Panasonic
CONNECT

IT/IP Platform "KAIROS" Achieving
Innovation in Live Video Production

KAIROS
Incredible Productivity

IP Wave of Video Production

Since the digitalization of broadcasting in the 2000s, the video production industry has seen remarkable technological advances in HD, 4K and even 8K. While this evolution has brought many benefits, the rapid pace of change has made it difficult to update equipment from a long-term perspective. Data volumes continue to increase due to increasingly higher content resolution, which in turn is requiring systems to be more scalable. In addition, as video content and viewing patterns diversify, more flexible video production methods are required to support different resolutions, aspect ratios and video formats. Furthermore, the impact of Covid 19 has expanded the need for remote-production and resource-sharing cases where remote personnel must handle both production and transmission. IP-based video production systems provide solutions to overcome these problems, making IP more important every day.

Advantages of IP-based Solutions

- High data rate transmissions
- Transmission quality irrespective of distance
- Support for control signals, not just video/ audio signals, for easy integration with external devices
- Remote operation and resource sharing via public lines
- Highly compatible with file-based video systems
- Streaming without the need for additional equipment.

Remote operation and resource sharing

SDI **Serial Digital Interface**

BNC Cable
up to 12G
BNC

IP **Internet Protocol**

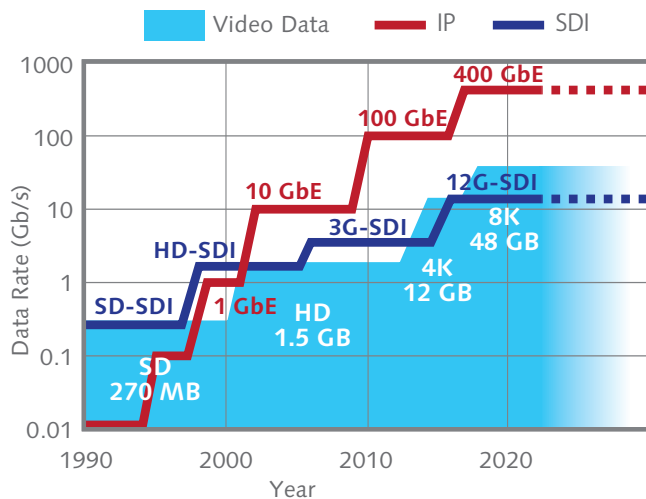LAN, Fiber-optic Cable

1G/10G   10G/25G   100G

RJ-45   SFP   QSFP

Ongoing IP evolution: IP allows multiple high data rate videos to be streamed simultaneously via a single cable, whereas the traditional SDI interface has becoming difficult to handle the data volumes of high-quality content.
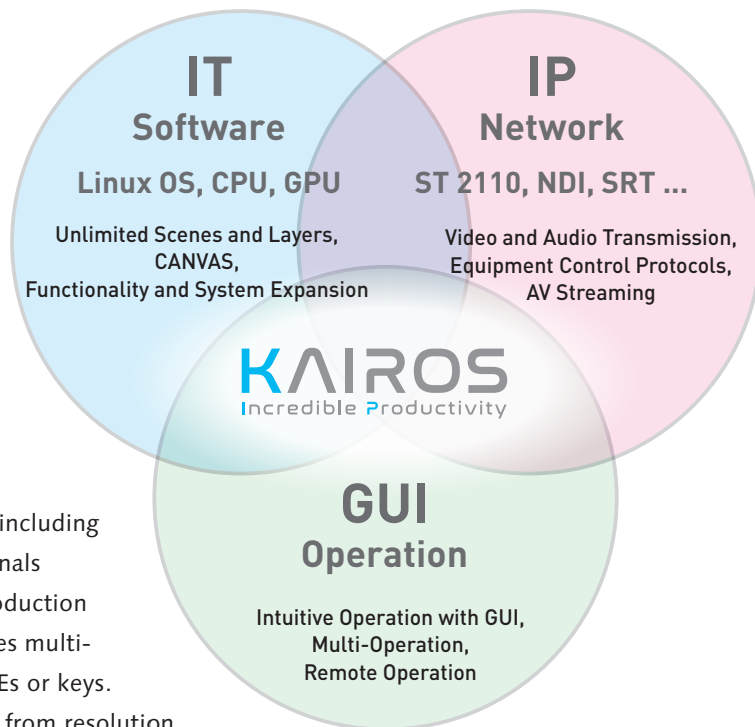
Panasonic IT/IP Platform "KAIROS"

Panasonic's IT/IP platform "KAIROS" enables live video production under a new concept and with innovative architecture, incorporating proprietary, groundbreaking software to maximize CPU and GPU capacities for video processing.
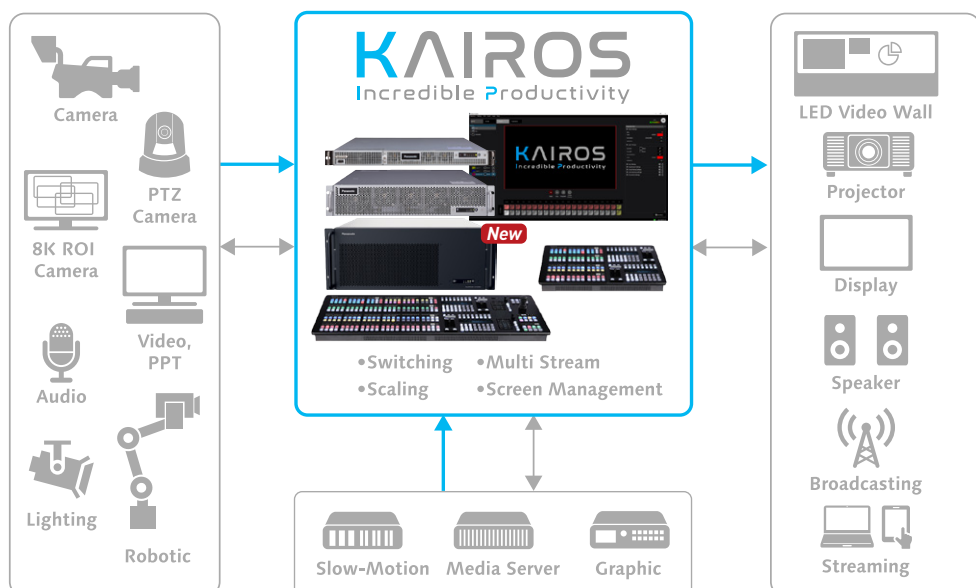
The platform uses general-purpose IT equipment running on the CPU and GPU in order to take advantage of the most advanced IT technology. Also, proprietary software technology realizes unprecedented flexibility for live video processing with low latency thanks to the GPU, while open software architecture ensures excellent scalability.

KAIROS offers a wide range of video inputs and outputs, including not only baseband signals such as SDI but also new IP signals including ST 2110, NDI and SRT for remote live video production and streaming. Using the GPU for video processing enables multi-layer video production with no limit on the number of MEs or keys. What's more, the "Canvas" screen frees video production from resolution and format limits.

IT
Software
Linux OS, CPU, GPU
Unlimited Scenes and Layers, CANVAS, Functionality and System Expansion

IP
Network
ST 2110, NDI, SRT ...
Video and Audio Transmission, Equipment Control Protocols, AV Streaming

KAIROS
Incredible Productivity

GUI
Operation
Intuitive Operation with GUI, Multi-Operation, Remote Operation

As an IT-based open-architecture platform, KAIROS enables additional software to be installed for expanded functionality and linkage with diverse external devices. Thanks to such flexible integration, KAIROS improves work efficiency and ensures future expandability. By offering flexibility at all levels of production, unlike any existing hardware-based system, KAIROS breaks new ground in live video production.

KAIROS Benefit

SHOOTING → COMPOSITION → VISUALIZATION

KAIROS
Incredible Productivity

New

•Switching •Multi Stream
•Scaling •Screen Management

Camera
PTZ Camera
8K ROI Camera
Video, PPT
Audio
Lighting
Robotic

Slow-Motion Media Server Graphic

LED Video Wall
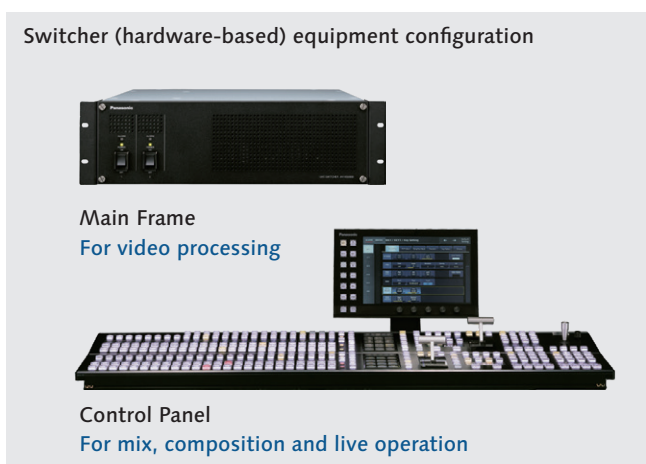Projector
Display
Speaker
Broadcasting
Streaming

- Provide flexible and diverse video production
- Improve efficiency and productivity
- Realize high flexibility and scalability

From Hardware to Software

KAIROS basically consists of a mainframe for processing video and audio, and a control panel for operating the mainframe. While this is not unlike conventional switchers, the structure within the mainframe is different.

While existing hardware-based switchers use FPGAs, software-based KAIROS uses CPUs and GPUs for control. As a result, video mix and composition settings that are conventionally handled on a physical control panel are instead performed via the software GUI. Other operations, such as input/output, transitions, macros, Multi-Viewer, video clips and still images setting, can also be performed using the same software.

The intuitive, easy-to-use GUI makes setup and production work more efficient than ever before. Also, GUI software is less dependent on the skills of individual operators, making it possible to utilize a wider range of operators.

Switcher (hardware-based) equipment configuration

Main Frame
For video processing

Control Panel
For mix, composition and live operation

KAIROS (software-based) equipment configuration

Main Frame "Kairos Core"
For video processing

GUI Software "Kairos Creator"
For mix and composition

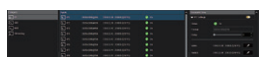**Control Panel "Kairos Contro"**
For live operation

Advantages of Software-based Solution

- Video configuration capability not restricted by ME or key limits.
- Diverse settings and video configuration possible with the same GUI software.
- Intuitive and easy-to-use GUI software for improved operability.
- Easy training of operators and equalization of staff skills.
- Software updates and options available for expanded functionality.
- General-purpose IT hardware enables use of latest IT hardware.
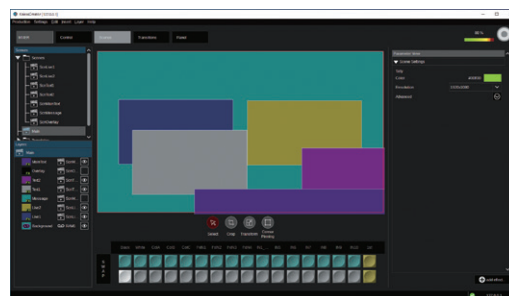
GUI Software "Kairos Creator" Scene (ME), Layer (KEY)

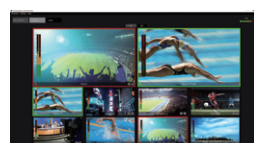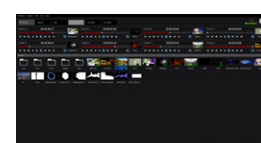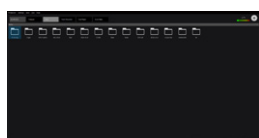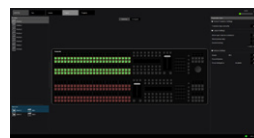| Input and Output	Transition	Macro	Multi-viewer	Video Player

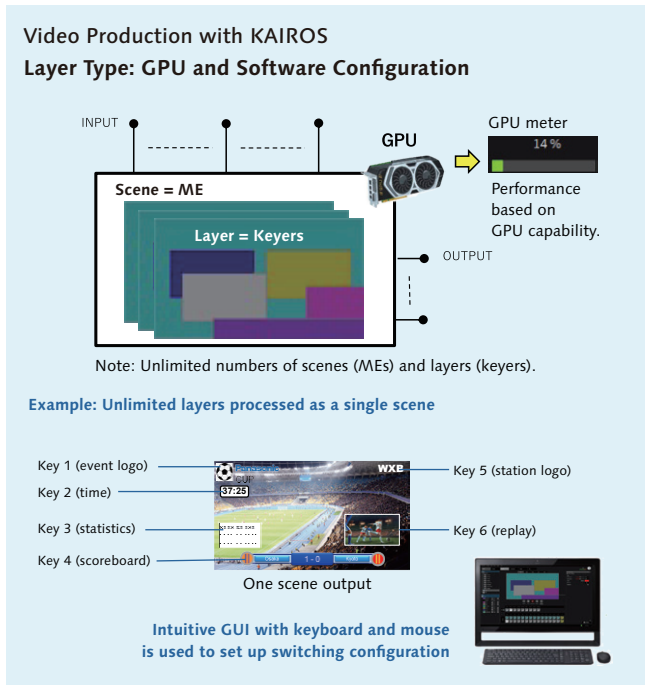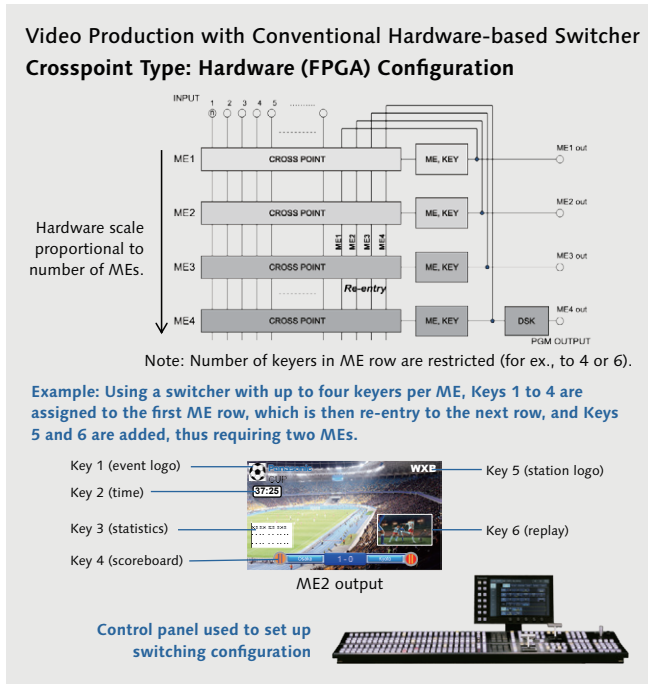| Still Pictures	Audio Mixer (Optional)	Title Generator	Control Panel Assignments	Software Control Panel

Unlimited Scenes and Layers

Conventionally, the number of MEs or keys on a switcher are a constraint that live video operators must always consider. Although video compositions that exceed ME limits can be handled by re-entry, priority changes across MEs require highly skilled operators.

KAIROS frees operators from this constraint by allowing them to flexibly arrange, resize and layer content with the GUI software, similar to Photoshop or PowerPoint.

In KAIROS, "scenes" are the equivalent of conventional MEs, and "layers" are the equivalent of keys. Since there is no limit to the number of MEs or keys, layers can be added as far as the GPU's capacity will allow. Priority can also be easily adjusted by simply switching between the front and rear layers.

Conventional switchers often keep the system on standby with a generous margin based on the expected maximum number of MEs, but KAIROS eliminates such concerns, allowing operators to leverage the power of the GPU to realize the videos that they envision.

Video Production with Conventional Hardware-based Switcher
Crosspoint Type: Hardware (FPGA) Configuration

Hardware scale proportional to number of MEs.

Note: Number of keyers in ME row are restricted (for ex., to 4 or 6).

Example: Using a switcher with up to four keyers per ME, Keys 1 to 4 are assigned to the first ME row, which is then re-entry to the next row, and Keys 5 and 6 are added, thus requiring two MEs.

Key 1 (event logo)
Key 2 (time)
Key 3 (statistics)
Key 4 (scoreboard)
Key 5 (station logo)
Key 6 (replay)

ME2 output

Control panel used to set up switching configuration

Video Production with KAIROS
Layer Type: GPU and Software Configuration

GPU meter
14 %
Performance based on GPU capability.

Scene = ME
Layer = Keyers

Note: Unlimited numbers of scenes (MEs) and layers (keyers).

Example: Unlimited layers processed as a single scene

Key 1 (event logo)
Key 2 (time)
Key 3 (statistics)
Key 4 (scoreboard)
Key 5 (station logo)
Key 6 (replay)

One scene output

Intuitive GUI with keyboard and mouse is used to set up switching configuration

Flexible Composition of Scenes and Layers

- Unlimited number of scenes (MEs) and layers (keys) for complex video composition.

- Priority changes simply by switching between front and back layers.

- Cropping, resizing and color correction available for each layer.

- X/Y, size, resolution, color theme, and macro can be set for each scene.

- Scene files can be created in advance, duplicated and reused.

- Layer material and scene output can be assigned to cross-point buttons.

- Intuitive and easy-to-understand GUI for short-term operator training.

Layer 4
Layer 3
Layer 2
Layer 1
BKGD A/B

Scene
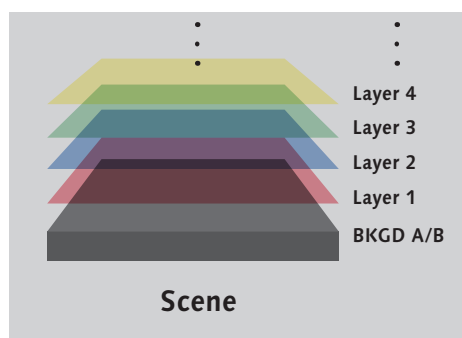
Flexible I/O and Video Formats

The system (video) format of a hardware switcher is fixed for each device, so conversion is required to input different video formats, including IP/SDI converters for IP signals. The same is true for streamings.
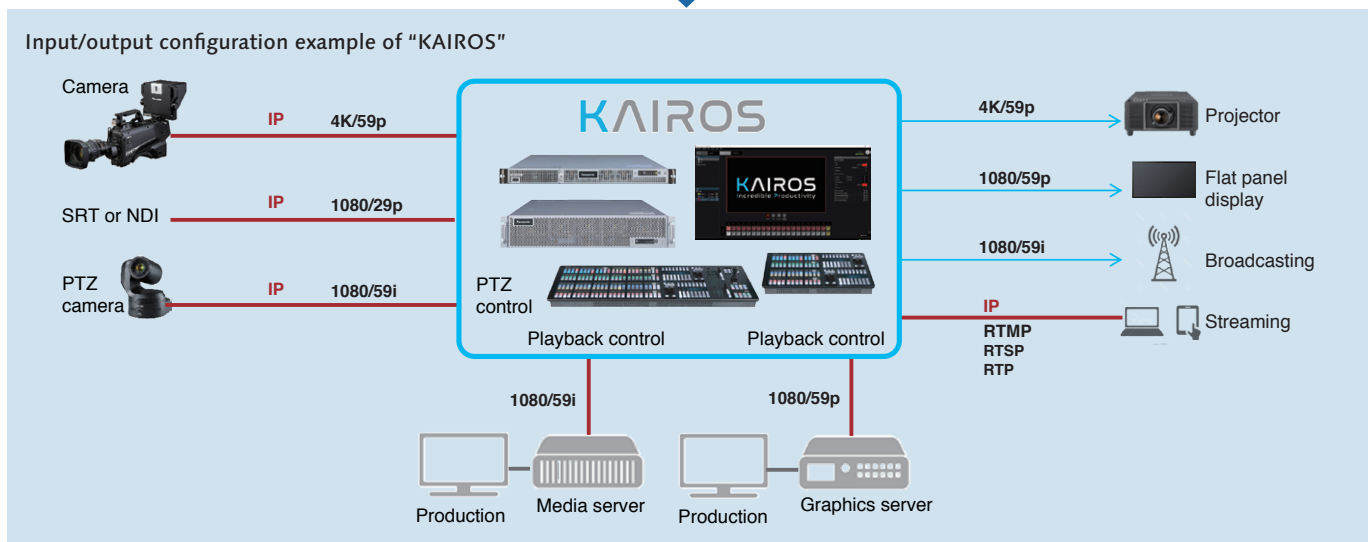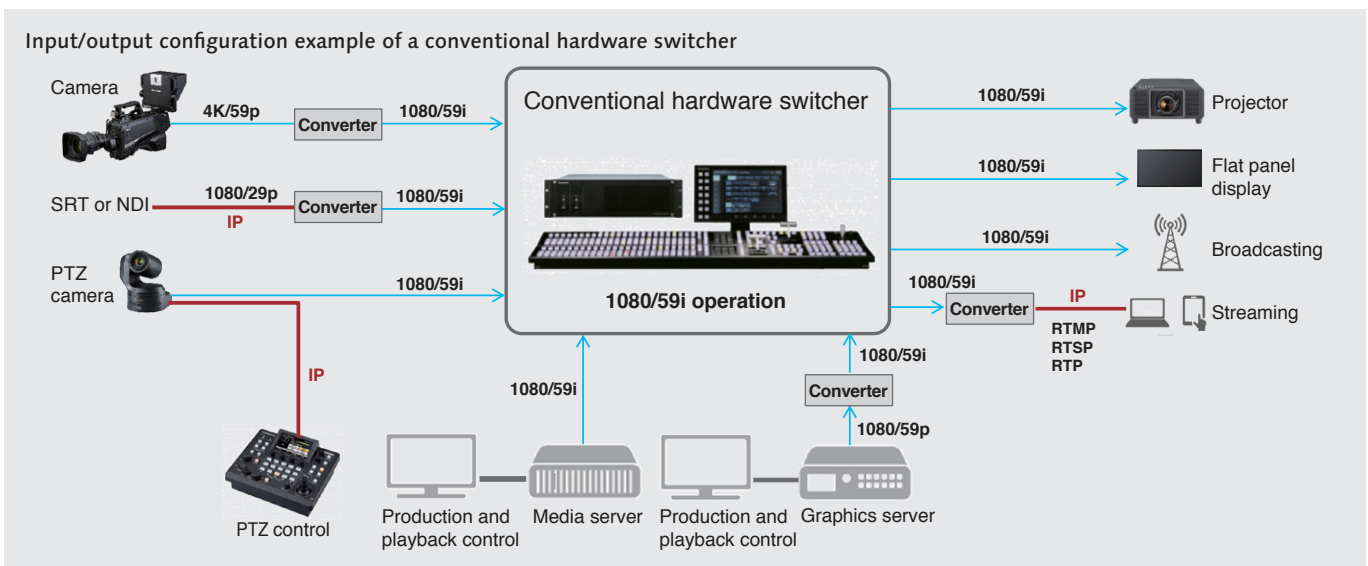
KAIROS, however, is not restricted in this way because it doesn't have a system format. Different resolutions, frame rates and interlaced/progressive signals can be input directly without conversion.

The video format is set per scene, and the source video is automatically converted to match the resolution and frame rate set for each scene. Output signals can also be freely configured. For example, a single system can provide multiple outputs, such as 4K for venue production, HD for broadcasting and IP for streaming.

KAIROS is fully IP-enabled for both input/output and internal processing, so no conversion is required for input/output of IP signals such as ST 2110 and NDI, and streaming signals such as SRT, RTMP, RTSP and RTP. In addition, baseband signals such as SDI and HDMI can be input/output via gateway devices or a DELTACAST gateway port.

The IP interface also supports control of IP-compatible devices such as PTZ cameras, eliminating the need for a dedicated controller or operator (conventionally required separately).

Simply put, KAIROS enables efficient operation with less resource.

Input/output configuration example of a conventional hardware switcher

Camera — 4K/59p — Converter — 1080/59i — Conventional hardware switcher
SRT or NDI — 1080/29p IP — Converter — 1080/59i
PTZ camera — 1080/59i
IP

1080/59i operation

PTZ control
Production and playback control — Media server — 1080/59i
Production and playback control — Graphics server — 1080/59p — Converter — 1080/59i

1080/59i — Projector
1080/59i — Flat panel display
1080/59i — Broadcasting
1080/59i — Converter — IP RTMP RTSP RTP — Streaming

Input/output configuration example of "KAIROS"

Camera — IP — 4K/59p
SRT or NDI — IP — 1080/29p
PTZ camera — IP — 1080/59i

KAIROS
PTZ control
Playback control   Playback control

Production — Media server — 1080/59i
Production — Graphics server — 1080/59p

4K/59p — Projector
1080/59p — Flat panel display
1080/59i — Broadcasting
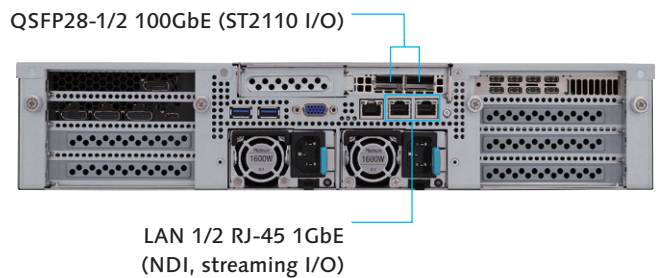IP RTMP RTSP RTP — Streaming

Flexible I/O and Video Formats
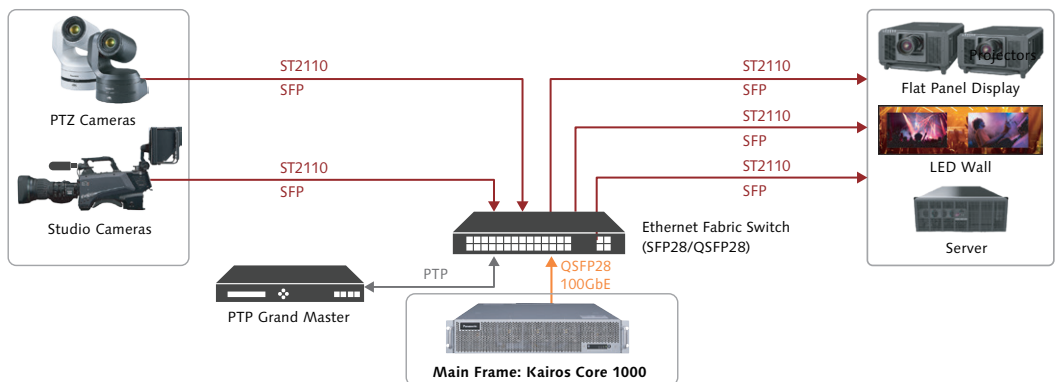
KAIROS I/O and Interface Features

- No video format conversion is required. Diverse resolutions, frame rates and interlaced/progressive video can be input directly.

- Video format can be set for each scene, and input video is automatically converted to match the scene.

- ST 2110, NDI IP signals and SRT/RTMP/RTSP/RTP streaming signals can be input directly without conversion.

- Baseband signals such as SDI and HDMI can be input and output via gateway device or DELTACAST gateway port.

- Output signals can be adjusted flexibly. Parallel output with multiple video formats and signals is possible.

- Supports remote control of IP-compatible devices such as PTZ cameras.
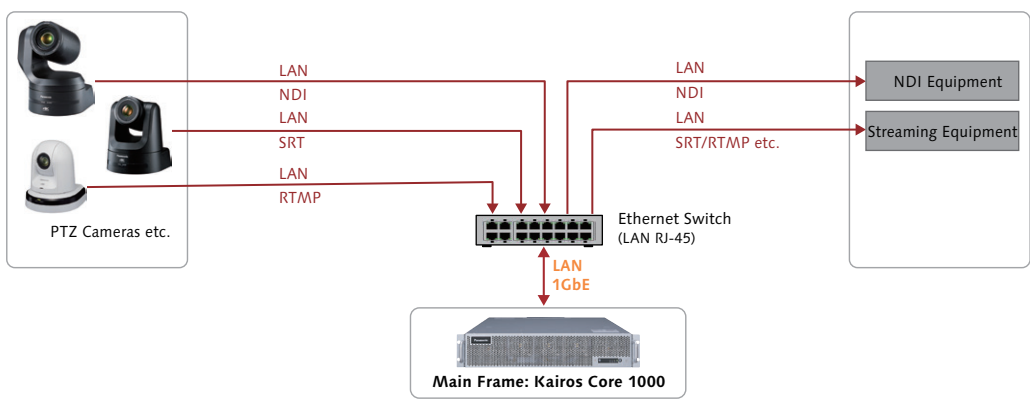
Full IP-based system configuration

Main Frame Kairos Core 1000 rear terminals

QSFP28-1/2 100GbE (ST2110 I/O)

LAN 1/2 RJ-45 1GbE
(NDI, streaming I/O)

Example of system configuration using ST 2110

ST2110
SFP

PTZ Cameras

ST2110
SFP

Studio Cameras

ST2110
SFP

ST2110
SFP

Flat Panel Display

ST2110
SFP

LED Wall

ST2110
SFP

Server

Ethernet Fabric Switch
(SFP28/QSFP28)

Projector

PTP

PTP Grand Master

QSFP28
100GbE

Main Frame: Kairos Core 1000

Example of system configuration using NDI, streaming

LAN
NDI

LAN
SRT

LAN
RTMP

PTZ Cameras etc.

LAN
NDI

LAN
SRT/RTMP etc.

NDI Equipment

Streaming Equipment

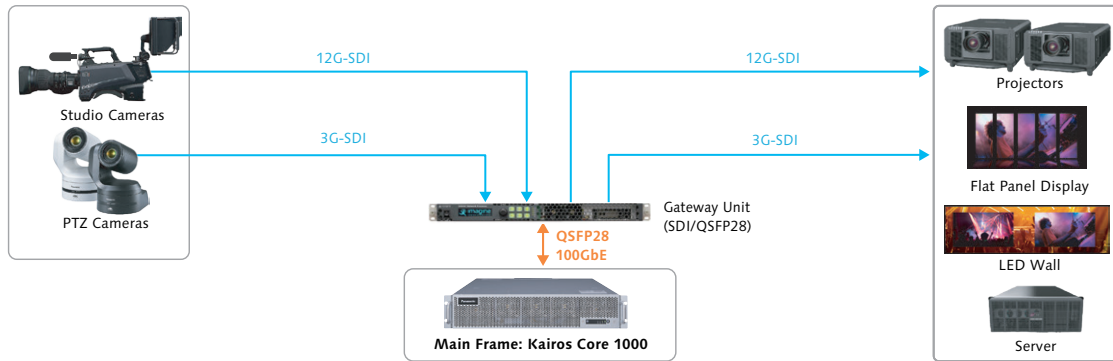Ethernet Switch
(LAN RJ-45)

LAN
1GbE

Main Frame: Kairos Core 1000

Flexible I/O and Video Formats

SDI and HDMI baseband signal-based system configuration

Main Frame Kairos Core 1000 rear terminals
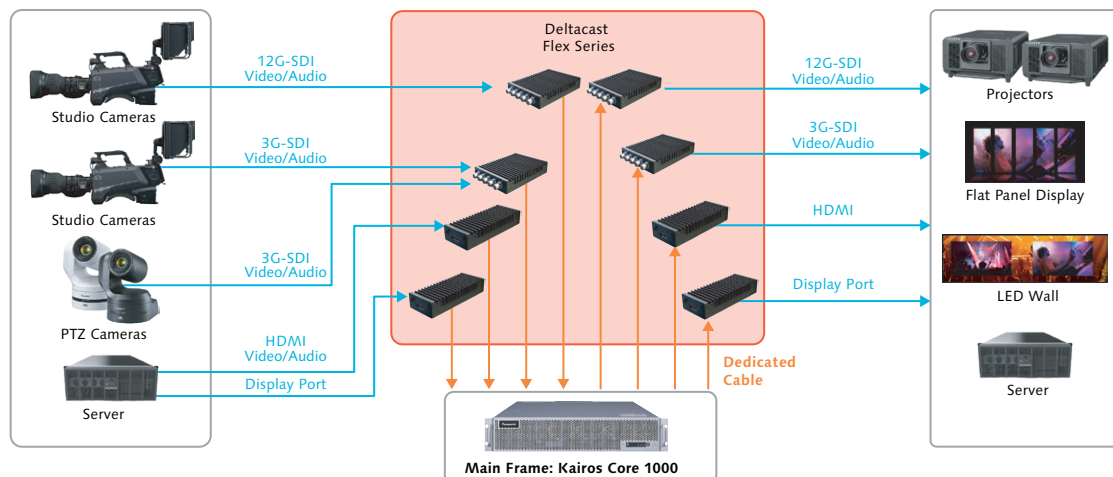
QSFP28-1/2 100GbE
(I/O at gateway device/box)

DELTACAST Module I/O
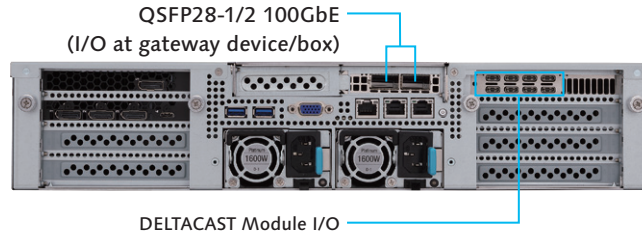
Example of system configuration using gateway equipment

Studio Cameras

12G-SDI

12G-SDI

Projectors

3G-SDI

3G-SDI

PTZ Cameras

Flat Panel Display

Gateway Unit
(SDI/QSFP28)

LED Wall

QSFP28
100GbE

Server

Main Frame: Kairos Core 1000

Example of system configuration using gateway boxes

Studio Cameras

12G-SDI

ST2110-20/30
(AES67)

ST2110-20/30
(AES67)

12G-SDI

Projectors

SFP28

SFP28

Gateway Box
SDI→IP

Gateway Box
SDI→IP

Flat Panel Display

3G-SDI

ST2110-20

ST2110-20/30
(AES67)

3G-SDI

PTZ Cameras

SFP+

SFP+

LED Wall

Ethernet Fabric Switch
(SFP28/QSFP28)

PTP

Server

PTP Grand Master

QSFP28
100GbE

Main Frame: Kairos Core 1000

Example of system configuration using DELTACAST Modules

Deltacast
Flex Series

Studio Cameras

12G-SDI
Video/Audio

12G-SDI
Video/Audio

Projectors

Studio Cameras

3G-SDI
Video/Audio

3G-SDI
Video/Audio

Flat Panel Display

PTZ Cameras

3G-SDI
Video/Audio

HDMI

LED Wall

HDMI
Video/Audio

Display Port

Display Port

Dedicated
Cable

Server

Server

Main Frame: Kairos Core 1000

Multi-screen, Format-free "CANVAS"

Since conventional hardware switchers only support standard 16:9 for output, a multi-screen processor is necessary for special formats such as 32:9 for wall displays or 9:16 for portrait mode. This requires additional equipment and setup/preparation time.

Since KAIROS uses a GPU for processing, it has no restriction regarding video formats and can therefore handle formats other than 16:9. It can even output multiple formats and resolutions from a single mainframe without the need for additional equipment.

Furthermore, "multi-operation" (see next page) from multiple devices enables the flexibility to control the system from a single or multiple control panels as needed.

KAIROS is a highly efficient solution for multi-screen displaying, broadcasting and IP distribution needs with minimal equipment and staffing requirements.

32:9 widescreen production
at Panasonic booth during InterBee 2021

Multi-screen operation using a conventional switcher

Multi-screen operation using KAIROS
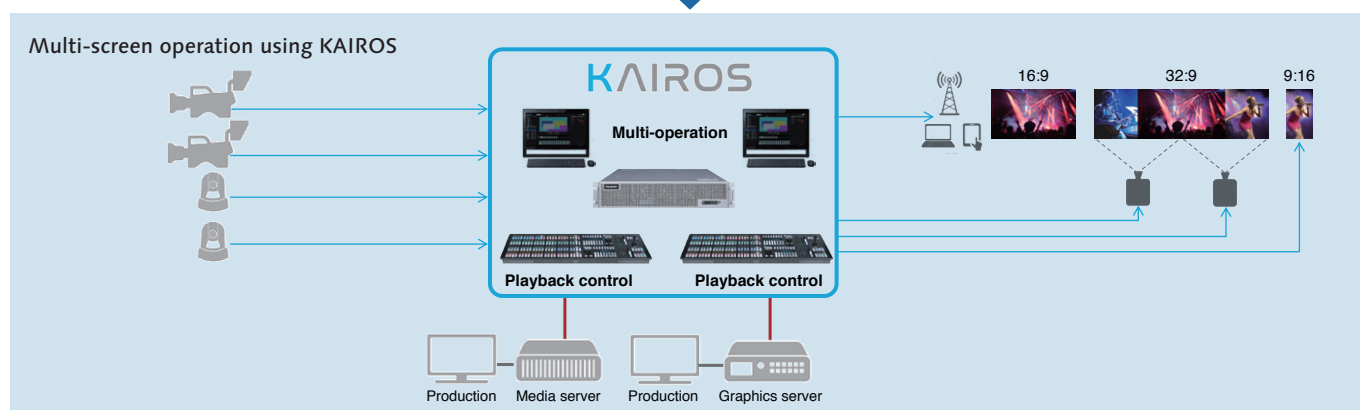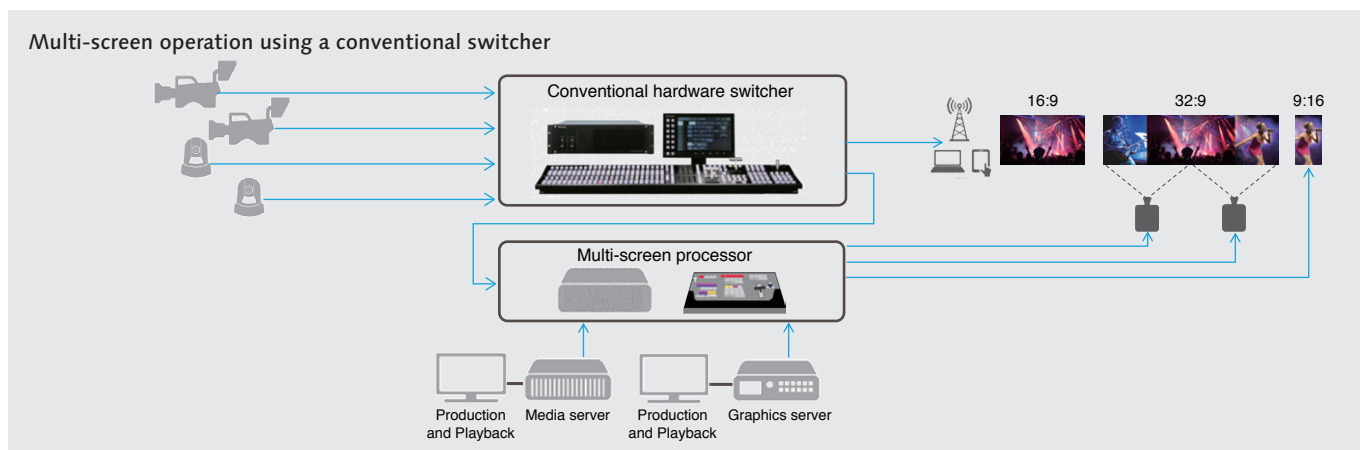
"CANVAS" Advantages

- Production of video in unconventional aspect ratio formats without a multi-screen processor.
- Output to multiple screens in multiple aspect ratio formats and resolutions from a single mainframe.
- Flexible system operation using one or more control panels.
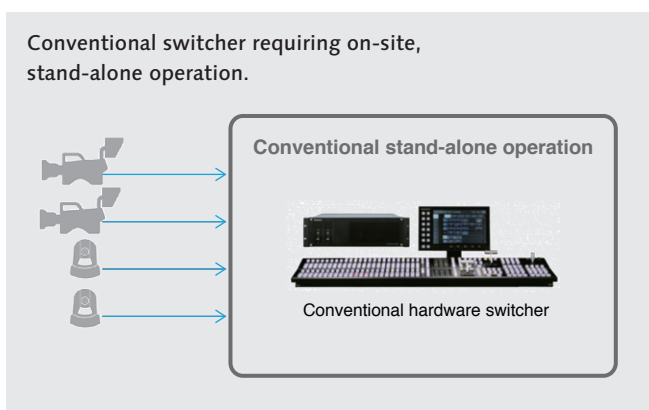- Minimal requirements for equipment, installation space and time.

Multi-Operation, Remote Operation

KAIROS uses client-server technology, which means that one server, or mainframe, can be accessed by multiple clients over a LAN for "multi-operation."
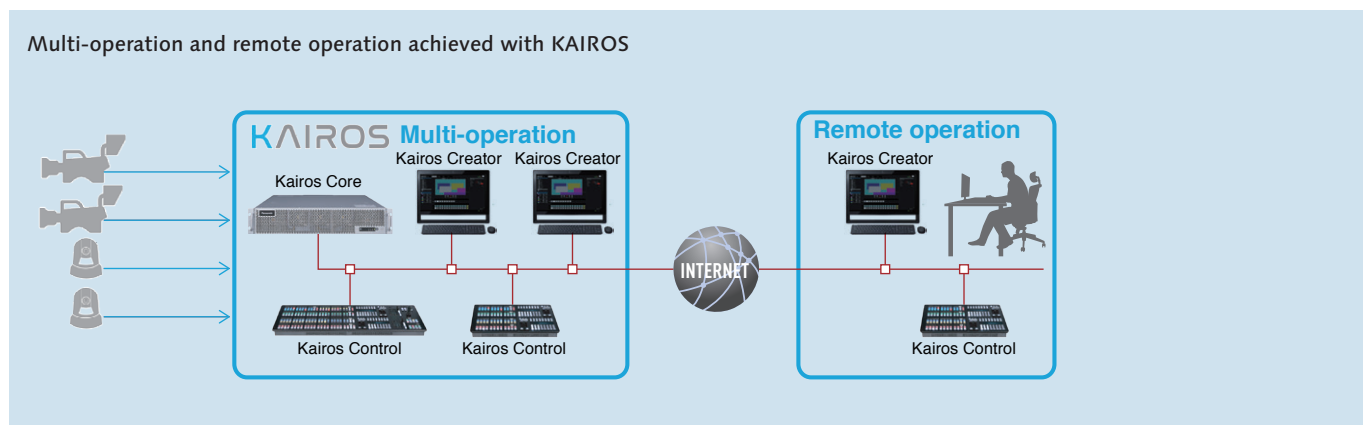
Each control panel can control one or more scenes, either individually or shared with other controllers. In addition, IP-compatible devices such as PTZ cameras can be controlled flexibly, either collectively on a single control panel or by multiple operators, each using their own control panel.

KAIROS can also be accessed from a PC over a LAN and all functions can be controlled using the Kairos Creator GUI software.

Furthermore, these operations can be performed over IP connections via public lines, enabling remote operation and resource sharing even when operators are not on site or in the studio.

Conventional switcher requiring on-site, stand-alone operation.

Conventional stand-alone operation

Conventional hardware switcher

Remote operation and resource sharing

Multi-operation and remote operation achieved with KAIROS

KAIROS **Multi-operation**

Kairos Core

Kairos Creator   Kairos Creator

Kairos Control   Kairos Control

INTERNET

Remote operation

Kairos Creator
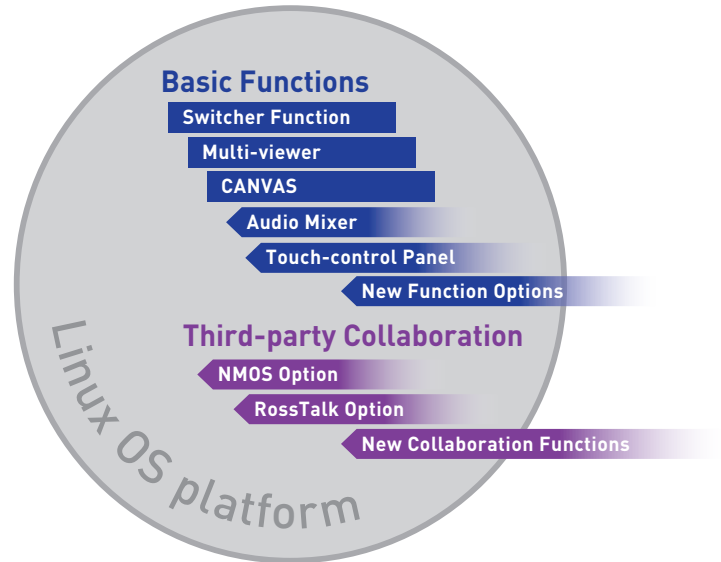
Kairos Control

IP-based Operability with KAIROS

- Multiple control panels can be connected to one mainframe over IP for multi-operation.
- Operation without a control panel possible from a PC installed with GUI software.
- Remote operation and resource sharing possible with IP connection via a public line.
- Enables centralized control of Panasonic PTZ cameras and third-party equipment.

Open Architecture for Collaboration and Scalability

With its open IT-based architecture, the highly flexible and scalable KAIROS platform enables additional software to be installed for expanded functionality and linkage with diverse external devices.

Optional functionality can be added to realize systems designed for specific applications and user needs. Expanding support for external protocols also helps to ensure flexibility for future system expansion and integration.

Meanwhile, Panasonic continues to promote its KAIROS Alliance Partners initiative for innovative collaboration with IT and video manufacturers and suppliers. Going forward, the extensive IT ecosystem will continue to be leveraged, aiming at expanding functionality through software upgrades and increased integration with internal/external devices to ensure that KAIROS never stops responding to the needs and expectations of its many users.

Basic Functions
- Switcher Function
- Multi-viewer
- CANVAS
- Audio Mixer
- Touch-control Panel
- New Function Options

Third-party Collaboration
- NMOS Option
- RossTalk Option
- New Collaboration Functions

Linux OS platform

Enhanced functionality envisioned through possible software upgrades

Highly Scalable and Forward-looking KAIROS

- Expanding functionality through ongoing software updates and new options.
- Open architecture for easy integration with third-party equipment and systems.
- Potential future developments through collaboration with KAIROS Alliance Partners.

KAIROS
Alliance Partners

AJA VIDEO SYSTEMS · ARISTA · AV stumpfl · BRAINSTORM
Chyron · CISCO · DELTACAST VIDEO SOLUTIONS FOR DEVELOPERS · DENSiTRON
FOR·A · GV Grass Valley WE LOVE LIVE · GREEN HIPPO · imagine COMMUNICATIONS
intel · KST MOSCHKAU GMBH · Leader · LiveU
matrox video · NDI · NVIDIA · RIEDEL
SEIKO SOLUTIONS INC. · SIMPLY LIVE · SKAARHOJ · TECNOPOINT www.tecnopointsrl.com
telestream · TSL Audio. Control. Power. · vizrt

KAIROS Alliance Partners (March 2023)
Current member list available
on Panasonic's website.

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Incredible Productivity

https://pro-av.panasonic.net/en/products/it_ip_platform/

Panasonic®

Panasonic Connect Co., Ltd.
2-15 Matsuba-cho, Kadoma, Osaka 571-8503 Japan

ISO
14001
JACO
UKAS
MANAGEMENT
SYSTEMS
EC98J2010   0051

Factories of Panasonic Connect Co., Ltd. have received
ISO14001:2015-the Environmental Management System
certification. (Except for 3rd party's peripherals.)

For more information, please visit
Panasonic web site
https://pro-av.panasonic.net/en/qr/

SP-KCWP1WEB

*Specifications are subject to change without notice.   202304Z-1