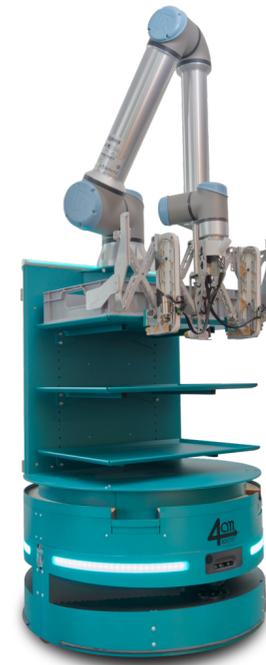


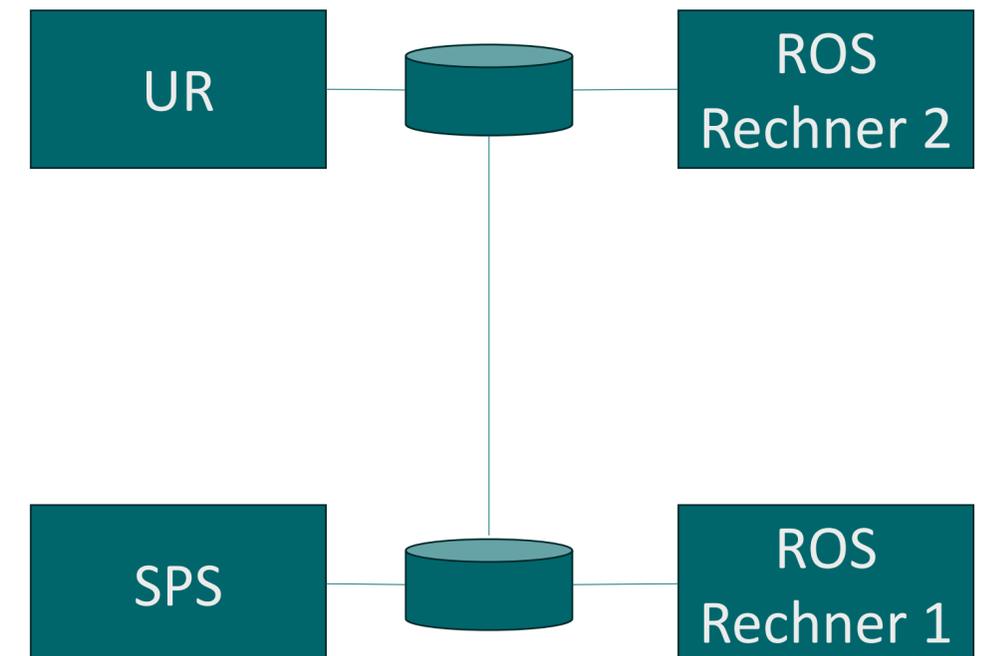
robmuxinator

Ein Roboter-Startup-Tool für eine
verteilte Rechnerarchitektur

Philipp Gehring
4am Robotics GmbH
Karlsruhe, 23.11.2023



- Fahrzeugflotte mit unterschiedlichen Rechnersystemen
 - SPS
 - verschiedene Linux Hosts (ROS Rechner)
 - Netzwerkkomponenten (bspw. Universal Robots UR10e)
- Netzwerkstatus der Komponenten prüfen (ROS machine tags)
- Softwarekomponenten starten



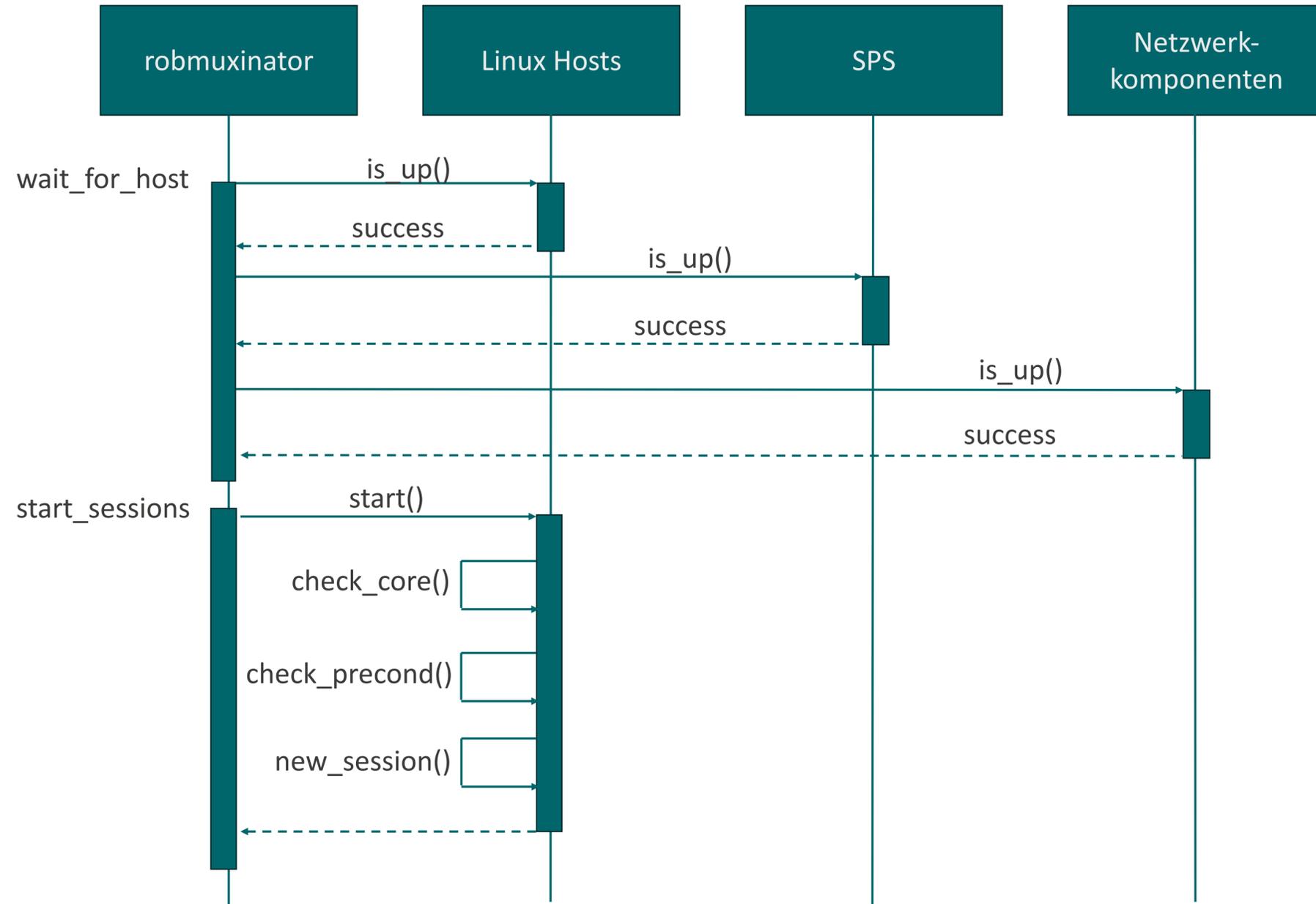
Anforderungen

- Parallelisierter Start und Stop der Rechner
- Netzwerkgeräte (Hosts) des Roboters sind einfach zu definieren
- Log soll temporär nachvollziehbar sein
- NFS Status Test, Port Check
- Intuitives CLI

Funktionsweise

- Kommunikation über SSH
- Befehle werden im Terminal gestartet
- tmux als Terminal Multiplexer

Ablauf des robmuxinator



Konfiguration

```

timeout: 120

# define hosts of robot
hosts:
  pc1:
    os: linux
    user: robot
    check_nfs: false

# define sessions of hosts
sessions:
  roscore:
    host: pc1
    user: robot
    command: "roscore"
    wait_for_core: false
    locked: true
  bringup:
    host: pc1
    user: robot
    command: "roslaunch robot_bringup robot.launch"

```

- `hosts` beschreiben Netzwerkkomponenten
- Jede `session` entspricht einer `tmux session`
- `timeout` gibt an wie lange auf einen `host` gewartet wird

weitere Features

- NFS Status Check ausschalten
- Priorität der `session` festlegen
- `rosmaster` status check ausschalten
- `sessions` sperren mit `locked`

Starten der Sessions

```
[I] [2023-11-13 18:24:25,866]: =====
[I] [2023-11-13 18:24:25,866]: wait for hosts:
[I] [2023-11-13 18:24:25,866]:   waiting for t1...
[I] [2023-11-13 18:24:25,868]:   waiting for ur-20225290026...
[I] [2023-11-13 18:24:25,868]:   waiting for PLC-WIN...
[I] [2023-11-13 18:24:25,877]:   ur-20225290026 is up
[I] [2023-11-13 18:24:25,879]:   PLC-WIN is up
[I] [2023-11-13 18:24:25,904]:   t1 is up
[I] [2023-11-13 18:24:25,905]: all hosts are up
[I] [2023-11-13 18:24:25,905]: =====
[I] [2023-11-13 18:24:25,905]: start sessions with prio 0:
[I] [2023-11-13 18:24:25,905]:   session roscore: start
[I] [2023-11-13 18:24:25,905]:   session roscore: roscore online
[W] [2023-11-13 18:24:26,360]:   session roscore: already running
[I] [2023-11-13 18:24:26,361]: sessions with prio 0 started in 0 secs
[I] [2023-11-13 18:24:26,361]: done
[I] [2023-11-13 18:24:26,361]: =====
[I] [2023-11-13 18:24:26,361]: start sessions with prio 1:
[I] [2023-11-13 18:24:26,362]:   session bringup: start
[I] [2023-11-13 18:24:26,362]:   session arm: start
[I] [2023-11-13 18:24:26,362]:   session bringup: waiting for roscore
[I] [2023-11-13 18:24:26,362]:   session perception: start
[I] [2023-11-13 18:24:26,362]:   session arm: waiting for roscore
[I] [2023-11-13 18:24:26,363]:   session plc_common_bridge: start
```

“robmuxinator start” wird per systemd service gestartet und wartet auf alle hosts

alle hosts sind erreichbar
sessions werden nach Priorität gestartet

tmux Schnittstelle

sessions sind in tmux verfügbar

```
mojin@b1.mrl-7.mojin-le-2:~$ tmux ls
application: 1 windows (created Fri Nov 17 10:22:43 2023)
bringup: 1 windows (created Fri Nov 17 10:22:42 2023)
empty: 1 windows (created Wed Nov 15 13:15:37 2023)
license: 1 windows (created Fri Nov 17 10:22:42 2023)
manipulate_protective_fields_channel1: 1 windows (created Fri Nov 17 10:22:44 2023)
nav_safety_limiter: 1 windows (created Fri Nov 17 10:22:44 2023)
nav_safety_monitor: 1 windows (created Fri Nov 17 10:22:44 2023)
nav_safety_publisher: 1 windows (created Fri Nov 17 10:22:44 2023)
plc_common_bridge: 1 windows (created Fri Nov 17 10:22:42 2023)
roscore: 1 windows (created Fri Nov 17 10:22:41 2023)
```

log ist in tmux sessions sichtbar

```
(0) + application: 1 windows
(1) + bringup: 1 windows
(2) + empty: 1 windows
(3) + license: 1 windows
(4) + manipulate_protective_fields_channel1: 1 windows
(5) + nav_safety_limiter: 1 windows
(6) + nav_safety_monitor: 1 windows (attached)
(7) + nav_safety_publisher: 1 windows
(8) + plc_common_bridge: 1 windows
(9) + roscore: 1 windows

roscore (sort: index)
* /roscore: noetic
* /rosversion: 1.16.0

NODES

auto-starting new master
process[roscore]: started with pid [1503061]
ROS_MASTER_URI=http://10.6.7.11:11311/

setting /run_id to dbbe1d62-852a-11ee-9309-eff4b97c8cf6
process[rosout-1]: started with pid [1503095]
started core service [/rosout]

[nav_safet0:[tmux]*
```



```
timeout: 120

# define hosts of robot
hosts:
  localhost:
    os: linux
    user: $USER
    check_nfs: false

# define sessions of hosts
sessions:
  roscore:
    host: localhost
    user: $USER
    command: "roscore"
    wait_for_core: false
bringup:
  host: localhost
  user: $USER
  command: "roslaunch robot_bringup robot.launch"
```

- Wenig Anpassung in der Konfiguration nötig

Häufige Befehle mit dem robmuxinator auf dem Roboter

```
$ robmuxinator start
```

```
$ robmuxinator restart
```

```
$ robmuxinator stop
```

```
$ robmuxinator shutdown
```

```
$ robmuxinator reboot
```

lokale Entwicklung

```
$ robmuxinator restart -f -c dev.yaml
```

```
$ robmuxinator restart -s bringup -c dev.yaml
```



**robmuxinator ist Open Source auf GitHub verfügbar!
Wir freuen uns auf Rückmeldung aus der ROS Community!**

<https://github.com/4am-robotics/robmuxinator>

career@4am-robotics.com

