

Quiz Sheet #5

Problem 5.1: *domain name system*

(4+2+2+2 = 10 points)

- a) The messages used by the domain name system protocol have four sections: the question section, the answer section, the authority section and the additional section. Briefly explain the purpose of each section.
- b) How are IPv4 addresses of the form `a.b.c.d` represented in the `in-addr.arpa.` zone? Explain the purpose of the `in-addr.arpa.` zone.
- c) You want to represent telephone numbers in the domain name system. Telephone numbers following the ITU-T recommendation E.164 consist of a country code (1-3 digits) followed by a national destination code plus a subscriber number. E.164 numbers are usually written with a `+` symbol in front of the number (e.g., `+49 421 200-40`) and space or punctuation characters are ignored. How would you represent E.164 numbers in the domain name system?
- d) What are anycasts? How are anycasts used in the domain name system?

Solution:

- a) The question section is carrying questions to be answered while the answer section is carrying answers to the queries contained in the question section. The authority section provides information about servers where authoritative answers can be found (i.e., servers that provide answers from a copy of the zone database). The additional section contains additional records provided by the DNS server in order to reduce followup queries. For example, a server may provide A and AAAA records for names returned in a response to an MX query.
- b) An IPv4 address of the form `a.b.c.d` is represented as the name `d.c.b.a.in-addr.arpa` in the domain name system. The `in-addr.arpa.` zone is used to provide mappings of IPv4 addresses to domain names using PTR records (so called reverse mappings). The 'reverse' representation allows to delegate responsibility for the reverse mappings for prefixes that are multiple of 8 bits.
- c) In order to be able to delegate authority, the phone numbers should be represented in reverse order. RFC 6116 defines a representation where every digit becomes a DNS label in reverse order and it allocates the zone `e164.arpa.` to represent phone numbers. Hence, the number `+49 421 200-40` would be represented as `0.4.0.0.2.1.2.4.9.4.e164.arpa.` in the domain name system.
- d) Anycasts are a mechanism to route datagrams to the nearest node in a group of potential receivers. IP anycasts can be implemented using routing policies. The DNS uses anycast to address root servers so that they can be replicated in multiple locations to improve scalability and robustness.