Studio Production and Directing

Broadcast and Live Program Systems

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What are recording and playout systems

- Recording and playout systems are a key part of any TV and multimedia studio.

- Their primary function is the capture and playback of audiovisual content..

- Playout ensures continuous broadcasting of content to viewers.

- In modern systems, recording and broadcasting are digital processes..

- Integration enables a direct workflow from ingest to playout.

- These systems support both live and pre-prepared content..

- Their reliability directly affects the quality and continuity of the program.
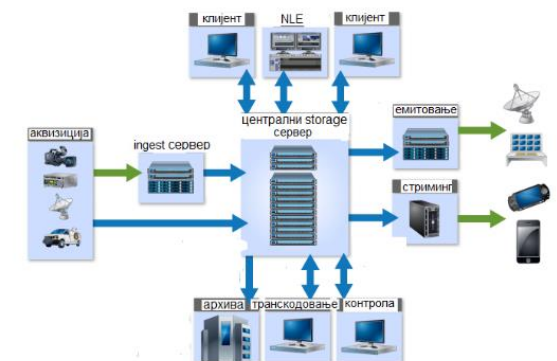
System evolution

- The first recording systems used VCRs and videotapes.

- Digitalization enabled the transition to disk- and server-based solutions..

- Linear editing processes were replaced by nonlinear digital workflows.

- The advent of SSDs and networked systems brought greater speed and reliability.

- IP technology allows transmission and distribution without SDI infrastructure.

- Today, hybrid systems (SDI + IP) are used.

- The trend is moving toward cloud-based and virtualized playout.

Standards and formats

- Signal transmission standards: SDI, HD-SDI, 3G-SDI, 12G-SDI.

- IP standards: SMPTE 2022, SMPTE 2110, NDI.

- Video formats: SD (720x576), HD (1920x1080), UHD (3840x2160).

- Professional codecs: Apple ProRes, Avid DNxHD, XDCAM.

- Audio standards: AES/EBU, MADI, Dante over IP-a.

- All systems must be compatible with industry standards.

- Modern playout must support multiple formats simultaneously.

The role of servers and networks

•Servers store and distribute all recorded material.

•Centralized storage allows simultaneous access for all users.

•Distributed storage offers flexibility and better fault tolerance.

•NAS and SAN solutions provide network connectivity between devices.

•Video routers connect servers with the control room and playout systems.

•IP networks enable remote access and cloud integration.

•Network reliability is crucial for stable broadcasting.
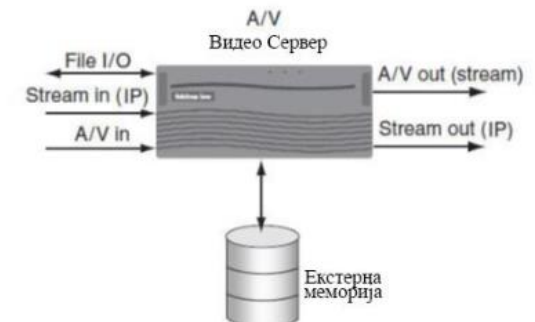
The primary role of recording systems

•Recording systems are used for ingesting and archiving video and audio content.

•They make the material available for editing, playout, or archiving.

•Recording is performed in real time from multiple sources.

•The quality and format depend on production standards.

•The systems must ensure stable, uninterrupted operation.

•Archived material must be quickly searchable and accessible.

•Recording is the first step in the overall broadcast workflow.
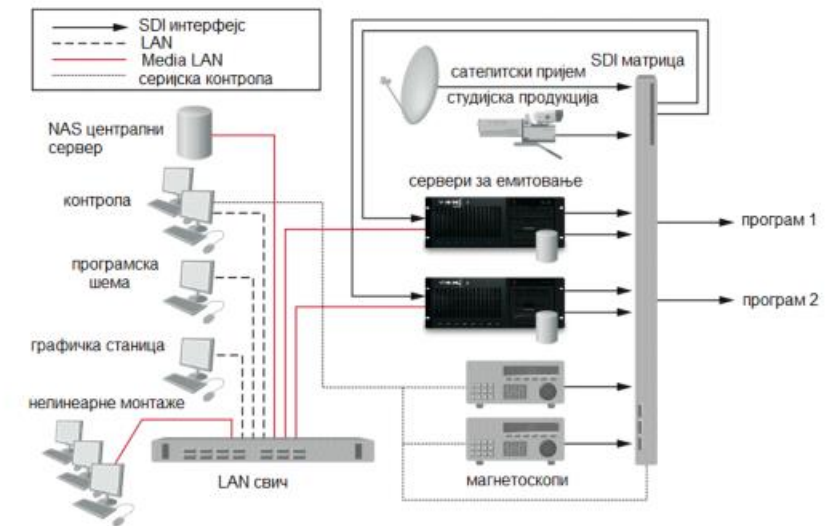
Disk-based recording

•Digital recorders use HDD and SSD media for data storage.

•SSD drives provide high write and read speeds.

•HDD drives offer larger capacity at a lower cost.

•Systems often combine multiple disks (RAID configuration)

•This provides both speed and data security.

•Disk-based recording is the standard in modern studios.

Archiving and storage of material

•All recorded and broadcast content must be archived.

•Material is stored on **NAS (Network Attached Storage)** or **SAN (Storage Area Network)** systems.

•NAS provides shared file access over the network.

•SAN uses high-speed Fibre Channel or 25/40 GbE connections for large bandwidth.

•A centralized archive enables simultaneous work by multiple users.

•Copies of material are created for safety (backup and mirroring).

•The archive can be short-term (online) or long-term (offline).
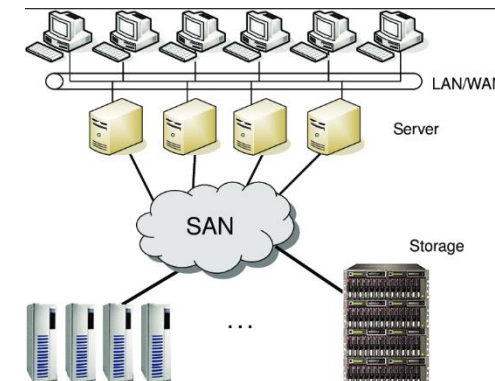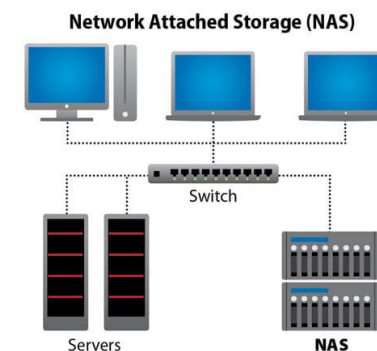
Long-term storage and backup

- Long-term storage of material is done on **LTO tapes** or in the cloud.

- The LTO (Linear Tape-Open) standard offers decades-long durability and large capacity.

- Cloud archives enable remote access and flexibility.

- Material is often stored in multiple copies (the 3-2-1 backup rule)

- Broadcast programs must also be available for legal purposes.

- Automated systems manage the archive and backups.

- Drawback: slow read speed.

- Trend: transition to hybrid solutions (local storage + cloud).

What is playout system

- The playout system ensures the playback and broadcasting of TV content.

- It functions as the "source" of the signal delivered to viewers.

- It supports live broadcasting and pre-prepared content.

- It can be hardware-based, software-based, or hybrid.

- It must guarantee continuous 24/7 broadcasting.

- Playout is the central part of every TV station.

- Without reliable playout, there is no stable programming.

Functions of the playout system

•Playlist management and playback.

•Generation and display of graphics (logo, subtitles, tickers).

•Management of commercial breaks and sponsorships.

•Support for multiple channels and multiple formats.

•IP streaming and SDI outputs.

•Logging and archiving of broadcast content.

•Redundant operation (failover systems).

Hardware foundation of the playout system

- The foundation consists of professional I/O cards.

- Most commonly used are Blackmagic DeckLink and AJA cards.

- The cards provide SDI and IP inputs/outputs.

- They support various formats: SD, HD, UHD.

- The cards have hardware support for encoding and decoding.

- They are installed in servers running the playout software.

- Card stability is crucial for the broadcast system..
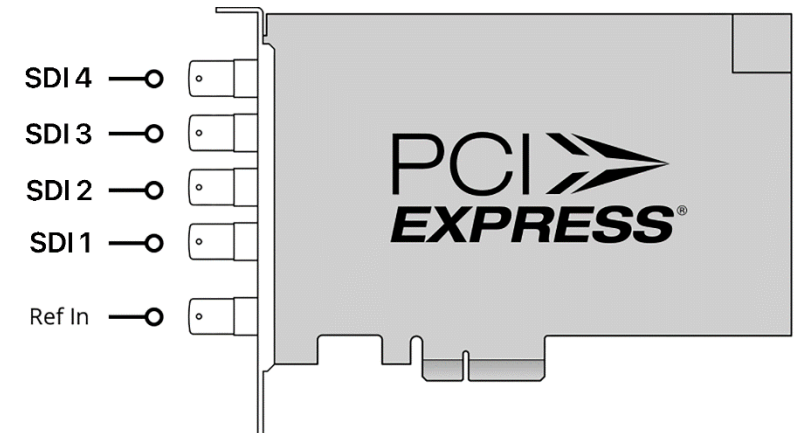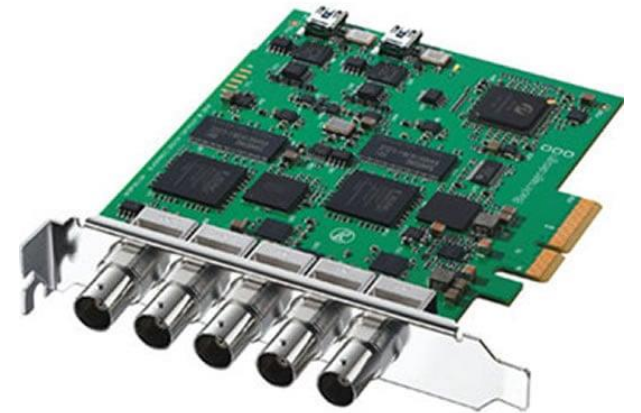
Software playout systems

- Software playout offers greater flexibility.

- It runs on standard servers with video cards.

- Examples: Elements, vMix, CasparCG, Playbox Neo.

- Supports multiple channels, subtitles, and graphics.

- Allows direct streaming to the internet.

- Integration with automation and scheduling.

- Often has a lower cost compared to hardware solutions.
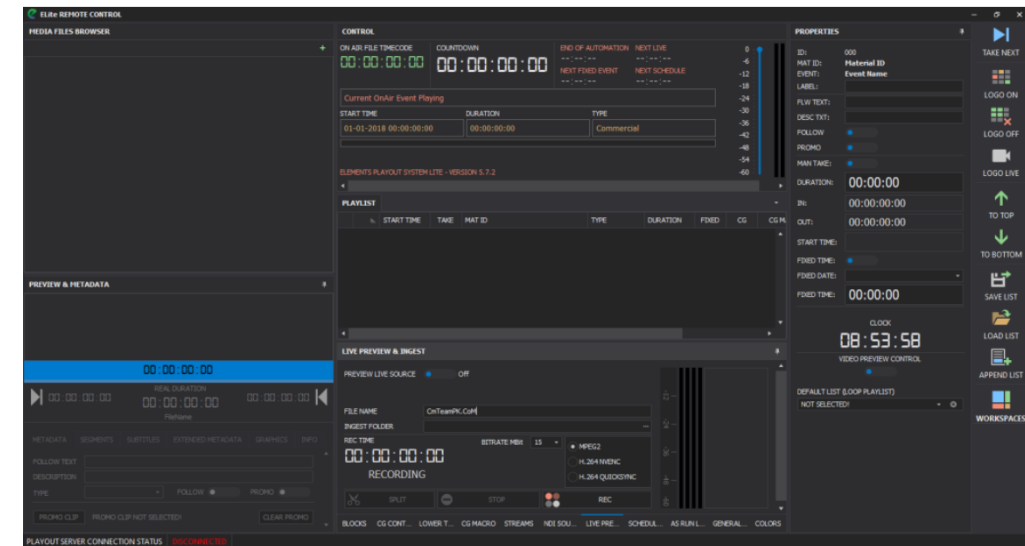
Centralized storage

- Centralized architecture uses a single main server or disk array.

- It allows multiple users to access the same files simultaneously.

- Advantage: simpler system control and management.

- Disadvantage: failure of the main server leads to downtime.

- Suitable for small and medium TV stations.

- Also used in educational and regional centers.

- Implementation is relatively inexpensive.

Distributed storage

- Each workstation or server has its own storage.

- The system provides flexibility and fault tolerance.

- It allows simultaneous recording and playout from multiple sources.

- Advantage: the system remains operational even if one server fails.

- Disadvantage: more complex data management and synchronization.

- Suitable for large networks and complex productions.

- Often used in combination with centralized archives.

What is broadcast automation

•Broadcast automation involves controlling a program through software and hardware systems.

•The main idea is to reduce the need for manual operation.

•Shows, commercials, and graphics are triggered automatically according to the schedule.

•Automation uses predefined playlists and schedules.

•Everything is executed in real time with minimal delay.

•The system is integrated with playout servers and CG modules.

•Automation ensures 24/7 program continuity.

Key functions of broadcast automation

- Program scheduling based on a timetable (schedule-based).

- Real-time event management (event-based).

- Switching various signal sources on and off.

- Automatic insertion of commercials and sponsorship messages.

- Control of subtitles and graphics from the same system.

- Logging of all broadcast elements.

- Remote control capability over the network.

The role of graphics in playout systems

•Graphics are an integral part of every television production.

•They are most commonly used for station logos (bugs), subtitles, and sponsorship elements.

•Graphics must be integrated in real time.

•CG (Character Generator) systems are responsible for displaying textual and visual information.

•Playout must support both dynamic and static graphics.

•Integration with automation allows automatic insertion of graphics.

•The quality of graphics directly affects the professional appearance of the program.

Lower thirds i subtitles

- Lower thirds are graphic elements that display the name and role of the speaker.

- Subtitles are used for translation and additional information.

- They are generated in CG software and linked to the playout system.

- They must be displayed at precisely defined times.

- Operator involvement is minimal in automated systems.

- Both static and animated formats are supported.

- Standard tools: vMix GT, CasparCG, VizRT.

Real-time graphics

- Real-time graphics allow the display of live data.

- They are most commonly used in sports and news programs.

- Graphics are connected to databases (results, statistics).

- VizRT and Ross Video provide professional tools for real-time graphics.

- AR graphics enable three-dimensional effects in the studio.

- Real-time graphics are rendered via GPU servers.

- They are directly linked to the playout system.

Commercials and sponsor elements

- Commercials and sponsor logos are part of graphic integration.

- The system must ensure precise broadcast timing.

- Automation takes control over commercial breaks.

- Graphic layers are combined with the video signal.

- Playout systems support overlay graphics.

- Redundant systems ensure display accuracy.

- Commercials can be regionally customized.

Questions & Answers

Co-funded by the European Union