To further the widespread availability of high quality audiovisual VR experiences, for the benefit of consumers

- First industry guidelines released and updated in 2018
  - http://www.vr-if.org/guidelines/
  - Covers production, delivery, security and user experience of On Demand VR experiences
- 2019 Guidelines update
  - To be published in later this month (April 2019)

VR - The Use-Cases

- Entertainment
  - Baobab Studios “Invasion”
- Marketing
  - Mission Impossible: Fallout
- Tourism and Travel
  - Visit Mammoth California
- Training
  - Walmart
- Specialized Applications
  - Robots
  - Manufacturing
  - Law enforcement
  - Journalism
  - Security
- And more

Membership


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verizon


irdeto


GAUDIO


TNO


Fraunhofer


NGCODEC
NEXT GENERATION VIDEO COMPRESSION


sky


HUAWEI


ittiam


intel


IRT


movie
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pixvana


PARACOSMA


AT&T


harmonic

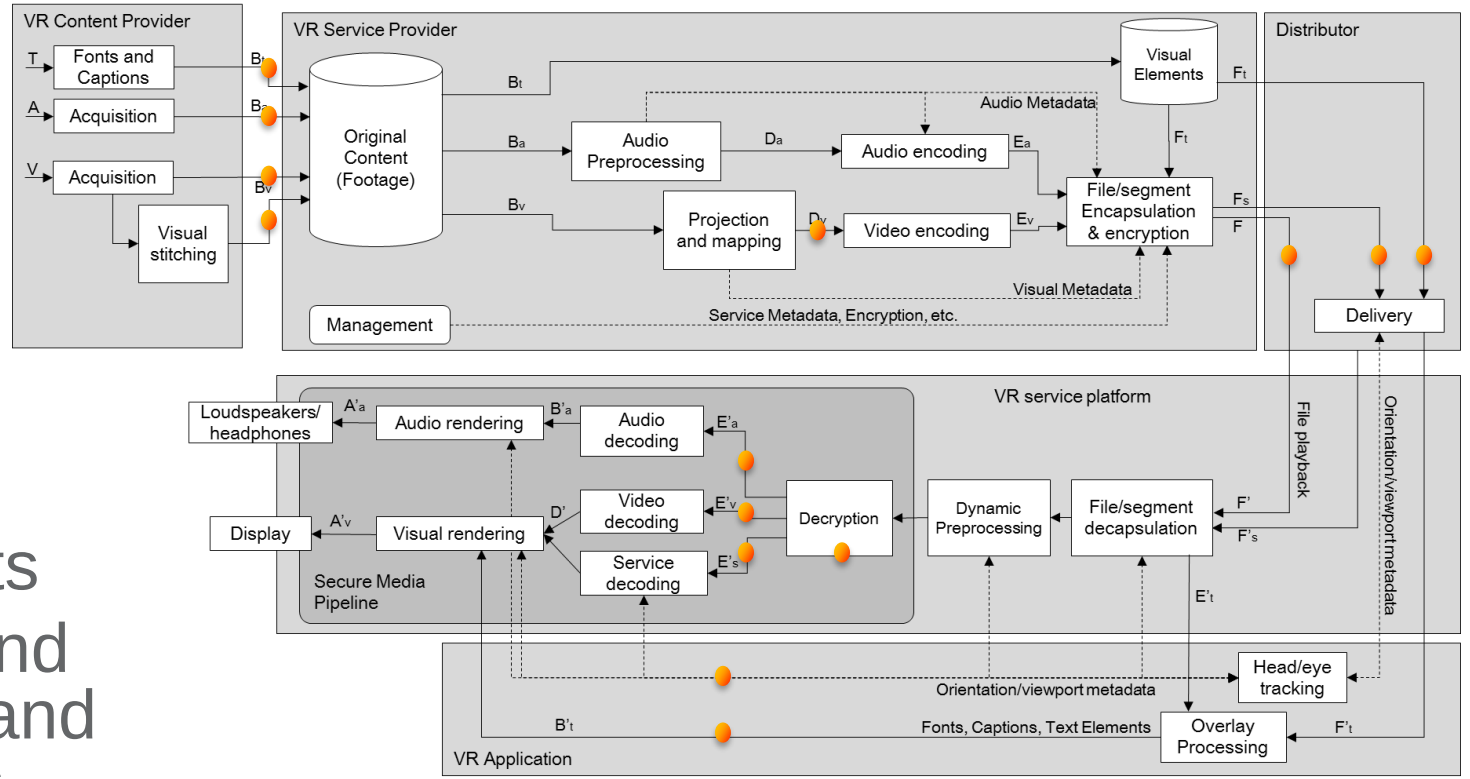

BITMOVIN


NOKIA


Whistling Woods
International
INSTITUTE OF FILM, COMMUNICATION & MEDIA ARTS

VRIF Activities

- Guidelines for end-to-end interoperable, high quality VR experiences
- Lexicon of terminology for Virtual Reality
- Interoperability and test events
- Support for member events and demonstrations at NAB, IBC and other relevant industry events



- Industry workshops exploring the current and expected technologies and approaches in virtual reality
- Coordination with standards bodies and other industry groups
- Analyst briefings

The Production Challenge

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- VR is a new medium and only a few of the current production rules can be directly applied
- The immersive experiences we seek may not always have the connectivity to stream live
- Immersive content acquisition requires significant bandwidth to Cloud based production facilities

5G will provide the reliable, high capacity connectivity demanded for VR productions

The Quality Challenge

UCG
FullHD

UCG(2)
4K

Studio
8K

Studio
16K

90° FoV, 4Kx2K pixels, ~45pixels/degree

Ready for 24K?

5G will permit delivery of the viewport in the highest possible quality

The Distribution Challenge

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Immersive experiences
- are interactive
- are untethered
- recreate reality

Standard	Early VR	Entry-level VR	Advanced VR	Ultimate VR
Video resolution	4K 2D video (3840×2160)	8K 2D video (7680x3840)	12K 2D video (11520×5760) 22K	24K 3D video (23040×11520)
Monocular resolution	960×960 (90º FoV) – 240p	1920×1920 (90º FoV) – 4800p	3840×3840 (120º FoV)	7680×7680 (120º FoV)
Pixels/degree	11	21	32 55-60	64
Colour depth	8 bit	8 bit	10 bit	12
Compression ratio	165:1	165:1	215:1	350:1 (3D)
Frame rate	30	30	60 100	120
Typical video bit rate	16M	64M	265M	2.18G
Typical network bandwidth requirement	25Mbps	100Mbps	398Mbps	3.28Gbps
Typical network latency requirement	40ms	30ms	20ms 15	10ms
Typical network packet loss requirement	1E-4	1.5E-5	2E-6	1E-7

Reality requires significant amounts of audible and visual data to be delivered with very low latency level

5G provides a predictable distribution medium for immersive content

VR360 streaming models

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Core network

Original panoramic video: 8K (or 12K … 22K)

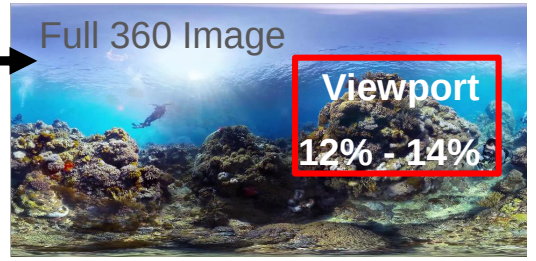
Decoding original video: 8K (no optimization)

8K → Storage & play-out server → 8K → 8K

- High Bitrate at NW edge
- High decoding requirements and low device reach
+High visual quality

Decoding 4K (Viewport Independent)

8K → Cloud Edge → 4K (360 video) → Reducing quality @ playout → 4K



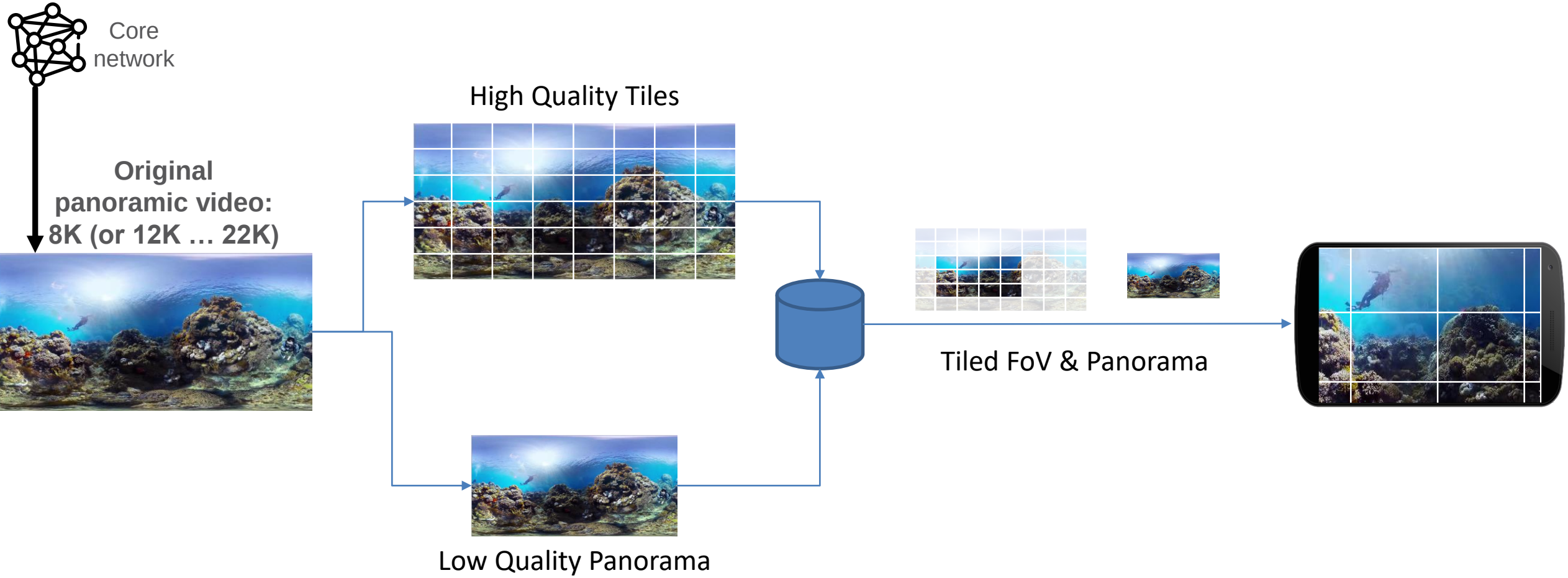
+ Low Bitrate at NW edge
+ Lower decoding requirements and better device reach
- Poor visual quality

Decoding 4K (Viewport Dependent)

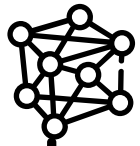
8K → Cloud Edge → Viewport @ 4K → Viewport selection feedback @ low delay → 4K

+ Low Bitrate at NW edge
+ Lower decoding requirements and better device reach
+ High visual quality

Tile based streaming

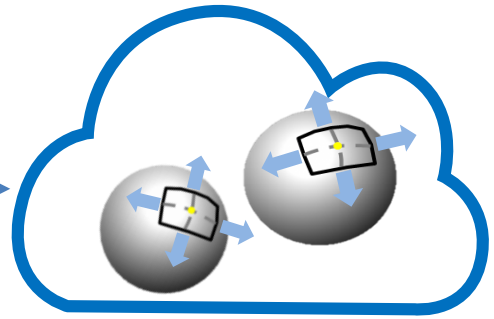


Edge viewport rendering



Delivery network

Original panoramic video: 8K (or 12K … 22K)



The Interoperability Challenge

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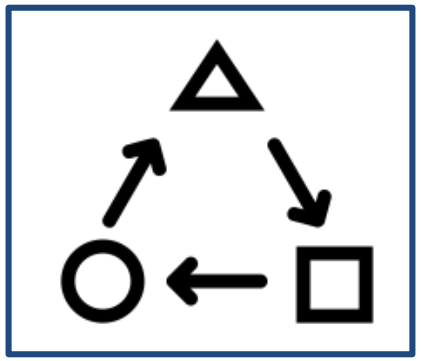
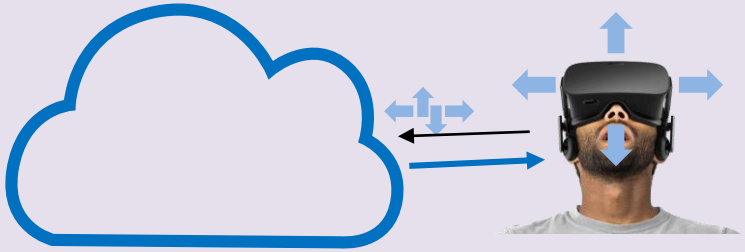


- Existing immersive experiences are either
  - built for specific devices with limited flexibility
  - built for many devices with compromised quality
- Real-time/interactive immersive experiences demand significant storage and processing resources
  - Often exceeding the “typical consumer” threshold

5G and Cloud Edge for full of partial rendering will reduce cost and complexity of consumer devices, removing a significant barrier to mass market adoption. Also experience adaptation for device capabilities.



➢ VR headset form factors that are comfortable and quality that is believable

The Connectivity Challenge

Wired connectivity has historically been positioned as high capacity, reliable and interoperable through standardized interfaces, but

- Wires restrict movement, artificially constraining the immersive experience

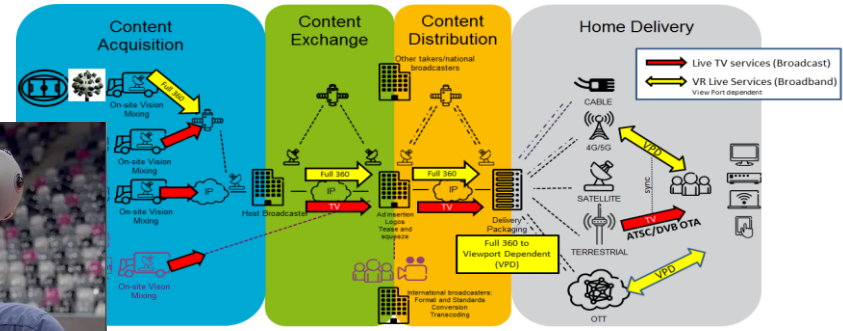
  “its like playing volleyball in a swimming pool”

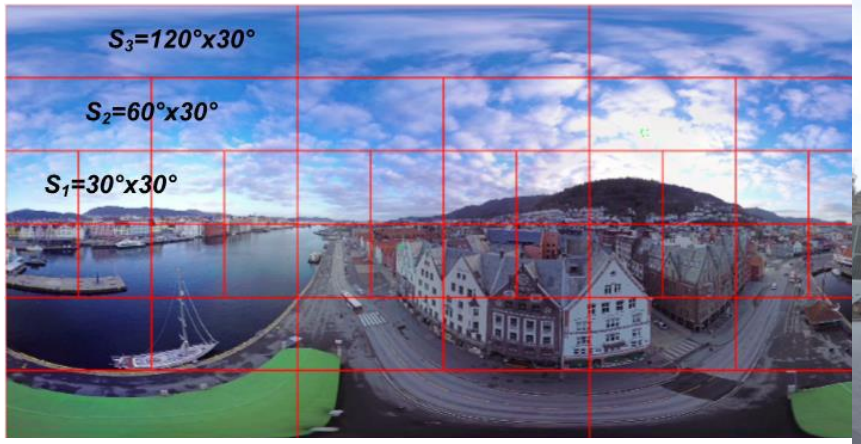
New wireless connectivity meets the demands of immersive experiences, permitting greater and wider freedom of expression

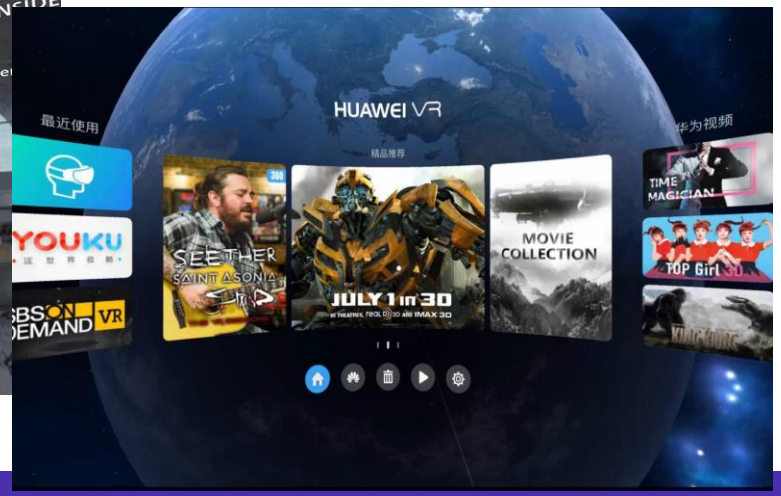
5G →  ← WiGig ← FTTx

VRIF Guidelines 2.0

- To be released at the end of April
  - Live VR services
  - Text & Fonts in VR experiences
  - Watermarking 2D frames
  - FOV emphasis for viewport independent content

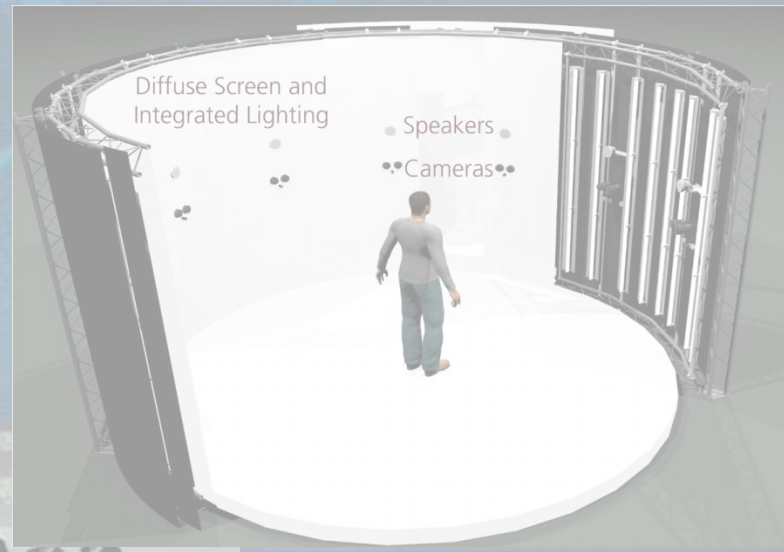






Next Work Packages

- Volumetric capture
  - Three dimensional elements
- Cloud AR/VR
  - Using 5G to powering the next level of immersive experience
- Augmented Reality
- Securing XR assets
- Social VR
  - Removing the VR isolation factor
- New industry verticals



Interoperability
Quality
Connectivity

www.vr-if.org/join

Connect With VRIF

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Interested in joining or knowing more

- See http://www.vr-if.org/join/ for membership
- Industry mailing list – open to all: http://goo.gl/4xZgbt
- Twitter: https://twitter.com/vrindustryforum
- LinkedIn group: https://www.linkedin.com/groups/12028849/

Join

Mail

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Take part in defining the ecosystem for immersive experiences

- great content on affordable, easy-to-use devices
- standards based sustainable ecosystem
- align VR service offering with traditional and future media distribution channels
- applications in the entertainment and non-entertainment sector