MAKING SMART TV OPERATOR APPS COMPARABLE WITH TV BOXES (STBS)

Alexandre Gabriel
Simon Gunkel
Emmanuel Thomas
Hans Segers
Teun van der Veen
Bas van den Heuvel

TNO innovation for life

› TNO MISSION

TNO connects people and knowledge to create innovations that boost the competitive strength of industry and the wellbeing of society in a sustainable way.

This is our mission and the professionals of TNO have used their knowledge and experience to this end for more than eighty years.

'INNOVATION FOR LIFE'

INNOVATION PROCESS

DEVELOPING KNOWLEDGE

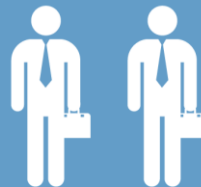APPLYING KNOWLEDGE

TRANSFERRING KNOWLEDGE

Together with universities
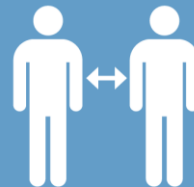
In public-private collaboration with partners from the golden triangle

Contract research for and with customers

Exploiting knowledge through spin-offs, licences, etc together with other companies

TNO innovation for life

SMART TVS – CURRENT SITUATION

› While most IPTV operators rely on the Set-Top Box (STB) to deliver linear TV services to consumers, several operators are moving towards app-based delivery.

› For Over-The-Top (OTT) service providers that offer video on demand or other non-linear TV services , delivery via apps is the default method.

› For IPTV operators offering linear TV services, TV apps are still a niche or non-existent in many countries.
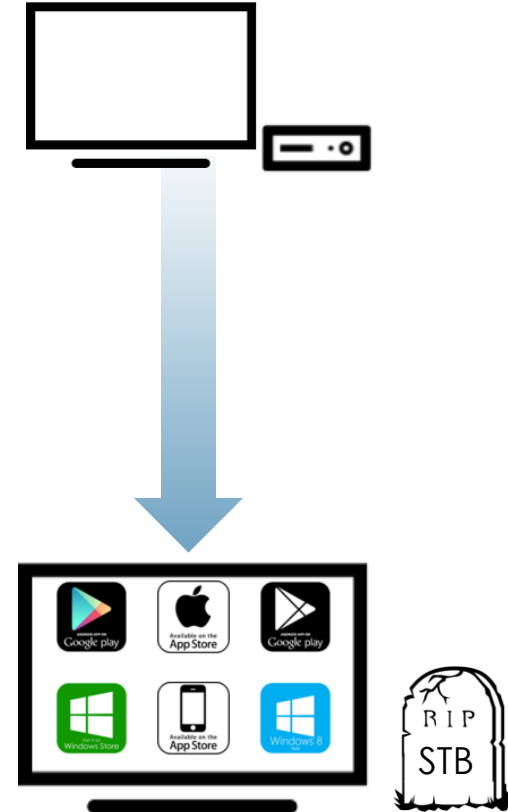
THE OPPORTUNITIES FOR TV APPS

› There are many benefits of launching a STB-less service with TV apps, such as

   › Cost saving

   › Clients are happier – less remotes and wires

   › Less power consumption

   › TV service not limited by legacy STB

   › Clients expect flexibility

   › Increasing interest in non-traditional subscriptions
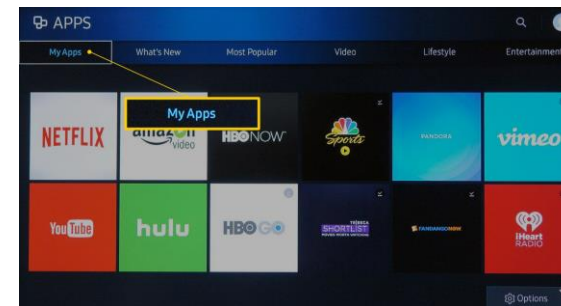
TV APPS ARE HAPPENING

› Viewing behaviour is changing: OTT, many devices, less linear
› Penetration of connected TVs will reach near 100% in a few years
› Operators moving into apps today

KPN launched first Smart TV app in April 2019

Liberty Global

„...ultimately a **STB will not be required** anymore to receive our services."
Mike Fries, LGI in NRC 28 Sept 2018

TDC, Denmark

TDC launched a **new app** for its YouSee TV service on LG TVs

Deutsche Telekom

The OTT service will initially be available through iOS and Android apps, through Chromecast and the web browser. Further operating systems will follow, including **Smart TV apps (broadband TV news)**

SMART TV LANDSCAPE

› **Many different platforms on each TV**
  › Multiple apps and app stores
  › Different user experience (ex. UI and layout)
  › Different performance (ex. zapping, latency)
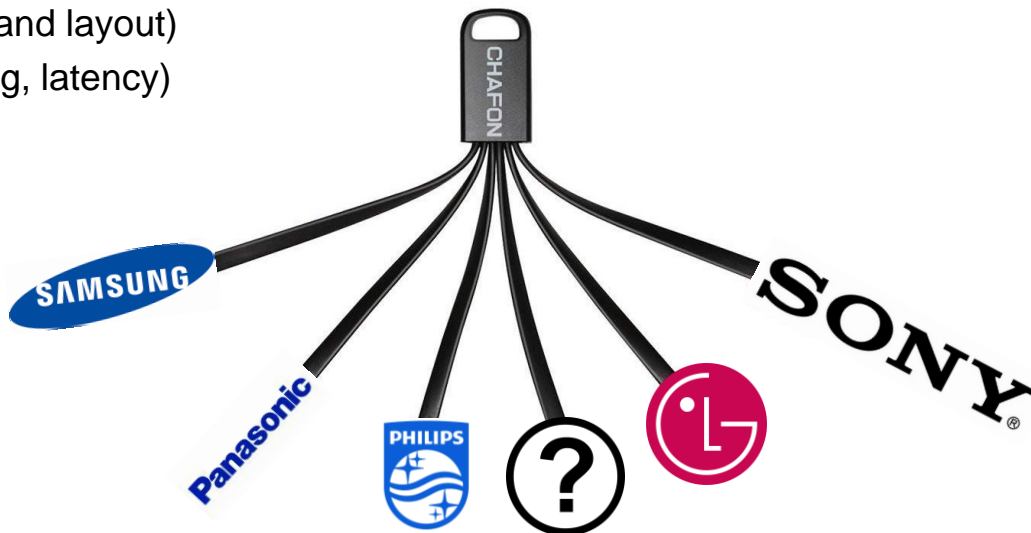
TECHNICAL CHALLENGES FOR OPERATORS

› **TV market fragmentation**
  › Developing a smart TV app for all brands and platforms is not feasible for most operators.
› **User Experience**
  › Make UI similar across different TV operating systems and TV models.
  › How to provide easy access to live TV, e.g. with "app-as-a-source"?
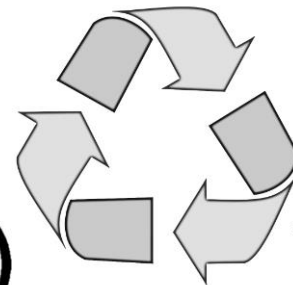› **Quality control**
  › How to monitor and control the quality of service to make it comparable with STB based TV.
› **Performance & experience**
  › How to guarantee similar performance as the STB
  › E.g. zapping time and glass-to-glass latency.

TV manufacturers

Operators

Standards

EXAMPLE CASE: ZAPPING ON A SMART TV

Internet / managed network

DSLAM

STB

Smart TV App

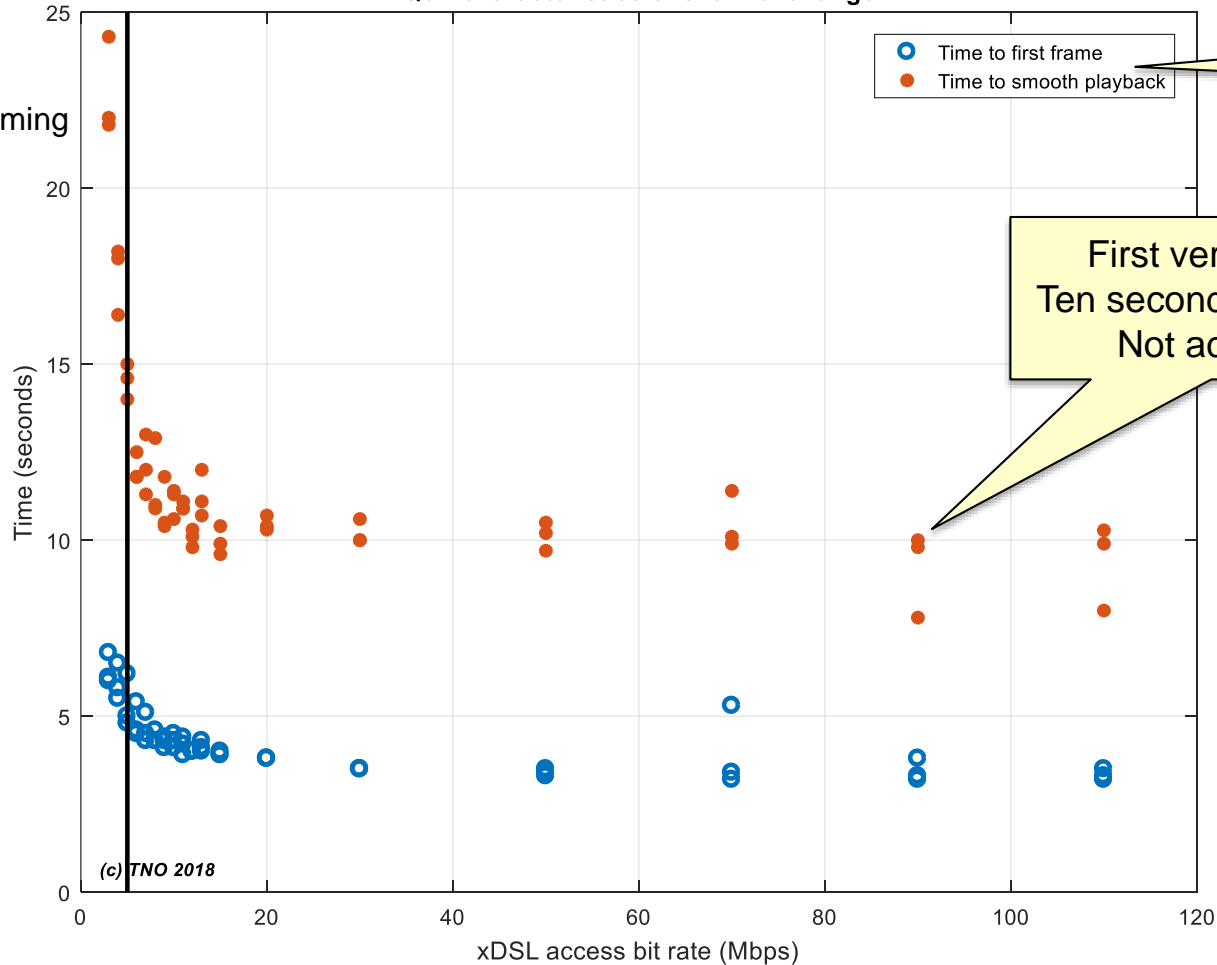› At TNO we were involved with testing a Smart TV App

  › 1st Aim: measure and try and improve performance

  › 2nd Aim: understand parameters that affect zapping time better

› Purpose of this example:

  › to demonstrate the things that can go wrong if you migrate naively to an App-based solution

› Our focus:

  › Can zapping QoE of a Smart TV Apps be on the same premium level as zapping on STBs?

QoE characteristics of channel change

App:
- Native TV player
- MS SmoothStreaming (over HTTP)
- 2 sec. segments

Two aspects

First version of App:
Ten seconds zapping time
Not acceptable !

Time to first frame
Time to smooth playback

(c) TNO 2018

Time (seconds)

xDSL access bit rate (Mbps)

Making Smart TV Operator Apps comparable with TV Boxes (STBs)

Zapping times and DRM (ignoring outliers)

App:
- Native TV player
- MS SmoothStreaming (over HTTP)
- 2 sec. segments

DRM:
Noticable increase in zap time

Legend:
- Zap times
- No DRM, 6 Mbps: Mean = 5.7 s
- DRM, 6 Mbps: Mean = 6.6 s

Y-axis: Zapping Time (s)

X-axis: Encryption — No DRM, 6 Mbps / DRM, 6 Mbps

(c) TNO 2019

Zapping times and SD/HD (ignoring outliers)

App:
- Native TV player
- MS SmoothStreaming (over HTTP)
- 2 sec. segments

SD vs HD:
About 0.5 seconds faster zap

Main conclusion for this implementation:
Video bitrate, SD/HD, codec, DRM are not <u>dominant</u> in determining the zapping time

Legend:
- Zap times
- SD: Mean = 5.1 s
- HD: Mean = 5.6 s

Zapping Time (s)

(c) TNO 2019

Video Resolution

SD   HD

Smooth Streaming
HD: 1920x1080, 6 Mbps
SD:1024X576, 2.5 Mbps

LESSONS LEARNED

Don't expect premium QoE from today's Smart-TV Apps directly "out of the box"

› Live-TV/linear-TV via Apps is different from Video-on-Demand: Stricter requirements/expectations on zapping time and end-to-end latency

› Quality expectations for TV/Apps may be (unconsciously) based on good performance of OTT VoD services such as NetFlix/YouTube

› Apps may use default player as provided by TV manufacturer, which could be typically optimized/developed for non-live viewing.

› Little information/control of detailed video parameters, in particular related to optimizing for live-TV: buffer sizes, time-to-live-edge, etc

› Almost no leverage to change parameters (<u>in particular on existing TV models</u>)
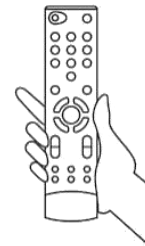
ADDRESSING THE CHALLENGES WITH STANDARDS

› **TV market fragmentation**

› **User Experience**

› **Quality monitoring and control**

› **Performance & experience**

HBBTV OPAPPS ADDRESSES TV MARKET FRAGMENTATION USER EXPERIENCE

› HbbTV OpApps is designed to be a virtual set-top Box

› Works on all TVs supporting the standard* developed by HbbTV
  › Based on open standards such as HbbTV2, HTML5,…
  › Standard covers discovery, installation and replacing the TV's native UI

› To the consumer, an OpApp running on the TV has all the benefits of the STB, without the hassle of cabling and multiple remotes
  › Behaves as an input source ("virtual HDMI")
  › Control via remote keys (e.g. P+, P-)
  › Comes back to OpApp after turning TV off and on

  *HbbTV Operator Applications ETSI TS 103 606

Key benefit of a set-top box: Delivers an operator branded experience on all TVs. For a smart TV app to be a true virtual STB it should have these features too.

STANDARDS TO IMPROVE STREAMING PERFORMANCE

› Standardized adaptive bitrate (ABR) streaming
  › Successfully deployed at scale for VoD (e.g. YouTube, Netflix)
  › OTT linear TV is also done with ABR (e.g. Hulu in the US)

› Recent developments:
  › **CMAF standard**
    › Convergence HLS and DASH on segment formats and codecs, broad industry support
    › Enables interoperability of low latency streaming mode between encoders, CDNs and clients
  › **Network assistance for enhanced performances DASH SAND**
    › Integration of Networks and Media instead of only "client-pull"
    › Useful for managed networks (fixed and mobile) where OTT approach is counter nature for telecom operators delivering their services

QUALITY MONITORING AND CONTROL

› Topic of discussion in different bodies

  › EBU, CTA WAVE,

› QoE control essential for offering good service to consumers
  › Being able to predict or react in case of QoE degradations

› Access to video QoE metrics precondition for network and media integration
  › https://github.com/cta-wave/R4WG20-QoE-Metrics

SUMMARY AND CONCLUSION

› Smart TV apps are happening
  › Increasingly demanded by consumers who are used to OTT app like delivery
  › Appealing to have STB-less (linear) TV

› Opportunity of delivering TV via smart TV comes with challenges, related to:
  › TV market fragmentation
  › User Experience (UX)
  › Quality monitoring and control
  › Performance & Quality of Experience

› Standards like HbbTV OpApps and DASH play a crucial role in addressing the challenges
  › Align market fragmentation and provide consistent and exceptional User Experience

Standards will make Smart TV apps comparable with "standard" TV boxes

THANK YOU

Take a look:
TNO.NL/TNO-INSIGHTS

Simon Gunkel
+31 6 15 40 54 47

Simon.Gunkel@tno.nl
linkedin.com/in/simongunkel

TNO innovation for life