CURRENT SECURITY THREAT

LANDSCAPE IN ROBOTICS

ALIAS ROBOTICS

Robot Cybersecurity

VÍCTOR MAYORAL VILCHES

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ALIAS ROBOTICS

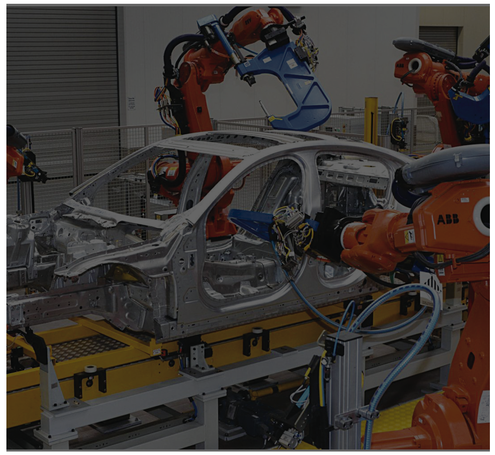
Alias Robotics is a robot cyber security firm. Founded upon previous experiences in robotics, we take a roboticists' approach to cyber security and deliver security solutions for robots and their components.

WHY NOW?

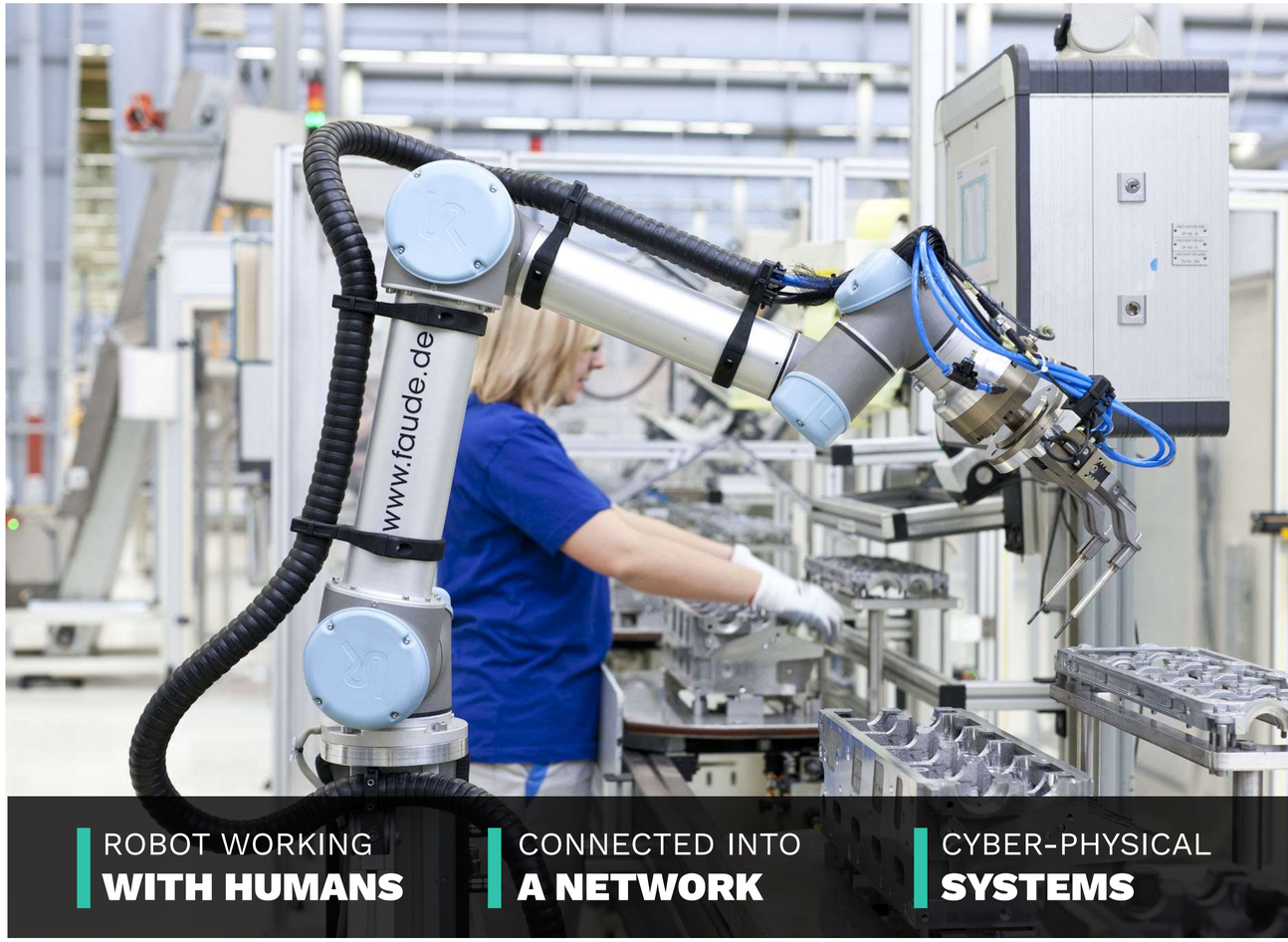
1.0
1784
MECHANIZATION STEAM POWER

2.0
1870
MASS PRODUCTION ASSEMBLY LINE

3.0
1969
AUTOMATION COMPUTERS & ELECTRONICS



4.0
2020



ROBOT WORKING **WITH HUMANS**

CONNECTED INTO **A NETWORK**

CYBER-PHYSICAL **SYSTEMS**

INDUSTRY **1.0**

INDUSTRY **2.0**

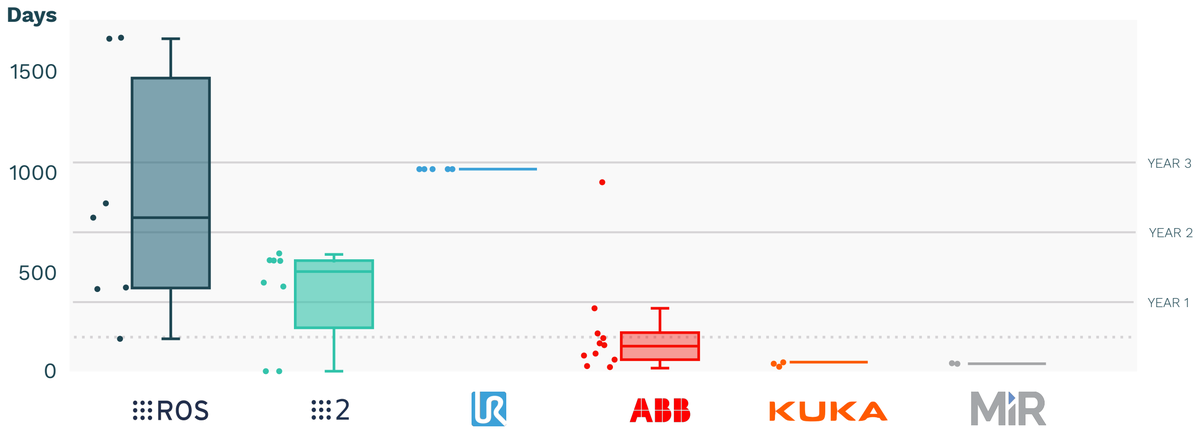
INDUSTRY **3.0**

INDUSTRY **4.0**

THREAT LANDSCAPE

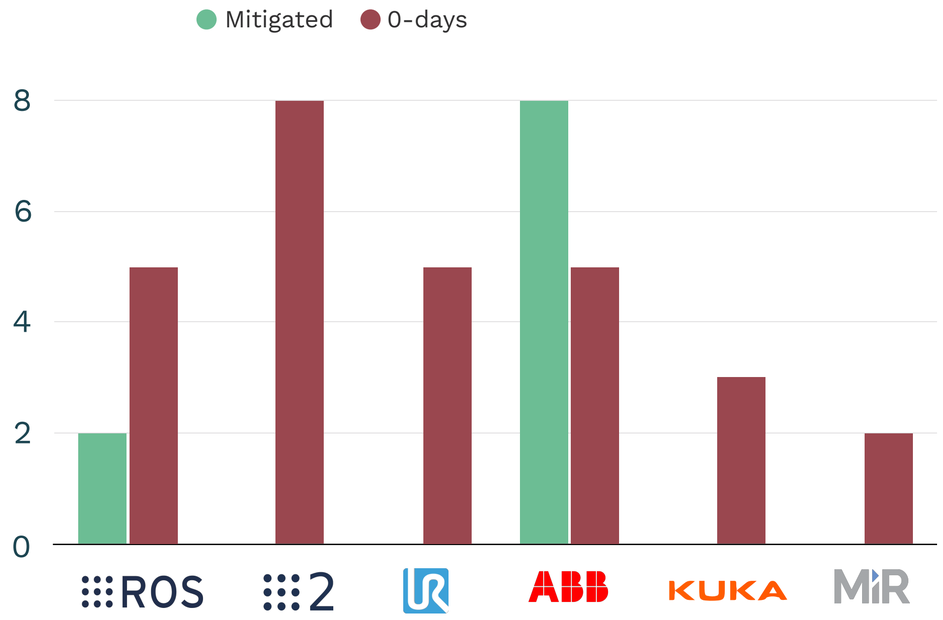
VULNERABILITY
MITIGATION AND 0-DAYS

DAYS UNTIL MITIGATION
OR UNTIL TODAY



Data from Robot Vulnerability Database (RVD),
https://github.com/aliasrobotics/RVD,
removed tickets in triage for ROS, ROS2, UR, KUKA and MiR

0-DAYS
PROPORTION



VULNERABILITY LANDSCAPE

ROBOT VULNERABILITY DATABASE
(RVD)

	OPEN	CLOSED	ALL
VULNERABILITIES	Vulnerabilities 101	Vulnerabilities 12	Vulnerabilities 113
BUGS	Bugs 346	Bugs 193	Bugs 537
OTHERS	Others 0	Others 1	Others 1

VULNERABILITIES (OPEN)	Vuln.**Critical** 23	Vuln.**High** 23	Vuln.**Medium** 11	Vuln.**Low** 1

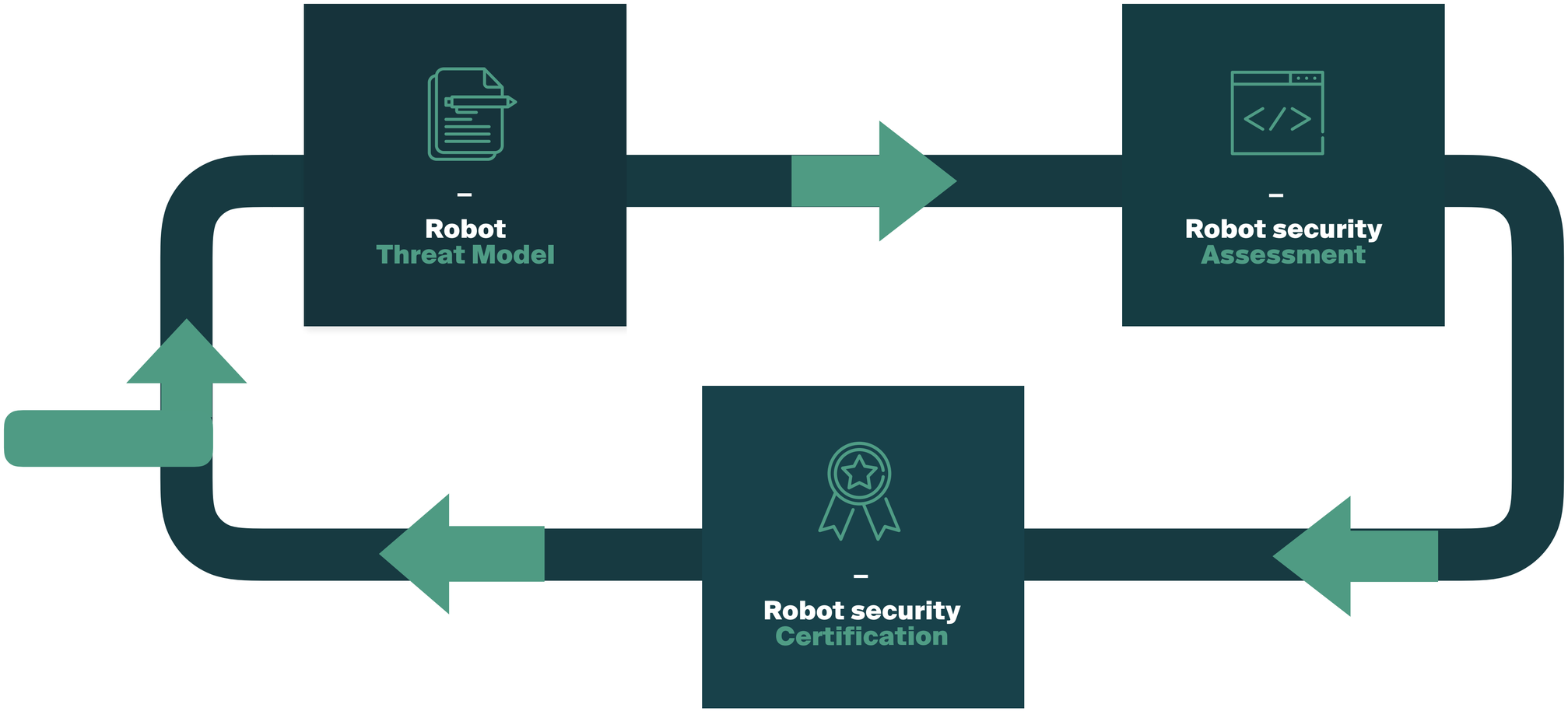
Last updated Mon, 02 Mar 2020 23:24:48 GMT

Robot Vulnerability Database (RVD), https://github.com/aliasrobotics/RVD

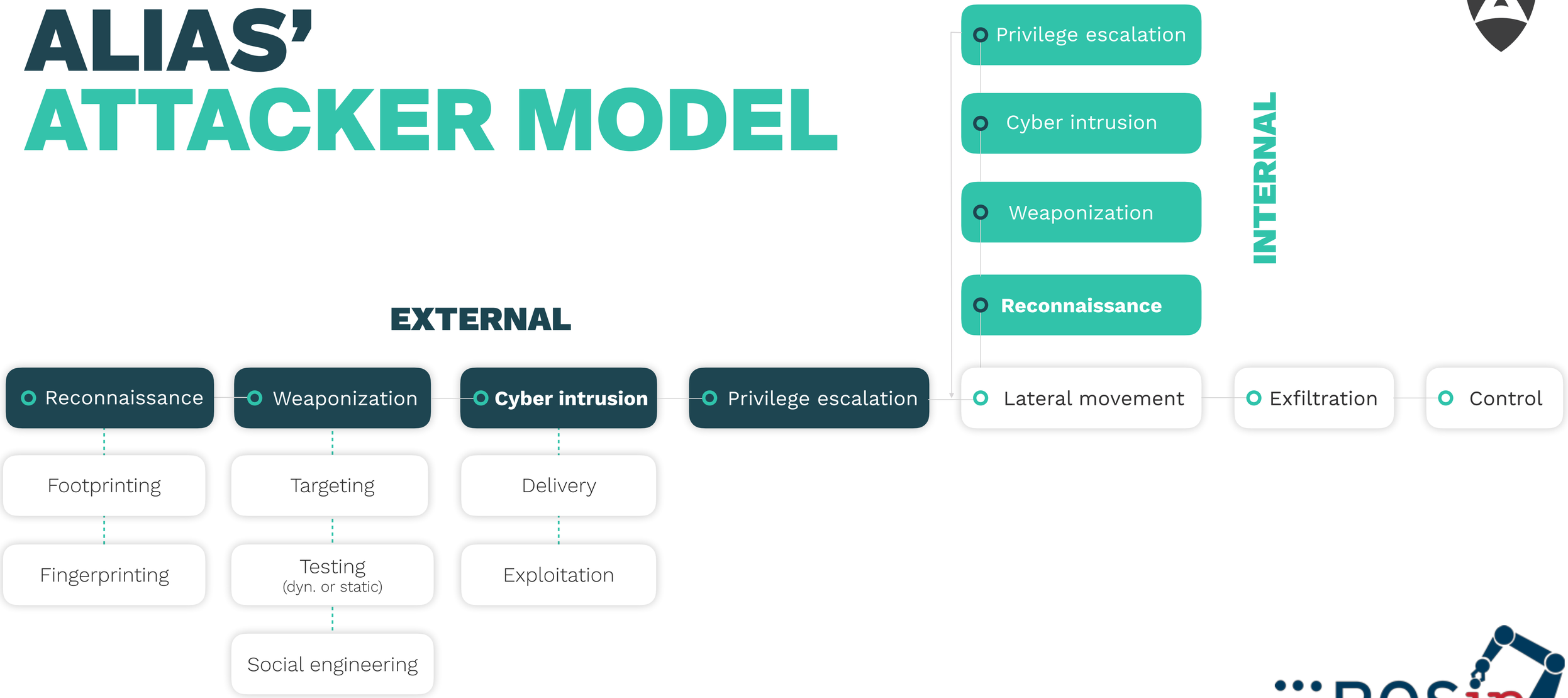
ROS-I 2-I

OFFENSIVE
ROBOT SECURITY

THE IDEAL SECURITY FLOW



ALIAS' ATTACKER MODEL



ROSin

ROS-I 2-I

TOOLS FOR SECURITY

FEATURING DOZENS OF TOOLS, ROBOTS AND ROBOT COMPONENTS

alurity

TOOLBOX FOR ROBOT SECURITY

SOLUTION
ALURITY

TOOLBOX FOR **ROBOT SECURITY**

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ROBOTS	TURTLEBOT, UR3, UR5, UR10, KUKA iiwa, DJI, YUNEEC
ROBOT COMPONENTS	ROS 2 (NAV 2, MOVEIT2, AUTOWARE); ROS (UR, KUKA, YASKAWA, ABB); ROS (ROBOTIQ, DJI); VXWORKS; NUTTX; PX4; MICRO-ROS
FORENSICS	BBTOOLS, VOLATILITY
EXPLOITATION	ROBOSPLOIT, METASPLOIT, ROSPENTO, ROSCHAOS
TESTING	CPPCHECK, SONARQUBE, HAROS, GOOGLE SANITIZERS
RECONNAISSANCE	AZTARNA, NIKTA, SPARTA, HARVESTER, SSLYZE, WIRESHARK
IDE / UI	CLION, ATOM, PYCHARM, GAZEBO, RVIZ

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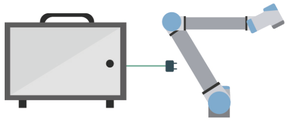
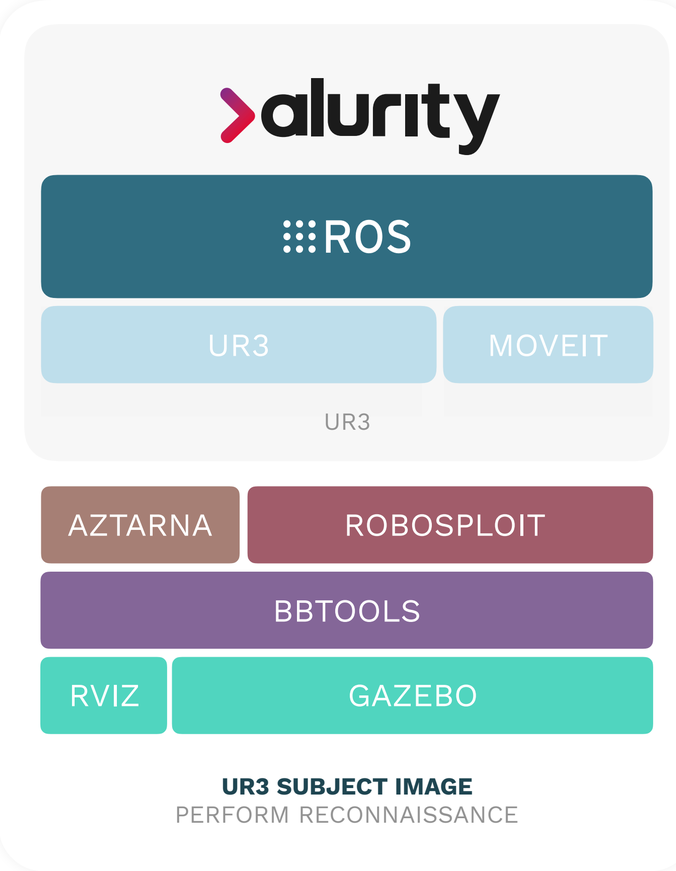
TOOLBOX FOR
ROBOT SECURITY

>ALURITY.YAML X

```yaml
# a simple configuration for a UR3 subject
ur3:
  - modules:
      - base: alurity:latest # base module
      - volume: comp_ros:kinetic
      - volume: robo_ur3:latest
      - volume: comp_moveit:latest
      - volume: reco_aztarna:latest
      - volume: expl_robosploit:latest
      - volume: fore_bbtools:latest
      - volume: deve_rviz:latest
      - volume: deve_gazebo:latest
      - network: bridge
```





UR3 SUBJECT IMAGE
PERFORM RECONNAISSANCE

>alurity

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TOOLBOX FOR **ROBOT SECURITY**

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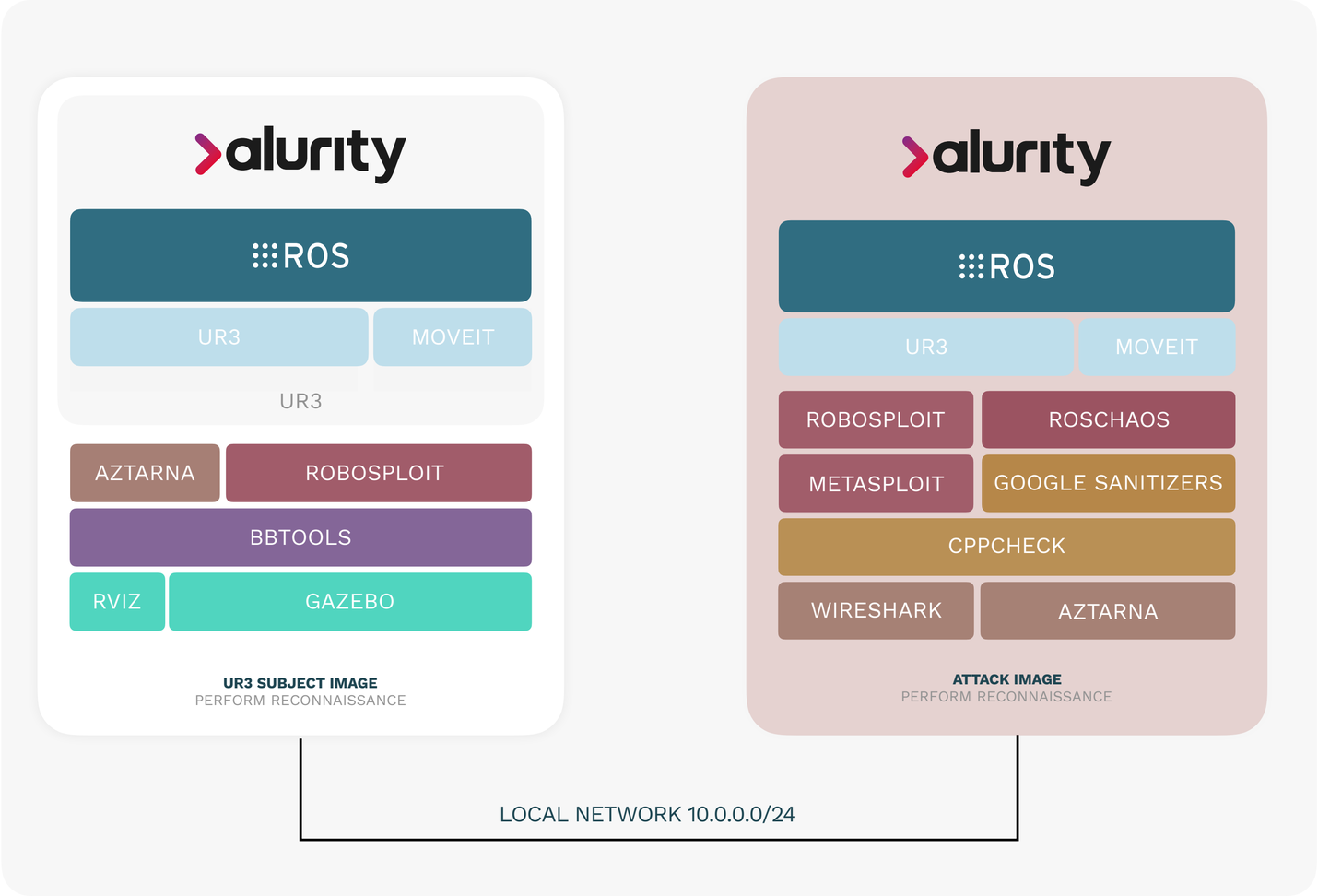

VXLAN

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ALURITY EDU

Thought for schools, universities and research centers

- Free for students and researchers
- Tutorials available
- Proven R&D or educational centers
- Contact now! **contact@aliasrobotics.com**

EDU

Alurity

An Academic license with unlimited users. Meant for proven Educational Institutions or R&D centers. Provides limited access to the tools, the documentation and the components for research and educational purposes.

Group license

Limited modules

Documentation

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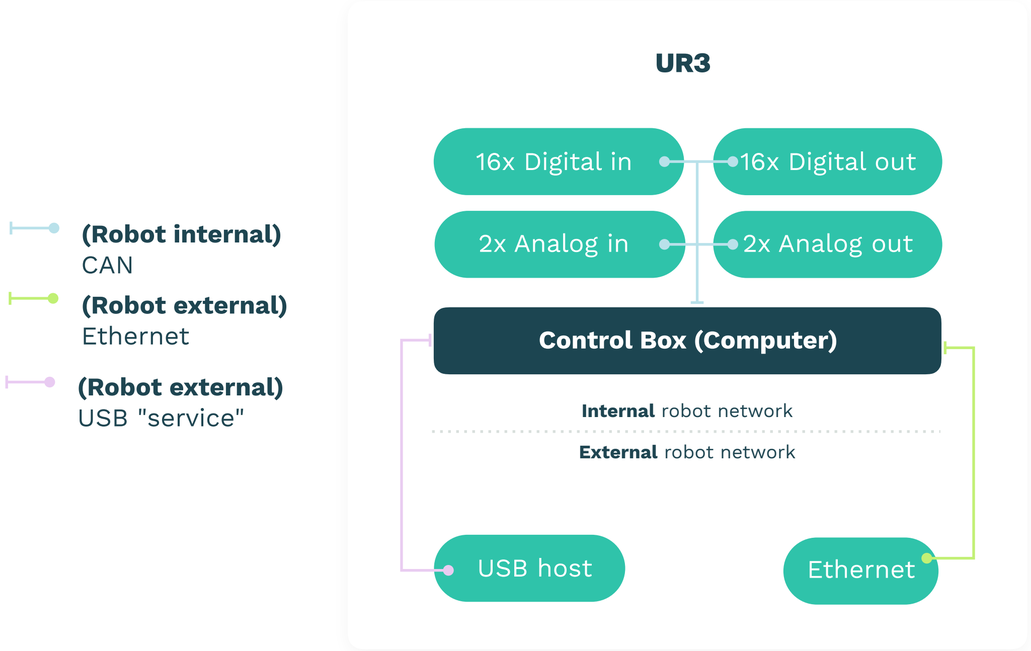
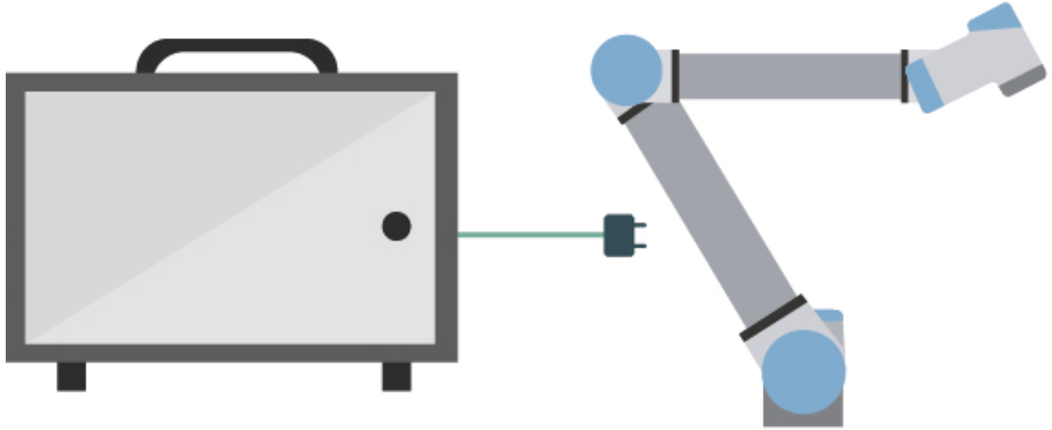
CASE OF STUDY 1
UR3/5/10

THREAT: TOTALLY INSECURE EXTERNAL COMMUNICATION BUSES (NO AUTH)





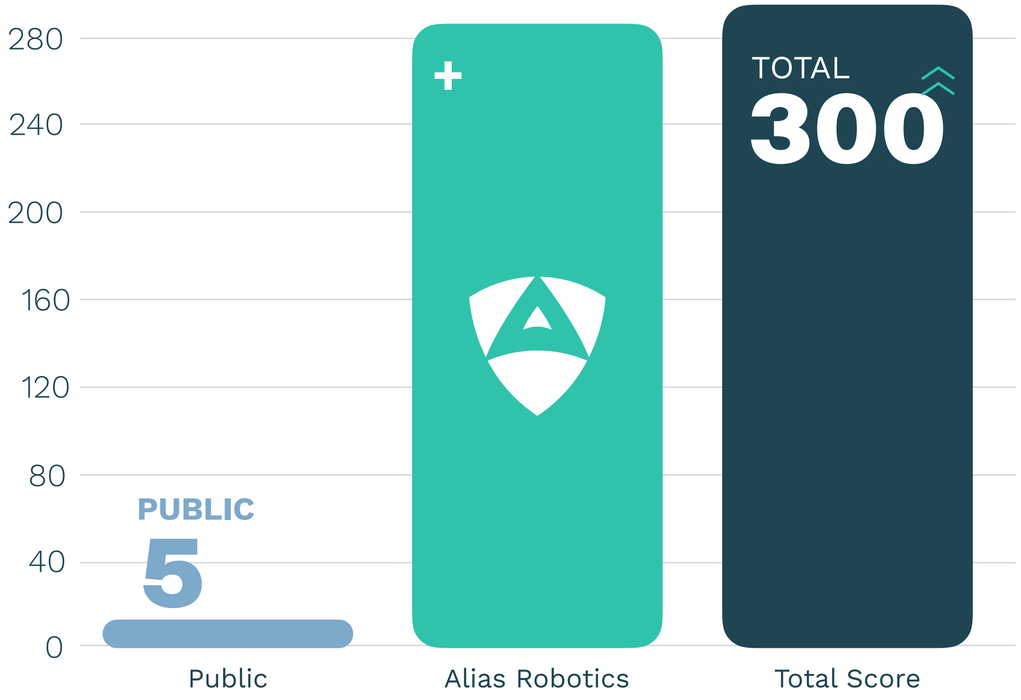
CVE-2019-19626
BASH SCRIPTS (MAGIC UR FILES) GET LAUNCHED AUTOMATICALLY WITH ROOT PRIVILEGES AND WITHOUT VALIDATION OR SANITIZING
22 OCT 2019 19:37:07 CET

CVE-2016-6515
OPENSSH REMOTE DOS IN CB
22 OCT 2019 15:12:00 CET

CVE-2016-6210
USER ENUMERATION IN CB
22 OCT 2019 15:20:00 CET

ADDED VALUE
OF ALIAS ROBOTICS

CASE OF STUDY
UNIVERSAL ROBOTS



- **Publicly** available
- Discovered by **Alias Robotics** (private)
- **All** (known) vulnerabilities

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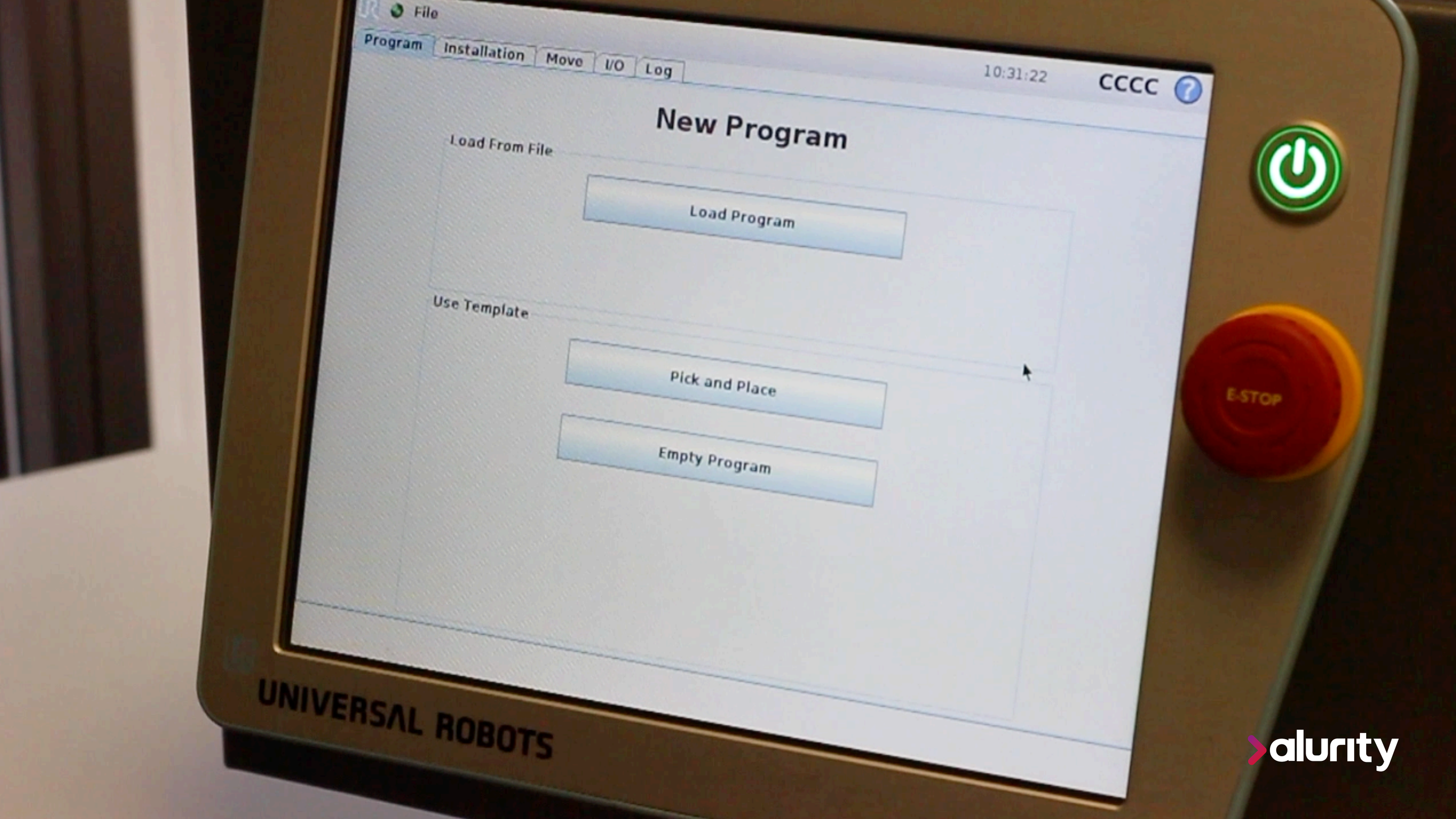
File
Program
Installation
Move
I/O
Log
10:31:22
CCCC
New Program
Load From File
Load Program
Use Template
Pick and Place
Empty Program
E-STOP
UNIVERSAL ROBOTS
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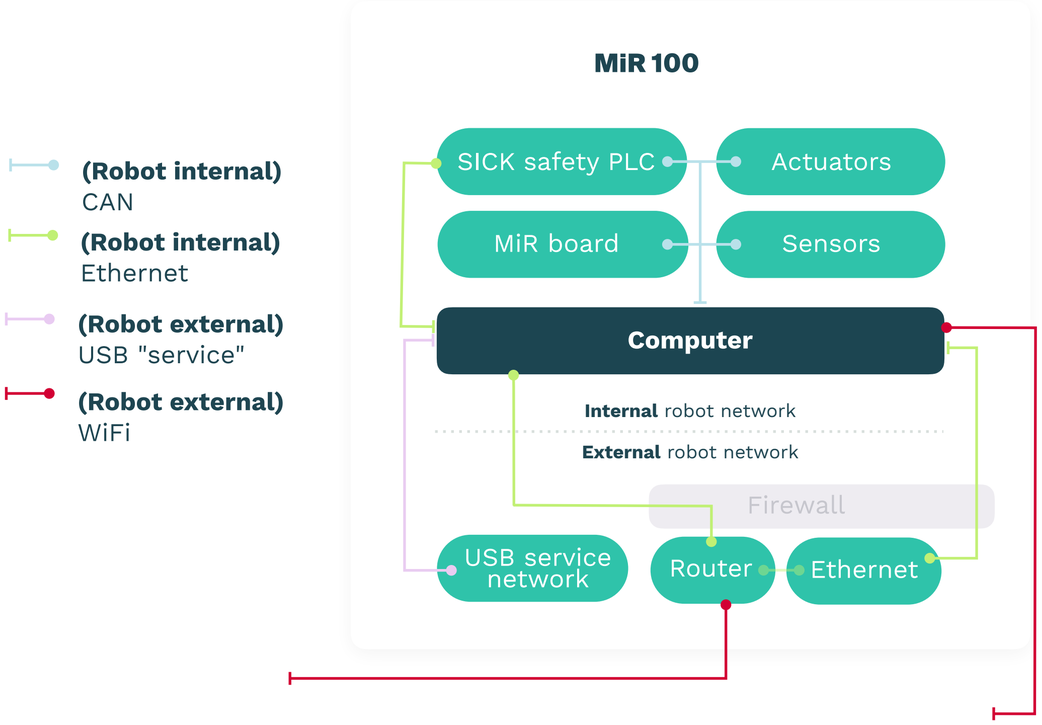
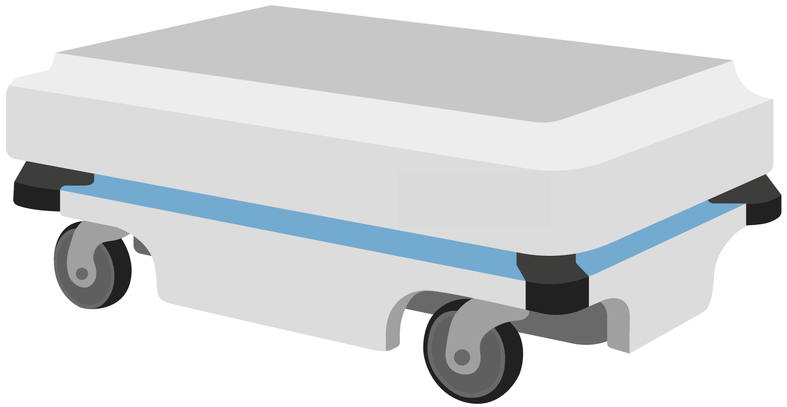
CASE OF STUDY 2
MIR-100

THREAT: SAFETY PLC IS DIRECTLY CONNECTED TO THE ROBOT INTERNAL NETWORK





CVE-2020-****
UNDISCLOSED
UNDISCLOSED

CVE-2020-****
UNDISCLOSED
UNDISCLOSED

REMOVING 0-DAYS

FROM ROBOTICS

ALIAS ROBOTICS

Robot Cybersecurity

www.**aliasrobotics**.com

contact@aliasrobotics.com