Summer Training

FINAL REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
4-Weeks Industrial Training (**TR-102**)
At
Doordarshan Bhawan New Delhi
(from 5th June 2024 to 5th July 2024)

SUBMITTED BY

Srijan Singh
(BTech Computer Science)
CRN: 2215174
URN: 2203565

Department of Computer Science Engineering
GURU NANAK DEV ENGINEERING COLLEGE
LUDHIANA, INDIA

Abstract

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During the 4-week training at DD News & DD India, Doordarshan Bhawan, provided by Prasar Bharti, I gained a comprehensive understanding of the technical workings of Doordarshan's two main news channels: DD NEWS, the national news media channel, and DD India, the international news channel. This report delves into the entire broadcast cycle, from studio production to the intricate operations within the Production Control Room (PCR) and Master Control Room (MCR) to Earth Station for final Broadcasting.

Key Learnings and Technological Insights

1. **Broadcast Cycle:**
   - Detailed exploration of the journey of broadcast content from the studio to various control rooms, highlighting the seamless integration and coordination required for live broadcasting.
   - The functioning of the Ingest Room and News Room, focusing on the processes involved in content acquisition, management, and dissemination.

2. **Newsroom Computer Systems (NRCS):**
   - The pivotal role of NRCS in connecting all components within the newsroom, facilitating efficient communication and workflow management.

- A comparison of the NRCS platforms used by Doordarshan: AP ENPS for DD NEWS and Blaze by Kathavya for DD India, examining their functionalities and contributions to news production.
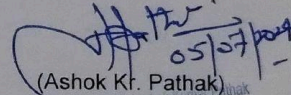
3. **In Depth analyzation of working of :**
    - **Ingest room**
    - **PCR room**
    - **MCR room**
    - **Earth Station**
    - **Studio**
    - **Archive Section**

4. **Technological Advancements:**
    - The potential of portable broadcasting solutions like TVU Backpack in enhancing live coverage from remote locations, indicating the future of flexible and dynamic broadcasting.

Training Certificate

दिनाँक/DATE

Ref :No. DDN/DE(AKP)/2024-25/02

05.07.2024

Training Certificate

TO WHOMSOEVER IT MAY CONCERN

It is to certify that Mr. Srijan Singh, a bonafide student of B.Tech(Computer Science) from Guru Nanak Dev Engineering College, Ludhiana has successfully completed summer training at DD News, New Delhi from 05.06.2024 to 05.07.2024

I wish him all success in his future endeavours.

(Ashok Kr. Pathak)
Director (Engg.)
DD News
अशोक कुमार पाठक
निदेशक (अभि.)
दूरदर्शन समाचार/Doordarshan News
नई दिल्ली-110001/New Delhi-110001

Declaration

I hereby certify that the work which is being presented in this training report for partial fulfillment of requirements for the award of degree of B.Tech. (Computer Science) submitted to the Department of Computer Science Engineering at **GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA under I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY** is an authentic record of my own work at Doordarshan Bhawan, Mandi House, New Delhi, during 4-Week Industrial (Summer) Training - **TR-102**.

Srijan Singh
URN:2203565
CRN:2215174

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History of Doordarshan

Early Beginnings and Establishment

Doordarshan, an autonomous public service broadcaster founded by the Government of India, is one of two divisions of Prasar Bharati. Established on September 15, 1959, it stands as one of India's largest broadcasting organizations in terms of studio and transmitter infrastructure. Initially, Doordarshan began as an experiment in public service telecasting but quickly grew to become a pivotal element in the country's media landscape. The first broadcast was inaugurated by then-President Dr. Rajendra Prasad, marking the start of a new era in Indian broadcasting.

Growth and Expansion

The initial phase of Doordarshan was modest, with broadcasts reaching only homes in and around New Delhi. By 1965, the service had become regular, extending its reach to Mumbai and Amritsar by 1972, and subsequently to seven more cities by 1975. During this period, Doordarshan was part of All India Radio (AIR). However, on April 1, 1976, Doordarshan became a separate department under the Ministry of Information and Broadcasting, later coming under the purview of Prasar Bharati.

Technological Advancements

The development of Doordarshan was marked by significant technological advancements. A key milestone was the adoption of color television, with the first color broadcast taking place on August 15, 1982, coinciding with the national Independence Day celebrations. The National Institute of Design crafted a new signature image for the broadcaster, while renowned musician Pandit Ravi Shankar composed a signature tune that became synonymous with Doordarshan.

Contribution to Indian Society

Over the decades, Doordarshan has played an essential role in the dissemination of information, education, and entertainment across India. It has been instrumental in broadcasting significant national events, government programs, and educational content, contributing to social development and national unity. The service extends

beyond television, providing content via online and mobile platforms to ensure widespread accessibility.

DD News and DD India

DD News

DD News, established to provide round-the-clock news coverage, broadcasts content in Hindi, Sanskrit, and Sign languages. The channel focuses on delivering balanced, fair, accurate, and authentic news without sensationalism. Its programming includes over 18 hours of live transmission daily, featuring more than 30 news bulletins and a variety of current affairs programs. DD News also produces special coverage of major events such as the Republic Day parade, fulfilling its role as a public service broadcaster.
 As a public service broadcaster, the channel has been fulfilling its responsibilities in covering constitutional dignitaries and institutions such as the President, Prime Minister, Chief Justice of India, and Election Commission of India, helping to disseminate information to the wider public, both domestically and abroad, regarding their events, activities, and programs.

DD India

DD India was launched to showcase Indian stories and perspectives to a global audience. The channel, which migrated to a High Definition platform in October 2020, has been recognized as a leading English news channel. DD India broadcasts international events, special programs like the live Yoga events from over 180 countries on International Yoga Day, and provides comprehensive coverage of national and international news. The DD India channel has now been recognized by BARC as an English news channel and is constantly competing neck and neck with other top private English news channels.

Regional News Units

DD News operates 31 Regional News Units (RNUs), broadcasting over 145 news bulletins in more than 22 languages and dialects, ensuring extensive coverage across India. These units produce regional news and contribute to DD News and DD India's national and international reporting. RNUs, besides producing regional news, also cater to DD News and DD India in reporting, visual feeds, and special programming. All states have a Regional News Unit (RNU), except Sikkim. Jammu and Kashmir have 2 RNUs,

while there is one in Leh for Ladakh UT. Over 900 stringers are working for the DD News Network, covering the entire length and breadth of the country.

Digital and Social Media Presence

In line with modern media trends, DD News and DD India have established a robust digital presence. Through their websites and social media platforms such as X(Twitter), Facebook, Instagram, and YouTube, they cater to millions of followers, providing real-time, fact-based news updates and countering misinformation effectively. Through its vast presence across social media platforms, the DD News/DD India network has been contributing to countering fake news in digital space by instant dissemination of fact-based information across social media platforms.

Detailed Workflow at DD News

1. News Generation and Studio Recording

News Generation:

- **Journalists:** The news generation process begins with journalists in the newsroom gathering information, conducting interviews, and writing scripts for news reports. They ensure that the content is accurate, current, and engaging for the audience.
- **Preparation:** Journalists work on preparing the news stories which include writing the scripts, editing the video clips, and preparing any necessary graphics. These are then reviewed and approved by editors and producers.

Studio Recording:

- **Recording:** Once the news content is ready, it is sent to the studio for recording. This includes live news presentations, interviews, and recorded segments.
- **Live Broadcasts:** During live broadcasts, the studio output is continuously monitored and controlled to ensure there are no technical glitches or errors. The live broadcast is transmitted directly to the Production Control Room (PCR).

2. Ingest Room Operations

The Ingest Room:

- **Purpose:** The ingest room is a crucial hub in the broadcasting process, ensuring that all incoming feeds are properly managed and routed. The personnel here handle the intake and recording of all video feeds, which are essential for news production and archiving.
- **Responsibilities:**
  Managing Incoming Feeds:

    - **Feed Lines:** The ingest room receives incoming feed lines from various sources through the MSR (Master Switch Room) screens. These feeds can come from field reporters, live events, or partner news agencies.

    - **Continuous Live Feeds:** Personnel continuously receive live feeds from ANI (Asian News International) and Reuters, recording these feeds on GV

(Grass Valley) servers. This ensures comprehensive news coverage and that nothing important is missed.
- ○ **Monitoring and Control:** Personnel ensure that all feeds are managed according to the protocols established by the GV and Quantel servers. They monitor the quality and stability of the feeds to ensure they meet broadcast standards.

- **Recording Important Events:**
  - ○ **Live Coverage:** For significant events such as live coverage of the Prime Minister or President, the ingest room records the feeds on both GV and Quantel servers. This redundancy ensures that there is always a backup recording.
  - ○ **VTR Player Usage:** Events are also recorded onto disks using Sony XDCAM series VTR (Video Tape Recorder) players. These VTR players use Fujifilm PD711DL Professional Discs for recording, providing a reliable physical backup.

3. AP ENPS (Electronic News Production System) - Used as NRCS

Connection and Access:

- **ENPS Server Room:** AP ENPS at Doordarshan News is connected to a dedicated server room that houses the ENPS servers. Workstations within the newsroom access the ENPS via specific IP addresses using LAN cables. This setup ensures a secure and stable connection, crucial for real-time news production.
- **Security and Privacy:** Doordarshan, as a government organization, prioritizes security and privacy. Sensitive information such as election results and budget announcements require robust security measures. An on-premise system like AP ENPS mitigates the risks associated with cloud-based solutions, which can be vulnerable to cyber threats.

Usage by Various Roles:

- **Journalists:** Journalists use ENPS for creating and editing news stories. The system provides a user-friendly interface for scriptwriting, research, and collaboration.
- **Graphic Designers:** Graphic designers integrate visual elements into news stories. ENPS allows them to manage and insert graphics seamlessly into the broadcast workflow.

- **Producers:** Producers use ENPS to manage rundowns, coordinate live broadcasts, and ensure that the news bulletin runs smoothly. They can adjust the rundown in real-time to accommodate breaking news.
- **Other Staff:** Various other roles within the newsroom, including editors and directors, use ENPS for content management, script approval, and scheduling.

Detailed Functionality of AP ENPS:

- **Story and Rundown Management:**
  - **Story Creation and Editing:** Journalists have access to comprehensive scriptwriting tools that include formatting options, spell check, and version control. Multiple users can collaborate on the same story, ensuring that updates are reflected in real-time and all contributors have the latest information.
  - **Rundown Management:** Producers organize stories into rundowns, which define the sequence and timing of each segment in the newscast. ENPS automatically updates the rundown as changes are made, ensuring everyone involved has the latest version. It tracks the duration of each story and provides warnings if the newscast is running over or under time.
- **MOS Protocol:**
  - **Integration:** The MOS protocol allows ENPS to communicate seamlessly with other newsroom systems such as video servers, graphics systems, and teleprompters. This integration ensures that all elements of a broadcast are synchronized and managed efficiently.
  - **Real-Time Data Exchange:** MOS supports real-time data exchange between ENPS and connected devices, allowing for instant updates and adjustments during live broadcasts.
- **Server Management:**
  - **GV and Quantel Servers:** Grass Valley (GV) and Quantel servers are used for managing video content. These servers handle the ingestion, storage, and retrieval of video files that are essential for news broadcasts.
  - **Tools:**
    - **SQ Edit:** A tool for editing video clips stored on the servers. It allows journalists and editors to cut and refine video content.
    - **SQ Cut:** Used for trimming video segments to the desired length, ensuring that they fit within the allocated time slots.
    - **SQ View:** Allows users to preview video content before it goes live, ensuring quality and accuracy.
    - **SQ Play:** Manages the playback of video clips during broadcasts, ensuring that the correct video is played at the right time.

- **WASP 3D Sting Server:**
  - **Graphics Integration:** WASP 3D Sting Server is used for integrating 3D graphics into broadcasts. This server allows designers to create, preview, and manage graphical elements.
  - **Preview and Management:** Users can preview how graphics will appear on screen and make adjustments as needed to ensure they complement the video content effectively.

4. Production Control Room (PCR)

The PCR:

- **Purpose:** The PCR is the nerve center of live television broadcasts, coordinating all elements of the broadcast to ensure a smooth flow. During the live news bulletin, the Producer controls everything from this room only.
- **Key Components:**
  Large Screen Displays:
  - **FS1, FS2 (Frame Synchroniser 1, Frame Synchroniser 2):** Monitors showing full-screen outputs from different video sources.
  - **ME1, ME2 (Mix Effects 1, Mix Effects 2):** Screens displaying mixed video effects and transitions managed by the video switcher.
  - **DD News TCR (Transmission Control Room):** Shows a live preview of the final broadcast output.
  - **AS1, AS2 (Auxiliary Screens 1, Auxiliary Screens 2):** Additional screens for monitoring auxiliary feeds and content.
  - **CASPER1, CASPER2 (Character Generator, Graphics):** Displays from the character generator system used for graphics, titles, and other visual elements.
  - **GFX (Graphics):** Monitors specifically for graphics overlays and animations used during the broadcast.
- **Roles and Responsibilities:**

  - **Producer:**
    - Oversees the entire broadcast, making real-time decisions to ensure the smooth flow of the show.

- Uses MOS (Media Object Server) protocol to take different shots and sequences from the ENPS (Electronic News Production System) servers.
- Finalizes the scheduling and rundown of the broadcast, ensuring all elements are in place.
- Establishes direct communication with the studio news anchor, providing guidance and instructions as needed.

- **Graphics and Video Editors:**
  - Prepare and manage visual content, including lower thirds, full-screen graphics, and video clips.
  - Use software like CasperCG Client to manage and trigger real-time graphics and video playouts, ensuring that all graphical elements are correctly timed and integrated into the broadcast.
- **Sound Engineers:**
  - Operate sound systems like Studer Vista 1 and Yamaha MG16XU to manage audio levels, ensuring clear and balanced sound for the broadcast.
- **Technical Director:**
  - Uses the vision mixer to switch between camera feeds, video clips, and graphics based on the producer's directions.
  - Manages transitions and visual effects using ME1 and ME2 feeds.
- **Teleprompter Operator:**
  - **Teleprompter:** A teleprompter is a device that displays scrolling text for news readers (anchors) to read on air. It allows anchors to maintain eye contact with the camera while reading scripts.
  - In the PCR, the teleprompter operator is responsible for controlling and providing text to the teleprompter system. They type live news updates into the system, which are then read by the news reader during the broadcast.
- **Maintenance Team:**
  - The PCR includes a maintenance team responsible for addressing technical issues. If rare errors occur on server systems like ENPS, the maintenance team performs the necessary adjustments and repairs to ensure continuous operation.
- **Other staff:**
  - Like teleprompter manager, Video wall manager, etc…

- **Key Systems:**
  - **ENPS (Electronic News Production System):**
    - While ENPS is located in a separate server room, it is integral to the broadcast process. The PCR uses MOS addresses to access and synchronize video, audio, and graphics from ENPS servers. This ensures that all elements are coordinated and timed perfectly for the broadcast.
  - **CasperCG Client:**
    - Software used by graphics and video editors to control the CasperCG server, which manages real-time graphics rendering and video playout. It allows the team to trigger graphics and videos during the broadcast, integrating them seamlessly with the live feed.
  - **Studer Vista 1 and Yamaha MG16XU:**
    - High-quality sound systems used to manage and control audio feeds, ensuring the best audio quality for the broadcast.
  - **Watchout:**
    - A multi-display software system that enables the coordination of complex video and graphic displays, used for visual effects and transitions during the broadcast.
  - **PCRL (PCR Software):**
    - Software specifically designed for managing all aspects of the PCR, integrating with various systems and ensuring smooth operation of the broadcast.

5. Edit Bay Operations

The Edit Bay:

- **Purpose:** Video editing is crucial for broadcast quality, making content engaging and professional. The Edit Bay is equipped with systems like Edius and Qube, which offer features such as fast rendering, user-friendly interfaces, integration with GV and Quantel servers, and support for multiple formats.
- **Backward Compatibility:**

- - **Archival Access:** Ensure new software supports older formats to preserve access to archival footage. This is crucial for news organizations that rely on historical footage for various segments and documentaries.
    - **Format Support:** Maintain compatibility with legacy formats to ensure a smooth transition when upgrading editing software.
- **Ease of Use and Integration:**
    - **User-Friendly Interfaces:** Develop user-friendly interfaces that are intuitive and easy to navigate, even for less experienced editors.
    - **Seamless Integration:** Ensure seamless integration with GV and Quantel servers, allowing for efficient workflows and easy access to video assets.

- **Comprehensive Maintenance:**
    - **Robust Maintenance Protocols:** Implement robust maintenance protocols to ensure software reliability and longevity. Regular updates and support are essential to keep editing systems running smoothly.
    - **Technical Support:** Provide comprehensive technical support to address any issues that may arise, ensuring minimal downtime and disruptions.

Observations and Key Takeaways

Precision and Coordination:

- **High Levels of Coordination:** Managing live broadcasts requires a high level of precision and coordination among various teams and systems. Every element, from video feeds to graphics and sound, must be perfectly timed and synchronized.

Technological Integration:

- **Advanced Systems:** The use of advanced systems like AP ENPS, GV servers, and Quantel servers plays a critical role in synchronizing all broadcast elements. These systems ensure that all content is managed efficiently and delivered smoothly.
- **Real-Time Management:** The integration of real-time management tools and protocols (like MOS) ensures that the broadcast can adapt to changes and updates instantly.

Team Dedication:

- **Focused Team Effort:** The dedication and focus of the team are essential to handling every aspect of the live news bulletin meticulously. Each role, from journalists to technical directors, contributes to the successful execution of the broadcast.
- **Continuous Monitoring:** Continuous monitoring and quick response to any issues by the maintenance team ensure that technical problems are swiftly resolved, minimizing disruptions.

Real-Time Script Management:

- **Teleprompter Operator:** The teleprompter operator plays a crucial role in updating and providing text for the news reader. They ensure that the newsreaders have the most current and accurate information during the broadcast.
- **Live Updates:** The ability to type and update news text live is essential for handling breaking news and last-minute changes.

Technical Support:

- **Swift Resolution:** The presence of a maintenance team ensures swift resolution of technical issues, minimizing disruptions and ensuring the broadcast continues smoothly.
- **Proactive Maintenance:** Regular maintenance and proactive measures help prevent potential issues and ensure the reliability of all systems and equipment used in the broadcast.

Detailed Workflow at DD India

Ingest Room Operations

- **Purpose:** The ingest room at DD India is responsible for collecting, processing, and managing data from various sources, including journalist reports, live feeds, and social media footage.
- **Data Management and Ingestion:**
  - **Blaze NRCS:** Data is ingested into the servers using the Blaze Newsroom Computer System (NRCS) by Karthavya. This system ensures efficient management and processing of incoming content.
- **Managing Incoming Feeds:**
  - **Feed Lines:** The ingest room receives incoming feed lines from various sources. These feeds can come from field reporters, live events, or partner news agencies.
  - **Continuous Live Feeds:** Personnel continuously manage and record live feeds, ensuring comprehensive news coverage and capturing all important events.
- **Recording Important Events:**
  - **Live Coverage:** For significant events such as live coverage of high-profile government activities, the ingest room records the feeds on both primary and backup servers. This redundancy ensures that there is always a backup recording.
  - **VTR Player Usage:** Important events are also recorded onto disks using high-quality VTR (Video Tape Recorder) players for reliable physical backup.

Newsroom Operations

The Newsroom:

- **Purpose:** The newsroom is the heart of the news production process, where journalists and producers prepare news bulletins, manage rundowns, and integrate graphics.
- **Blaze NRCS:**
  - **Connection and Access:** Blaze NRCS by Karthavya is connected to a dedicated server room that houses the Blaze servers. Workstations within the newsroom access Blaze via specific IP addresses using LAN cables.

This setup ensures a secure and stable connection, crucial for real-time news production.

- ○ **Security and Privacy:** Sensitive information requires robust security measures. Blaze NRCS mitigates the risks associated with cloud-based solutions, ensuring data security.

Usage by Various Roles:

- **Journalists:** Use Blaze for creating and editing news stories. The system provides a user-friendly interface for scriptwriting, research, and collaboration.
- **Graphic Designers:** Integrate visual elements into news stories. Blaze allows them to manage and insert graphics seamlessly into the broadcast workflow.
- **Producers:** Manage rundowns, coordinate live broadcasts, and ensure that the news bulletin runs smoothly. They can adjust the rundown in real-time to accommodate breaking news.
- **Other Staff:** Various other roles within the newsroom, including editors and directors, use Blaze for content management, script approval, and scheduling.

Production Control Room (PCR)

The PCR:

- **Purpose:** The Production Control Room (PCR) is crucial for live broadcasts, where the team manages live news bulletins with precision.
- **Key Components:**
  Large Screen Displays:
  - ○ **Monitoring and Control:** The PCR contains various screens to monitor different feeds and outputs, ensuring seamless broadcast management. These screens display inputs from live feeds, pre-recorded videos, graphics, and other visual elements.
- **Roles and Responsibilities:**
  - ○ **Producer:**
    - ■ Oversees the entire broadcast, making real-time decisions to ensure the smooth flow of the show.
    - ■ Uses the Blaze NRCS to take different shots and sequences from the servers.
    - ■ Finalizes the scheduling and rundown of the broadcast, ensuring all elements are in place.
    - ■ Establishes direct communication with the studio news anchor, providing guidance and instructions as needed.
  - ○ **Graphics and Video Editors:**

- - Prepare and manage visual content, including lower thirds, full-screen graphics, and video clips.
    - Use software tools to manage and trigger real-time graphics and video playouts, ensuring that all graphical elements are correctly timed and integrated into the broadcast.
  - **Sound Engineers:**
    - Operate sound systems to manage audio levels, ensuring clear and balanced sound for the broadcast.
  - **Technical Director:**
    - Uses the vision mixer to switch between camera feeds, video clips, and graphics based on the producer's directions.
    - Manages transitions and visual effects using advanced feed management.
  - **Teleprompter Operator:**
    - **Teleprompter:** A device that displays scrolling text for news readers (anchors) to read on air. It allows anchors to maintain eye contact with the camera while reading scripts.
    - Responsible for controlling and providing text to the teleprompter system, ensuring the news reader has the most current and accurate information during the broadcast.
  - **Maintenance Team:**
    - Addresses technical issues swiftly to ensure continuous operation. They perform necessary adjustments and repairs to keep all systems and equipment functioning smoothly.

Transmission Control Room (TCR)

The TCR:

- **Purpose:** The Transmission Control Room (TCR) oversees technical monitoring and control, ensuring the smooth transmission of broadcasts.
- **Key Functions:**
  - **Technical Monitoring:** Continuously monitors the technical quality of the broadcast, ensuring all signals are clear and free of interference.
  - **Direct Feeds Management:** Manages direct feeds from outside broadcasting systems, integrating them into live broadcasts seamlessly.

Edit Bays Operations

The Edit Bays:

- **Purpose:** The Edit Bays are equipped with advanced editing tools, facilitating detailed video editing and post-production work.
- **Advanced Editing Tools:**
    - **Avid Media Composer:** A non-linear editing software used for video editing. It provides comprehensive tools for cutting, refining, and enhancing video content.
    - **QuickEdge Broadcast Playout Automation:** Automates the playout process, ensuring efficient and error-free broadcasting. It handles the scheduling and playback of media content, streamlining the broadcasting workflow.
    - **QuickEdge Media Asset Management (MAM):** Helps in organizing, storing, and retrieving media assets, ensuring efficient workflow management.

Technologies Used at DD India

Sun Broadcast Management:

- **Purpose:** Sun Broadcast manages the broadcasting operations at DD India, similar to how SHAF Broadcast manages DD News. They ensure the smooth functioning of all technical systems and workflows.

Blaze Newsroom Computer System (NRCS) by Karthavya:

- **Purpose:** Provides tools for journalists, producers, and graphic designers to create and manage news content.
- **Key Features:**
    - **Story Creation and Rundown Management:** Tools for creating and editing stories, managing rundowns, and integrating graphics.
    - **Real-Time Collaboration:** Allows for real-time collaboration among team members, ensuring efficient news production.

QuickEdge Broadcast Playout Automation:

- **Purpose:** Automates the playout process, ensuring efficient and error-free broadcasting.
- **Key Functions:** Handles the scheduling and playback of media content, streamlining the broadcasting workflow.

QuickEdge Media Asset Management (MAM) & Archive:

- **Purpose:** Organizes, stores, and retrieves media assets.
- **Key Features:**
  - **Integration with Archive System:** Ensures long-term storage and easy access to historical content.
  - **Efficient Media Management:** Helps in managing large volumes of media content efficiently.

Tape Technology (LTO-8):

- **Purpose:** Used for archiving important content.
- **Key Features:**
  - **High Storage Capacity:** LTO-8 tapes offer high storage capacity and durability, making them ideal for long-term storage.
  - **Efficient Archiving:** MAM and DAM technologies are employed to manage and preserve these archives efficiently.

Observations and Key Takeaways

Precision and Coordination:

- **High Levels of Coordination:** Managing live broadcasts requires a high level of precision and coordination among various teams and systems. Every element, from video feeds to graphics and sound, must be perfectly timed and synchronized.

Technological Integration:

- **Advanced Systems:** The use of advanced systems like Blaze NRCS, QuickEdge, and Avid Media Composer plays a critical role in synchronizing all broadcast elements. These systems ensure that all content is managed efficiently and delivered smoothly.
- **Real-Time Management:** The integration of real-time management tools and protocols ensures that the broadcast can adapt to changes and updates instantly.

Team Dedication:

- **Focused Team Effort:** The dedication and focus of the team are essential to handling every aspect of the live news bulletin meticulously. Each role, from journalists to technical directors, contributes to the successful execution of the broadcast.
- **Continuous Monitoring:** Continuous monitoring and quick response to any issues by the maintenance team ensure that technical problems are swiftly resolved, minimizing disruptions.

Real-Time Script Management:

- **Teleprompter Operator:** The teleprompter operator plays a crucial role in updating and providing text for the news reader. They ensure that the newsreader has the most current and accurate information during the broadcast.
- **Live Updates:** The ability to type and update news text live is essential for handling breaking news and last-minute changes.

Technical Support:

- **Swift Resolution:** The presence of a maintenance team ensures swift resolution of technical issues, minimizing disruptions and ensuring the broadcast continues smoothly.
- **Proactive Maintenance:** Regular maintenance and proactive measures help prevent potential issues and ensure the reliability of all systems and equipment used in the broadcast.

Introduction to Earth Stations

Earth stations are pivotal components within satellite communication networks, facilitating the transmission and reception of signals to and from satellites. These stations play a crucial role in ensuring reliable communication across various services such as fixed satellite service (FSS), mobile satellite service (MSS), and broadcast satellite service (BSS). Their design and functionality are tailored to maintain optimal signal quality and efficiency.

Design Considerations: Designing an earth station involves several critical factors to meet specific communication requirements:

- **Type of Service:** Determining whether the station supports fixed, mobile, or broadcast services dictates its configuration and capabilities.
- **Communication Requirements:** Whether handling telephony, data, television, or a combination thereof, each application influences the station's design.
- **Signal Quality:** Ensuring high-quality baseband signals through proper modulation and demodulation processes.
- **Traffic Requirements:** Considering factors like the number of channels, traffic type (continuous or bursty), and bandwidth allocation.
- **Cost and Reliability:** Balancing operational costs with reliability metrics to ensure continuous service uptime.
- **International Regulations:** Adherence to ITU regulations is crucial, especially in managing spectrum allocation and minimizing interference with terrestrial systems.

Technical Constraints: Earth station hardware and software face various technical constraints that impact their design and operation:

- **Transmitter Power Limitations:** Influenced by satellite power constraints and amplifier capacities.
- **Antenna Gain Constraints:** Determined by antenna size and frequency, impacting effective radiated power (EIRP) at different frequencies.
- **Hardware Costs and Maintenance:** Ensuring quality of service (QoS) maintenance while managing environmental factors and interference.

- **Regulatory Compliance:** Meeting international standards for electromagnetic interference (EMI) and spectrum utilization.
- **General Configurations:** Every earth station comprises several subsystems essential for its operation:
- **Transmitter:** Generates RF signals for uplink transmission to satellites.
- **Receiver:** Captures and processes downlink signals received from satellites.
- **Antenna:** Focuses RF signals to and from satellites, critical for establishing communication links.
- **Tracking Equipment:** Ensures precise alignment with satellites to maintain stable communication links.
- **Additional Subsystems:** Include terrestrial interface equipment for connecting with terrestrial networks and power supply systems.

Antenna Systems: Antennas are crucial components of earth stations, characterized by their size, configuration, and operational efficiency:

- **Reflective Antennas:** Predominantly parabolic reflectors due to their high gain and favorable sidelobe characteristics.
- **Asymmetric Configurations:** Such as Cassegrain and Gregorian designs optimize aperture efficiency and minimize blockage.

Antenna Mounts: The choice of antenna mount influences operational flexibility and performance:

- **Azimuth-Elevation Mount:** Enables precise two-axis rotation for accurate satellite tracking.
- **X-Y Mount:** Provides orthogonal horizontal axes for comprehensive dish rotation, albeit with limitations like zenith keyhole effects.

Tracking Systems: Tracking systems ensure continuous alignment with satellites for uninterrupted communication:

- **Automatic Tracking:** Utilizes beacon signals for automatic alignment and correction.
- **Manual and Program Tracking:** Allows for operator intervention and computer-driven position control, respectively.
- **Advanced Techniques:** Include electronic beam squinting and optimal control algorithms for enhanced accuracy and cost-effectiveness.

Amplification Systems: Amplifiers play a critical role in signal transmission and reception:

- **Low Noise Amplifier (LNA):** Amplifies weak received signals to improve signal-to-noise ratio, crucial for stable communication.
- **High Power Amplifier (HPA):** Provides RF carrier power for uplink transmission, utilizing technologies like Klystron, Traveling Wave Tube, or Solid State for different applications.

Frequency Bands: Earth stations operate across various frequency bands tailored to specific applications:

- **C Band:** Frequencies from 4 to 8 GHz, suitable for professional broadcasting and long-distance communication due to reduced susceptibility to rain fade.
- **Ku Band:** Frequencies from 12 to 18 GHz, ideal for Direct-To-Home (DTH) television services, offering higher bandwidth despite higher susceptibility to rain fade.

Satellite Communication at Doordarshan Bhawan:

- **Uplinking Using C Band:**
  - Doordarshan Bhawan uses the C band for uplinking signals to the satellite. This band is chosen due to its reliability and wider coverage area, making it ideal for professional broadcasting purposes.
- **Ku Band for DTH:**
  - For Direct-To-Home (DTH) services, the Ku band is utilized. This allows for high-quality video and audio transmission directly to homes using smaller satellite dishes.

MPEG Format:

- **What and Why:**
  - MPEG (Moving Picture Experts Group) is a set of standards for compressing digital video and audio data. MPEG formats are used to efficiently store and transmit video and audio files.
  - **MPEG-2** is commonly used for broadcasting and DVD video.
  - **MPEG-4** is used for streaming media, online video, and mobile applications due to its higher compression rates and improved quality.
  - These formats help in reducing the bandwidth required for transmission without compromising on quality.

Uplinking and Downlinking Cycles:

- **Uplinking Cycle:**
  - The process begins at the Earth station where the video and audio signals are encoded using MPEG format.
  - These signals are then modulated onto a carrier wave and amplified.
  - The amplified signals are transmitted to the satellite via the Earth station's antenna using the C band.

- **Downlinking Cycle:**
  - The satellite receives the uplinked signals and retransmits them back to Earth.
  - At home, a DTH receiver using a Ku band dish captures these signals.
  - The signals are then demodulated and decoded back into video and audio formats for viewing on television.

Detailed Explanation Using the Diagram:
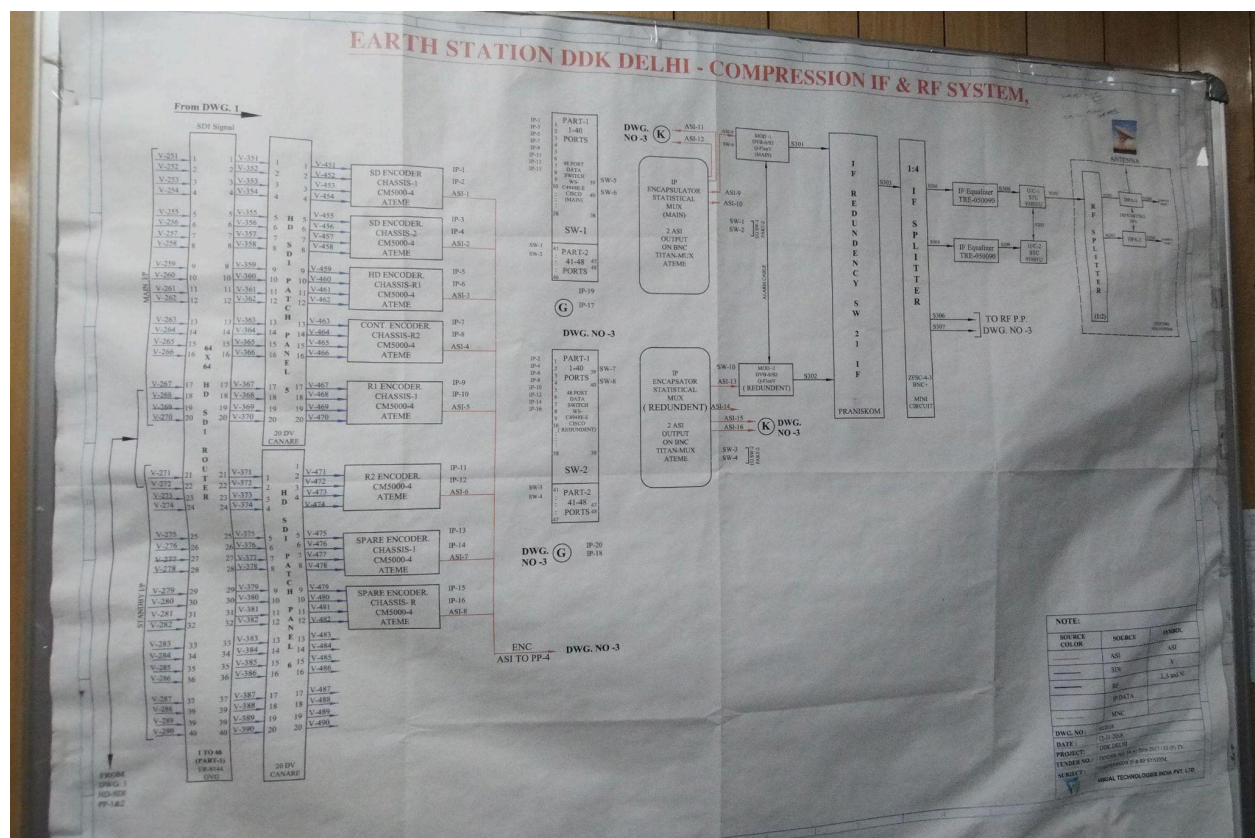
The provided diagram outlines the flow of signals within the Earth station at Doordarshan DDK Delhi.

Here is a detailed breakdown of the process:

1. **Signal Input:**
   - **SDI Signal:** The video signals are input into the system as SDI (Serial Digital Interface) signals.

2. **Encoding:**
   - **SD Encoder Chassis (CMS5004 - ATEME):** The SDI signals are passed through multiple encoders. Each encoder is responsible for compressing the video signals using MPEG format (e.g., SD Encoder for standard definition, HD Encoder for high definition, etc.).

3. **Switching and Redundancy:**
   - **Encapsulation and Statistical Multiplexing:** Encapsulators combine multiple video streams into a single stream. Statistical multiplexing optimizes bandwidth usage.
   - **Redundancy:** There are systems in place for redundancy to ensure continuous transmission even if one part fails.

4. **Modulation and Transmission:**
   - **IF (Intermediate Frequency) Equalizer:** The signals are converted to an intermediate frequency.
   - **IF Splitter and Amplifier:** The signals are split and amplified.
   - **Transmission:** Finally, the signals are transmitted to the satellite using the uplink antenna.

5. **Satellite to Home:**
   - The satellite receives the signals and transmits them back to Earth in the Ku band.
   - At home, a satellite dish receives the Ku band signals, which are then demodulated and decoded for television viewing.

NRCS (News Room Control System)

What is NRCS?
A Newsroom Control System (NRCS) is an integrated software platform used in broadcast journalism to manage and streamline the production process within a newsroom. It serves as the central hub for news operations, facilitating the planning, creation, editing, scheduling, and dissemination of news content across multiple platforms. NRCS software is essential for coordinating the various tasks and workflows involved in news production, ensuring efficiency, accuracy, and timely delivery of news broadcasts.

Importance of NRCS

1. **Centralized Workflow Management:**
   - **Integration:** NRCS integrates various newsroom functions, from story ideation to final broadcast, in a unified system.
   - **Collaboration:** It allows journalists, editors, producers, and technical staff to collaborate seamlessly in real-time.
2. **Efficiency and Productivity:**
   - **Task Automation:** Automates repetitive tasks, reducing the time and effort required for content creation and scheduling.
   - **Resource Management:** Manages newsroom resources, including staff, equipment, and studio space, to optimize productivity.
3. **Real-time Updates and Coordination:**
   - **Live Updates:** Provides real-time updates on news stories, rundowns, and production schedules.
   - **Coordination:** Ensures all newsroom staff are informed and coordinated, minimizing errors and miscommunications.
4. **Content Management:**
   - **Archive Access:** Allows easy access to archived content, enabling reuse and repurposing of media assets.
   - **Metadata Handling:** Manages metadata for better organization, searchability, and retrieval of news content.
5. **Multi-platform Distribution:**
   - **Cross-platform Publishing:** Supports publishing content across various platforms, including TV, radio, online, and social media.
   - **Audience Reach:** Enhances the ability to reach and engage with diverse audiences through different channels.

6. **Editorial Control:**
    ○ **Approval Workflows:** Implements editorial workflows to ensure content accuracy and compliance with editorial standards.
    ○ **Version Control:** Manages versions of stories and scripts, maintaining a clear record of edits and updates.

Blaze NRCS by Karthavya

Overview: Blaze NRCS by Karthavya is a comprehensive newsroom control system designed to meet the dynamic needs of modern newsrooms. It offers a suite of tools for journalists, producers, and graphic designers to create, manage, and deliver news content efficiently.

Key Features:

1. **Story Creation and Management:**
    ○ **User-friendly Interface:** Intuitive interface for creating and managing news stories.
    ○ **Templates and Scripts:** Provides templates and script formats for consistent content creation.
2. **Rundown Management:**
    ○ **Drag-and-Drop Interface:** Easy-to-use rundown management with drag-and-drop functionality.
    ○ **Real-time Updates:** Instant updates to rundowns and scripts, ensuring everyone is on the same page.
3. **Graphics Integration:**
    ○ **Seamless Integration:** Integrates with graphics systems for adding visual elements to news stories.
    ○ **Customizable Graphics:** Allows customization of graphics to match the broadcast style and branding.
4. **Collaboration Tools:**
    ○ **Real-time Collaboration:** Enables real-time collaboration among newsroom staff, improving coordination.
    ○ **Messaging and Notifications:** Built-in messaging and notification systems for instant communication.
5. **Multimedia Support:**
    ○ **Media Management:** Handles various media formats, including video, audio, and images.
    ○ **Editing Tools:** Provides basic editing tools for quick adjustments to media content.

6. **Multi-platform Publishing:**
   - **Cross-platform Support:** Facilitates publishing to multiple platforms, including TV, web, and social media.
   - **Automated Distribution:** Automates content distribution based on predefined rules and schedules.

AP ENPS

Overview: AP ENPS (Electronic News Production System) is one of the most widely used newsroom control systems globally. Developed by the Associated Press, ENPS offers a robust platform for news production, designed to enhance the workflow of newsrooms of all sizes.

Key Features:

1. **Comprehensive News Production:**
   - **Story Management:** Advanced story management tools for creating, editing, and organizing news stories.
   - **Script Writing:** Integrated scriptwriting features with support for multiple formats.
2. **Rundown and Scheduling:**
   - **Rundown Creation:** Powerful tools for creating and managing rundowns, with support for complex broadcast schedules.
   - **Dynamic Updates:** Real-time updates to rundowns, ensuring accurate and timely broadcasts.
3. **Collaboration and Communication:**
   - **Team Collaboration:** Facilitates collaboration among newsroom teams, with tools for sharing notes and updates.
   - **Integrated Messaging:** Built-in messaging system for instant communication within the newsroom.
4. **Integration with Broadcast Systems:**
   - **MOS Protocol:** Supports Media Object Server (MOS) protocol for seamless integration with various broadcast systems.
   - **Third-party Integration:** Integrates with third-party systems for graphics, playout, and other broadcast operations.
5. **Cross-platform Distribution:**
   - **Multi-platform Publishing:** Enables content distribution across multiple platforms, including TV, radio, web, and social media.
   - **Automated Workflows:** Automates workflows for efficient content distribution and management.

6. **Data and Analytics:**
   - **Performance Analytics:** Provides insights into newsroom performance and content reach.
   - **Audience Engagement:** Tools for tracking audience engagement across different platforms.

Comparison: Blaze NRCS vs. AP ENPS

User Interface and Usability:

- **Blaze NRCS:** Known for its user-friendly interface with drag-and-drop functionality, making it easy for users to create and manage content.
- **AP ENPS:** Offers a robust interface with comprehensive features, though it may have a steeper learning curve for new users.

Integration Capabilities:

- **Blaze NRCS:** Integrates seamlessly with graphics and media management systems, offering customizable options, Internally it also uses MOS Protocol.
- **AP ENPS:** Supports MOS protocol and integrates well with a wide range of third-party broadcast systems and media and graphics systems.

Collaboration and Communication:

- **Blaze NRCS:** Emphasizes real-time collaboration with built-in messaging and notification systems.
- **AP ENPS:** Provides strong collaboration tools, including an integrated messaging system, enhancing team communication.

Multi-platform Support:

- **Blaze NRCS:** Excels in cross-platform publishing with automated distribution features.
- **AP ENPS:** Offers extensive multi-platform support with automated workflows for efficient content distribution.

Customization and Flexibility:

- **Blaze NRCS:** Highly customizable, allowing newsrooms to tailor the system to their specific needs.

- **AP ENPS:** Offers a flexible platform with comprehensive tools, though customization may require more technical expertise.

Detailed Explanation of the Working of a Camera

Main Part of the Studio: The Camera
Understanding how a commercial camera works, especially in a professional broadcasting studio, involves a detailed look at the critical components and processes that ensure high-quality video capture and transmission. A commercial camera integrates advanced optics and electronics, making it a sophisticated tool for professional use.

Components and Working of a Commercial Camera

1. **Lens:**
   - **Function:** The lens is crucial for focusing light onto the image sensor, creating a real and inverted image on the sensor.
   - **Parts of the Lens:**
     - **Iris:** Controls the amount of light entering the camera. Adjusting the iris maintains the desired light level for optimal exposure under varying lighting conditions.
     - **Focus Ring:** Adjusts the clarity of the image. Rotating the focus ring ensures the subject is sharp and clear.
     - **Zoom Ring:** Alters the focal length of the lens, allowing the operator to zoom in (telephoto) or zoom out (wide-angle) on the subject. This capability is essential for framing the shot appropriately.
2. **Light Splitting and Processing:**
   - **Prism:** After passing through the lens, the light hits a prism that splits it into the three primary colors: Red, Green, and Blue (RGB), reflecting the human eye's sensitivity to these colors.
   - **White Balance:** Adjusts the balance between the RGB components to ensure accurate color reproduction under different lighting conditions, maintaining consistent color tones.

3. **Black Balance:**
    ○ **Function:** Ensures the camera's blacks remain true black, not tinted with unwanted colors like green or blue.
    ○ **Process:** Sets a ratio for RGB components to ensure that black levels are accurately represented, maintaining a true black in the footage.
4. **Image Sensors (CCDs):**
    ○ **Function:** Convert the RGB light components into electrical signals.
    ○ **Charge-Coupled Devices (CCDs):** These are specialized image sensors that capture light and convert it into an electrical signal. CCDs are known for their high-quality image capture, particularly in low light conditions.
    ○ **Process:**
        ■ Red, Green, and Blue components are processed separately by the CCDs.
        ■ The signals from the CCDs are then combined in the camera's matrix to form a full-color image.
5. **Signal Processing:**
    ○ **Matrix Conversion:** Converts the RGB signals into Y (luminance), R-Y, and B-Y (chrominance) signals, representing brightness and color information.
    ○ **Analog to Digital Conversion (ADC):** The combined signals are converted from analog to digital form by an ADC for digital processing and transmission.
    ○ **Serialization:** Prepares the digital signals for transmission over a single channel, ensuring efficient data transmission without quality loss.
6. **Output - SDI (Serial Digital Interface):**
    ○ **Function:** The SDI carries the digital video signal, ensuring high-quality and high-speed transmission.
    ○ **Process:** The serialized digital signal is sent through the SDI for further processing, recording, or broadcasting, supporting various resolutions and frame rates.

Further Processing and Broadcasting

1. **Graphics and Keying:**
    ○ **Concept of Keying:** Used to superimpose one image over another, adding graphics, text, and other visual elements to the video feed.
    ○ **Types of Keys:**
        ■ **Alpha Key:** Overlays text or logos using an alpha channel to define transparency.

- **Chroma Key:** Replaces a specific color (commonly green or blue) with another video or image, used for effects like weather maps.
        - **Luminance Key:** Uses brightness levels to create transparency, useful for specific effects.
2. **Integration with Camera Input:**
    - **Processing:** The high-quality camera input is fed into a video mixer or switcher where keying and other effects are applied.
    - **Graphics Addition:** Adds channel logos, lower thirds, and other visual elements, enhancing the broadcast and maintaining the channel's branding.
3. **Final Output:**
    - **Encoding and Compression:** The processed video is encoded and compressed for efficient transmission without excessive bandwidth usage.
    - **Transmission:** The final video feed is transmitted through various means such as satellite, cable, or the internet. The SDI signal may be converted into other formats depending on the transmission medium and the receiving equipment.

Detailed Explanation of 1080 Interlaced (1080i)

Introduction to 1080i HD

1080i HD refers to a high-definition video format with a resolution of 1920x1080 pixels. The "i" in 1080i stands for interlaced scanning. This method effectively doubles the perceived frame rate, providing smoother motion, especially beneficial for fast-moving content.

- **Resolution:** 1920x1080 pixels
- **Scanning Method:** Interlaced
- **Field Rate:** Typically 50 or 60 fields per second (equivalent to 25 or 30 frames per second)

Key Characteristics of 1080i HD

1. **Interlaced Scanning:**
    - **Fields:** Each frame is divided into two fields: one containing all the odd-numbered lines and the other containing all the even-numbered lines.
    - **Display:** These fields are displayed alternately, creating the full frame.

Understanding Interlaced Scanning with Matrix Form

Consider a 1080i frame represented as a matrix with 1920 columns (pixels per line) and 1080 rows (lines).

1. **Odd Field:**
    - Contains all the odd-numbered lines (1, 3, 5, ..., 1079).
2. **Even Field:**
    - Contains all the even-numbered lines (2, 4, 6, ..., 1080).

These fields are displayed alternately, creating the full frame.

Usage of 1080i 50Hz by Doordarshan

Doordarshan, India's public service broadcaster, has adopted the 1080i 50Hz format for its production and broadcasting needs. This transition from the earlier SD (Standard Definition) PAL format to 1080i HD represents a significant upgrade in picture quality, enhancing the viewing experience for the audience.

1. **Higher Resolution:** Enhanced detail and clarity in the broadcast content.
2. **Improved Motion Handling:** Interlaced scanning at 50Hz provides smoother motion portrayal, beneficial for dynamic content like sports and live events.
3. **Better Visual Experience:** Overall improved visual quality, aligning with modern broadcast standards.

Transition from SD PAL to 1080i HD

- **SD PAL Format:** Operates at a resolution of 720x576 pixels with a 50Hz refresh rate.
- **1080i 50Hz Format:** Offers several advantages over the SD PAL format:
    - **Higher Resolution:** 1920x1080 pixels for enhanced detail and clarity.
    - **Improved Motion Handling:** Smoother motion portrayal due to interlaced scanning.
    - **Better Visual Experience:** Aligns with modern broadcast standards, offering a superior viewing experience.

Why Framework Synchronization is Done

Frame synchronization is crucial in broadcasting to ensure that multiple video sources can be seamlessly integrated and broadcasted without issues. It involves aligning the timing of video signals from different sources, making them consistent in terms of frame rate, resolution, and phase.

Role of Frame Synchronizer

A frame synchronizer plays a vital role in the production and broadcasting of 1080i content. Here are the key functions and benefits:

1. **Synchronization:** Ensures all video sources are synchronized to a common timing reference, preventing frame drops and misalignment.
2. **Stabilization:** Provides a stable video signal by correcting any timing variations, essential for maintaining high broadcast quality.
3. **Conversion:** Converts various input formats and frame rates to match the desired output, ensuring compatibility and uniformity across different sources.
4. **Correction:** Fixes issues such as time base errors and jitter, which can occur during signal transmission.

Connection with Interlaced HD and Fields

1. **Interlaced Fields:** In 1080i, each frame is split into odd and even fields. The frame synchronizer ensures that these fields are correctly timed and displayed alternately to form a complete frame.
2. **Field Alignment:** Proper alignment of odd and even fields is crucial for maintaining the smooth motion effect of interlaced video.

Consequences of Not Using a Frame Synchronizer

Without a frame synchronizer, several issues can arise:

1. **Frame Misalignment:** Different video sources might not align correctly, causing visible artifacts and frame drops.
2. **Unstable Signal:** Video signals might suffer from jitter and instability, degrading the quality of the broadcast.
3. **Compatibility Issues:** Inconsistent formats and frame rates from various sources can lead to problems during broadcast, impacting the viewer's experience.
4. **Field Errors:** Misalignment of interlaced fields (odd and even) can cause noticeable flickering and loss of motion smoothness.

List of some Companies whose products were being used at Doordarshan

Companies and Their Products Used at Doordarshan

1. Grass Valley (GV)

Description: Grass Valley, a Belden Brand, is a leading provider of broadcast technology solutions. They offer a comprehensive range of products for live production, news, playout, and more. **Products Used:** Video production switchers, cameras, and video servers.

2. Quantel

Description: Quantel, now part of Snell Advanced Media (SAM), specializes in high-end post-production and broadcast technology. They are known for their innovative video editing and graphics systems. **Products Used:** Video editing systems, graphics, and effects equipment.

3. Karthavya Technologies

Description: Karthavya Technologies is a provider of newsroom and broadcast solutions. They focus on developing software that enhances the efficiency of news production and distribution. **Products Used:** Blaze NRCS (Newsroom Computer System) for managing newsroom operations.

4. Avid Technology

Description: Avid Technology is a well-known provider of audio and video editing software, as well as digital audio workstations. They cater to film, video, audio, and broadcast professionals. **Products Used:** Media Composer for video editing, Pro Tools for audio editing, and Interplay for asset management.

5. Stanton Video LLC (Jimmy Jib)

Description: Stanton Video Services, known for the Jimmy Jib, provides camera crane solutions used in broadcast and film production. The Jimmy Jib is known for its versatility and stability in capturing dynamic shots. **Products Used:** Jimmy Jib camera cranes.

6. Blackmagic Design

Description: Blackmagic Design is a manufacturer of creative video technology. They are known for their affordable and high-quality video production equipment. **Products Used:** DaVinci Resolve for color correction and video editing, Blackmagic cameras, and ATEM live production switchers.

7. ATEME

Description: ATEME is a global leader in video compression and delivery solutions for broadcast, cable, DTH, IPTV, and OTT. They provide advanced encoding and transcoding products. **Products Used:** Video compression and encoding systems.

8. TP-Link

Description: TP-Link is a global provider of reliable networking devices and accessories. Their products include routers, switches, and wireless equipment. **Products Used:** Networking equipment like routers and switches.

9. European Broadcasting Union (EBU)

Description: The European Broadcasting Union is an alliance of public service media organizations, providing services and establishing standards for the broadcast industry. **Products Used:** Standards and guidelines for broadcast quality and interoperability.

10. Casper CG

Description: CasparCG is an open-source graphics platform used for broadcast graphics, video, and audio playout. It is widely used by broadcasters for creating real-time graphics. **Products Used:** Graphics and video playout systems.

11. Sony

Description: Sony Corporation is a leading manufacturer of electronic products, including professional broadcast cameras and equipment. **Products Used:** Broadcast cameras, monitors, and video production equipment.

12. Panasonic

Description: Panasonic Corporation provides a wide range of electronic solutions, including professional broadcast and video production equipment. **Products Used:** Broadcast cameras, switchers, and video recording equipment.

13. Ikegami

Description: Ikegami Tsushinki Co., Ltd. specializes in professional broadcast cameras and equipment. They are known for their high-quality imaging solutions. **Products Used:** Studio and field broadcast cameras.

14. EVS Broadcast Equipment

Description: EVS is a provider of live video production systems, known for their instant replay and live slow-motion systems. **Products Used:** Live video production and replay systems.

15. Harris Broadcast (Imagine Communications)

Description: Imagine Communications, formerly Harris Broadcast, provides a wide range of broadcast and multimedia solutions, including automation and playout systems. **Products Used:** Broadcast automation and playout systems.

16. Vizrt

Description: Vizrt provides real-time 3D graphics, studio automation, sports analysis, and asset management tools for the broadcast industry. **Products Used:** Real-time 3D graphics systems and studio automation.

17. LiveU

Description: LiveU is a leader in live video streaming and remote production solutions. They are known for their portable transmission devices that allow broadcasters to go live from anywhere. **Products Used:** Portable live video transmission units for remote and on-the-go broadcasting.

18. TVU Networks

Description: TVU Networks offers a wide range of solutions for live video acquisition, transmission, distribution, and management. They specialize in IP-based video solutions. **Products Used:** TVU One portable transmitter for live video streaming.

19. Yamaha

Description: Yamaha Corporation is renowned for its high-quality audio equipment and sound systems. They provide professional audio solutions for a variety of applications, including broadcasting. **Products Used:** Audio mixing consoles, speakers, and other sound system components.

20. Kiloview

Description: Kiloview provides a variety of video transmission and management solutions, focusing on IP-based video processing and streaming technology. **Products Used:** Video encoders and decoders, streaming solutions.

Thank You

Special Thanks to :

GNDEC for providing training request letter

- Jaswant sir

Prasar Bharati and Doordarshan Mandi House:

- Ashok Pathak sir (Director(Engg.))
- Ajay Sharma sir (A.D.(E))
- K Ramesh sir (A.D.(E))