developed by
the R&D department
of
Animationsinstitut at Filmakademie Baden-Württemberg

Contents

VPET - Virtual Production Editing Tool

Congratulations on employing VPET - an unique, holistic toolset for real-time on-set light, asset and animation editing developed by the R&D-Department of the Animationsinstitut at Filmakademie Baden-Württemberg.

VPET is a tablet based onset editing application to work within a virtual production environment. It is designed to run on mobile and head mounted devices, allowing easy access to operators without dedicated training. Additionally, it is designed to be easily set-up and modified by your technical director, simplifying smooth cooperation and quick exchange for all parties on-set.

This guide will enable you to unlock the full creative potential within the combination of VPET and your mobile device.

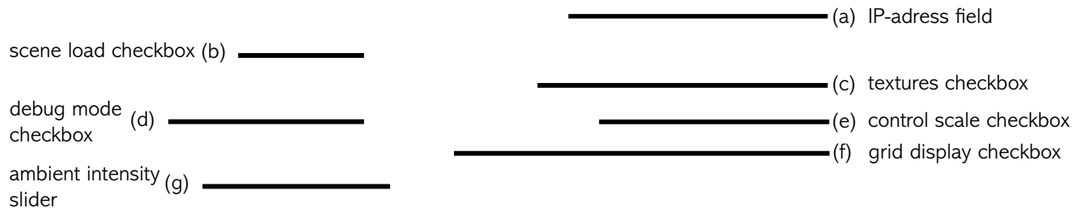
1. User's Guide

1.1.Starting VPET using your mobile device

In this chapter, you will learn how to launch VPET on your device and connect it to the distribution server.

1. Consult your IT-support to check if VPET is installed on your mobile device.
2. If it is, just tap the "VPET" icon on your screen once.

3. The configuration menu will appear full-screen.



The IP-adress in textfield (a) should be predefined by your IT-support.
If you can't connect to the server, check troubleshooting (chapter 1.7.)

Checkbox (b) allows the loading of a precached scene. Unless instructed otherwise, uncheck it.

Checkbox (c) toggles textures. High resolution textures may lead to slower performance on some mobile devices.

Checkbox (d) loads the scene in debug mode. Consult with your IT-support before checking this option.

Checkbox (e) decreases the measurement units. This increases control accuracy in small-scaled virtual scenes.

Checkbox (f) overlays your virtual scene with a grid.

Slider (g) increases or decreases ambient light intensity of your scene, allowing for improved overall view for darker virtual scenes.

4.Once all options are set, tap LOAD once.

VPET connects to the Distribution Server and loads the scene.

1.2. Starting VPET using your AR - mobile device

Some AR-equipped mobile devices of the iOS- and Google Tango product lines allow for inside-out tracking, enhancing the control cababilities of the user. While the configuration menu remains largely the same as in chapter 1.1.,

1. Consult your IT-support to check if an AR-enabled VPET-build is installed on your mobile device.

2. If it is, just tap the “VPET” icon on your screen once.

3.The configuration menu will appear full-screen.

(g) AR - toggle

(h) AR positional sensitivity slider

All other options remain unchanged from the standard configuration menu as described in chapter 1.1.

Checkbox (g) toggles positional control by AR on or off. By default, AR is inactive.

Slider (h) allows scaling the sensitivity of AR-positioning (relational scale of user’s movements)

4.Once all options are set, tap LOAD once.

VPET connects to the Distribution Server and loads the scene.

1.3. The viewport

In this chapter, you will learn about the viewport and the first basic options for on-set editing.

This is the basic VPET view with the precached “farm scene” already loaded.

This symbol denotes a light source within your scene.

This icon opens up the options dialog and contains most of your tools within VPET.

(a) radial toolset

(b) value controller

(c) selected lightsource

(d) selected movable asset

In this image, a light source (c) has already been selected. Whenever an asset is selected, the available tools will be displayed in the center of the screen in a radial pattern (a).

Parameters of various assets may be adjusted by the value controller (b)

Selected light sources will be displayed within a translucent light volume. (c)

Selecting a movable asset will display a yellow outlining (d).

Tapping this symbol toggles the VPET tracking on or off, as explained in 1.4.3.

Tapping this symbol takes you to the configuration menu, as explained in chapters 1.1. and 1.2.. Use this if you are instruced to change your settings.

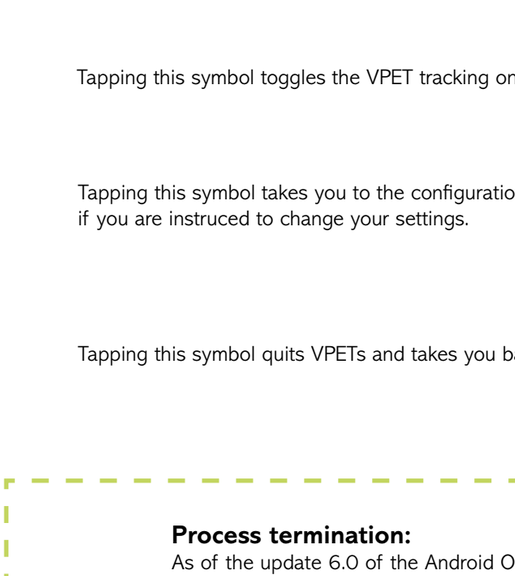
Tapping this symbol quits VPETs and takes you back to the main screen of your mobile device.

Process termination:
As of the update 6.0 of the Android OS and iOS in general, apps are not authorized to shut themselves down. The VPET app will continue running as a suspended background process.

1.4. Touch Screen Controls

1.4.1. Three-dimensional camera movement controls

In this chapter, you will learn how to control the virtual camera within your VPET scene on your mobile device. While we presume that you are familiar with mobile devices, the multitude of features of VPET calls for some particular control methods, which are nevertheless easy to master.



1. Touch the fingertips of both index- and middle finger to the interface of your mobile device.

2. With both fingertips touching the glass, move your fingers up / down / left / right.

3. This allows you to move up (pedestal up) / down (pedestal down) / or move laterally left (truck left) / right (truck right).

Once you are familiar with the two-digit movement controls, move to the next step.

4. Touch the fingertips of index- and middle and ring finger to the interface of your mobile device.

5. With all three fingertips touching the glass, move your fingers up / down.

6. This allows you to move forward (dolly in) / backward (dolly out.

You are now able to move three-dimensionally through your VPET scene.

1.4.2. Optional joystick movement controls

Some mobile devices can be equipped with additional controllers, i.e. the gamevice product range for iOS devices. If available, analogue thumbsticks offer smooth and fast control of your virtual camera within VPET.

Most commercially availabe controllers offer one or more joysticks / thumbsticks (configuration may deviate from above figure) - usually, the right thumbstick will be configured for controlling the horizontal virtual camera movement.

The secondary joystick controls vertical virtual camera movement. Manual virtual camera control as described in chapter 1.4.1 remain unchanged and may be used for accurate control.

Primary Joystick (c)	
Up	Dolly in
Down	Dolly Out
Left	Truck Left
Right	Truck Right

Secondary Joystick (f)	
Up	Pedestal Up
Down	Pedestal Down

1.4.3. View controls.

In this chapter, you will learn how to control your camera view within your VPET scene. VPET utilizes the rotational tracking in your mobile device for view control. Rotating your tablet allows you to rotate the virtual camera.

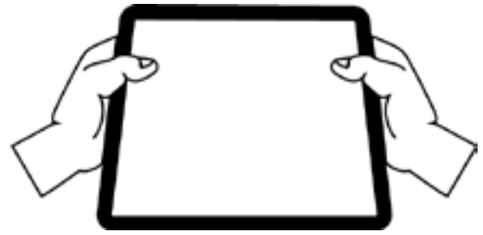
1. Take your tablet firmly in both hands.

2.Turn your tablet left or right. The virtual camera in your scene will follow your tablet's movement.

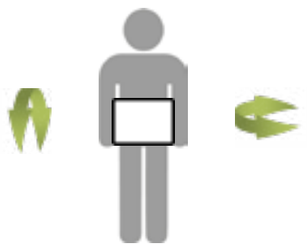
3.This allows you to turn the virtual camera left (pan left) / and right (pan right).

Once you are familiar with the panning camera movement controls, move to the next step.

4.Tilt your tablet down / up. The virtual camera in your scene will follow your tablet's movement.



5.This allows you to tilt the virtual camera up (tilt up) and down.



You are now able to control your virtual camera in your VPET-scene.

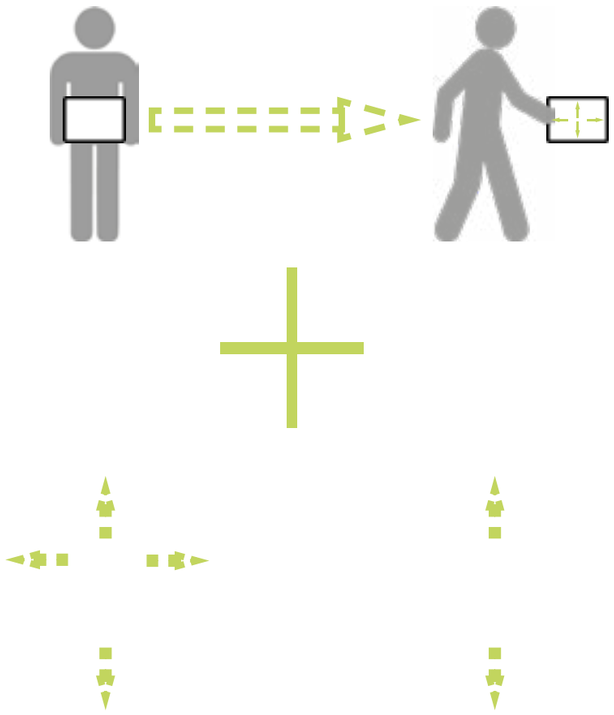
1.4.4. Positional controls

Technical innovation led to several mobile devices with inside-out tracking. VPET fully utilizes this feature to enhance the user experience with exceptionally natural and accurate movement controls. At the time of writing those products encompass devices using Tango AR or operating on Apple iOS, starting with the iPhone 6s (based on the A9 CPU). If these are available, a build with positional tracking enabled should be installed on your mobile device.

Watch your surroundings:
Remain aware of moving through a movie set.
Negligence may lead to material or even personal damage.
Do not keep eyes on screen while moving.

While the view controls remain the same as described as in chapter 1.4.3.., the positional control gains authenticity when compared to the three-dimensional movement controls as described in chapter 1.4.1.

After extensive testing, we concluded that a combination of three-dimensional movement controls and positional tracking provide the user with the most intuitive and effective method of control.



1.4.5. Icons

Icons within VPET work by the common single-tap method like most mobile apps.
Special mechanics regarding icons will be explained in the chapter below.

Icon Swapping:
VPET aims for a maximum of clarity and usability in your mobile interface. To condense as many features as possible within the smallest possible space, VPET regularly swaps icons. We will notify you within this guide whenever an icon swap occurs. An example of said notification is shown below.

Greying out icons:
Some icons will be replaced with a greyed-out version of themselves when tapped.
In most cases, this means the icon is "active" and the icons of the corresponding options are displayed.

Greyed out swap:
Some icons will be replaced with a greyed-out version of another icon.
Normally, this icon has a separate function which will be explained accordingly in this guide. An example of the corresponding notification is shown below.

1.5. VPET Tools

1.5.1. View tools

This chapter will give a brief overview of the predefined camera view functions in VPET

1.Tap the Menu - icon once.

2.The upper menu bar will be displayed.

3.Tap the View - button once.

4.The “general toolset” menu bar will be displayed at the bottom of the screen

You are now able to utilize the preset camera positions. Refer to the table below for specific information regarding the icons.

	Tapping the snapshot icon calls up your defined virtual camera positions, as explained in chapter 1.5.7. This feature is not yet active.		Tapping the Camera Left - icon brings you in a predefined horizontal ortographic view of the scene.
	Tapping the Camera Top - icon brings you in a predefined top-down ortographic view of the scene.		Tapping the Camera Bottom - icon brings you in a predefined bottom-up ortographic view of the scene.
	Tapping the Camera Front - icon brings you in a predefined horizontal ortographic view of the scene.		If available, tapping the NCAM - icon allows you to connect / disconnect to the NCAM realtime camera tracking system.
	Tapping the Camera Right - icon brings you in a predefined horizontal ortographic view of the scene.		Tapping the Perspective - icon cycles through a set of predefined cameras.

1.5.2. Geometry toolsets

The real-time modification of assets is the heart and centre of VPET.
In this chapter, you will learn how to handle and modify your scene’s assets with the VPET toolset.
The applications starts in Toolset - mode by default.

When the Edit - icon is displayed in the upper menu bar, Toolset - mode is active (a).

1. Select a geometrical asset by tapping on it once. For demonstration purposes, we selected the farmhouse on the left, as indicated by the yellow outline (b).

(a) Edit icon

(c) radial asset toolset icons

(b) selected geometry

2.Once an asset has been selected, the radial asset toolset icons (c) are displayed.

	Tapping the Translation - icon enables you to move the selected geometrical asset along the X-/Y-/Z-Axis (see this section).		Tapping the Gravity - icon enables you to engage or disengage the scene’s virtual gravitational forces. (gravity is active by default).
	Tapping the Rotation - icon enables you to rotate the selected geometrical asset along the X-/Y-/Z-Axis (see this section).		
	Tapping the Scale - icon enables you to scale the selected geometrical asset up and down along the X-/Y-/Z-Axis (see this section).		
	Tapping the Reset - icon resets the selected geometrical asset to its default state.		

1. Tap the Translation Icon once.

(a) colored axes

(b) value controller

(c) axes icons

Analogue controls:
If the axes are displayed, VPET controls are modeled for flexibility - either tap and scroll the colored axes (a), or choose the corresponding Axis icon (c) and utilize the value controller (b). Corresponding symbols are explained in the table below.

2. Tap and hold either an axis(a) or single-tap the corresponding axis-icon (c).

3. Depending on your choice, scroll along the axis, or scroll the value controller (b) up / down.

You are now able to move your geometries along the three dimensional axes.

	Tapping the “X” - icon enables you to move the selected asset along the X-Axis. Corresponding axis color is		Tapping the “point to floor” - icon allows you to move the selected asset automatically to a user-specified (single-tap) point at the scene’s floor.
	Tapping the “Y” - icon enables you to move the selected asset along the Y-Axis. Corresponding axis color is		Tapping and holding the YZ - translation plane allows you to move the selected asset along the Y- and Z- axes synchroneously.
	Tapping the “Z” - icon enables you to move the selected asset along the Z-Axis. Corresponding axis color is		Tapping and holding the XZ - translation plane allows you to move the selected asset along the X- and Z- axes synchroneously.
	Tapping the “attach to camera” - icon moves the selected asset according to your mobile devices view tracking (see section 1.4.3.)		Tapping and holding the XY - translation plane allows you to move the selected asset along the X- and Y- axes synchroneously.

1. Tap the greyed Translation Icon once. This takes you back to the radial asset toolset icons.

2. Tap the Rotation Icon once.

3. Tap and hold either an axis or single-tap the corresponding axis-icon.

4. Depending on your choice, scroll the axis along its curvature, or scroll the value controller (b) up / down.

You are now able to rotate your geometrical assets around the three dimensional axes.

	Tapping the “X” - icon enables you to rotate the selected geometrical asset round the Y-Axis. Corresponding axis color is	
	Tapping the “Y” - icon enables you to rotate the selected geometrical asset round the Y-Axis. Corresponding axis color is	
	Tapping the “Z” - icon enables you to rotate the selected geometrical asset round the Z-Axis. Corresponding axis color is	

1. Tap the greyed Rotation Icon once.  This takes you back to the radial asset toolset icons.

2.Tap the Scale Icon once.

3.Tap and hold either an axis or single-tap the corresponding axis-icon.

4. Depending on your choice, scroll along the axis, or scroll the value controller (b) up / down.

 You are now able to transform your geometrical assets around the three dimensional axes.

	Tapping the X - icon enables you to scale the selected geometrical asset up and down along the X-axis. Corresponding axis color is	**Uniform scale:** The scale - toolset offers the additional option of scaling assets up or down at the same rate in all three dimensions. To do so, tap and hold the yellow-colored cube at the center of the three axles, then push or pull to scale up or scale down, respectively. Corresponding cube color is
	Tapping the Y - icon enables you to scale the selected geometrical asset up and down along the Y-axis. Corresponding axis color is	
	Tapping the Z - icon enables you to scale the selected geometrical asset up and down along the Z-axis. Corresponding axis color is	

1.5.3. Virtual camera toolsets

In this chapter, you will learn how to handle and modify your scene's virtual camera assets.

The translucent camera denotes a Virtual Camera asset. Virtual Cameras and their respective positions are predefined in your scene, as described in chapter 1.5.1. - you may cycle through available virtual cameras by tapping

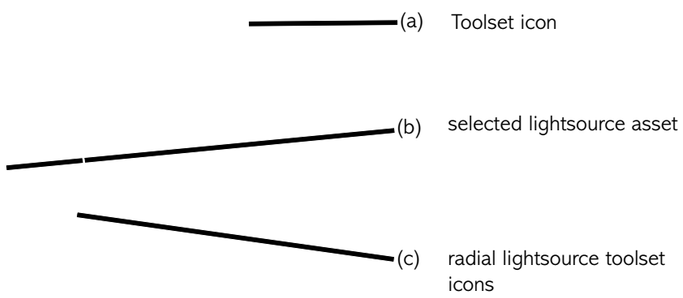
The available tools are completely the same as those of the VPET geometry toolset (chapter 1.5.3) - enabling you to move and turn the camera in three dimensions.

1.5.4. Lightsource toolsets

In this chapter, you will learn how to handle and modify your scene's lightsource assets with the VPET toolset. The applications starts in "Edit" - mode by default.

When the edit icon is displayed in the upper menu bar, edit - mode is active (a).

1. Select a lightsource asset by tapping on it once. For demonstration purposes, we selected the lantern in the middle, as indicated by the translucent sphere (b)



Reuse of icons:
For ease of handling, graphical user interface icons will be reused as often as possible in VPET. The translation, rotation, and reset - icons in the radial lightsource tools look and work the same as in the radial geometry asset tools (see section 1.5.2.). All other icons will be described below.

2.tap once on a lightsource icon.

3.Once an asset has been selected, the radial lightsource toolset icons are displayed.

4.Tap the Palette Icon once.

5.To the right, the light colour palette will be displayed. Tap or scroll to the color of choice.

You are now able to change your lightsource asset's color.

1. Tap once on a lightsource icon.

2. Once an asset has been selected, the radial lightsource toolset icons are displayed.

3. Tap the light settings icon once.

4. The corresponding submenu will be displayed at the left side of the screen, as shown below. Light setting can only be modified by using the value controller.

	Tapping the light intensity - icon enables you to change the lightsources intensity by scrolling the value controller up / down.
	Tapping the light range - icon enables you to change the range of your lightsource by scrolling the value controller up / down.
	Tapping the light cone angle - icon enables you to change the angle of a spotlight source by scrolling the value controller up / down. This works exclusively for spotlight assets.

You are now able to change your lightsources' settings.

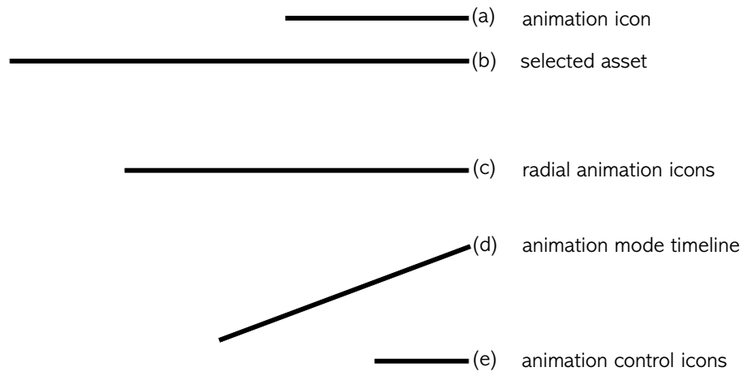
1.5.5. Animation tools

1.5.5.1. The animation toolset

In this chapter, you will learn how utilize VPETs animation controls. VPET enables you to conveniently realize your vision by using an automated keyframe system in an easy-to-use playback tool. Additionally, you are enabled to synchronize up to three animation commandes via the numbered layers.

Tap once on the toolset - icon in the upper menu bar. It is swapped with the animation icon.

The radial toolset menus are automatically switched for their animation counterparts.
New components within the user interface are explained below.



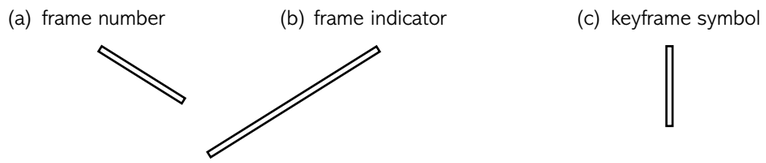
Reuse of icons:
As mentioned in section 1.5.6., several icons that are in use in the asset toolset will return within the animation subset. Translation-, rotation-, and scale icons funtionalities remain unchanged. **Note:** animation mode currently only allows translation, rotation and scaling of lightsource assets.

	The add layer - icon enables you to assign an animated asset to a numbered layer, as shown in the row below.		The cancel animation - icon enables you to delete all keyframes in the animation timeline.
	The numbered layer - icon enables you to set/recall a previously defined animation timeline. There are three numbered cues available.		

	Tapping the previous keyframe - icon brings you to the last previous defined keyframe in the timeline.		Tapping the play - icon allows you to start the currently active animation timeline. Once active, the icon is swapped with the pause - Icon.
	Tapping the next keyframe - icon brings you to the next defined keyframe in the timeline.		Tapping the layer - icon allows you to call up one of the three numbered animation timelines.

The play - icon will be automatically swapped for the pause icon, as shown above. The pause icon allows you to stop the running animation.

The timeline is the central operating element within the animation toolset. As demonstrated below, the measurement scale in use are frames (0-100).



1.5.5.2. Using the animation toolset

This chapter demonstrates step by step how to create a working animation in VPET, from start to finish.
Ease of use in regard to automated keyframes, animation qeueing and playback are the key features of VPET and offer a unique advantage to the creative process on-set.

For demonstration purposes, we will move the selected rocket (b) to the middle of the scene and back, while simultaneously scaling the rocket, then down.

1.Tap the menu icon once.

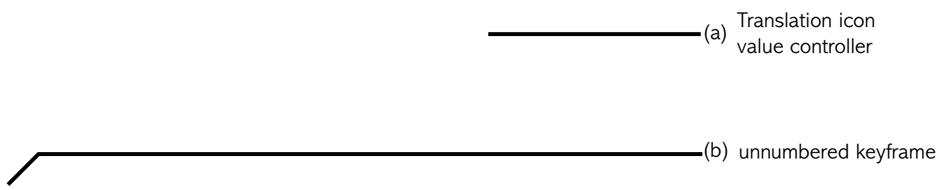
2.Tap the edit icon once.

You are now working within the animation toolset, as indicated by the animation icon in the upper menu bar. Additionally, the timeline is displayed at the bottom of your screen.

3. Select the geometrical asset “rocket”. Your screen should now look approximately like this.

Keyframes:
in the context of animation and filmmaking a keyframe is defined as the starting and ending points of any smooth transition. If you want to animate any asset, it is especially crucial to define the starting keyframe for the animation to take effect. Each animation layer within VPET allows up to a 100 keyframes.

12.Tap the translation icon once

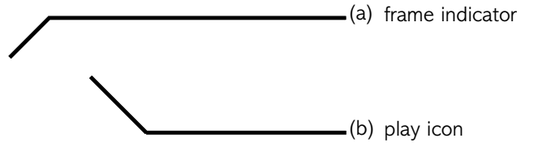


13. Tap the center translation icon of the value controller (shown to the right) once.

Step 7 defines your first (starting) keyframe. If you followed this guide correctly this far, your timeline should look like this.

14. Tap once on the frame indicator and scroll it to frame number 100.

15. Use either the Y-axis icon and the value controller, or scroll the axis to move the selected asset (“rocket”) upwards.
The keyframe is generated automatically (c).

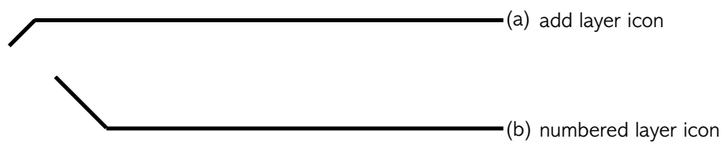


16.Tap the play icon (c) once.
The animation plays in a loop, moving your selected asset (“rocket”) to your defined positions.

1.5.5.3. Creating layered animations

VPET allows you to create single, dedicated animation processes for one or several assets, which can be replayed on command by using numbered layers. The following chapter will demonstrate how to create layered animations and continues from the instructions in chapter 1.5.5.2.

1.Tap the greyed-out play icon once. This takes you back to the radial animation toolset icons.



2.Tap the add layer icon (a) once.

3.Tap the numbered layer - icon 1 (b) once.

This assigns your currently selected asset's animation to the "1" layer. Whatever modifications you carry out, they can be called up by tapping the corresponding numbered layer.

4. To replay your numbered layer, tap the layer icon (a).

5. Next, tap the numbered layer 1 icon, then the play icon.

6. Your numbered layer - animation will play once, as often as it is called up by tapping.

If you are unsure of your results so far, just delete the current animation keyframes by tapping the Cancel - Animation Icon and start over.

You are now able to provide an animation with keyframes and add numbered layers.

1.5.6. Camera Tools

In this chapter, you will learn how to utilize VPETs virtual camera controls.

Tap once on the Animation Icon in the upper menu bar. It is swapped with the Camera Icon.

The camera toolset menu bar will be displayed at the bottom of the screen

	Tapping the focal length icon allows you to change the focal length by scrolling the value controller.		The snapshot icon allows you to capture specific camera positions, which can be called up in the view tool menubar (see chapter 1.5.1.) This feature is not yet active.
	Tapping the sensor size icon allows you to adjust the camera sensor size values, creating an exact simulation of the camera in use on-set. This feature is not yet active.		Tapping the Point to Floor - icon allows you to move the active camera automatically to a user-specified (single-tap) point at the scene's floor.
	Tapping the camera parameters icon allows you to adjust additional values, creating an exact simulation of the camera in use on-set. This feature is not yet active.		
	Tapping the recording icon saves your cameras movement, allowing you to replay tracking shots. This feature is not yet active.		

Camera Tools:
Several of the Camera Tools have yet to be fully implemented.

1.6. VPET Menu Tree overview

1.7. Troubleshooting

Being an open-source software in ongoing development, VPET may show some unexpected behaviour. While the developers and community strive to eliminate those, this chapter should enable you to work around the currently known technical hangups.

Operating System / VPET build	Problem	Solution
Android + Tango iOS + ARKit	Loss of AR-positional tracking	AR - positioning depends strongly on your camera tracking structured surfaces. Avoid featureless, plain textured surfaces when tracking your position via AR.
Android / Tango iOS / ARKit	Occasional disappearance of radial menus in animation mode	restart VPET
Android / Tango iOS / ARKit	unresponsive animation controls	Reset objects animation status and/or transformation.
Desktop Android / Tango iOS / ARKit	outdated animation keyframes get reloaded upon restarting VPET.	Manually delete all numbered / unnummbered animation cues, reset geometrical / lightsource assets
Desktop Android / Tango iOS / ARKit	On connecting VPET to the distribution server, loading stops at 10%.	Check distribution server. Check IP - configuration on client, alternatively check general network configuration.
Desktop Android / Tango iOS / ARKit	Scene changes are not synchronized on multiple clients	Check if the synchronization server is running correctly.

2. Administrator's Guide

As an administrator, using VPET gives you unprecedented freedom by speeding up interdisciplinary cooperation and expanding the scope of data currently available on set.

As the production's administrator, your job is realizing the technical setup, deciding on software choices and exploiting optional addons. The the R&D - Department of Filmakademie continues to develop VPET for the express purpose of simplifying your tasks and lessen the pressure on those technical responsible in any modern media production.

This guide will take you through building a suitable scene for VPET, deploying a Unity Game Engine build for the currently supported operating systems and setting up the necessary network requirements.

2.1.Technical Requirements

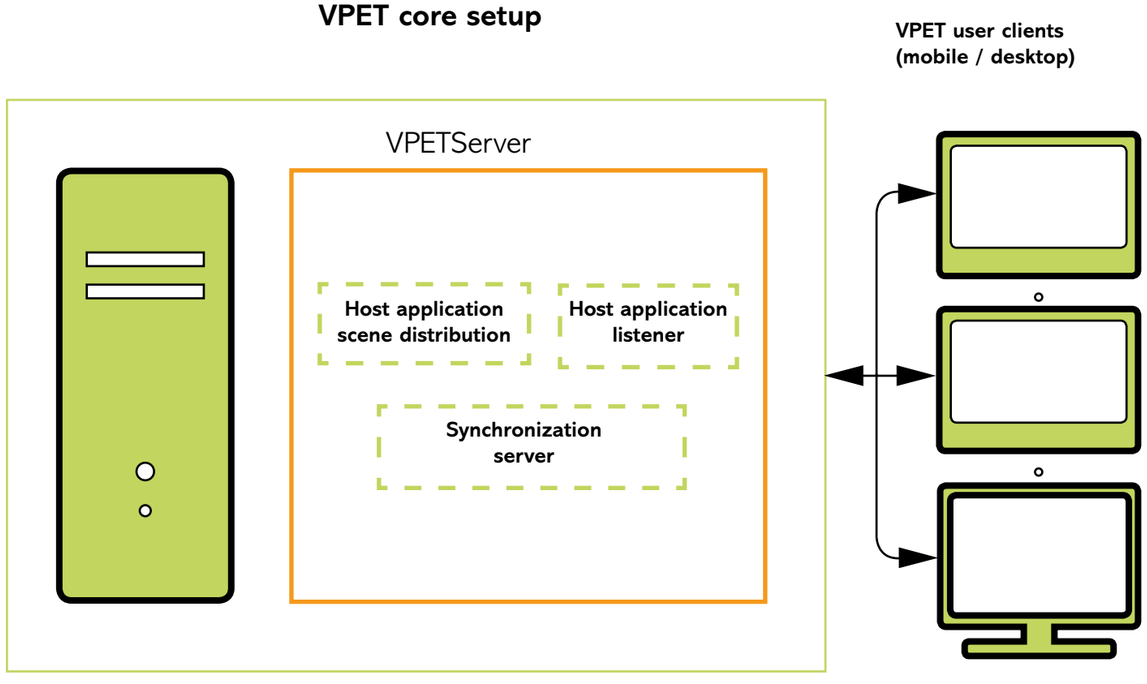
This chapter will comprehensibly list the technical requirements for deploying VPET from an IT-standpoint.
A further distinction will be made between technical core requirements and additional options that enhance VPETs capabilities.

2.1.1. Hardware requirements

This chapter will detail the necessary hardware for a basic VPET setup, using only the core components.
For demonstration purposes, we will presume an installation based on the combination of Katana and VPET, which are available with the required plugins.

In general, the choice of software suites and their combination is up to the user. VPET is designed for utmost adaptability, and depends only on the respective plugins, which are either available or may be developed to your standards and needs.

VPET core setup



If using Katana, any changes made to the scene by any client are managed by the Katana Listener.
Communication works without a synchronization server, though synchronizing the input of more than one client requires its use.
Depending on your choice of software, a different approach may be viable - as long as input and output of your scene are functionally received and redistributed by your DCC and scene management tool, you are able to deploy a basic VPET-setup, which consists of:

- √ VPETServer
- √ one or more client devices able to run VPET.
- √ the SyncServer (in case of >1 client in your setup).

To take full advantage of VPET, the optional components enhance your interaction features within your virtual.
These are listed in detail in chapter 2.8.

2.1.2. Software requirements

2.1.2.5. Katana

Although VPET comes with a prepared scene ("ranch scene"), you can realize your own creative vision and start from there. You need a working scene managed by the digital content creation software of your choice. While VPET was developed with Katana, it is completely adaptable for any software, depending on the available plugins in future development or already in existence. For demonstration purposes, we will show the process of deploying VPET using Katana and Unity.

Katana is basically a look development and lighting software suite and serves as a scene management tool in regard to VPET: creating and assigning asset IDs, applying textures and correlating values.

Additionally, you need a plug-in that enables Katana to receive updates from the Network, the Katana listener, as well as the scene distribution plug-in. If you want to run multiple clients, the synchronization server has to run as well.

- √ Katana software suite
- √ Katana listener-plugin
- √ Katana scene distribution plug-in. (included with the VPET-Master)
- √ a network - connected VPET client (mobile or desktop)
- √ renderer of choice
- √ synchronization server (for multiple clients)

and of course, a prepared scene.

VPET was developed within the eu fp7 project dreamspace and is designed to work with Katana.
Out of the box, Katana works with the following rendering software options:

Renderman	V-Ray	Arnold	3Delight

Adaption and integration of other renderers is possible and welcome in the open-source-development of VPET. The renderer needs to support Live Update. VPET was extensively tested with the Arnold renderer, update functionality of any other render software depends on working plugins.

2.1.2.6. Unity

Apart from exporting your VPET build to the desired mobile devices, Unity can also serve as the VPETServer to setup your scene and control your assets.

Get the most recent version of Unity here.

Operating systems + builds
At the time of writing, VPET may be run on five common operating systems. Depending on the OS you want to deploy to, you may need to fulfil some further requirements in regard to your VPET build.

VPET for Windows / Mac / Linux standalone

buidling VPET as standalone desktop version for windows does not require any additional software.

VPET for iOS / ARKit

building VPET as standalone mobile version for iOS-based devices requires:

√ A Mac computer running running OS X 10.11 or later.

Building for iOS requires at least a free Apple ID or enrollment in the Apple Developer Program.

√ The latest version of Xcode.
√ A device running iOS.
√ Your prepared scene.

VPET for Android / Tango

building VPET as standalone mobile version for iOS-based devices requires:

√ The latest Java Development Kit (JDK)
√ Either Android Studio, alternatively the Android SDK Platform Tools.
√ A device running Android.
√ Your prepared scene.

JDK as well as SDK is regularly updated. Building your app in unity relies on those components, and will not work if there are conflicts. Keep your software development kits updated.
If you encounter any problems after an update, refer to the troubleshooting section xxx, the unity forums or post a bug report / feature request to the VPET github repository.

2.2. Setting up your network

Naturally, VPET can only work with an established network, adhering to the IPv4 protocol standard.

When using mobile clients and/or a camera tracking system, you need a wireless router for handling network communication. For heavy workload (i.e. video streams, or the principal camera image), you might consider using a fibre channel network card for your real-time renderer of choice.

The VPET-network setup requires the following components:

√ WiFi - router
√ clients (desktop or mobile)
√ a running scene distribution plug-in for your DCC (included with the VPET-Master)
√ a running listener plugin (included with the VPET-Master)
√ a running synchronization server (included with the VPET-Master)
√ a conflict-free network configuration (including the subnet mask)

1. Set up your network.

2. Connect the VPETServer to the WiFi router and make sure the client uses the correct wireless network. Double check the IP addresses.

3. Make sure your host application listener is running.

4. Opening the VPET app, you will be asked to enter the IP address of the LiveView server.

5. If everything has been set up correctly VPET will start to load the scene directly from the server.

10% loading freeze.
In case of VPET locking up at 10% loaded status, it has not connected to the VPETServer correctly. The reason is usually an incorrect IP on the client, or a general network adress conflict.

6. If edits from VPET are not applied at the VPETServer workstation, make sure that the system is not expecting any data to be handled by the synchronization server (e.g. NCam data), if not providing this data. In case of need, remove the correspondent part in the startup script:

```
-nacmserver 192.168.11.1
```

7. Inversely, when using multiple clients and/or the NCam system requires the synchronization server to run and having the necessary lines included in the code. (see chapters 2.4. and 2.6.2.).

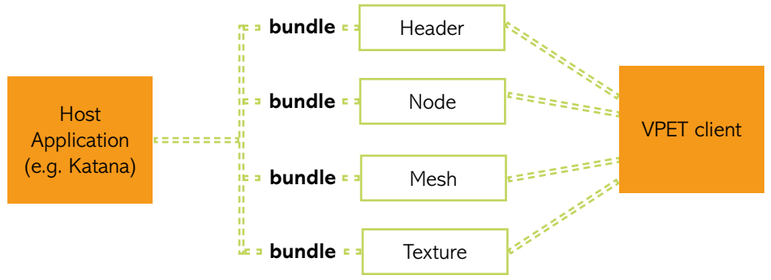
You have learned the requirements of the VPET network and the respective addons.

2.3. The distribution protocol

The distribution of your scene and the data stored within is at the core of the ccoperation-mindset in which VPET was developed.

The following chapter gives a detailed overview over the distribution message itself and the contents of its components, giving greater scope of creative capabilities and potentially enabling you to enhance the possibilities of VPET in development.

The illustration below gives a basic idea of the distribution messages structure.



Header	contains global scene infomation
Node	contain further attributes (objects, hierarchy information, transformations, object specific information as name, type, object parameters etc.)
Mesh	polygonal meshes with asset-matching topology with unique IDs.
Textures	textures contain image material with unique IDs

Animations are not yet transferable between host application / distribution application and VPET.

In this case, the message is not sent in one block, but is separated into four separate bundles.

The following chapter details the messages in the order in which they are sent, with data type and ranges denoted.

2.3.1. The distribution message in detail

Header

The header message consists of information regarding the global light intensity factor and texture type.

data type	Object	default value	possible value range (if applicable)
float	lightIntensityFactor	1.0	-1000 to 1000
int	textureBinaryType	0	0, 1

Node

Objects defined within the general struct Node are common to all inheriting nodes, the specific objects of the -Geo / -Light / -Cam nodes define either flags (like editable), references or the parameters of your scene's assets.

Node

data type	type	default value	possible value range (if applicable)
bool	editable	false	true / false
int	childCount	0	positive integer range
float3	position	1, 2, 3	float range
float3	scale	1, 2, 3	float range
float4	rotation	1, 2, 3, 4	float range
char[64]	name	‘ ‘	ASCII char range

To reiterate, all objects of the Node Struct and their respective values are inherited by the follwing structs:

Geo:Node

data type	parameter	default value	possible value range (if applicable)
int	geoId	-1	positive integer range
int	textureId	-1	positive integer range
float	roughness		positive float range
float3	color	{ 1,1,1 }	positive float range(rgb-color values)

Light:Node

data type	parameter	default value	possible value range (if applicable)
int	type	SPOT	SPOT, DIRECTIONAL, POINT, AREA, NONE=0
float	intensity	1.0	positive float range
float	angle	60.0	float range
float	range	500.0	positive float range
float	exposure	3.0	positive float range
float3	color	1.0,1.0,1.0	positive float range(rgb-color values)

Cam:Node

data type	parameter	default value	possible value range (if applicable)
int	type	SPOT	SPOT, DIRECTIONAL, POINT, AREA, NONE=0
float	intensity	1.0	positive float range
float	angle	60.0	float range

Mesh

The next message handled by the distribution package contains information about any polygon mesh within your scene, divided into vertices, indices, normals and UVs.

Mesh			
data type	parameter	default value	possible value range (if applicable)
`int`	number vertices	-	positive integer range
`int`	number indices	-	positive integer range
`int`	number normals	-	positive integer range
`int`	number UVs	-	positive integer range
`float[]`	vertex array	-	positive float range
`int[]`	index array	-	positive integer range
`float[]`	normal array	-	positive float range
`float[]`	uv array	-	positive float range

Texture

The next message handled by the distribution package contains information textures, as data array in use and dimensions.

Texture			
data type	parameter	default value	possible value range (if applicable)
`int`	size color data array	-	positive integer range
`int`	texture width	-	positive integer range
`int`	texture height	-	positive integer range
`byte[]`	texture data	-	byte range

2.4. The synchronization protocol

VPET is designed for creative exchange on-set. Accordingly, the synchronisation protocol is one of the core components.
At the time of writing, distribution of messages is handled by netMQ.
Though every message contains a series of standard strings with all necessary values, this chapter will detail the individual sections.

Each message adheres to a specific form, as shown below as an example. Subsequently, it is broken down in its specific components.

client 129|r|CubeParent/Cube|0.01386935|-0.1318762|-0.6923447|0.7092779|physics								
client	129	r	CubeParent/Cube	0.01386935	-0.1318762	-0.6923447	0.7092779	physics
a	b	c	d	e	f	g	h	i

Message separation:
Correct separation of netMQ - messages warrants particular attention:
while the topic is separated by a simple space, every other value is separated by a simple "|". As usual, special characters should be avoided, unless used in the example above.

component	avaiiable values
a	topic = client / ncam / record
b	unique ID of the sender
c	information type = r / t / s / c / i / a / d / k / l / f
d	directory path to a scene node, separated by "/"
e	values according to information type (see section"c").
f	values according to information type (see section"c").
g	values according to information type (see section"c").
h	additional (optional) value for information type rotation (r) and translation (t)
i	"physics" or blank (see following page)

Every component is described in full detail on the following page.

2.4.1. The synchronization message in detail

topic	according to the netMQ Publish / Subscribe pattern, the following topics are available for VPET: • client = updates are directly transfered from the clients (tablets). • ncam = ncam data (position / rotation / focal length) for each frame (provided the synchronization server is used. • record = the synchronization server stores the current scene state and is thereby able to provide an initialisation update to new subscribers (this functionality is in BETA status and is not yet reliable).
unique ID	a string of numbers issued by the synchronization server, identifiying the sender within your network.
information type	The exact nature of available types of information processed by VPET is listed below: √ rotation (r) √ translation (t) √ scale (s) √ light color (c) √ light intensity (i) √ light spot angle (a) √ light range (d) √ kinematic change (k) = enables / disables gravity for an object. √ lock boolean value (l) = defines true / false and locks an object if edited, avoiding conflicts in parallel editing. √ focal length (f) of the optional ncam camera
directory path	the path to the object (lightsource / geometrical / camera) is relative to the scene folder, with the exception of ncam data (in this case, it is “cam”). Separation of values by “/”
values	information types - dependant value. Four to one values, as listed in detail below:

type	number / value type	Value Range if applicable
r / rotation	**4 float values (quaternion)**	**-**
t / translation	**3 float values (xyz-axes)**	**-**
s / scale	**3 float values (xyz-axes)**	**-**
c / light color	**3 floats (rgb - color)**	**0 - 1**
i / light intensity	**1 float.**	**0 - 8**
a / light spot angle	**1 float.**	**0 - 179 (degrees, incl. penumbra angle)**
d / light range	**1 float**	**0 - infinity**
k / kinematic change	**1 bool**	**0 - 1**
l / lock bool	**1 bool**	**0 - 1**
f / focal length	**1 float**	**-**

optional spatial value	This value is only added if the information type is either “rotation / r” or “translation / t”, its value is always “physics”. On clients with an active physics engine (commonly tablets and other mobile devices), the “physics” - component will be ignored, since physics can be individually calculated by these clients. On clients without physics engine (most desktop renderers), this enables watching the physics interaction and should be handled as a normal scene update.

2.5. Setting up VPET + Katana

Although usage of Katana is not implicit, VPET was developed due to the numerous choices of rendering software for easy integration. If you prefer a different software suite, developing the necessary plugin is absolutely possible. For this guide, we will presume that Katana will be used for the management of the scene.

If any other scene management software is used, please refer to the respective documentation.

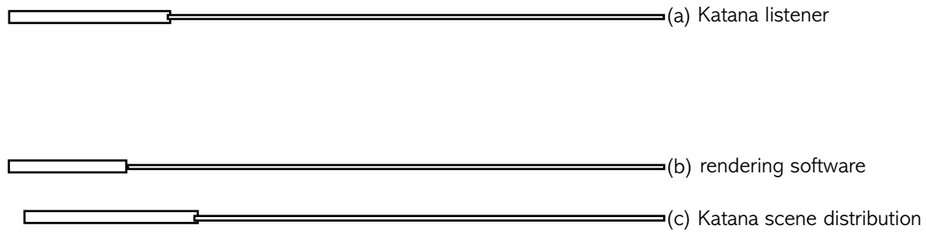
Choice of 3D-computer animation software

You are completely free in your choice of 3D modeling / animation software, provided the import in your host application works. For restrictions regarding the import process, see below.

Pivots and transformations:
Setting correct pivots for every asset is imperative to avoid erroneous bounding boxes when transfering to Unity (and VPET, respectively).
Additionally, transformations may not be frozen.

2.5.1. Katana setup

Preparing your scene for the specific handling of assets and customizing it to the requirements of Katana (or your DCC of choice) is considerably easier to handle when adhering to this file structure.



Katana needs three components in defined file locations to work as your scene management tool.

- √ the Katana listener “resources” (a)
- √ a rendering software (b)
- √ the Katana scene distribution “resources” (c)

Renderer Software:
As mentioned in chapter 2.1.2.1., the VPET-user is completely free in the choice of the preferred rendering software. Arnold will be used as an example in this guide and does not indicate benefits or disadvantages.

Next, Katana needs to be pointed to the relevant directories for the plugins.
Open the shell in the directory, and create a startup script to set the environment variables and enable automatic startup of Katana once the script is complete.

Naming / File Locations:
All described actions within this guide regarding file location, file naming and designations used in scripting are exemplary and do not have to be imitated for Katana to work.
This guide will eplicitly point out if this does not apply.

Create your bash script within the appropriate folder containting the files.

create script:

```
[rnd@localhost YourVPETscene]$ gvim vpetYourDCC
```

set permissions:

```
[rnd@localhost YourVPETscene]$ chmod 744 vpetYourDCC
```

run script:

```
[rnd@localhost YourVPETscene]$ ./vpetYourDCC
```

Using Katana, our example script looks like the figure on the following page (in Vi style editing).

Run the script, Katana will now automatically start up.

Successful integration of the plugins is tested by checking for “Katana Live update” within Katana, as pictured below.

In the context of VPET, Katana “live update” is directly tied to the listener plugin. Any change made to the scene by any client is received within the DCC, and resynchronized to every other client in the network automatically by the SyncServer.

1. Click the LMB once on the tab “Tabs”.

1. A drop-down menu is displayed.

2. click LMB once on “Katana Listener” tab.

3. A slide-out menu is displayed.

4. Click the LMB once on “Live Update”.

The “Katana Listener / Live Update” window will open. Since it is a central module in the scene management, we strongly suggest fixing it to a Katana compartment window as described below.

5. Drag and drop the “Katana Listener / Live Update” into the present “Parameters” compartment.

Listener / Live Update:
Independet of your choice of DCC, the Listener / Live Update (or any equivalent plugin with analogue functionality) are at the center of your VPET setup.
We strongly suggest testing your setup before deploying on-set to avoid delays in your producation pipeline.

Once the Listener / Live Update is active, Katana is ready to act as scene management tool.

The next page gives a more detailed overview over its functions.

Depending on your choice of view mode, the nodes will be displayed either by directly choosing the specific node to be rendered in the viewport (a), or displaying the node parameters (b).

The Live Update textfield (toggled by start/stop in the figure below) is used to start / stop the live rendering and Katana Listener respectively, as well as defining the network port for the Listener. By default, the network port in use ist set to 5555.

Of specific importance is the Session cache - attributes and values received by the listener are shown here, and may be used as an indication of a functioning VPET setup.

The session log / network activity indicator (d) incorporates any changes made to the scene in human-readable text, archiving transmitted data objects consisting of attribute–value pairs and array data types, and may be dumped into the .json - file when you finish your VPET session or cleared if deemed unnecessary.

(a) Render Node in viewport

(b) View parameters of selected Node

(c) Live Update

(d) Session Cache activity indicator / session log

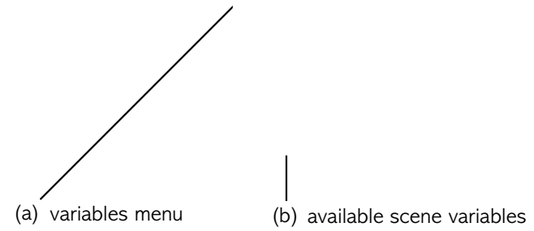
You have succesfully defined the Katana plugin paths, started up Katana, and integrated the Katana Listener in your workspace.

2.5.2. Opening the example scene in Katana

This chapter deals with the loading of your scene and gives an overview of additional options offered by VPET within Katana, as well as detailing their content.

1.Click LMB on "File" once, then open up your scene as shown exemplary below.

2.Next, click on the yellow-tinted menu in the top bar.



(a) variables menu

(b) available scene variables

3. Choose your available variables. The most common variables (depending on your scene's setup) are:

daytime	defines lighting settings
lod	level of detail for rendered objects
renderer	allows the choice of rendering software
view	allows the choice of virtual camera within your scene

2.5.3. Setting level of detail

While the rendering in Katana usually shows your scene in the selected LoD, distribution to your mobile devices works by delivering an alternative version of your scene with a lower polygon count.

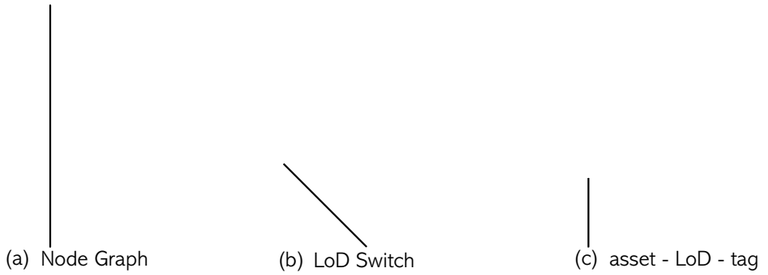
To avoid unnecessary complexity, this is achieved by creating tags for your assets.

These tags assign your assets to either the high-polygon group rendered within Katana or to the low-polygon group for distribution to the mobile devices.

The common abbreviation for “level of detail” is LoD or lod.

The common abbreviation for “high” or “low” polygon count is “hi” and “lo” respectively.

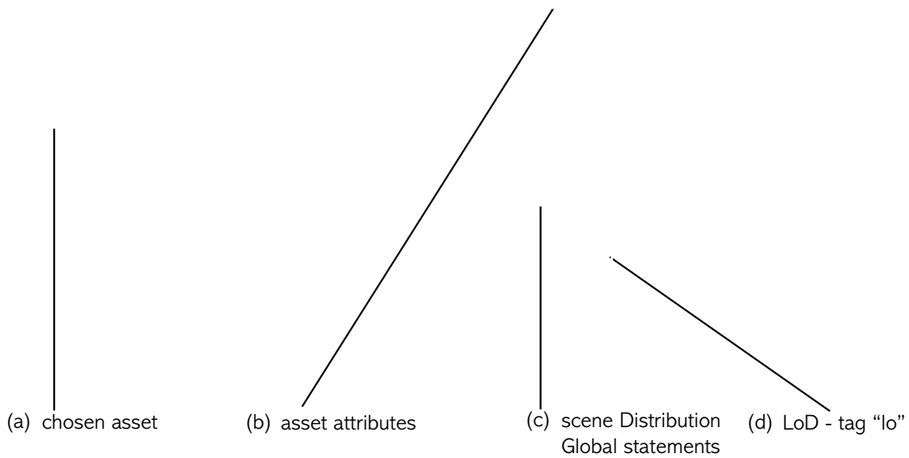
These abbreviations will be used in this guide.



The Node Grap (b) gives a general overview of your scene’s structure.

VPET requires a certain set of prerequisites for a scene, which are explained in chapter 2.5.. The central distinction at the core of the inner workings of VPET and its scene management software Katana is the LoD-switch (b) as explained above. these switches work by assigning tags (c) to your assets.

The switch shown above is exemplary, but the node structure of your scene will be similar.

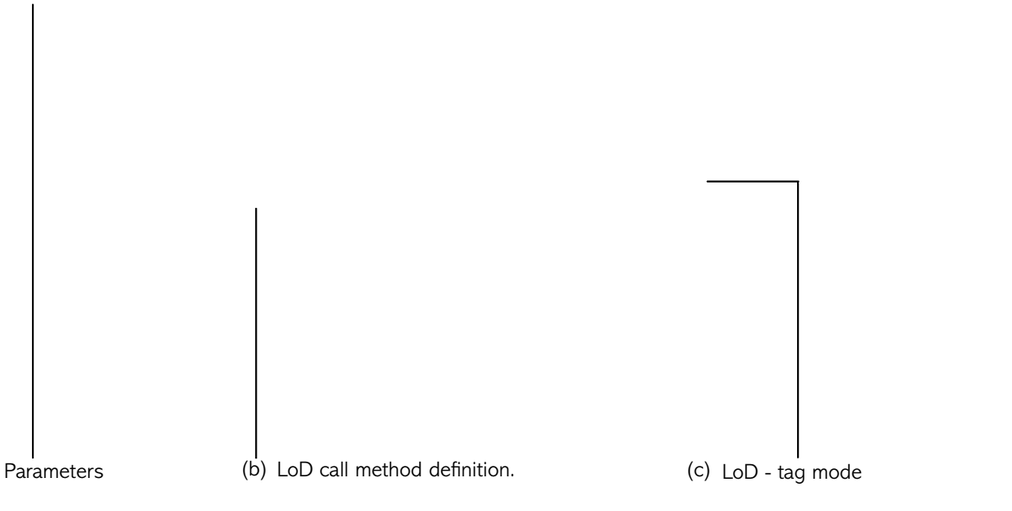


As shown in the figure above, setting the level of detail for a specific asset is possible in the sceneDistributorGlobal-Statements by typing in the appropriate tag (d).

At this point, your assets needs to be assigned the LoD-tag according to its polygonal count.

high polygonal count tag = hi

low polygonal count tag = lo



Depending on the node which defines chosen LoD in your scene setup, the figure above demonstrates the method of defining and calling the respective LoD settings. By design, VPET calls by mode of tag (c).

In this exemplary case, scene assets will be called by the tag “lo”, as shown in (b).

The same method is used to call assets assigned to the assets defined with the tag “hi”.

For distribution to your mobile devices, your library must contain a set of “lo” and “hi” version of every asset, as shown below.

2.5.4. Defining editable objects

As mentioned in the user's guide, most scenes consist of edtiable assets as well as uneditable assets. This distinction must be made within your scene management tool.

For demonstration purposes, this chapter will show how to flag an obect as editable within Katana. As usual, you are free to do so within any other scene management software.

Normally, there will be a categorized set of editable assets with appropriate naming, as depicted in the left figure.

Scene clarity:
every camera, geometrical, or lightsource asset in your scene may be flagged as editable, this is generally not recommended though.
Pinpoint selection of assets is impeded by an excess of editable assets.

The flag itself is set within the "Parameters" tab of the respective asset within Katana, as shown in the figure below.

Definition of editable assets should be decided in consultation with your creative team.

Make sure to select the asset itself, not the groupings.

Central element is the "attributeName" - tag.

For any editable object, the text field needs to be set as `dreamspace.editable`

Every editable asset within your scene will be defined this way. This allows for quick addition and removal of editable assets on-set.

2.5.5. Your VPET scene in the Katana Viewer

To check if your scene works with Katana and is ready for deployment to your mobile devices, use the Katana Viewer (by default in the lower right compartment of your screen within Katana) as shown below.

1. Expand the complete hierarchy of your scene by clicking RMB once, and clicking LMB once on "expand all".

2. Choose the appropriate node to render from by doubleclicking it with LMB, then click RMB once.

3. Click “Live Render” with LMB once.

“Live Render” offers the same options as the “View Node”, as explained in chapter 2.5.1.

4. If your scene does not show in the Viewer Grip Map, press “F” once to focus on the chosen object.

5. Your Viewer should show your scene in preview, as shown in the “ranch” example below.

You are now able to check your compability of your scene with your defined rendering softwares in Katana.

2.6. Setting up your scene in Unity

This chapter explains the setup of your scene within Unity as well as possible options and settings.

This will take you from opening the project itself, to setting and changing the options for your scene within Unity, as well as deploying it to the currently supported mobile operating systems.

This is the general layout of your VPET file structure, provided you pulled the repository from github.

We are using the prepared VPET_client scene as an example.

Your own scene will have to be prepared and structured according to chapter 2.5.1.

This chapter explains the setup of your scene within Unity as well as possible options and settings.

This will take you from opening the project itself, to setting and changing the options for your scene within Unity, as well as deploying it to the currently supported mobile operating systems.

The VPET-package contains not only the exemplary “ranch” scene, but the complete VPET program, including the plugins and necessary export options.
While the ranch scene is used for demonstration purposes, please keep this distinction in mind.

1.Make sure to save your prepared VPET-scene in a memorizable location.

2.Once you have started Unity and created a new project, click the tab “Assets” once with LMB.

3.In the dropdown menu (see left), click “import package”.

4. Click “custom package” once.

5.Check for the icon / name - combination of your VPET-scene

6.Select the Unity package of your scene. (marked left)

7.Click “open” once.

8.By default, the “Project” - folder of Unity is placed in the lower left compartment of your screen. Click LMB once on “Assets”, then “VPET”, then “Scenes”.

9.Double click the apropppriate Scene symbol (marked in the left figure).

10.Once selected, click the “Play” icon in the top bar of Unity once, as marked below.

11. The selected scene is displayed in the “Game” preview screen of Unity, as shown below.

Depending on your choice of scene and setup, load a scene from your server after supplying your IP, or load a cached scene.

Independent of the chosen host software, the following scene structure is definite for successful distribution.

- root directory
  - world directory
    - geo directory — containing geometrical assets
    - cam directory — containing virtual cameras
    - lgt directory — containing lightsource assets

root node	must contain all objects to be transfered to mobile devices
editable tag	must be set up in distribution application (e.g. Unity), and applied to assets for editing in VPET
camera	creating one or more virtual cameras for switching views within VPET.

(a) root directory

(b) world directory

(c) geo directory

(d) cam directory

(e) lgt directory

Cached scenes

while not dependent on the distribution tool or script, the usage of cached scenes on your desktops or mobile devices follows the same guidelines as described above, i.e. scene structure.

Instead of live distribution and synchronization, cached scenes are stored on the device you are using VPET on.

You are now able to load and correctly deploy a VPET-customized scene in Unity.

2.6.1. Creating the client configuration file

Deploying your VPET build to your mobile devices is simple, quick and efficient. The process of building VPET as an app is explained in detail in this chapter.

1. First, check your additional software requiremenets in regard to your build or builds, depending on the operating system used on your mobile devices (see chapter 2.7.).

> **Config file creation:**
> Although not inherently necessary, it is highly advised to customize the editing_tool.cfg. This defines the prest values on the client devices, and drastically reduces time spent in on-set client setup.

2. The VPET config file is by default stored in:

```
▶ VPET root directory
    ▶ VPET_Unity
        ▶ Assets
            ▶ VPET editing_tool.cfg
```

3.The .cfg reads colon separated key value pairs per line, which are case sensitive.
Every value key which matches a public property in VPETSettings.cs (see API documentation) will be read from the config file.

4. Common property examples:

```
serverIP:172.17.21.188
doLoadFromResource:False
sceneFileName:my_VPET_scene
doLoadTextures:True
```

sceneFileName is replaced by the individual name for your scene, set in the Server Adapter/Inspector Window of Unity (as in textfield (a) shown below).

(a) Scene file name textfield

2.6.2. Setting up the SyncServer

The Synchronisation Server Script is included within the VPET Master Package.
Its main purpose is synchronizing changes made to the scene by the clients on-set. This chapter explains the contents and deployment of the Syncserver functionality.

By default, the SyncServer directory can be found under:

```
▶ VPET root directory
    ▶ VPET_Master
        ▶ install
            ▶ SyncServer.exe
```

The folder structure should contain the files shown in the following figure:

1. Call up the cmd.exe. and enter:

```
SyncServer.exe
```

2. This gives you the following options:

```
-h, -help:          display this help
-ownIP:             NP address of this computer
-ncamIP:            ncam server IP address
-ncomPort:          ncam server port, necessary if not 38860
```

3. For the purpose of synchronizing your client, just add your server's IP adress in the command line.

as usual, the values used are exemplary.

```
SyncServer.exe -ownIP 172.17.21.165
```

4. As long as your firewall allows, your SyncServer is running.

You have successfully deployed the Syncserver and enabled the clients to synchronize on-set editing.

2.7. Building your VPET - app

Deploying your VPET build to your mobile devices is simple, quick and efficient if done via Unity. As usual in the scope of VPET, you are completely free to utilize any other distribution application, provided you develop suitable plugins. The process of building VPET as an app is explained in detail in this chapter.

1. First, check your additional software requiremenets in regard to your build or builds, depending on the operating system used on your mobile devices (see chapter 2.1.2.2.)

2. Depending on the operating system you want to deploy VPET to, proceed to the corresponding subchapter.

VPET for Windows / Mac / Linux standalone
VPET for iOS / and ARKit
VPET for Android / Google Tango
VPET for Android / Lenovo Phab 2 Pro

3. Depending on your technical options and needs in regards to devices running iOS, you may install the ARKit for VPET. Please refer to the corresponding chapter.

2.7.3. VPET for Windows / Mac / Linux standalone

Building for desktop - standalone versions is a simple process in general.
Any detail regarding OS - specific builds is explained in this chapter

Windows
When building a standalone desktop or mobile version for Windows, all you need to to do is setting the “architecture” to x86_64 (b).

MacOS
When building a standalone desktop version for MacOS, please make sure you have all necessary provisioning profiles installed in your keychain. For further details, please visit the relevant Unity documentation topic.

Linux (various distributions)
Due to the multitude of Linux variants avaiable and the respective frequency of updates, make sure to recompile your builds regularly. There is a high probability of conflicts with older Linux versions.

1. Within Unity, check your “build settings” - options, as shown below.

2. Click “Build” once, and select an easily memorizable file location for your build.

3. Copy your build to the directory of your choice and start VPET.

(a) cached scene for build

(b) architecture dropdown menu

You are now able to build and deploy your VPET-app to the Windows, MacOS and most Linux Distributions.

2.7.4. VPET for iOS and ARKit

Building for iOS wfrom VPET works largely analogous to building for Windows, but enforces some specific requirements for deployment.

The few key differences will be explained in this subchapter.

XCode requirements:
We strongly advise to aquire and update the required files and licenses for XCode - projects before trying to deploy. If unsure how to proceed, deploy a test build as described in the Unity documentation to ensure a smooth workflow for your VPET - project.

These are the specific elements required:

- √ an Apple ID (either personal or linked to a team).
- √ an Apple Developer Program certificate (if submitting your project to the App Store).
- √ a valid provisioning profile certificate (if submitting your project to the App Store).

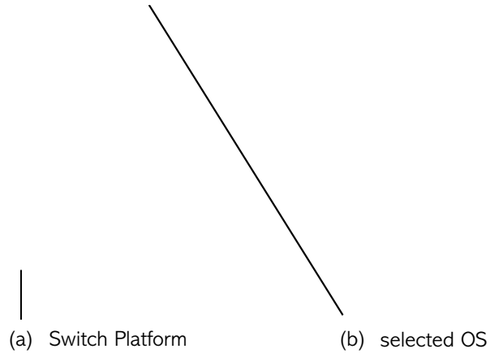
2. Within Unity, check your “build settings” - options, as shown below.

3. After choosing “iOS” (a) from the available options click once on “Switch Platform”.

4. The required files will be loaded, and the output format will be changed to Xcode.

XCode
Switching to SCode reimports all assets within the project. Depending on the size and complexity of your scene, this may take some time.

5. At this point, it is imperative to enter the correct bundle identifier.



Bundle identifier:
While it is not unusual to use a personal Apple ID during development and testing of your VPET build, submitting it to the App Store requires a different bundle identifier than the one linked to a free Apple ID / Personal Team.

6. Within Unity, Navigate to Edit / Project Settings / Player.

7. In the Inspector window, check for “Mac App Store Options” and fill out the textfield “bundle identifier” according to this format:

```
com.yourCompanyName.yourVPETTest
```

8. Connect your iOS device to your desktop, add it to trusted devices via the Apple ID settings, and deploy your build for testing the functionality.

You are now able to build and deploy your VPET-app to a mobile device running iOS.

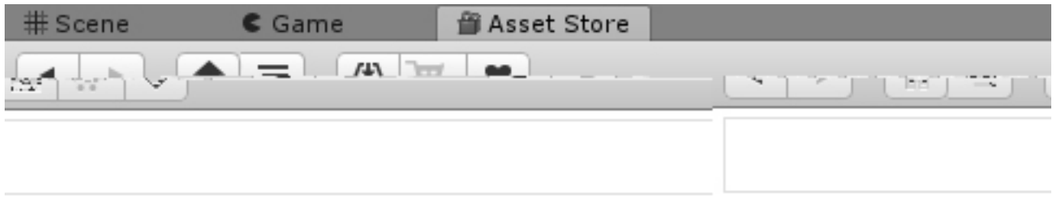
2.7.4.1. Importing the ARKit

Employing AR-features widens the scope und useability of VPET considerably due to an improved user experience.

Additionally, it enhances your scene by optional camera video input. light estimation, hit testing API and plane detection.

Deploying your user's devices along with the Unity-embedded ARkit is free at the time of writing. The process will be explained below.

1. By default, the "Asset Store" - tab is located above the scene preview - window within Unity.



2. In the search textfield within the asset store, type in "Arkit Unity". Make sure the chosen plugin is developed by Unity Technologies.

Project import:
Since the assets for the Unity AR-Kit are directly imported, it is strongly advised to do so without an active project within Unity. If unsure, close your project, restart Unity and import the AR-Kit first, before loading your project to avoid conflicts.

3. Import the Unity ARKit plugin.

You are now able to employ Unity AR - functionalities within your VPET scene.

2.7.5. VPET for Android

Deployment for devices running on Android is not fundamentally different from deploying to other OS, though there are some key differences. These will be explained in detail in this chapter.

Software development kit conflicts:
As a rare instance, the occasionally rapid development of Android builds may result in conflicts between Android SDK / Tango SDK / Java JDK.
If you encounter these conflicts, please consult the respective help desks, and report the problem to the VPET-development team on Github.

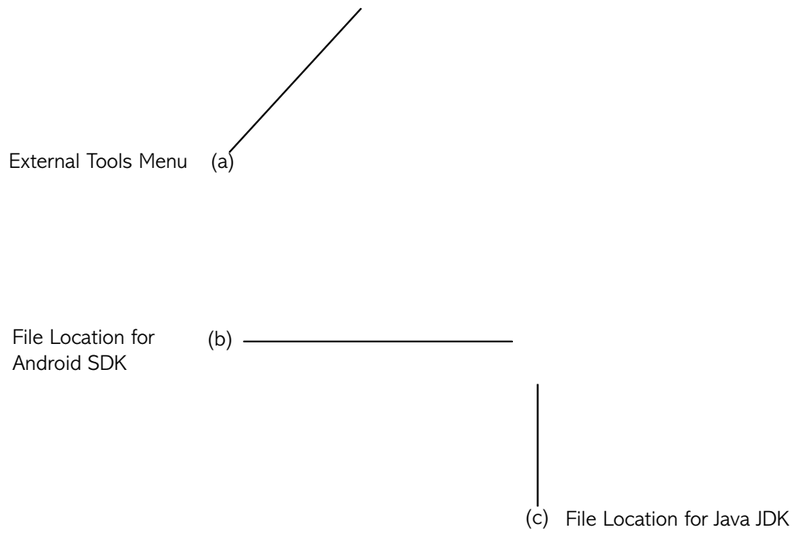
1. Get the most recent Java development kit from here.

2. Get the most recent Android software development kit from here.
This will most likely be in form of Android Studio, which contains the SDK in bundled form along with the required toolkits

3. After installing Android SDK and Java JDK, please memorize the location of the kits carefully.

4. Navigate to "Edit / Preferences" within Unity.

5. Click on "External Tools" (a) once.



6. Click "Browse", and point Unity to the file locations of your Android SDK (a) and Java JDK (c) respectively.

You are now able to build and deploy your VPET-app to a mobile device running Android.

2.7.5.2. VPET for Google Tango

If you plan to build your VPET app for an AR-equipped Google Tango device, get the latest Tango SDK for Unity from here. Beyond that, the building of an Android - app is described in chapter 2.7..

1.Once downloaded, open Assets / Import Package / Custom Package within Unity.

2. Point the dialog window to the file location of your Google Tango SDK . At the time of writing, Ikariotikos SDK is the latest version. - this may have changed at the time of reading).

3. Leave the default settings and click “Import”.

4. After importing, check if the “Tango Manager” is active (see below).

5. Next, check for the active “Tango Application Script”.

6. Finally, click the “Player Settings” - button in your “Build Settings” - dialogue window. (as described in chapter 2.7.) Make sure to have switched the platform to Android.

7. Check under the “Inspector” tab at the right side of your screen.
Under “other settings”, check for the Scripting Define Symbols textfield. It should look exactly like shown to the right.

You have now successfully imported the Google Tango SDK.

2.7.5.3. VPET for Lenovo Phab 2 Pro

At the time of writing, the latest commercially available Tango - enabled AR Product is the Lenovo Phab 2 Pro Smartphone. Since there are a few peculiarities to take into account, this chapter will demonstrate the build and deployment for this specific device. Beyond that, the building of an Android - app is described in chapter 2.7..

> The last tested SDK-version for deploying on Google Tango was Caporales (Version 1.49). As mentioned, conflicts between various SDKs or the upstream software of VPET is possible. Please check on xxx for updates in regard to compability.

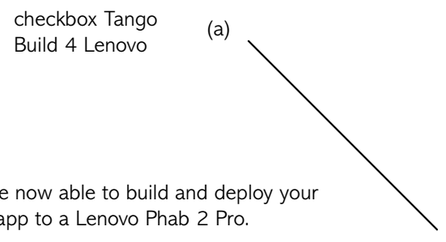
1. Click the “Player Settings” - button in your “Build Settings” - dialogue window (as described in chapter 2.7.).
Make sure to have switched the platform to Android.

2. Under the “Inspector” - tab to the right of your screen, check for “Other Settings / Identification”.

3. Set your Minimum API Level to Android 6.0 “Marshmallow”.

4. Navigate to “Hierarchy / Cameras / Main Camera”.

5. In your Inspector, check for “Move Camera (Script)”.
Activate the checkbox “Tango Build 4 Lenovo Phab 2 Pro” (a)



You are now able to build and deploy your VPET-app to a Lenovo Phab 2 Pro.

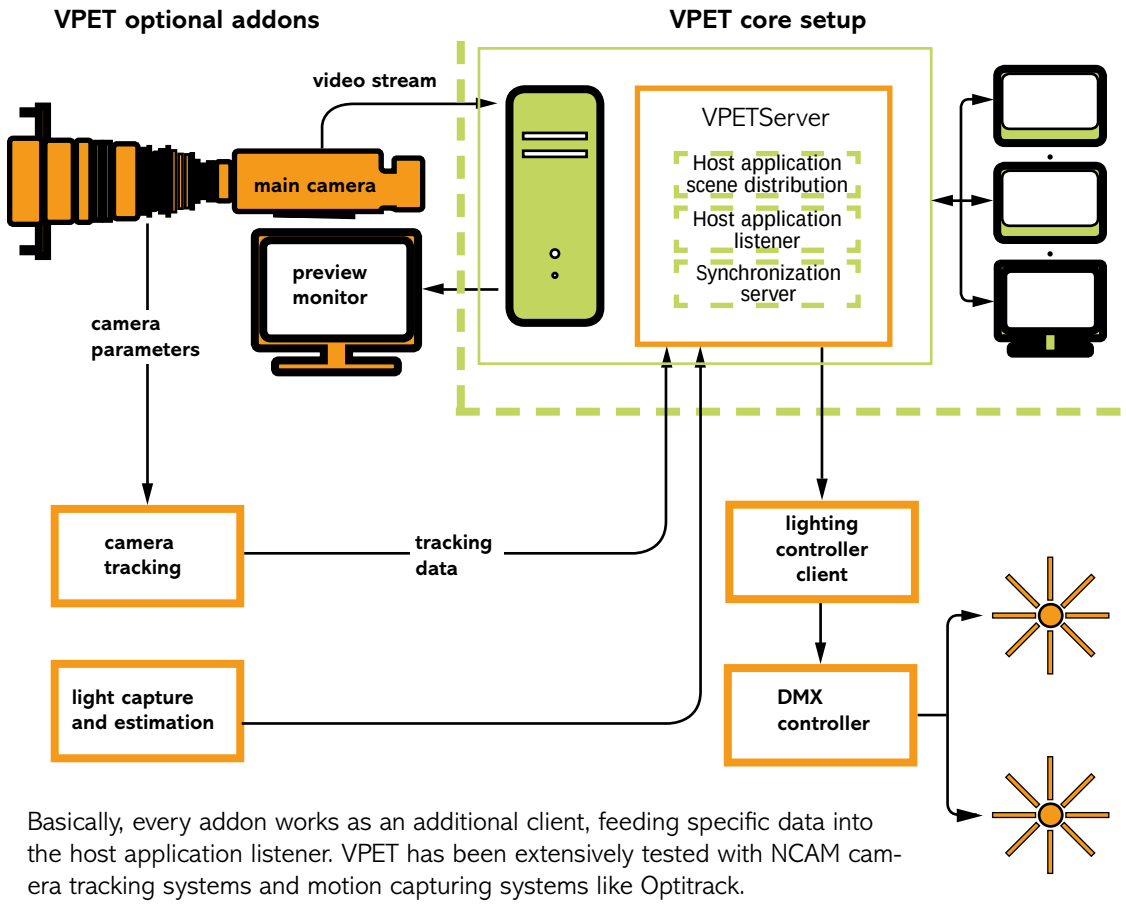
2.8. Optional VPET addons

By now, this guide has enabled you to install a working VPET - Server, distributing, receiving and synchronizing with its respective clients.

To widen cooperation capabilities and encompass common on-set technologies, VPET can include the following addons:

√ Camera tracking systems
√ Motion capturing systems
√ DMX-controller lighting systems

This chapter will give a brief overlook on how to utilize these addons. Please refer to the documentation of the respective product of your choice for detailed information.



Basically, every addon works as an additional client, feeding specific data into the host application listener. VPET has been extensively tested with NCAM camera tracking systems and motion capturing systems like Optitrack.
Please refer to the respective documentaton when utilizing your addons of choice.

3. Imprint

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