End-to-End IP: Trends in broadcast and the impact on modern TV lighting systems

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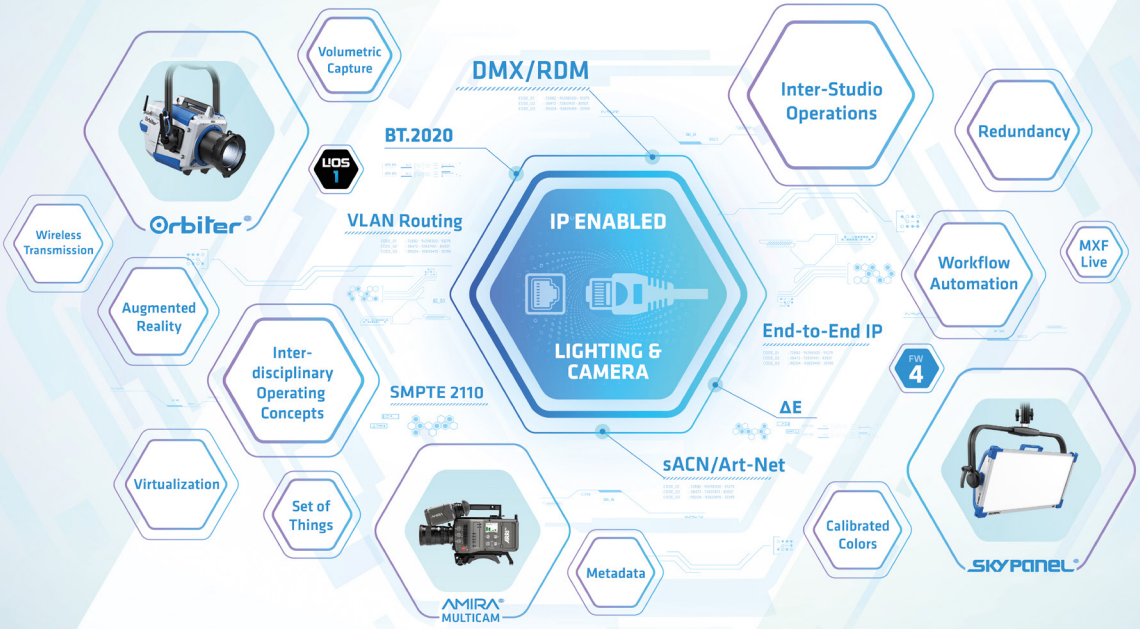
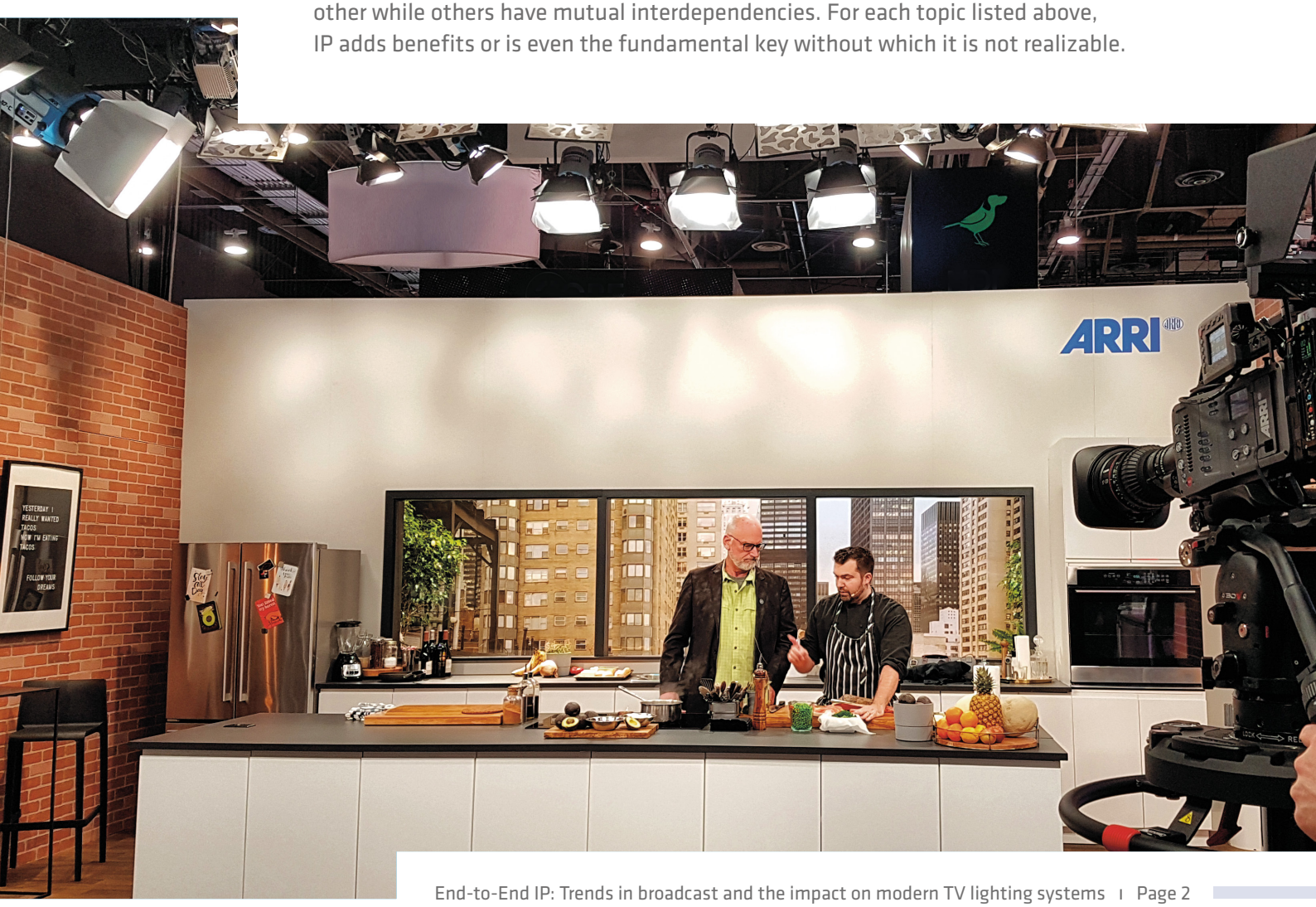


End-to-End IP: Trends in broadcast and the impact on modern TV lighting systems

New technologies and workflows in audio and video technologies take some time to be applied to lighting. Consequently, in a discussion relating to broadcast trends, broadcast lighting workflows, and technologies may appear somewhat old-fashioned when viewed from an audio and video broadcast prospective. For the lighting department, the following topics serve as an agenda for my discussion:

- IP connectivity
- Higher resolutions
- System stability, redundancy, and backup scenarios
- Interdisciplinary operators
- Inter-studio operations
- Virtualization of hardware
- Workflow automation

Some of these points can be discussed and implemented independently of each other while others have mutual interdependencies. For each topic listed above, IP adds benefits or is even the fundamental key without which it is not realizable.



1. IP connectivity

IP has been a popular topic of discussion for quite a while. But what about the lighting? What about IP enabled luminaires?

When we talk about IP-based lighting networks today, the reality is a combination of IP-based and DMX-based networks. The key items of the control network such as the lighting desks, the backup desk, and the network distribution between the studios is based on IP infrastructure. However, the DMX protocol is used for the last few meters to the luminaires and the reason is simple; limited availability of lighting fixtures with network connectivity.

The DMX protocol is a lighting, technology-specific, digital protocol developed in the late 1980s based on the symmetrical RS485 protocol. DMX was developed to connect dimmers to the lighting control panel via one cable. Previously, an analog 0 to 10 V signal was used for each dimmer channel and a wire pair was required for each channel. DMX is limited to 512 channels; if more parameters are required, another cable must be used. The advantage of the robust protocol is increasingly being consumed by its limitation.

What are the advantages of using IP-based protocols compared to using DMX?

DMX is robust against electrical interference, can be transmitted over 1000 m, and offers the possibility of wiring luminaires in series—simplifying the wiring effort. IP-based networks offer greater flexibility; all parameters are available at all network points. By integrating IP networks into the luminaires, all the tools that the engineers can use to test, monitor, and administer IP audio and video systems can also be applied to the lighting system. It is therefore no longer necessary to have lighting-specific knowledge to administer lighting systems. The advantages that an IP-based workflow offers for television technology are only fully exploited when all systems are based on IP, including lighting technology.

2. Higher resolution

Admittedly, for most people, nothing new can be said about HD but what about UHD? Higher resolution is more than just an increase in pixels and data rates. Increased image resolution also means higher visibility of different colors in set decoration, more detail in decoration and in costumes makeup and hairstyling, and also in the deviation of individual lights from one another. Where a halogen lamp could be dimmed up to 70% under SD without a too negative impact of the red shift being noticed in the transmission image, deviations of 100 Kelvin are visible with HD. When we talk about HDR, it also means that parts of the set that had been flooded or outshone without HDR, will have perceivable markings. Sets can and must be illuminated differently and this has an impact on the requirements for lights. There are visible differences when lighting concepts from the 1980s – 1990s encounter current camera technology.

- Higher color rendering
- Color temperature optimized for camera systems
- Lower tolerances in ΔE

At first glance, the connection to IP may seem far-fetched. Luminaires that allow color temperature to be adjusted require several parameters and therefore, control channels. Of course, it is possible to work in a studio with several DMX universes, i.e. multiples of 512 channels. All channels 1 to 512 are transmitted in each DMX universe. If the color temperature is controlled with channel 12 in a certain luminaire, channel 12 is transmitted in every DMX universe, possibly with other functions. The light will only work as desired if it is connected in the correct DMX line. In addition, each DMX universe must be run on a separate line. In comparison, IP-based protocols offer more than 16 million parameters. The repositioning of multichannel lights in the studio is simplified by means of IP-based protocols or standardized when compared to other IP-based components.

3. System stability, redundancy, and backup scenarios

Reliability is a key issue when it comes to designing television technology. But there were, and still are, significant differences in the rating of audio-video systems and lighting systems. For decades, television light used a halogen dimmer system. A lighting console was connected to a dimmer cabinet via a cable which in turn was connected to the lights via individual cables. The only way to increase reliability was through a backup light control panel and a secured power supply for the dimmer or selected dimmer channels. When evaluating the probability of failure, systems with a human-machine interface are at the top of the list. However, these devices are mostly installed in the PCR where space is limited. Therefore, a backup lighting console is not very common. As a result, most current lighting systems are designed without redundancies. This does not mean that the components are not designed for stability and reliability but there are no redundancies as we know them from audio and video technology in broadcast.

With the development towards intelligent luminaires–luminaires that are connected to electricity and data–this "tradition" has not changed. With the growing demand for more and more control channels in the lighting network and thus the integration of IP-based systems, the workload for lighting networks has increased along with the possibility of redundancies.

- Possibilities of backup concepts through integration of IP

4. Interdisciplinary operators

Personnel costs make up a large part of a studio company's budget and specialists are a rare commodity. In the context of the tendency to implement workflow automation practices, rationalization in personnel is another method to accommodate a reduced budget.

One operators already manage RCPs, camera robotic, teleprompter, and lighting controls at the same time. This results in new requirements for the automation of light control and human-machine interfaces while also considering the human factor and the tolerances for operator errors. These new requirements lead to an expansion in the operator's roles and today, broadcast engineers must be able to administer the entire range of the systems. Pure IP-based systems in lighting naturally form part of the solution. If all systems are based on the same protocols and network principles, an understanding of the overall system as well as of special requirements for subsystems is easier for the individual engineer to provide. Specialized individual departments for image or lighting are in decline and IP systems help to guarantee a consistent functional principle across all systems. Not only does this lead to reduced personnel costs, but also to more stable systems through faster troubleshooting and faster administration.

- State of the art operating concepts
- Optimized use of space in PCR
- Reduction in training costs

5. Inter-studio operations

The ability to flexibly assign studio space and broadcast technology leads to increased reliability of studio infrastructure and the ability to realize new broadcast formats. Inter-studio facilities allow for studio areas and technology to be combined into larger spaces. It can reduce broadcast technology costs with fewer control or equipment rooms than studios, leading to a more efficient utilization of broadcast technology. Redundancies can be shared across the control rooms reducing overall costs. Important to note is that this is only possible when all subsystems can be routed equally and flexibly using an IP-based workflow. Presently, the main deficits are in the area of lighting. By using DMX on the last meters, flexible assignment is only possible up to the DMX nodes. Accordingly, a large part of the network devices are physically bound to a studio so that its resources cannot be easily shared with other studios. By using IP up to the luminaires, a more flexible allocation of network resources is possible. Standardization based on the IP protocol is necessary in this case.

- Higher utilization of resources
- Extended flexibility
- IT based backup concepts

6. Virtualization of hardware

Hardware virtualization is one method of using resources efficiently while increasing resilience. Independent hardware is not installed for each component but the software components are installed on virtual operating system. In terms of hardware, several servers are connected together. The advantage is in the better utilization of the available computing power combined with the possibility of central administration and increased reliability.

The prerequisite is the use of software-based solutions that do not require specialized hardware. IP-based networking is a necessary requirement. Currently only lighting control desks or controllers for e.g. LED walls can be virtualized.

- No specialized hardware
- Load balancing
- Easier expansion of resources

7. Workflow automation

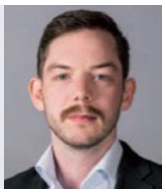
The automation of processes can be seen, on the one hand, as a rationalization measure but also as the optimization of processes with the aim of ensuring repeatability and the precise interaction between individuals or all subsystems.

The integration of workflow automation systems prefer IP-based protocols to control components and subsystems. The integration of devices that only allow for external trigging by not using IP based protocols, leads to a greater amount of work every time adjustments to the program sequence are needed. Furthermore, these devices restrict the parameters that can be controlled through the broadcast automation. The full exploitation of the possibilities of transmitter automation is only possible if all subsystems are integrated and IP based protocol standards are utilized.

- Integration of lighting technology in studio automation
- Control via IP interfaces

The use of IP-based infrastructure offers additional advantages also for the lighting system, which brings us back to the beginning: The overall system is only as flexible, stable, efficient, etc. as the sum of the subsystems, and therefore, End-to-End IP in all systems in a broadcast environment is the key to a state of the art broadcast solution.

Author



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