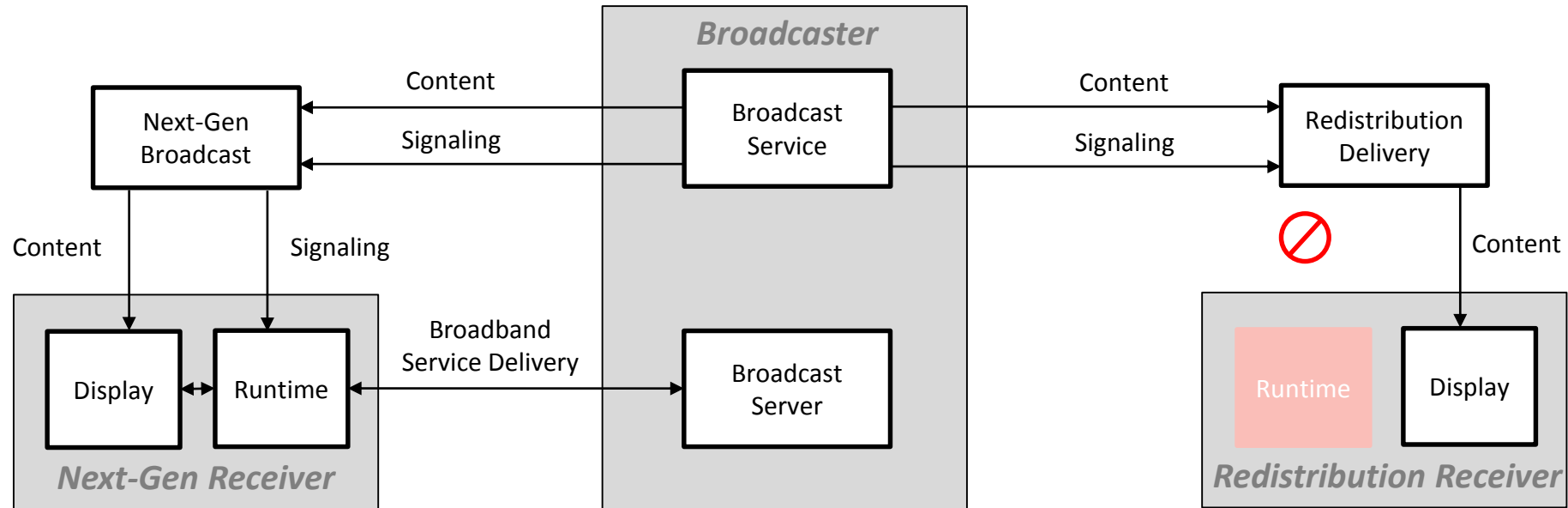


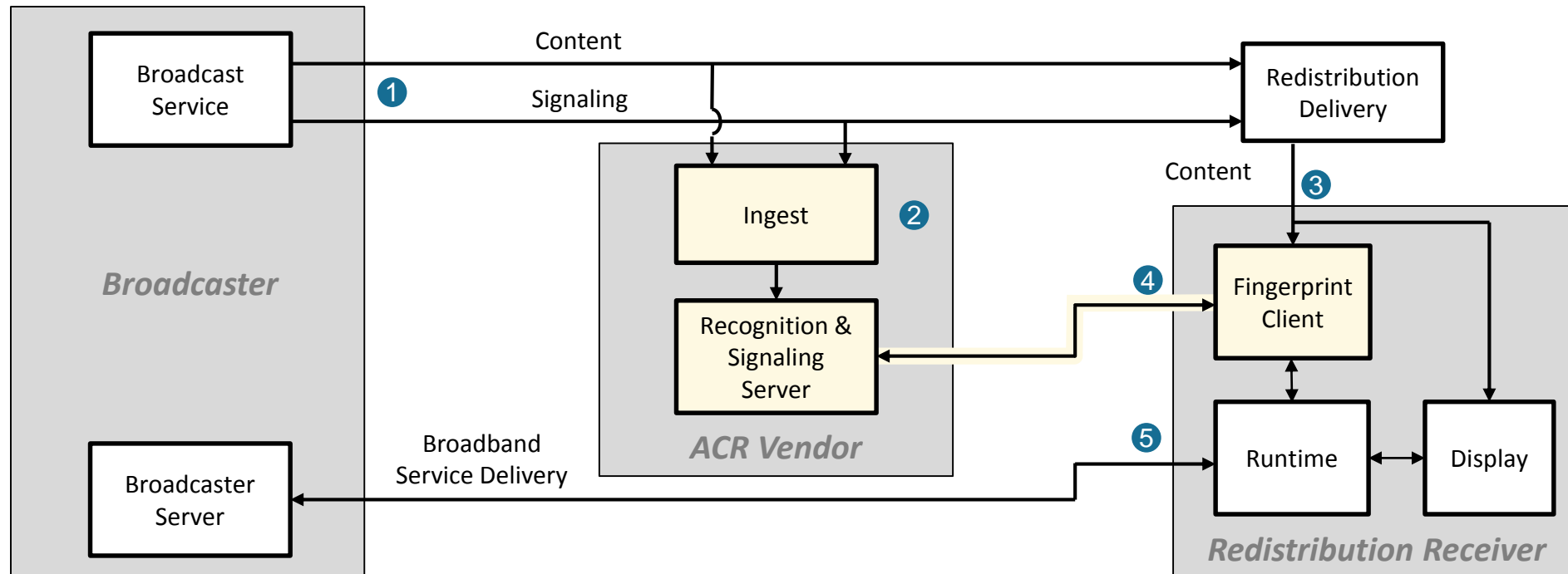
# **Open ACR: A Standards-Based Approach for Hybrid Broadcast/Broadband TV**

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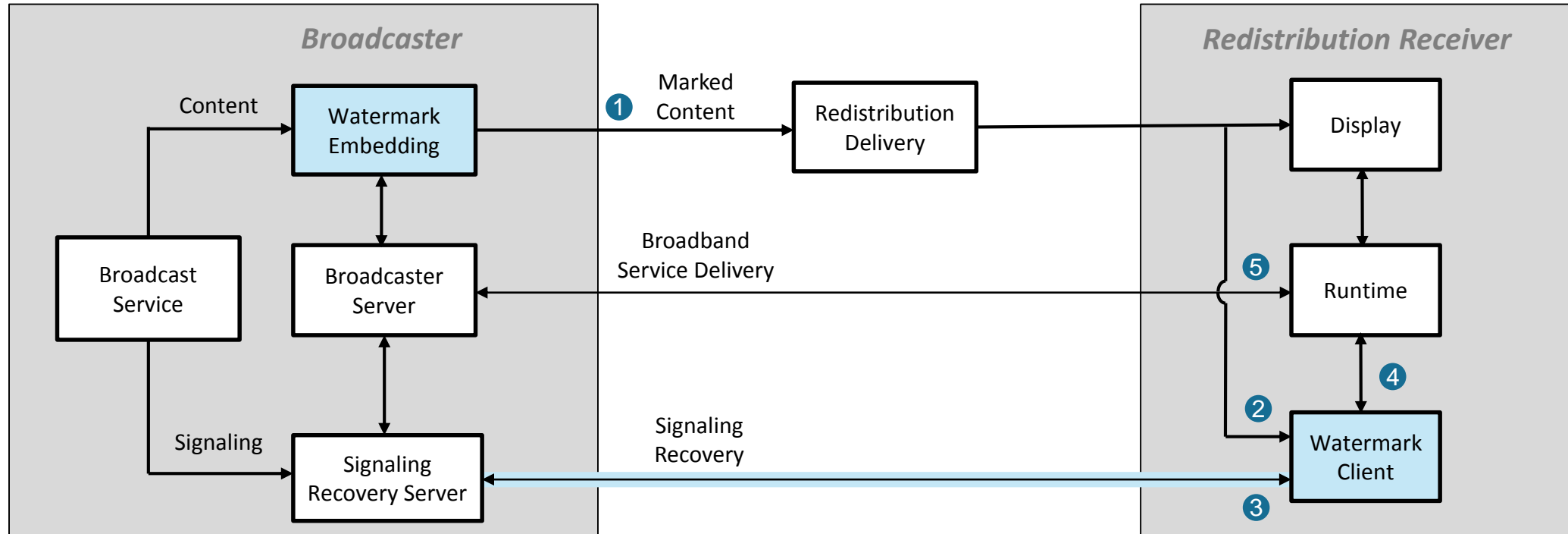
*HbbTV Symposium, December 2015*



- ⇒ 90%+ of US viewers receive broadcast TV via redistribution
  - MVPD STB connected to TV via HDMI
  - Redistribution diversity increasing (OTT, CVP-2, mobile broadcast...)
- ⇒ Many redistribution paths do not deliver signaling, making advanced services unavailable to viewers
- ⇒ This obstacle exists in many regions of the world



- ⇒ TV manufacturer selects ACR vendor with proprietary fingerprint technology
- ⇒ ACR vendor manages proprietary service platform to ingest broadcasts and recognize and serve signaling to TVs
- ⇒ *Limitations:*
  - Broadcaster has no involvement or control
  - TV manufacturer must adopt proprietary and closed technology
  - ACR vendor may modify broadcaster signaling and receives viewing data

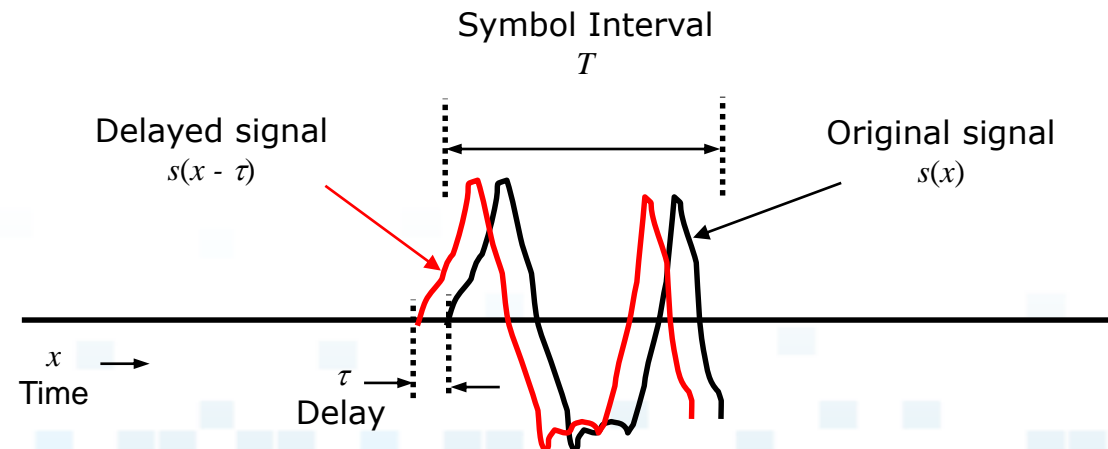


- ⇒ Open emission specifications for audio and video watermarks carried in broadcast content
  - Receive server URLs, frame-accurate timestamps, and real-time event info with 1.5 second repetition/recovery rate
- ⇒ Open network protocol specifications for receiver/broadcaster interaction *with no ACR middleman*
  - RESTful HTTP for low-cost scalability, web-equivalent privacy & security, all signaling delivery under broadcaster control

## ⇒ Audio Watermark Technology

- Differential autocorrelation modulation in 2.5 kHz-5 kHz frequency band
- 50-bit data payload transmitted every 1.5 seconds with error protection
- Perceptually transparent with EBU Broadcast Quality
- Reliable through cable / satellite / OTT redistribution channels to 32 kbps stereo, including during silence
- Supports timing recovery with 2ms accuracy
- Removable, modifiable, extensible via layering
- Publicly available example implementation

$$R(t, \tau) = \int_{t-T}^t s(x)s(x - \tau)dx$$



⇒ **Video Watermark Technology**

- Luminance modulation in video lines 1 and 2
- Multiple data rates supported (240 bits-per-frame and 480 bits-per-frame)
- 50-bit data payload transmitted every 1.5 seconds with error correction
- Additional data capacity allows direct delivery of signaling to offline receivers
- Reliable through cable / satellite / OTT redistribution channels to 2.5 Mb/s
- Removable, modifiable, extensible
- Publicly available example implementation

