

# IETF Year in Review for 2021

ICANN Office of the Chief Technology Officer

Paul Hoffman  
OCTO-030  
28 January 2022



---

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>3</b>
<b>2</b>	<b>IETF MEETINGS IN 2021</b>	<b>3</b>
<b>3</b>	<b>PRIMARY WORKING GROUPS AND BOFS</b>	<b>4</b>
<b>3.1</b>	<b>DNSOP</b>	<b>4</b>
<b>3.2</b>	<b>DPRIVE</b>	<b>5</b>
<b>3.3</b>	<b>ADD</b>	<b>5</b>
<b>3.4</b>	<b>REGEXT</b>	<b>5</b>
<b>3.5</b>	<b>DANCE</b>	<b>6</b>
<b>4</b>	<b>LEADERSHIP, ADMINISTRATION, AND OTHER ACTIVITIES</b>	<b>6</b>
<b>4.1</b>	<b>IESG and IAB</b>	<b>6</b>
<b>4.2</b>	<b>IETF Hackathon</b>	<b>7</b>
<b>4.3</b>	<b>Nameservers for .arpa</b>	<b>7</b>
<b>4.4</b>	<b>Other DNS-related RFCs Published</b>	<b>7</b>
<b>5</b>	<b>EXPECTED ACTIVITIES OF INTEREST DURING 2022</b>	<b>7</b>
<b>5.1</b>	<b>Plans for IETF Meetings</b>	<b>7</b>
<b>5.2</b>	<b>Working Group Activities</b>	<b>8</b>

This document is part of ICANN's Office of the Chief Technical Officer (OCTO) document series. Please see the [OCTO publication page](#) for a list of documents in the series. If you have questions or suggestions on any of these documents, please send them to [octo@icann.org](mailto:octo@icann.org).

This document supports ICANN's strategic goal to support and grow active, informed, and effective stakeholder participation. It is part of ICANN's strategic objective to improve the effectiveness of ICANN's multistakeholder model of governance.

---

# 1 Introduction

.This document is an informal overview of the activities conducted by the Internet Engineering Task Force (IETF) in 2021 that are of most interest to ICANN. The primary audience is those in the greater ICANN community who are interested in the technical side of ICANN's remit but do not actively follow the IETF. Thus, the coverage of what the IETF has done is fairly narrow; a document like this prepared for a different organization such as a large company would have a very different focus.

Readers who want more background on the IETF should see "[The Tao of the IETF](#)" and the [introductory material](#) on the IETF website. Links in this document for working groups are in the [IETF Datatracker](#); readers who want to browse IETF working groups, Internet-Drafts, RFCs, meetings, and so on should explore the Datatracker.

In keeping with the IETF working model, participation by ICANN staff at IETF meetings is on an individual basis, not necessarily representing the interests of the ICANN organization (org) or community.

If there are questions or comments regarding this document, please send email to [octo@icann.org](mailto:octo@icann.org).

## 2 IETF Meetings in 2021

Under normal circumstances, the IETF has physical meetings three times a year in various parts of the world. This year, like in 2020, all meetings were held virtually. The meetings used [Meetecho](#) for all online participants, just as they had done for many years before the pandemic. The IETF continues to develop features in Meetecho to better mimic the IETF working group process in face-to-face meetings.

The three meetings had about 1,300 to 1,400 attendees each, which compares favorably to the face-to-face meetings before the pandemic. The meetings were scheduled from Monday to Friday during the week to mimic pre-pandemic IETF meetings.

The [IETF 110 meeting](#) in early March 2021 had sessions scheduled from 12:00 to 18:00 UTC (the meeting had originally been scheduled for Prague). Given the dire COVID-19 statistics from the preceding winter and the very small number of people who had been vaccinated, the feeling was that it would become normal in 2021 for IETF meetings to be remote, and work needed to proceed in that light.

The [IETF 111 meeting](#) in late July 2021 had sessions scheduled from 19:00 to 01:00 UTC (the meeting had originally been scheduled for San Francisco). There was a relatively high turnout despite the times being bad for both Europe and Asia.

The [IETF 112 meeting](#) in early November 2021 had sessions scheduled from 12:00 to 18:00 UTC (the meeting had originally been scheduled for Madrid). In virtual hallway discussions, some people were hopeful that the IETF meetings in 2022 would be hybrids with some face-to-face interaction, but others said that the uneven vaccination rates and timing of national COVID-19 spikes would make it difficult to plan for travel. Many participants were talking more about

---

how the IETF would work if we assumed another year of all virtual meetings; the announcements of the plans for hybrid meetings in 2022 (see below) came well after IETF 112.

## 3 Primary Working Groups and BoFs

This section covers the primary IETF working groups of interest to ICANN, based on the topics covered.

### 3.1 DNSOP

The [Domain Name Systems Operations \(DNSOP\) Working Group](#) is responsible for most of the DNS-related work in the IETF. Although the name suggests that the group's focus is only operations, most new DNS protocol work is also done in the DNSOP Working Group.

Between the IETF 111 and 112 meetings, the working group leadership announced they would help move current working group drafts along before adopting new work. This plan will help make it more predictable when adopted drafts will be finished, although it will cause the drafts that would normally have been adopted to languish while waiting for the current queue to drain.

During 2021, DNSOP published six RFCs:

- ⦿ [RFC 8976](#), “Message Digest for DNS Zones,” describes a new resource record that zone maintainers can add to zones to help recipients of those files assure that the contents of the zones are not changed in transit. The new ZONEMD record can be applied to any zone whose values change slowly, like the DNS root zone. After the publication of RFC 8976, ICANN's Root Zone Evolution Review Committee (RZERC) issued [RZERC003](#), a report encouraging the adoption of the new record type in the root zone after it has been studied.
- ⦿ [RFC 9018](#), “Interoperable DNS Server Cookies,” is a new standard that extends the DNS cookies defined in [RFC 7873](#). The earlier RFC allowed a wide variety of contents in DNS cookies; the new RFC describes how to create cookies that will be useful in authoritative servers that have anycast addresses, and how to do so while protecting the privacy of DNS users.
- ⦿ [RFC 9077](#), “NSEC and NSEC3: TTLs and Aggressive Use,” makes some small but important corrections to earlier RFCs that relate to Domain Name System Security Extensions (DNSSEC). The errors in the earlier standards caused the validated denial of certain names for longer than intended, and the changes (when applied in DNSSEC validators) will make those denials have the expected lifetimes.
- ⦿ [RFC 9108](#), “YANG Types for DNS Classes and Resource Record Types,” defines some new standard terminology for DNS data that could be used in network modeling.
- ⦿ [RFC 9156](#), “DNS Query Name Minimisation to Improve Privacy,” is a major update to the earlier specification for how DNS resolvers can increase privacy by sending less information in queries to authoritative servers. This new specification, which is now a standard, can lead to less exposure of the contents of users' DNS queries on the Internet. It is co-authored by ICANN's Paul Hoffman.
- ⦿ [RFC 9157](#), “Revised IANA Considerations for DNSSEC,” is a small update to the requirements for getting assignments in IANA registries for two types of DNSSEC algorithms. Its publication was needed in order to allow national cryptographic algorithms

---

and future experimental algorithms to get assignments. It is authored by ICANN's Paul Hoffman.

## 3.2 DPRIVE

The [DNS PRIVate Exchange \(DPRIVE\) Working Group](#) covers issues related to adding privacy to the DNS. It is the working group in which DNS over Transport Layer Security (TLS) or DoT was developed. Recently, it has focused more on privacy in DNS operations.

During 2021, DPRIVE produced two RFCs:

- ⦿ [RFC 9076](#), “DNS Privacy Considerations,” catalogs the myriad of privacy issues with the DNS. It covers all parts of the DNS, from stub resolvers to authoritative servers, as well as the names in the DNS. This RFC completely replaces RFC 7626.
- ⦿ [RFC 9103](#), “DNS Zone Transfer over TLS,” standardizes the method of transferring zones between DNS servers using TLS. Using the cryptographic protection of TLS for zone transfers adds privacy for zones that have sensitive information in them, and also adds authentication for the contents of the zone transfer. (Authentication can also be given by RFC 8976, covered above, but RFC 9103 uses transport authentication instead of ZONEMD's source authentication.)

## 3.3 ADD

The core of the [Adaptive DNS Discovery \(ADD\) Working Group](#) charter states, “This working group will focus on discovery and selection of DNS resolvers by DNS clients in a variety of networking environments, including public networks, private networks, and VPNs, supporting both encrypted and unencrypted resolvers.” The working group was chartered in early 2020, and was busy during that year exploring the use cases that would be of interest to the group.

In 2021, the working group gained focus on which of the many proposed solutions in the space it would work on. Its main work is in three areas: using the Dynamic Host Configuration Protocol (DHCP) to allow networks to specify which resolvers are available, a protocol to aid in the discovery of resolvers that did not appear in DHCP, and a format for carrying information about resolvers in the DNS.

## 3.4 REGEXT

The [Registration Protocols Extensions \(REGEXT\) Working Group](#) is the main place where extensions to the Extensible Provisioning Protocol (EPP) are developed. EPP is the standard way for registries and registrars to communicate, so EPP extensions are of particular interest to ICANN. The working group also covers the Registration Data Access Protocol (RDAP).

2021 was a busy year for REGEXT, with seven RFCs published:

- ⦿ [RFC 8977](#), “RDAP Query Parameters for Result Sorting and Paging,” describes an extension to RDAP to let clients provide servers with their preferences for managing large responses. This is expected to be useful for servers because they will be able to

---

provide less data to clients that do not want it, or to at least give large amounts in more manageable chunks.

- ⦿ [RFC 8982](#), “RDAP Partial Response,” has a goal similar to RFC 8977, namely to help RDAP clients and servers limit the amount of data returned from responses if the client only wants (or can only handle) a small number of records.
- ⦿ [RFC 9022](#), “Domain Name Registration Data (DNRD) Objects Mapping,” defines a set of XML objects for a domain name registry that uses RFC 8909, “Registry Data Escrow Specification” for escrow. This specification sets interoperability standards that will make business recovery from an escrow server much more likely. This document was co-authored by ICANN’s Gustavo Lozano.
- ⦿ [RFC 9038](#), “EPP Unhandled Namespaces,” describes how EPP servers can tell clients that the servers have namespaces that the client does not currently know about, but might know in the future. This also enables client discovery of new namespaces, such as when a server has upgraded its software.
- ⦿ [RFC 9082](#), “RDAP Query Format,” and [RFC 9083](#), “JSON Responses for RDAP,” are newer versions of the original query and response formats from RFC 7482 and RFC 7483. They contain many clarifications and corrections to the earlier specifications.
- ⦿ [RFC 9154](#), “EPP Secure Authorization Information for Transfer,” describes how to use short-lived authorization tokens in EPP to replace object-specific passwords.
- ⦿ [RFC 9167](#), “Registry Maintenance Notification for EPP,” is an EPP extension for notifying about registry maintenance events. It also allows those clients to query EPP servers about upcoming or past events.

## 3.5 DANCE

The [DANE Authentication for Network Clients Everywhere \(DANCE\) Working Group](#) seeks to extend and apply the DNS-Based Authentication of Named Entities (DANE) protocol defined in RFC 6689 to encompass TLS client authentication using either cryptographic certificates or raw public keys. The working group was formed late in 2021, and members were discussing the structure of the work to be undertaken and an initial architecture document.

# 4 Leadership, Administration, and Other Activities

## 4.1 IESG and IAB

In the last months of each year, approximately half of the [Internet Engineering Steering Group \(IESG\)](#) and half of the [Internet Architecture Board \(IAB\)](#) are selected through the Nominating Committee ([NomCom](#)). Members of the IETF NomCom are selected at random from volunteers who have attended at least three of five previous IETF face-to-face meetings, although this criterion is being adapted due to the current lack of face-to-face meetings. The IETF NomCom also selects members for other boards and committees that are related to the IETF’s work.

Most of the area directors that were up for renewal indicated that they wanted to continue. The sole exception is Benjamin Kaduk, a long-serving Security Area Director; his replacement will be Paul Wouters, an active ICANN technical community member. A total of 14 people applied for the six open slots on the IAB.

---

## 4.2 IETF Hackathon

At face-to-face meetings, the [IETF Hackathon](#) attracts hundreds of developers who are working on a variety of IETF standards to come together to code, design, and test existing or emerging Internet standards, helping ensure that IETF standards are implementable. In the past few years, the DNS community has been well represented at the hackathons. A common theme has been to ensure that protocols that are near completion actually work as described, and to find edge cases that need to be documented before the protocols are standardized. ICANN has helped sponsor these events in the past.

In 2021, the virtual IETF Hackathons attracted even less interest than in 2020. The DNS community is still represented, but at greatly reduced levels.

## 4.3 Nameservers for .arpa

In October 2021, the IAB published [RFC 9120](#), “Nameservers for the Address and Routing Parameter Area (“arpa”) Domain.” This document originated in the IAB because they are responsible for the definition of the .arpa zone. It describes how the nameservers for .arpa (which are currently most of the DNS root servers) will transition to other systems. The impetus for this change is that some proposals for extensions to the .arpa zone were considered controversial because they could affect root zone service. This document was co-authored by ICANN/PTI’s Kim Davies.

## 4.4 Other DNS-related RFCs Published

In August, [RFC 9102](#), “TLS DNSSEC Chain Extension,” was published as an experimental RFC. It describes an extension to the TLS protocol which enables the transmission of a full set of DNS data that can be used by DNSSEC to perform a complete DANE transaction. The document started in the TLS Working Group, but then lost steam due to disagreements on some fundamental design issues, so the RFC was eventually published by the Independent Submissions Editor. At this time, no browser vendors have expressed interest in implementing it.

# 5 Expected Activities of Interest During 2022

It is difficult to make long-term predictions about the IETF and its activities because of shifting trends in Internet traffic, unexpected security threats, changes in the ways that billions of Internet users access their favorite content, and now, the pandemic. Thus, this section focuses only on short-term, one-year predictions that relate to IETF work that is of most interest to ICANN.

## 5.1 Plans for IETF Meetings

Like other standards development organizations, the IETF had become quite reliant on face-to-face meetings for making progress on its work. Many working groups continue to make slower

---

progress than in the pre-pandemic years, but many report better progress than during 2020. The IETF follows [RFC 8719](#), “High-Level Guidance for the Meeting Policy of the IETF,” in its scheduling of all meetings, including the virtual ones; that document was published just before the pandemic hit in 2020.

At the time that document was published, the IETF had plans for three hybrid meetings in 2022. IETF 113 will be a hybrid meeting with the in-person part in Vienna in March 2022; it was originally scheduled for Bangkok. IETF 114 is scheduled to have the in-person portion in Philadelphia in late July. IETF 115 in early November is planned to have the in-person portion in London (the site of the 2018 meeting that was sponsored by ICANN).

## 5.2 Working Group Activities

Despite the recent efforts of the chairs, the DNSOP Working Group still has 11 documents it has agreed to work on, and has many more waiting to be adopted. Working group sessions at IETF meetings still spend the majority of their time discussing these yet-to-be-adopted documents, while interim working group meetings (between the IETF meetings) focus on preparing the adopted documents for a last review in the working group. There is no overall theme for the adopted work: it includes better error handling in the DNS protocol, private-use names, new DNSSEC extensions, and many other topics. ICANN org staff are active in the working group as both document authors and reviewers.

The REGEXT Working Group is working on numerous documents about RDAP and further extensions to EPP. The recent focus has been much more on RDAP than on EPP.

The DPRIVE Working Group is still discussing possibly extending privacy between resolvers and authoritative servers using DoT, although the working group’s progress is quite slow in all areas. ICANN org staff are active in promoting this future work to reduce the amount of user-identifiable data leaked in the normal use of the DNS.

The ADD Working Group is likely to make progress during 2022 with its first set of documents relating to resolver discovery. That progress is not assured, however, because the working group still gets sidetracked with attempts to expand the scope of the proposed protocols.