

DNS Record Types Explained

Before we dive into setting up your DNS server, it's important to understand the key DNS record types you'll encounter. These records tell the DNS server how to translate domain names and IP addresses.

- **A (Address) Record:** Maps a domain name to an IPv4 address.
- **AAAA (IPv6 Address) Record:** Maps a domain name to an IPv6 address.
- **PTR (Pointer) Record:** Maps an IP address to a domain name, used for reverse DNS lookups.
- **NS (Name Server) Record:** Specifies the authoritative DNS servers for a domain.
- **SOA (Start of Authority) Record:** Provides administrative information about the zone, including the primary name server, email of the domain administrator, and zone parameters.

Understanding these records will help you configure your DNS zones correctly.

Setting up a DNS server using BIND (Berkeley Internet Name Domain) is a foundational skill for network administrators. This guide walks through the process step-by-step, using the example of the domain contoso.com.

1. What Is DNS?

DNS (Domain Name System) translates human-readable domain names (like contoso.com) into IP addresses (like 192.168.1.1). It also supports reverse lookups, translating IP addresses back into domain names.

2. Install BIND

On a Debian-based system:

```
sudo apt update
sudo apt install bind9 bind9utils bind9-doc
```

On other Linux distributions, use the appropriate package manager:

- **Red Hat, CentOS, Fedora:**

```
sudo dnf install bind bind-utils
```

- **OpenSUSE:**

```
sudo zypper install bind bind-utils
```

- **Arch Linux:**

```
sudo pacman -S bind
```

Ensure you have root or sudo privileges when installing packages.

3. Configure Zone Files

Zone files define DNS records for your domain and its reverse mappings.

Forward Zone File: `/etc/bind/db.contoso.com`

```
$TTL 604800
@ IN SOA contoso.com. root.contoso.com. (
                                4          ; Serial
                                604800     ; Refresh
                                86400      ; Retry
                                2419200    ; Expire
                                604800 )   ; Negative Cache TTL
@ IN NS ns.contoso.com.
@ IN A 192.168.1.1
@ IN AAAA 2001:db8::1
server IN A 192.168.1.1
server IN AAAA 2001:db8::1
ns IN AAAA 2001:db8::1
```

Reverse Zone File (IPv4): `/etc/bind/db.192`

```
$TTL 604800
@ IN SOA ns.contoso.com. root.contoso.com. (
                                2          ; Serial
                                604800     ; Refresh
                                86400      ; Retry
                                2419200    ; Expire
                                604800 )   ; Negative Cache TTL
@ IN NS ns.
1 IN PTR ns.contoso.com.
1 IN PTR contoso.com.
1 IN PTR server.contoso.com.
```

Reverse Zone File (IPv6): `/etc/bind/db.2001`

```
$TTL 86400
$ORIGIN 0.0.0.0.0.0.0.0.0.8.b.d.0.1.0.0.2.ip6.arpa.
@ IN SOA contoso.com. root.contoso.com. (
    3          ; Serial
    604800     ; Refresh
    86400      ; Retry
    2419200    ; Expire
    604800 )   ; Negative Cache TTL
@ IN NS ns.contoso.com.
1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0 IN PTR contoso.com.
```

4. Define Zones in BIND

Edit `/etc/bind/named.conf.local` to include your zones:

```
zone "contoso.com" {
    type master;
    file "/etc/bind/db.contoso.com";
};

zone "1.168.192.in-addr.arpa" {
    type master;
    file "/etc/bind/db.192";
};

zone "0.0.0.0.0.0.0.0.0.8.d.b.0.1.0.0.2.ip6.arpa" {
    type master;
    file "/etc/bind/db.2001";
};
```

5. Test DNS Configuration

Use `named-checkzone` and `named-checkconf`:

```
named-checkzone contoso.com /etc/bind/db.contoso.com
named-checkzone 1.168.192.in-addr.arpa /etc/bind/db.192
named-checkzone 0.0.0.0.0.0.0.0.0.8.d.b.0.1.0.0.2.ip6.arpa /etc/bind/db.2001
named-checkconf
```

6. Restart BIND

```
sudo systemctl restart bind9
```

7. Query the DNS Server

Use `nslookup`, `dig`, and `ping` to test your DNS server and network connectivity. Here are some example commands:

```
# Using nslookup to query domain and IP addresses
nslookup contoso.com
nslookup 192.168.1.1
nslookup 2001:db8::1

# Using dig to query DNS records
# Query contoso.com for default DNS server
dig contoso.com

# Query contoso.com specifying your DNS server
dig @192.168.1.1 contoso.com

# Reverse lookup for IPv4 address
# Using dig with -x option for reverse lookup
dig -x 192.168.1.1

# Reverse lookup for IPv6 address
# Using dig with -x option for reverse lookup
dig -x 2001:db8::1

# Using ping to test network connectivity and DNS resolution
ping contoso.com
ping 192.168.1.1
```

8. Teaching Tips

- Explain each record type (A, AAAA, PTR, NS, SOA).
- Use diagrams to show forward and reverse lookups.
- Let students build their own zones for practice.

This setup provides a complete local DNS server with both IPv4 and IPv6 support, including reverse lookups. Perfect for labs, simulations, or small networks.