Sustainable TV Distribution by Delivering Universal DVB-I TV Services

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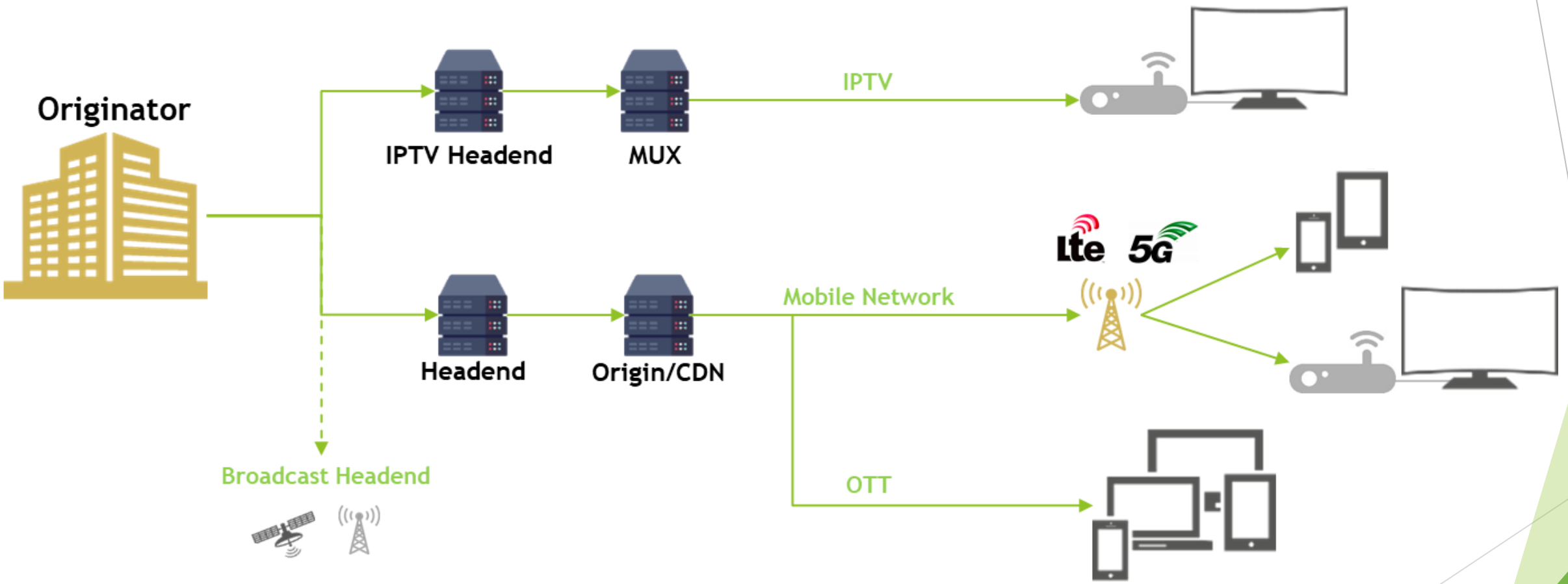
Streamlining TV Distribution

- Operators' situation today :



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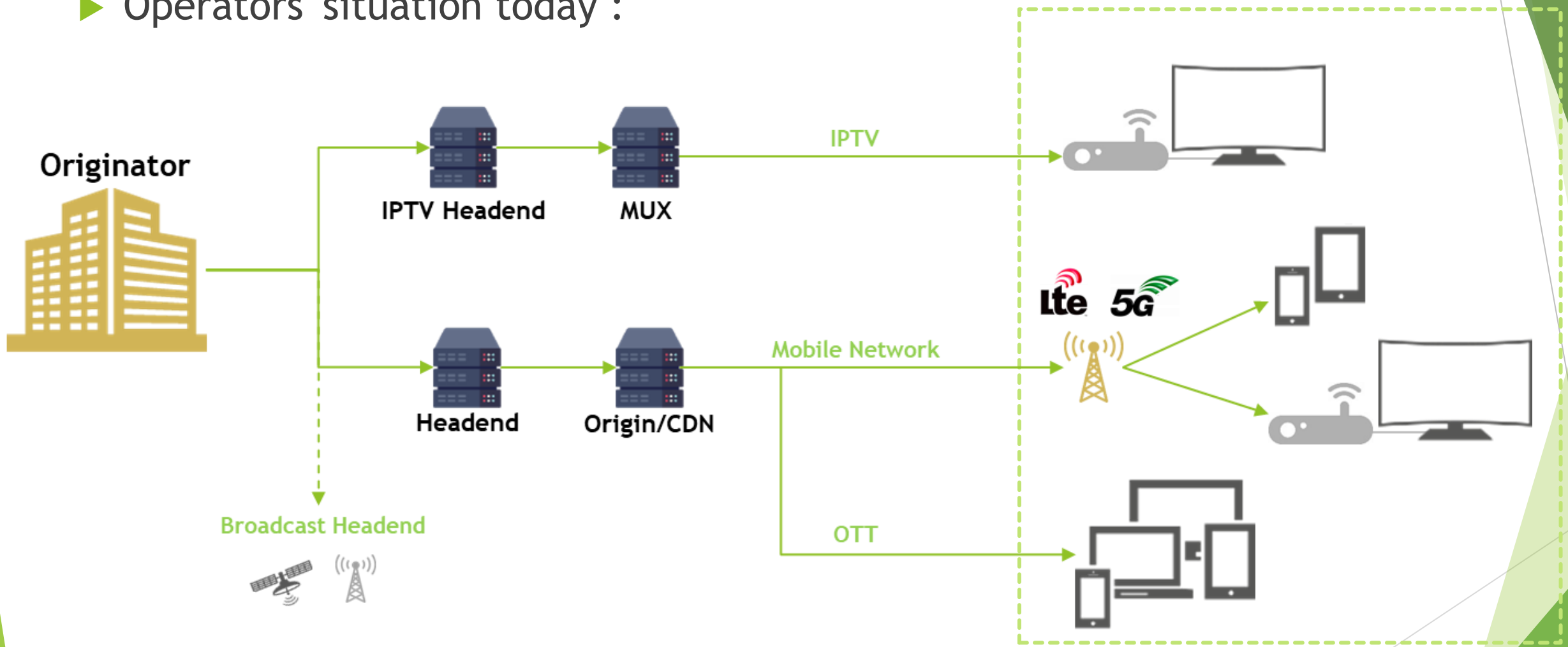

Streamlining TV Distribution

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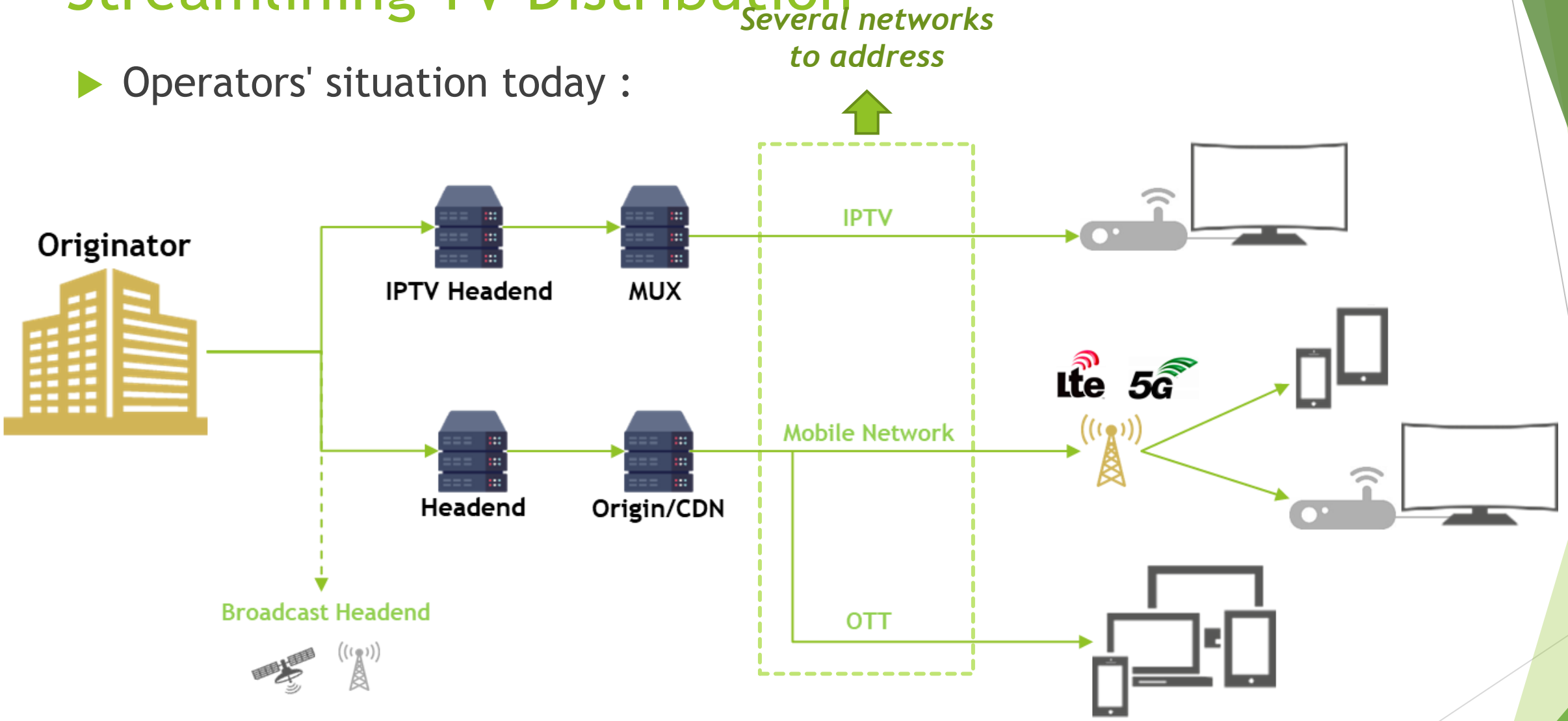

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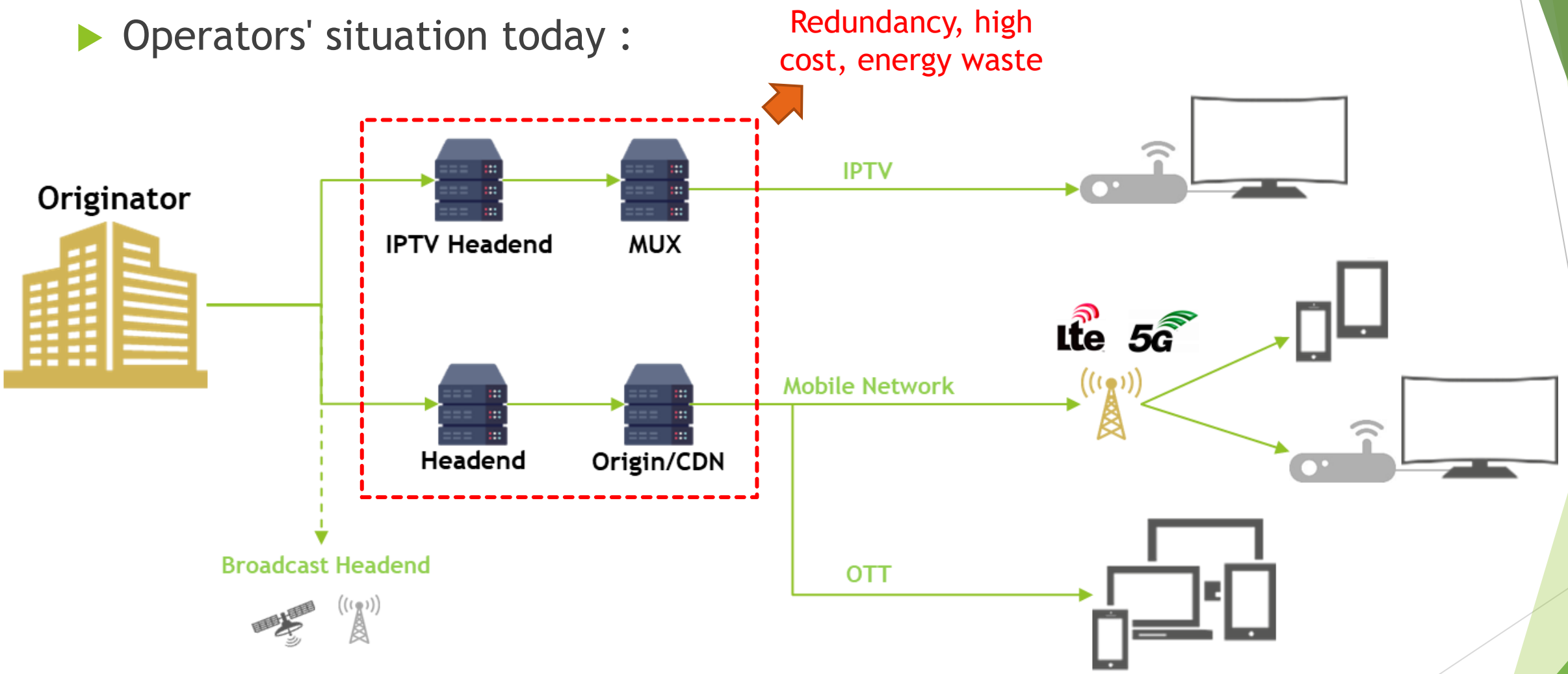
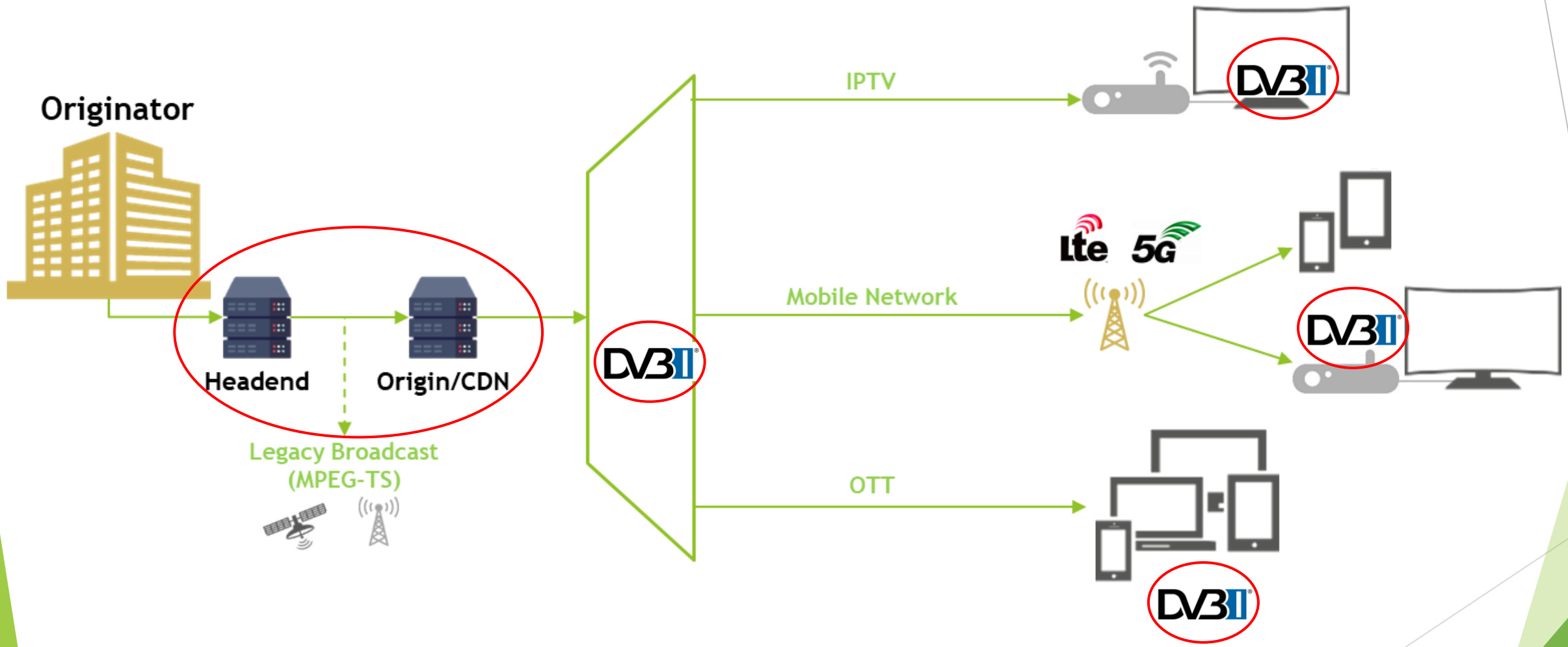


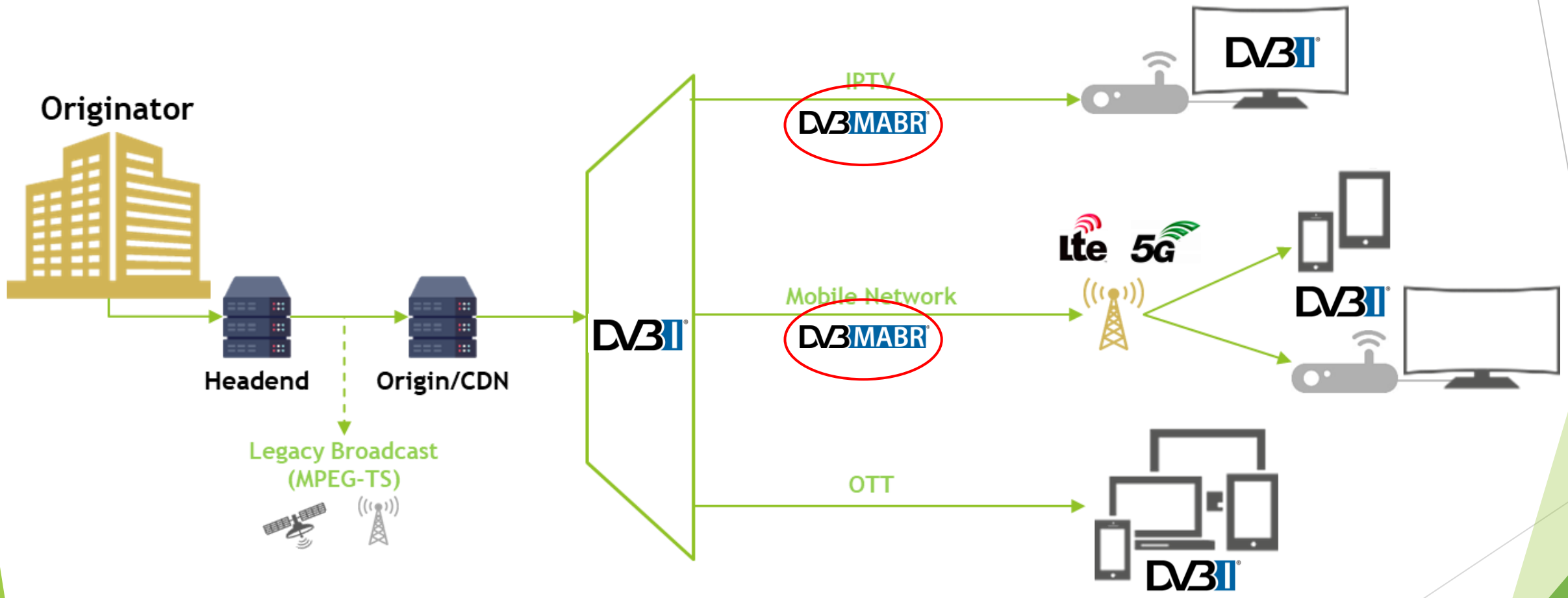
Streamlining TV Distribution

Step #1 ➔ One head-end, leveraging DVB-I to make services network and device agnostic



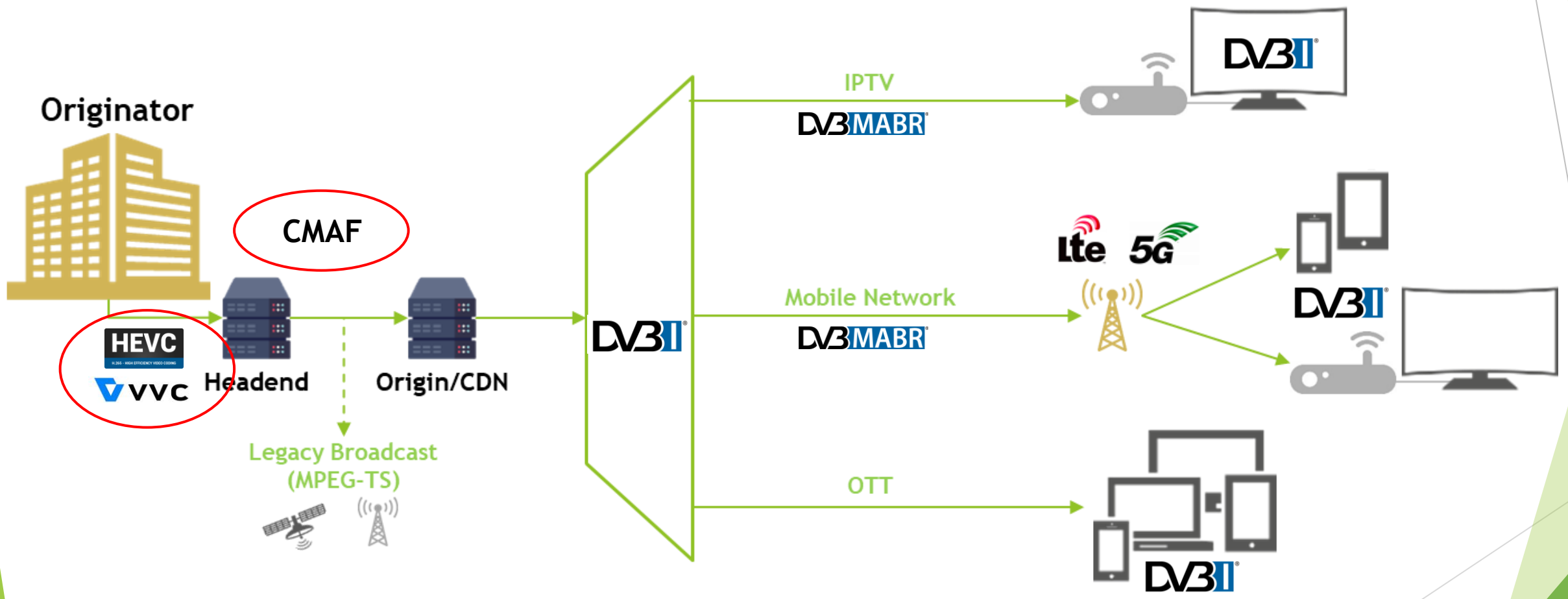
Streamlining TV Distribution

Step #2 ➔ optimise networks to remove unicasting as much as possible with to DVB-MABR



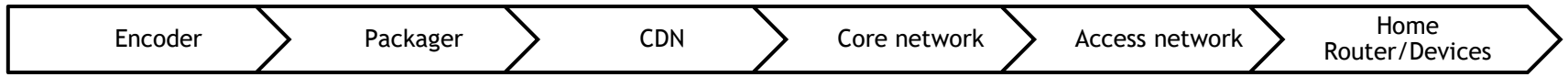
Streamlining TV Distribution

Step #3 ➔ improve coding efficiency and transport with HEVC/VVC and CMAF

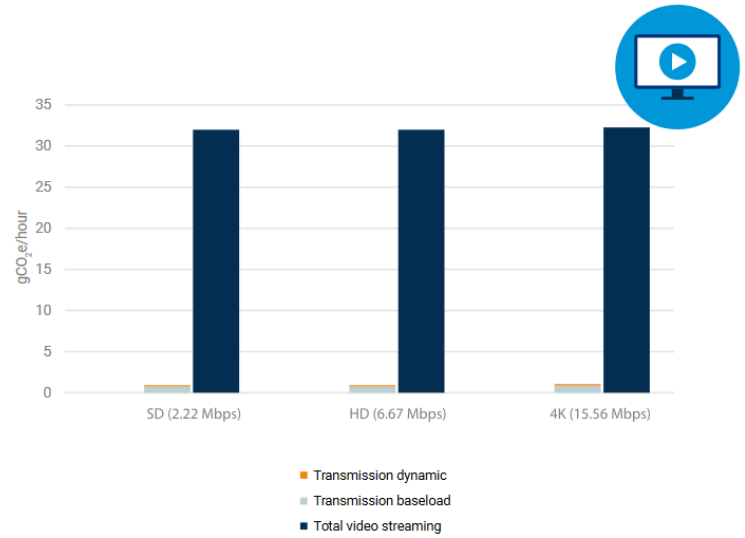


Energy savings

- All selected technologies have an impact on energy consumption on the end-to-end delivery chain

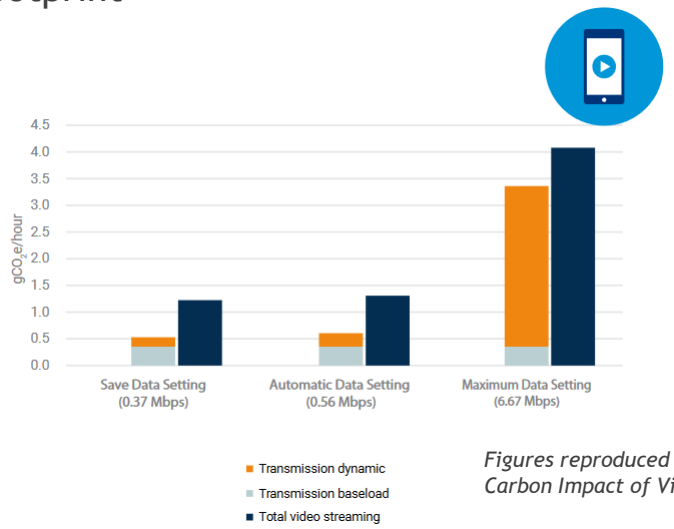


- On data center and fixed networks, marginal impact of video streaming is low



- Improvements located in head-end and CDN will help absorbing the video streaming growth without re-dimensioning data centers, by contributing to their energy efficiency

- On mobile networks, energy for transmission is practically proportional to the bitrate and is a very significant component of the total footprint



Figures reproduced from Carbon Trust Carbon Impact of Video Streaming

- Any gains on bitrate can immediately save energy

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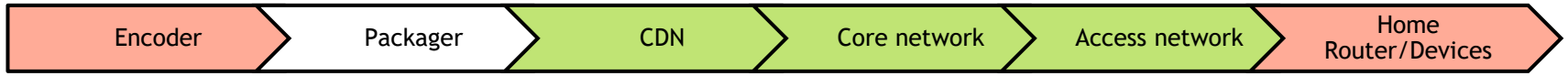
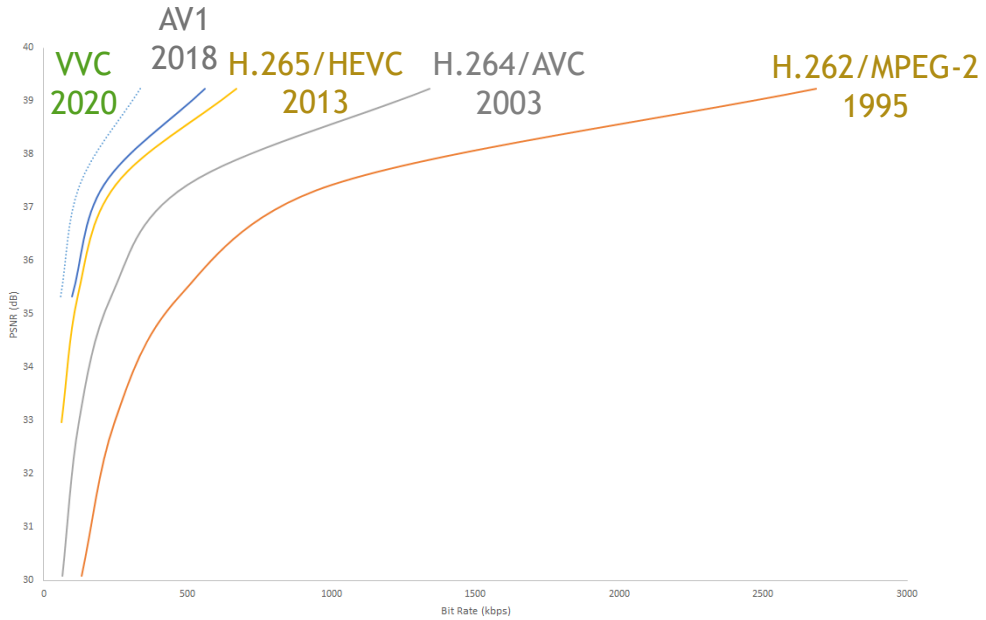
Energy savings

VVC impact

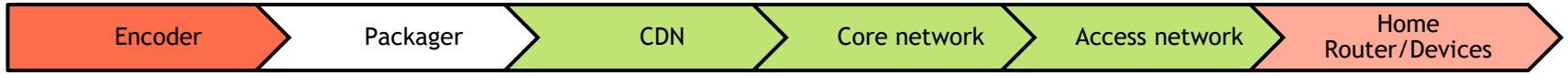


- Up to 40% bandwidth savings / HEVC
- but increased complexity requires more pwer (5*CPU for encoder and 1,5*CPU for decoder)
- the huge savings in transmission power arising from the reduced bandwidth demand will weigh much more in the balance sheet



Energy savings

VVC impact

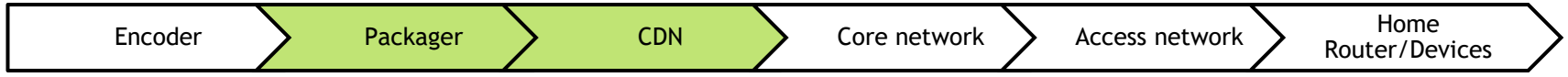


- On Going measurements (see *Taking Steps Towards Greener Streaming – IBC 2022 Tech paper*) shows that the additional power to decode and play a VVC stream without hardware acceleration on a smartphone matches with the energy gain on the mobile networks

	HEVC - 720p 5Mbps	VVC - 720p 3 Mpbs
Power consumption by the decoder (W)	1,44	2,19
Power consumption for transmission (W) (1.5W/Mbps as estimated by Malmodin 2020)	7,5	4,5
Total Consumption Transmission + decoder	8,94	6,69

Energy savings

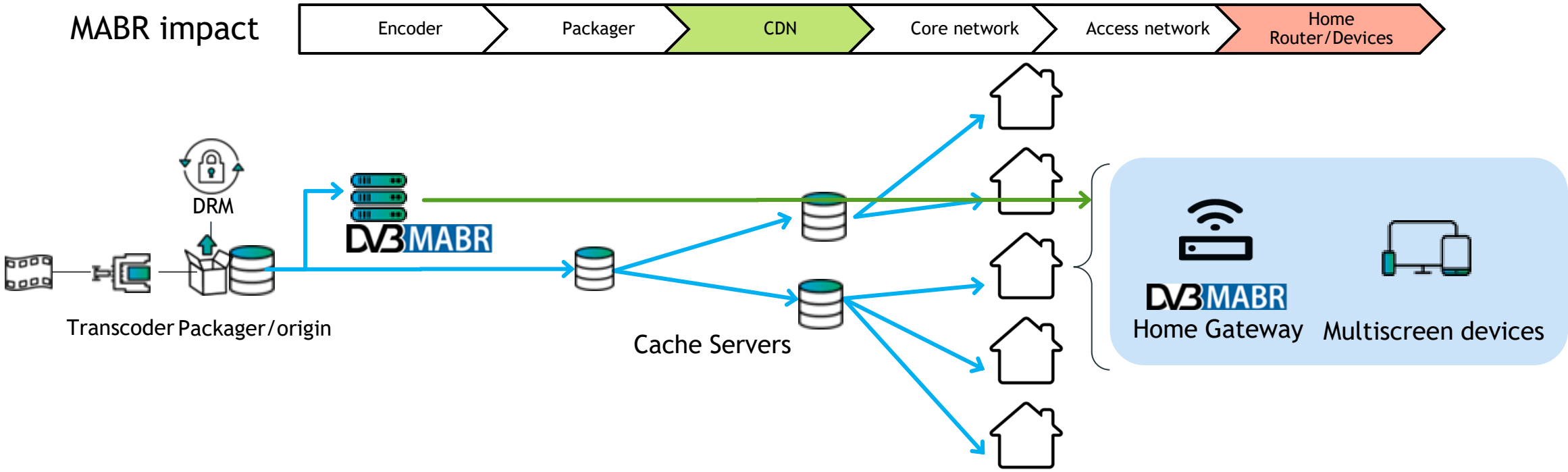
CMAF impact



- By packaging and storing once with CMAF, to serve both HLS and DASH players, up to 50% storage savings for the CDN
  - On a typical tier-1 operator:
  - Subscribers: 1 million
  - VoD library: 50000 hours
  - catchup TV library: 200 linear services for the 3 last days.
  - When the contents are packaged twice for HLS and DASH, at least **260 TB** per PoP is required, cut to **130 TB** if CMAF is used as common format
- CMAF adoption:
  - Universally supported on active Android and iOS devices
  - CMAF-IF effort to converge on Low latency DASH and HLS (Byte-range support)
  - Key factor is the support of the ‘cbcs’ protection scheme on the target devices:
    - iOS devices: since iOS 10 (99,2% of active devices)
    - Android: since 7.1 (Nougat) (95% of active devices)
    - Browser: fully supported.
    - SmartTV: models since 2019/2020. Need to wait 3 to 4 more years for market rollout

Energy savings

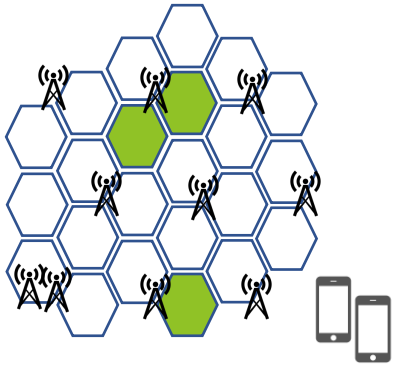
MABR impact



- On a typical tier-1 operator (50 Live TV services with high audience + 400 less popular): on the CDN, with MABR, number of cache servers for live TV can be cut by 10, and energy consumption decreased by 60%
- Additional consumption of 170mW on the Home Gateway

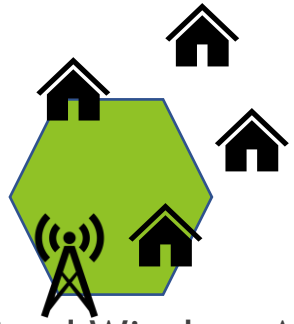
Energy savings

5MBS impact



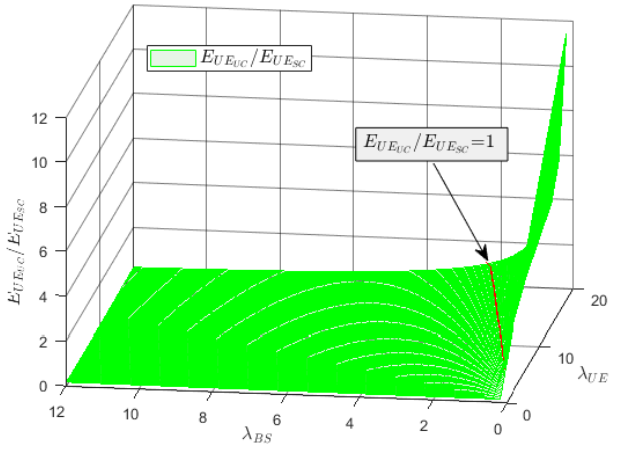
- 5MBS: New 5G capability (3GPP release 17), allowing multicast/broadcast from a 5G network
- Decision to multicast/broadcast can be cell-based
- 2 considered use cases:

- In venue



- Fixed Wireless Access

- Evaluation on going
  - Highly depends on cell density, audience per cell, support of Single Frequency Network, broadcast mode or multicast mode with retransmission
  - First insights in IBC tech paper “Taking Steps Toward Greener Streaming”



- Ratio Energy multicast/Energy unicast on the UE according to cell and device densities

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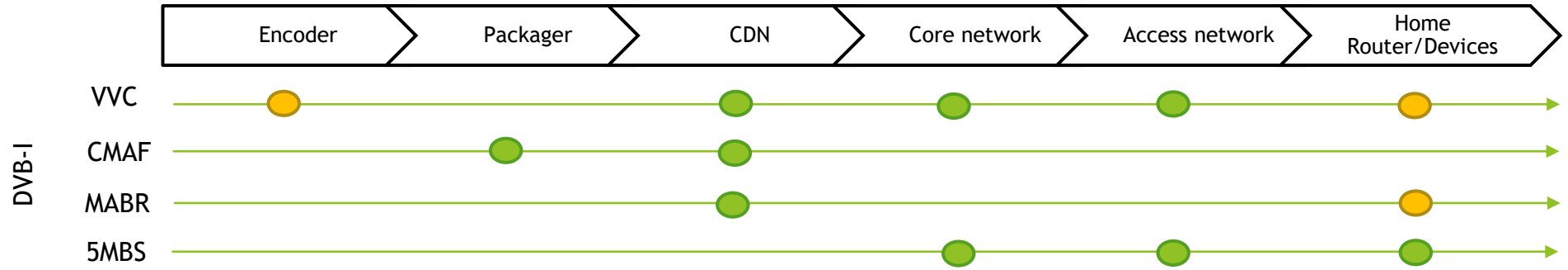
Conclusion



- New standards offer a set of tools to reduce the end-to-end energy footprints for OTT streaming, whose impacts are spread on the full delivery chain.
- End-to-end impact footprint evaluation requires common metrics and methodology from the industry, which leads the efforts of the Greening of Streaming industrial forum and main SDOs (3GPP, MPEG, ATSC, DVB)