Introduction

OZO Live enables the revolutionary Nokia OZO VR Camera to be used for live VR broadcasts. It is a software product, running on GPU-assisted reference hardware, which converts the compressed 1.5Gb/sec HD-SDI signal from the OZO into either a standard 4K UHD video signal for live post-production, delivered via quad-link HD-SDI, or an RTMP uplink to a cloud delivery service. OZO Live provides advanced real-time stitching functionality, spatial audio processing, color correction, h.264 encoding, and a variety of advanced options in a powerful and easy-to-use package.

OZO Live is designed for professional broadcast production use. It supports three primary deployment modes: (1) single-camera workflow with direct RTMP uplink; (2) single-camera workflow to a single external broadcast encoder, and (3) multi-camera workflows with full production switching and sound reinforcement. A typical single-camera workflow is diagrammed below:
Disclaimers

OZO Live has very significant demands on GPU, CPU and memory bandwidth. Both hardware and software are subject to frequent updates, and configuration problems will likely cause errors in software operation. We strongly recommend the use of certified hardware with specified drivers. OZO Support cannot provide assistance with configuration issues caused by nonstandard hardware or drivers.

OZO Live runs on Ubuntu Linux. The installation and configuration of OZO Live requires familiarity with Linux system integration, up to and including the compiling of drivers from source. If you do not have this expertise within your organization, we recommend the purchase of a pre-built Certified OZO Live system from one of our partners. Contact OZO sales for a list of OZO Live system integration partners.

These specifications are current as of October 1 2016, but may change at any time. We are committed to providing best-of-breed performance, and as a result future OZO Live releases may make a previously-specified machine obsolete or in need of extensive upgrade.

OZO Live Machine HW Specification

**OZO Live Reference Machine, January 2017**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Motherboard</td>
<td>Minimum 2 dual width 16-lane, one single width 4-lane and one 1-lane PCIe slots. Dual XEON CPU support</td>
</tr>
<tr>
<td>Barebone Systems</td>
<td>Tyan FT77C-B7079(4U), ASUS ESC4000G3S (2U), SuperMicro 1028GQ-TR (1U)</td>
</tr>
<tr>
<td>CPU</td>
<td>2 Xeon Processors (e.g. E5-2630 v3 or better)</td>
</tr>
<tr>
<td>GPU</td>
<td>2 NVIDIA Pascal based GPU cards (e.g. GTX 1080, Titan-X Pascal)</td>
</tr>
<tr>
<td></td>
<td>nVidia driver v367, v370 or v375</td>
</tr>
<tr>
<td>RAM</td>
<td>64 GB DDR4</td>
</tr>
<tr>
<td>SDI Input Card</td>
<td>Blackmagic Decklink Mini Recorder, Mini Recorder 4K, SDI 4K</td>
</tr>
<tr>
<td></td>
<td>Blackmagic Desktop Video 10.7.x or 10.8.x</td>
</tr>
<tr>
<td>SDI Output Card</td>
<td>AJA Corvid 88, AJA KONA 4, AJA Corvid 44</td>
</tr>
<tr>
<td></td>
<td>AJA driver 12.4.x, Blackmagic Decklink SDI 4K, Mini Monitor 4K</td>
</tr>
<tr>
<td>Network Interface</td>
<td>Gigabit Ethernet</td>
</tr>
<tr>
<td>Operating System</td>
<td>Ubuntu 16.04 LTS</td>
</tr>
</tbody>
</table>
Selecting Motherboards

When you are selecting a motherboard or barebone system for OZO Live, in order to ensure the system can accommodate two dual-width GPU cards and work at best performance, you need to go through the user manual of your motherboard or barebone systems. Most manufacturers provide very detailed user manuals on their web sites.

The block diagram in the manual will help you identify 2 x16 (16-lane) PCIE gen3 slots where the GPU cards can sit. Additionally you need to check the dimensions of motherboards to confirm your GPU cards have enough physical clearance along with SDI I/O cards.

The following block diagram shows the bus layout of a typical dual XEON motherboard.

In the example diagram, there are three x16 (16-lane) PCIe Gen 3 slots: PCIE1, 3 and 6. In order to maximize the performance, we should use PCIe slots under same CPU which are PCIE1 and 3 in this case. Although PCIE6 is x16 PCIe slot, we cannot use that for a GPU, since that will make GPUs communicate over CPU-to-CPU channel which is sub-optimal.

Once PCIe slots for GPU cards are chosen, check the layout/dimension diagram in the user manual to verify the clearance for dual-width GPU cards and spaces for SDI cards.

The example diagram shows that the slots for GPUs (PCIE1 and PCIE3) are spaced enough for dual width GPU cards. Since the two GPU cards will occupy the spaces for PCIE2 and 4, the only slots available for SDI cards are PCIE5 and 6.
SDI Interface Cards

OZO Live supports SDI interface cards from AJA and Blackmagic. Following table shows the supported combinations of SDI cards.

<table>
<thead>
<tr>
<th>SDI input cards</th>
<th>SDI output cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackmagic input &amp; AJA output</td>
<td>One of Blackmagic Mini Recorder or Mini Recorder 4K</td>
</tr>
<tr>
<td>Blackmagic input &amp; Blackmagic output</td>
<td>One of Blackmagic Mini Recorder or Mini Recorder 4K</td>
</tr>
<tr>
<td>Blackmagic in/output</td>
<td>Blackmagic SDI 4K</td>
</tr>
</tbody>
</table>

Please note that Blackmagic Mini Monitor 4K and SDI 4K cards don’t support 59.94 or 60 fps output formats.
OS Configuration and Setup

1. Install Ubuntu 16.04 LTS

You can download and install Ubuntu from http://www.ubuntu.com/download/server. During the installation, you will be asked the automatic update option. It is important to choose "No automatic updates" which is the default selection; otherwise the Ubuntu kernel will update itself automatically, which may cause system instability.

![Configuration tasksel]

Applying updates on a frequent basis is an important part of keeping your system secure.

By default, updates need to be applied manually using package management tools. Alternatively, you can choose to have this system automatically download and install security updates, or you can choose to manage this system over the web as part of a group of systems using Canonical’s Landscape service.

How do you want to manage upgrades on this system?

- No automatic updates
- Install security updates automatically
- Manage system with Landscape

(Tab) moves; (Space) selects; (Enter) activates buttons.
In Software Selection page, choose "OpenSSH server"

If you missed the above steps, please use following command after installation in order to disable the automatic updates and install ssh server package.

```
$ sudo apt remove unattended-upgrades
$ sudo apt-mark hold linux-signed-image-generic
$ sudo apt install openssh-server
```

Take a note of ip address of the machine. Static IP address may be pre-configured in the dhcp server in router. You can find the ip address of the machine with following command.

```
$ hostname -I
```
2. Disable GUI login

Ubuntu comes with GUI login by default. This login does not work if a graphical environment, like Unity, isn’t installed. If you are using a standard keyboard and monitor (rather than SSH login), you need to disable the GUI login screen and show the console login directly. To disable the GUI, perform the following steps:

1. During Ubuntu boot, press Ctrl+Alt+F1 to switch to console mode, and login with the account that was set up during the Ubuntu installation

2. Edit the Grub configuration located in /etc/default/grub:

   ```
   $ sudo vi /etc/default/grub
   ```

   Change the value of GRUB_CMDLINE_LINUX_DEFAULT to "text".
   
The line should look like: `GRUB_CMDLINE_LINUX_DEFAULT="text"
   
   Remember to update:

   ```
   $ sudo update-grub
   ```

3. Notice systemd not to load the GUI:

   ```
   $ sudo systemctl enable multi-user.target --force
   $ sudo systemctl set-default multi-user.target
   ```

3. Install dependent packages

OZO Live depends on several third-party packages. Install them with the below commands.

```
$ sudo apt-get install libzip4 libpng12-0 libjpeg8 libjasper1
$ sudo apt-get install openjdk-8-jre
``` 

4. Install NVIDIA driver

You need to install the latest validated NVIDIA drivers in order to support OZO Live’s requirements. Please run the following commands:

```
$ sudo add-apt-repository ppa:graphics-drivers/ppa -y
$ sudo apt-get update
$ sudo apt-get install nvidia-375
```

Reboot the system and check the installation
5. Installing GPU cards

Be sure that GPU cards are installed in 16-lane (x16) slots. Check your motherboard specs to confirm which slots support full 16-lane bandwidth. Some motherboards also have more than one QPI I/O Hub. In order to achieve the best performance we recommend that GPU cards be installed in PCIe slots which are on the same host bridge.

You can verify it by running

```
$ nvidia-smi topo -m
```

The example shows two GPU cards are connected over host bridge. If you see SOC in the output matrix, please consider rearranging the GPU slots.
6. Install Blackmagic driver

If you are using Blackmagic PCI cards for SDI input or output, you must install the Blackmagic driver. Download it from [https://www.blackmagicdesign.com/support/family/capture-and-playback](https://www.blackmagicdesign.com/support/family/capture-and-playback)

You may need to install dkms package:

```
$ sudo apt-get install dkms
```

Install latest Desktop Video (c.f. Desktop Video SDK is for development and is part of streamer source code package)

After you download, you may need to copy the files to the OZO Live machine. You can use USB stick, scp or ftp whatever available and familiar. (Same for AJA driver and OZO Live package files)

```
$ tar xf Blackmagic_Desktop_Video_Linux_xxx.tar.tar
$ sudo dpkg -i Blackmagic_Desktop_Video_Linux_xxx/deb/amd64/desktopvideo_xxx_am64.deb
$ BlackmagicFirmwareUpdater status

0:    (null) [/dev/blackmagic/io0]    0x41d7ca    PLEASE_UPDATE

$ BlackmagicFirmwareUpdater update 0

/dev/blackmagic/io0 firmware update completed successfully.
Please reboot your system now to activate new firmware
```

7. Install AJA driver

If you are using an AJA PCI card for SDI output, you must install the AJA driver. Download v12.4.1.1 (latest version as of writing) Linux driver from the AJA website, and build according to the instructions. It is important to download this specific version. (e.g. v12.3.x doesn't work with OZO Live.)


Compile the driver with following commands:

```
$ unzip ntv2linux-driver-12.4.1.1.zip
$ tar zxf ntv2linux-driver-12.4.1.1.tar.gz
$ cd ntv2linux-driver-12.4.1.1/ntv2projects
$ make
```

Install the driver files:

```
$ sudo mkdir -p /opt/aja/bin
$ cd ..
$ sudo cp bin/* /opt/aja/bin
```
Check the installation with following commands:

```
$ cd /opt/aja/bin
$ sudo ./loadOEM2K
```

(should work without error)

AFTER installing the OZO Live package, using the instructions in the following section, you must copy the AJA drivers into the OZO Live directory using the below instructions:

Copy scripts for automatic load on boot.

```
$ sudo cp /opt/nokia/ozo_live/bin/aja-devices /etc/init.d/
$ sudo ln -s /etc/init.d/aja-devices /etc/rc2.d/S01aja-devices
```

Reboot the system and check if driver loaded automatically without error.

```
$ dmesg | grep oem2k0
```

You should see log message from "oem2k0"

If you have older firmware (2016/02/16 is latest as of May 15, 2016 for Corvid-88), please upgrade it. You may need to contact AJA support for the latest firmware and instruction for update.

**Note on kernel upgrade:**

Whenever the Ubuntu kernel is upgraded, either automatically or manually, the AJA driver is invalidated. Since AJA doesn’t provide automatic installer or DKMS (dynamic kernel module support), the AJA driver must be recompiled and reinstalled using the instructions above after any kernel upgrade.
Installing OZO Live Application

Copy package file to machine
In case that the OZO Live machine is not connected to network, you need to copy the deb file using a USB stick.

1. Make sure the USB stick is FAT32 formatted. (Ubuntu doesn’t support exFAT by default.)
2. Copy the deb file to USB stick in your laptop or PC.
3. Plugin the USB stick on the streamer machine.
4. Use following step in the OZO Live machine to mount the USB stick and copy the file:
   
   ```
   $ dmesg
   You should see output similar to the following:
   [82807.081078] sd 6:0:0:0: Attached scsi generic sg1 type 0
   [82807.081234] sd 6:0:0:0: [sdb] 15728640 512-byte logical blocks: (8.05 GB/7.50 GiB)
   [82807.081370] sd 6:0:0:0: [sdb] Write Protect is off
   [82807.081372] sd 6:0:0:0: [sdb] Mode Sense: 0b 00 00 08
   [82807.081489] sd 6:0:0:0: [sdb] No Caching mode page found
   [82807.081858] sd 6:0:0:0: [sdb] Assuming drive cache: write through
   [82807.103226] sdb:
   [82807.103947] sd 6:0:0:0: [sdb] Attached SCSI removable disk
   ```

5. Find the drive name for your removable disk; in this case it is sdb
   
   ```
   $ sudo mount /dev/sdb /mnt
   $ cp /mnt/OZOxxx.deb ~/
   ```
In case the machine is connected over network, please find the ip address of it and use it for transferring the file.

1. Find the ip address of OZO Live machine.
   You can check the DHCP lease log in router or you can use following command to find from the machine:

   ```bash
   $ hostname -I
   192.168.96.103
   ```

   In this case, the ip address is 192.168.96.103.

2. Use following command from your PC to copy the deb file:

   ```bash
   $ scp OZO_Live-xxxx.deb nokia@192.168.96.103:/home/nokia
   ```

**Installing package**

The OZO Live application is delivered as a debian package. You need to run following command to install:

```bash
$ sudo dpkg -i OZO_Live-xxx.xxxx.xx-Linux.deb
```

All the related files will be installed under /opt/nokia/ozo_live

Take time to review release notes located in /opt/nokia/ozo_live/ReadMe.txt

In some cases, an upgrade may require update of dependencies such as device drivers. These requirements will generally be specified in the release notes. If you get an error for a dependency please install/update the dependent packages.
As an example, an installation without proper GPU drivers installed might provide an error similar to the below:

```bash
$ sudo dpkg -i OZO_Live-20160713.1249-Linux.deb
(Reading database ... 129937 files and directories currently installed.)
Preparing to unpack OZO_Live-20160713.1249-Linux.deb ...
Unpacking ozo_live (20160713.1249) over (20160713.1249) ...
dpkg: dependency problems prevent configuration of ozo_live:
    ozo_live depends on nvidia-367(or 370); however:
    Package nvidia-367(or 370) is not installed.
dpkg: error processing package ozo_live (--install):
    dependency problems - leaving unconfigured
Errors were encountered while processing:
    ozo_live
```

The solution is to install the nvidia driver:

```bash
$ sudo apt-get install nvidia-375
```

And try the dpkg command again.

```bash
$ sudo dpkg -i OZO_Live-2017XXXX.XXXX-Linux.deb
```

Once you have completed an installation successfully, reboot the system, and OZO live will start automatically after reboot.

**Uninstalling OZO Live**

In case you want to remove OZO Live from system, use following command.

```bash
$ sudo apt remove ozo_live
```
License Activation

OZO Live installs with full functionality, but a watermark is imposed on the output video. In order to remove the watermark and validate the ability to use OZO Live for commercial broadcasts, an Activation Key must be applied.

Don’t wait until production day to request your Activation Key, as the turnaround time can be as long as 72 hours!

Requesting Activation Key

Open a web browser and go to http://<ip address of OZO Live machine>/, then click “Settings” on left pane. You will see a screen like the following image.

Click “REQUEST ACTIVATION KEY” button and download the identifier file. The name of the file is “ozo_live.license_request”.

Send this file in the email to OZOsupport@nokia.com with the reference to your purchase order number. The OZO Support team will validate your purchase and provide an Activation Key within 72 hours.

Installing Activation Key

Once you get an ozo_live_<anything>.lic file from OZO Support, open a web browser and move to “Settings” page. Click “ADD ACTIVATION KEY” button and point to the Activation Key file that you saved from email.

The Activation Key will be stored and validated.
The entire OZO team wants to make sure your experience with OZO Live is a good one. We are ready to help and are eager for your feedback.

**OZO Live Forum**

The OZO Live Forum is a place for OZO Live users and partners to exchange information. It may be found as part of the “Support and Community” section of the Nokia OZO website, at http://support.ozo.nokia.com/

**Support**

Registered users of OZO may access the OZO Support team via email at OZOsupport@nokia.com or online form at https://ozo.nokia.com/ozo_en/contact/. All customer support request will be responded within 24 hours.

If you find any issue with OZO Live, we recommend to report your issues with more information for better analysis. Please run following command in the folder that you ran the ozo_live application.

```
$ /opt/nokia/ozo_live/bin/report.sh
```

report_201610281154.txt.gz is generated, please attach the file in the support request.

Then you will see report_xxxx.txt.gz in the same folder. Attaching this file to your support request will help the support team diagnose your issue more efficiently.
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