Broadband Wireless Access and NPO

Possibilities and limitations of BWA

Agenda

- Introduction
- Trends in mobile content consumption
- Content delivery via Broadband Wireless Access networks:
  - Technological perspective
  - Operator perspective

  } Capacity, service differentiation
- Implications for NPO

Introduction

- Presentation is subset of Final TNO-presentation of BWA-survey for NPO, the public service broadcaster in The Netherlands
  - Finalised on April 18, 2010 (Slide Book en Management Summary)

- Why TNO-study?
  - Larger parts of potential audience are mobile on-line
    - Social media
    - Video, audio
  - NPO's policy is reach as many 'content consumers' with it's content
    - Internet has become important
      - Popularity
      - Accessibility

- TNO survey focused on
  - What are the possibilities and limitations of mobile networks (BWA) for broadband content?
  - What are the operators' views on this?

Trends in content streaming

Predictions on the growth of mobile data traffic

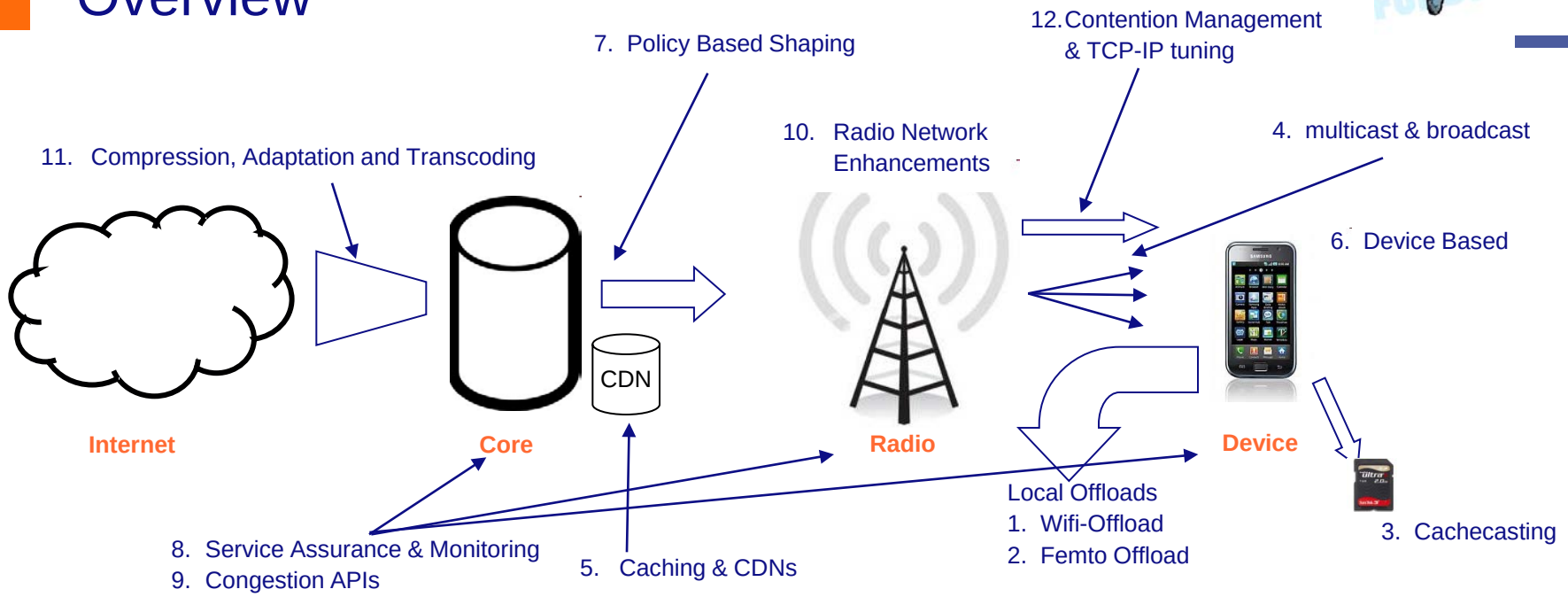
- Most research reports and traffic analysts predict large growth. Predicted growth rates are 100 – 200% CAGR (Compound Annual Growth Rate) until 2015
- Growth is due to three trends that lead together to the “mobile data explosion”
  - *device trends: more smartphones, tablets, 3G laptops and HSPA dongles, new features like 3D (shown in MWC Barcelona)*
  - *user trends: more mobile data subscriptions and more video use*
  - *content trends: steep content growth on social sites and video sites*
- Video (streaming, download, P2P) is the dominant shareholder in worldwide traffic. Streaming accounts for 35% and video in total for 70%
- Notebooks with 3G connections (dongles) account for ~75% of the worldwide mobile traffic, with even higher figures in Europe!
- Some analysts foresee a much slower growth after 2012, because laptop usage is not increasing strongly anymore. Further, (free) public wifi networks increase, which may relieve the mobile network usage

Implications of mobile data growth

- ***CONGESTION***
- Uptake of content streaming or video usage will continue to rise as social media and video sites increase popularity
- Mobile video will drive the future network upgrades (clear indication from MWC Barcelona)
- More and more content providers produce dedicated apps to deliver their content to customers (and get opportunity to obtain more control of the consumer experience and information)
- Content providers have various options to increase guaranteed data delivery
- Operators are implementing data caps and data policies

Content delivery via BWA-networks

Content delivery strategies
Overview

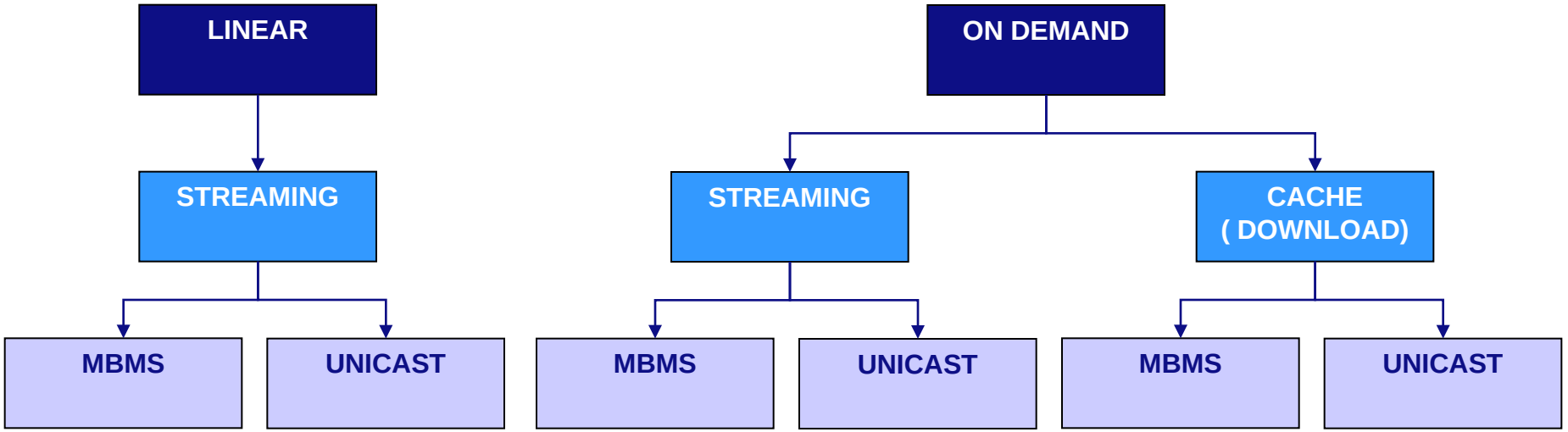


Smart traffic routing	
1.	Wifi Offload
2.	Femtocell Offload
3.	Cache-casting (PushVoD, Store and Forward)
4.	Multicast & broadcast
5.	Caching & CDNs
6.	Device Based traffic management techniques

Enhancements and differentiation	
7.	Policy Based Traffic shaping, DPI
8.	End to End service Assurance and Monitoring
9.	Congestion APIs
10.	Radio Network Enhancements
11.	Compression, adaptation and transcoding
12.	Contention Management & Tuning TCP/IP

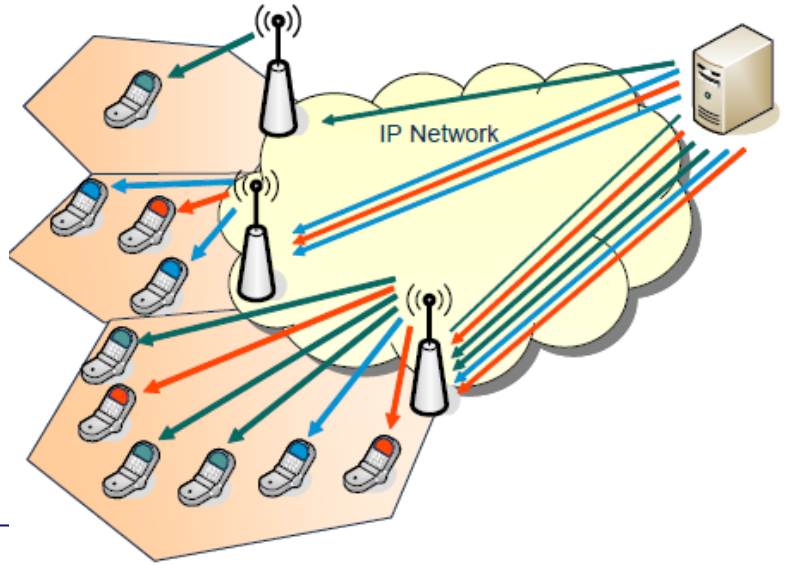
Mapping services to transmission

- **Linear (audio/)video service**
  - (Conventional) RTV channels or live events such as a sports match or a live newscast
- **On-demand video service**
  - Access to archived content (at any time)



Wireless transmission modes – Unicast

- **Unicast**
  - Separate connections for individual users, regardless of whether they access the same or different content
- **Advantages**
  - Users can access different services
  - Transmission parameters are optimized per user, i.e. adapted to e.g. their location and propagation conditions
- **Drawback**
  - Resource inefficiency in case multiple users demand the same content

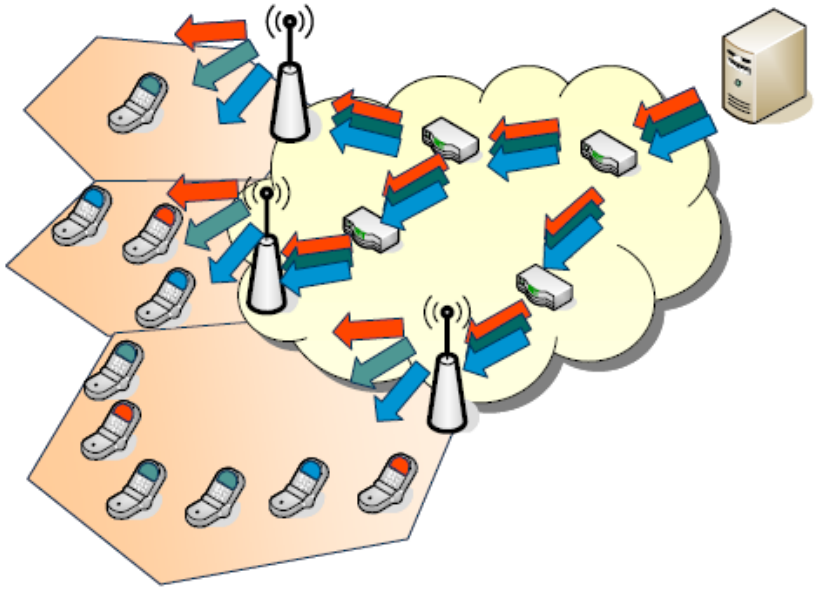


Wireless transmission modes – MBMS

- **MBMS**
  - Extension of ‘traditional’ mobile networks for large-scale distribution of multimedia content
  - Single ’shared data stream’ is broad/multicast via single or multiple cells, irrespective of the number of sharing users
  - ‘Multicast’ (LTE) or ‘Broadcast’ (UMTS, LTE)

- **Advantages**
  - Radio Resource efficiency in case of content desired by many users
  - Allows low-power, low-coverage broadcast

- **Drawbacks**
  - Less service differentiation
  - Target coverage is ensured by choosing worst-case transmission parameters



Operator interest in switching between unicast and MBMS

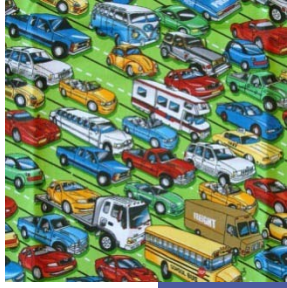
- The answer to this question is implementation-specific.
- If there is a significant number of users trying to simultaneously access the same live streaming video content, then it is in *the interest of* the mobile operator to use MBMS instead of unicast.
- On the other hand, if there are few users trying to simultaneously access the same live streaming video content, it is in the *interest* of the mobile operator to use unicast instead of MBMS
- Unless NPO has access to video session data, which is normally only available to the mobile operator (e.g. via the Operations and Maintenance Center), there is no way to verify whether the users are indeed receiving NPO content in broadcast mode.

MBMS from operator's perspective

- MBMS adoption and rollouts are rather slow.
- To-date there are no noteworthy commercial MBMS offerings for UMTS.
- There have not been any successful mobile television services in Europe or the US
  - DVB-H service will end June 1, 2011 in The Netherlands
- With the coming of LTE in combination with larger screens (tablets), this might change, but this depends on a number of (still) uncertain factors

Capacity aspects

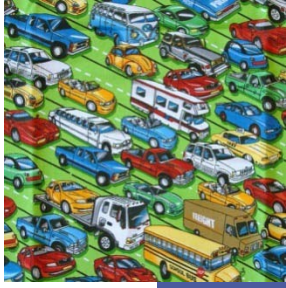
Capacity calculations
Some general notes



- **We limit the scope of the capacity calculations to video which is the traffic type producing the bottleneck**

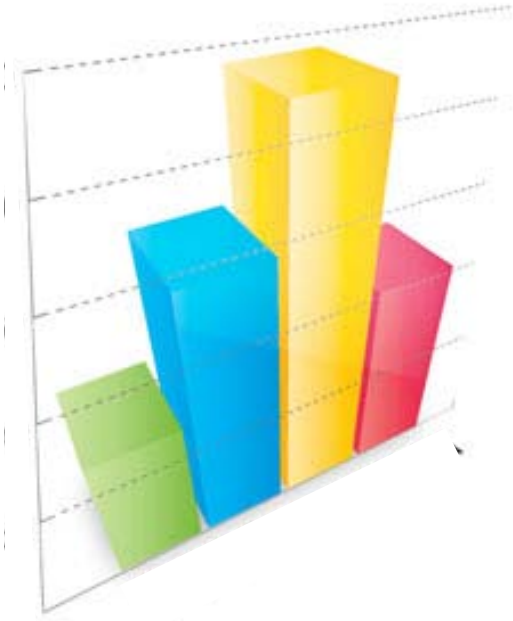
- **Unicast video**
  - Capacity is expressed on a per cell level
  - In principle, any capacity per km^2 can be realized by adding sites
  - Investment in more sites must be supported by higher revenues
  - Operators choose/adapt a business model to make this profitable

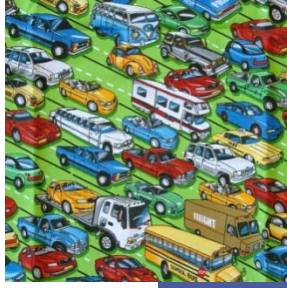
- **MBMS video**
  - Capacity is expressed on a per MBMS-SFN area level, since all cells in the area transmit the same content
  - Site densification provides only a limited capacity increase
  - MBMS capacity is affected by the number of participating cells
  - Key means for capacity increase is additional spectrum



Capacity calculations
Some general notes

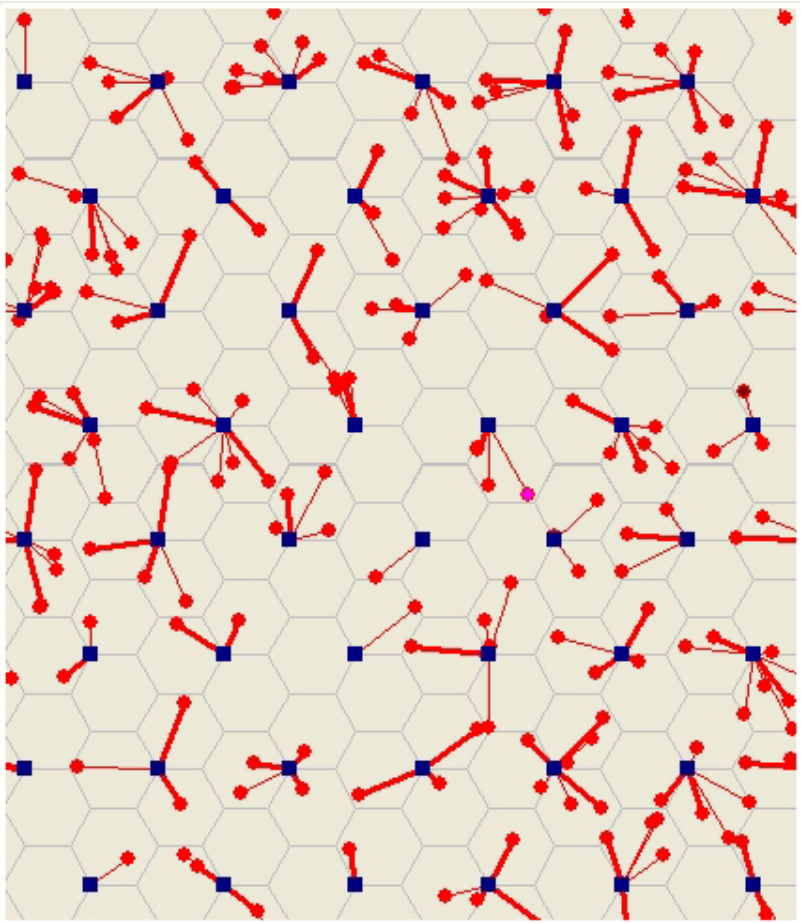
- **Capacity estimates are very sensitive to …**
  - Propagation environment
    - Urban, suburban, rural areas
  - User/service characteristics
    - Terminal capabilities
    - Mobility, bit rate, QoS requirements
  - Network technology/configuration
    - Radio access technology
    - Antenna configuration
    - Packet scheduling policies
    - Available resources for video traffic
    - …



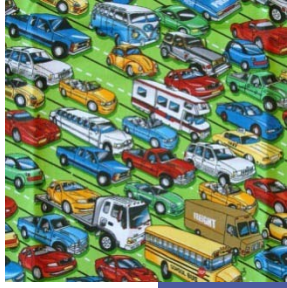


Capacity calculations

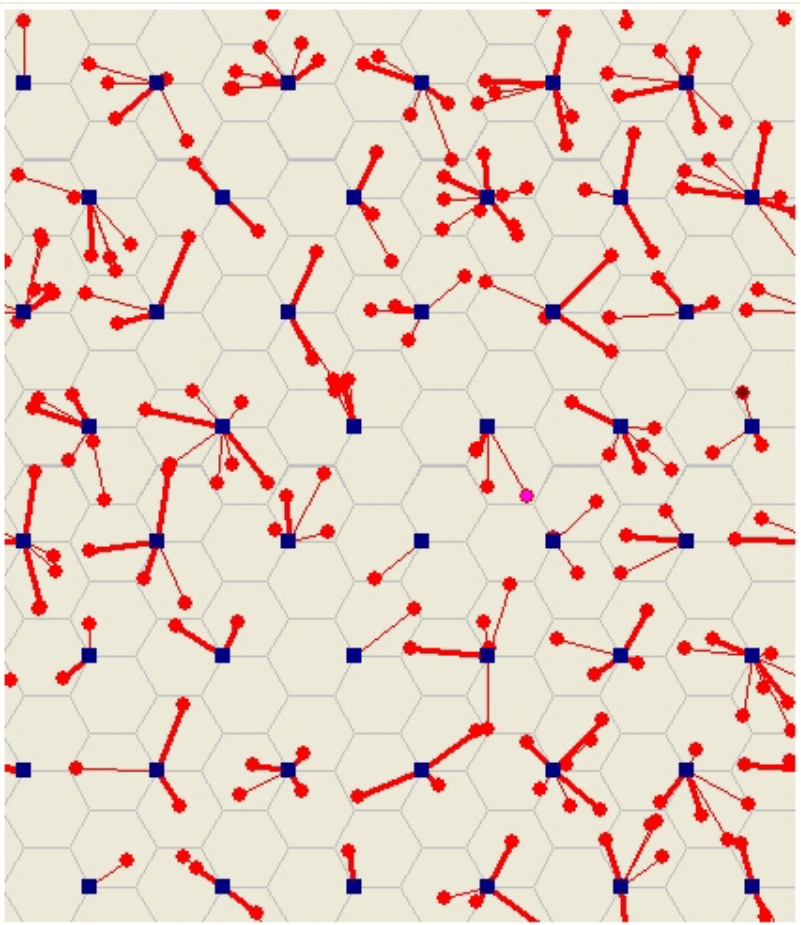
- **Illustrative example**
  - Consider an urban area of about 10.4 km^2 (Rotterdam: 25.000 inhabitants, Tokyo: 42.000 inhabitants), served by about 48 sectorised sites (with typical 3 sectors (= cells) per site), at a *typical* site-to-site distance of about 500 m.
  - Assume:
    - 10 MHz spectrum availability per sector
    - 3 km/h user velocity
    - 2 GHz carrier frequency
    - Only video traffic at a bit rate of 512 kbit/s (serving max. 4.5 inch screens)



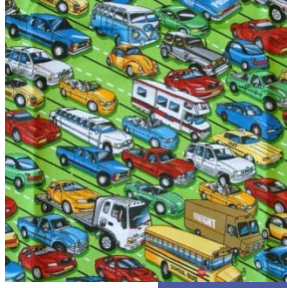
Capacity calculations



- **Illustrative example**
  - Then we can support
    - 6 concurrent *unicast* video streams per cell in an *HSDPA R6* network
      - This is 48 × 3 × 6 = 864 streams in the entire area
    - 20 concurrent *unicast* video streams per cell in an *LTE R8* network
      - This is 48 × 3 × 20 = 2880 streams in the entire area
    - 61 concurrent *multicast/ broadcast* video streams throughout the area, for an *LTE R9 MBMS* network



Capacity management



- **Done on three levels:**
  - Performance management
    applied by a network operator to monitor the observed quality of handled services/sessions
  - Capacity management
    applied by a network operator to monitor the need for capacity expansion, e.g. via additional sites, spectrum, hardware, ...
  - Radio resource management:
    a suite of mechanisms mobile networks apply to coordinate the efficient sharing of the radio resources, including service differentiation

Service differentiation

Fair Use Policy (FUP)

- Max. 10 times the average usage of all users/month is allowed
- Max. 2 GB/month is allowed
- No restrictions (T-Mobile until recently)

For the end user, a fair use policy is rather vague.

Differentation

- There are two types of differentiation that are ***inter-related***, but have ***different objectives***:
  - **Subscription-based**
    - Objective: customers are different from each other, so give them options to pay for what they need.
    - Implementation: different types of subscriptions, e.g. Gold, Silver, and Bronze. More complex forms of subscriptions beyond just those based on “bundel” and “snelheid”, e.g. specific video content (channels) could be offered.
    - Who benefits? Mobile operators and subscribers
  - **Service-based**
    - Objective: different services (video, voice, e-mail, www) have different QoS (quality of service) requirements, therefore give them different priorities (regardless of the subscriber).
    - Implementation: in unicast mode video packets (that are **delay intolerant**) have higher priority than e-mail or www packets (that are **delay tolerant**).In broadcast mode, there are resource reservations for video content.
    - Who benefits? Mobile operators, content providers (e.g. NPO), and subscribers.
    - Especially beneficial to mobile operators because this allows for **more efficient resource utilisation in their networks**.

The need to limit heavy users will continue to exist, and so will differentiation

- A mobile operator's need to limit very heavy users will **not** go away.
  - This may be implemented via a fair use policy, or
  - via other mechanisms (e.g. within a subscription plan).
- Mobile operators will **not** eliminate their fair use policies entirely in the short- to medium term because of limited capacity on the radio network.
  - Mobile operators generate most of their revenues from voice calls and **not** from mobile data.
  - Expenses to increase capacity to allow mobile data traffic growth do not have **direct** profits associated with them, i.e. customers are not charged per bit of data traffic they use.
  - Rather, to remain competitive (and avoid customer churn), mobile operators need to offer data in a 'sensible' way.
- From a customer point of view, differentiation **already** exists based on the subscription.

Consequences of differentiation for NPO

- The need for a mobile operator to limit disproportionately high users of the network will not go away because it is too costly to dimension the network to handle such a high level of traffic. Such a limitation can for instance be done through a “fair-use policy”, a data bundle and/or differentiation.
- Differentiation offers threats and opportunities for NPO.
- Threat:
  - Service-based differentiation is not beneficial for delivery of video content, in case the operator decides to throttle video services.
    - video is a more capacity-intensive application than many other types of services.
- Opportunities:
  - *Paid video channels with enhanced quality*, enabled through an agreement between mobile operator and video content provider
    - Benefit for mobile operator: value added services
    - Benefit for video content provider: premium quality video services to the mobile operator’s subscribers.
  - Service-based differentiation is beneficial for *superior delivery of video content*, in case the stringent requirements attached to video content delivery are addressed
    - video has much more stringent requirements than other types of content.

Most important findings of study

- Excessive growth of mobile data traffic. For the time being video is not the bottleneck but this may change very soon.
- Strong growth in content streaming, but potential popularity of lineair mobile TV is estimated as low by TNO. On-demand video content will dominate. For audio (radio) lineair is important.
- Audience prefers personalised video content delivery
  - Need for broadcast and multicast capabilities, for capacity growth, is not evident
  - The added value of (costly) MBMS is not evident for operators (compared with e.g. alternative WiFi offloading).
- Operators are currently considering service differentiation as measure to control capacity usage, incl. differentiation of tariffs.
  - Can be potential win-win situation for both operators and content providers because of better QoS garanties.
  - NPO could consider split up between managed delivery and best effort delivery possibly with cache casting

TNO recommendations to NPO

- Thorough market survey in The Netherlands into streaming content services amongst mobile users.
- Participation of NPO in LTE trial planned by TNO
- Usage of state of the art codecs for audio and video to alleviate congestion (AAC+ and H264)
- Stimulate mobile operators to hold a beauty contest for the deliviry of NPO streaming content services to their subscribers. Do so based on the experiences in the LTE-trial.
- Investigate the feasibility of offering intelligent cache casting services in The Netherlands
- Investigate further the concept of Hybrid Broadcast Broadbanding (both TV and Radio) particularly Dynamic Broadcasting (initiative of University of Braunsweig).

Thank you for your attention!