ManySecured Workshop

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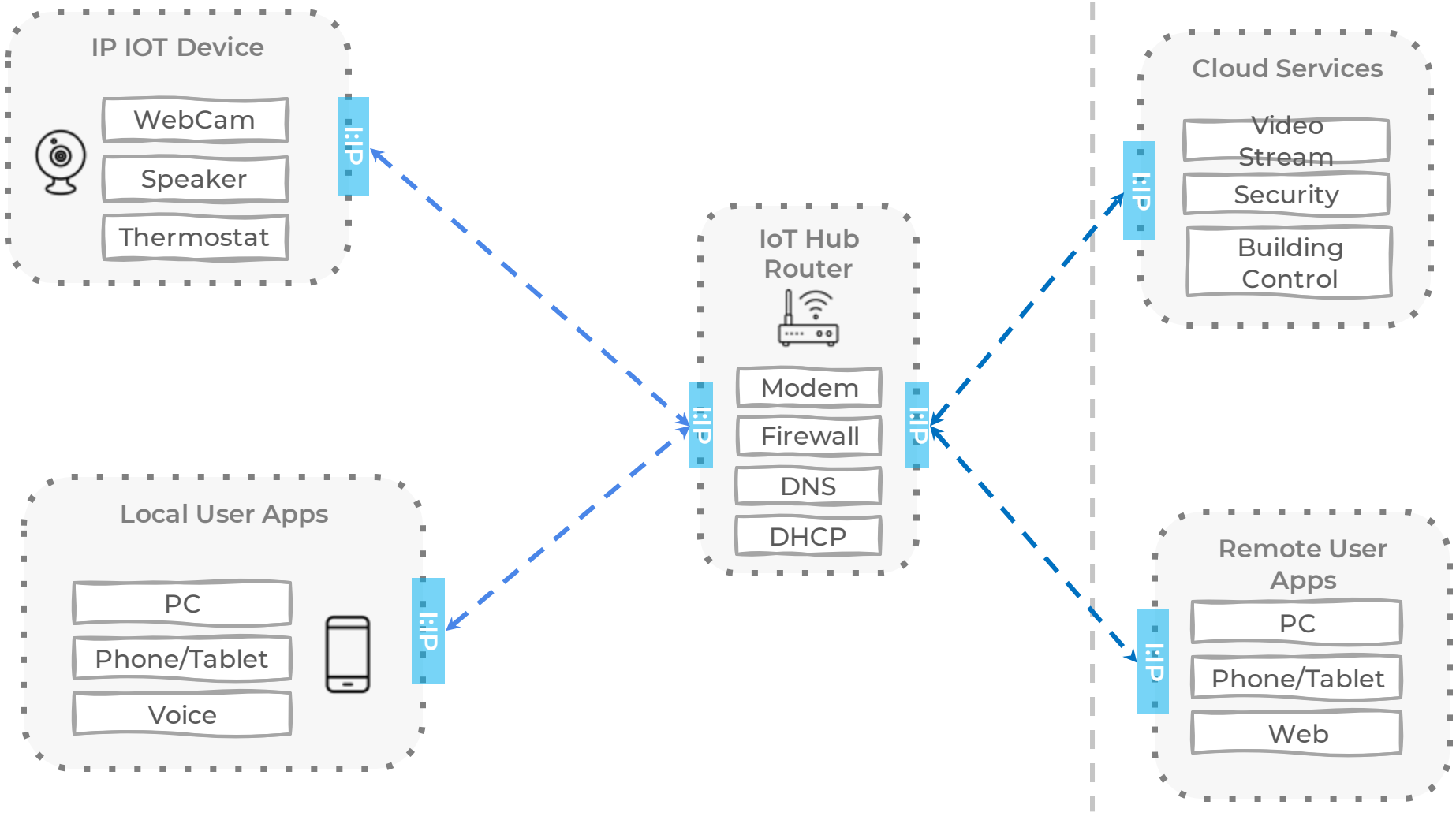
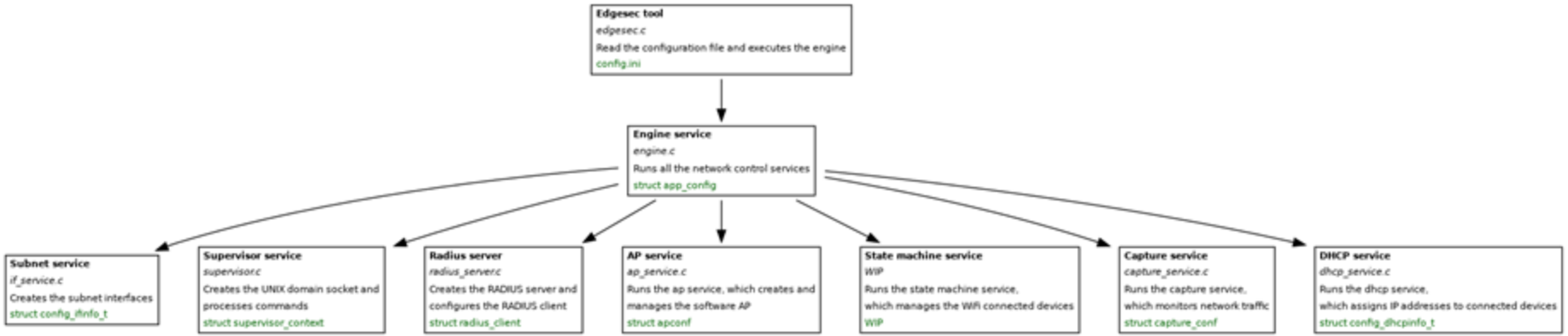
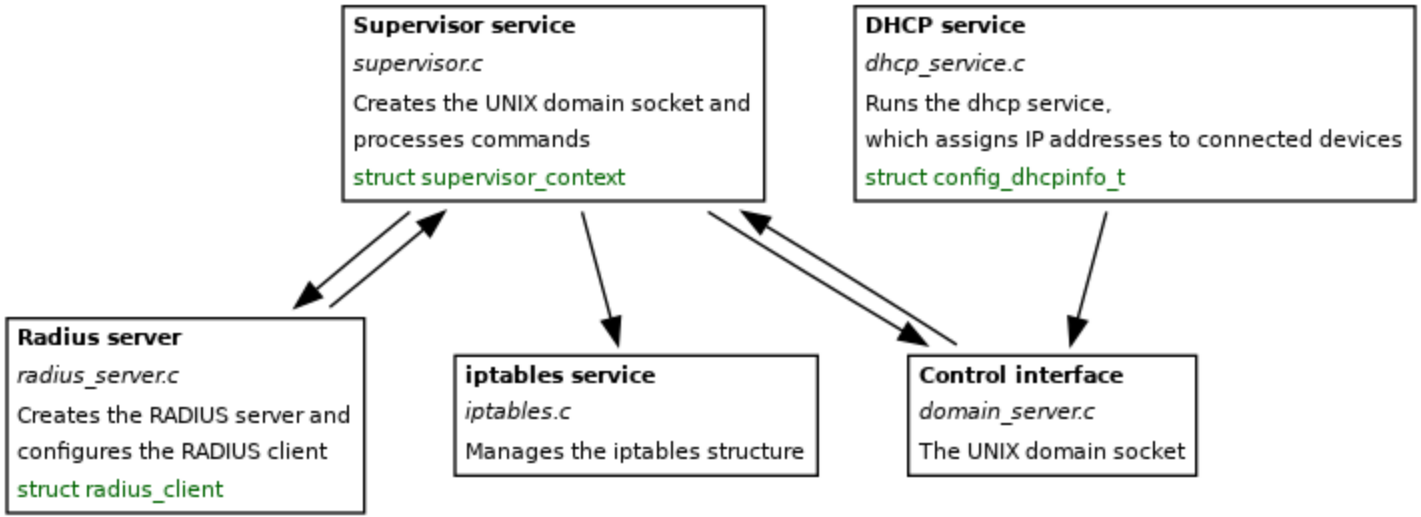

IP IOT Device
WebCam
Speaker
Thermostat
IP
Cloud Services
Video Stream
Security
Building Control
IP
IoT Hub Router
Modem
Firewall
DNS
DHCP
IP
IP
Local User Apps
PC
Phone/Tablet
Voice
IP
Remote User Apps
PC
Phone/Tablet
Web
IP

Architecture



Supervisor service



Subnet service

This service creates subnets and maps VLAN IDs to a subnet IP range. It uses the Netlink protocol library suite to access network kernel functionality from the user space.

```
if0 = "0,10.0.0.1,10.0.0.255,255.255.255.0"
if1 = "1,10.0.1.1,10.0.1.255,255.255.255.0"
if2 = "2,10.0.2.1,10.0.2.255,255.255.255.0"
if3 = "3,10.0.3.1,10.0.3.255,255.255.255.0"
if4 = "4,10.0.4.1,10.0.4.255,255.255.255.0"
if5 = "5,10.0.5.1,10.0.5.255,255.255.255.0"
if6 = "6,10.0.6.1,10.0.6.255,255.255.255.0"
if7 = "7,10.0.7.1,10.0.7.255,255.255.255.0"
if8 = "8,10.0.8.1,10.0.8.255,255.255.255.0"
if9 = "9,10.0.9.1,10.0.9.255,255.255.255.0"
if10=
"10,10.0.10.1,10.0.10.255,255.255.255.0"
```

Subnet service

For each subnet the service creates a bridge interface and assigns an IP.

- Create interface
- Set interface IP
- Set interface state

Subnet service

For each subnet the service also resets the iptables firewall rules.

- Reset iptables
- Set default iptables rules for each subnet interface

```
iptables -P INPUT ACCEPT
iptables -P FORWARD ACCEPT
iptables -P OUTPUT ACCEPT
iptables -F -t nat
iptables -F -t mangle
iptables -F
iptables -X
```

```
iptables -A FORWARD -t filter -i br0 -j REJECT
iptables -A FORWARD -t filter -i br1 -j REJECT
iptables -A FORWARD -t filter -i br2 -j REJECT
iptables -A FORWARD -t filter -i br3 -j REJECT
iptables -A FORWARD -t filter -i br4 -j REJECT
iptables -A FORWARD -t filter -i br5 -j REJECT
iptables -A FORWARD -t filter -i br6 -j REJECT
iptables -A FORWARD -t filter -i br7 -j REJECT
iptables -A FORWARD -t filter -i br8 -j REJECT
iptables -A FORWARD -t filter -i br9 -j REJECT
iptables -A FORWARD -t filter -i br10 -j REJECT
```

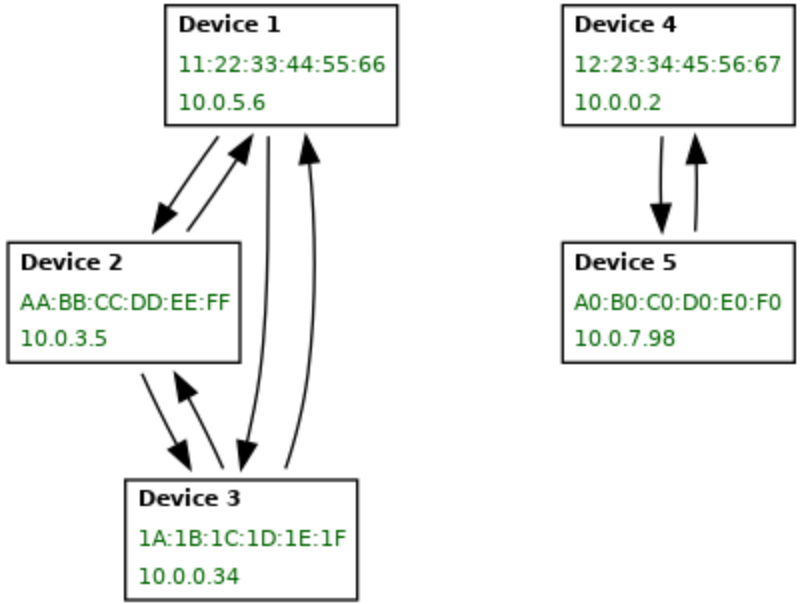
Subnet service

The subnet service creates a secure “enclosure” around each subnet by using the bridge interfaces and iptables firewall rules. It also allows connecting devices into two modes:

- Bridge
- NAT

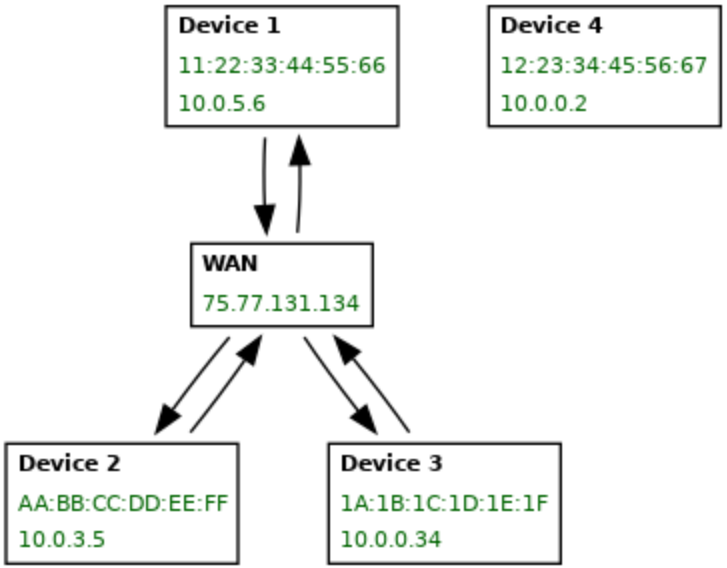
Bridge

The supervisor allows connecting two network devices into a bridge.



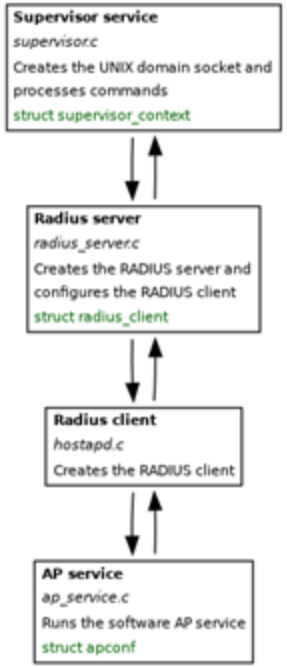
NAT

The supervisor can allow or deny network access to a network device.



Software AP service

The software AP service creates a WiFi access points for network device connection.



The Network Capture architecture

- Packet decoder
- Packet capture
- SQLite header storer
- Raw packet storer

Packet decoder

- The packet decoder extract the metadata from captured packet.
- For each decoded packet the service stores the hash of the header as well as the timestamp.

Packet capture

- The packet capture implements the actual network sniffing process.
- Currently it uses pcap library.
- It also allows interfacing with PF_RING kernel module that implements zero-copy technique.

SQLite storer

The SQLite storer implements the storage process for packet metadata into sqlite databases.

```
CREATE TABLE eth (hash INTEGER NOT NULL, timestamp INTEGER NOT NULL, ethh_hash INTEGER NOT NULL, caplen INTEGER, length INTEGER, ether_dhost TEXT, ether_shost TEXT, ether_type INTEGER,PRIMARY KEY (hash, timestamp, ethh_hash))
```

```
CREATE TABLE ip4 (hash INTEGER NOT NULL, timestamp INTEGER NOT NULL, ethh_hash INTEGER NOT NULL, caplen INTEGER, length INTEGER, ip_hl INTEGER, ip_v INTEGER, ip_tos INTEGER, ip_len INTEGER, ip_id INTEGER, ip_off INTEGER, ip_ttl INTEGER, ip_p INTEGER, ip_sum INTEGER, ip_src TEXT, ip_dst TEXT, PRIMARY KEY (hash, timestamp, ethh_hash))
```

Raw packet storer

- Stores the raw packet into pcap files and the metadata for each file is stored in a SQLite database.
- The file name for each packet is randomly generate and subsequently the name is stored in a SQLite database together with the timestamp and packet length.

Supervisor API

- **PING_SUPERVISOR** - pings the supervisor service
- **ACCEPT_MAC** - add a MAC address to the accept list
- **DENY_MAC** - add a MAC address to the deny list
- **ADD_NAT** - add NAT access to a MAC address
- **REMOVE_NAT** - remove NAT from a MAC address
- **ASSIGN_PSK** - assign a WIFI key to a MAC address
- **GET_MAC** - get the connection info for a MAC address
- **GET_ALL** - get the connection infos for all MAC addresses
- **ADD_BRIDGE** - add a bridge between two MAC addresses
- **REMOVE_BRIDGE** - removes a bridge between two MAC addresses
- **CLEAR_BRIDGE** - removes all bridges for a MAC address
- **GET_BRIDGES** - returns all assigned bridges

Router Hardware Tests

- **The EDGESec toolset was tested on the following devices:**
  - Raspberry Pi 3 B+
  - Raspberry Pi 4 B (Debian, OpenWRT)
  - PCengines apu2 platform
  - NVIDIA Jetson Nano
  - Turris Omnia (OpenWRT)
- **The compatible WiFi modems:**
  - USB Wifi Adapter for the Raspberry Pi
  - Panda Wireless PAU09 N600 Dual Band WiFi adapter
  - Compex WLE200NX 802.11a/b/g/n miniPCI express wireless card
  - Compex WLE600VX 802.11ac miniPCI express wireless card
- **The compatible hardware secure storage modules:**
  - ZYMKEY4i Raspberry Pi and Jetson Nano module