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Built to Evolve: Navigating the Shift to Software-Defined

AI-Augmented Broadcast

Baseband, IP, and AI — Looking Back 20, Looking Forward 10

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AGENDA

Six stops on a 20-year arc — and a 10-year horizon

01 The Last 20 Years

Baseband to file-based to IP — how we got here

02 Why SDI Won

The engineering virtues that made baseband the right answer

03 Why SDI Hit a Wall

Where the model started costing us flexibility

04 IP, ST 2110 & NMOS

Broadcast meets IT — essence, timing, orchestration

05 AI Enters Operations

Metadata, QC, compliance, provenance — not creative replacement

06 The Next 10 Years

Hybrid, intelligent, trusted — what to plan for now

35 minutes
main talk

05 minutes
Q&A + discussion

Practical, standards-focused — a working engineer's view

PART I

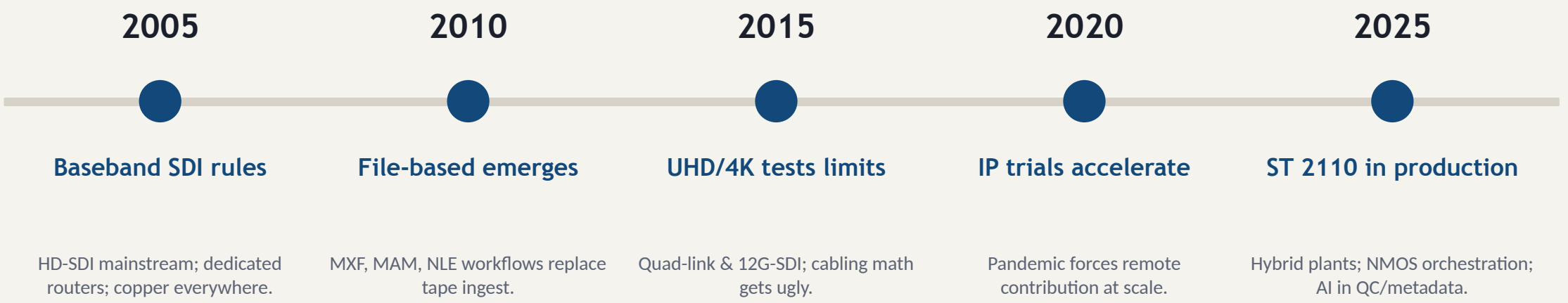
The Last 20 Years

From baseband racks to software-defined plants

2005 → 2025: From SDI dominance to IP disruption

Each five-year window forced the industry to rethink architecture, not just refresh hardware.

The shift wasn't one event — it was four cumulative pressures: bandwidth, formats, distribution surface, and remote work.



Why SDI won — and lasted 30+ years

Deterministic timing

Genlock + black burst gave us microsecond-stable sync without thinking about networks.

Physical debugging

A patch cable, a rasterizer, an oscilloscope. Problems were visible and findable.

Reliable live switching

Frame-accurate cuts, no buffer juggling, no jitter analysis. It just worked.

Standard tools & training

Decades of training material, certifications, and muscle memory across the workforce.

Straightforward redundancy

Parallel paths, identical wiring, easy to reason about under pressure.

SDI wasn't a mistake.

It was the right engineering answer for a deterministic, hardware-bounded era.

Where the model started costing us flexibility

Strengths became constraints

— **Cabling at scale**

100+ channels of 4K HDR on copper is an architectural problem, not a budget one.

— **Fixed point-to-point**

Every new source/dest needed physical re-patch or a bigger router.

— **Format proliferation**

UHD, HDR, HFR, multi-language audio — quad-link math broke productivity.

— **Geographic locality**

Signals were tied to the building. Remote contribution meant trucks, not workflows.

— **CapEx-heavy growth**

Each expansion was a hardware order, not a software change.

What the market started demanding

\+ **Channel multiplication**

FAST, streaming variants, regional feeds — many outputs from one workflow.

\+ **Remote everything**

Contribution, production, monitoring, master control — from anywhere.

\+ **Elastic compute**

Pay for peaks (sports, elections, breaking news) without owning peaks year-round.

\+ **Format flexibility**

Same plant must do SD legacy, HD, UHD, mobile, social — concurrently.

\+ **IT convergence**

Security, identity, observability — broadcast had to join the IT stack, not parallel it.

PART II

Where We Are Now

ST 2110, NMOS, hybrid cloud, and AI in operations

ST 2110: Broadcast meets IT

SMPTE ST 2110 is not "video over IP" — it's essence-separated, PTP-timed, networked media transport.

Essence streams

Video, audio, and metadata travel as separate, independently routable flows.

PTP timing

IEEE 1588 Precision Time Protocol replaces black burst; microsecond sync across the network.

Open transport

Uncompressed media over standard 10/25/100G Ethernet — vendor-neutral interop.

THE SHIFT

~~Hardware-defined~~

→

Software-defined

Routing becomes orchestration. The facility starts looking like a data center with broadcast policies on top.

NMOS makes IP plants operable at scale

IS-04

Discovery & registration

Sources, senders, receivers, and devices announce themselves. The orchestrator always knows what's on the network.

IS-05

Connection management

Making/breaking flows becomes an API call, not a router panel push. Same operator workflow, very different plumbing.

IS-06 / IS-07 / IS-08 …

Audio mapping & control

Channel mapping, event signalling, network control — the standards keep extending into the operational layer.

Without NMOS, ST 2110 is a transport. With NMOS, it becomes a manageable broadcast plant.

What changed for broadcast engineers

01 **IP networking**

VLANs, LACP, multicast (PIM, IGMP snooping), QoS, traffic engineering.

02 **PTP timing mastery**

Boundary clocks, grandmaster redundancy, holdover behavior, PTP-aware switches.

03 **Cybersecurity**

Segmentation, identity, patching, zero-trust principles applied to a live plant.

04 **Orchestration & APIs**

REST/JSON, NMOS, automation tools — comfort with code-driven workflows.

05 **Observability**

Flow analyzers, packet capture, telemetry pipelines, alert design.

STILL REQUIRED

Video & audio fundamentals

Color, levels, loudness, sync, latency, frame timing — none of this goes away. Networking is added to the job, not substituted for it.

Remote and hybrid production is permanent

Once a pandemic workaround.

Now standard operating procedure.

Contribution from anywhere

Cellular bonded encoders, IP transport, SRT/RIST/2110-30 inputs — venue to plant in milliseconds.

Distributed control rooms

Producers, directors, TDs, audio engineers operating in different cities on the same event.

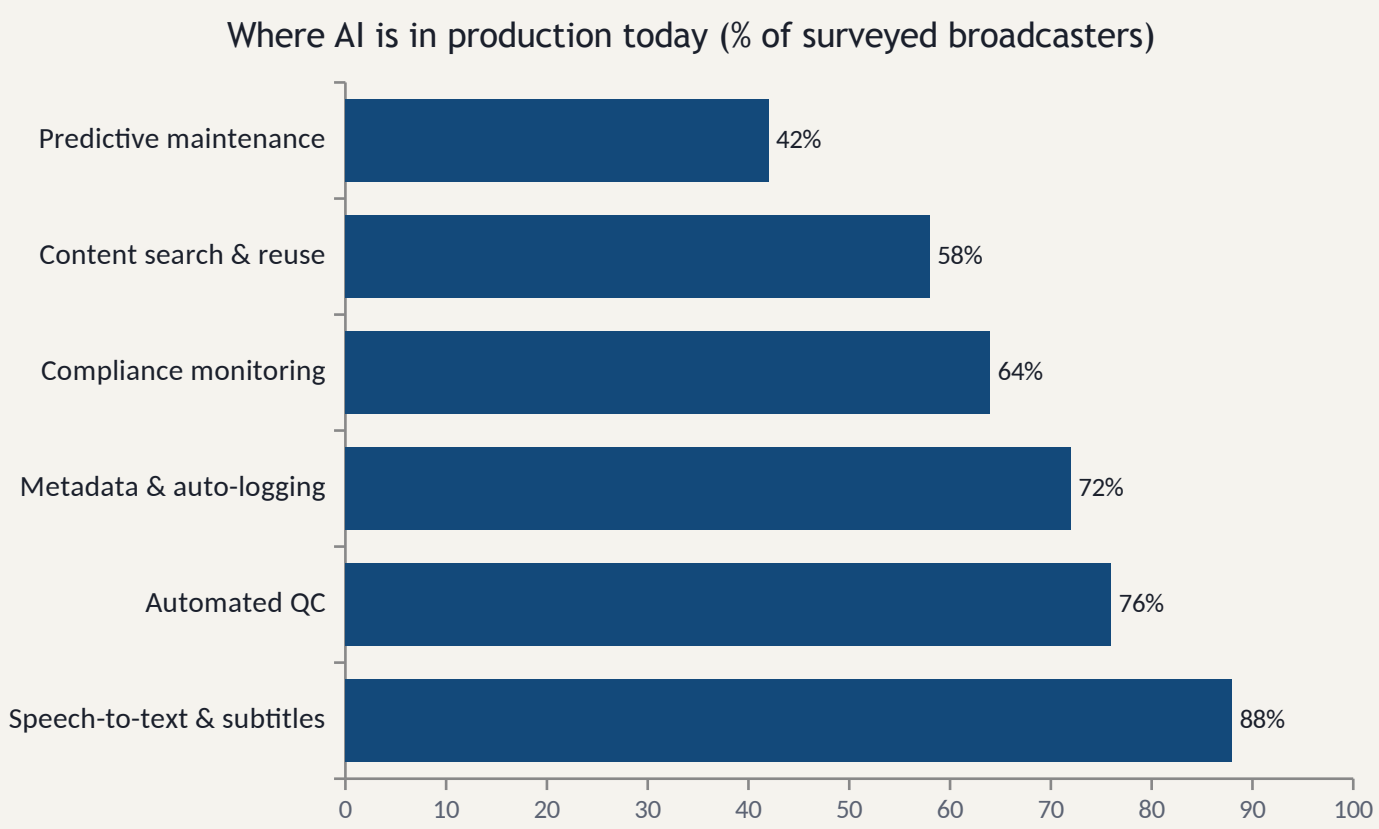
Elastic compute

Cloud spin-up for tentpole events; scale down between them. CapEx → OpEx where it matters.

Reduced OB-truck dependency

Venue-side gets lighter (cameras, encoders, simple comms); the heavy lift moves to the home plant or cloud.

From hype to operations — where AI is actually working



What the data tells us

Boring beats brilliant

Captions, QC, and logging — the highest-ROI AI work is the unglamorous work.

Assists, doesn't replace

AI is a layer on top of operations, not a replacement for the operator.

Trust gates adoption

Provenance and verifiability now matter as much as accuracy.

Illustrative — composite of industry adoption surveys; see SMPTE and IABM industry reports.

Authenticity and provenance in an AI era

THE PROBLEM

Generative and manipulated media now cost less to create than to detect. Audience trust in video is no longer free — it has to be engineered.

01

Provenance

C2PA-style content credentials; signed manifests travel with the asset through the pipeline.

02

Watermarking

Imperceptible marks survive transcoding and distribution; verify origin downstream.

03

Chain of custody

Every transformation logged, attributable, and reproducible — from camera to delivery.

04

Verification at edge

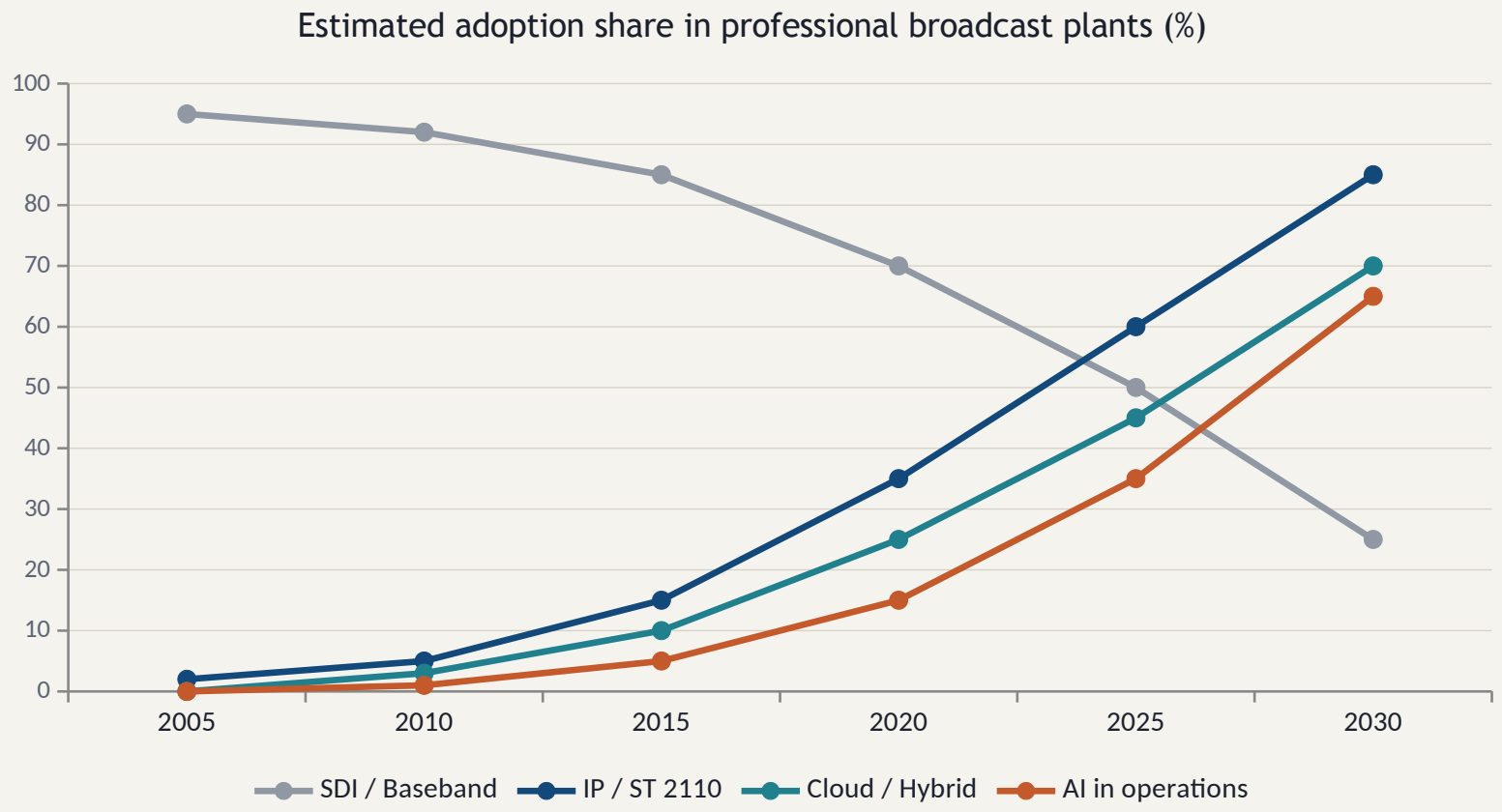
Players, MAMs, and partners check authenticity before display or republish.

PART III

The Next 10 Years

Predictions, planning advice, and where to be skeptical

Technology adoption curves, 2005 → 2030



Three crossings to watch

IP overtakes SDI

Expected late 2020s in new builds; brownfield trails by ~5 years.

Cloud share crosses 50%

Late this decade for elastic & overflow workloads.

AI becomes default

> 60% of facilities by 2030 for captions, QC, metadata.

Illustrative trajectory based on SMPTE and IABM industry adoption commentary.

PART III · 8 PREDICTIONS

What to plan for in the next decade

01

IP becomes the default

ST 2110 + NMOS anchors every greenfield build.

02

Hybrid cloud is permanent

On-prem + cloud + remote as a single operating model.

03

AI in operations is standard

Captions, QC, metadata, compliance — assumed, not optional.

04

Content authenticity matters

Provenance, watermarking, chain-of-custody become buyer requirements.

05

Remote production is normal

Distributed control rooms; venues stay lighter.

06

Engineering looks more like IT

Networking, security, orchestration alongside video/audio.

07

One workflow, many outputs

Linear + streaming + FAST + social as one packaging plane.

08

Automation pushes into back-office

Scheduling, rights, reporting, monitoring — increasingly AI-assisted.

What could go wrong (and how to hedge)

Standards fragmentation	Multiple incompatible IP/AI stacks slow interop and inflate integration cost.	HEDGE *Insist on conformance testing; require NMOS/2110 compliance in RFPs.*
Vendor lock-in	Proprietary control planes wrapped around open transport.	HEDGE *Buy on open APIs; avoid one-throat-to-choke architectures.*
Cybersecurity gaps	A live plant is a high-value, low-patch-window target.	HEDGE *Segment ruthlessly; tabletop incidents quarterly; identity-first.*
Skills transition gap	Mid-career engineers without IP/AI exposure get pushed out unfairly.	HEDGE *Train internally before hiring externally; invest in cross-skilling.*
Trust in AI outputs	AI errors going to air destroy credibility faster than they save time.	HEDGE *Human-in-the-loop where it matters; metrics + audit trails.*

SMPTE's role in the next decade

SMPTE wrote the book on SDI. The next 10 years asks us to write it again — for IP, AI, and trusted media.

01

Standards

Continue evolving 2110, NMOS, and new authenticity standards.

02

Interop testing

Conformance and plug-fests keep "open" actually open.

03

Trust frameworks

Industry-wide provenance, watermarking, chain-of-custody.

04

Training & education

Bring the next generation up the curve faster than we came up.

If you're in this room, you're part of writing it. Show up to working groups. Comment on drafts. Train the next engineer.

CLOSING

Five things to take home

01 **SDI wasn't wrong — the era changed.**

Honor the past; design for the present requirements.

02 **IP + NMOS is the new foundation.**

New builds start there; brownfield trails by ~5 years.

03 **AI belongs in operations, not in the director chair.**

Captions, QC, metadata, compliance — high-ROI today.

04 **Trust has to be engineered.**

Provenance and verifiability are core, not optional.

05 **Your team is the leading variable.**

Cross-skill, don't replace. Networking + broadcast + AI literacy.

THANK YOU

Questions?

Let's talk about what trends you're seeing in your facilities — and how you're planning for IP and AI.

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