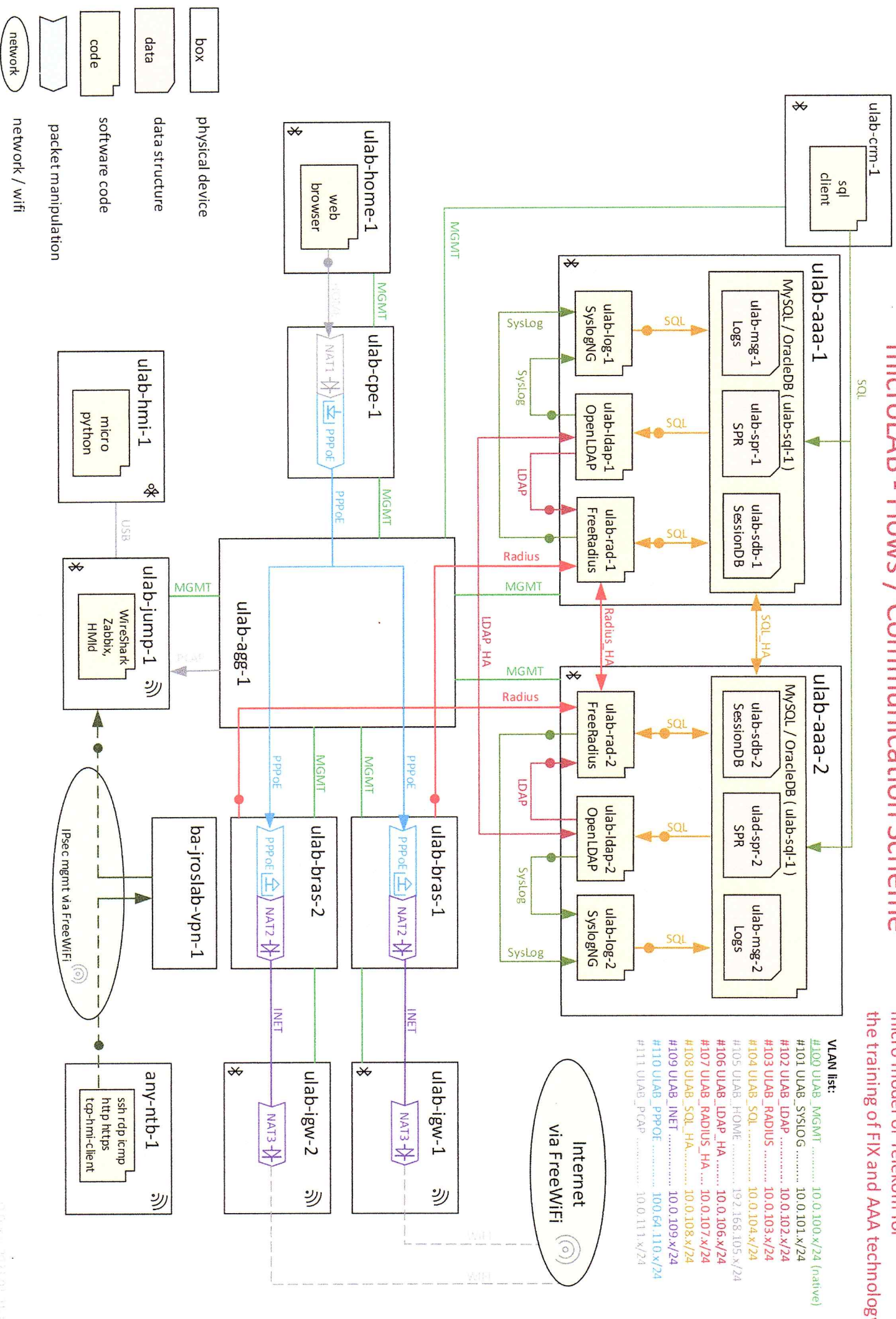# microLAB - Flows / Communication Scheme

micro model of Telekom for
the training of FIX and AAA technology

Legend

- box — physical device
- data — data structure
- code — software code
- network — network / wifi — packet manipulation

Devices / Components

ulab-crm-1
- sql client

ulab-home-1
- web browser

ulab-cpe-1
- NAT1
- PPPoE

ulab-hmi-1
- micro python

ulab-jump-1
- WireShark, Zabbix, HMId

ulab-agg-1

ulab-bras-2
- PPPoE / NAT2

ulab-bras-1
- PPPoE / NAT2

ba-jiroslab-vpn-1

ulab-igw-2
- NAT3

ulab-igw-1
- NAT3

any-ntb-1
- ssh rdp icmp
- http https
- tcp-hmi-client

Internet via FreeWiFi

IPsec mgmt via FreeWiFi

ulab-aaa-1

- ulab-log-1 SyslogNG
- ulab-ldap-1 OpenLDAP
- ulab-rad-1 FreeRadius
- MySQL / OracleDB (ulab-sql-1)
  - ulab-msg-1 Logs
  - ulab-spr-1 SPR
  - ulab-sdb-1 SessionDB

ulab-aaa-2

- MySQL / OracleDB (ulab-sql-1)
  - ulab-sdb-2 SessionDB
  - ulad-spr-2 SPR
  - ulab-msg-2 Logs
- ulab-rad-2 FreeRadius
- ulab-ldap-2 OpenLDAP
- ulab-log-2 SyslogNG

Flow labels

MGMT, PPPoE, SyslogNG, Syslog, SQL, SQL_HA, LDAP, LDAP_HA, Radius, Radius_HA, INET, PCAP, USB

VLAN list:

- #100 ULAB_MGMT .... 10.0.100.x/24 (native)
- #101 ULAB_SYSLOG 10.0.101.x/24
- #102 ULAB_LDAP 10.0.102.x/24
- #103 ULAB_RADIUS 10.0.103.x/24
- #104 ULAB_SQL 10.0.104.x/24
- #105 ULAB_HOME 192.168.105.x/24
- #106 ULAB_LDAP_HA 10.0.106.x/24
- #107 ULAB_RADIUS_HA 10.0.107.x/24
- #108 ULAB_SQL_HA 10.0.108.x/24
- #109 ULAB_INET 10.0.109.x/24
- #110 ULAB_PPPOE 100.64.110.x/24
- #111 ULAB_PCAP 100.111.x/24

microLAB - VLANs and IP Plan

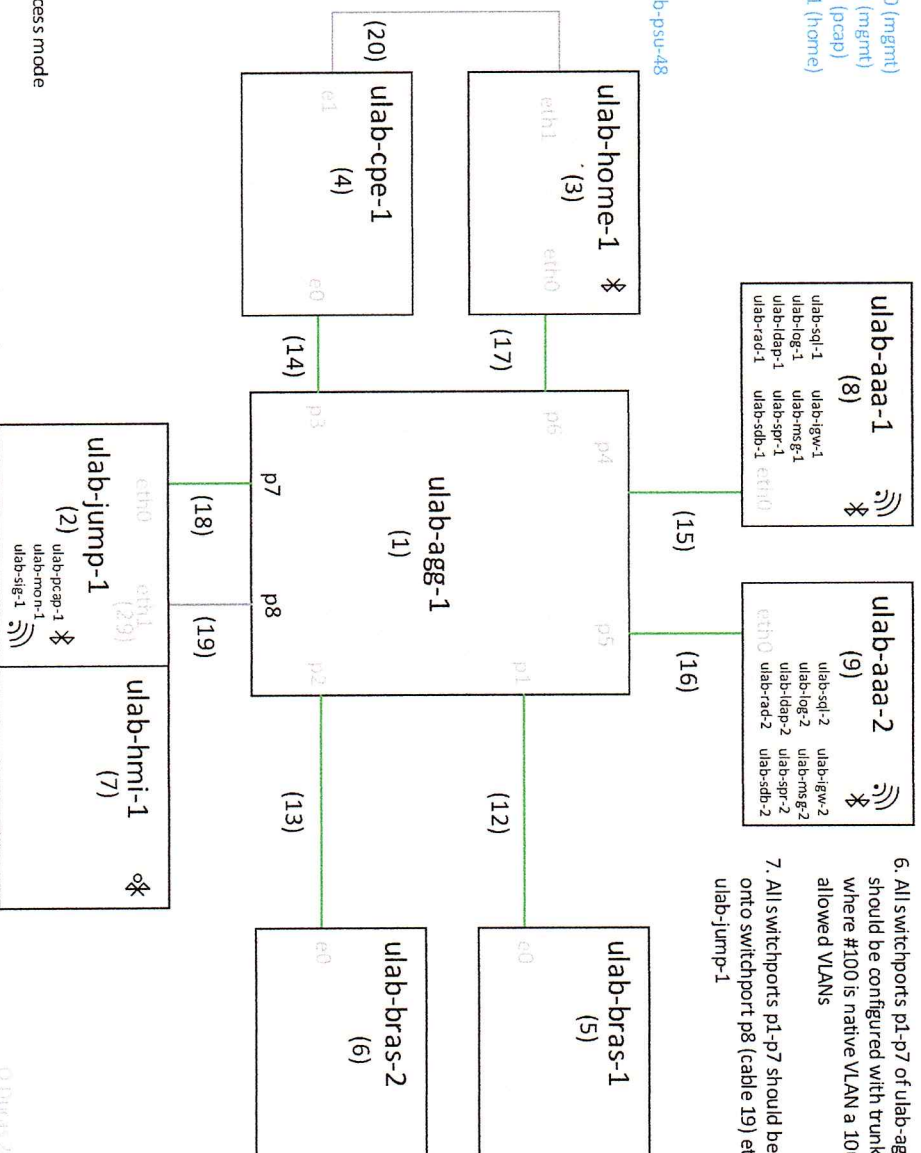(Inventory number - I3D) Inventory-name - IIN : Description of inventory item

(1) ulab-agg-1 : TP-Link TL-SG108PE   aggregation switch - interconnecting everything
(2) ulab-jump-1 : Raspberry Pi v3 B+   Jump Server with the config repository
(3) ulab-home-1 : Raspberry Pi v3 B+   Server simulating home client device
(4) ulab-cpe-1 : Mikrotik RB952Ui-5ac2nD CPE router
(5) ulab-bras-1 : Mikrotik RB960PGS   BRAS
(6) ulab-bras-2 : Mikrotik RB960PGS   BRAS
(7) ulab-hmi-1 : Micro:bit v2   Human-Machine-Interface - for signaling issues
(8) ulab-aaa-1 : LattePanda 4G/64G   Radius, LDAP, SQL server and Internet Gateway All-in-One
(9) ulab-aaa-2 : LattePanda 4G/64G   Radius, LDAP, SQL server and Internet Gateway All-in-One
(10) ulab-psu-5 : USB charger 4x 5V x 3A 60W charger for all SBCs
(11) ulab-psu-48 : DC48V psu   Power Supply Unit for Switch, CPE, Bras-1 and BRAS-2
(12) ulab-cat5-12 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p1 <-> ulab-bras-1:e0
(13) ulab-cat5-13 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p2 <-> ulab-bras-2:e0
(14) ulab-cat5-14 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p3 <-> ulab-cpe-1:e0
(15) ulab-cat5-15 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p4 <-> ulab-aaa-1:eth0
(16) ulab-cat5-16 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p5 <-> ulab-aaa-2:eth0
(17) ulab-cat5-17 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p6 <-> ulab-home-1:eth0 (mgmt)
(18) ulab-cat5-18 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p7 <-> ulab-jump-1:eth0 (mgmt)
(19) ulab-cat5-19 : Cat5E cable with 2x RJ45 interconnects: ulab-agg-1:p8 <-> ulab-jump-1:eth1 (pcap)
(20) ulab-cat5-20 : Cat5E cable with 2x RJ45 interconnects: ulab-home-1:eth1 <--> ulab-cpe-1:e1 (home)
(21) ulab-usb-21 : USB Cable A-microB   delivers power to ulab-aaa-2
(22) ulab-usb-22 : USB Cable A-microB   delivers power to ulab-aaa-1
(23) ulab-usb-23 : USB Cable A-microB   delivers power to ulab-home-1
(24) ulab-usb-24 : USB Cable A-microB   delivers power to ulab-jump-1
(25) ulab-usb-25 : USB Cable A-microB   interconnects: ulab-jump-1 and ulab-hmi-1
(26) ulab-pwr-26 : Cable for DC48V / 2A / Jack   Delivers power to aggregation switch from ulab-psu-48
(27) ulab-pwr-27 : Power cable 230V EU   Delivers power to ulab-psu-5
(28) ulab-pwr-28 : Power cable 230V EU   Delivers power to ulab-psu-48
(29) ulab-sql-1 : MySQL / MariaDB server SQL database engine hosted on ulab-aaa-1
(30) ulab-log-1 : Syslog-NG server   Syslog server hosted on ulab-aaa-1
(31) ulab-ldap-1 : OpenLDAP server LDAP server hosted on ulab-aaa-1
(32) ulab-rad-1 : FreeRadius server   RADIUS server hosted on ulab-aaa-1
(33) ulab-igw-1 : InternetGateway script configuring internet connection on ulab-aaa-1
(34) ulab-msg-1 : Syslog database Database used by Syslog-NG on ulab-aaa-1
(35) ulab-spr-1 : Provisioning database Provisioning database used by LDAP on ulab-aaa-1
(36) ulab-sdb-1 : Session database   Session database used by RADIUS on ulab-aaa-1
(37) ulab-sql-2 : MySQL / MariaDB server SQL database engine hosted on ulab-aaa-2
(38) ulab-log-2 : Syslog-NG server   Syslog server hosted on ulab-aaa-2
(39) ulab-ldap-2 : OpenLDAP server LDAP server hosted on ulab-aaa-2
(40) ulab-rad-2 : FreeRadius server   RADIUS server hosted on ulab-aaa-2
(41) ulab-igw-2 : InternetGateway script configuring internet connection on ulab-aaa-2
(42) ulab-msg-2 : Syslog database Database used by Syslog-NG on ulab-aaa-2
(43) ulab-spr-2 : Provisioning database Provisioning database used by LDAP on ulab-aaa-2
(44) ulab-sdb-2 : Session database   Session database used by RADIUS on ulab-aaa-2
(45) ulab-pcap-1 : WireShark on Eth1 of ulab-jump-1 for traffic analysis
(46) ulab-mon-1 : Zabbix or alternative to train possibilities of monitoring on ulab-jump-1
(47) ulab-sig-1 : Daemon for collecting LAB-related signalisation a forwarding it to ulab-hmi-1
(48) ulab-wiki-1 : Simple wiki hosted on ulab-jump-1
(49) ulab-git-1 : Configuration repository hosted on ulab-jump-1
(50) ulab-crm-1 : Scripts, simulating CRM, hosted on ulab-jump-1

VLAN list:

#100 ULAB_MGMT .... 10.0.100.x/24 (native)
#101 ULAB_SYSLOG 10.0.101.x/24
#102 ULAB_LDAP 10.0.102.x/24
#103 ULAB_RADIUS 10.0.103.x/24
#104 ULAB_SQL 10.0.104.x/24
#105 ULAB_HOME 192.168.105.x/24
#106 ULAB_LDAP_HA 10.0.106.x/24
#107 ULAB_RADIUS_HA 10.0.107.x/24
#108 ULAB_SQL_HA.......... 10.0.108.x/24
#109 ULAB_INET 10.0.109.x/24
#110 ULAB_PPPOE 100.64.110.x/24
#111 ULAB_PCAP 10.0.111.x/24

DESIGN NOTES:

1. "x" in IP address should be replaced by "box inventory ID" as depicted on drawing.

2. If there is collision of two possible IP addresses on the same box, then inventory ID of particular component should replace "x" within 4th octet of IP address

3. VIP addresses should have "1" in 4th octet of IP address.

4. MGMT contains none VIPs. "1" is a management IP address of ulab-agg-1 switch.

5. VLAN ID is a third octet of each IP address

6. All switchports p1-p7 of ulab-agg-1 should be configured with trunk mode where #100 is native VLAN a 100-111 are allowed VLANs

7. All switchports p1-p7 should be mirrored onto switchport p8 (cable 19) eth1 port of ulab-jump-1

---

ulab-home-1 ✱
(3)
eth1   eth0

ulab-cpe-1
(4)
e1   e0
(20)

ulab-aaa-1 ⌇
(8)
ulab-sql-1   ulab-igw-1
ulab-log-1   ulab-msg-1
ulab-ldap-1   ulab-spr-1
ulab-rad-1   ulab-sdb-1
eth0

ulab-aaa-2 ⌇
(9)
ulab-sql-2   ulab-igw-2
ulab-log-2   ulab-msg-2
ulab-ldap-2   ulab-spr-2
ulab-rad-2   ulab-sdb-2
eth0

ulab-agg-1
(1)
p3   p6   p4   p5
p7   p8   p2   p1
(14) (17) (15) (16) (18) (19) (13) (12)

ulab-jump-1
(2)
eth0   eth1
ulab-pcap-1 ✱ (29)
ulab-mon-1 ✱
ulab-sig-1 ⌇

ulab-hmi-1 ⌇
(7)

ulab-bras-1
(5)
e0

ulab-bras-2
(6)
e0

Trunk mode, #100 native, 100-111 allowed VLANs
——— Access mode

microLAB - Cabling Scheme and the List of Inventory Items