Advanced Internet and IoT Technologies   Assignment 01

HAW Hamburg   SS 2022

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1. **The powerful IoT**

   A Raspberry Pi is a more powerful platform for the Internet of Things than tiny, cheap microcontrollers. Due to its CPU and memory resources, it is an ideal candidate to act as edge routers for the IoT and perform protocol translations. In this first exercise, we want to familiarize with the Raspberry Pi and its connectivity to the Internet.

   Login credentials for each RasPi will be shared during the lab class.

   Tools: `ssh`, `htop`, `free`, `ip`, `ping`.

   Tip: use `tmux` after `ssh` to multiplex multiple terminal sessions in a single window.

   (a) Find out the number of CPU cores and the maximum available RAM.

   (b) How many network interfaces does the RasPi provide and what are the corresponding link technologies? Use the `ip` command.

   (c) What is the default route of your RasPi and what other routing entries are installed? Familiarize with all information in the routing entry output.

   (d) Why does the arp cache change when you ping another RasPi? You can display the arp cache using the `ip` command.

2. **IPv6 configuration**

   The Internet of Things mainly focuses on IPv6 networking. In this exercise, we will configure our RasPi with a global IPv6 address and correct routing entries.

   IPv6 addresses will be assigned during the lab class.

   Tools: `ip`, `tshark`

   (a) Observe traffic (`tshark`) on the eth0 interface and configure an IPv6 address on the eth0 interface. What packets do you see and what is their purpose?

   (b) Delete your IPv6 address and configure an address that your classmate is already using. What messages do you now see in `tshark` and what do they mean? Afterwards, re-assign your previous address before continuing.

   (c) What are the five IPv6 neighbor discovery cache states?

3. **IPv6 for the Internet of Things**

   Resource-constrained *things* usually connect to a border router, which then provides upstream connectivity. In this exercise, we will look at some of the protocol adaptations that are necessary for deploying energy-efficient IoT networks.

   IPv6 addresses will be assigned during the lab class.

   Tools: `radvd`

   (a) Think and discuss: Which steps are necessary on an IPv6 protocol level for a border router and an IoT device to establish a bidirectional connectivity?

(b) Configure another IPv6 address on the lowpan0 interface and then look at the file in */etc/radvd.conf*. Enter the correct addresses in this configuration file and then start the router advertisement daemon. What are the implications of using a `/112` prefix?

(c) Observe the `icmp6` traffic: how do the messages differ from the messages we observed earlier on eth0?

(d) Find out the automatically assigned global IPv6 address of the IoT node and then ping it.