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DOMAIN NAMES - IMPLEMENTATION and SPECIFICATION

This memo discusses the implementation of domain name servers and resolvers, specifies the format of transactions, and discusses the use of domain names in the context of existing mail systems and other network software.

This memo assumes that the reader is familiar with RFC 882, "Domain Names - Concepts and Facilities" which discusses the basic principles of domain names and their use.

The algorithms and internal data structures used in this memo are offered as suggestions rather than requirements; implementers are free to design their own structures so long as the same external behavior is achieved.

***** WARNING *****

This RFC contains format specifications which are preliminary and are included for purposes of explanation only. Do not attempt to use this information for actual implementations.

TABLE OF CONTENTS

INTRODUCTION

Overview

The goal of domain names is to provide a mechanism for naming resources in such a way that the names are usable in different hosts, networks, protocol families, internets, and administrative organizations.

From the user's point of view, domain names are useful as arguments to a local agent, called a resolver, which retrieves information associated with the domain name. Thus a user might ask for the host address or mail information associated with a particular domain name. To enable the user to request a particular type of information, an appropriate query type is passed to the resolver with the domain name. To the user, the domain tree is a single information space.

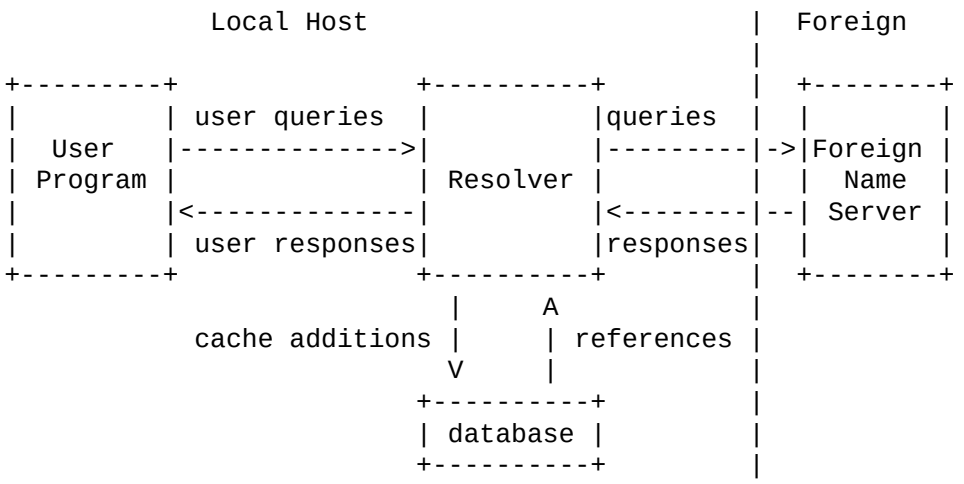
From the resolver's point of view, the database that makes up the domain space is distributed among various name servers. Different parts of the domain space are stored in different name servers, although a particular data item will usually be stored redundantly in two or more name servers. The resolver starts with knowledge of at least one name server. When the resolver processes a user query it asks a known name server for the information; in return, the resolver either receives the desired information or a referral to another name server. Using these referrals, resolvers learn the identities and contents of other name servers. Resolvers are responsible for dealing with the distribution of the domain space and dealing with the effects of name server failure by consulting redundant databases in other servers.

Name servers manage two kinds of data. The first kind of data held in sets called zones; each zone is the complete database for a particular subtree of the domain space. This data is called authoritative. A name server periodically checks to make sure that its zones are up to date, and if not obtains a new copy of updated zones from master files stored locally or in another name server. The second kind of data is cached data which was acquired by a local resolver. This data may be incomplete but improves the performance of the retrieval process when non-local data is repeatedly accessed. Cached data is eventually discarded by a timeout mechanism.

This functional structure isolates the problems of user interface, failure recovery, and distribution in the resolvers and isolates the database update and refresh problems in the name servers.

Implementation components

A host can participate in the domain name system in a number of ways, depending on whether the host runs programs that retrieve information from the domain system, name servers that answer queries from other hosts, or various combinations of both functions. The simplest, and perhaps most typical, configuration is shown below:

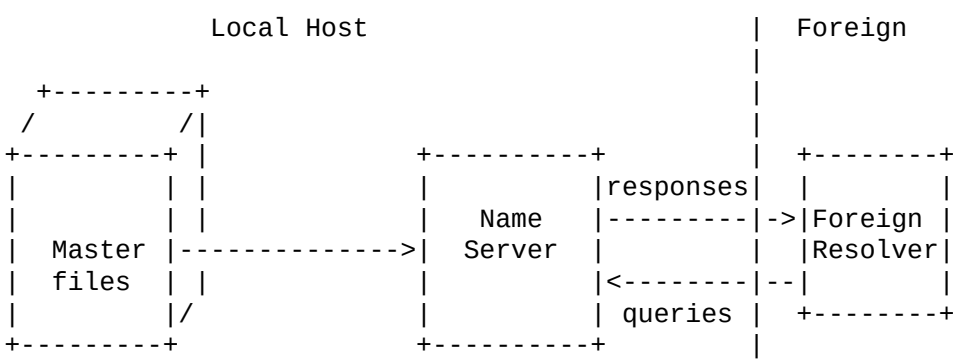


User programs interact with the domain name space through resolvers; the format of user queries and user responses is specific to the host and its operating system. User queries will typically be operating system calls, and the resolver and its database will be part of the host operating system. Less capable hosts may choose to implement the resolver as a subroutine to be linked in with every program that needs its services.

Resolvers answer user queries with information they acquire via queries to foreign name servers, and may also cache or reference domain information in the local database.

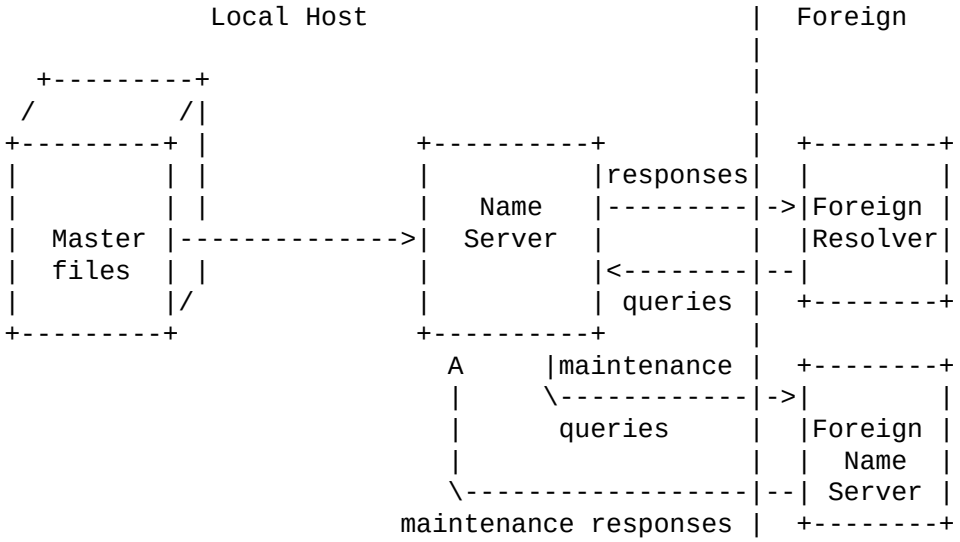
Note that the resolver may have to make several queries to several different foreign name servers to answer a particular user query, and hence the resolution of a user query may involve several network accesses and an arbitrary amount of time. The queries to foreign name servers and the corresponding responses have a standard format described in this memo, and may be datagrams.

Depending on its capabilities, a name server could be a stand alone program on a dedicated machine or a process or processes on a large timeshared host. A simple configuration might be:



Here the name server acquires information about one or more zones by reading master files from its local file system, and answers queries about those zones that arrive from foreign resolvers.

A more sophisticated name server might acquire zones from foreign name servers as well as local master files. This configuration is shown below:



In this configuration, the name server periodically establishes a virtual circuit to a foreign name server to acquire a copy of a zone or to check that an existing copy has not changed. The messages sent for these maintenance activities follow the same form as queries and responses, but the message sequences are somewhat different.

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