which allowed us to replace the separate issue tracker, wikis, and repos with a single development platform while leveraging the continuous integration capabilities of GitLab. We invested significant effort into getting our automated BIND 9 tests to run in parallel to speed them up; now nothing is committed to BIND 9 without first passing our continuous integration tests.

BIND 9 development is now tracked entirely through GitLab.
One unexpected benefit of the shift to GitLab is our ability to accept contributed patches more gracefully, via merge requests rather than email. We opened our issue tracker for BIND so new issues are now open by default; only a few sensitive issues are non-public. We believe we are receiving better-quality bug reports, which could be because they are public. We have been pleased to see many people create accounts on https://gitlab.isc.org to open issues, comment on existing issues, and offer to help.

Because we migrated our issue tracker and some of the open issues, all of our bug ticket metrics are somewhat messed up, to be honest. Here are some approximate numbers of BIND issues created and closed in 2018:

- 777 issues were created since the migration to GitLab (some were brought over from RT).
- 508 issues have been closed.
- 269 are still open.

In our pre-GitLab system, there were 96 BIND bug reports closed/rejected and resolved in 2018, and 62 new issues opened.

**BIND 9 Refactoring**

We made significant progress on BIND 9 refactoring in 2018. Our initial goal was to reduce the software’s complexity, but we are also adapting to modern cryptography standards and taking more advantage of well-supported LINUX OS features that didn’t exist when BIND 9 was first written. In January 2018 we released BIND 9.12, with refactored query logic (query_find and resquery_response). These massive and complex functions were split into smaller functions, and we created an external library, libns. These changes simplified the query processing code and made it much easier to subsequently implement QNAME minimization.

Our next project was tackling BIND’s network interface; the results of that will be seen in BIND 9.14.0, where we expect to see significant improvements in performance on modern hardware.
New BIND 9 Release Strategy

Early in 2018 we implemented a new BIND 9 release strategy. The goal was to pare down the number of supported branches to (1) development/unstable, (2) stable, (3) extended support, and (4) subscription edition. We accomplished this by declaring End-of-Life for the 9.9 and 9.10 branches in 2018. It is too early to tell if the new model will result in improving the quality of the early releases on our next stable branch, BIND 9.14, but it has already enabled us to get more users and more feedback on the development branch.
BIND 9’s new release roadmap will help us provide both stability and important new features for our users.

Key Initiatives for 2018

When BIND 9 was originally written, there was a wider variety of available operating systems, including HP/UX, AIX, BSD, DOS, and Linux, and we proudly supported all of them. Many of these are no longer maintained well enough to be viable options for most users, so we decided it was time to cut our support for them and focus on improving BIND for the majority. We supported antiquated software all those years because we really cared about providing all our open source users the platforms they needed, but we reached a point where that no longer made sense.

Some of the changes:

- Workarounds for old versions of UnixWare, BSD/OS, AIX, Tru64, SunOS, TruCluster, and IRIX were removed. On UNIX-like systems, BIND now requires support for POSIX.1c threads (IEEE Std 1003.1c-1995), the Advanced Sockets API for IPv6 (RFC 3542), and standard atomic operations provided by the C compiler.
- Previously, it was possible to build BIND 9 without thread support. BIND now requires threading support (either POSIX or Windows) from the operating system, and it cannot be built without threads.
- BIND 9 no longer builds on platforms that don’t have proper IPv6 support. BIND 9 now also requires non-broken POSIX-compatible *pthread* support; such platforms are usually long after their end-of-life date and they are neither maintained nor supported by their respective vendors.
- BIND 9 can no longer be built without DNSSEC support. A cryptography provider (i.e., OpenSSL or a hardware service module with PKCS#11 support) must be available. DNSSEC validation is now enabled by default.
- The BIND team partnered with other open source DNS projects to announce the **DNS Flag Day** in 2019, ending support for “fixups” to accommodate non-compliant DNS implementations. This is, to some extent, the culmination of the campaign Mark Andrews started back in 2015 to expose and correct the gaps in EDNS standards compliance.
- We also removed support for Windows XP™, finally.

Windows is still a very popular platform for BIND, but there are no engineers on the BIND team who specialize in it, nor do we have adequate automated test coverage for Windows. We had an external contributor, Rockerinthelocker (later revealed to be Thomas Jach), who contributed several needed Windows fixes and also advised us on some Windows issues.

Ralph Dolmans of NLnet Labs, Ondřej Surý, and Petr Spaček of CZ.NIC announce plans for DNS Flag Day at the DNS-OARC meeting in Puerto Rico in March, 2018.
After removing those legacy system requirements, we were able to modernize our networking stack to take better advantage of threading and reduce context-switching. Software engineer Witold Kręcicki spent the last three months of 2018 refactoring the networking code; through a massive series of commits, he eventually managed to successfully replace our ancient task manager and socket code. The manager uses per-cpu queues for tasks and the network stack runs multiple event loops in CPU-affinitive threads. This greatly improves performance on large systems, especially when using multi-queue NICs.

This project is equivalent to removing the bald, flat tires from a car, while it’s in motion, and replacing them with steel-belted radials. We are expecting that these new tires will really pay off when we implement DNS over TLS in 2019.

**User Trends**

We saw increasing demand for binary packages from ISC, for both BIND 9 and Kea. Our users have asked us to incorporate software dependencies (particularly for BIND 9 – DNSTAP support), provide a fresher software version for older OS releases, and offer a “supported binary” with our support contracts that includes our premium features. We responded by contributing BIND 9 packages for Debian and Ubuntu in their repositories. We have also created our own RHEL/CentOS 6 and 7 binaries for open source users and pioneered similar bundles for our BIND 9 Subscription Edition users. We are definitely appreciating the challenge our OS packagers have had for many years, in deciding which of BIND 9’s many compile-time options to enable for their packages! We expect to iterate on this more in 2019 in an effort to improve the ease of installation and updating.
ISC began offering BIND 9 binary packages in 2018, in response to customer demand.

Customers and users asked for resources on performance tuning and information on the impact of the choice of OS and features on BIND performance. We have shared what we have, but we can see a need for more experimentation in this area to meet the requests. Unfortunately, this isn’t what our Perflab tool was designed to do and it isn’t really suited to this job.

The continued inability of the DNS standards community to settle on a “solution” to the CNAME-at-zone-apex problem is frustrating BIND 9 users. (ISC has participated vigorously in the debate about CNAMEs at the apex of a DNS zone, and has put forth three proposals:

BIND customers are curious about DNS cookies and anxious about whether this change will introduce problems. DNS cookies were first added in BIND 9.10, but now that they have matured they are enabled by default.

After much fanfare – and years of preparation and testing – the root KSK rollover in October was wonderfully uneventful. Far more angst was caused by GDPR compliance. Towards the end of 2018 we prepared ourselves for a spike in questions related to EDNS compliance issue identification and troubleshooting, related to the DNS Flag Day coming on February 1, 2019.

2018 Releases

We issued releases in the following branches of BIND 9 in 2018:

- 9.9.13 (this branch went to End-of-Life as of July 2018)
- 9.10.7-S (this branch went to End-of-Life as of July 2018)
- 9.11.3-S, 9.11.3-S2, 9.11.4, 9.11.4-S, 9.11.5, 9.11.5-S1, 9.11.5-S2, 9.11.5-P1 (released in January 2019)

Our focus in 2018 was refactoring.

New Feature Development

- QNAME minimization, sponsored by the Open Technology Fund.
- Mirror Zones, intended to facilitate running a local copy of the root, sponsored by ICANN.
- Implementation of Serve Stale to provide additional protection against an outage like the massive DDoS that hit Dyn in October 2016, thanks to a patch contributed generously by Akamai.
Other Accomplishments

In late 2018, we commissioned a BIND 9 project logo from Richard de Ruijter, who also designed the new NLNET Labs project logos. It was nice to be able to afford the small luxury of a professionally-designed logo!

Common Vulnerability Exposures (CVEs)

There were eight BIND 9 CVEs in 2018. We are fully committed to responsible disclosure of any significant vulnerabilities in our software, while we also work hard to minimize their occurrence.
ISC DHCP

Our work on ISC DHCP in 2018 was mostly limited to fixing reported bugs and responding to support-customer issues. We are minimizing new development on ISC DHCP as it gradually nears its end of active maintenance.

We weren’t able to invest much more work into our ISC DHCP-to-Kea configuration migration tool, which we are currently testing with some of our ISC DHCP support customers. It is expected that the most difficult part of an ISC DHCP configuration to migrate will be the client classification, because ISC DHCP is so flexible. We have been identifying and tracking all the differences between the two projects that potentially could trip up some users as they migrate in a GitLab milestone (https://gitlab.isc.org/isc-projects/kea/milestones/6).

Of the 86 new ISC DHCP tickets, nearly half (40) were opened as confidential tickets. 21 of the tickets opened in 2018 were resolved or closed in 2018. Overall, we resolved 26 ISC DHCP tickets and closed another four in 2018.

2018 Releases

We put out a new branch of ISC DHCP, 4.4, which we intend to be the last major branch of this software.

- DHCP 4.4.0 & 4.4.1 – the last major branch featured improvements in DDNS, the DHCP client, and Dual-stack mixed mode.
- DHCP 4.1-ESV-R15, 4.1-ESV-R15-P1
- DHCP 4.3.6-P1
Kea DHCP

In 2018 we started attracting a solid base of Kea DHCP support customers, and we began to see more ISC DHCP support customers prepare to migrate to Kea. Our premium hooks packages (sold on our website for US$499) turned out to be a successful experiment that we plan to continue.

Tomek Mrugalski, our Director of DHCP Development, led the team through the migration to GitLab, the introduction of our Perflab testing tool, and the addition of several new Kea hook libraries.

Migration to GitLab

As with BIND 9, Kea’s development migrated entirely to GitLab, with gitlab.isc.org serving as both the source repo and the issue tracker. We disabled issue tracking on the Kea GitHub, which we are keeping as a read-only repository. We are still doing our integration testing in Jenkins (jenkins.isc.org), but we are looking at migrating that to GitLab in the future. Our old Kea Trac site is still available at oldkea.isc.org for reference.
We opened 393 new Kea issues in Gitlab in 2018; some of these were migrated over from our older Trac system. We closed 295 issues in our old Trac system in 2018; 184 of them were for Kea 1.4, which was completed before we migrated to GitLab. We closed 181 tickets in the Kea GitLab instance, so we closed at least 181 + 184 = 365 issues, and probably more. At any rate, it seems that we are closing issues roughly as fast as we are opening them, which is a good indication that we are keeping up.

**New Kea Hook Libraries**

We produced two more premium hook libraries to help manage Kea – the RADIUS integration hook and the client classification hook – as well as an open source hook implementing our new High-Availability feature. We also added a hooks API guide to the documentation.

**Key Initiatives in 2018**

The new high-availability feature removed the last remaining significant obstacle for ISC DHCP users to migrate to Kea. By implementing a less-complicated HA feature instead of failover, we were able to support multiple deployment models with one feature (DHCPv4 and DHCPv6, the standard memfile, and DB backend options). Using a significant code contribution from Deutsche Telekom, we also added Cassandra database backend storage for host reservations. We are finding that Cassandra, as a noSQL database, is different enough from our other backends that we may not be able to support all the same features in Cassandra as we support for MySQL. Kea 1.5 added YANG model support through integration with the Sysrepo open source configuration datastore. This was the culmination of work begun at an IETF hackathon.

The Kea team spent many hours working on a thorough revision of the DHCPv6 standards, which were standardized in November, 2018 as [RFC 8415](https://www.rfc-editor.org/rfc/rfc8415) *(was draft-ietf-dhc-rfc3315bis)*: Dynamic Host Configuration Protocol for IPv6 (DHCPv6). This was a big project; it took 13 revisions to complete this 150-page RFC, which obsoleted seven existing RFCs.
User Trends

We have seen a healthy interest in our “premium” Kea hooks software package, which provides a moderate-cost (US$499) way to support ISC’s open source work.

Our new Kea support customers are mostly service providers and access providers. We have both greenfield networks and some larger established network providers who are evaluating a migration to Kea from ISC DHCP or another DHCP platform. Several service providers have leveraged the Kea hooks interface to integrate with their own provisioning systems. This service provider focus is also putting pressure on Kea’s performance; we have seen increasing requests for advice about hardware choices and tuning for performance optimization. In 2019 we plan to add more performance profiling to our quality-assurance process and also focus development on performance improvements.

2018 Releases

We issued two major feature releases of Kea, which continues to be a very active project with an emphasis on new feature development. Currently, we produce only new feature versions, and we support only two versions at a time. As our user base grows, we are considering introduction of parallel stable and development branches, with maintenance-only releases on the stable branch.

New Feature Development

New features added in 2018 included, by release:

- Kea 1.4 – High Availability (HA), RADIUS integration, and a supported Cassandra backend.
- Kea 1.5 – The sysrepo YANG model configuration store, HA improvements, an authoritative flag, global host reservations, and a new client classification hook module.
Other Accomplishments

ISC participated in the Google Summer of Code (GSOCS) program for the first time in 2018, mentoring two student developers who contributed a new feature to Kea and released an open source dashboard for Kea. While it was valuable for ISC, with such a small team it was a challenge to spare the resources to mentor and support the GSOC students adequately. On the whole, though, it was a positive experience and we look forward to participating again in 2019.

One big thrill of the year was adding a much-needed new development team member, a senior QA engineer.

Common Vulnerability Exposures (CVEs)

There were two ISC DHCP CVEs and one Kea CVE in 2018.

<table>
<thead>
<tr>
<th>Software</th>
<th>Software Releases 2018</th>
<th>Security Vulnerabilities 2018</th>
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<tr>
<td>BIND 9</td>
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<td>ISC DHCP</td>
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<td>2</td>
</tr>
<tr>
<td>Kea DHCP</td>
<td>6</td>
<td>1</td>
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Software Support

Our support business is a barometer of how our open source work is being received by users. Many of our new support customers are adopting Kea DHCP, which is gratifying because this project has been under-supported for the past several years. While the IETF work on DHCP is winding down, and the standards-setters are enthusiastic about router-advertised address assignments, DHCP seems to be a continuing core requirement of most networks.

Support Ticketing

Our busiest quarter for customer support was Q2 (April-June) – and it wasn’t followed by the usual summer holiday slow-down, so our support team was very busy throughout 2018. BIND 9 was a steady workload; ISC DHCP ticket volumes gradually decreased, while Kea questions and issues to our support team steadily increased. This is to be expected, since we ended the year with many more Kea support customers than we started it with. We averaged just over six new support issues per week, and the mid-year return of an experienced, former ISC systems and support engineer helped us to handle the increased workload.

Support Trends

![ISC's Software Support Business](chart.png)

<table>
<thead>
<tr>
<th>Year</th>
<th>Support Customers</th>
<th>Support Tickets</th>
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<tr>
<td>2013</td>
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<td>2015</td>
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<td>2017</td>
<td>109</td>
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<tr>
<td>2018</td>
<td>119</td>
<td>275</td>
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</tbody>
</table>
Knowledgebase

We migrated our Knowledgebase to a new platform. The old software was unmaintained and starting to decay, and we wanted to make sure that the KB would continue to be a useful resource for our users. This was a big project for our new Marketing Communications staff member because the markdown and links all had to be updated and we needed to maintain many of the old URLs, since many of the documents are linked from elsewhere. So far, user response has been positive.

ISC’s new Knowledgebase offers a wide range of useful information.

Other Projects

In 2018, our researcher worked on the following projects:

- Updating the ISC Dig app, available on iOS; 2271 copies were downloaded in 2018 (and over 500 of these were from Japan!)
- The ISC DNS Checker app, available on iOS; 670 copies were downloaded in 2018. It was most popular in the US, Germany, and the UK.
Other ISC Services

F-Root

ISC is one of the twelve global Root Server Operators (RSOs). We operate a large number of F-Root instances worldwide and participate in global RSO coordination. (It is important that RSOs not be too coordinated; diversity is good.) We outsource the operation of some F-Root instances to Cloudflare.

The number and location of all the F-Root servers can be seen at https://root-servers.org. As of early 2019, there are 209 F-Root nodes around the world.

Domain Survey

ISC hosts and distributes the quarterly Internet Domain Survey, which has been in continuous operation for 25 years. Despite its name, it is not a survey of domains but of IPv4 address usage. No one is entirely sure what it measures, but whatever that may be, it is the same year after year, so year-to-year comparisons are valid. There was a noticeable drop in the number of measured IPv4 hosts in 2017, and the 2018 results, continuing those lower numbers, showed that they were not a fluke. The Domain Survey Host Count graph is included in almost all introductory Computer Science textbooks worldwide.

ISC also offers onsite training; engineer Eddy Winstead traveled to China in 2018 to assist Huawei with their BIND 9 configuration.
IETF Standards and Drafts Authored by ISC Staff in 2018

ISC developers participate vigorously in the creation and evolution of the Internet standards. In 2018, ISC staff authored or co-authored three new or updated RFCs:

**RFC 7793**: Adding 100.64.0.0/10 Prefixes to the IPv4 Locally-Served DNS Zones Registry  
M. Andrews

**RFC 7828**: The edns-tcp-keepalive EDNS0 Option  
P. Wouters, J. Abley, S. Dickinson, R. Bellis

**RFC 8415**: Dynamic Host Configuration Protocol for IPv6 (DHCPv6)  

Public Presentations

ISC staff members gave 14 presentations at various conferences throughout 2018.
WHERE WE’RE GOING

Looking Ahead to 2019

In 2019, we plan to continue the renewal of BIND 9, rewriting more of the networking stack. Previous enhancements have already made BIND 9.14.0 higher-performing than 9.12, which in turn performs better than 9.11, and we see further opportunities for performance improvement in our flagship software product in 2019.

Based on the continued strong demand, we are continuing to work with the rest of the DNS community to devise an interoperable solution for CNAMEs at the apex of a zone. We also plan to implement the IETF drafts for EDNS tags and DNS Extended Errors. We will provide better options for encrypted DNS with a DNS-over-TLS solution and a DNS-over-HTTPS solution. (As stated previously, we are not fans of DNS over HTTPS, but we want our users to be able to evaluate a solution based on DoH.)

ISC plans to begin monthly time-based development releases in 2019, during the third week of each month. Early in 2020 we will be issuing BIND 9.16, which will be our next extended support version.

In response to many requests from users for help in building Kea, we are committing to publishing ISC-supported RPM and Debian packages for Kea, starting with Kea 1.6.0. Our Kea development team is already pursuing moving the Kea configuration to a separate database, which will make it easier to coordinate configurations across multiple Kea servers, create new servers based on templates, and integrate Kea into service-provider provisioning systems. After this major feature is released in Kea 1.6, we plan to shift our focus to improving Kea performance, with multi-threading and other speed-ups in Kea 1.7.
We have also agreed to start a new project in 2019. In response to user requests for a supported, maintained Kea management tool, we plan to create a dashboard for Kea that will incorporate the key features of the Anterius GSOC project, but that will have ISC support and development behind it.

While maintaining one of the most performant and heavily used root systems, ISC is also participating vigorously in discussions about the evolution and future of the DNS root system. Fred Baker, one of ISC’s directors, has taken over as co-chair of the Root Server System Advisory Committee (RSSAC) of the Internet Corporation for Assigned Names and Numbers (ICANN). We are also developing more technical options for deploying a root server. Ray Bellis is developing a tiny Raspberry Pi-based root server which will be open-sourced when it is finished, and BIND 9.14.0 includes ISC’s implementation of mirror zones, a way to serve root zones locally without becoming an authoritative root server.

2018 was ISC’s best year so far. We hope to be able to say the same thing about 2019 in our next annual report!
WHO WE ARE

Internet Systems Consortium, Inc. is a US nonprofit 501(c)(3) corporation. ISC Inc. has Public Charity status 509(a)(1) and 170(b)(1) (A)(vi), which means that contributions to ISC can be deducted from US income taxes. Our US Federal EIN is 20-0141248.

Board of Directors

ISC’s Board of Directors is currently made up of four members, each with a long and important history of involvement with the Internet: Rick Adams (Chairman of the Board), Fred Baker (Director), David J. Farber (Director), and Stephen Wolff (Director).

Management

ISC is currently managed by Jeff Osborn (President), Ondřej Surý (Director of DNS Development), Tomek Mrugalski (Director of DHCP Development), Stephen Morris (Senior Director of Research & QA), Brian Reid (Director of Operations), Vicky Risk (Director of Marketing and Product Marketing), and T. Marc Jones (Director of Sales).

Professional Affiliations

ISC staff contribute in a number of technical fora. The list below describes some of our more substantial commitments.
**APNIC** – Asia-Pacific Network Information Centre (APNIC) is the Regional Internet Registry (RIR) responsible for the Asia-Pacific region. They are an active supporter of our F-Root projects, and a research partner.

**DNS-OARC** – ISC was instrumental in setting up the DNS Operations, Analysis, and Research Center (DNS-OARC) and is a "Silver" member. ISC staff attend the DNS-OARC meetings and participate in their mailing list discussions. In addition, we contribute annually to the “Day In the Life” data project, providing the raw data for continuing research into the growth and changes of the global DNS. Ray Bellis, ISC Research Fellow, served as chair of the Program Committee for DNS-OARC in 2018; Ondřej Surý is a DNS-OARC board member.

**ICANN** – As part of our ongoing participation in root server policy, ISC participates in the Internet Corporation for Assigned Names and Numbers (ICANN) Root Server System Advisory Committee (RSSAC). Ondřej Surý is one of the seven Recovery Key Share Holders for Root Zone DNSSEC Keys, a member of The Registry Services Technical Evaluation Panel (RSTEP), and a member of the RSSAC. Brian Reid, Fred Baker, and Jeff Osborn represented F-Root on the RSSAC in 2018. Ondřej Surý, Brian Reid, and Ray Bellis are also members of the RSSAC Caucus.

**IETF** – ISC sends developers to every Internet Engineering Task Force (IETF) meeting and our engineers participate vigorously in the development of new standards. ISC’s association with the DNSOP working group continued in 2018. Tomek Mrugalski, the lead developer on our Kea DHCP project, continued as co-chair of the IETF DHC working group in 2018.

**ISOC** – The Internet Society promotes the open development, evolution, and use of the Internet for the benefit of all people throughout the world. The work is mainly focused on influencing policy and education. ISOC is the umbrella organization for the IETF. In 2015, Jeff Osborn became the ISC delegate to the Advisory Council and continues in that role; David Farber, one of ISC’s directors, is a current trustee of the Internet Society.

PLNOG – Members of ISC technical staff participate regularly in meetings of the Polish Network Operators Group (PLNOG).

RIPE – Réseaux IP Européens (RIPE, French for "European IP Networks") is the RIR responsible for Europe and the Middle East. They also host a network operators' meeting twice a year that brings together much of the European networking community. ISC is a paying member of RIPE, to get addressing needed for F-Root. We also participate in various RIPE projects such as ATLAS, hosting equipment in Palo Alto. RIPE is also a Root System Operators peer, as they operate K-Root. ISC technical staff participate in the RIPE community meetings and Ondřej Surý is a RIPE Program Committee Member.
UKNOF – Stephen Morris of ISC sits on the Advisory Committee and Cathy Almond, our Lead Technical Support Engineer, is a vice chair of the Programme Committee for the UK Network Operators Forum (UKNOF).

Cathy Almond hard at work at the IETF conference in London in March, 2018.

Staff

By early 2019, ISC had 35 employees in nine countries and nine US states. We were delighted to add three new BIND 9 developers, a senior QA person, a systems and support engineer, and a documentation/communications person to our team in 2018. One BIND 9 engineer left and went to one of our OEM partners, and one BIND 9 engineer who had previously left for another open source project returned to ISC.
OUR SUPPORTERS AND CONTRIBUTORS

When software is open and useful, contributions flow in from around the globe.

Many thanks to...

..these people who made technical contributions to BIND 9 in 2018:

- Tony Finch with an impressive 16 commits in GitLab, and five in our pre-GitLab system
- Petr Menšík with 12 commits in GitLab, plus one in our pre-GitLab system
- Andreas Hasenack
- Bhargava Shastry
- Bill Parker
- Håvard Eidnes
- Kevin Chen
- Mathieu Arnold
- Paul Hoffman
- Roland Gruber
- Thomas Jach
- Tomas Hozza
- Zhaolong Zhang
- We also love to see comments, suggestions, and even complaints from all our users on the bind-users mailing list and in our gitlab.isc.org BIND project.

...these people, who submitted patches, reported bugs, or suggested valuable features or changes to ISC DHCP in 2018:

- Bill Shirley
- Brad Fitzpatrick
- dgutier-at-cern-dot-ch
- Felix Wilhelm of the Google Security Team
- Fernando Soto from BlueCat Networks
- Gabriel Valcazar
• Peter Anvin
• Indy, of the Fireball ISO open source project
• Jiri Popelka of Red Hat
• Naiming Shen and Enke Chen of Cisco
• Pavel Kankovsky
• Pavel Zhukov at Redhat
• Peter Lewis
• Tim DeNike of Lightspeed Communications

...these people, who made significant technical contributions to Kea DHCP in 2018:
• Our top contributor, Razvan Becheriu (spoiler alert: we hired him in early 2019!)
• Andrei Pavel
• Franciszek Górski
• Franek18
• Piotr Strzyżewski
• Plyul
• Sebastian Schrader
• Sunil Mayya and Jerin John (our GSOC students)

...and all these people and organizations, who generously provided financial support to ISC in 2018:

Major Sponsors
ICANN – funded development of the BIND 9 mirror zone feature
Open Technology Fund – funded development of QNAME minimization in BIND 9
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Our Patreon donors
Steven Arntzen
Phil Benchoff
Ben Cotton
Matthew Jacob
Thomas Pusateri
Randall Webb
The Commerce Company – Thank you for the many years of maintaining and enhancing BIND. When we get the new onlineyellowpages.com released, we’ll be able to provide more substantial support, for now, please accept this token of thanks from The Commerce Company.
2018 FINANCIAL INFORMATION

Unaudited Financial Data

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<th>2018 Q3</th>
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* Excludes depreciation expense

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* At end of quarter