Professional Lighting Networks in the Age of IP

WHITE PAPER

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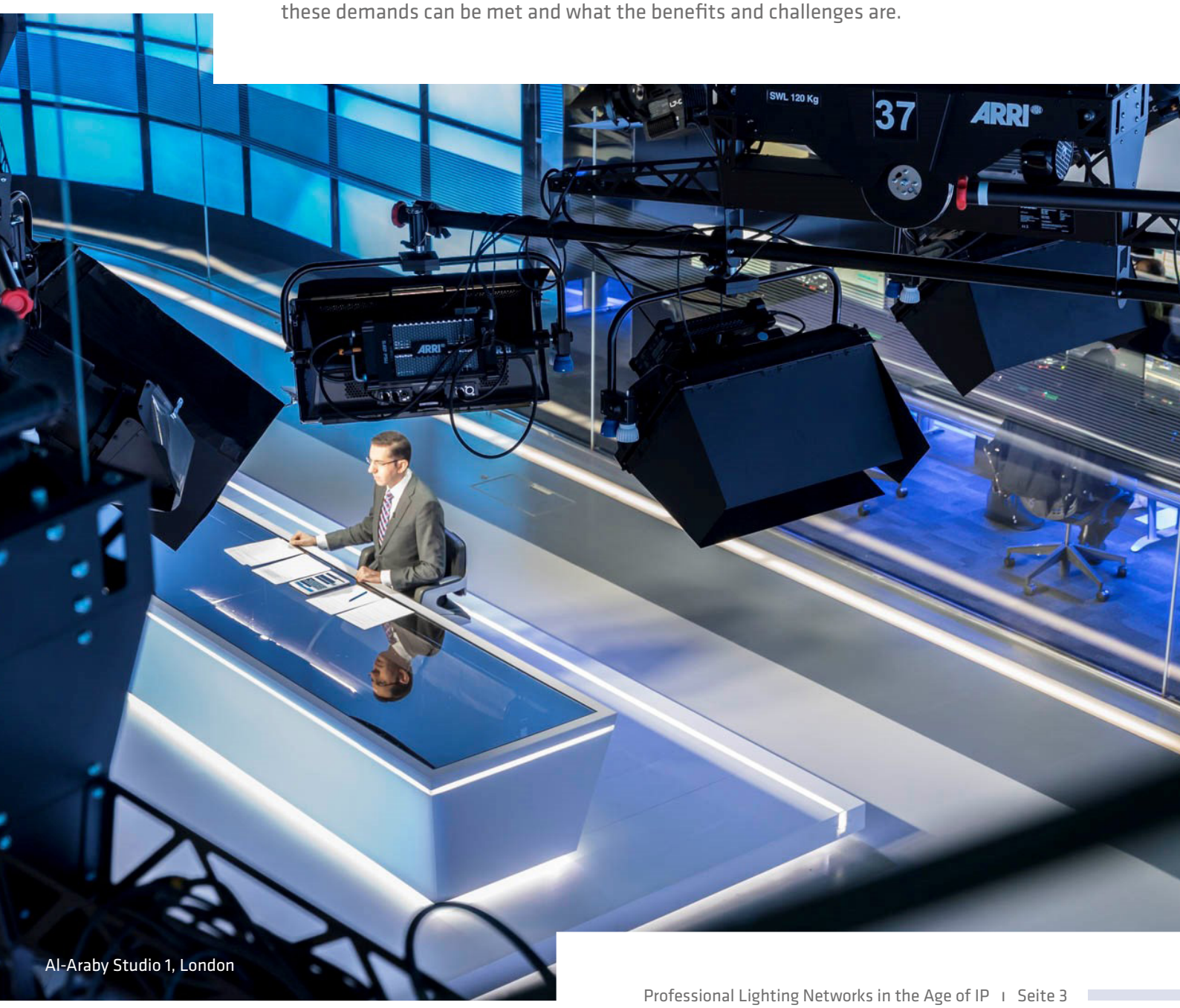
Professional lighting networks in the age of IP

The use of LED technologies for professional lighting solutions in studio and location applications has gained increasingly widespread acceptance in recent years–a process which will continue to accelerate as a result of the anticipated cost savings. It should be noted and not underestimated that LED lights are what are referred to as "multi-channel devices." This means that the demands on networks for control change significantly due to the greater number of channels to be controlled. Added to this is the development towards IP-based workflows, which is starting to be used in AV networks and increasingly in lighting networks as well. Related to this is the demand for increased flexibility in network configurations. The following paper outlines how these demands can be met and what the benefits and challenges are.



Al-Araby Studio 1, London

LED lights as multi-channel devices

LED lights are not incandescent lamps simply with new lamps. With LED lights a variety of functions can be implemented which enable new applications and quality improvement measures in the field of broadcasting, such as colour temperature and green/magenta adjustment to match white light to monitors or projections (5600K), RGBW colour for decoration or colour design, fan controls, etc. To control these functions, eight to twelve DMX channels are required per luminaire. As a result, LED spotlights as multi-channel devices also impose new demands on lighting networks and lighting control. Today, very few studios manage with two or fewer DMX universes, with 512 channels per universe, for lighting control. Most studios require at least four DMX universes, of which at least two are available parallel on the ceiling. If LED modules are added in the decoration, then more control channels are quickly required. Effect lighting, such as moving lights, are hereby not taken into consideration.

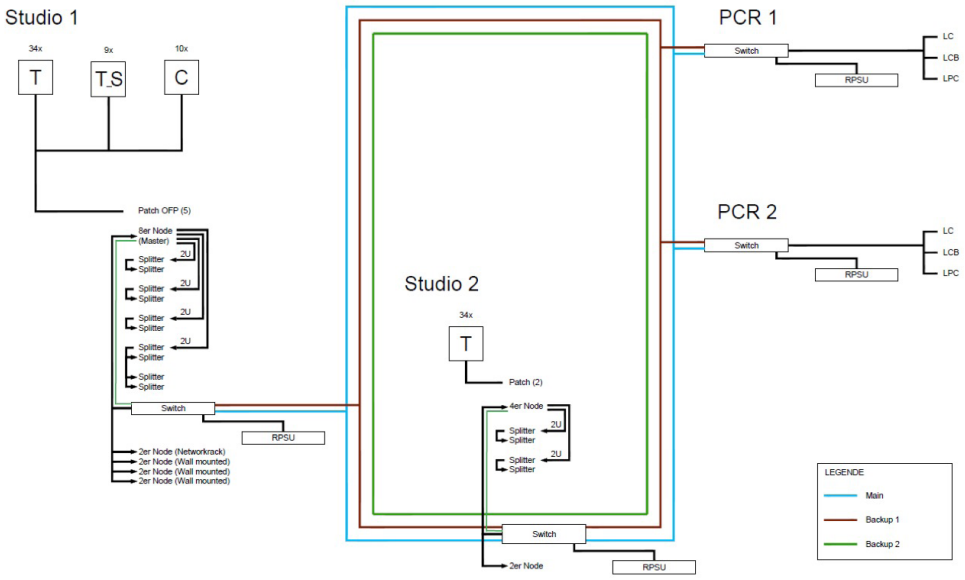
The final few metres as DMX–IP and DMX in combination

With the development of tungsten lights based on central dimmers to LED lights and the significantly greater number of required control channels per light associated with them, networks with only one DMX universe and thus only 512 control channels are too small for most studio applications. One solution to this is the use of IP-based lighting protocols that allow multiple DMX universes to be routed between the lighting control panel and the network cabinet using only one cat cable. The protocols, such as sACN, Art-Net, or proprietary manufacturer formats, are used here like a multicore. However, the performance of IP-based protocols goes far beyond these.

In the lighting network cabinet, these IP protocols are then converted by nodes into DMX. The lights are controlled via DMX. DMX, as a control signal, will probably continue to be used in the final few metres until lights are used that require one or more DMX universes (512 channels) for control. The ability to daisy-chain the signal from light to light, in the case of a comparably stable signal with low susceptibility to failure, is convincing compared with a point-to-point network topology with faster transmission and no limitation of 512 channels per cable based on IP. Transferring the last few metres as DMX is important for another reason: because of the signal frequencies, it is also not possible to transmit IP signals via shielded conductors, which is possible with DMX. This is mainly used for telescopic lamp hangers. The advantages are: a telescope procedure over the whole movement range without reconnection of cables as well as no wiring of the light hangers, which leads to a tidy ceiling and reduced fire loads.

Flexibility of IP networks

The demand for flexible (direction) PCR studio allocation has increased significantly in recent years. The requirement to control a studio from another PCR (production control room) if necessary, to operate several studios as PCRs, or, if the set design permits it, to temporarily merge two studios into one studio and control them from a PCR, can only be guaranteed by a combination of IP and DMX technology (Image 2).



Lighting network with two PCRs and two studios. The network is divided into four areas (PCR 1, PCR 2, Studio 1, Studio 2) which are connected to each other redundantly. Within the network areas, further redundancies are built in (double switches, redundant power supplies, etc.). Both studios can be controlled separately or as a studio. Undesired cross control is intercepted by the lighting panels.

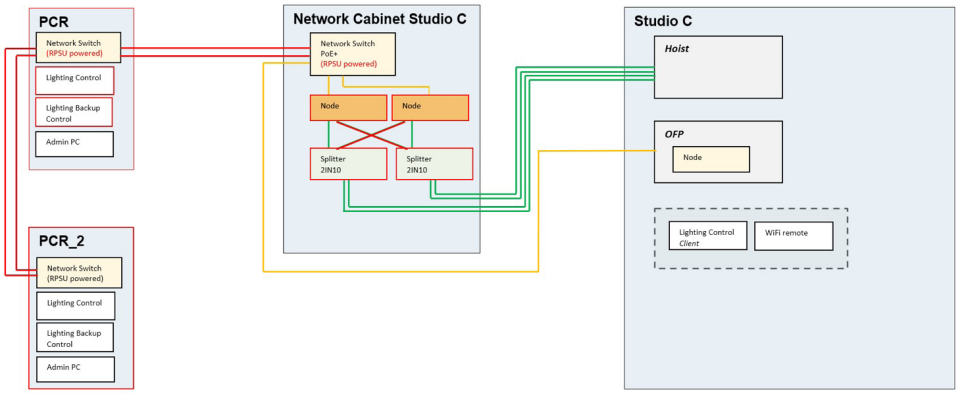
As the signal between the PCR (lighting control panel) and the studio (network rack) is carried out via IP signals for the reasons described above, not only can IP components, such as switches, be used, but rather IP network concepts can be implemented.
For example:

- VLANs (Virtual Local Area Networks) to separate network areas in the lighting network
- Link redundancy (RlinkX) to connect components redundantly via several cables.
- Link aggregation (MultiLinkX) to aggregate the bandwidth of the redundant connections.
- Quality of Service (QoS) to prioritise the transfer of time-critical applications or IP packets in the network, etc.

The increased demands on lighting networks can be met by choosing the most suitable network solution for the respective application. A further advantage of IP technology is that all the network components can be centrally controlled and managed right down to the individual lights. The risk due to operating error of controlling lights in an incorrect studio, or patching them into a universe so that they are no longer accessible or visible through the selected console, must be mitigated by the network and lighting control concept, as well as workflow concepts and training. This requirement for flexibility in the lighting network is particularly present in 24/7 studios (Image 1) or studios with frequent to very frequent production changes but is also apparent in the demand for central administration of the network.

Redundancy and back-up concepts

In the past, back-up concepts in a lighting network usually provided a second lighting control panel and passive back-up components (replacement components to be installed if needed). By using IP technology, it is also possible to implement back-up strategies that come from network technology. Devices can be configured in parallel operation and, in the event of an error, signal routing can be adjusted automatically or semi-automatically. Individual network locations can be redundantly cabled to secure each other. If the connection between PCR 1 and Studio 1 fails, the data packets automatically run on the connection PCR 1 - PCR 2 - Studio 1. Central components such as switches are equipped with a second power supply. If a node fails, the DMX splitters automatically switch to the parallel node as the signal source (Image 3).



Lighting network with the following redundancies:

- Redundant connection between PCR and studio
- Redundant lighting control panel
- Redundant execution of DMX nodes
- Automatic switching of the DMX splitter inputs in the event of DMX line failure
- Incorporation of another PCR, protection in the event of PCR failure

By means of status inquiries of all the network components before the start of broadcasting, spotlight disturbances, caused by overheating for example, can be prevented. A component failure and takeover by a redundant component can be logged and reported.

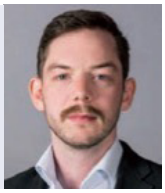
Summary

The integration of IP technology in professional lighting solutions enables:

- **More flexible lighting networks:**
  e.g. adjustments in the Studio – PCR allocation or DMX universe distribution
- **Central administration:**
  The lighting network can be monitored and if necessary configured anywhere in the network by means of a PC. A fault in Studio 1 can be analysed and addressed from PCR 5 or Studio 6.
- **Higher-performance networks:**
  Several universes can be transmitted; service data of the network components is transmitted in parallel via the same network.
- **Simple extension options:**
  More universes can be retrofitted by means of an update of the lighting panel and/or additional nodes, for example.

In conclusion, this means IP-based lighting networks offer a wide range of options to meet the growing demands of our industry in terms of cost, workflow and flexibility.

Authors:



Paul Flemming
Head of Projects at
ARRI System Group

Carolin Schramm
Project Engineer and Network Specialist
at ARRI System Group

Contact

For questions, criticism or suggestions, please contact
www.arri.com/systemgroup

Imprint

Arnold & Richter Cine Technik GmbH & Co. Betriebs KG
Tuerkenstrasse 89
80799 Munich
Germany

www.arri.com/systemgroup

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