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1. Software Architecture

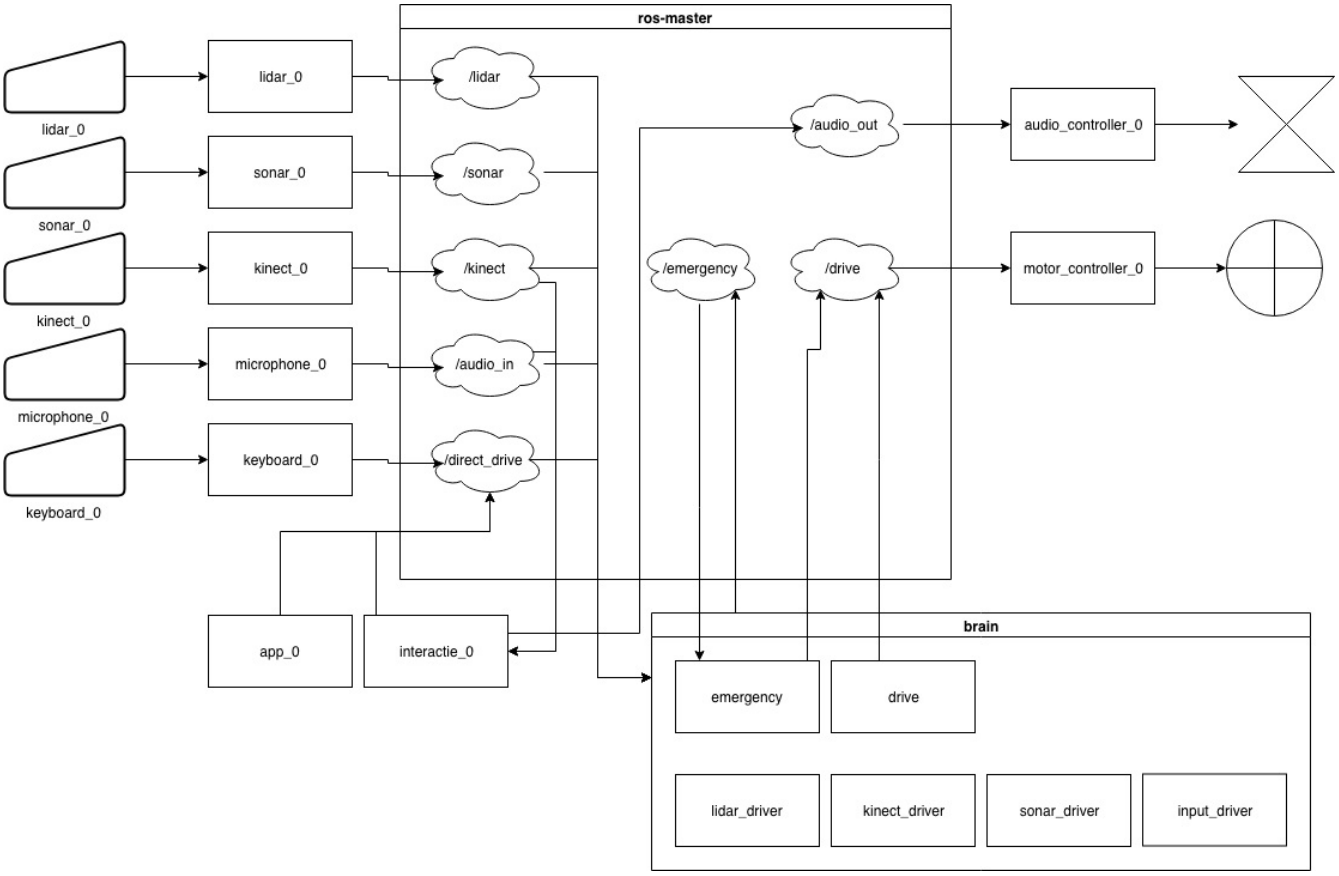
1.1. Standpoints

The software architecture needs to be compartmented for development purposes. To make sure the development does not compromise the system as a whole the following standpoints are defined to fortify the design.

- Each separate function gets a separate repository
- Each separate function has no dependency to another
- The GiT proces is applied for every repository
- Every function is running hardware independent
- Every function is running OS independent

1.2. Design

Embedding these standpoints into the Robotic Operating System (ROS) resulted in the following architecture design.



1.3. ROS Master

A key feature of ROS is the topic communication. Separation of each function in the ROS master, which facilitates the topics, is a key component. Every function communicates according a topic and therefore ROS master functions as a servicebus for each current and future feature.

Designing this architecture and keeping it up to date can be done by importing/editing the xml files in https://www.draw.io/. Draw.io is free of charge to use and requires no client.

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2. Hardware Architecture

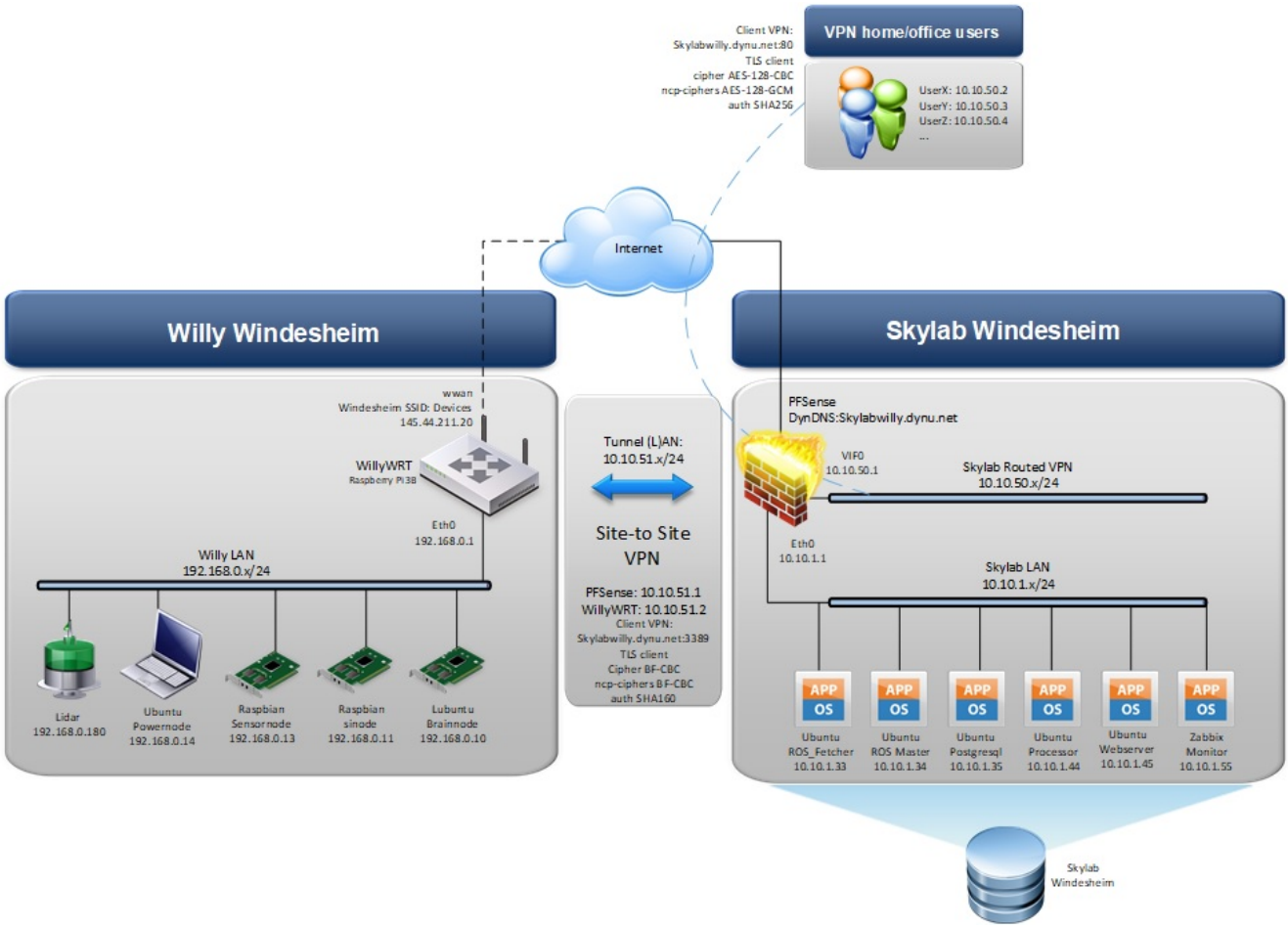
2.1. Standpoints

The hardware architecture is designed with a set of standpoints just as the software architecture.

- Use low-power hardware if possible to reduce power consumption
- Clustering similar functions on a separate hardware node
- Using multiple hardware nodes to ensure non-disruptive node failure
- Functions that can be run offsite - Skylab - should
- Variations of OS software is possible as long as topic communication is possible
- Variations of ROS software is possible as long as topic communication is possible
- Simultaneous development is possible
- Skylab communicates safely with Willy

2.2. Design

These standpoints resulted in the following hardware design.



2.3. Usability

By having multiple VPN instances, it's possible - if all hardware is powered on - to connect through Skylabs to the individual hardware nodes on Willy even if not physically near him. Another option is to physically connect to WillyLAN and access either Skylab or Willy hardware nodes.

Designing this architecture and keeping it up to date can be done by editing the vsdx files in Microsoft Visio.

Unresolved directive in index.adoc - include::Skylab.adoc[]

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3. ROS topics

These are the topics at the ROS master of Willy. There are several communication protocols defined in ROS, but in Willy only the topics system is used. The topics are shown in the next table.

Topic name	Purpose	Publisher	Subscriber	Message type	Message protocol
/willy/health	Is Willy healthy or is there an issue?	All nodes	All nodes	Int32	• 1 = healthy • 2 = non-critical issue • 3 = critical issue
/willy/health_reason	If Willy is not healthy, the reason for that is published in clear text here	All nodes	All nodes	String	Clear text
/willy/activity	What is Willy doing?	Brain SI	All nodes	Int32	• 1 = cruising • 2 = conversation • 3 = enquête • 4 = driving with a defined target

Topic name	Purpose	Publisher	Subscriber	Message type	Message protocol
/interaction/is_active	If the social interaction is busy?	Social interaction speech recognition	All nodes	Int32	• 0 = not active • 1 = active
/interaction/clear_text	The unprocessed text what the person said	Social interaction speech recognition	All nodes	String	Who are you?
/move_action	Move actions for willy	Navigation brain	SI	String	• turn_around = Turn Willy around
/human_detect	Is there a human in front of Willy?	Power node	Brain	String	• 1 = id • 2 = accuracy • 3 = distance