netPI – Open Edge Connectivity Ecosystem

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What is netPI?

netPI manifests itself in expandable hardware and freely programmable software as an open ecosystem for realizing individual "Internet of Things" and "Industry 4.0" automation solutions of the IT/OT Edge domain.

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What is the base of netPI?

- Combination of Raspberry Pi 3 and Hilscher netHAT Modul

Which aim does netPI pursue?

netPI pursues the principle of "open innovation" or the creation of work shared added value. Hilscher provides with netPI the environment for the active extension of the product functionality as a basis, the customer completes it at his own discretion in the form of software or hardware. The goal is to bind external knowledge to netPI and to jointly increase the end product‘s overall system value for all involved parties.

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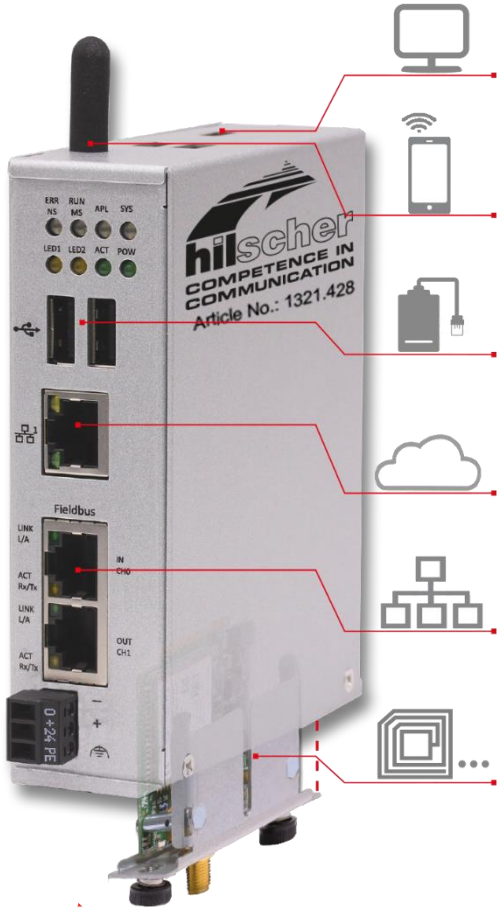
Device connectivity



HDMI Display, HD graphics 1920 x 1080

Wireless network, 802.11ac b/g/n, BT 4.1

USB connection, 4 x 2.0, 1A max.

LAN network, 1 x 10/100Mbit

Field network, 2 x RJ45, Profinet IO, EtherNet/IP …

Expansion modules, E/A, RFID, RS485…

Power supply, 19.2V … 28VDC

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Integrated components

CPU, BCM2837 / 4 x ARM Cortex-A53, 1.2GHz

RAM, LPDDR2 / 1GByte

FLASH, XQS8C016Z / microSD 8GByte

Ethernet/USB, LAN9514

WLAN/BT, BCM43438

RTC, PCF8563

FRAM (Ferroelectic RAM), FM24CL64B / 8kByte

netX, netRAPID NRP 51-RE-IO / ARM-966 100Mhz

Expansion slot, 52 pin / mPCIe Sockel

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Industrial Grade „Raspberry“

- Design
  - 8 layer PCB design (6 with Pi 3 B) for best EMC compliance and heat dissipation
  - Cooling concept for full 1.2GHz quad-core CPU performance up to 50°C without throttling
- Connectivity
  - netX51 multi-protocol Industrial Networks Controller for Fieldbus and Industrial Ethernet (model RTE 3)
  - Two extra Industrial Ethernet ports for protocols such as PROFINET, EtherNet/IP and more (model RTE 3)
  - Expansion slot for additional plug-in modules such as RS485, RFID, Analog, Digital I/O and more
  - Top hat rail mountable robust metallic housing for longevity in industrial environments
- Environments
  - On-board WiFi/BT radio antenna extended beyond chassis for best wireless coverage
  - EMC compliant to latest standards
  - Shock and vibration compliant to latest standards
  - Extended temperature range -20°C to 60°C (no thermal CPU throttle up to 50°C)
  - 24 Volt DC powering

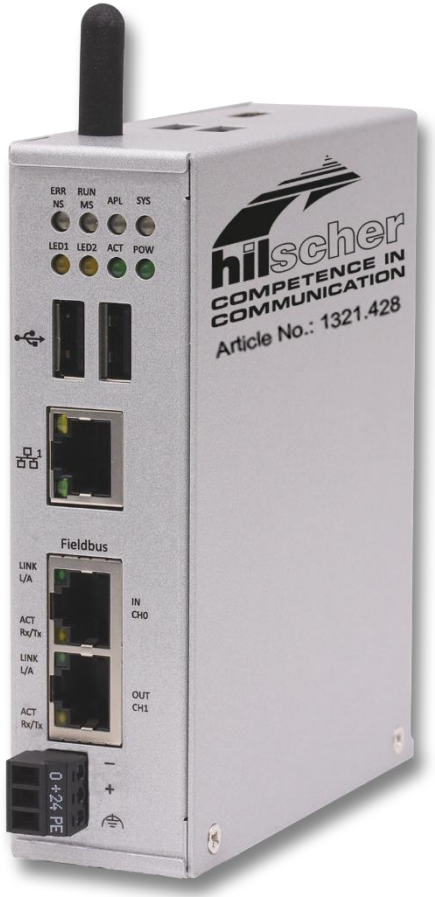
netX to Pi CPU communication

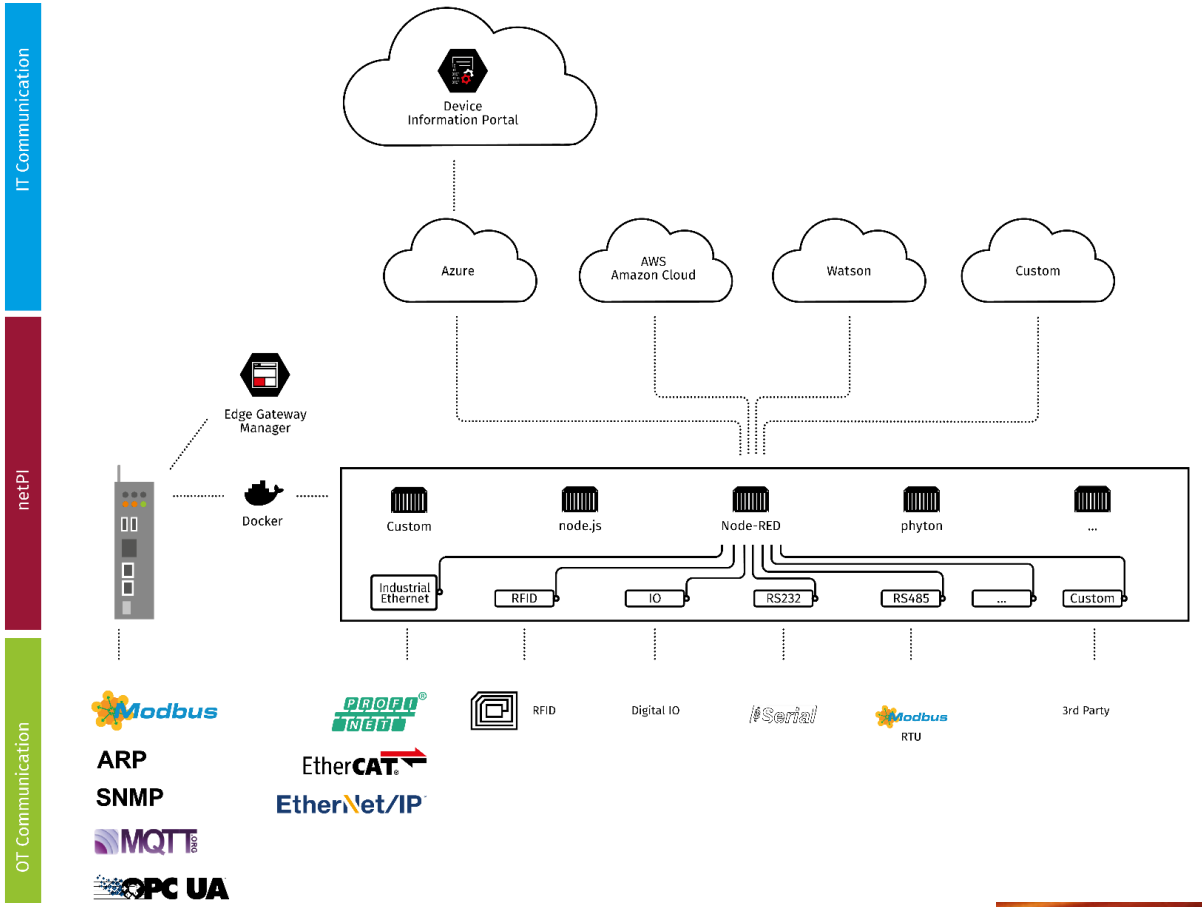
- Using 31.2 MHz high speed SPI bus
- Transmission over DMA (Direkt Memory Access), data transport nearly without any influence on the Pi CPU
- Data modelling over netX SPM interface (Serial Port Memory)
- Using the standard cifX linux driver package well known from Hilschers PC cards
- Drive access to cyclic I/O data and acyclic services possible

Hardware Real-Time clock (RTC)

- RTC controller connected to I2C bus
- Precision +/- 40ppm
- Supplies system software with actual time
- Buffering via super capacitor for at least 7 days
- Maintenance free without battery
- In case of NTP Server automatic resynchronization across NTP services

How is the software / base structure?





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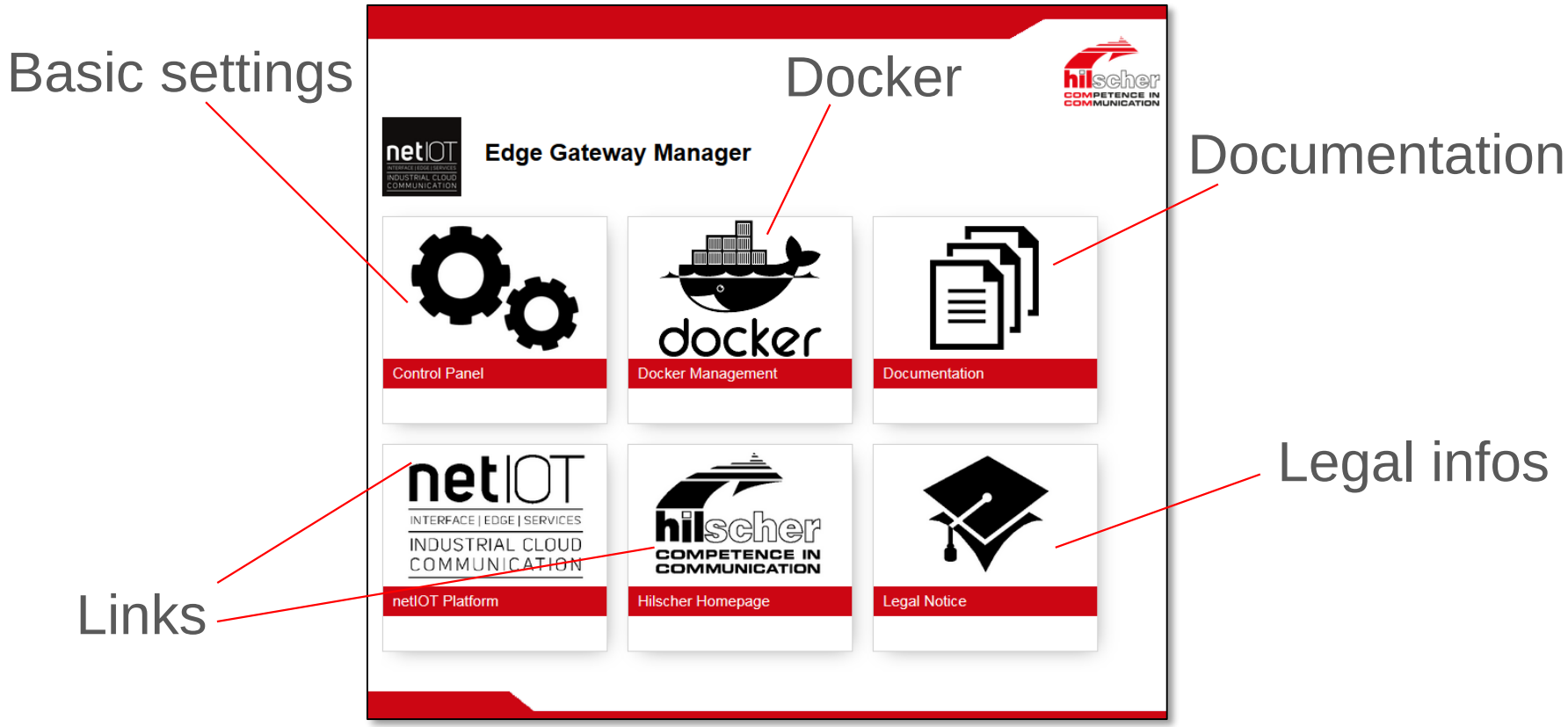
Secured Web Browser access

- Access to device software via web browser only
  - Only over https secured connections
  - Data encryption in accordance with TLS 1.2
  - Guarantees listening protection
- Certificate management
  - Pre-installed Hilscher certificate
  - Can be replaced with own certificate

The web landing page

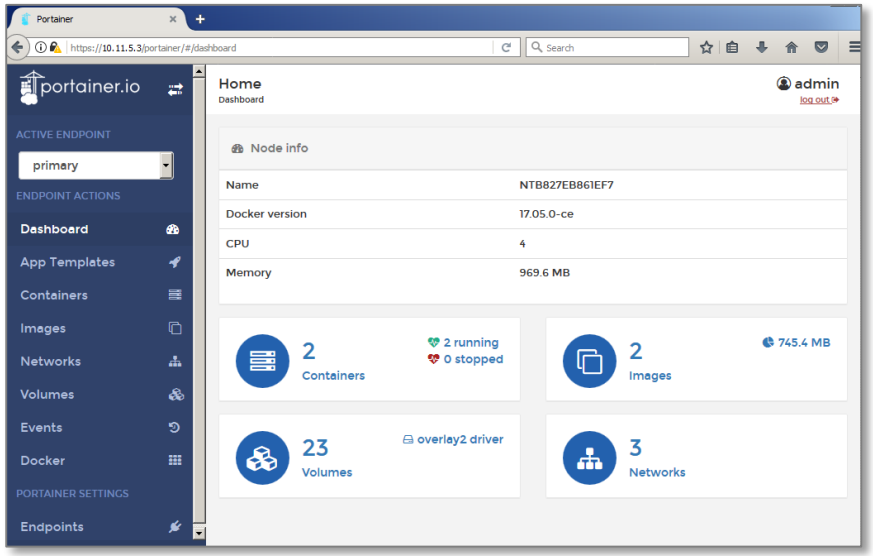


Docker preinstalled

- Is the only preinstalled user software
- Comes with web gui for easy management
- Docker creates software virtualization environment
  - Enables installing additional software
  - Encapsulates software in so called „Containers“
  - Isolates multiple containers against each other
  - Offers a maximum security at factory default settings
  - Allows to install additional containers by administrator only

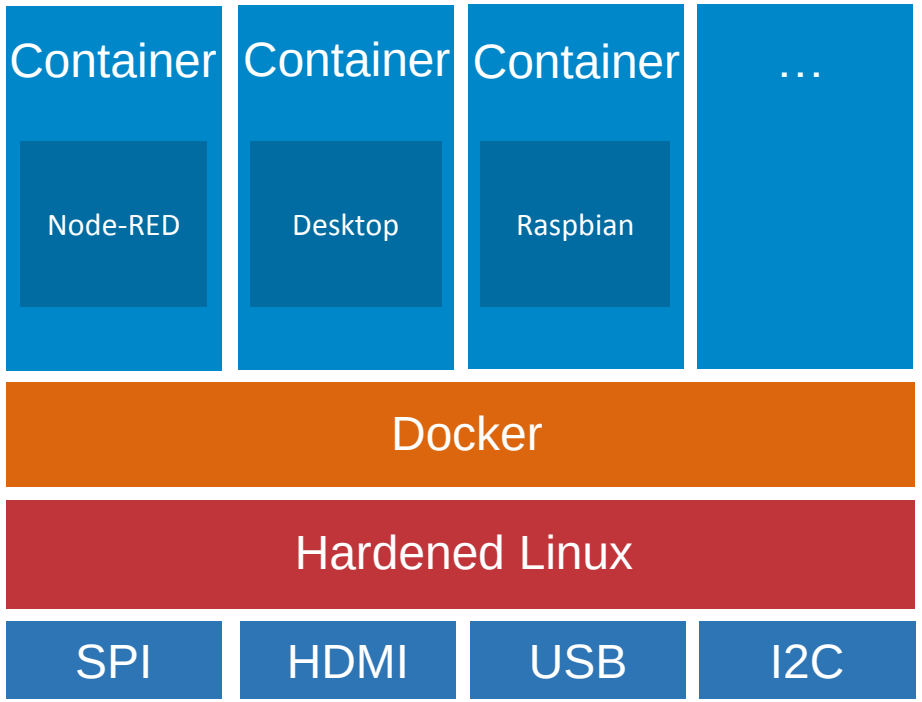
Docker web user management

- Portainer.io as simple to use Docker web GUI
- Services for easy management of Docker containers
- E.g. load, start, stop, unload containers
- Settings of advanced access authorizations



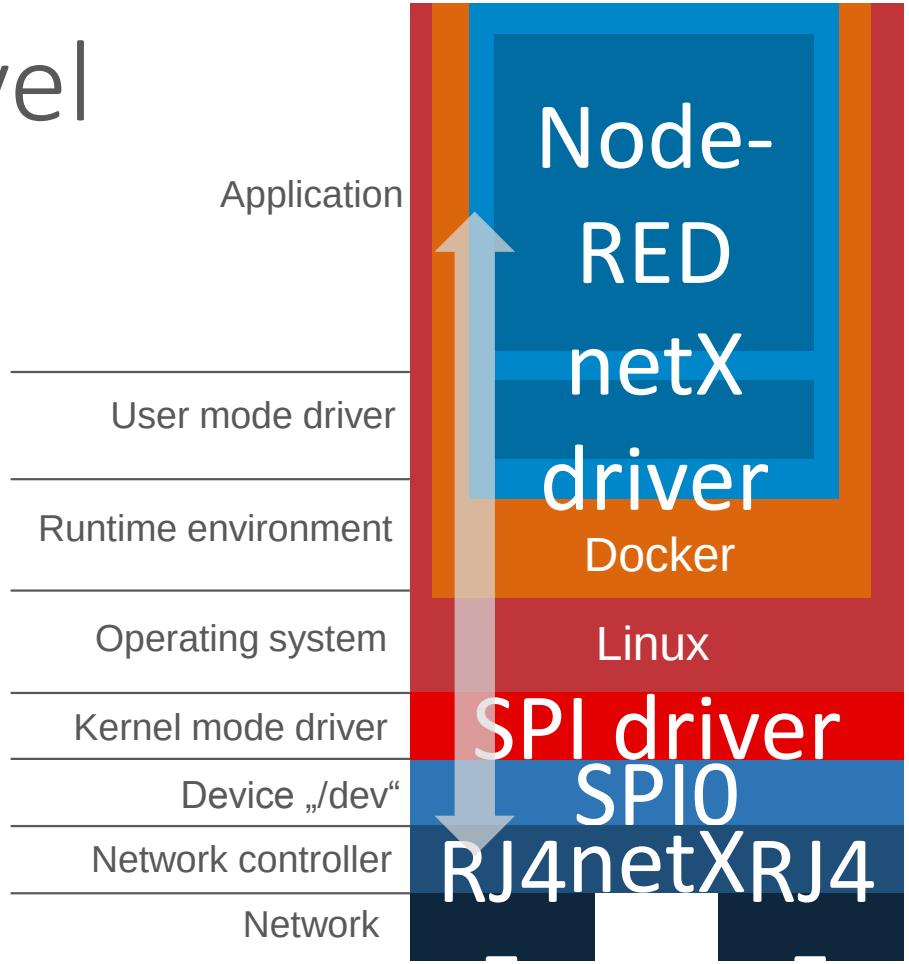
Software block diagram

- Parallel containers
- Arbitrarily expandable
- Isolated against each other
- Embedded securely
- Start-/ stoppable
- Loadable over www



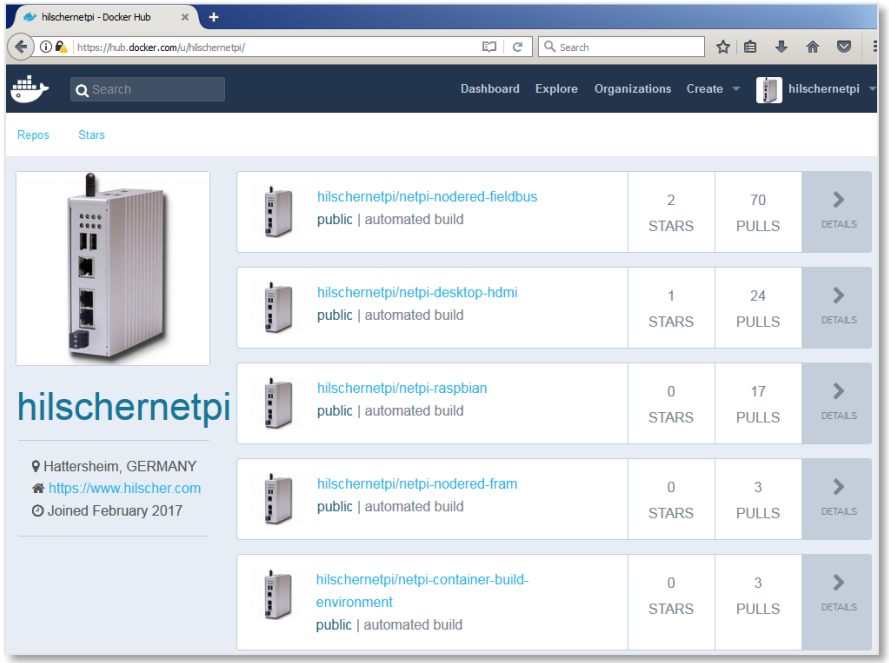
Full access to „device“ level

- Exposing „/dev“ to containers
- Using Linux kernel mode drivers possible
- Full performance as on system level



Free software repository for netPI

- Link: https://hub.docker.com/u/hilschernetpi/
- Loadable ready to use containers
  - Node-RED
  - Raspbian
  - FRAM access
  - HDMI desktop
  - netX programming
  - …



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Intelligent solutions for industrial communication

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