Computer Networks
Assignment 1

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Assignment

In this assignment, you first explore how to encode some plaintext data and take its checksum. You then implement a simplified version of a process responsible for converting a bit-stream into separate frames.

Ada Lovelace Protocol (ALP)

This protocol uses frames with a layout similar to Ethernet frames. An ALP frame contains data for each of the fields described in the list above. A visual overview of an ALP frame is shown in Figure 1. Similar to Ethernet frames, ALP frames also include an error detection code. However, whereas Ethernet uses CRC, ALP uses a checksum. To calculate the value of checksum bits, ALP uses the following algorithm: add up all the bytes in the frame (excluding the checksum bytes), and take the result modulo (decimal) 128.

1. Exploration

In this part of the assignment, you transform the string "My cabbages!" into a frame. This involves encoding the string using an ASCII table (see Figure 2), computing the appropriate headers and trailers, and finally concatenating them all into a frame.

1. What do each of the columns (Dec, Hex, Oct, Chr) in the ASCII table in Figure 2 mean?

Answer:

The first three - Dec, Hex and Oct - are different number systems, each having a different base, that are used to represent/encode numbers, letters, symbols, etc.

Dec stands for Decimal Numeral System, which has base 10 and therefore uses digits from 0 to 9.

Hex is Hexadecimal Numeral System, with base 16. This means that apart from the 0-to-9 digits, it also consists of digits from A to F.

Oct is Octal Numeral System, base 8. It only uses digits from 0 to 7.

Meanwhile, Chr represents the character, or the symbol that is to be encoded. These symbols are decided by ASCII - American Standard Code for Information Interchange. These include control characters (e.g NULL, ESC), printable characters (e.g space, 1, 2, a, b, A) and other extended characters.

2. Which decimal numbers correspond to each of the characters in the string "My cabbages!"? Using the ASCII table in Figure 2, list the twelve numbers separated by commas.

Answer:

77, 121, 32, 99, 97, 98, 98, 97, 103, 101, 115, 33

3. What is the hexadecimal representation of the string "My cabbages!"? Using the ASCII table in Figure 2, list the hexadecimal digits as a single lower-case string, not separated by spaces or commas.

Answer:

4d79206361626261676573 21

4. How many bytes of data are there in your payload? What is the length of your payload as a three-digit hexadecimal number? Considering the layout of an ALP frame and the given payload, what is the length of the total frame?

Answer:

If ALP makes use of hexadecimal representations, the number of bytes are calculated as followed: every hex symbol corresponds to 4 bits, according to the answer to question 3 above, the string requires 24 hex digits =¿ 24 x 4 = 96 bits = 12 bytes.

The length of this payload = 12 bytes → when represented as a 3-digit hex number = 00c.

Considering the format of an ALP frame, the total frame will be 2 + 2 + 4 + 12 + 1 = 21 bytes in length.

5. Given the the destination address 004b and source address 0049, what is the hexadecimal-encoded checksum of your frame? Use the ALP checksum algorithm. Please show your work.

Answer:

The checksum shall be computed as followed:

(00 + 75 + 00 + 73 + 00 + 00 + 00 + 21 + 77 + 121 + 32 + 99 + 97 + 98 + 98 + 97 + 103 + 101 + 115 + 33) mod 128 = 88 (dec) = 58 (hex)

6. What is your complete frame? List it as a single lower-case string, not separated by spaces or commas, in the following order: destination, source, length, encoded payload, checksum. Hint: in total, your answer should be 42 digits long.

Answer:

004b0049000000154d7920636162626167657321 58

2. Implementation

See attached .py file.