SYSTEM REQUIREMENTS

SUMMARY

SYSTEM REQUIREMENTS

1. History - Changelog

Version	Date	Changes	Owner
21			
22	22/02/2022	Changed layout Modified the the network configuration adding the application type communciation	IT, MKTG
23	26/10/2022	Modified browser requirements	SRV, MKTG
24	01/02/2023	Modified Server HW Specification and Server Communications table	IT, MKTG
25	20/04/2023	Added dvcrm and Electronic TopHolder rules	IT, SRV
26	08/09/2023	Added FW rules for DVC Master EVO Dunfell OS	IT, SRV

2. OVERVIEW

The Digital Ventilated Cage (DVC®) is a unique and revolutionary home-cage monitoring system, designed for mice's standard Tecniplast IVC cage system, composed of a mix of electronics and software components to collect a set of information directly from the home cage in the home rack.

The DVC® system has been designed to be used in any animal Facility and lab since its main component, the DVC® rack, can be easily washed and autoclaved without affecting current SOPs.

3. DVC® SYSTEM DIAGRAM
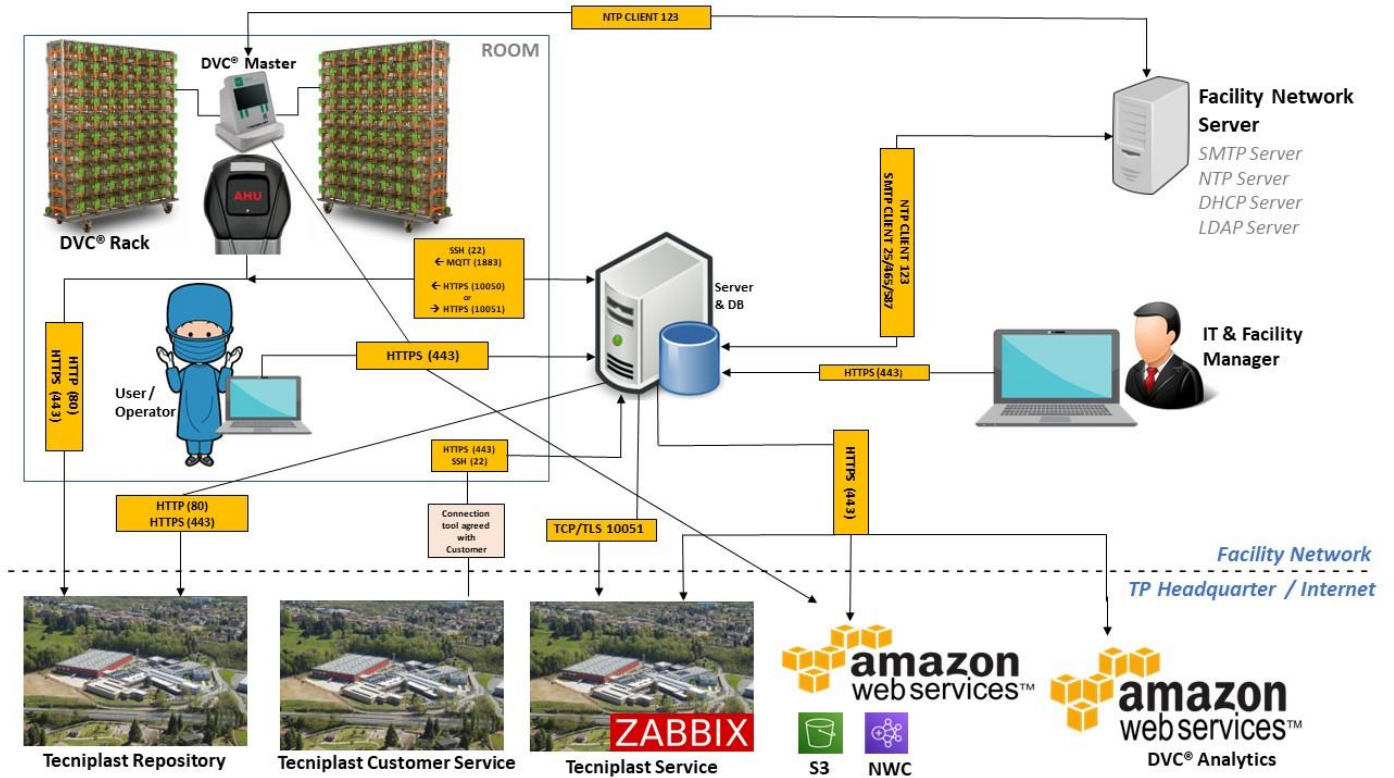
*********CRITICAL*********

DVC® Server must be reachable remotely from the Tecniplast Service Team to install the entire DVC® Server Applications remotely. If this is not possible, specific and, necessary travel quotations and accommodations must be invoiced.

SYSTEM REQUIREMENTS

4. REQUESTED DVC® SERVER HARDWARE SPECIFICATION

	MINIMUM HARDWARE SPECIFICATIONS (less than 20 RACKS)	RECOMMENDED HARDWARE SPECIFICATIONS (more than 20 RACKS)*
N° CPU'S	8	16
RAM MEMORY	16 GB	32 GB
SWAP MEMORY	16 GB	64 GB
HDDs (mountpoints)	1st partition 50GB (OS) 2nd partition /var/dvc/ 300GB (Data)	1st partition 50GB (OS) 2nd partition /var/dvc/ 1TB (Data)
NETWORK CARD	1 Ethernet card 1Gbps	1 Ethernet card 1 Gbps or higher
LINUX OS**	Centos 7 Minimal RedHat 7* RedHat 8* Oracle Linux 7* Oracle Linux 8* Rocky Linux 8	Centos 7 Minimal RedHat 7* RedHat 8* Oracle Linux 7* Oracle Linux 8* Rocky Linux 8

*DVC System is compatible with REDHAT, but customer needs to provide REDHAT subscriptions.

5. SERVER MAINTENANCE

5.1. SERVER BACKUP:

Tecniplast performs a daily DB backup in the Server machine itself (virtual or physical). Optionally, but recommended, Tecniplast could automatically export DB backups into AWS S3 for Disaster Recovery strategy.
The customer is responsible for the backup of the entire machine.

5.2. SERVER MACHINE UPDATES:

The customer is responsible for the Server machine security updates and patches. However, because the DVC® is a real-time system, it is highly suggested to alert the Tecniplast Service Team before proceeding with the updates to handle the machine's off-period carefully.

6. DVC® NETWORK COMMUNICATION

The DVC® system is a real-time system providing different software interface functionalities to the users and generating alarms related to the cage/animal safety; therefore, **any communication hereinbelow described has to be maintained open and stable** (for instance, if there is a proxy in between some components or outbound to internet, be sure that the communications are allowed, and the components' IPs are placed in the whitelist).

Moreover, **some network communications are mandatory to have the DVC® system fully operative**, while others are optional and related to the customer preferred choices. Below in red are reported the optional network requirements. More specifically:

AMAZON WEB SERVICE – S3: is highly suggested but not mandatory. The same DVC® raw data can also be stored locally if the customer provides Tecniplast with a specific repository.

AMAZON WEB SERVICE – NWC: is probably the main feature of the DVC® system for improving animal welfare management.

AMAZON WEB SERVICE – DVC® Analytics: Not mandatory if the customer does not want to purchase this extra platform for researchers.

SYSTEM REQUIREMENTS

6.1. DVC® SERVER communications:

Source	Direction	Destination	Protocol	Port	Description
DVC® SERVER	Inbound	DVC® USER DEVICE / END-USER POINT	HTTPS	443	Web UI access
	Inbound	DVC® equipments (Master - Rem)	MQTT	1883 / 8883	DVC communication
	Inbound	DVC® Master	TCP TLS	10051	ZABBIX
	Outbound	DVC® Master	TCP TLS	10050	ZABBIX
	Outbound	Customer NTP server	NTP	123	Time Sync
	Outbound	Customer DNS server	DNS	53	DNS
	Outbound	Customer SMTP server	SMTP	25/465 /587	Mail Service
	Outbound	zabbix.dvc.tecniplast.it	TCP TLS	10051	ZABBIX - TECNIPLAST SERVICE platform
	Outbound	DVC® Master	TCP TLS	5000	System Check service
	Outbound	DVC® Master	SSH	22	Maintenance
	Outbound	Operating System repository	HTTP / HTTPS	80 / 443	Repos for SW update
	Outbound	nexus.tecniplast.it	HTTP / HTTPS	80 / 443	Repos for SW update
	Outbound	amazonaws.com	HTTP / HTTPS	80 / 443	S3, NWC
	Outbound	amazonaws.com	HTTP / HTTPS	80 / 443	DVC® Analytics
	Outbound	kms.eu-west-1.amazonaws.com	HTTPS	443	DVC® SW installation
	Outbound	rm.dvc.tecniplast.it	HTTPS	443	DVC® SW installation

6.2. DVC® MASTER communications:

SYSTEM REQUIREMENTS

Source	Direction	Destination	Protocol	Port	Description
DVC® MASTER	Outbound	DVC® SERVER	MQTT	1883 / 8883	DVC® Communication
	Outbound	DVC® SERVER	HTTPS	443	DVC® equipments (Electronic TopHolderEVO)
	Outbound	DVC® SERVER	TCP TLS	10051	Zabbix
	Inbound	DVC® SERVER	TCP TLS	10050	Zabbix
	Outbound	vivatronics.tecniplast.it	HTTP-HTTPS	80 / 443	Tecniplast Repos
	Outbound	vt-raw-data.s3-eu-west-1.amazonaws.com	HTTPS	443	S3 raw data
	Outbound	Customer NTP server	NTP	123	Time Sync
	Outbound	Customer DNS server	DNS	53	DNS
	Outbound	DVC®SERVER	TCP	24224	Fluentbit
	Outbound	rm.dvc.tecniplast.it	HTTPS	443	DVC® SW installation
	Outbound	kms.eu-west-1.amazonaws.com	HTTPS	443	DVC® SW installation
	Inbound	DVC® SERVER	SSH	22	Maintenance
	Outbound	conda.anaconda.org	HTTPS	443	DVC® SW installation
	Outbound	repo.anaconda.org	HTTPS	443	DVC® SW installation
	Outbound	nexus.tecniplast.it	HTTP / HTTPS	80 / 443	Repos for SW update

7. END-USER REQUIREMENTS

- Allowing outbound access to the DVC® Server on port 443 (HTTPS)
- Operating System:
  - Windows 7 or Above
  - Linux

- Browser requirements:
  - Google Chrome (Official build) – Latest version highly suggestion

- Desktop/Laptop screen resolution: 1366 x 768 or higher

DVC® System Requirements
Version 26

SYSTEM REQUIREMENTS

8. TERMINOLOGY AND USAGE

8.1. DVC® SERVER

The end-user has to provide a physical or virtual machine where all the applications needed to run the system are installed.
The user provides the Server machine by following the requirements described in the corresponding section.
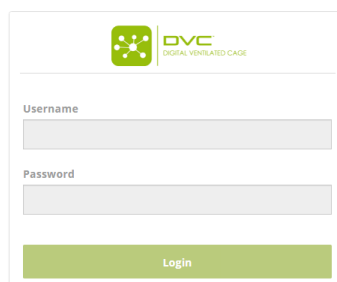

8.2. DVC® SOFTWARE INTERFACES

Two different DVC® web applications are running in the DVC® Server.
DVC® workplace: this is an administrative interface used to create user accounts, build structure, set thresholds for alarms, etc.

DVC® Operator: this is the operative interface designed to support the animal caretakers while managing cages and animals directly in the animal rooms.

8.3. DVC® MASTER

This is a physical machine usually placed over the Tecniplast Air Handling Unit. It powers the DVC® boards and exchanges data & information with them. It can manage up to 4 different DVC® racks in the Animal Rooms.

The DVC® Master must be connected <u>by hardwiring</u> to the DVC® Server, and so it must be in the user's intranet (one straight Ethernet cable for each DVC® Master).

### 8.4. DVC® Reader/DVC® Electronic Top Holder

The animal caretakers use these DVC® components to interact with the Cages while opened over the working bench in the animal rooms.

The DVC® Reader is connected wirelessly to the DVC® Master, while the DVC® Electronic Top Holder can also be linked to the customer's wireless network is available.

8.5. DVC® RACK

The Tecniplast ventilated rack is equipped with DVC® boards firmly attached at Rack level. For each cage slot of the rack, there is one dedicated DVC® board.
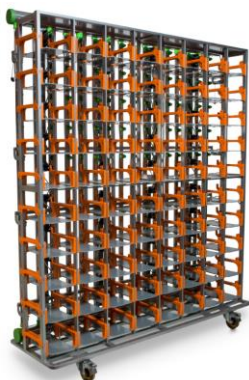
8.6. USER DEVICE / END-USER POINT

In order to access the DVC® web applications, the user needs a device with a web browser. Requirements for the browser are listed in the belove section.

The user's device needs to reach the DVC® Server.

It is essential to underline that the DVC®applications are intended for desktop use (DVC® workplace) and, probably even more important, for the animal room use (DVC® Operator), where a dedicated laptop each animal caretaker located closed to the working area is highly suggested.

For the best user interface experience, a **1366x768** (or higher) screen resolution is suggested.

8.7. TECNIPLAST REPOSITORY

This is the official Tecniplast repository where all the last software releases related to all the DVC® software components (DVC® Server, DVC® Master, DVC® Reader/Electronic Top Holder) are stored.

Tecniplast automated the DVC® Server upgrade by manually launching specific jobs directly in the DVC® Server located in the field, which connects to the Tecniplast repository through specific secure credentials access.

Tecniplast Repository

DVC® System Requirements
Version 26

8.8. TECNIPLAST CUSTOMER SERVICE

The tecniplast Service team might have different reasons for remotely entering the DVC® Server and DVC® Master elements. The most common reasons are for installation and update purposes, troubleshooting and manual bug fixing if needed, and lastly, for customer care support during remote training.

The customer can provide multiple ways to allow the Tecniplast Service team to connect to the local DVC® system remotely. The preferred option is to allow this through a secure customer VPN connection that can be left open or be opened on request. This is a customer's choice based on the speed of reaction to be achieved.

Tecniplast Customer Service

8.9. TECNIPLAST SERVICE (ZABBIX)

Tecniplast uses the ZABBIX platform (https://www.zabbix.com) for DVC® application monitoring purposes. DVC® metrics are the ones related to the performance of the system like the status of the DVC® Server and DVC® Master RAM status, the CPUs status and so on, but also metrics related to the DVC® board functionalities, the fact that the 24/7 generated DVC® raw data are still falling in the linear working range and so on.

For the sake of clarity, no sensitive data (for instance, the name of the cage or its content or any experiment fields) are neither collected nor monitored.

Tecniplast Service

DVC® System Requirements
Version 26

SYSTEM REQUIREMENTS

8.10.   AMAZON WEB SERVICE – S3 and NWC

There are two reasons for pushing DVC® raw data to the Tecniplast cloud (Amazon Web Service - AWS). The first is to store DVC® raw data outside the Facility directly into a dedicated AWS S3 bucket for any recovery reason (it can be to recover DVC® server data and to support the running of the playback task for the DVC® Analytics platform). The second reason is that a specific DVC® Algorithm called Night Welfare Check (NWC) runs continuously in the cloud (to support faster updates and easier maintenance). It analyses DVC® data (DVC® raw data plus Cage ID and the number of animals only) to provide a daily output to the animal caretakers related to the specific cage animal activity status (normal status or hyper/hypoactivity detected) so that they can be supported during their animal welfare checks activities.

8.11.   AMAZON WEB SERVICE – DVC® Analytics

DVC® Analytics is the dedicated scientific cloud-based platform developed by Tecniplast for researchers to access and analyze DVC® data to improve and complement experiments with novel findings.

It is entirely running in the Tecniplast AWS cloud, and therefore, it is accessible from anywhere through a valid internet connection.

For the sake of clarity, this platform is optional for the customer. For more information, please refer to the dedicated documentation and visit https://digitalcage-tecniplast.com/en/products/dvcr-analytics.html