Connected Production

Uplink Video

Streaming

Content Delivery

OTT

5G MAG MEDIA ACTION GROUP

Media + Connectivity

Standards. Software. Collaboration.

5G/6G Networks

APIs

Internet

Immersive Media

eXtended Reality

5G-MAG - International Industry Association

Media + Connectivity

Standards. Software. Collaboration.

Standards

Driving **standards** for **connected media** experiences across the **Internet, mobile** networks (**5G/6G**), and **connected devices**

Software

Accelerating technology **adoption** into **products** via **open-source software** tools and **reference implementations**

Collaboration

Supporting companies **engaging** in **standardization**, applying and adapting **specifications** towards **real-world** applications

5G-MAG - Our work in 3 steps

1 Pre-Standardization

Technical **requirements** driven by commercial and market needs
Consensus view on architectures & features towards standards

2 Interaction with SDOs & Industry Organizations

Driving **enhancements**, **features** and provision of **feedback**
Guidelines, documents focused on deployment and implementation

3 Post-Standardization

Open-source software development to catalyse **market adoption**
Specification **validation**, **interoperability** testing and proof-of-concepts

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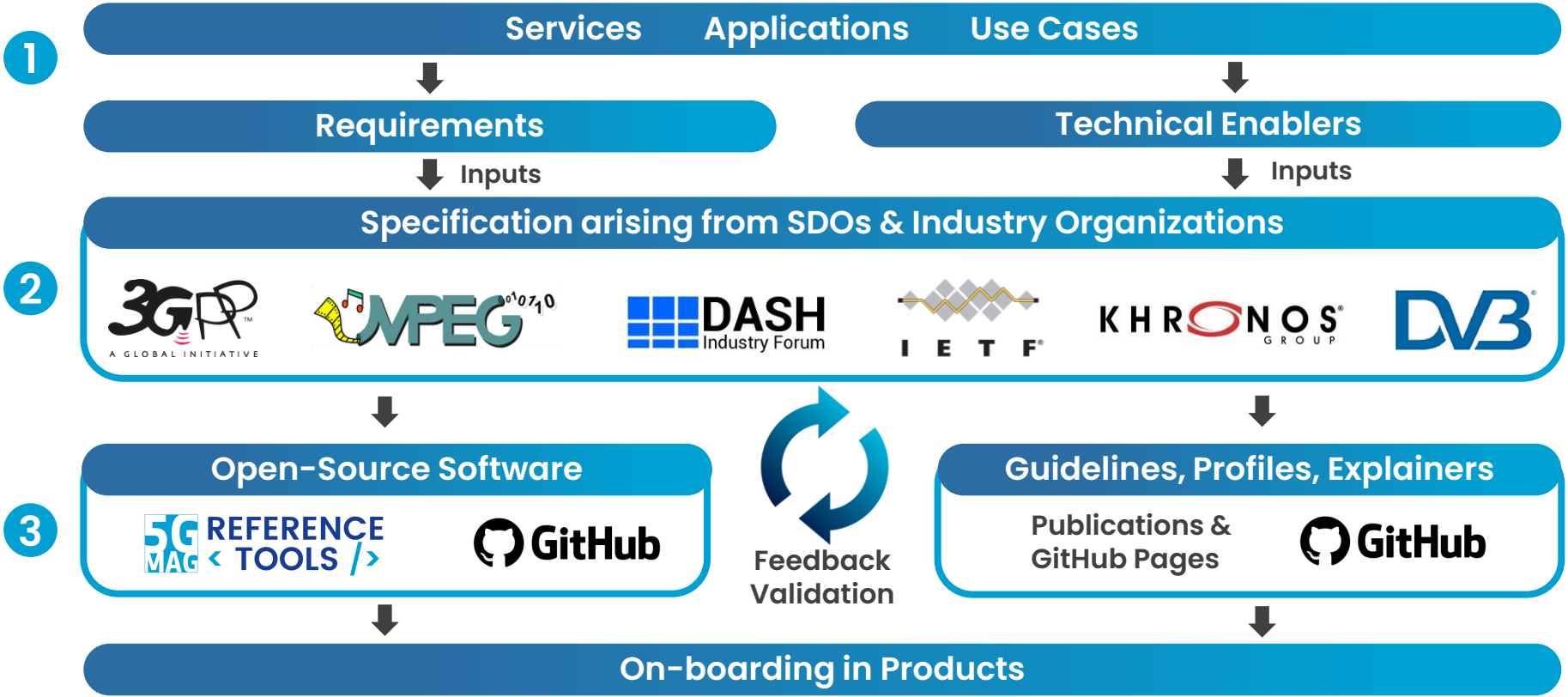
5G-MAG - Our work in 3 steps



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Connected Production

5g-mag.com/connectedproduction

Content Delivery

5g-mag.com/contentdelivery

Immersive Media

5g-mag.com/immersive

Connected Production
Technology and Enablers

Non-Public Networks	Standalone network deployments, venues, public network integrated NPNs
Time Sensitive Communications	Time synchronization, PTP distribution
3GPP Media Delivery Systems	Uplink contribution, network assistance, real-time communications
Network Capability Exposure & APIs	Discoverability and use of network features and capabilities
6G & IMT-2030 Technologies	Preliminary work on use cases, features, architecture and vision

Find all the details of our work at 5g-mag.com/connectedproduction

5g-mag.com/technology

Content Delivery
Technology and Enablers

3GPP Media Delivery Systems	Content hosting, network assistance, consumption reporting, QoE metrics,...
5G Broadcast & MBMS	Delivery of TV, radio and emergency alerts over broadcast networks
5G Multicast Broadcast Services	Scalability of content in 5G networks
Network Capability Exposure & APIs	Discoverability and use of network features and capabilities
Non-Terrestrial Networks	Content distribution, reliable multicast, GEO/MEO/LEO orbits
6G & IMT-2030 Technologies	Preliminary work on use cases, features, architecture and vision

Find all the details of our work at 5g-mag.com/contentdelivery

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Immersive Media
Technology and Enablers

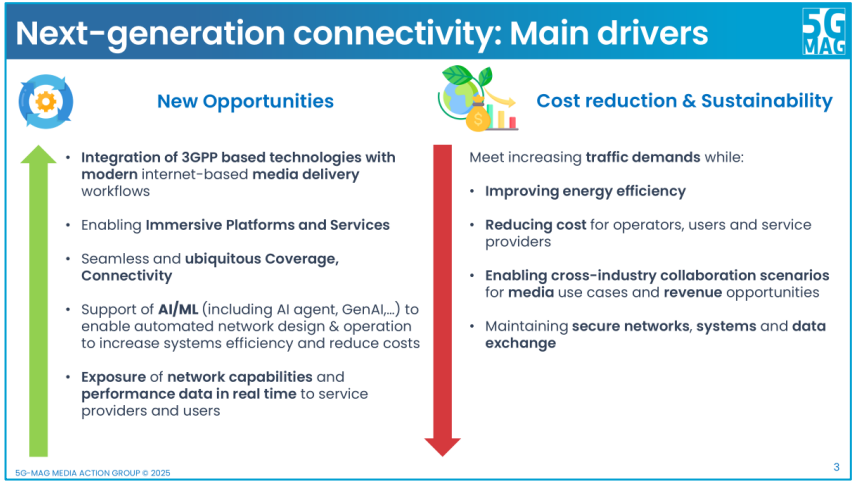
XR Media Integration in 5G	Split rendering, IVAS, 3D media messages, XR architecture
MPEG-I Scene Description	glTF 2.0 extension, media, interactivity, anchoring, haptics, avatars, lighting
MPEG-I V3C Volumetric Video	Video-based Point Cloud Compression, MPEG Immersive Video
6G & IMT-2030 Technologies	Preliminary work on use cases, features, architecture and vision

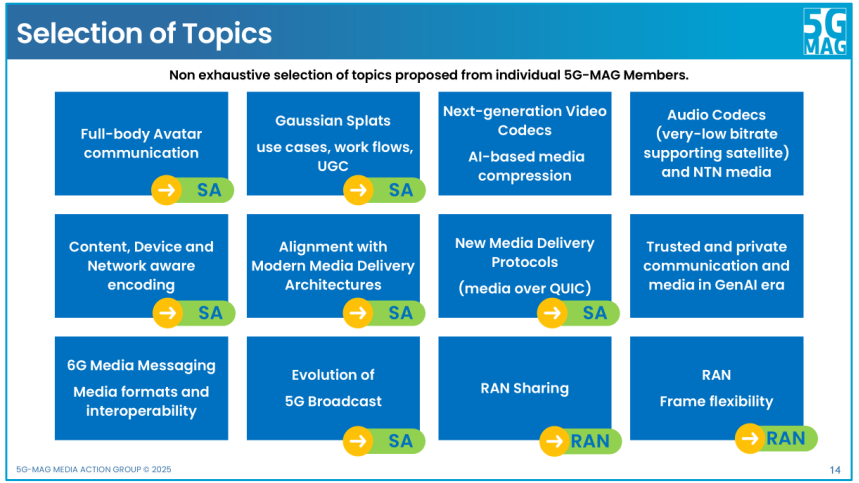
Find all the details of our work at 5g-mag.com/immersive

Highlights: Requirements

Participation in 3GPP Workshops on 6G

- Tech enablers for adapting to user shifts towards online media
- Enabling new **Connected Immersive Media Experiences**
- 3GPP systems **compatible with modern media delivery systems**
- Support **upcoming and future media and transport protocols**
- **Early RAN consideration** for key features for media delivery and production





More information at www.5g-mag.com/requirements

Highlights: Standards Work

Standards

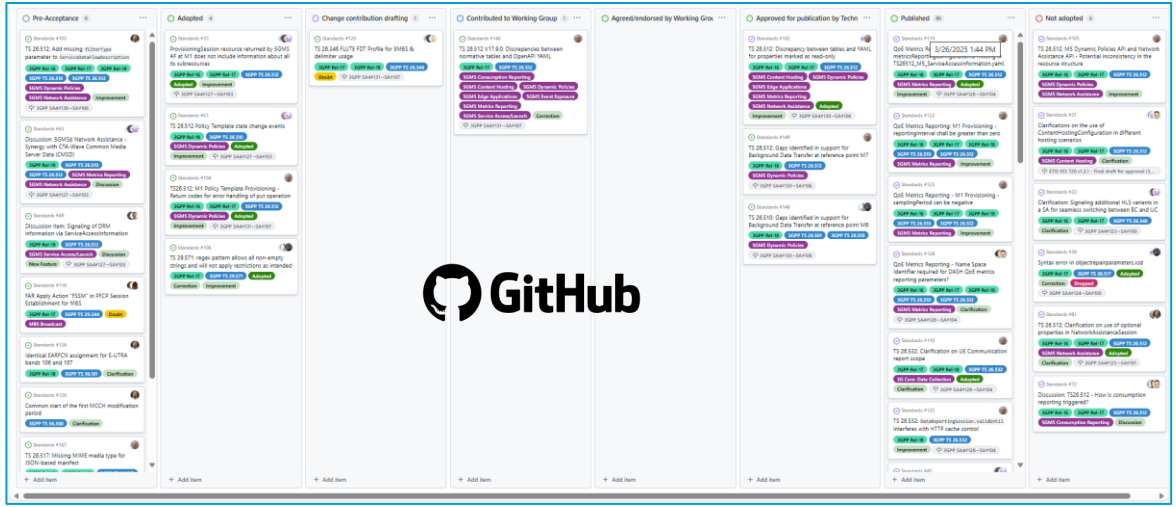
- Preparation of ETSI 103 720 5G Broadcast Specification (compliant Rel-18) (Link)
- 5G-MAG views on Advanced Media Delivery (Link/Link)

Continuous feedback on 3GPP specifications

- https://github.com/5G-MAG/Standards/projects?query=is%3Aopen

Resulting from reference implementations and requests from developers

5G MAG REFERENCE < TOOLS />



More information at www.5g-mag.com/standards

Highlights: Publications

Reports

- Uplink media delivery: Architectures & Features
- Uplink media delivery: Protocols & Encoding
- Content delivery over Non-Terrestrial Networks
- Media Services Beyond 2D: Requirements and Architecture

GitHub Technology Pages (https://5g-mag.github.io/Tech)

- 5G Multicast Broadcast Services (MBS)
  - Documentation available on this topic is listed here.
- Network Capability Exposure and APIs
  - Documentation available on this topic is listed here.
- Non-Terrestrial Networks
  - Documentation available on this topic is listed here.

GitHub Standards Pages (https://5g-mag.github.io/Standards)

Highlights: Software

5G MAG REFERENCE < TOOLS />

Open-source Toolbox for Connected Media Applications

We champion **open-source software**, accelerating technology **adoption** into **products** and bringing **specifications to life**

- **Open and interoperable software components, libraries and enablers**
- **Permissive software license model to foster contributions from industry players**
- **Support implementation of specifications into products, feedback to SDOs, V&V**
- **Developer community sponsored by 5G-MAG and open to the public**

Streaming, content delivery and collaboration with 5G networks
Reference Tools

- **5G Media Streaming Architecture** — Server, Client, Provisioning APIs, Network Assistance, Dynamic QoS, QoE metrics,...
- **5G Core Network Components** — Integration with 5G Core components (BSF, PCF) via service consumer libraries
- **UE Data Collection, Reporting & Event Exposure** — Generic Data Collection AF and instantiation in the 5GMS AF
- **3GPP RAN and Core Platforms** — Open-source 5GC, NG-RAN, EPC, E-UTRAN used for demonstrators

Reference Implementations based on open standards

3GPP A GLOBAL INITIATIVE · MPEG · DASH Industry Forum · IETF · KHRONOS GROUP · DVB

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Content scalability though broadcast and multicast systems

Reference Tools

MBMS & LTE-based 5G Broadcast	End-to-end system including transmitters, middleware and client app
Emergency Alerts over 5G Broadcast	Initial implementation of emergency alerts based on CMAS
Multimedia delivery protocols	Including support of FLUTE and ROUTE for content delivery over multicast
DVB-I Services over 5G Systems	Initial implementation supporting DVB-I over LTE-based 5G Broadcast
5G Multicast Broadcast Services	Initial implementation of MBS 5G Core components and MBS User Services

Reference Implementations based on open standards

3GPP A GLOBAL INITIATIVE · MPEG · DASH Industry Forum · IETF · KHRONOS GROUP · DVB

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Immersive media experiences and eXtended Reality
Reference Tools

XR Media Integration in 5G

Initial implementation of MPEG-I Scene Description extensions for glTF2.0 assets

V3C Immersive Platform

V3C immersive platform supporting V-PCC, MIV and V3C carriage

Reference Implementations based on open standards

developer.5g-mag.com

Supporting other standardization activities
Reference Tools

AI/ML Evaluation Framework

Implementation of the AI/ML evaluation framework defined in 3GPP SA4 TR26.927

Reference Implementations based on open standards

3GPP A GLOBAL INITIATIVE | MPEG | DASH Industry Forum | IETF | KHRONOS GROUP | DVB

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Highlights: Software

All **development** is handled in GitHub

https://github.com/5G-MAG

Getting Started guides with documentation, access to repositories, projects, releases, tutorials,...

5g-mag.github.io/Getting-Started/

5G-MAG Developer Community

tinyurl.com/join5gmagslack

Mailing List with Releases & News

tinyurl.com/join5gmaggroup

Join the Developer Calls

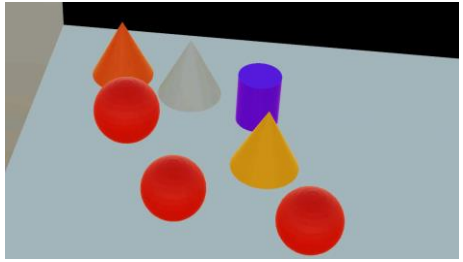
5g-mag.com/community

Public Friday Calls

Last Friday of the month

13:00 - 14:30 CEST

Highlights: Software



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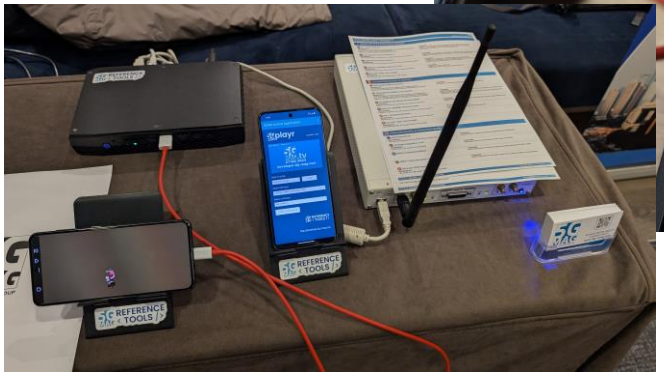
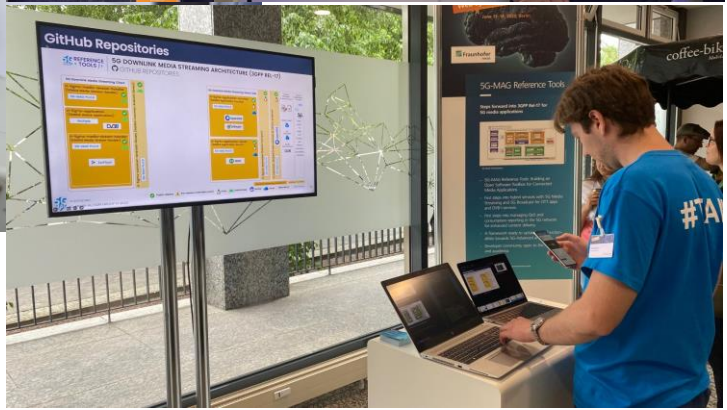
5g-mag.com/tutorials

5G Media Streaming Architecture
Demonstrations and Trials

- 5G-MAG Reference Tools in use: 5g-mag.com/trials





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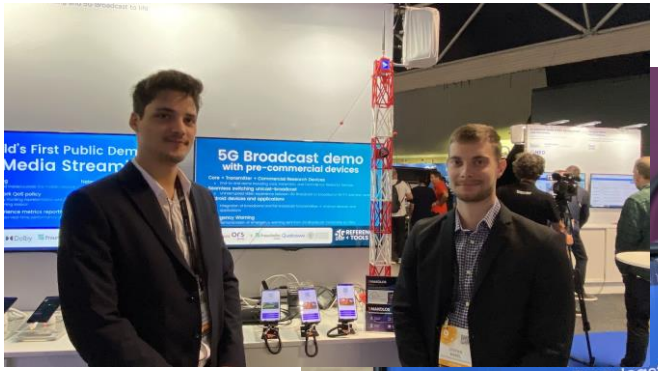
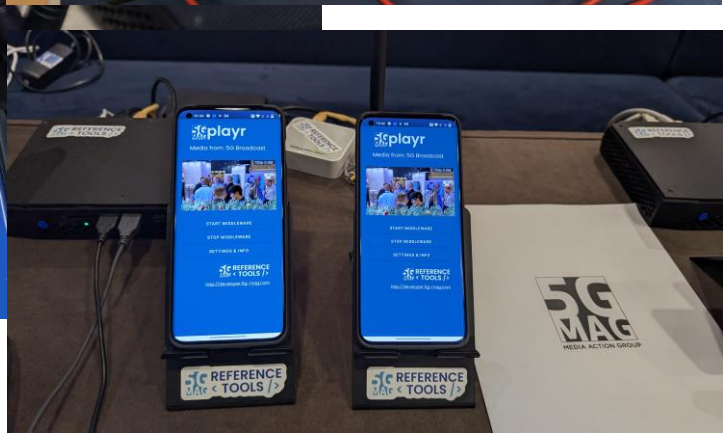
5G Broadcast Hybrid Services
Demonstrations and Trials

- 5G-MAG Reference Tools in use: 5g-mag.com/trials





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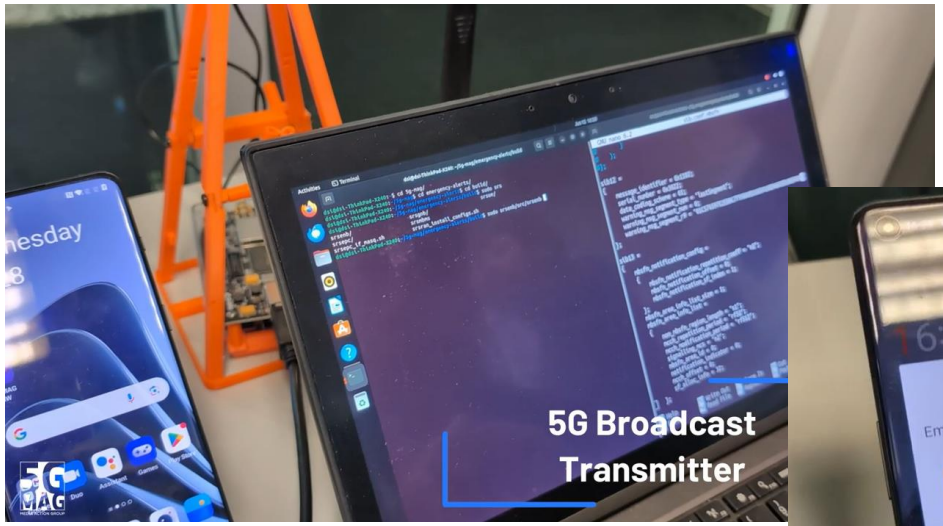
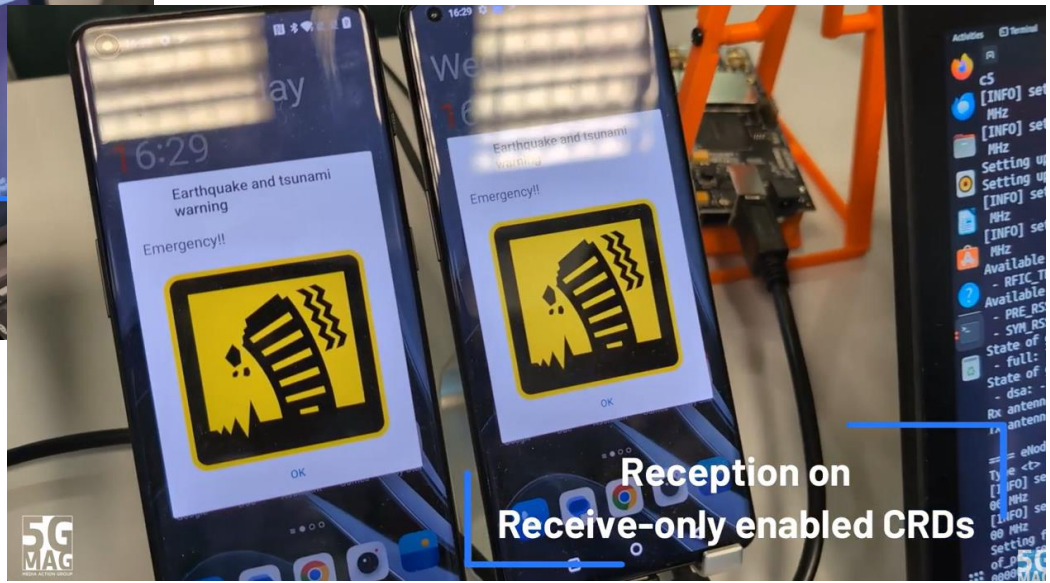
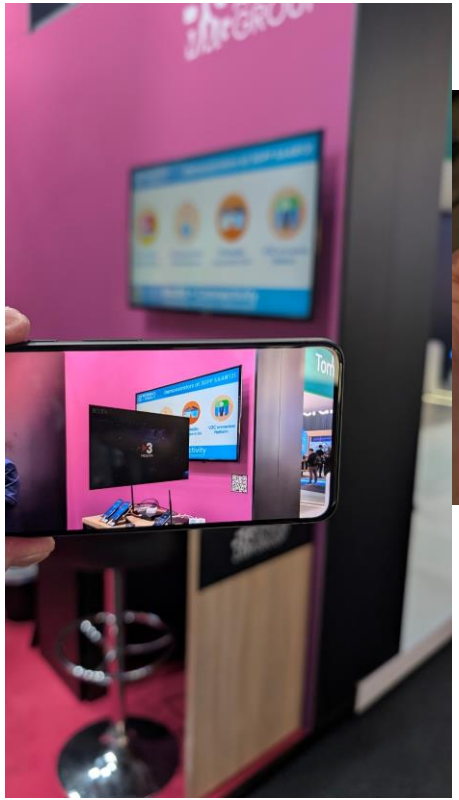
Emergency Alerts over 5G Broadcast
Demonstrations and Trials

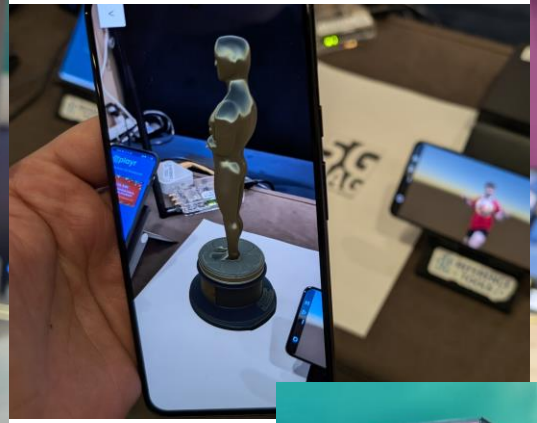
- **5G-MAG Reference Tools in use: 5g-mag.com/trials**

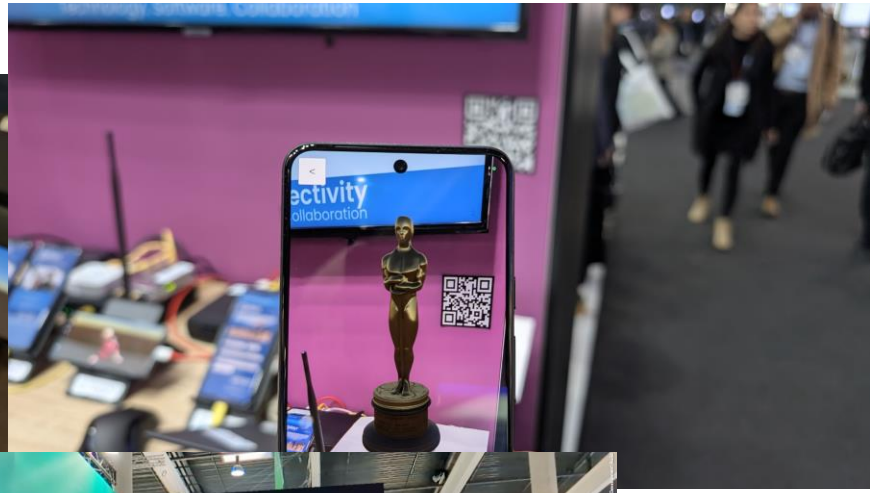


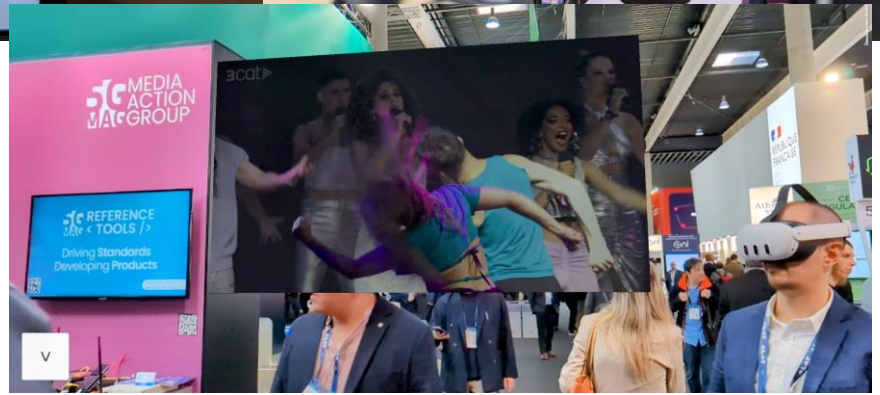


- 5G-MAG Reference Tools in use: 5g-mag.com/trials

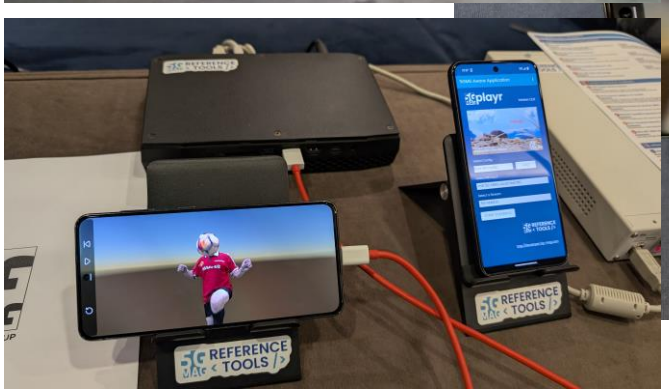


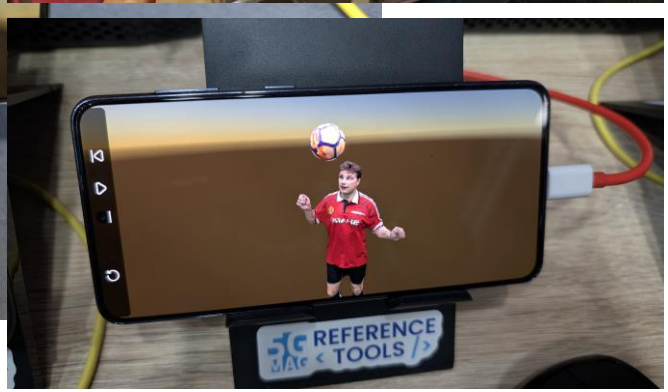




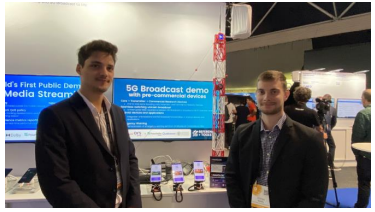


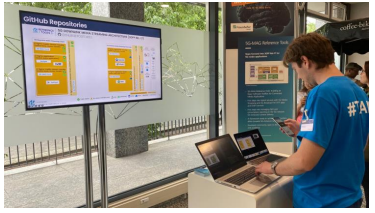
- **5G-MAG Reference Tools in use: 5g-mag.com/trials**

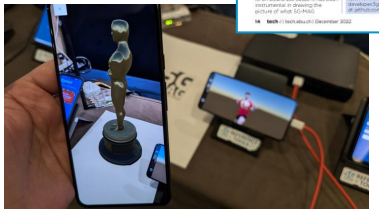


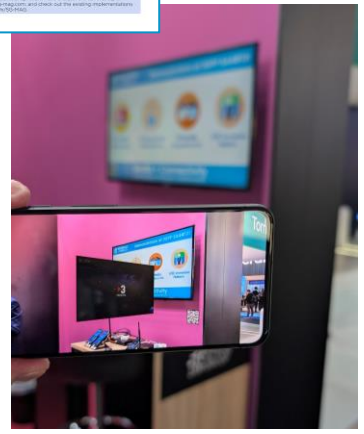


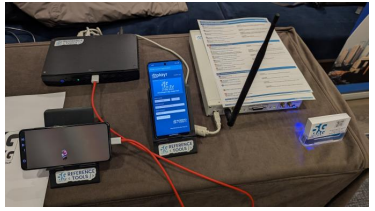
Highlights: Promotion











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6G & MEDIA

Consolidated views from inputs to 3GPP Workshops

5G-MAG Media Action Group

info@5g-mag.com

5G MAG MEDIA ACTION GROUP

May 2025

Next-generation connectivity: Main drivers

New Opportunities

- **Integration of 3GPP based technologies with modern** internet-based **media delivery** workflows
- Enabling **Immersive Platforms and Services**
- Seamless and **ubiquitous Coverage, Connectivity**
- Support of **AI/ML** (including AI agent, GenAI,…) to enable automated network design & operation to increase systems efficiency and reduce costs
- **Exposure** of **network capabilities** and **performance data in real time** to service providers and users

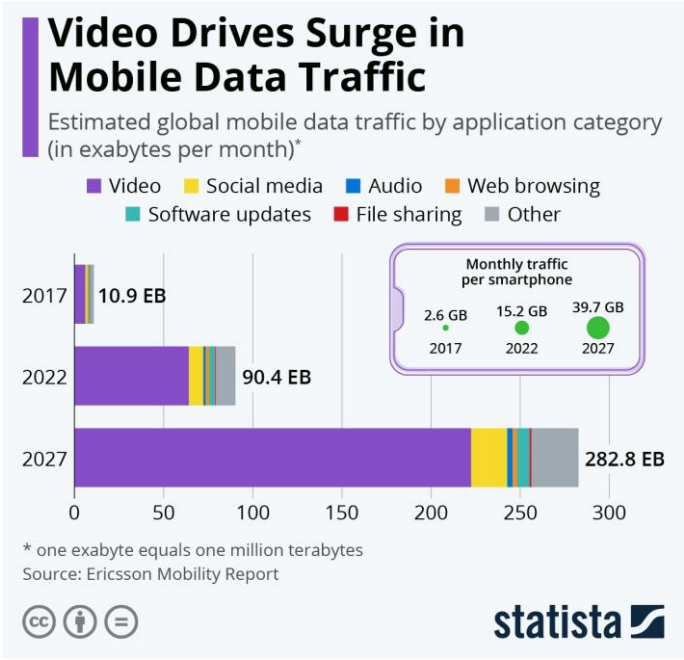
Cost reduction & Sustainability

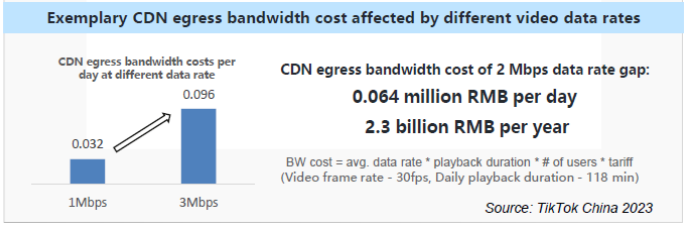
Meet increasing **traffic demands** while:

- **Improving energy efficiency**
- **Reducing cost** for operators, users and service providers
- **Enabling cross-industry collaboration scenarios** for **media** use cases and **revenue** opportunities
- Maintaining **secure networks**, **systems** and **data exchange**

Media Traffic driving Mobile Data Traffic

- **Increasing** media production, consumption, storage, processing over mobile and data networks
- Immersive applications with **higher bandwidth** requirements can further increase **data volumes**
- Warning on transmission cost CDN egress bandwidth
- Concerns on **Sustainability** and **Cost**





Design principles: Sustainability

The 6G System should **positively contribute towards reducing mobile network energy consumption** while still meeting traffic demand

- Prior Gs prioritized performance requirements (throughput, latency) while Energy Efficiency was only a qualitative measure (mainly for UE and Radio).
- All parts of the network to be taken into account **holistically** by considering sustainability and energy consumption as key aspects to minimize the footprint of next-generation networks.
- Key design principle for **foundational enablers** such as registration, connectivity management, session management, QoS, mobility, handover, security, identifiers,...
- **Video** is a key driver of increased mobile data traffic → reduce environmental impact through **design and measurement**.

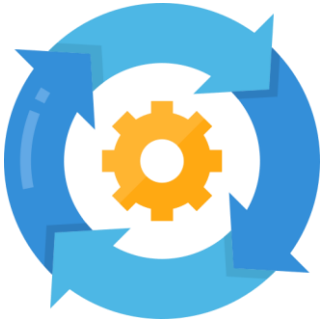
Design principles: Cost Reduction

Cost reduction for operators and users to foster **technology adoption**

Help reducing the **cost of video delivery**

- **6G cost per GB** may pose problems.
  - https://www.fiercewireless.com/tech/trouble-ahead-6g-cost-gb-may-pose-problems-madden
  - Cost/GB and retail price/GB both reducing. With retail price further reducing, how to **reduce cost**?
- **Reducing…**
  - **deployment cost** with new spectrum deployment, existing network upgrade, cost effective coverage, leverage device density, …
  - **operating cost** energy saving, automation, cooperative communications, …
  - **total costs of ownership** with shared RAN deployment, separate Core networks and service differentiation, RAN resource sharing
- **Cost of video** delivery
  - New codecs, AI, Smart delivery, Monetization, New KPIs, Energy Saving
  - Enhance **collaboration** models between Media Service providers and MNOs

Design principles: Operation, Automation, Security



Enhancing **deployability**, efficiency, operational cost

Secure data framework

Exposure of data and **management options** to service providers

- Features such as AI/ML can provide **automated network operation to increase systems efficiency** and **reduce costs**.
- More and more **data** is collected in multiple parts of the network and consumer by, e.g., ML agents and network analytics. Need for **common exposure, discovery and delivery framework**
- Combination of resources and information from **multiple networks**, **clouds** and **third-party** providers
- Provide simple, intuitive, on-demand, and elastic **access to network resources**, **capabilities** and **analytics**
- **Hiding complexity** of the federated telco capabilities to open the network for **innovation**

General views on Streaming, Immersive Media, Connected Production,...

Views on STREAMING Services at Scale

- **Audiovisual content (TV/Radio)** increasingly consumed over the internet and mobile networks

- **What is needed?**
- **Highly reliable access**
  - on almost all roads, trains, rural and urban areas where audiences would expect to watch video or listen to radio (both live and on-demand)

- **Consistent experience** vs very high bit rates in limited locations.
  - **Requirements for realistic mass media delivery** (in the medium term even for Ultra High Definition) **are relatively 'low'** - 10s of Mbit/s rather than 100s Mbit/s **- but with reliably lower latency**
  - **Radio/Audio requires consistent low latency for low bitrates** (50kbps per stream, in the minimum) as opposed to very high bitrates. Experience shows consistency of **latency at these low bitrates is still a significant challenge** for today's networks.

Views on STREAMING Services at Scale

- **What is needed? (continued)**

- **Scalability** techniques to deal with the **peaks** required to deliver large live events to mass audiences

- Better **inter-working between 3GPP and non-3GPP** systems, i.e. **service continuity** between 3GPP/Wi-Fi, and access networks (e.g. **TN-NTN**)

- **Resilience**
  - Robust techniques to counteract jamming – being able to deliver critical services when needed.

- **Content Provenance**
  - Help to provide greater certainty around where and when content has been captured to verify content origin

Views on IMMERSIVE Media Experiences

- Enabling new **Connected Immersive Media Experiences**
  - Physical (Human) and Digital (AI Agents) interaction
  - real time XR/avatar communications at scale and with light weight devices

- **What is needed?**
- **Immersive** experiences require **consistent latency**
- **Interaction** requires **low latency** , **low jitter** and **low packet loss**
- **Synchronization** of **audio**, **video**, **lighting**, and **volume**
- **Media protocols** to capture/consume **audio**, **video**, **text**, **sensor**, **intents**,...
- **Solutions** to additional **challenges** such as privacy, user experiences, social impacts, authenticity, security, etc.

Views on Connected Media PRODUCTION

- Enable the transition from **legacy wireless** production equipment to **3GPP technologies**

- **What is needed?**
- **Facilitate** network deployments with **consistent capabilities** and **performance** across different **bands**
- **Flexibility** to **select** & **configure** **RAN parameters** to adapt to (TDD/FDD) deployment constraints
- **Guarantee** for **low latency** , **low jitter**, **low packet loss** and **time synchronization** of devices.
- **Facilitate** the selection of **technology profiles** tailored to certain **KPIs** while **maximizing commonalities** with technology adopted in network and UEs
- **Enable** the introduction of **new media protocols** and **network interactions** by means of APIs with a focus on **real-time configuration**

Views on NETWORK Collaboration

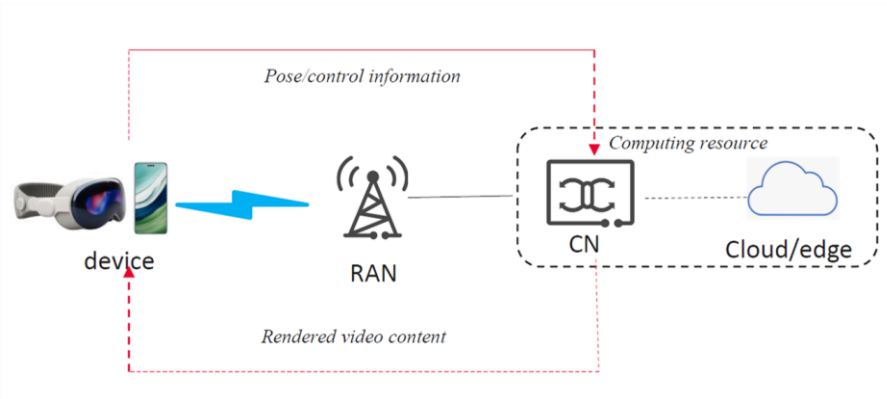
- Facilitate **ecosystem-friendly collaboration** between applications and 6G networks

- **What is needed?**

- **Awareness** for overall **quality improvement**, taking into account devices, users, content, resources, subscription models, latency, etc.

  - **Real time awareness** of available network and computing **resources** so **applications can adapt content accordingly**

  - **Coordination** and **negotiation** of **service requirements** with the network



Views on NETWORK Capabilities

- Continue and accelerate the **integration of Media into 3GPP global delivery platform** – economy of scale

- **What is needed?**

- 3GPP systems should be **compatible with modern media delivery systems** for **easy integration and deployment**

- **Support upcoming and future media protocols and transports** (e.g. media Over QUIC)

- **Early RAN consideration** for key features for media delivery and production
  - Multicast, Broadcast, NTN
  - even if not addressed in first release, ensure extensibility, not an afterthought - **reduce barriers for deployment**

5G-MAG & 6G: A Platform for Media Innovation

Support enhancing Network APIs

Simple, **intuitive**, **on-demand**, and **elastic** access to network resources, capabilities and analytics
Hiding complexity of federated telco capabilities, **open the network for innovation**

&

Focus on Developer-friendly and implementable specs

APIs, code, examples, git-environments, **exchange with developers**, **testing**, **evaluation**, **code**, **reference software**

Support 3GPP developing specifications

against **meaningful KPIs** for media services and supporting **gap analysis to justify why new RAT is needed**

5G MAG MEDIA ACTION GROUP

Evolve technology based on experiences and learning

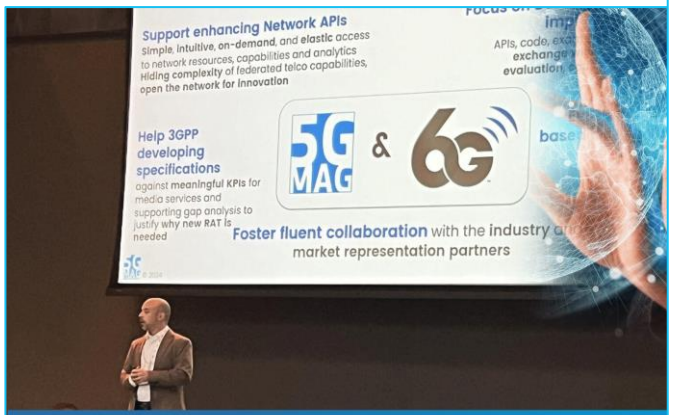
building **principles established in 5G**

Media + Connectivity

Technology. Software. Collaboration

The details? Find out Tdocs at the 3GPP Portal

- Please refer to our inputs to the definition of 6G & Media
- Requirements towards SDOs | 5G-MAG – Standards
  - 5G-MAG shares its perspectives on 6G MEDIA at the 3GPP workshop in Incheon
  - Future Media Experiences: Exploring Possibilities at the 3GPP Stage-1 Workshop on 6G



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