

PHOTON BY VYV
Meet the mæstro

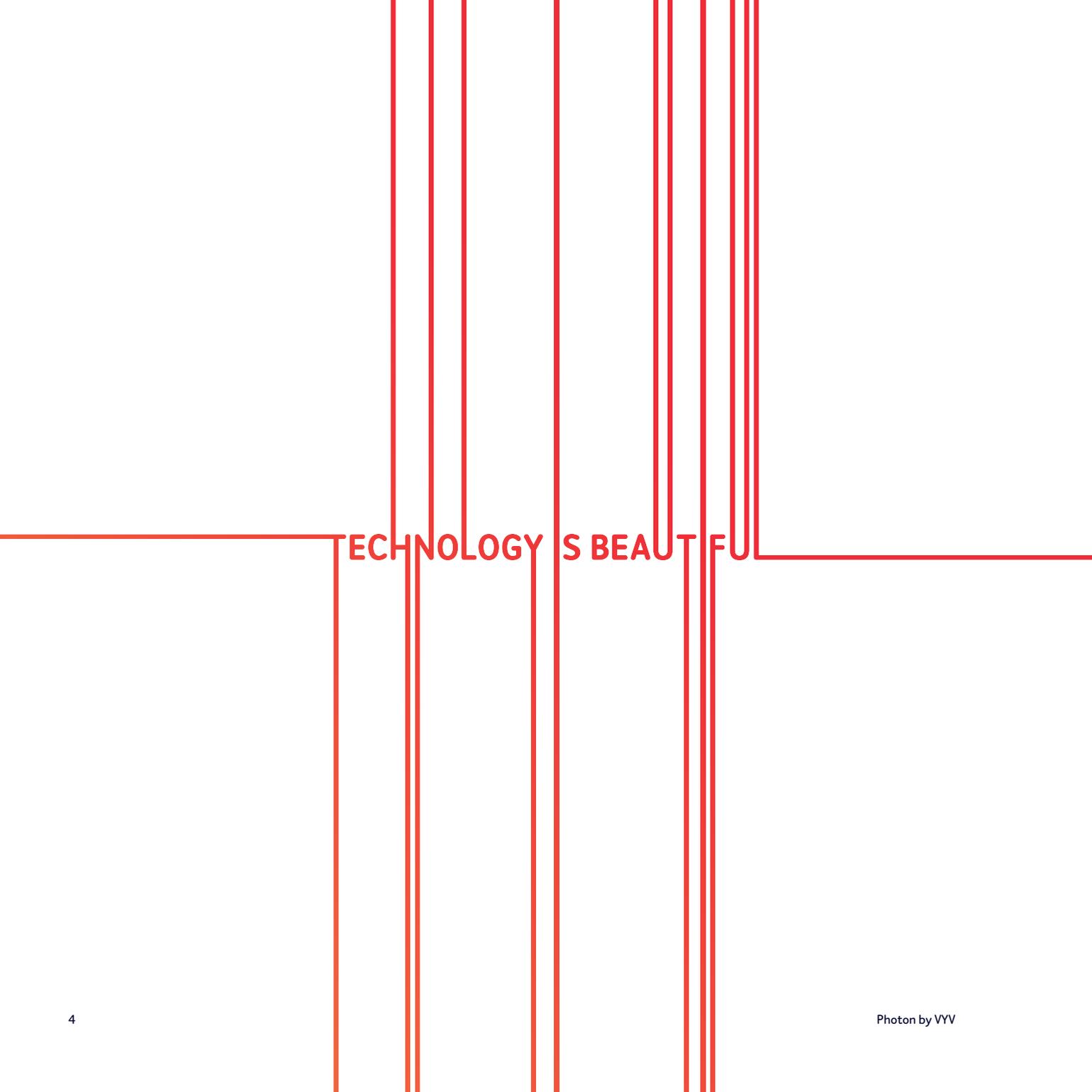
The all-in-one media server
for infinite possibilities





TABLE OF CONTENTS

| | |
|-----------------------|-----------|
| Our philosophy | 4 |
| - | |
| Introduction | 6 |
| - | |
| Image | 8 |
| Compositing & editing | 10 |
| Playback | 12 |
| 3D scene | 14 |
| - | |
| Vision | 16 |
| Tracking | 18 |
| Projection | 20 |
| LED & flat surfaces | 22 |
| - | |
| System | 24 |
| Network | 26 |
| Show control | 28 |
| Hardware | 30 |
| - | |



TECHNOLOGY'S BEAUTIFUL

OUR PHILOSOPHY

Behind every great show, concert, performance and installation, there is a visionary. Someone who sees something the rest of us don't. Someone who wants to do something that's never been done before. Someone who's just crazy enough to believe in magic.

And behind that visionary, there is a team of people who know — right down to the algorithm and calibration protocol — how to bring that vision to life. We are those people. At VYV, we develop video display technologies to enhance the experience of art and entertainment. Our systems, our servers and our technical innovations are the product of our knowledge and the result of our determination and drive. We speak geek. And we talk tech. But our mother tongue is beauty.

It is the language of seeing what we've built in our studios transform into art once on stage. It's the pleasure of harnessing tools that make a brick and mortar building ripple with light. It's taking what's tangible — projector positions, lens ratios, brightness, resolution — and transforming it into something intangible until it inspires awe.

We have the chance to work with some of the most inspired visionaries of our time. They come to us for our technical prowess and our agility. They come back to us for our never-say-never approach. And every time, we give them something more.

We give them beauty.

VYV — TECHNOLOGY IS BEAUTIFUL

What happens when you combine computer science research in **image** and **vision** with an advanced show control **system**? Photon happens.

What does this mean exactly? Let's take a minute to break it down.

IMAGE includes fields of research such as computer graphics and image processing, which study methods to digitally synthesize and manipulate visual content.

VISION refers to computer vision research, which includes methods specifically made to acquire, process, analyze, and understand real-world images.

The Photon **SYSTEM** was designed to present the user with intuitive interfaces to drive the scientific algorithms invented and developed in VYV labs. It provides all the necessary tools to control every single piece of video equipment used in shows and artistic installations.



The only way of discovering the limits
of the possible is to venture a little way
past them into the impossible.

From Arthur C. Clarke's Three Laws

I M A G E

V I S I O N

S Y S T E M



COMPOSITING & EDITING

Photon was designed to provide real-time tools to respond to almost any kind of on-site creative request. That's why there is no pre-rendering and no controller to display synchronization.

KEYFRAME ANIMATION

In some situations, it's easier and more convenient to use a defined curve to control certain parameters. The keyframe editor allows you to create key points and control their tangents to drive any parameter in the application: from the timeline, to clip properties, to node parameters from the FX tree, to particle system behaviours.

TIMELINE

Photon's timeline will immediately appear familiar to users of modern video editing systems. It can follow a timecode but is just as easily used in more flexible and less predictable structures, thanks to the integration of such concepts as cues and timeline regions with automatic transitions. It is fully interactive and can perform compositing of as many as 32 layers of HD (or 64 MPixels) per server, in real time, using flexible alpha management and all the requisite blend modes.

FX TREE

Photon includes an easy-to-use and efficient flow graph with more than 200 nodes. This FX tree allows for the easy creation of interactive effects using custom and complex treatments that include conditional nodes, tracking data, image processing and analysis — all by connecting simple building blocks.

COLOUR GRADING

The colour correction module enables the precise and advanced control of colours per clip, thanks to a simple but powerful interface familiar to video editors. The ability to store and recall looks quickly and easily saves you a serious amount of re-rendering time on site.

PARTICLE SYSTEM

Integrated in the FX Tree, the 3D Particle System uses nodes to define the type of particles, their properties, their behaviour, whether they are sprites or Gaussian patterns, and their interactions with the real world using Albion tracking data. You can literally create anything your imagination dreams up, from flocks of birds, to subtle smoke, to a raging fire.

PLAYBACK

Pixel screen density has vastly increased over the last decade. The VCI (VYV codec interface) was designed in 2005 to address this and to offer advanced features such as smooth slowed-down playback with frame blending, real-time splitting for really large screens and frame-accurate network synchronization.

VYV CODEC INTERFACE

VCI VYV Codec Interface (VCI)

Photon's internal uncompressed media format is a container format for video and audio data designed to deliver the highest playback performance and stability possible. Any media imported in Photon is automatically uncompressed into this format. This enables Photon to play extremely large video files without compromising the quality, and guarantees consistency in the delivery of each and every frame. This means that, as long as the video content remains uncompressed across the entire content production chain, you'll never experience annoying compression blocks or performance drops due to the complexities of video content.

FRAME RATES

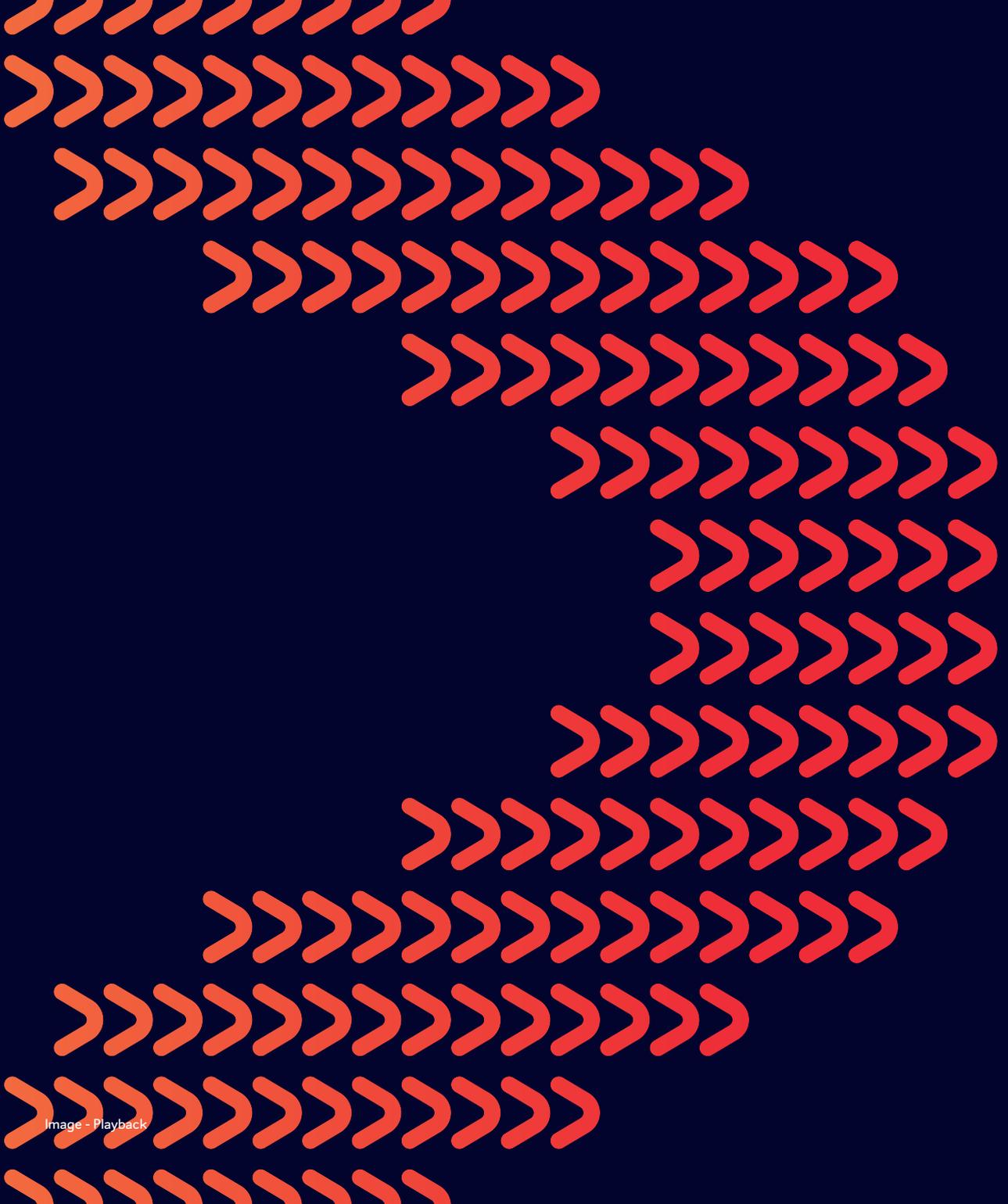
Frame rates are detected from the original file when imported, and frame rate cross conversion happens automatically so you never have to worry about it. You can set your timeline to the desired rate and your projector can be at another rate (generally 60Hz). You can also play your media at any speed and frame since blending will be used to interpolate between frames. A handy way to slow down those fast-moving videos that were not designed with such a huge canvas in mind.

AUDIO PLAYBACK

Photon supports professional audio interfaces such as RME's Fireface UFX, and all of the hardware's output channels. Using them is simply a matter of loading clips with any number of audio tracks and mapping them to the audio device's playback channels however you like. It's that easy.

REAL-TIME SPLITTING

In Photon, content is never pre-split per projector, as content and projector locations are entirely independent. Changing projector locations, adding or removing projectors, scaling or rotating content does not require re-renders because the content to be sent to each projector is determined dynamically. For ultra-high resolutions, VYV's proprietary VCI format also provides YA16 encoding, which is ultra-flexible and enables virtually unlimited resolution by allowing each server to read only what it requires from the media. The Photon network can play content in real time whose sheer size alone would make it unreadable on most systems.





3D SCENE

Photon offers real-time 3D scene rendering featuring projection coverage, a projector illumination heat map and simulation, precise shading and real-time shadow visualisation. Creative directors and content designers can import 3D assets and preview the scene or stage before it's even built, giving them the chance to design and experience their future show at no rendering cost.

MODELLING TOOLS

Once imported, models can be translated, scaled and rotated as easily as in any 3D modelling application. Photon also includes a large number of basic primitives that can be used as building blocks to create a model representation of your environment.

PREVISUALISATION

As surfaces are added to the scene, Photon's timeline gets populated, each line corresponding to a projection surface. Add some layers, as you would in any editing software, and place clips. They immediately appear in your scene and you can start seeing what your show will look like in the venue. By adding projectors to the scene and placing them in hypothetical positions, you can verify possible occlusions through real-time shadow generation.

MODEL ACQUISITION

Photon supports the industry-standard FBX format, making it easy to import 3D objects from AutoCAD®, Maya® and 3ds Max®. The XSI format from Softimage® is also natively supported, as well as the legacy Wavefront OBJ format. If you use a surveying station to acquire points from the real world, they can be loaded directly into Photon as an IDX file.

PROJECTION STUDY

Photon can display pixel size, overlapping pixel shapes, blend zone visualisation and the incident luminous intensity on each surface in lux. Shadows cast by each projector are also realistically depicted. The chosen field of view for each projector is automatically translated to a lens zoom factor, making Photon the ideal tool for the early stages of design. It's easy to determine the precise number of projectors needed to achieve the desired brightness, which type of lens each projector will need to be equipped with, where tracking cameras should be installed and how many there should be. Photon also allows you to take possible rigging points and occlusions into account so that you can effectively avoid casting unwanted shadows.

Any sufficiently advanced technology
is indistinguishable from magic.

From Arthur C. Clarke's Three Laws

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TRACKING

VYV's ten years of research and development have resulted in Photon having a true 3D understanding of the stage. It is aware of any moving or static object that video needs information about – from the projectors, to the screens, to the cameras and to the performers.

POSISTAGENET | PSN

In 2013, VYV and MA Lighting designed, implemented and released the industry standard PosiStageNet (PSN) stage positioning protocol. This standard protocol allows any system supporting it to communicate or receive realtime tracking data (positions, IDs, speed, etc.) with extremely low latency on local networks. Photon's Albion module acts as a producer of PosiStageNet data, using cameras to stream the 3D positions of VYV Copernic NIR on stage to all devices supporting the protocol. These devices, such as MA Lighting's GrandMA 2 lighting console can then use these positions to react automatically to what is happening on stage. The possibilities don't stop at lighting: video, sound, automation, SFX, choreography and artistic direction can all benefit from live stage position data.

INTERACTIVITY

Thanks to the openness of the system, IR or thermal cameras as well as Albion's tracking data can be used to create interactive and original content that reacts to real-world inputs. These captured inputs can be treated, transformed and filtered through an infinite combination of effects to produce the desired results.

DEFORMATION TRACKING

Photon's Albion module can track larger numbers of emitters on a single object, which Photon can then use to track an object's deformation. Cloth, giant inflatables, flags and more can become projection surfaces even as their shapes change.

INSTANT WORLD CALIBRATION USING VYV CONSTELLATION

While most optical motion tracking systems use lengthy, unreliable and error-prone calibration procedures (which often involve waving calibration objects in the capture volume), Photon's Albion module uses VYV Constellation Solutions, an in-house method that instantly calibrates every camera in the 3D capture volume at the press of a button. VYV Constellation can be customized to efficiently calibrate any stage.

OBJECT TRACKING

Photon can read automation data from many vendors straight out of the box. Reading custom TCP or UDP data is also possible. Even freely moving objects that haven't been automated pose no problem for Photon. The Albion module enables over-the-stage POE tracking cameras and embedded NIR Copernic emitters to track, follow and project on any kind of object, which can be moved freely by performers, by simple motors, or even by the wind's sway. The geometric complexity of the shape is not an issue.

PROJECTION

One of the primary goals with Photon was to be able to project on any kind of complex geometry and blend (soft-edge) as many projectors as desired on a given surface with total precision. Why? Because this allows you to adapt to almost any situation, such as trimming projectors to a different height in a new venue, moving projectors because of rigging or other constraints, or adding and removing projectors without having to modify content or re-author soft edges by hand.

PROJECTOR ALIGNMENT

On setups with a small number of projectors, it is smart and cost effective to position your projectors manually and then have Photon automatically compute the zoom, lens shift and optical centre for each one. This involves placing a small number of an object's reference points through the projector, a process that can easily be done thanks to the Photon remote control software for Android devices (designed for NVIDIA SHIELD portable and tablet).

STRUCTURED LIGHT AUTOMATIC CALIBRATION (SLAC)

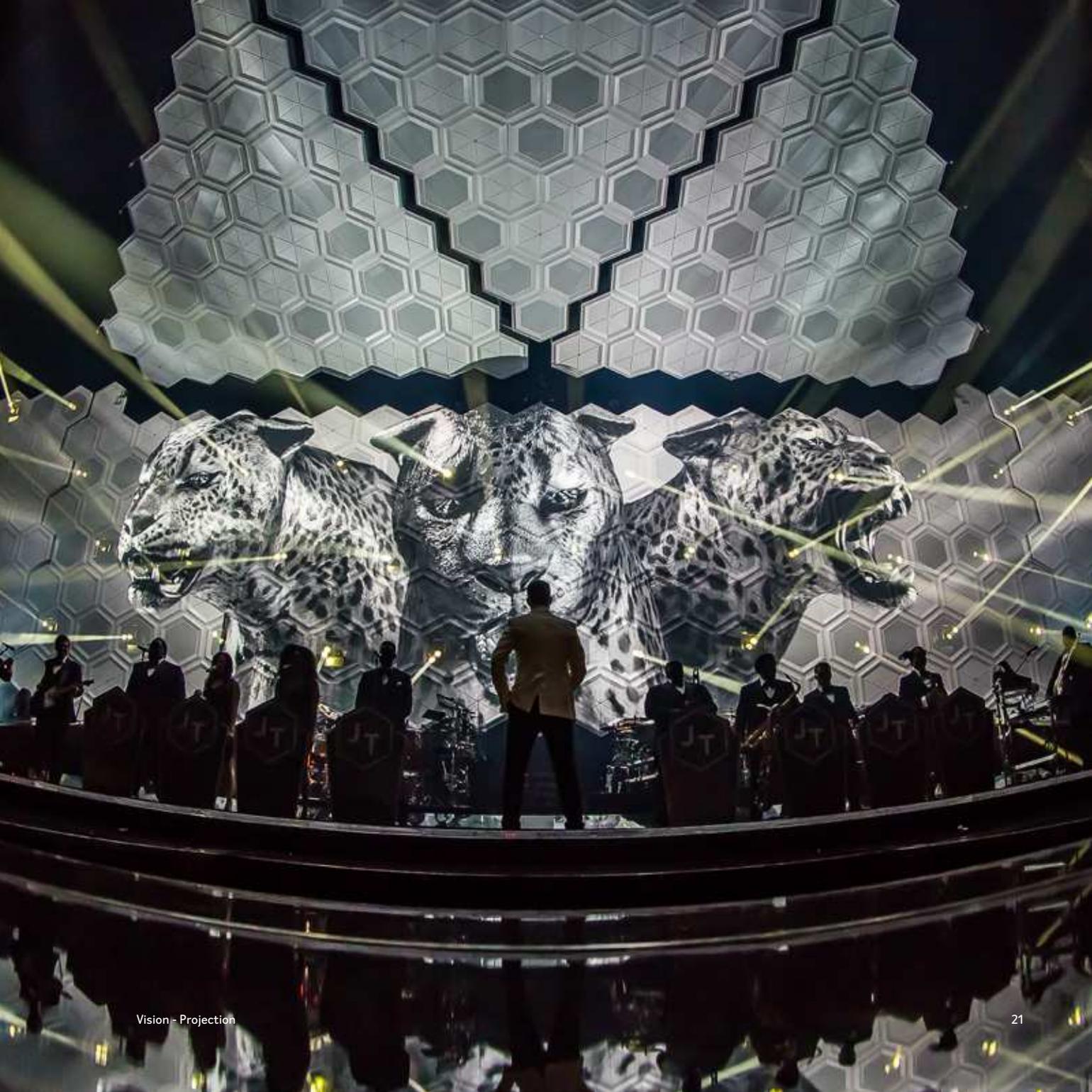
One of Photon's greatest time-saving features is the Structured Light Automatic Calibration interface. Cameras calibrate instantly and then observe light patterns emitted by the projectors. Within seconds, Photon can automatically compute the projector parameters, dramatically reducing setup time. In certain cases, the same result can also be achieved by replacing the cameras on the projectors by light sensors embedded in the projection surface, resulting in additional cost savings.

REAL-TIME PROJECTOR ALIGNMENT AND AUTO FOLLOW

What happens if you attach a camera to a projector and the projector gets moved? Simple: it will re-align itself in real time. Just imagine what you could do with projectors on moving heads, or several projectors in an arena or a stadium installation. You could have a complete SLAC auto-alignment of your projectors at one end of the stadium and then simply point them to the stage, using Photon to direct them to follow any desired screen automatically. The projector will stay centered on the screen, but it will re-align itself in real time to display the correct image.

REAL-TIME BLENDING

Soft edge blending is completely transparent to the user. It is computed on every frame and it can adapt to any kind of configuration — multiple screens, multiple projectors in convergence, etc. Projectors can be matched with different response curves using manual control on the mask contrast, brightness and gamma.





LED & FLAT SURFACES

In Photon, content is authored per surface and is treated independently from how outputs are driven. How an LED processor expects images to be laid out doesn't need to dictate how your content should be authored. You also don't need to worry about which machine needs which content. This approach allows for greater simplicity and flexibility, and enables cost-effective and intuitive redundant designs for optimal show robustness.

LED MAPPING

Photon's scene authoring includes a native LED Processor object to create maps between the content layout and the layout that your physical LED processors expect, with pixel-perfect accuracy. Any number of quads can be mapped between scene objects and processors, allowing for total flexibility.

VIRTUAL PROJECTORS

With Photon, you can easily manipulate virtual projectors — images that appear to emanate from a given point in space, as if a handheld projector were located there. The virtual projector can then shine on multiple surfaces. They can be projection surfaces or LED screens. They can be static, moving in space through automation, or moving freely and tracked with Albion stage positioning. This makes it easy to apply content across several panels or to use reveal effects as LED tiles move in space. It's as simple as pointing a flashlight.

KEYSTONE

Photon offers quick and simple tools to align flat surfaces. You can blend overlapping zones without the need for manual intervention. With a single camera, Photon can automatically align your screen regardless of the number of projectors or their configuration in space. Importing non-rectangular screens of arbitrary shapes from a 3D model file is a cinch, and Keystone will effectively manage the mask to avoid spill beyond the screen.

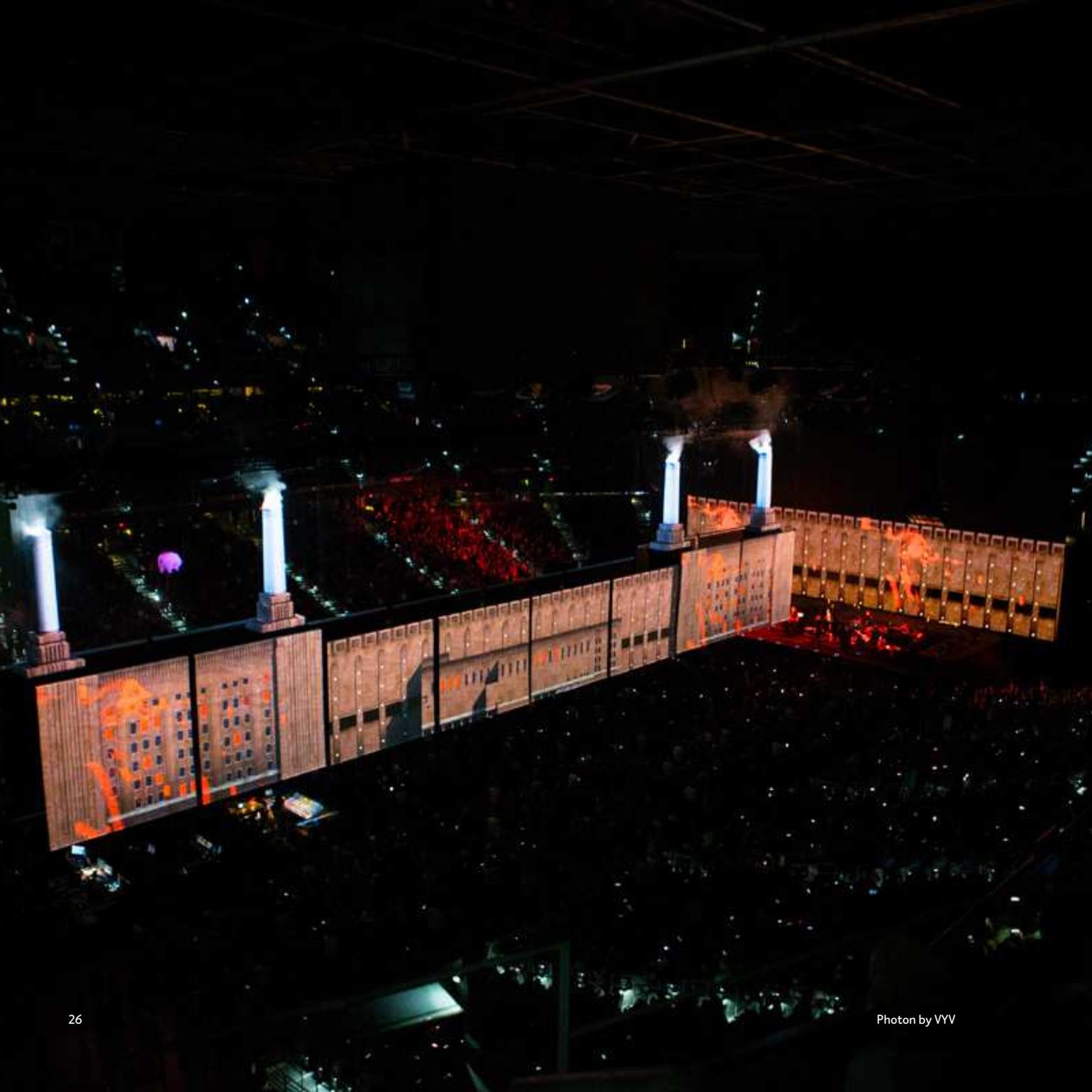
When a distinguished but elderly
scientist states that something is
possible, he is almost certainly right.
When he states that something is
impossible, he is very probably wrong.

From Arthur C. Clarke's Three Laws

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NETWORK

A Photon-driven projection setup can handle large numbers of projectors and involves multiple Photon servers. But to the user, it feels like a single machine. That's because the intricacies of synchronizing every aspect of the show across the network are all taken care of in the background.

MEDIA MANAGEMENT

Importing media in Photon looks quite simple, but under the hood, each Photon in a network shares the content you import at very high rates using Photon's internal TCP based peer-to-peer sharing protocol. This enables Photon to ensure that all servers have the same data, and that data is transferred at maximum network speed. To the user, it simply looks like importing a file into the control station. That's because the hard work of distributing it to multiple machines is all done automatically behind the scenes.

NETWORK ASSISTANT

Photon ships with a straightforward server fleet management tool that executes the necessary operations across all machines. If, for instance, you're upgrading the fleet to a new version of Photon, the Network Assistant spares you the trouble of having to perform operations on each machine individually.

MULTIPLE SYSTEM MANAGEMENT

A network of Photon servers behaves as a single system. Everything is automatically replicated across the network — from selecting input devices, to importing content, to making changes to the show, to syncing all outputs with sub-frame accuracy, to monitoring system performance, to switching between projects.

LIVE BACKUP

To the user, a Photon network consisting of a large number of servers looks like a single, powerful machine. Under the hood, each physical server automatically receives all the content for the show and any server can be dynamically set to drive any output, even in the middle of a show. This allows for highly flexible live backup solutions, as any server can take over from any other at any time, at the press of a button.

SHOW CONTROL

Photon has the built-in ability to control, and be controlled, by a whole ecosystem of devices that are typically found in shows. This allows for impressive flexibility in how such communication is made and what actions are triggered.

CUE INTERFACE

In Photon, any sequence of actions can be chained and stored in a macro, which it refers to it as "cues." Once recorded, these cues can be triggered from any input device (like a MIDI keyboard or a computer keyboard), via ArtNet from other devices (like lighting consoles), and even from Photon's timeline to set off complex actions at specific moments of the show. The system is versatile and can be used in a number of contexts, from show control, to reactive video that adapts to what is happening on stage.

ART-NET DEVICE CONTROL

In cases where projection devices cannot be controlled via TCP/IP, Photon can control them via Art-Net. This is typically the case with projectors on moving heads, and so Photon has native support for controlling Barco DML-1200's as well as ZAP VIP One and ZAP VIP Dual yokes through ArtNet. With such precise control of moving projectors and Photon's real-time recalibration capabilities, you can achieve never before seen projection coverage of huge venues with a level of brightness and resolution that would be much more expensive with fixed projectors.

EXTERNAL CONTROL

In addition to its clear and efficient UI, Photon can also be controlled externally in several ways. MIDI signals, ArtNet channel values, TCP and UDP are all accepted inputs that can trigger cues and send commands to Photon. Additionally, Photon supports many of the most common automation protocols, which allow it to project onto moving objects without the need for motion capture. And in cases where automation is not available or surfaces are moving freely, Photon also supports the open PosiStageNet protocol (also developed by VYV) to receive stage positions from systems such as VYV's Albion server.

MATRIX CONTROL

The show must always go on, even in the case of hardware failures. To ensure show consistency, Photon delivers efficient and intuitive control of video matrices — natively supporting Lightware, Blackmagic Design and Evertz — together with a powerful cue interface.

HARDWARE

The Photon architecture is used around the world on permanent shows and tours alike. Its ruggedness and reliability are second to none, and the Photon 4-HD/Photon 8-HD models output setup, combined with Photon's flexible approach to live backups, make for cost-efficient live redundancy.

HARD DRIVES & MEDIA FORMATS

| | |
|--------------------------------|--|
| Storage capacity | <ul style="list-style-type: none">• 3.5 TB (Photon 4-HD model, 8 x 512 GB SSD in RAID 5)• 7 TB (Photon 8-HD model, 8 x 1 TB SSD in RAID 5) |
| Maximum file resolution | 16K x 16K |
| Video formats | Quicktime (Preferred) |
| Quicktime video codecs | <ul style="list-style-type: none">• Animation+• Apple ProRes 422/444• Photo-JPEG• Uncompressed (None)• MP4• H.264 |
| Stills file format | <ul style="list-style-type: none">• JPEG• PNG (Alpha support)• TGA |
| 3D File formats | <ul style="list-style-type: none">• OBJ• FBX |
| Audio file formats | <ul style="list-style-type: none">• WAV• AIFF• MP3 |
| Peripherals | <ul style="list-style-type: none">• 4 x USB 2.0• 4 x USB 3.0 |
| Network | 2 x 10 Gigabit Ethernet |

PERFORMANCE

| | |
|------------------|--|
| Bandwidth | 3.5 GB/sec. playback <u>Equivalent of:</u> 8 x 4K30p videos in uncompressed 4:2:0 or 32 x 1080P30p videos in uncompressed 4:2:0 |
|------------------|--|

VIDEO CONNECTION

| | |
|--|---|
| Video outputs | <ul style="list-style-type: none">• 2 x 4K or 4 x HD (Photon 4-HD model)• 4 x 4K or 8 x HD (Photon 8-HD model) |
| Video output connectors | <ul style="list-style-type: none">• 4 x DP 1.2 (Photon 4-HD model)• 8 x DP 1.2 (Photon 8-HD model) |
| Maximum output resolution | 4096 x 2160 @ 60 through DP 1.2 3840 x 2160 @ 60 through HDMI 2.0 |
| 4K support | <ul style="list-style-type: none">• 4K+ uncompressed playback• 2560 x 1600 DVI Dual link• 4K output via DisplayPort 1.2 |
| Video input standards | 10 bit SD / HD / 2K / 4K |
| Video input interfaces (may require additional hardware) | <ul style="list-style-type: none">• 3G / 6G SDI / 12G - SDI• HDMI• DVI-D• Component |
| Genlock | Optional Genlock board |

AUDIO CONNECTION

| | |
|---|--|
| Audio output connectors | Stereo 1/8 jack |
| Audio input connectors | Stereo 1/8 jack |
| Optional audio input/output connectors | <ul style="list-style-type: none">• 12 x Analog I/O (TRS Balanced + XLR)• 2 x 8-channel ADAT I/O or 1 ADAT + 1 S/PDIF• 2 x AES/EDU I/O |

GENERAL INFORMATION

| | |
|--------------------------|---------------------------------------|
| Power supply | 100-240V AC 50-60 Hz Auto Switching |
| Power consumption | Normal 480W Max 540W |
| Unit size | W462 x H178 x D673 mm |
| Case | 4U 19" Rackmount |
| Weight | 40 Kg |
| Operating range | Temp: 5 - 35 Celcius 8-90% humidity |
| Heat | Max 1842 BTU/h |

CONTROL PROTOCOLS

| | |
|---------------------------------|---|
| Timecode | <ul style="list-style-type: none">• LTC / SMPTE input via Stereo 1/8 jack• MTC (MIDI TC requires additional MIDI interface) |
| Control protocol outputs | <ul style="list-style-type: none">• ArtNet• PosiStageNet• Lightware DVI Matrix• Evertz HD-SDI Matrix• Blackmagic Design HD-SDI Matrix• Projector control (ChristieNet)• Barco Projector Control• Panasonic Projector Control (PJ-Link)• Custom network messages (TCP/UDP) |
| Control protocol inputs | <ul style="list-style-type: none">• ArtNet• MIDI• VVY TCP/UDP Control Protocol• PosiStageNet• Automation Protocols (real-time screen tracking)• TAIT Navigator• Stagetech• Stagehands Spikemark• Kinesys• PRG automation• VVY automation protocol |

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