

UHDTV Production Standards: SDI vs IP

Hans Hoffmann, EBU Head of Media technology

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UHDTV PRODUCTION STANDARDS: SDI VS. IP

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AGENDA

1. Short review on UHD TV parameters
2. Beyond the resolution debate
3. Chicken-and-Egg – Challenge for production
4. Infrastructure debate not only an UHD issue
5. Roadmap of JT NM
6. Summary



- Consumers are buying 4K TVs today
- From a given size, only 4Ks are on sale.
- Some events are being produced in UHDTV e.g. EURO 2016 Semi Finals and Finals 2016
- BT Sport, Sky, Netflix, Amazon SwissCom, all have a UHD strategy
- Broadcasters just begin.....

Vatican City ~ October 7, 2016

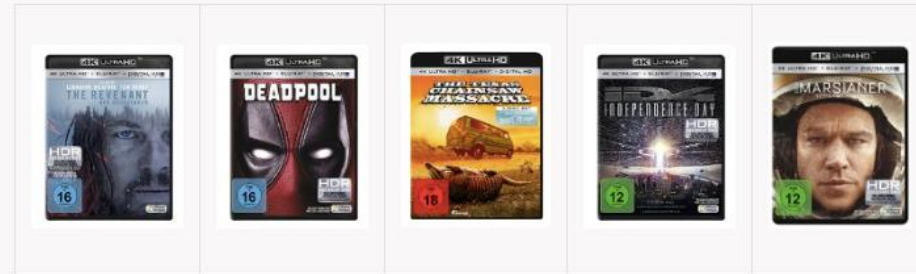
It's not just 4K TVs that are breaching sales records, 8K TVs will start selling too: 1 million units by 2019

by Stephen on July 14, 2015



4K Blu-ray Disc – Informationen zur Ultra HD Blu-ray

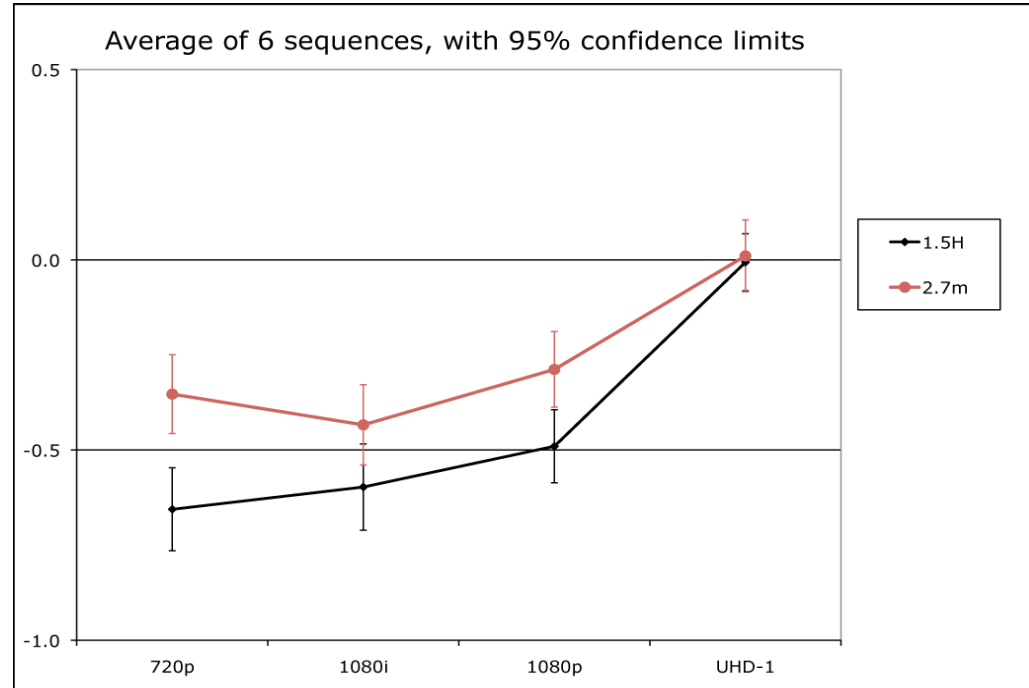
Top 5 auf Amazon.de (Anzeige): Zeige mir alle verfügbare 4K Blu-rays





BEYOND RESOLUTION

- In 2013 the industry realized that a resolution increase only will NOT provide a significant better perceived image quality
- We needed a perceptible quality improvement also at wider viewing distances!





HDR to solve this problem



WHY DO WE NEED DYNAMIC RANGE

- Details in dark or bright not perceptible
- Can even lose important information
- Research has shown that HDR is a significant perceptible parameter for UHD and HDTV
- First standards are defined
- ITU-BT 2100, SMPTE 2084, ARIB67
- ATSC and DVB getting there.....



But there are open issues

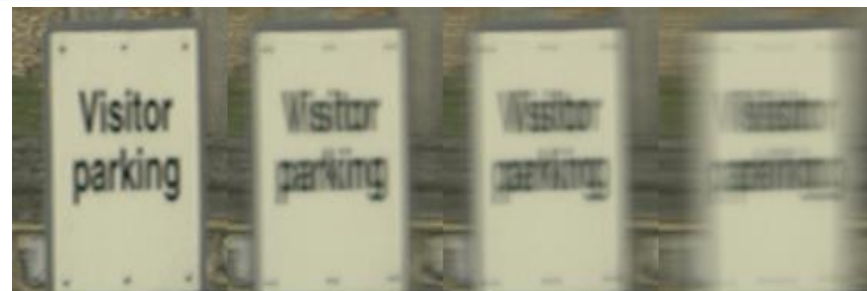
- IMAGE DEPENDENT DYNAMIC METADATA
- OPERATIONAL IMPACT
- HDR CROSS CONVERSIONS
- SDR-HDR



NEXT THING - HFR

Higher Frame Rate

- 100 Hz, 120 Hz in the standards
- For fast motion, sport etc.
- Sharpness effect and clearly perceptible for certain genre
- **In baseband significant bitrate increase**
- In distribution, only 10..20 % increase due to entropy benefits
- DVB Phase 2 will define the standards



300 Hz

150 Hz

100 Hz

50 Hz

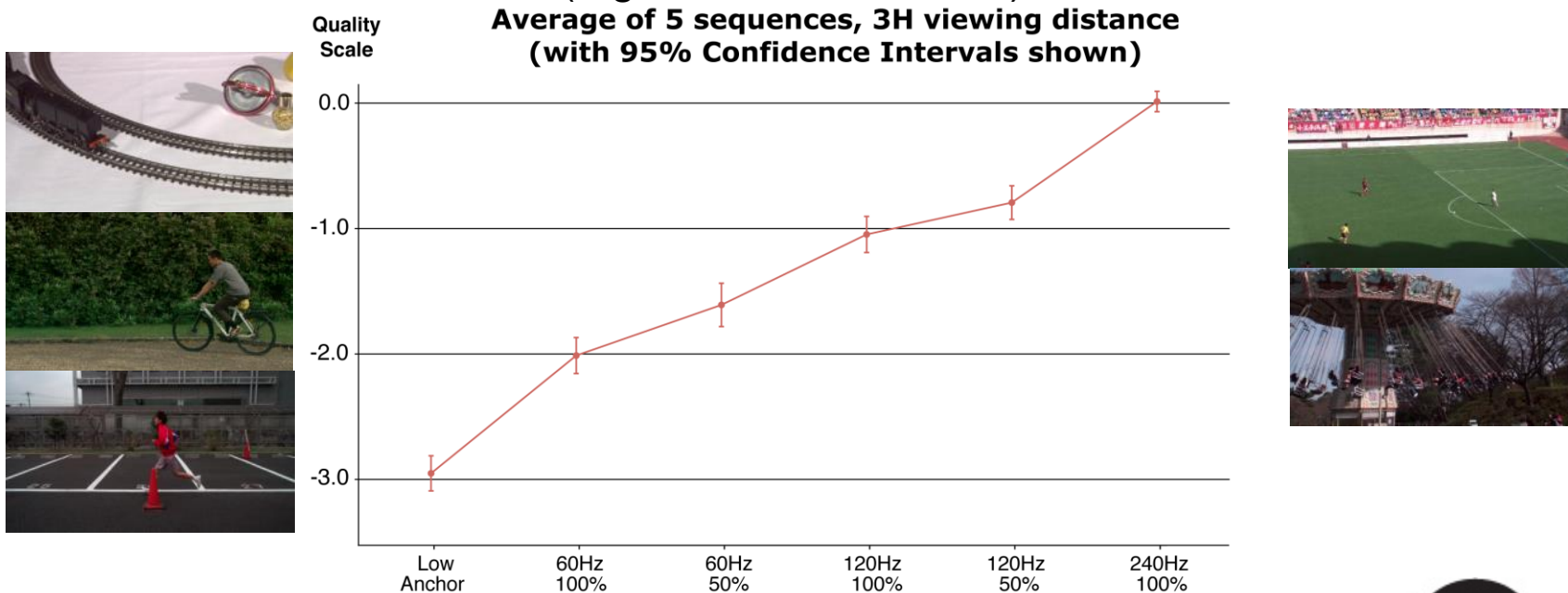


Figure 3. Still from BBC test shoot, above as it would have been captured with 50 Hz frame rate, and below, at 300 fps.



HFR SHUTTER SETTING VISUAL QUALITY ASSESSMENT

- Comparing 60Hz, 120Hz at different shutter settings with a 240Hz 100% shutter content (high anchor/reference).





TR 037

VIDEO SYSTEM REQUIREMENTS FOR UHDTV AND AN ADVANCED 1080P TELEVISION FORMAT

EBU TECHNICAL REPORT

6. Recommended image formats overview

The following table outlines the potential image formats that could be used during the migration from current HDTV formats to a fully specified UHDTV format.

Image format	Resolution	Frame Rate (fps)	Higher Dynamic Range	Bit-Depth	Colorimetry
1080p Advanced 1	1920 x 1080	24, 25, 50, 60*	ITU-R BT.(HDR-TV) (PQ10, HLG10)	10, 12	ITU-R BT.2020
1080p Advanced 2	1920 x 1080	[24, 25, 50, 60] 100, 120*	ITU-R BT.(HDR-TV) (PQ10, HLG10)	10, 12	ITU-R BT.2020^e
UHD-1 Phase 2	3840 x 2160	24, 25, 50, 60*	ITU-R BT.2020 ITU-R BT.(HDR-TV) (PQ10, HLG10)	10, 12	ITU-R BT.2020^e
UHD-1 Phase 2	3840 x 2160	[24, 25, 50, 60] 100, 120*	ITU-R BT.2020 ITU-R BT.(HDR-TV) (PQ10, HLG10)	10, 12	ITU-R BT.2020^e
Future use					

* This includes the fractional frame rate variants.

THE OLD CHICKEN AND EGG PROBLEM ...



THE OLD CHICKEN AND EGG PROBLEM ...

DISPLAYS
&
DISTRIBUTION

BUSINESS
MODEL
and
CONTENT

PRODUCTION
INFRASTRUCTURES

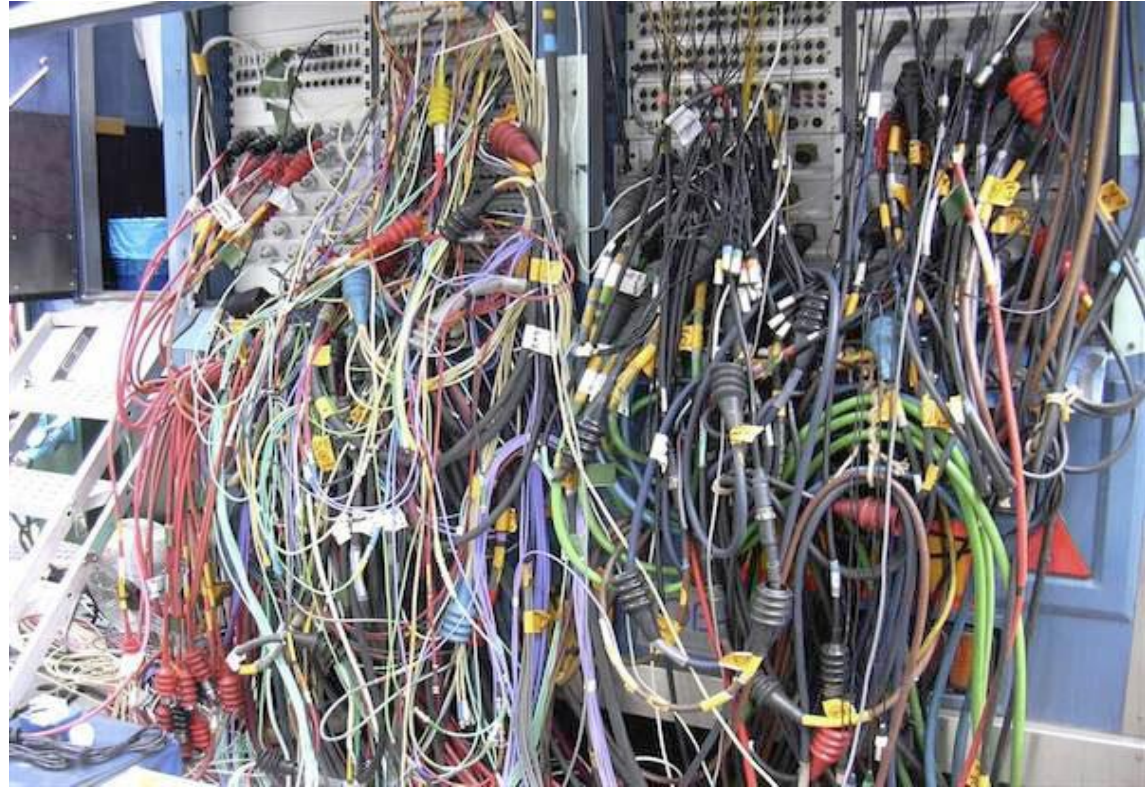
PRODUCTION
COSTS





TODAY'S COMPLEX VIDEO & AUDIO INFRASTRUCTURE

From this...

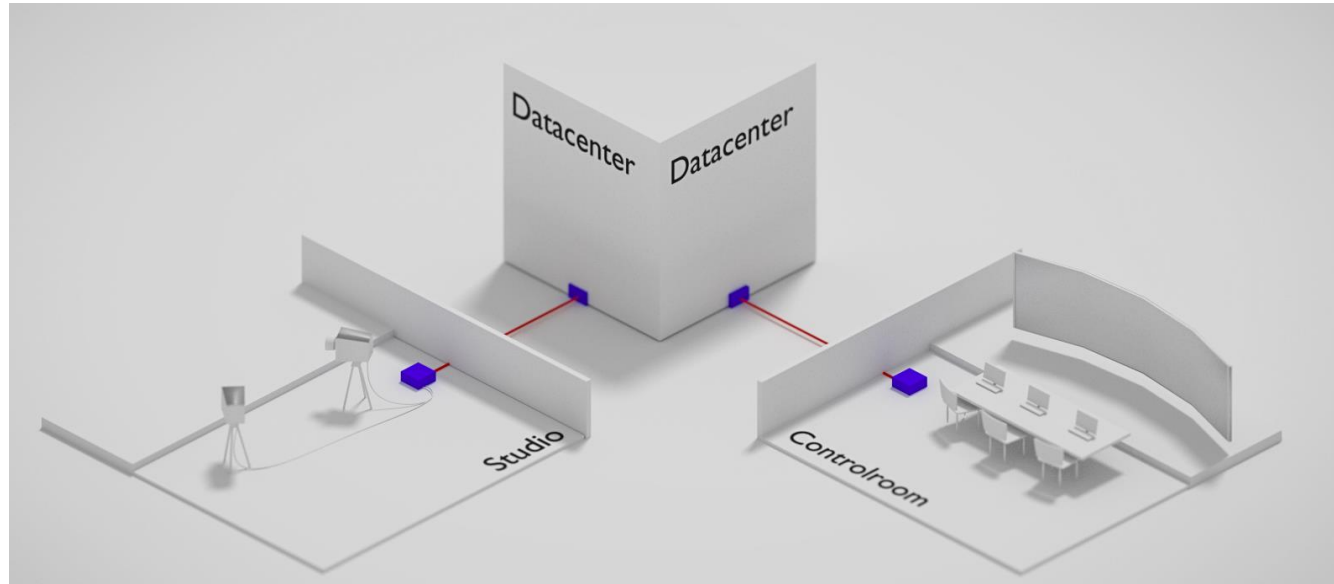




THE IP STUDIO OF THE FUTURE ALLOWS

The future IP studio will allow remote production over fiber networks, reducing facilities and personnel on-site

To this





THE DEBATE IS ACTUALLY NOT A DEBATE

SDI based production Infrastructures

- Point to Point
- Unidirectional
- Easy to use, PnP
- Less flexible to changing workflows
- 3G, 12G is state of the art (4k, 60p, 10 bit)
- Multi-links (multi 12Gs etc)
- Uncompressed (usually)
- SMPTE Standards suite

IP based production Infrastructures

- Bi-directional
- Scalable (10G, 25G, 40G, etc)
- Based on ICT industry
- Real Time Live PTP (SMPTE 2059)
- Multiformat
- Flexible to agile workflows
- Complex
- Compressed and Uncompressed
- The way into the cloud
- The way into virtualization



THE DEBATE IS ACTUALLY NOT A DEBATE

SDI based production Infrastructures

- Point to Point
- Unidirectional
- Easy to use, PnP
- Less flexible to changing workflows
- 3G, 12G is state of the art (4k, 60p, 10 bit)
- Multi-links (4x12G)
- Uncompressed
- SMPTE Standard

IP based production Infrastructures

- Bi-directional
- Flexible to agile workflows
- Complex
- Compressed and Uncompressed
- The way into the cloud
- The way into virtualization

Decision point is based on the application



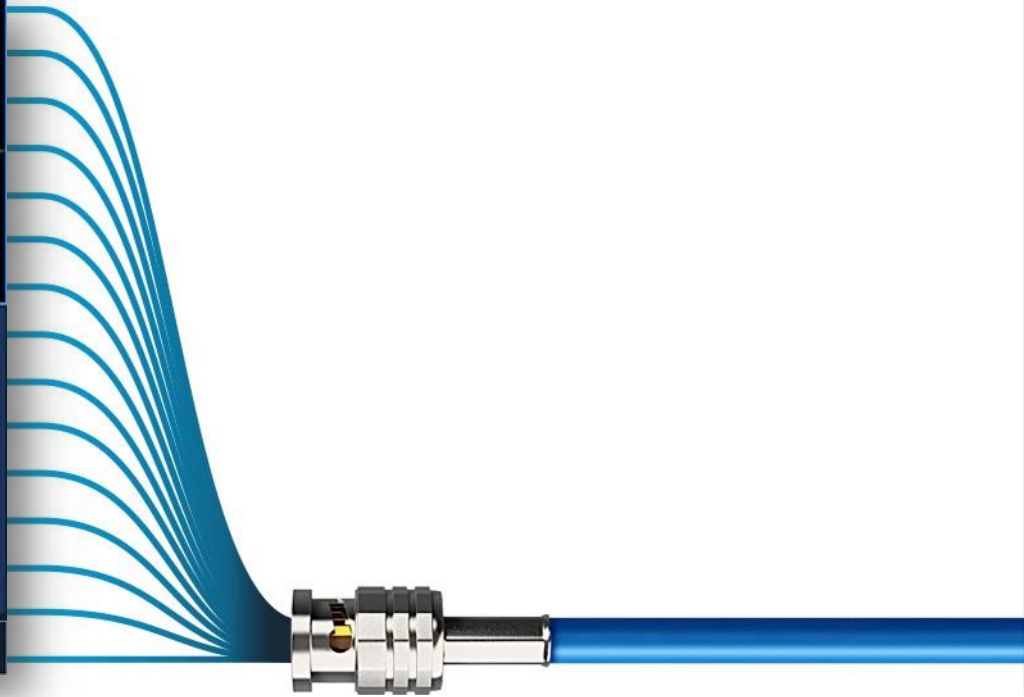
DIGITAL IMPACT – WHY CHANGE TO IP

- Cost pressure and efficiency
- Distributed production
- More programmes, agile, faster and for cross-media
- More software less specific hardware
- Everything more and everything faster.....





SDI = SERIAL BITSTREAM OF THE RASTER – SMPTE 2022 SERIES





IT IS NOT ABOUT REPLACING SDI

Current industry status is to replace SDI with tunneling over IP.

- SMPTE 2022 Series of standards
- Industry commitments and implementation
- First advancements in workflows
- Remote production also in UHD TV
- Learn to handle timing and sync via IP

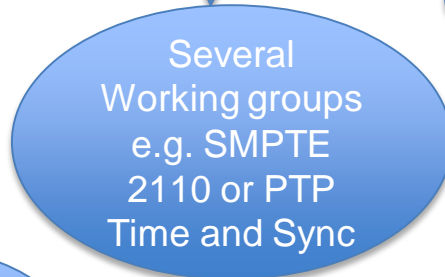




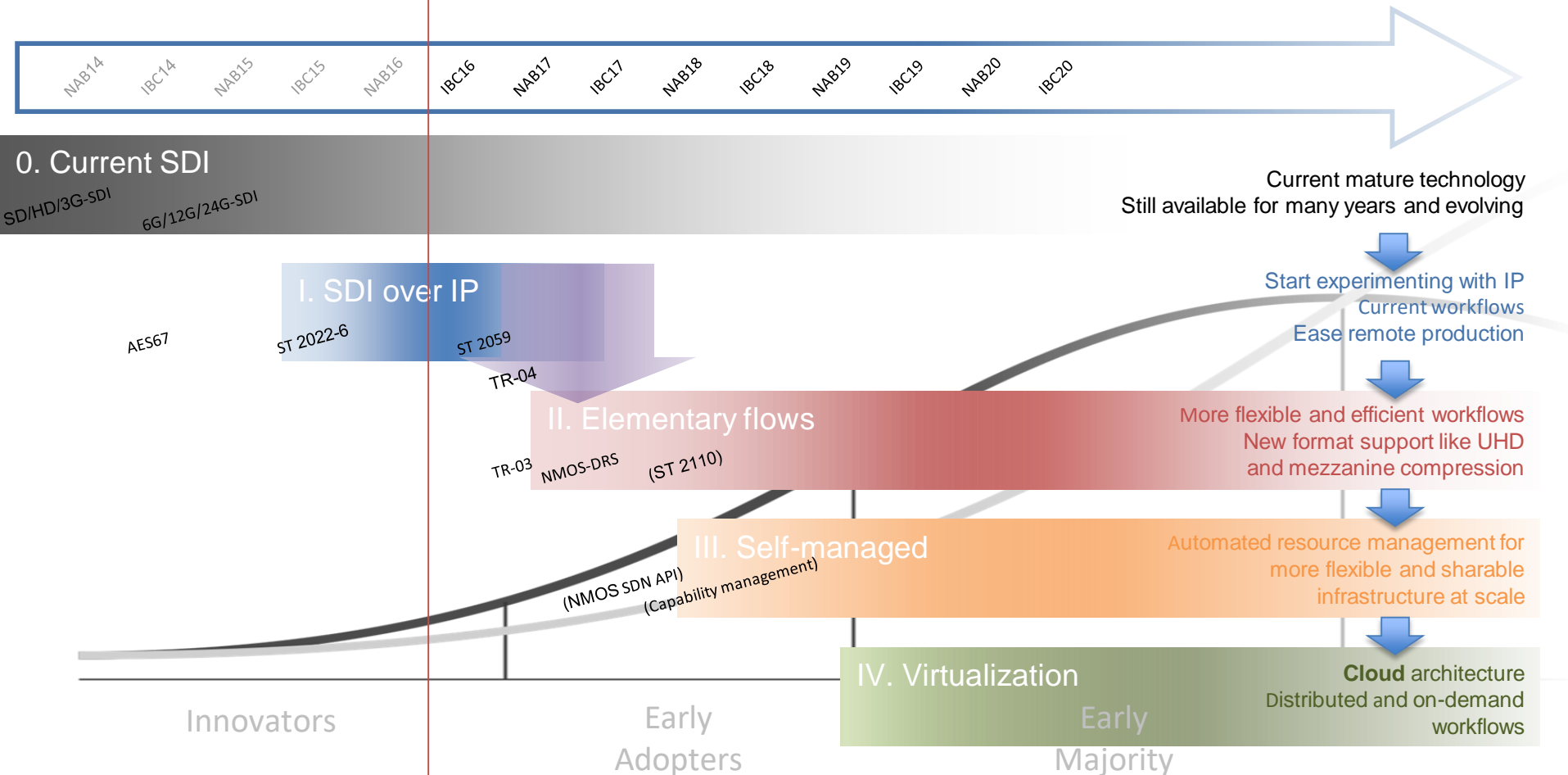
COMPLEX INTERNATIONAL CONTEXT



JOINT TASK FORCE NETWORKED MEDIA



JT-NM NETWORKED MEDIA ROADMAP OF OPEN INTEROPERABILITY



*current view as of June 2016 and it will evolve over time. Contact JT-NM for the latest update (jt-nm-info@videoservicesforum.org)



BEYOND TUNNELLING SDI: THE NETWORKED MEDIA REFERENCE ARCHITECTURE (JT-NM)

Workflows

Live

Non-Live

Near-Live

Remote / Distributed

Object-Based

User Generated Content

Applications

Apps, UI & Control Surfaces

Monitors & Multiviewers

Management Dashboards

Platforms

Media Transport

Resources Management

Audio

Video

Metadata

Flow Mngt.

Device/Capability Mngt.

Codecs

Time &
Sync

Discovery & Registration

Identity

Encapsulation

Network Orchestration

Cloud APIs

Infrastructure

Common IT HW

Speciality HW & Gateways

COTS Switches (LAN)

Inter Networks (WAN)

Best Effort Networks (Internet)



WHAT WE LEARNED?

(FROM FIRST “SDI OVER IP” POCS)

- **Confidence** that IP can work
- **Current workflows: transparent** for the users
- **Remote** production **easier**
- Cabling **simpler** but Configuration **more complex**
- “**Clean enough**” switching is accepted for most operations
- Need **hybrid broadcast/network teams** (for system design and tech. support)
- **Training** and re-training!
- Lack of proper monitoring **tools** for quick **troubleshooting**
- **PTP** still have **implementation** and **practical** issues
- **FEC** apparently **not needed** on managed (e.g., SDN) networks



WHAT WE DON'T KNOW YET

- What is the new **cost model** and how to generate savings and efficiencies?
- What is missing for **interoperable cloud-based** production and first experiences?
- What **new workflows** and new types of **content** will be enabled?
- **Security**: what are the best practices adapted to media orgs
- How does it **scale up** to large systems and facilities?
- What will be the common **network orchestration**, SDN or COTS?
- What will be the impact on **power consumption**?
- What is the new “**good enough**” performance and quality?
- How much **redundancy** do we need to get desired reliability?
- More long-haul **distributed** production experiences
- How to **update** systems in operations
- How can we better **organize** the work?, etc.



UHD and IP – there is no escape

- Just a question of time...
- Standards safeguard investments



Impact:

Editorial-Technical-Organizational Changes, Skills-Level of complexity, Retraining

Vatican City ~ October 7, 2016



Thank You

OUR WORKING GROUPS

TECH.EBU.CH