MICROLEARNING IN COMPUTER NETWORKS AT SDU

In nowadays there are many kinds of problems in the system of higher education. One of them is: everyday students get very huge amount of information. All of them take very big amount of time for a student to understand lesson and it is very hard for him/her to do everything in time. This paper explains a study of work microlearning application for computer networks. It consists of general introduction and purpose.

Introduction

In nowadays there are many kinds of problems in the system of higher education. One of them is: everyday students get very huge amount of information. All of them take very big amount of time for a student to understand lesson and it is very hard for him/her to do everything in time. This paper explains a study of work microlearning application for computer networks. It consists of general introduction and purpose.

- Time: Each topic can be touched at most 5-7 minutes. If topic is more complex it is divided into small parts. For example IPv4 topic is separated 4 small parts, represented in 4 microlessons below.
- Content: Each topic is represented in A4 page, where topic description, simple test or simple tasks are given.
- Curriculum: As shown in microlessons below, topics are divided into small subtopics.
- Form: Mostly each Computer Network protocol is taken simpler as can be, for example to explain IPv4 addresses types, can be given comparison with a university within many groups and some students in those groups.
- Process: Learning of Computer Networks is same as swimming; it needs a lot of practice. Because each topic contains simple test questions and tasks students can solve each of them in 2-10 minutes.
- Mediality: Microlearning in Computer Networks is prepared as book in PDF format with hyperlinks. It can be also used in cell phones because of PDF format.
- Learning type: In class there is a projector, where lecturer shows A4 page, then after explanation students’ answers for test questions and do simple tasks.

To pass through all subjects it will be better to use literature in microlearning style which provides understanding of Computer Networks terminology in basic way by dividing information into small micro parts which have a log of graphics and pictures and not too many words for explanation. These examples show that in learning it is important to begin from small parts to construct big parts. Microlearning is a new method of teaching which become more popular day by day. According to Hug there are 7 dimensions of microlearning.
Microlearning in Computer Networks

In this section demonstrated 4 microlessons from our book.

• Lesson 1 – IPv4 Characteristics
  – Consists of 32 bits
  – Divided into 4 octets
  – Each octet consists of 8 bits (1 byte)
  – Represented in decimal form

Example of IPv4 address: 192.168.1.21 Computer works only with binary numeral system, to understand listed above IPv4 address computer converts it from decimal to binary

Table 1 – Shows decimal and binary representations of IPv4 address

<table>
<thead>
<tr>
<th></th>
<th>1st Octed</th>
<th>2nd Octed</th>
<th>3rd Octed</th>
<th>4th Octed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal representation</td>
<td>192</td>
<td>168</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Binary representation</td>
<td>11000000</td>
<td>10101000</td>
<td>00000001</td>
<td>00010101</td>
</tr>
</tbody>
</table>

• Test for Lesson 1:
  1. How many octeds in IPv4?
     (a) 3
     (b) 4
     (c) 5
     (d) 1
  2. In which numeral system computer understand IPv4 address?
     (a) Decimal
     (b) Binary
     (c) Hexadecimal
     (d) Octed
  3. How many bits take 3 octeds?
     (a) 1
     (b) 4
     (c) 18
     (d) 24
  4. In which numeral system IPv4 represented?
     (a) Decimal
     (b) Binary
     (c) Hexadecimal
     (d) Octed

• Lesson 2 - Decimal to binary Convertation
  – Divide by 2 technique
  – Mapping technique
– Divide by 2 technique

Example: $17_{(10)} = ?_{(2)}$

Figure 1 explains “divide by 2 technique” in process

Result: $17_{(10)} = 10001_{(2)}$

• Mapping Technique

Example: $114_{(10)} = ?_{(2)}$

Table 2 – Describes mapping process

<table>
<thead>
<tr>
<th>Position (value)</th>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiplication</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Given binary stream</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Result of Multiplication</td>
<td>64 + 32 + 16 + 0 + 0 + 2 + 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addition</td>
<td>64 + 32 + 16 + 0 + 0 + 2 + 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Result = 114

• Task for Lesson 2:
  1. Convert from decimal to binary by using "division by 2" technique
     (a) 14 = ...........
     (b) 67 = ...........
     (c) 78 = ...........
  2. Convert from decimal to binary by using "mapping" technique
     (a) 234 = ...........
     (b) 123 = ...........
     (c) 510 = ...........

• Lesson 3
  – Network address
  – Host address
  – Broadcast address

Group’s and student’s names in university are good examples of network and host addresses in computer networks. In Green group there are students A, B, C and in Red group can be same names of students and they are unique only in group. In figure 2 represented example of comparison network addresses, host addresses with university groups and students.
Network address
Network address is the common part of every networking device in same network (cannot be assigned to networking device).

Host address
Host address is the unique address of networking device in single network.

Broadcast address
Broadcast address is the common address for all networking devices in one network which is usually used to make request to all devices in same network (cannot be assigned to networking device).

Task for Lesson 3:
1. What three types of IPv4 addresses explained in this lesson (choose three)?
   (a) Multicast
   (b) Broadcast
   (c) Host
   (d) Network

2. Which addresses cannot be assigned to networking devices (choose two)?
   (a) Broadcast
   (b) Host
   (c) Super
   (d) Network

Lesson 4
IPv4 Characteristics
- Consists of 32 bits
- Separated into Network and Host addresses by prefix
- Prefix defines number of bits of Network address starts from the left side
- Subnet mask shows how many bits belong to network address, defined by prefix

Broadcast address is the last combination in host address portion

Example of IPv4 with prefix: 192.168.1.4/24

Table 3 – IPv4 address and Subnet mask binary and decimal representation

<table>
<thead>
<tr>
<th>Prefix</th>
<th>8bits</th>
<th>8bits</th>
<th>8bits</th>
<th>8bits</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.168.1.4/24</td>
<td>192</td>
<td>168</td>
<td>1</td>
<td>4</td>
<td>/24</td>
</tr>
<tr>
<td>110000000</td>
<td>101010000</td>
<td>000000001</td>
<td>00000100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>255</td>
<td>255</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>111111111</td>
<td>111111111</td>
<td>111111111</td>
<td>00000000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Computer defines network address by IPv4 address “AND” Subnet mask

Table 4 – Logical AND Operation

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A AND B</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Computer defines network address by IPv4 address “AND” Subnet mask

Table 5 – Separating Network address from Host address

<table>
<thead>
<tr>
<th></th>
<th>8bits</th>
<th>8bits</th>
<th>8bits</th>
<th>8bits</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPv4</td>
<td>11000000</td>
<td>10101000</td>
<td>00000001</td>
<td>00000100</td>
<td>/24</td>
</tr>
<tr>
<td>Subnet mask</td>
<td>11111111</td>
<td>11111111</td>
<td>11111111</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>IPv4 Subnet mask</td>
<td>11000000</td>
<td>10101000</td>
<td>00000001</td>
<td>00000000</td>
<td></td>
</tr>
<tr>
<td>Network address</td>
<td>192</td>
<td>168</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Host address</td>
<td>192</td>
<td>168</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Broadcast address</td>
<td>192</td>
<td>168</td>
<td>1</td>
<td>255</td>
<td></td>
</tr>
</tbody>
</table>

• Task for Lesson 4:

1. Find Network, Host and Broadcast addresses
   (a) 192.168.11.123/17
   (b) 10.12.54.34/28
   (c) 99.88.77.66/30

Table 6 – Answer table for 4th lesson's task

<table>
<thead>
<tr>
<th></th>
<th>Answer for A</th>
<th>Answer for B</th>
<th>Answer for C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network address</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Host address</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broadcast address</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usable addresses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion

Microlearning gives a great opportunity to mankind to be more educated. Now every person unconsciously use the microlearning approach while reading tutorials, forums, wiki, blogs and other resources. We started to teach students in our university by using microlearning method and we have good feedback from them. Now students provide more interest for subject and learn more material than in previous years. Our paper shows how to use microlearning principles in teaching computer networks. This study is new and needs more research in this area. We already established “Microlearning Research Center” in our university, in future we plan to develop it and provide Microlearning method to other universities to solve problem of higher education.

List of references


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