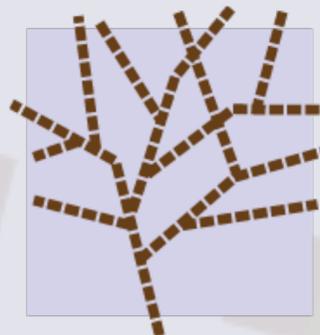


# AS 112 Site Redesign

**Matthew Pounsett**  
**DNS-OARC Systems Engineering**

**ARIN 51 — April 2023**  
**Tampa, FL**



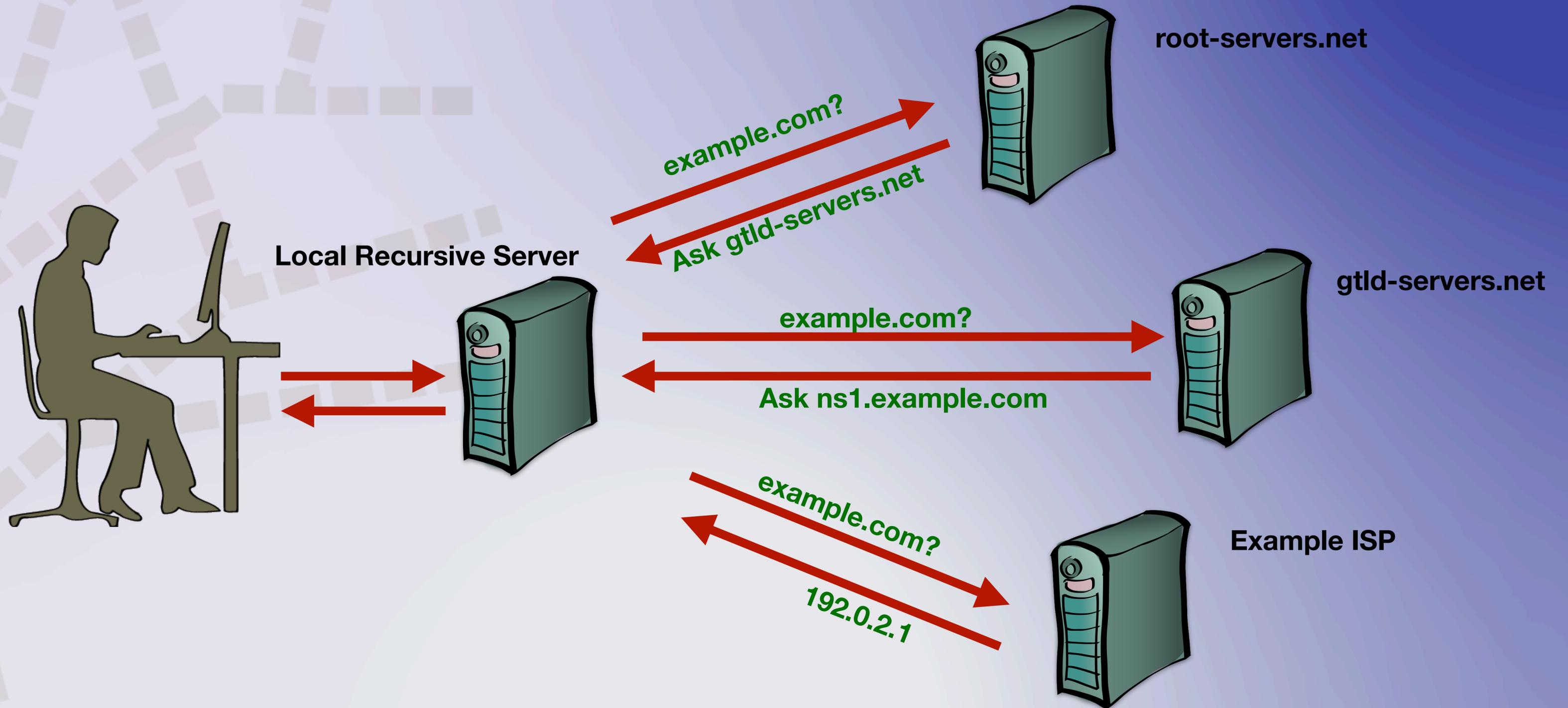
**DNS-OARC**

Domain Name System Operations Analysis and Research Center

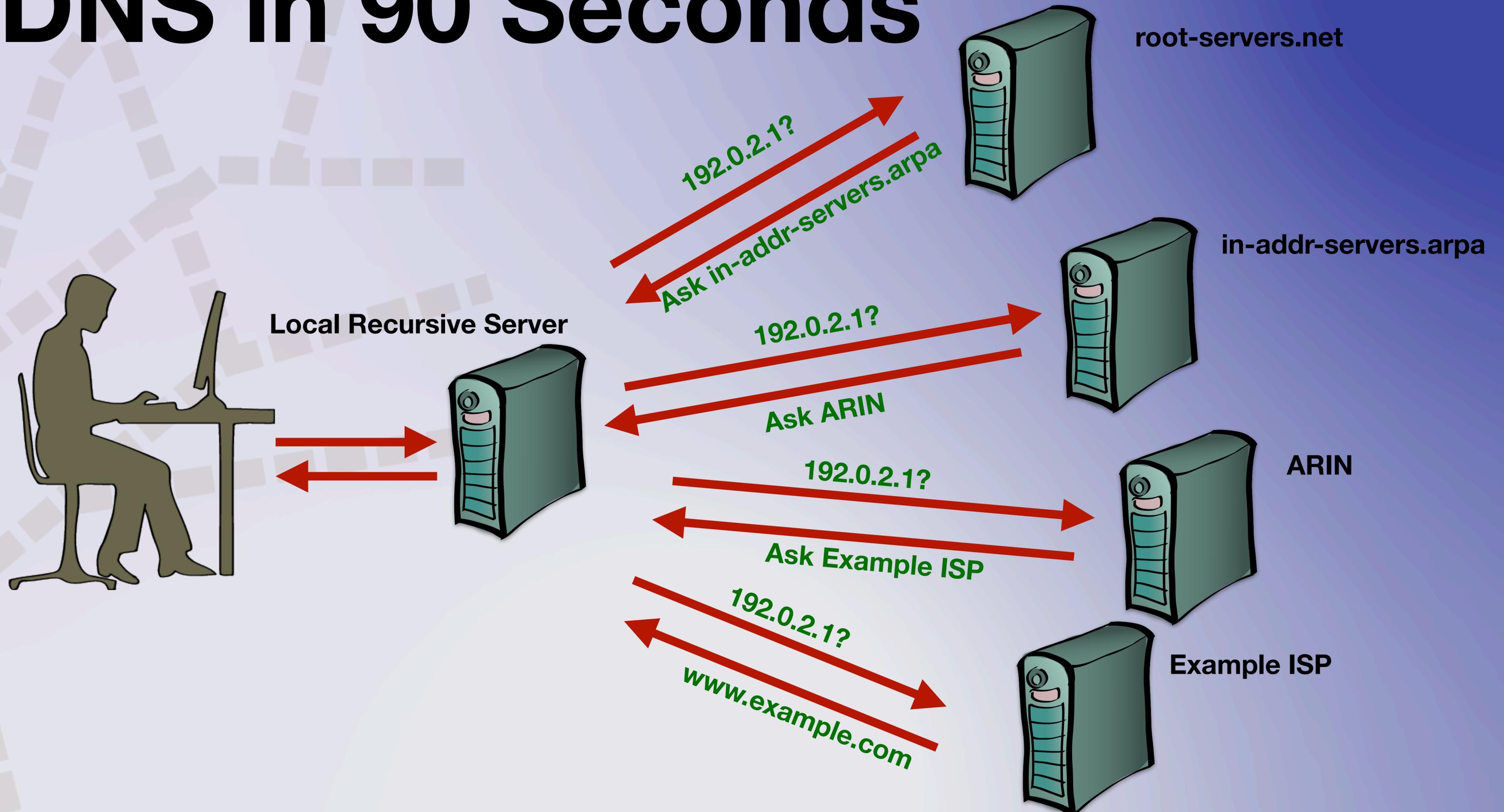
# Agenda

- **What & why is AS112?**
- **Project motivations and goals**
- **New site examples**
- **AS112 Instance Survey with RIPE Atlas**

# DNS in 90 Seconds



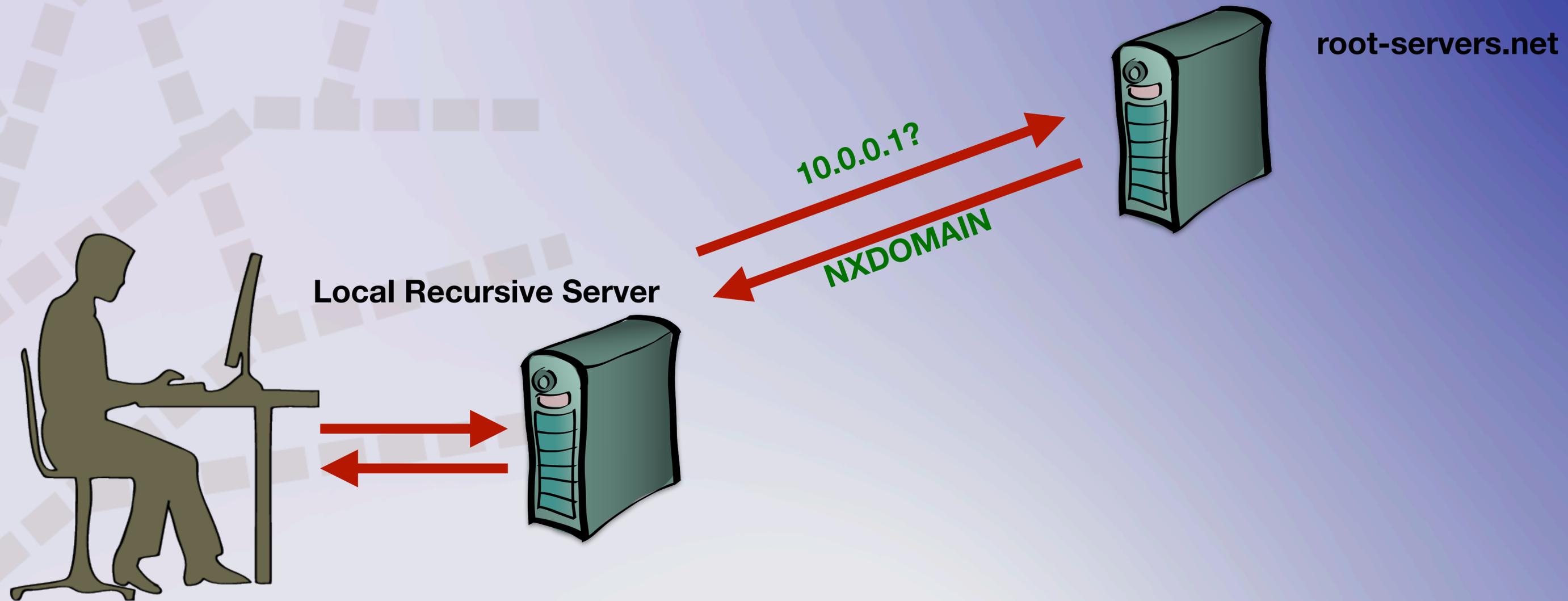
# DNS in 90 Seconds



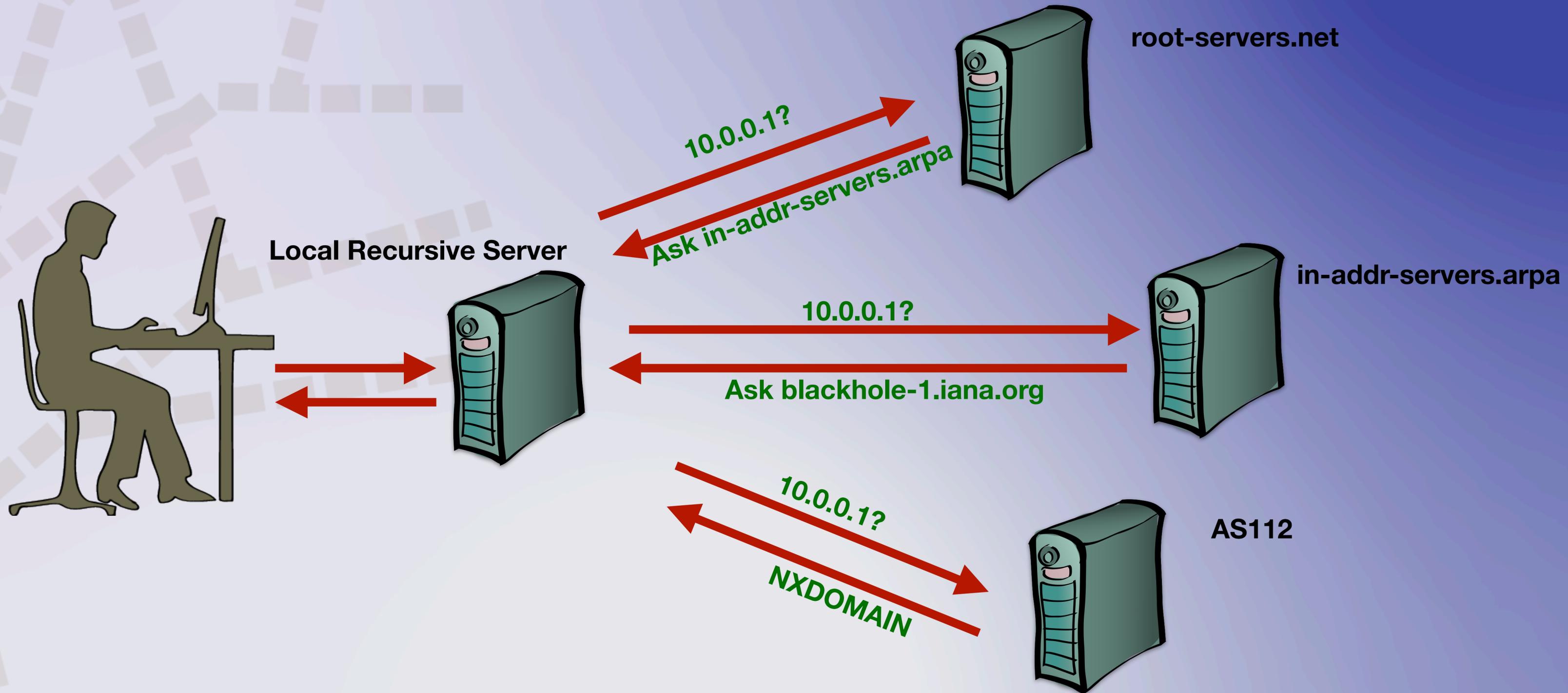
# Why is AS112?

- **1996: RFC 1918 delegates three address blocks as “private” address space**
- **DNS queries for these blocks continue to pollute the Internet**

# RFC 1918 Queries Before

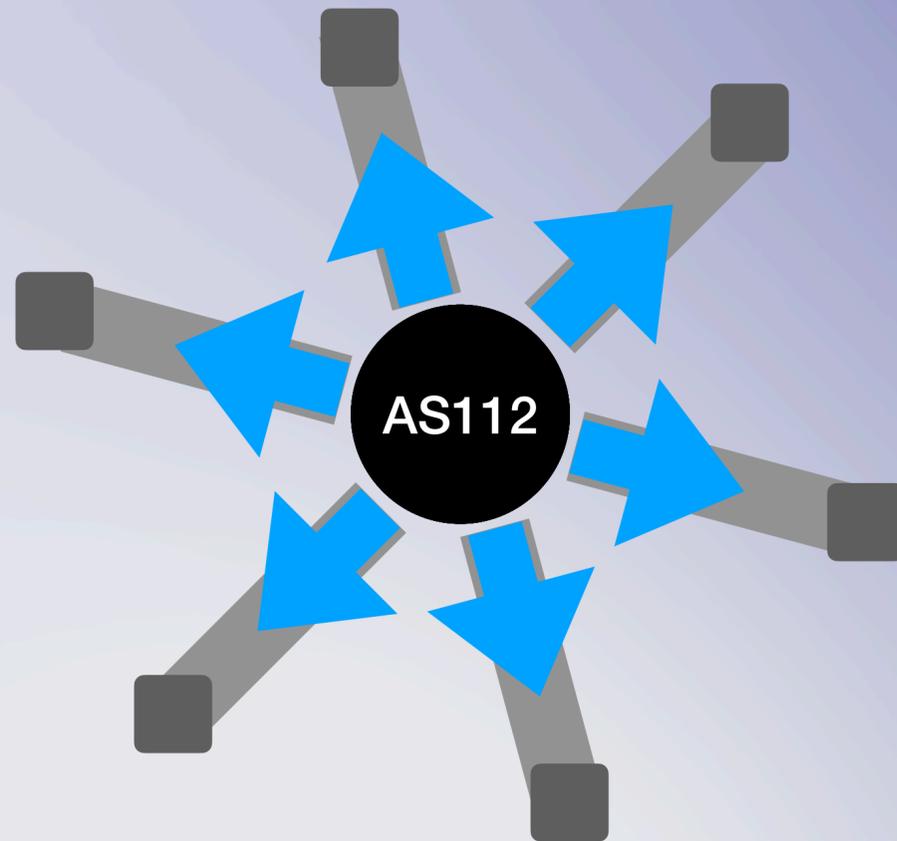


# RFC 1918 Queries After



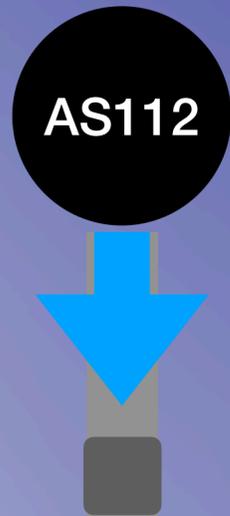
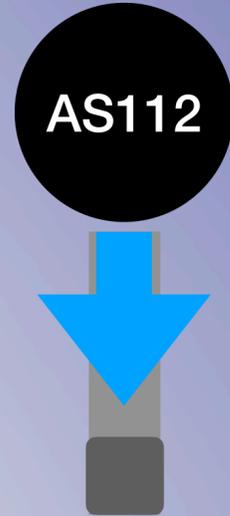
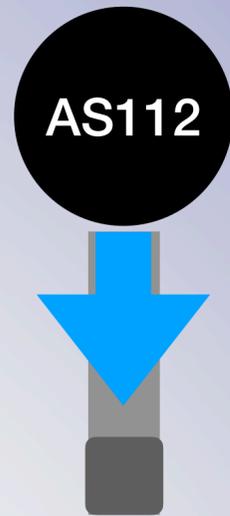
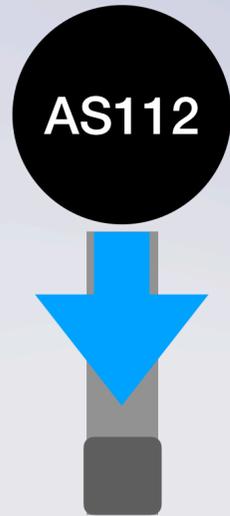
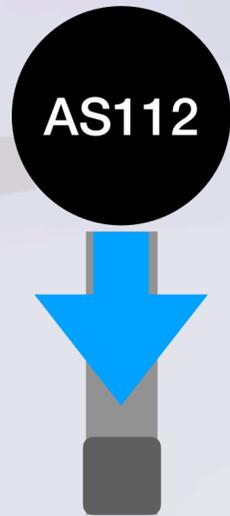
# Stupid ~~Pet~~ Tricks

Routing



# Stupid ~~Pet~~ Tricks

Routing



# What is AS112?

- **Loosely coordinated, community operated, Anycasted, “autonomous” system**
- **Acts as a sink for DNS queries that should never hit the public Internet**
- **RFC 1918 blocks, RFC 6890 link-local, empty.as112.arpa**

# Project Motivation

- **Excellent example of 1995 web design**
- **Poorly organized, difficult to find information**
- **Difficult to manage operator listing**

# AS112 PROJECT

## Overview

[ [IANA](#) | [RFC 1918](#) | [RFC 6304](#) (obsolete) | [RFC 6305](#) | [RFC 7534](#) | [RFC 7535](#) | [RootOps](#) | [AS112 Ops listing](#) ]

**NEWS: New zone home.arpa has been delegated to AS112 servers effective March 14, 2018.**

**NEWS: RFC 7534, which obsoletes RFC 6304, was published by the IETF in May of 2015. Operators are strongly advised to review changes to AS112 operations, specifically around IPv6.**

**NEWS: RFC 7535, describes a method to delegate additional zones to the AS112 project without the requirement for AS112 operators to manually synchronise their configurations. This is done through DNAME. It describes the use of two additional prefixes to advertise this component of the AS112 service.** The IANA and ICANN have not yet implemented this feature as it requires changes to the root zone. Until the impact has been studied, there are currently no plans to do this.

Many private and some public networks generate PTR (reverse lookup) queries for RFC 1918 addresses, dynamic DNS updates and other ambiguous addresses, such as the ones below:

- 10.0.0.0/8
- 172.16.0.0/12
- 169.254.0.0/16
- 192.168.0.0/16

Through the IETF process, other delegations may be made periodically to the AS112 servers for other private or special use purposes, such as the one below:

- home.arpa

This happens because many of the same people running those networks neglect to run a DNS server of their own, or worse, simply don't enumerate their IP address use in both forward and reverse DNS zones. This creates many queries which are ultimately sent up to the root DNS server system which in turn responds with negative answers. So what? The problem is the load this creates on the overall global DNS system: As more devices with private addresses connect to the Internet, the higher the load becomes without properly administered DNS servers for those devices.

There are now separate (non-root) servers for answering these queries on behalf of the global DNS system, [described in an operator's listing here](#).

As a way to distribute the load across the Internet for RFC1918-related queries, we use IPv4 and IPv6 addresses as *anycast* addresses. The address blocks are 192.175.48.0/24 and 2620:4f:8000::/48 and its origin AS is 112. These address blocks are advertised from multiple points around the Internet, and these distributed servers coordinate their responses back to networks making those requests. These servers also co-ordinate back-end [statistical analyses](#).

The people who run these anycast AS112 DNS servers are known as the [AS112 Operators](#). They operate these servers using a constellation of anycast DNS servers using a [certain set of well-known addresses](#). The operations are described in greater detail through [IETF RFC 7534](#) and [RFC 6305](#).

A mailing list for AS112 operators is open. For subscription information, please visit [the list website](#) and follow the instructions.

Finally there are several important [references](#) which should be consulted by current and prospective AS112 operators and others with an interest in general subjects on AS112 and anycast DNS operations.

- RFC 1918
- RFC 6304 (obsolete)
- RFC 6305
- RFC 7534
- RFC 7535
- RFC 8375

is a loosely-coordinated, community-operated set of [anycast](#) service addresses which are designed to sink DNS queries that should not be sent to public DNS servers, such as the root servers or IN-ADDR.ARPA servers.

Originally described in [RFC 6304](#) in 2011, the description and scope of the project was updated in [RFC 7534](#) (in 2015) which had this to say:

Many sites connected to the Internet make use of IPv4 addresses that are not globally unique. Examples are the addresses designated in [RFC 1918](#) use within individual sites.

Devices in such environments may occasionally originate Domain Name System (DNS) queries (so-called "reverse lookups") corresponding to those private-use addresses. Since the addresses concerned have only local significance, it is good practice for site administrators to ensure that such queries are answered locally. However, it is not uncommon for such queries to follow the normal delegation path in the public DNS instead of being answered within the site.

It is not possible for public DNS servers to give useful answers to such queries. In addition, due to the wide deployment of private-use addresses and the continuing growth of the Internet, the volume of such queries is large and growing. The AS112 project aims to provide a distributed sink for such queries in order to reduce the load on the corresponding authoritative servers. The AS112 project is named after the Autonomous System Number (ASN) that was assigned to it.

— Abstract from [RFC 7534](#)

In addition to updating the above description of the project, RFCs [RFC 7534](#) and [RFC 7535](#) defined a new redirection method for AS112, using [DNAME](#) to redirect queries to a second set of anycast service addresses. Although not yet deployed for any domains (the issue of adding DNAME records to the root zone requires some study, as does any novel change to the content of the root) many AS112 operators also announce this second set of service prefixes and are prepared to handle those DNS queries when they eventually arrive.



### About

The AS112 Project is a loosely-coordinated, community-operated set of [anycast](#) service addresses which are designed to sink DNS queries that should not be sent to public DNS servers, such as the root servers or IN-ADDR.ARPA servers.

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Devices in such environments may occasionally originate Domain Name System (DNS) queries (so-called "reverse

# Operator Listing

- Hand-edited HTML table, not machine readable
- Missing information
- No garbage collection

Who	Where	Unicast Addresses	Transit AS	Statistics
<a href="#">ARIX</a>	Fremont, CA, USA			
<a href="#">AS250</a>	Nuremberg, DE	194.150.168.112	250, and its peers	
<a href="#">Abovenet Communications, Inc</a>	?	?	3557, via 6461	
Accretive Technology Group, Inc.	Seattle, US	?	3557, via 11608	
ACTIX (ACT Internet Exchange)	Canberra, AU	218.100.59.8		
Afilias	?	?	12041	
<a href="#">Aplitt S.A.</a>	Gdynia, PL	91.212.242.247	49420	<a href="#">Statistics</a>
Areti Internet	Bromley, UK	?	21321	
Armenian Datacom Company	Yerevan, AM	91.103.24.1	42109	<a href="#">Stats</a>
<a href="#">ASP Networks</a>	Dorset, UK	193.178.223.33	20538	
<a href="#">Autonomica</a>	Stockholm, SE	192.36.144.115	8674	
<a href="#">Camel Network</a>	London, UK	194.145.210.62	34159	
CERNET	Beijing, CN	202.38.119.2	4789	
Cogent Communications	?	?	3557, via 174	
<a href="#">Datahata Ltd.</a>	Minsk, Belarus	31.130.200.59	56740	<a href="#">Stats</a>
DARS Telecom	Ulyanovsk, RU	79.132.98.151		
DCS1 Pte Ltd	Singapore, SG	203.123.48.17, 2405:fc00::112	37989	
DE-CIX	Frankfurt, Hamburg, DE; New York City, USA; and Istanbul, Turkey	(on IXP fabric)		
Dawnet	Dawsonville, GA			

# Operator Listing

- No distinction between globally reachable and IXP instances
- No consideration for operators with multiple instances

Who	Where	Unicast Addresses	Transit AS	Statistics
<a href="#">ARIX</a>	Fremont, CA, USA			
<a href="#">AS250</a>	Nuremberg, DE	194.150.168.112	250, and its peers	
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DE-CIX	Frankfurt, Hamburg, DE; New York City, USA; and Istanbul, Turkey	(on IXP fabric)		
Dawnet	Düsseldorf, DE			

# New Listing

- **Global instances stored as structured data (YAML)**
- **Set up to handle multiple instances per operator**
- **IXP instances pulled from PeeringDB using their API**

# Organizing the Listing

- RIPE Atlas measurement from 6094 probes

```
-zsh
INSERT matt ~
00:42:24 dig +noall +answer hostname.as112.net TXT IN
hostname.as112.net. 604787 IN TXT "Unique IP: 203.0.113.1."
hostname.as112.net. 604787 IN TXT "Hurricane Electric" "Fremont, C
alifornia,USA"
hostname.as112.net. 604787 IN TXT "See http://www.as112.net/ for m
ore information."
INSERT matt ~
00:42:26
```

# Organizing the Listing

- **List of unique responses from Atlas**
- **Compare against old listing and PeeringDB entries**
- **Build new structured listing by hand**
- **Future entries added by moderated submission form**

