

# Implementing DNS in C0

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## Abstract

We have implemented a **DNS** server in the **C0** language called **c0ns**,<sup>1</sup> and evaluated it for both safety and performance.

## 1 Background

**Domain Name System (DNS)** is a hierarchical database that maps domain names to IP addresses in a distributed manner augmented with caching to achieve a better performance [Mockapetris, 1987a,b, Mun and Lee, 2005]. In fact, there are three major parts:

1. Domain name space with resource records: The domain name space is a tree-like data structure with a root, and nodes labeled with at most 63 characters. The domain name of a label is the sequence of labels on the path from the node to the root. Each node of the tree, associated with a domain name, has a set of resource records.
2. Name servers keep information about a complete sub-tree of the domain name. They may also cache pointers to other name servers.
3. Resolvers are responsible for sending a query to name servers upon clients request and extract information from them. They may also have some parts of the name space cached themselves. In fact, their role is to provide an interface between applications and DNS in the process of *name resolution*. Name resolution starts when an application program (the host) sends its query for an IP address to a local name server, continues by the local name server which extracts the information in an iterative/recursive manner from different name servers (If it does not already have it in its own cache), and ends when the local name server returns the IP address to the host.

The messages exchanged between host and name servers adhere to a simple format, which is divided into 5 sections: (1) Header, (2) Question, (3) Answer, (4) Authority, and (5) Additional. Each of these sections also has its own special format, some of which will be covered in more detail in next parts of this document.

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<sup>1</sup>Source code available on GitHub: <http://www.github.com/jonsterling/c0ns.git>.