# System Environment

Technical requirements and recommended system configurations for operating NDPro.

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## Hardware.

Recommended hardware and virtualization requirements for production environments.

| COMPONENT | MINIMUM | RECOMMENDED |
|---|---|---|
| **Processor** | Intel Xeon E5 or newer / AMD Ryzen 5 or newer | |
| **CPU** | 4 cores | 8 cores or more |
| **RAM** | 4 GB | 8 GB or more |
| **Disk space** | 80 GB | 260 GB or more (SSD) |
| **Network card** | Gigabit Ethernet | |
| **Operating system** | Debian 13 (Trixie) or newer | |

## Software.

NDPro runs on Debian as user "ndpro" without root privileges, with sudo rights for maintenance.

| COMPONENT | VERSION AND PURPOSE |
|---|---|
| **Operating system** | Debian 13 (Trixie), "No-Desktop" default setup |
| **Runtime** | Node.js LTS (22.11 or newer), PM2 as watchdog, npm/ncu |
| **Web server** | Apache2 for HTTPS forwarding/proxying (VirtualHost) |
| **VPN & firewall** | OpenVPN client to the NDPro update bridge, UFW firewall |
| **File sharing** | SMB/Samba for directory sharing (optional) |
| **Modules** | via the installer script: curl, openssl, htop, zip, unzip, sqlite3, ca-certificates, gnupg |

## Network & firewall.

Outbound rules from NDPro, plus the inbound access to NDPro in the local network.

| OUTBOUND | PORT | PURPOSE |
|---|---|---|
| **HTTPS** | TCP 443 | Status, operational and error reports |
| **DNS** | TCP/UDP 53 + 853 | Domain name resolution |
| **NTP/SNTP** | UDP 123 | Time server for system events |
| **VPN** | UDP 1201 | NDPro update server and patches |
| **OS updates** | TCP 80/443 | Packages from the Debian repositories |
| **Inbound to NDPro** | SSH 22, HTTP 80, HTTPS 443, SMB 445 | Administration, visualization, file access |

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## Installation.

This is how an installation runs: from an empty server to the NDPro web interface.

### 01 PREPARE

**Provide the server**

1. Debian 13 (Trixie), "No-Desktop" default setup, one partition
2. IPv4 adapter (static or DHCP) via 1GbE or 10GbE Ethernet
3. SSH access for administration, user "ndpro"
4. Hostname and hosts file according to project requirements

### 02 INSTALL

**Run the script**

1. Installation via the included *.sh script
2. Download of the current NDPro package from update.ndpro.app
3. Node.js LTS, PM2 and all modules are installed
4. UFW firewall is set up, Samba optional

### 03 FINISH

**Put into operation**

1. Self-signed certificate, later replaced by a user-provided one
2. Apache2 VirtualHost and OpenVPN to the update bridge
3. Provision of the system key for documentation purposes
4. Further configuration via the NDPro web interface

## Operation, DNS & certificates.

So touch panels and browsers reach NDPro securely.

### Local operation

- All core functions run fully offline
- Internet only for system updates, NDPro Updater and NDC Monitoring
- To the end devices: ANY TCP/UDP + ICMP

### DNS routing

- Access through a domain, e.g. projectdomain.ndpro.app
- DNS resolves it to the IP address of the NDPro server
- Date, time zone and NTP of the end devices are correct

### TLS certificates

- Valid, publicly trusted certificate for production systems
- Automatic renewal recommended, wildcard possible
- Self-signed only for initial setup and for tests

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## Limited online access as an option.

Minimum requirements for updates, monitoring, and external services. Depending on the individual system configuration, outbound Internet connections may be required for the operation of NDPro. The following destinations represent the recommended minimum requirements. Services that are not required can be excluded from the customer's firewall rules.

### NDPro services

- **`update.ndpro.app`**
  Provision of NDPro software and system updates.
- **`Address on request`**
  Central NDPro services for monitoring, licensing, and certificate management.

### Operating system and software updates

- **`*.debian.org`**
  Debian package repositories and security updates, including security.debian.org.
- **`*.nodesource.com`**
  Provision and updates of the Node.js runtime environment.
- **`*.npmjs.org`**
  Node.js package management and updates of required npm components.

### Remote service

- **`*.teamviewer.com`**
  Remote service via TeamViewer. Access should only be permitted through approved and appropriately secured company accounts.

### DNS and time synchronization

- **`8.8.8.8 / 1.1.1.1`**
  External DNS resolution if no customer-provided DNS servers are available.
- **`*.ntp.org`**
  NTP servers for system time synchronization if no customer-provided NTP servers are available.

### Microsoft 365 / Graph API

- **`login.microsoftonline.com`**
  Microsoft OAuth 2.0 authentication and token provisioning.
- **`graph.microsoft.com`**
  Microsoft Graph API, for example for room calendars, room booking, email, and Microsoft 365 integrations.

### Service PCs: Windows and Google Chrome

Not for the NDPro server, only for service PCs in the project.

- **`*.windowsupdate.com / *.microsoft.com`**
  Microsoft services for Windows operating system and security updates.
- **`*.google.com / *.googleapis.com / *.gvt1.com`**
  Google services required for the operation and updating of Google Chrome.

If DNS, NTP, or other infrastructure services are provided by the customer's network, the corresponding external access permissions are not required.

## Ports & protocols.

NDPro communicates directly with connected devices and systems using standard network protocols and manufacturer-specific interfaces. The following overview lists the outbound ports used by NDPro for device communication.

| TCP · PORT | PROTOCOL | MANUFACTURER |
|---|---|---|
| 22 | TCP/SSH | Various |
| 23 | TCP/Telnet | Various |
| 45 | TCP | Sennheiser |
| 80 | TCP/HTTP/WS | Various |
| 100 | TCP | Exsys |
| 443 | TCP/HTTPS/WSS | Various |
| 445 | TCP/HTTPS | Cisco |
| 502 | TCP/Modbus TCP | NDPro |
| 587 | TCP/SMTP | NDPro |
| 1400 | TCP/UPnP | Sonos |
| 1515 | TCP/MDC | Samsung |
| 1710 | TCP | Q-SYS |
| 1986 | TCP | Vestel, Toshiba |
| 2202 | TCP | Shure |
| 3535 | TCP/HTTP | ProDVX |
| 3629 | TCP/ESC/VP.net | Epson |
| 4001 | TCP | NDPro |
| 4003 | TCP | Barco |
| 4352 | TCP/PJLink | Panasonic, Sony |
| 4660 | TCP | BenQ |
| 4664 | TCP | Clevertouch |
| 5000 | TCP | Crestron, iiyama, Philips |
| 5200 | TCP | NovaStar |
| 6107 | TCP | Lightware |
| 6688 | TCP | i3 |
| 7078 | TCP | P5 Automation |
| 7142 | TCP | NEC, Sharp |
| 8001 | TCP | NovaStar |

| TCP · PORT | PROTOCOL | MANUFACTURER |
|---|---|---|
| 8002 | TCP/HTTPS/WSS | Samsung |
| 8003 | TCP | Cisco |
| 8006 | TCP/HTTPS | Proxmox |
| 8080 | TCP/HTTP | ZeeVee |
| 8374 | TCP | Fohhn |
| 8890 | TCP | Televic |
| 9006 / 49160 | TCP | Humax |
| 9090 | TCP | Barco |
| 9990 | TCP | Blackmagic ATEM |
| 10008 | TCP | Sharp |
| 10600 / 10606 | TCP | Analog Way |
| 11000 | TCP | Bluesound |
| 27182 | TCP | Sedna |
| 49280 | TCP | Yamaha |
| 50000 | TCP | Yamaha |
| 50915 | TCP | WolfVision |

| UDP · PORT | PROTOCOL | MANUFACTURER |
|---|---|---|
| 9 | UDP/Wake-on-LAN | Various |
| 161 | UDP/SNMP | Various |
| 3671 | UDP/KNXnet/IP | Various |
| 5000 | UDP | BrightSign |
| 6000 | UDP | NovaStar |
| 6454 | UDP/Art-Net | Various |
| 8600 | UDP | ExPromo |
| 8711 | UDP | Audac |
| 9910 | UDP | Blackmagic ATEM |
| 47808 | UDP/BACnet/IP | Various |
| 52381 | UDP/VISCA over IP | AVer |