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Contents

1. VR-TheWorld First Experience

1.1. Installing VR-TheWorld Software and Data	6
1.1.1 Considerations for Using Docker	6
1.2. Installing VR-TheWorld on Linux	7
1.2.1 Setting Up Your Computer	8
1.2.2 Installing Docker	8
1.2.3 Using Podman Instead of Docker for RHEL 8 and Later	9
1.2.4 Creating a New Network	10
1.2.5 Installing the Data Drive	10
1.2.6 Copy Data or Mount the Data Drive	10
1.2.7 Installing VR-TheWorld	11
1.2.8 Installing the MAK-Supplied Database	13
1.3. Installing VR-TheWorld on Windows	14
1.3.1 Prerequisites for Using Docker	14
1.3.2 Docker or Podman Desktop Application	15
1.3.3 Attach the Data Drive and Copy Data	16
1.3.4 Configuring Podman to Autostart	16
1.3.5 Configuring WSL2 Networking	18
1.3.6 Installing VR-TheWorld	18
1.3.7 Installing the MAK-Supplied Database	19
1.4. Connecting to a MAK-Supplied Server	20
1.5. Managing VR-TheWorld Global Imagery Layers	20

2. Using VR-TheWorld

2.1. Connect VR-Vantage to VR-TheWorld	24
2.1.1 Start VR-Vantage and Connect to VR-TheWorld	24
2.2. Navigating the Terrain	25
2.3. View Simulated Entities on VR-TheWorld Terrain	26

2.3.1 Connect to a Simulation Network	27
2.3.2 Start the Logger and Play a Simulation	27
2.3.3 View the Entities	27
2.4. Explore Terrain in the VR-TheWorld Web Interface	28
2.4.1 Explore a Layer	29

3. Installing VR-Vantage and MAK Data Logger

3.1. Install VR-Vantage and the Logger	32
3.2. Setting Up the License Manager	32
3.2.1 Identify the Host ID and License Server Name	33
3.2.2 Put the License File in the MAKLicenseManager Directory	33
3.2.3 Run the License Server	33
3.2.4 Specify the License Server	34



1. VR-TheWorld First Experience

Thank you for deciding to try VR-TheWorld. This first experience with VR-TheWorld demonstrates how easy it is to connect to the server and view streaming terrain in a 2D or 3D simulation application. Although you can stream terrain to any application that supports the osgEarth libraries, to ensure a consistent experience, this guide assumes that you have installed and licensed MAK Data Logger and VR-Vantage as described in "Chapter 3. Installing VR-Vantage and MAK Data Logger" on page 31.

The exercises in this guide use the free VR-TheWorld at VR-TheWorld.com. This allows you to evaluate VR-TheWorld without actually installing a local server. However, if you choose to install and evaluate a local server, this chapter explains how to do so. MAK can also provide you with a URL for a dedicated instance of the server. If you prefer this last option, please contact your MAK salesperson.

 VR-TheWorld.com is accessible via server configuration files (earth files). It is not directly accessible as a URL in a web browser.

Complete documentation of VR-TheWorld is in *VR-TheWorld Users Guide*, which is included with the product.

1.1. Installing VR-TheWorld Software and Data

VR-TheWorld is built on the Docker platform. This allows you to use Linux or Windows as platforms to run VR-TheWorld.

A VR-TheWorld installation has the following software and hardware components:

- Docker. A web-based application used to deliver the VR-TheWorld database structure and data.
- VR-TheWorld software.
- VR-TheWorld database structure and data files. The database provided by MAK is optional. You can create your own database and use your own data files. You can also add your data files to those provided by MAK.
- Hard drive. MAK provides a hard drive with installation scripts and data files.

The minimum recommended hardware configuration for running VR-TheWorld is:

- Server:
 - Multi-core
 - 32 GB RAM
 - 250 GB hard drive
- Data storage:
 - 5 TB or more of usable space (after configuration).
- Operating system. Preferably the latest versions of Ubuntu, Windows, or Red Hat Enterprise Linux (RHEL), but at a minimum:
 - Ubuntu 20.04
 - Windows 10
 - RHEL 8

 Installing and configuring Docker on Windows requires changes to your system's BIOS as well as Windows features. Please follow the instructions closely.

1.1.1 Considerations for Using Docker

This section discusses the following issues that you may need to consider when using Docker:

- Ports
- Handling crashes and reboots
- Path syntax

Ports

Docker does not bypass firewalls. It creates rules inside the kernel to redirect traffic that comes to the host. The *docker-compose* file lists the used ports in the following format:

```
host_port : docker_port
```

By default, Docker exposes container ports to the IP address 0.0.0.0. (This matches any IP on the system). If you want to, you can tell Docker which IP address to bind on. For example, to bind on localhost port 3000 and container port 80, specify:

```
127.0.0.1:3000:80
```

Some customers may prefer this for security reasons. Otherwise, that host port becomes open to all incoming connections.

Handling Crashes and Reboots

You can implement a restart policy for your Docker container that prevents the need to manually restart the containers in the case of a crash or reboot.

You do this through the `--restart` argument, which can be called within the `docker run` command or the `docker update` command (once containers are running). For our case, the `docker update` command makes more sense because the `docker run` command is not called explicitly during the installation process.

Here is how to set this for a single container:

```
docker update --restart unless-stopped container_name
```

Here is how to set this for all containers:

```
docker update --restart unless-stopped $(docker ps -q)
```

Table 1 lists the potential values for the `--restart` flag. `unless-stopped` is the most commonly used value. It is designed for the use case of handling a server crash / reboot.

Table 1. Values for `--restart` flag

Command	Description
no	Default value - containers would not be restarted.
on failure	Restarts container in the case of an error (container crashes).
always	Always restart container if it stops.
unless-stopped	Always restart container unless it is manually stopped.

Specifying Paths in Docker

Declare all paths using a forward slash (/), not the Windows-standard backslash (\). Items are appended to Docker paths following a Unix format, therefore a path that mixes backslashes with forward slashes becomes invalid. If you want to declare the paths in a Windows format, set the `COMPOSE_CONVERT_WINDOWS_PATHS` environment variable to 1.

1.2. Installing VR-TheWorld on Linux

This section explains how to install VR-TheWorld on Linux operating systems.

Docker is supported for versions of Linux including Ubuntu. For RHEL 8 or later, use Podman.

1.2.1 Setting Up Your Computer

Variations in Linux systems may create problems installing Docker and running VR-TheWorld. Please review the issues discussed in this section to ensure that your system is properly set up.

Partition Setup

It is recommended that you configure */etc/fstab* to point to drives by UUID. If drives are not configured by UUID, the mount locations or order of the drivers might change after you restart the server.

Partitions should use the XFS scheme. Non-XFS partitions may experience problems when copying the contents of the external drive to the internal drive.

1.2.2 Installing Docker

Download and install Docker. Follow the instructions at <https://docs.docker.com/engine/install>. You also must install Docker Compose, which is a separate installation if you are using Docker Engine but is included if you install Docker Desktop.

❗ For RHEL 8 or later, Docker is not fully supported. It is recommended that you use Podman to provide comparable functionality to the Docker environment. See "1.2.3 Using Podman Instead of Docker for RHEL 8 and Later" on the facing page. (You can choose to download and install the experimental RHEL version of Docker but, because that is not final, it is not supported by MAK Technologies.)

Using docker-compose or docker compose

Docker Compose is a tool for defining and running multi-container applications. It stops and starts the server. Compose has had several versions over the years. The original format for invoking the commands was `docker-compose`. Newer versions, however, use `docker compose`, although `docker-compose` should also be aliased. The documentation still uses `docker-compose`.

Configure the Firewall

Firewall settings may restrict the usage of certain ports through docker.

► To set up the firewall:

1. Find out which zone the docker interface it bound to, most likely "no zone":

```
sudo firewall-cmd --get-zone-of-interface=docker0
```
2. Add the docker0 interface to the public zone. Changes will be visible only after firewalld reloads:

```
sudo nmcli connection modify docker0 connection.zone public
```
3. Add masquerading, which allows for docker ingress and egress:

```
sudo firewall-cmd --zone=public --add-masquerade --permanent
```
4. Reload firewalld:

```
sudo firewall-cmd --reload
```
5. Reload dockerd:

```
sudo systemctl restart docker
```

1.2.3 Using Podman Instead of Docker for RHEL 8 and Later

For RHEL 8 or later, Docker is not officially supported because it was replaced with the Red Hat tools *buildah*, *podman*, and *podman-compose*. Although you could manually download and install the compatible CentOS versions of Docker, it is best to use the native tools.

Like Docker, Podman is a tool designed to make it easy to find, run, build, share, and deploy applications using Containers and Container Images. Podman provides a command line interface (CLI) familiar to anyone who has used the Docker Container Engine. Most users can simply alias Docker to Podman (alias docker=podman) without any problems, or you can use the corresponding podman commands (for example, podman-compose).

For VR-TheWorld, Podman uses the same Docker container and the provided docker-compose.yml.

To install podman and podman-compose on Red Hat, you can either download and install the Podman Desktop for Linux from <https://podman-desktop.io> or run the following commands:

- `sudo yum -y install podman`
- `sudo yum -y install python3-pip`
- `sudo pip3 install podman-compose`

Continue with the rest of the Linux installation instructions. If you have not aliased docker to podman, use the corresponding podman command (for example, podman-compose instead of docker-compose).

i The firewall may also restrict the usage of certain ports through Podman. See "Configure the Firewall" above.

1.2.4 Creating a New Network

Use either Docker or Podman to create a new network and give it the name `vrtheworld_default`.

1.2.5 Installing the Data Drive

You must mount the data drive and create the installation directory. The drive is in XFS format.

► **To mount the data drive:**

1. The data drive has a USB connection. Attach it to a USB 3.0 port on your computer.
2. Issue the following command to get the location of the drive:

```
sudo fdisk -l
```

This lists all drives connected to the computer. The MAK data drive is called `/dev/sd*`, where `*` is a letter from a–z. The data drive size is 6000 GB. Write down the name of the MAK drive.

3. Create the data directory:

```
sudo mkdir -p /data
```



If your machine already has a `/data` directory or you want to install the VR-TheWorld software, source data, and tiles into another location (for example, a different large partition), use a different directory. If you do install to a directory other than `/data`, be sure to use that directory name instead of `/data` in the following installation steps. You must also edit the `docker-compose.yml` file that you created and map all the volumes from the installed location to the internal `/data` used within the Docker images.

1.2.6 Copy Data or Mount the Data Drive

You can run VR-TheWorld from the data drive or copy the data to your computer's hard drive. For best performance, MAK recommends that you copy the data to your computer's hard drive.

- To copy the contents of the MAK data drive to an internal drive, run the following command:

```
xfsdump -J - /dev/NAMEOFDRIVE | xfsrestore -J - /data
```

where `NAMEOFDRIVE` is the name you recorded when you got the location of the disk.



- Copying the data can take more than 8–10 hours. Do not interrupt the process.
- Partitions should use the XFS scheme. Non-XFS partitions may experience problems when copying the contents of the external drive to the internal drive.

 When installing a new version of VR-TheWorld and the MAK data over an older version of VR-TheWorld, be aware that the xfsrestore will merge with the existing data, replacing duplicate files but leaving any different files intact. This can result in retaining MAK data that is no longer used, but it also preserves any customer data that you have added.

- If you choose to run VR-TheWorld from the data drive, rather than copying data, mount the data drive to `/data`:

```
sudo mount /dev/NAMEOFDRIVE /data
```

where *NAMEOFDRIVE* is the name you recorded when you got the location of the disk.

1.2.7 Installing VR-TheWorld

VR-TheWorld organizes data into layers, which reference the data files. You must install the database structure. You can do so automatically or manually.

VR-TheWorld requires a post-installation license key. Request a license at <https://www.mak.com/mak-one/support/portal>. Include your contact information, the purchase order for the server, and any relevant program details. You use the license key in step 4.

► **To install VR-TheWorld:**

1. After you receive your license key from MAK support, change directory to the install directory:

```
cd /data/VRTheWorld
```

2. Ensure that the prefix is set to 24. (RHEL 8.x defaults to 8.) If it is, continue to step 3.

If it is not:

- a. Run:

```
sudo vi /etc/sysconfig/network-scripts/ifcfg-<eno1>
```

where *<eno1>* is the name of your ethernet port.

- b. After changing the name of the ethernet port, run:

```
sudo nmcli connection down eno1
```

```
sudo nmcli connection up eno1
```

3. Copy the default Linux setting file, *docker-compose-linux.yml*, to *docker-compose.yml*.
4. Edit that *docker-compose.yml* file. At the end of it, there is a line `LICENSE_TEXT=`. Copy the license key text that you received and then paste it to the end of that line. Save the file.
5. Optionally, when you edit *docker-compose.yml*, you can configure the options. The file includes comments that explain the options. For more information, see "Configuration Options for Docker" on the next page.

6. Load the images for VR-TheWorld (you must have elevated permissions to run these commands):

```
docker load < postgis_9.5-alpine.tar.gz
docker load < redis_5.0-alpine.tar.gz
docker load < maptiler-gl_5.0.0.tar.gz
docker load < dozzle_8.7.1.tar.gz
docker load < vrtheworld_VERSIONOFVRTW.tar.gz
```

where *VERSIONOFVRTW* is the version of VR-TheWorld you are installing.

i If you have RHEL 8 or later and are using Podman, use the podman command line instead if you have not aliased docker. For example:

```
podman load < postgis_9.5-alpine.tar.gz
```

7. Start VR-TheWorld:

```
docker-compose up -d
```

At this point, you can access VR-TheWorld using its IP address. The default username and password are readymap. Note that the server contains no predefined layers.

Configuration Options for Docker

In the *docker-compose.yml* file, you can pass optional arguments to our docker container to increase your VR-TheWorld performance. These are defined in the optional environment section of the file. Table 2 describes the environment variables.

Table 2. Docker environment variables

Variable	Description
NUM_WORKERS	The number of background workers started for processing general background tasks.
NUM_TILERS	The number of background workers started for seeding map tiles via cache jobs.
NUM_TILE_GENERATORS	The number of background workers started for generating map tiles on demand.
GENERATE_TILES_IN_BACKGROUND_WORKER	Whether to generate tiles on demand in a background process or in the main Apache process. By default, tiles are generated in a background process to avoid bogging down the server during periods of high load. Set this environment variable to False to restore the original behavior of generating tiles in the main Apache process.
USE_LAYER_NAMES	When set to True, VR-TheWorld will expose layers using their name instead of their ID in GIS services. This could make switching between VR-TheWorld servers that have similar layer names easier when configuring earth files.

As a general guideline, you should match NUM_TILE_GENERATORS and NUM_GENERATE_ON_DEMAND_PROCESSES to how you plan to use the server and the number of cores on the system. For example, increasing NUM_TILE_GENERATORS helps if you plan to add and

tile new data and layers. Increasing `NUM_GENERATE_ON_DEMAND_PROCESSES` helps during server runtime if some layers are not fully tiled and have enabled the **Generate tiles on demand** option. The specific number for each should map to the number of cores on your system, and therefore should be different for 8 versus 16 versus 32 cores. Remember to reserve cores for other processes and the server web services.

To set environment variables in *docker-compose.yml*, read the instructions at: <https://docs.docker.com/compose/compose-file/#environment>.

1.2.8 Installing the MAK-Supplied Database

VR-TheWorld does not presume any particular data. You can load your own database or the database supplied by MAK. If you are using MAK ONE applications such as VR-Vantage or VR-Forces, the terrain database files provided with these applications presume use of the MAK database structure and data files.

This section explains how to load the MAK database.

 If you load the MAK database using `readymap_restore`, it removes all of the other previously defined layers from the server. Be sure to back up your existing database if you have made any changes, for example:

```
docker-compose exec readymap readymap_backup /data/backups/vrtw-  
myDB.db (Windows)
```

► To install the MAK database:

1. Change directory to the VR-TheWorld install directory:

```
cd /data/VRTheWorld
```

2. Shut down the docker containers and restart them:

```
docker-compose down  
docker-compose up -d
```

3. Load the database into readymap:

```
docker-compose exec readymap readymap_restore  
/data/backups/vrtw4.db
```

Docker sees this as */data/backups/vrtw4.db* because the default mount location is */data/added*, as configured by the *docker.yml* file. Once the installation process is complete, you can log in to the web interface of VR-TheWorld. The default username and password are admin.

Starting with the March 2024 MAK database, there is a significant change to the data layers provided with VR-TheWorld. VR-TheWorld now supports WebP format raster imagery layers. WebP combines the best of the JPEG and PNG formats, providing lossy or lossless compression and supporting transparency. WebP also produces images that are smaller than both corresponding PNG or JPEG images. The database introduces a new global imagery layer, based on Sentinel-2, which is a WebP layer. Depending on which versions of the MAK ONE products that you need to support, you may want to manage tiling of the global imagery layers to either conserve disk space or pre-tile areas for better performance. See "1.5. Managing VR-TheWorld Global Imagery Layers" on page 20 for more details.

1.3. Installing VR-TheWorld on Windows

This section explains how to install VR-TheWorld on Windows.

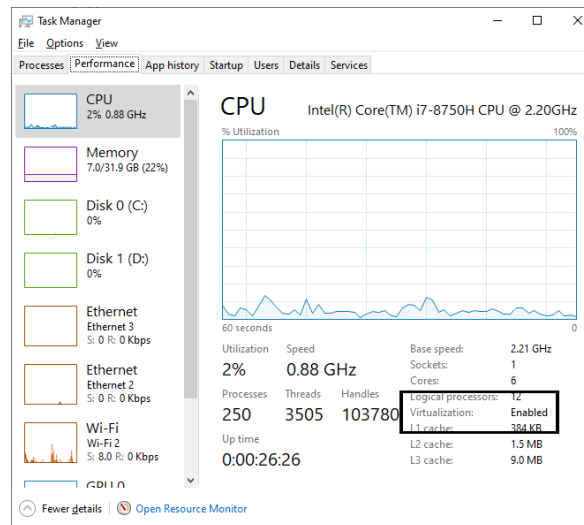
1.3.1 Prerequisites for Using Docker

To use Docker on Windows, you must enable virtualization, WSL2 (Windows Subsystem for Linux version 2), and Hyper-V. These are all capabilities that are built into Windows, but which might not be enabled.

► **To check the status of virtualization:**

1. Open Task Manager.
2. Select the Performance tab.
3. The status of virtualization displays under the graph (Figure 1).

Figure 1. Task Manager, Performance tab



If virtualization is not enabled, you must enable it. Instructions for doing so are readily available using an internet search.

Windows 10

► **To enable Hyper-V and WSL on Windows 10:**

1. Open the Control Panel.
2. Click Programs.
3. Click Turn Windows Features On or Off. The Windows Features window opens.
4. In the list, locate Hyper-V and Windows Subsystem for Linux. Select those check boxes.
5. Click OK.
6. Restart the machine to apply your changes.

Windows 11

► To enable Hyper-V and WSL on Windows 11:

1. Open Settings.
2. Click Apps.
3. Click Optional Features.
4. Click Add a Feature and then locate Hyper-V. Select the check box and then click Install.
5. Click Add a Feature and then locate Windows Subsystem for Linux. Select the check box and then click Install.
6. Restart the machine to apply your changes.

Check for and Install Latest Version of WSL2

► To check the WSL version and ensure that version 2 is enabled or either Windows 10 or 11:

1. As an administrator, run a Command Prompt window (or PowerShell).
2. Type `wsl -v` and then press Enter.
3. When the version is returned, check that it begins with 2.
4. You should also ensure that the latest version of WSL is installed. To install it, type `wsl --update` and then press Enter.

1.3.2 Docker or Podman Desktop Application

For Windows, there are two supporting environments that you can use to run Docker containers: Docker Desktop or Podman Desktop.

As of 2022, Docker Desktop changed from an open-source model to a paid subscription. Commercial use of Docker Desktop at a company of more than 250 employees or more than \$10 million in annual revenue requires a paid subscription. If this applies and you prefer not pay the subscription, use Podman Desktop.

Installing Docker Desktop

► To install Docker Desktop:

1. Download and install Docker Desktop.
2. Follow the instructions at <https://docs.docker.com/desktop/install/windows-install>.

Installing Podman Desktop

► To install Podman Desktop:

1. Download and install Podman Desktop for Windows.
2. Follow the instructions at <https://podman-desktop.io/docs/installation/windows-install>.
3. Once the installation is complete, be sure to set up the Compose Resources.

You can run Podman either under the root user (rootful) or a non-privileged user (rootless). When installed, rootless is the default. However, Docker containers normally function with root privileges. You can switch the machine to rootful by stopping it and using the set command.

► **To switch your machine to rootful:**

1. Open a Command Prompt window.
2. Enter the following commands:

```
podman machine stop
podman machine set --rootful
podman machine start
```

i If you update the components of the Podman Desktop for Windows (for example, you update to a new version in the Desktop GUI), after updating, you must repeat this step and restart the VR-TheWorld Docker container.

1.3.3 Attach the Data Drive and Copy Data

The drive provided by MAK for Windows is in NTFS format.

► **To attach the data drive and copy the data:**

1. Plug the USB cable from the data drive into a USB port on your machine.
2. Open a console window.
3. Enter `diskmgmt.msc`. The screen displays a list of all drives connected to the system.
4. Write down the letter of the data drive provided.
5. In Windows File Explorer, create a directory (folder) called **data** on the target drive. VR-TheWorld uses this directory to store all the files it needs to use.

i If you had a previous installation of VR-TheWorld, be sure to delete all the files in your data drive. If you added your own data, do not delete that data but do delete everything else. Depending on the copy process you use, it may or may not overwrite your data.

6. Copy the data from the source directory to your data directory. The source and tile data contain millions of files, which can cause the copy process to take a very long time.

Be sure the copy process that you use preserves symbolic links. See "Troubleshooting Installation Problems" if you cannot access the OpenStreetMap data using your configurations files.

1.3.4 Configuring Podman to Autostart

If you are using Podman, you must ensure that the VR-TheWorld container automatically starts when Windows boots up.

► **To configure Podman to autostart on Windows boot:**

1. Run the Windows Task Scheduler as a user with Administrator privileges.
2. Create a new task by clicking **Action > Create Task**.
3. In the General tab:
 - a. Enter a Name, such as `Start VR-TheWorld`.
 - b. Enter a description, such as `Start the VR-TheWorld Sever at login`.
 - c. Select the option `Run Whether User Is Logged On or Not`.
 - d. From the `Configure For` list, select the version of your OS (Windows 10 or 11).
4. Select the Triggers tab and then click `New`. The New Trigger dialog box opens.
5. In the New Trigger dialog box:
 - a. From the `Begin the Task` list, select `At Startup`.
 - b. Select the `Delay Task For` check box and then select `1 Minute`.
 - c. Select the `Enabled` check box.
 - d. Click `OK` to add the new trigger and return to the Create Task dialog box.
6. Select the Actions tab and then click `New`. The New Action dialog box opens.
7. In the New Action dialog box:
 - a. From the Action list, select `Start a Program`.
 - b. Click the `Browse` button next to the `Program/Script` box.
 - c. Locate `podman.exe` (for example, `C:/Program Files/RedHat/Podman/podman.exe`) and then click `Open`.
 - d. In the `Add Arguments` box, enter `machine start`.
 - e. Click `OK` to add the new action and return to the Create Task dialog box.
8. In the Actions tab, click `New` to add a second action.
9. In the New Action dialog box:
 - a. From the Action list, select `Start a Program`.
 - b. Click the `Browse` button next to the `Program/Script` box.
 - c. Locate `docker-compose` (or `podman-compose`), select it, and then click `Open`.
 - d. In the `Add Arguments` box, enter `up -d`.
 - e. In the `Start In` box, enter the location of where you copied the VR-TheWorld directory (for example, `D:/VRTheWorld`).
 - f. Click `OK` to add the new action.
10. In the Actions tab, make sure that both actions are listed and also that `podman.exe` is first in the list.
11. Select the Conditions tab and clear all of the `Start` check boxes.
12. Select the Settings tab and:

- a. Select Run Task as Soon as Possible After a Scheduled Start Is Missed
 - b. Select If The Task Fails, Restart Every and then select 1 Minute.
 - c. In the Attempt to Restart Up To box, enter 5.
13. Click OK to add the scheduled task. When you reboot the machine, VR-TheWorld should be accessible as a service without requiring a login.

1.3.5 Configuring WSL2 Networking

By default, WSL uses a NAT (Network Address Translation) based architecture for networking. WSL2 has a virtualized ethernet adapter with its own unique IP address. To connect to the web service running in the Docker container, running as part of WSL2, you must complete the following steps to allow access to VR-TheWorld using the IP address of your Windows PC.

Use the Netsh interface command to add a port proxy that listens on your host port and connects that port proxy to the IP address for the WSL2 VM.

► **To configure WSL2 networking:**

1. As an administrator, run PowerShell or open a Command Prompt window.
2. Enter the following command, where *eth0 IP address* is the address of the ethernet adapter inside WSL2. To get this address, start a terminal for the Linux running inside WSL2 and then type `ifconfig`. The inet address will be displayed with `eth0`.

```
netsh interface portproxy add v4tov4 listenport=80  
listenaddress=0.0.0.0 connectport=80 connectaddress=eth0 IP  
address
```

In this command, the port numbers are both 80. The `listenaddress=0.0.0.0` means that incoming requests will be accepted from any IP address.

You also need to do this for other ports that are used by the server, for example, ports 8080 and 8081, if using the defaults, or the specific port you choose in your `docker-compose.yml` file.

3. You may also need to update your Windows Firewall rules to enable connections to port 80. If you are unable to because of security restrictions, you can use an alternate port, but you must then update the ports definition to `<port#>:80` in your `docker-compose.yml` file and access the server using `<PC nameorIP address>:<port #>/vr-theworld`.

1.3.6 Installing VR-TheWorld

You can pass optional arguments to our docker container to increase your VR-TheWorld performance. These are defined in the optional environment section of the file. Table 2 on page 12 describes the environment variables.

VR-TheWorld requires a post-installation license key. Request a license at <https://www.mak.com/mak-one/support/portal>. Include your contact information, the purchase order for the server, and any relevant program details. You use the license key in step 6.

► **To install VR-TheWorld on Windows:**

1. After you receive your license key from MAK support, open a console window.
2. Change directory to the data drive:

```
cd DATADRIVE:\data\VRTheWorld
```
3. Copy *docker-compose-windows.yml* to *docker-compose.yml*.
4. In a text editor, open *docker-compose.yml*.
5. In the lines under `volumes:`, replace `DATADRIVE` with the drive letter where you installed the data.
6. At the end of the file, there is a line `LICENSE_TEXT=`. Copy the license key text that you received and then paste it to the end of that line.
7. Save the file and close it.
8. In your console window, in `DATADRIVE:/data/VRTheWorld`, execute the following commands:

```
docker load -i postgres_9.5-alpine.tar.gz
docker load -i redis_5.0-alpine.tar.gz
docker load -i maptilergl_5.0.0.tar.gz
docker load -i dozzle_8.7.1.tar.gz
docker load -i vrtheworld_VERSIONOFVRTW.tar.gz
```

where `VERSIONOFVRTW` is the version of VR-TheWorld that you are installing.

9. Start VR-TheWorld:

```
docker-compose up -d
```

 If you use Podman Desktop, use the `podman` command-line option instead, if you have not aliased `docker`. For example:

```
podman load < postgres_9.5-alpine.tar.gz
```

You can now access VR-TheWorld using its IP address. The default username and password are `readymap`.

1.3.7 Installing the MAK-Supplied Database

VR-TheWorld does not presume any particular data. You can load your own database or the database supplied by MAK. If you are using MAK ONE applications such as VR-Vantage or VR-Forces, the terrain database files provided with these applications presume use of the MAK database structure and data files.

This section explains how to load the MAK database.

 If you load the MAK database using `readymap_restore`, it removes all of the other previously defined layers from the server. Be sure to back up your existing database if you have made any changes, for example:

```
docker-compose exec readymap readymap_backup /data/backups/vrtw-myDB.db (Windows)
```

► **To install the MAK database:**

1. Change directory to the VR-TheWorld install directory:

```
cd DATADRIVE:\data\VRTheWorld
```
2. Shut down the docker containers and restart them:

```
docker-compose down  
docker-compose up -d
```
3. Load the MAK database into readymap (this takes 5 to 10 minutes):

```
docker-compose exec readymap readymap_restore  
/data/backups/vrtw4.db
```

Docker sees this as `/data/backups/vrtw4.db` because the default mount location is `DATADRIVE:data/added`, as configured by the `docker.yml` file. Once the installation process is complete, you can log in to the web interface of VR-TheWorld. The default username and password are `admin`.

Starting with the March 2024 MAK database, there is a significant change to the data layers provided with VR-TheWorld. VR-TheWorld now supports WebP format raster imagery layers. WebP combines the best of the JPEG and PNG formats, providing lossy or lossless compression and supporting transparency. WebP also produces images that are smaller than both corresponding PNG or JPEG images. The database introduces a new global imagery layer, based on Sentinel-2, which is a WebP layer. Depending on which versions of the MAK ONE products that you need to support, you may want to manage tiling of the global imagery layers to either conserve disk space or pre-tile areas for better performance. See "1.5. Managing VR-TheWorld Global Imagery Layers" below for more details.

1.4. Connecting to a MAK-Supplied Server

If you have a server that was provided by MAK, VR-TheWorld is configured to use DHCP and it has a static IP address. If your network has dynamic DNS set up, you can connect to the server without further configuration. If you do not have dynamic DNS, you must configure an IP address for the server.



- For web connections, the default user is `admin`. The default password is `admin`. You can change these passwords.
- VR-TheWorld does not work with Internet Explorer. Use Firefox, Chrome, or Edge.

1.5. Managing VR-TheWorld Global Imagery Layers

As of March 2024, VR-TheWorld now includes a new global imagery layer, based on Sentinel-2, which is a WebP format layer. WebP layers are only supported by products part of the MAK ONE 2024 release and later. VR-TheWorld still includes the old layer, although it has also been updated to the Sentinel-2 dataset, but it is in JPEG format and only partially tiled.

The two main imagery layers used by the MAK ONE demonstration scenarios and terrains are:

- Raster Layer 142, which is the WebP layer
- Raster Layer 224, which is the JPEG layer

Layer 224 was the imagery primary layer used in the MAK ONE examples until March 2024, when it was replaced by Layer 142. Both layers are marked as **Generate tiles on demand**, and therefore create tiles for areas that were not previously tiled. However, if you know which layers will be used, you can manage the tiles to conserve disk space or tile your specific areas of interest for improved performance.

Layer 142 is a Collection Layer, comprised of a number of other layers. It is mostly tiled, especially for areas that are heavily used in the MAK ONE examples (for example, Southern California and Hawaii). It is globally tiled to LOD 11.

Layer 224 is also a Collection Layer. It is comprised of the Global EOX Sentinel-2 Cloudless 2020 layer (LODs 0-8) and Layer 142 (LODs 9+), essentially making it a mirror of Layer 142. However, each layer requires its own tiles.

If you use only products that are part of the MAK ONE 2024 release and later:

- You do not need Layer 224. If you want, you can select the layer, go to the Tiles tab, and Delete All Tiles.
- If you have specific areas of interest, you may want to choose Layer 142, zoom to that area, use **Shift**+click, drag to draw a box around the area, and then Generate Area to pre-tile that area.

If you use only products prior to the MAK ONE 2024 release:

- Layer 224 will be your primary imagery layer. If you have specific areas of interest, you may want to choose Layer 224, zoom to that area, use **Shift**+click, drag to draw a box around the area, and then Generate Area to pre-tile that area.
- You must not delete the tiles for Layer 142 because tiling 224 uses 142 to generate tiles for 224.

If you use a combination of products released before and after the MAK ONE 2024 release:

- If you have specific areas of interest, you will likely want to tile that area in both 142 and 224.



2. Using VR-TheWorld

This chapter will help you:

- Connect VR-Vantage to VR-TheWorld
- View Simulated Entities on VR-TheWorld Terrain
- Explore Terrain in the VR-TheWorld Web Interface

2.1. Connect VR-Vantage to VR-TheWorld

The purpose of a terrain server such as VR-TheWorld is to provide high-quality streaming terrain to applications that need it for simulation purposes. That is, the terrain is not only for looking at (imagery) but must provide the elevation data required by applications that are simulating entities on the land, the sea, and in the air. In this part of the guide, we show how easy it is to get terrain data from VR-TheWorld into an application (VR-Vantage).

The procedure in this chapter uses the MAK public version of VR-TheWorld. To use your own server instead, simply change your hosts file to point to your server instead of the MAK public server. To do this on Windows:

1. Log into your computer with administrator privileges.
2. In a text editor, open `C:\windows\system32\drivers\etc\hosts`.
3. Add the following lines to the file:

```
10.10.10.10 www.vr-theworld.com
10.10.10.10 vr-theworld.com
```

where `10.10.10.10` is replaced with the IP address of your server.

2.1.1 Start VR-Vantage and Connect to VR-TheWorld

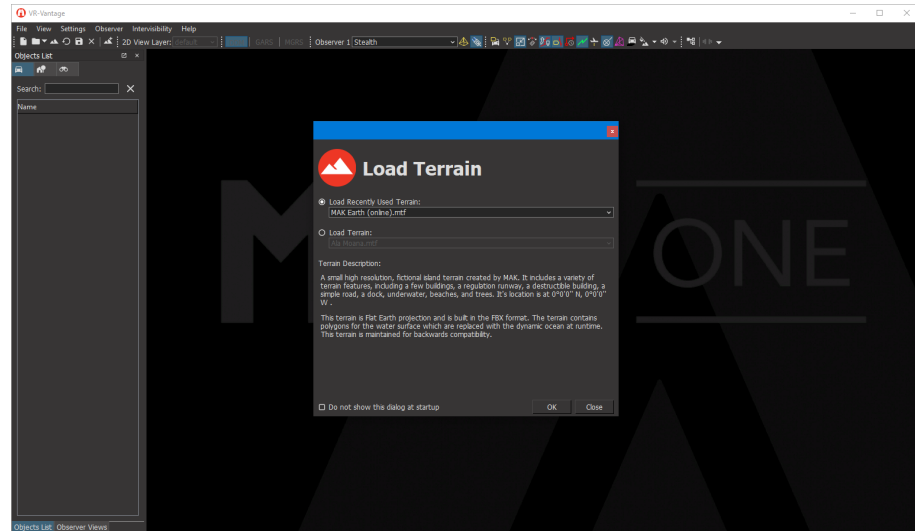
VR-Vantage provides a 3D situational awareness view of the world. VR-Vantage includes a server connection configuration file (an *.earth* file) that is configured to connect to the VR-TheWorld running at VR-TheWorld.com.

► **To start VR-Vantage:**

1. On the Windows Start menu, choose **MAK Technologies > VR-Vantage #.#**. VR-Vantage starts.

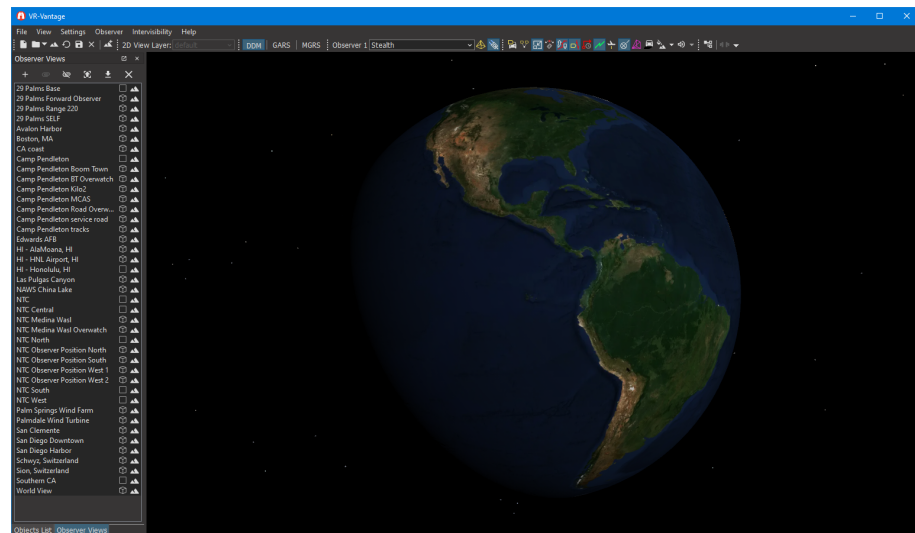
The Load Terrain dialog box opens (Figure 2).

Figure 2. Load Terrain dialog box



2. Click Load Terrain and then locate and select *MAK Earth (online).mtf*.
3. Click OK. VR-Vantage uses the terrain configuration file to connect to the server and immediately starts to stream in terrain data.

Figure 3. MAK Earth (online) terrain



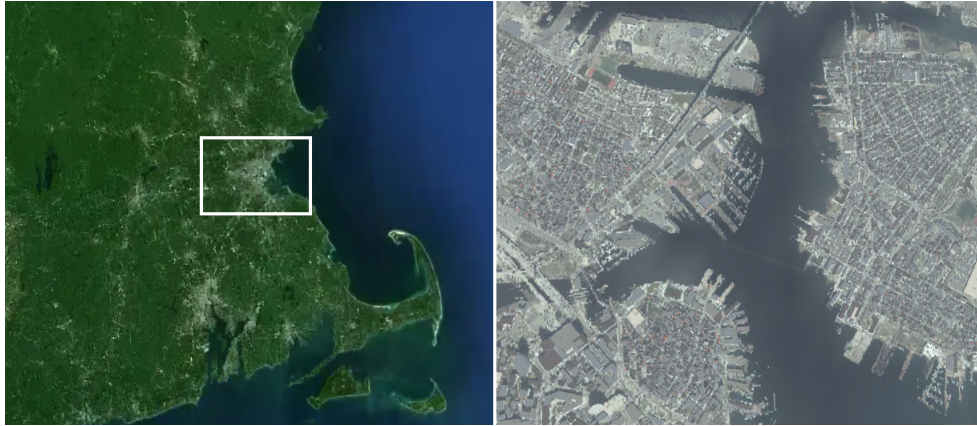
2.2. Navigating the Terrain

When you first connect to VR-TheWorld, the data is streamed in at a low resolution because the observer is high above the earth. Use the mouse and the **Q**, **W**, **E**, **A**, **S**, and **D** keys, or the mouse and its wheel, to rotate the view of the earth and zoom in and out:

- Press the **Q** key to rotate the earth so that North America is centered.
- Press the **W** key to zoom in. Zoom in a little bit at a time. As you zoom in, see how the detail increases as terrain is streamed in.

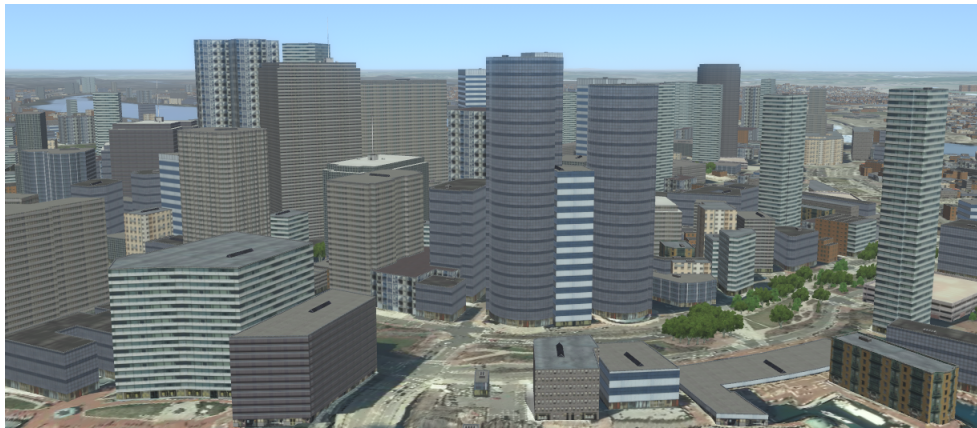
- Use the mouse to drag the terrain so that Boston, Massachusetts is centered in the view. Then zoom in to see the highly detailed inset.

Figure 4. Boston inset



- Hold down the right mouse button and move the mouse to change the orientation. Then press the **E** key to move the eyepoint down towards the ground. The terrain is populated with geotypical buildings on the footprints of the buildings in the city (Figure 5).

Figure 5. Geotypical buildings



VR-TheWorld has footprint data for many cities and can procedurally generate buildings using those footprints. Continue to explore the terrain until you are ready to move to the next exercise in this guide.

2.3. View Simulated Entities on VR-TheWorld Terrain

So far, we have demonstrated VR-TheWorld in a world without any simulated entities. Now we will show how you can use VR-TheWorld to provide terrain under distributed simulation scenarios. To do this, we need to connect to the DIS network, start the Logger, and play a Logger recording.

❗ If for some reason you decided not to install the Logger, please skip this section. However, if you have a simulation application that you can use to generate entity messages, you can use it to evaluate how you can view entities on VR-TheWorld terrain.

The default connection for the Logger and the DIS (7) connection for VR-Vantage use port 3000. If you have changed the default port for one or both of these applications, you must change them to make sure they match.

You must also make sure that the exercise IDs match.

2.3.1 Connect to a Simulation Network

1. In VR-Vantage, choose **Settings > Connection**. The Simulation Connections dialog box opens.
2. In the list of connections, select DIS (7).
3. Click Connect.

2.3.2 Start the Logger and Play a Simulation

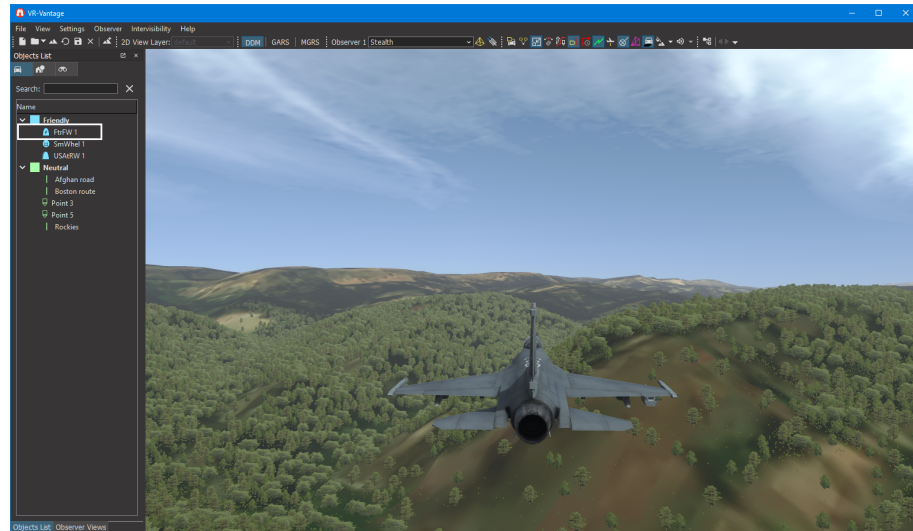
1. On the Start menu, choose **MAK Technologies > Logger #.#.# DIS**. The Logger starts.
2. Choose **File > Open**. The Open File dialog box opens.
3. Select *VR-TheWorld_FirstExperienceDIS.lgr*.
4. Click Open.
5. Choose **Play > Toggle Loop at End**. This causes the recording to continuously loop back to the beginning when it reaches the end.
6. Choose **Play > Play/Pause**, or click the Play button.

2.3.3 View the Entities

The scenario you are viewing has three entities: a jet flying over the Rocky Mountains, a helicopter flying over an inset of Boston, Massachusetts, USA, and a truck driving on a road in Afghanistan.

1. In the Objects List Panel at the left of the VR-Vantage window, right-click FtrFW 1 and choose **Observer Attach > Attach Follow**. VR-Vantage displays a fighter flying through the Rocky Mountains as terrain streams in from VR-TheWorld underneath. Notice how the server is providing both imagery and elevation.

Figure 6. Fighter jet over the Rocky Mountains



2. In the Objects List Panel, right-click USAtRW 1 and choose **Observer Attach > Attach Follow**. The observer is now attached to a helicopter flying over the Boston inset. (It may take a few seconds for VR-Vantage to stream in the highest resolution imagery from the server.)

VR-TheWorld comes with 10 m imagery for the entire earth. However, as with this Boston inset, it can support very high-resolution data as well. We have provided a few free, high-resolution insets to demonstrate this capability. When you deploy VR-TheWorld, you can add as much data as you would like, based on the needs of your application.

You might want to press the **W** key to zoom out a little for a better view of the inset. Press **Spacebar** to return to the default view of the entity.

3. In the Objects List Panel, right-click SmWhel 1 and choose **Observer Attach > Attach Follow**. This entity is a HMMVW driving along a road in Afghanistan. (Again, it may take 30 seconds or so for terrain to stream in at the highest level of resolution. Until then, the HMMVW may appear to be in the air.)

The application that we used to generate this recording, VR-Forces, used the VR-TheWorld streaming terrain in its simulation engine. Since the terrain used to simulate the entities and the terrain you are using to visualize them is the same, as you watch the HMMVW drive in VR-Vantage, you can see that it maintains its proper relationship to the terrain. VR-TheWorld can provide perfectly correlated streaming terrain to a variety of simulation and visualization applications.

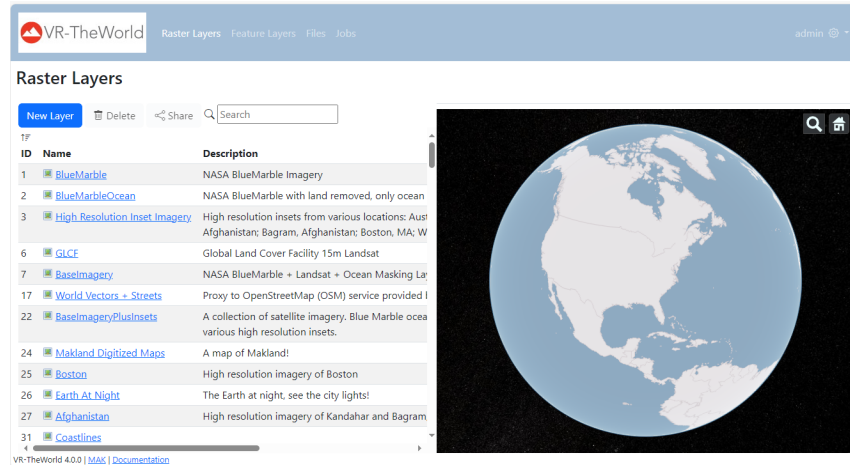
2.4. Explore Terrain in the VR-TheWorld Web Interface

Up to now we have been viewing the data set specified in a connection configuration file included with VR-Vantage. Suppose you want to know what else is available on your server? You can open the VR-TheWorld web interface and explore the maps and layers on the server.

i You must have access to a local server for this part of the first experience.

- To open the web interface, connect to your local server as described in "1.4. Connecting to a MAK-Supplied Server" on page 20. The browser displays the interface.

Figure 7. VR-TheWorld web interface



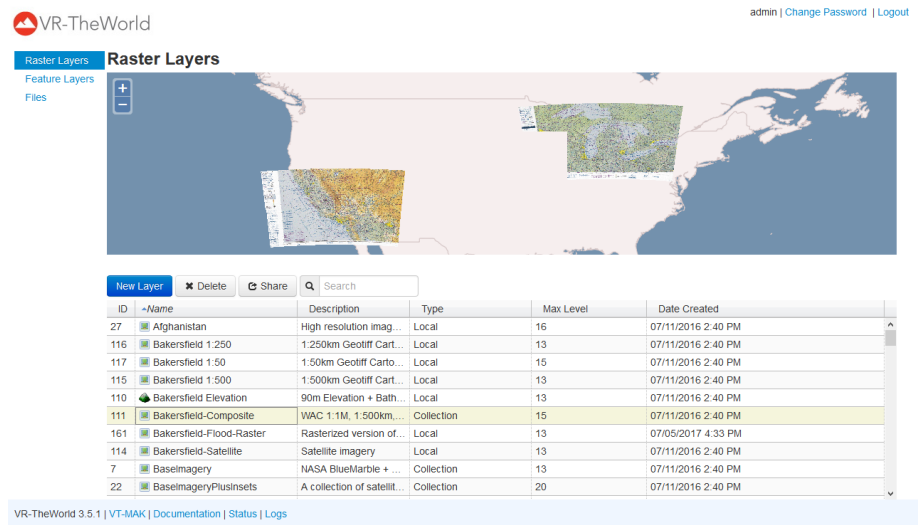
2.4.1 Explore a Layer

VR-TheWorld's data sets are organized in layers. Layers are composed of files. The VR-TheWorld web interface lets you view the individual layers and their characteristics. Most importantly, it provides URLs that allow you to connect your application to the terrain server.

(Creating and editing your own layers is an administrative task, which is not covered in this guide.)

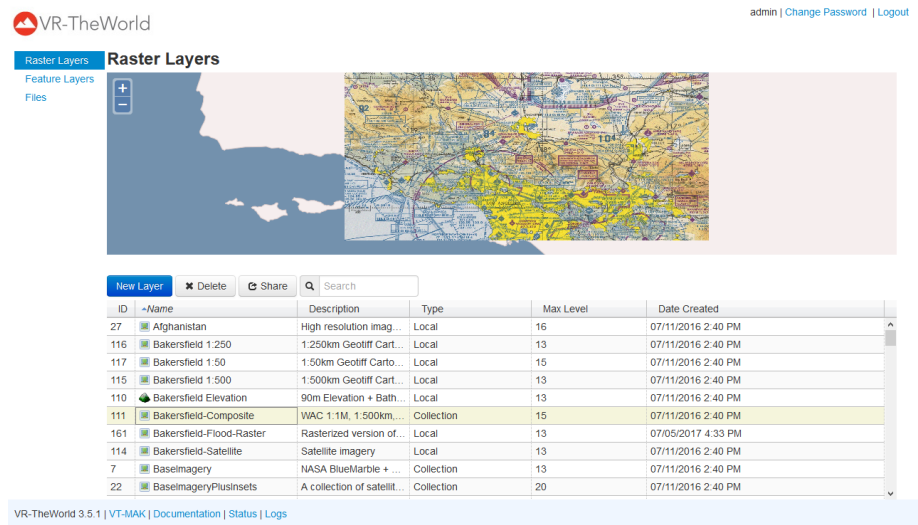
1. The default view is the list of raster layers
2. In the list, select the Bakersfield-Composite layer. A map is displayed. Note the topographic map in the southwestern United States.

Figure 8. Bakersfield composite layer



3. Zoom in on the west coast of the United States. As you zoom in, the map becomes more detailed. VR-TheWorld is actually providing different maps with increasing detail, based on the zoom level in your web client.

Figure 9. San Diego layer





3. Installing VR-Vantage and MAK Data Logger

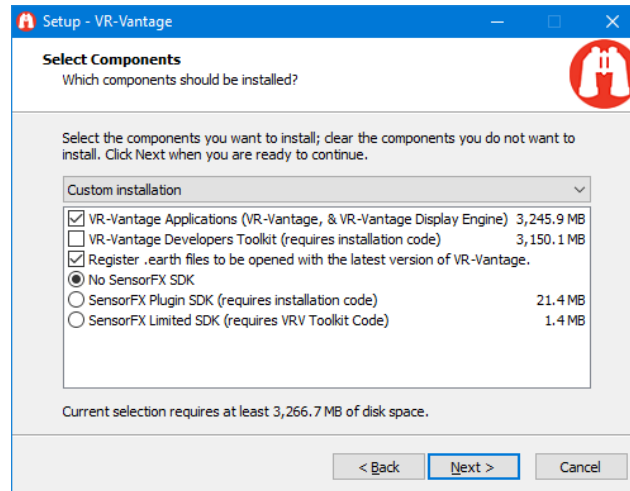
To evaluate VR-TheWorld Sever, you need an application that can connect to the server and use the streaming data. Ideally you should also have an application that can generate entity data to visualize. For that purpose, MAK has provided an evaluation license for VR-Vantage, our 3D viewing application, and MAK Data Logger, to send some entity traffic over the network. This chapter provides installation and setup instructions for these applications.

3.1. Install VR-Vantage and the Logger

Your MAK salesperson has given you a link to the VR-Vantage and Logger installers, the license manager installer, and possibly a sample Logger file to support your first user experience. Download the files. Before you install the applications, note the following possible issues:

- When you install VR-Vantage, there may be a delay of up to several minutes from the time you try to run the setup program to the time that an installation dialog box is displayed. If you experience this problem, turning off User Access Control can reduce or eliminate this delay.
 - These instructions assume you are familiar with installing Windows applications that use a wizard-style installer. They also assume that you have an unzipping application and know how to use it.
- To install VR-Vantage, run the installer. On the VR-Vantage Installation Code page, click Skip Toolkit Installation.

Figure 10. VR-Vantage setup wizard



- Run the MAK Data Logger installer. Accept all of the default settings.

3.2. Setting Up the License Manager

To use a MAK product, you must install the MAK License Manager and get a license for your product. Before you can use a MAK product, you must obtain a valid license file and specify the license server.

- To install the MAK License Manager, run the installer.

The general procedure for configuring license management is as follows:

1. Identify the name and ID of the license server and request a license file.
2. Put the license file in the *MAK/MAKLicenseManager* directory on the license server.

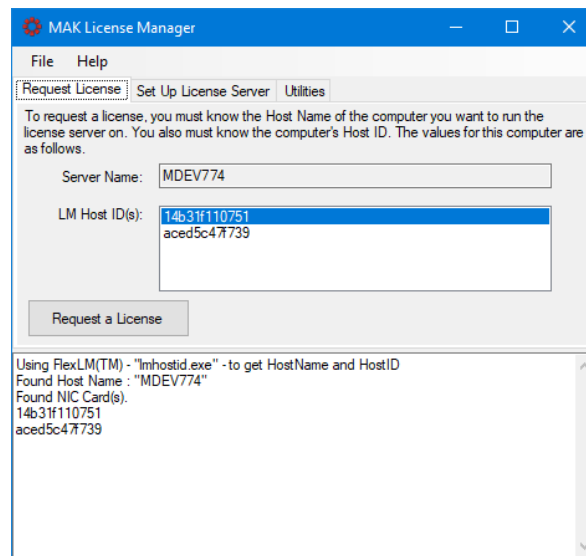
3. Run the license server.
4. Specify the license server location.

3.2.1 Identify the Host ID and License Server Name

For simplicity, use the computer on which you installed VR-TheWorld as the license server. To find out the host ID and license server name:

1. On the Start menu, choose **MAK Technologies > MAK License Manager**. The MAK License Manager utility opens.

Figure 11. License Manager



2. Select the Request License tab. It displays the server name and the IDs for your network cards.
3. If you have more than one network card, select the one that you want to use as Host ID.
4. Send the host ID and hostname to your MAK salesperson. MAK will e-mail you a license file.

3.2.2 Put the License File in the *MAKLicenseManager* Directory

When you receive your license file, put it in the *MAKLicenseManager* directory on the license server. The file should have the extension *.lic*. If it does not, please send an email to keys@mak.com to clarify why it did not follow this convention.

3.2.3 Run the License Server

- To start the license server daemon, on the server machine only, execute **runLm** from the *MAKLicenseManager* directory.

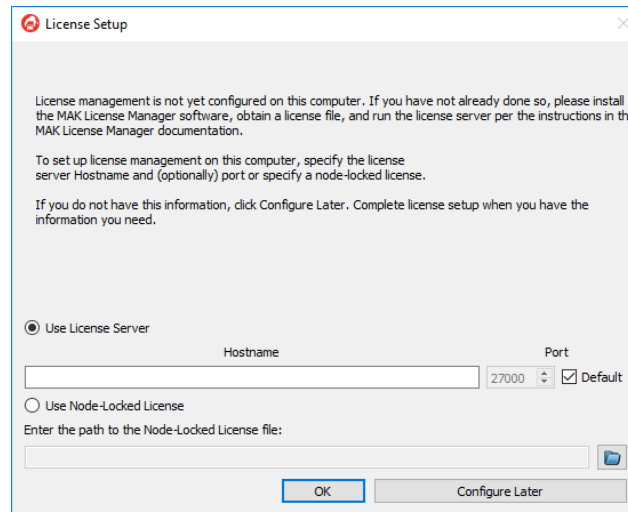
Shutting Down the License Server

- To force all applications to check in their licenses and shut down the license server daemon, run **lmdown**.

3.2.4 Specify the License Server

The first time you run a MAK application on a computer, the License Setup dialog box opens. It prompts you to enter the hostname of the license server and optionally, a port number.

Figure 12. License Setup dialog box



1. Type the hostname in the Hostname box.
2. Click Add License Server. The application will start.



VRW-4.6-3-241030