

# BROADVISION

Q4 2017

Your personal IPTV/OTT business advisor



## WHY DOES A MISER PAY TWICE?

HAVE YOU EVER WONDERED WHY ONE PRODUCT COSTS MORE THAN ANOTHER? ARE YOU REALLY SAVING MONEY? LET'S FIND OUT USING THE CHOICE OF THE STB AS AN EXAMPLE.

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**Igor Oklander**

Head of Marketing  
Department, Infomir

**Dear Friends!**

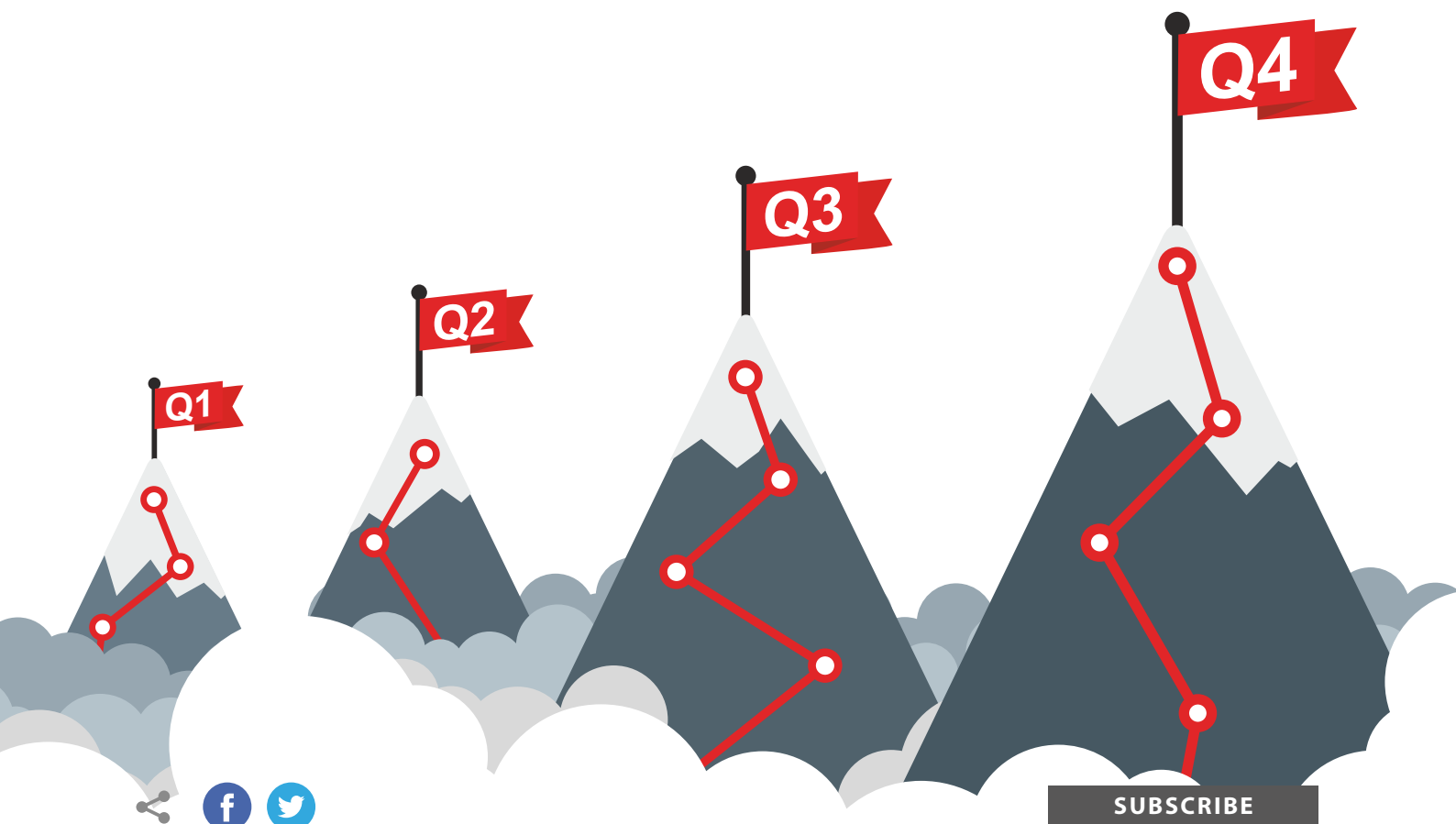
**You are looking at the fourth edition of BROADVISION magazine. This is the result of our team's first year of working on the project. When taking this road, we did not fully realize how hard, meticulous, and scrupulous the work on each edition would be. Countless sketches, designs, and drafts have been polished for hours and hours to come together in the final shape which we are happy to show you.**

We are grateful to our customers who shared their recipes for success; our partners, without whom this edition could not have been released; our colleagues, who worked with dedication on each article; and, of course, our readers – whose feedback encouraged and inspired us to keep on!

Personally, I would like to say: Thank you to our incredible, cohesive team. I knew you would go a long way. But now I am convinced that your vocabulary does not contain the word 'impossible'.

BROADVISION by now is not just a project. It is an integral part of our life. We are watching it grow and develop. And we are growing with it, too. Every new edition is the next step we must scale, inspired by your support. Next year we are planning to publish even more interesting and helpful material, new reviews and interviews with authoritative players. So, what's in store for us? A limitless ocean of work, sleepless nights, piles of information, and... a fair wind, of course.

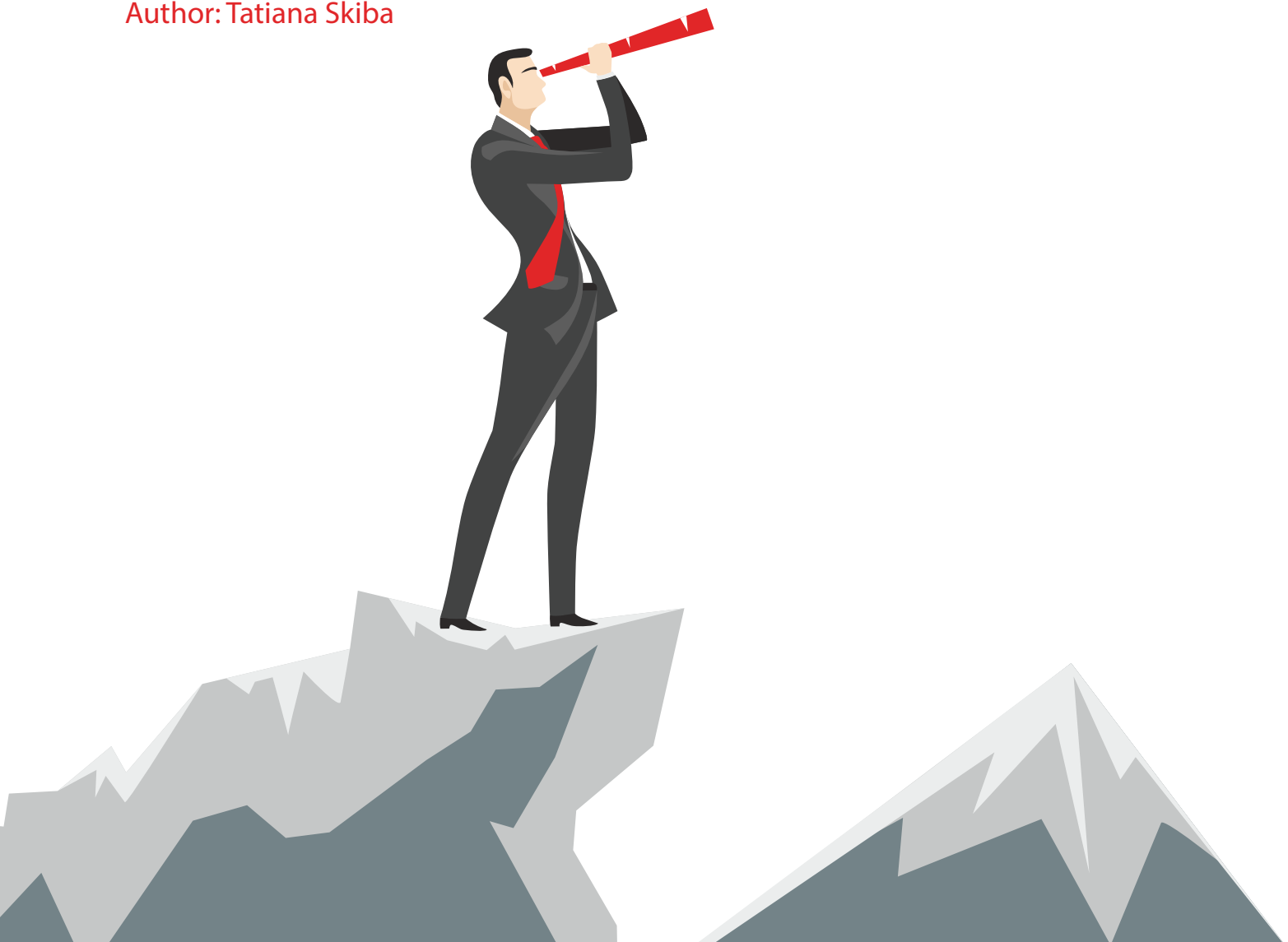
Igor Oklander  
BROADVISION Project Manager



# WHAT HAS CHANGED IN 2017

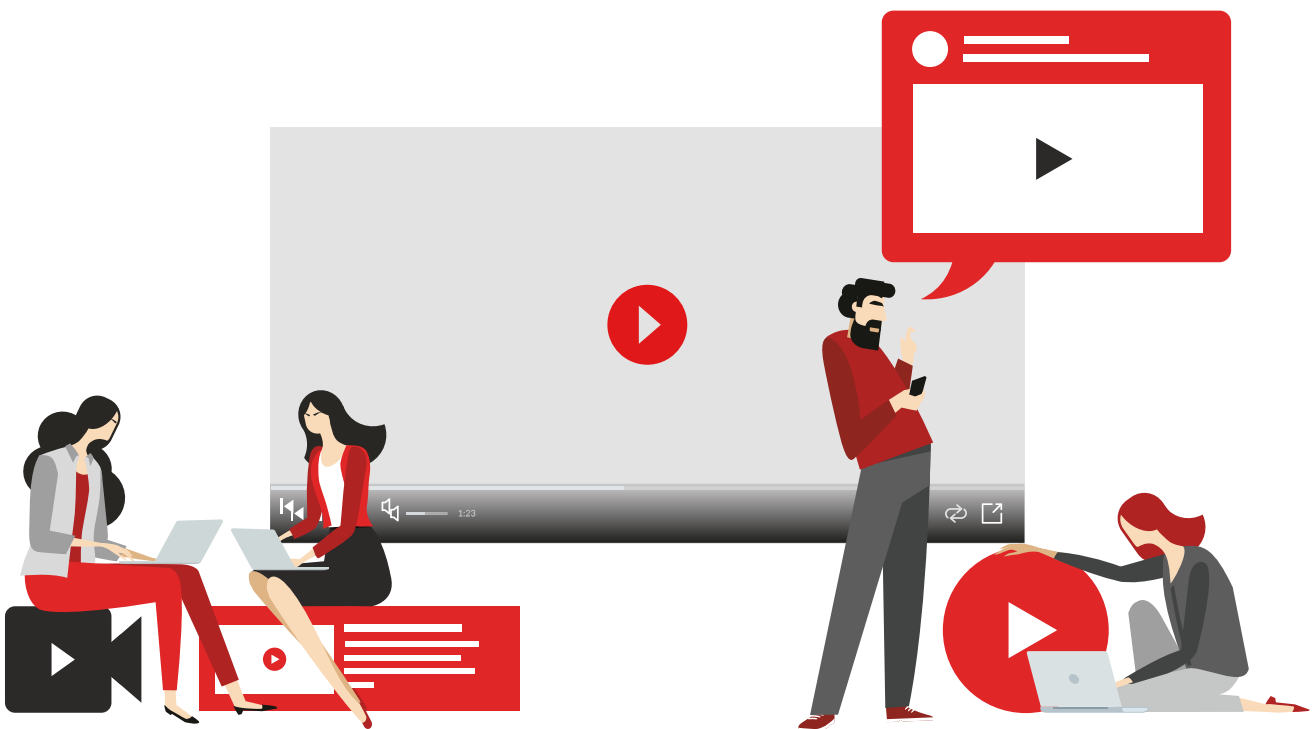
What has the departing year been like in terms of television? What have your customers been watching this year and what are they going to watch in 2018? VR: the future, or just another trend? We have picked up the most interesting things about TV services for you to read up on, and, of course, predictions for the future.

Author: Tatiana Skiba



**The need to watch diverse content has long been established in the life of a modern person. As the Internet has become widespread it has opened new opportunities for watching favorite channels and movies anytime, anywhere, and on any device.**

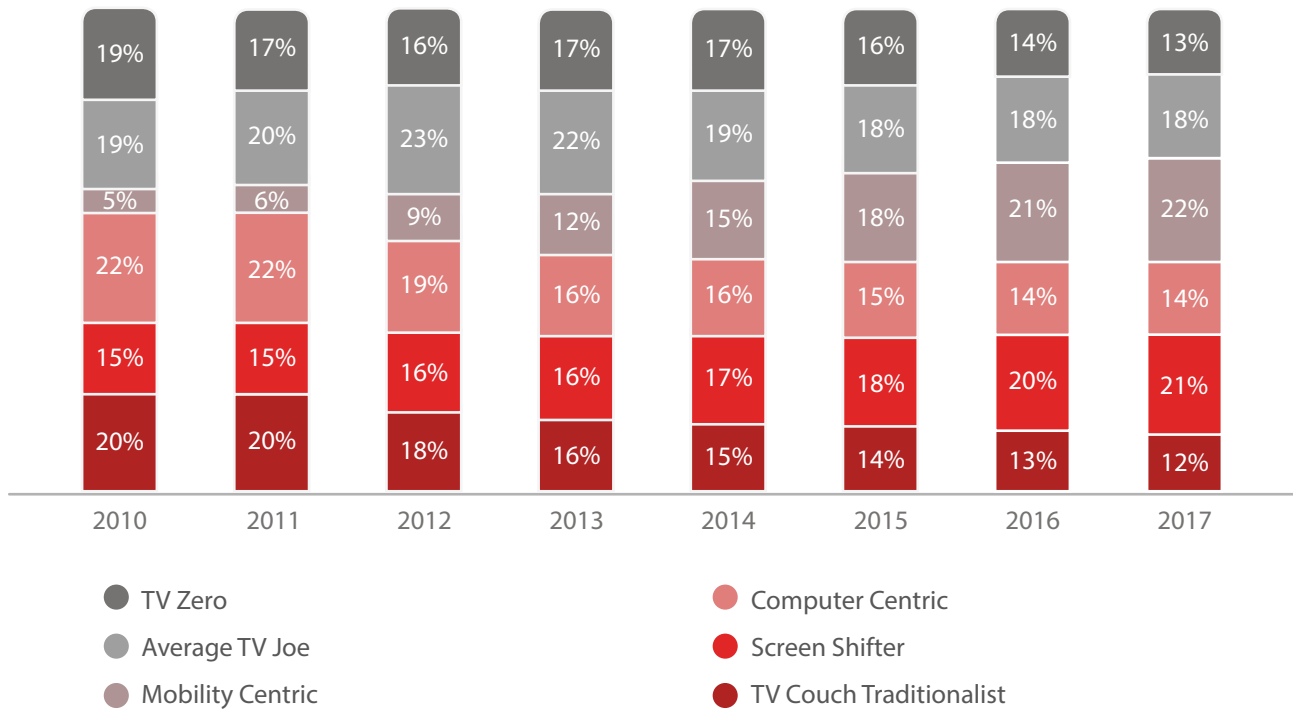
Consumers are more and more tending to use personal devices. They are consuming content on public transport, while queuing or even on-the-go. However, TV still remains the center of home entertainment. Families or friends still gather in front of it.



2017 has seen a reduction in the number of people who seldom watch TV and armchair traditionals. At the same time, there has been an increase in the number of those who watch videos on a variety of mobile devices.

The fact that the segment of consumers with mobile devices is growing fastest stresses the importance of a good user interface on a small screen. This can also be viewed as a sign that the omnipresence of mobile viewing will continue to grow, perhaps even to the extent that mobile viewers will outrun fixed screen viewers.

## Changes in TV service consumer groups

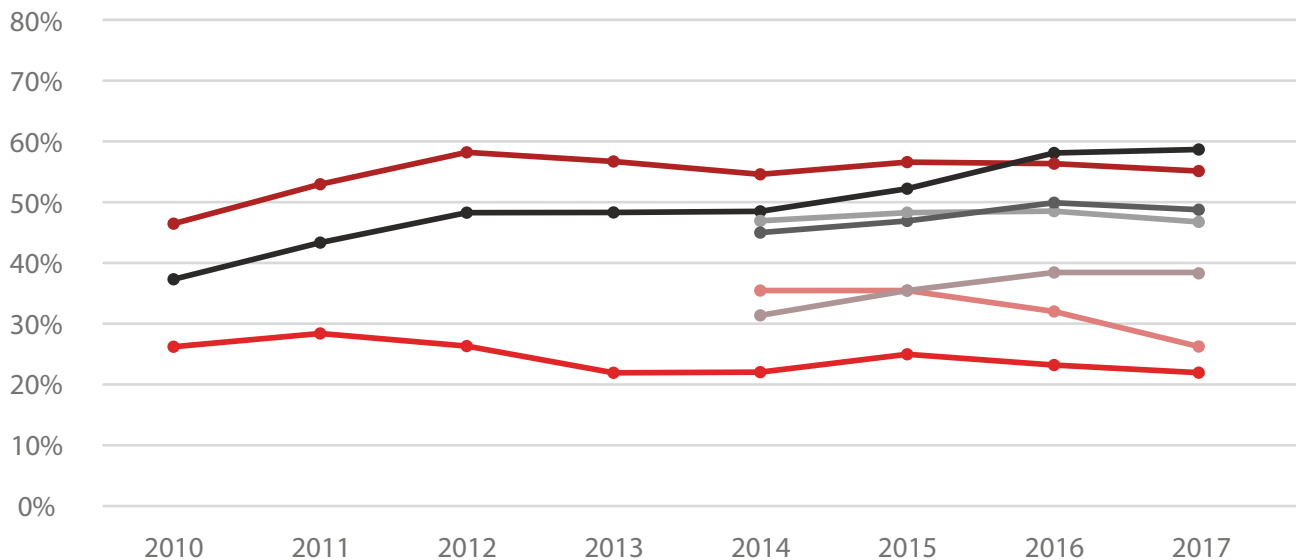


Source: Ericsson ConsumerLab

It can also be said that consumer attitudes to television have changed in 2017. The number of users who prefer video-on-demand and those who want to watch favorite content outside their country has grown. The number of users who are absolutely satisfied with traditional TV has significantly reduced.



## Change of consumer sentiment



The internet is a natural part of my TV habits



I prefer on-demand over scheduled viewing



Full TV series should be released at once



Accessing TV and video content is a major reason for having a fast internet connection



I need all my TV/video content when I'm abroad



My traditional TV service provider gives me all I need



If I can't legally find the content I need, it's okay to pirate

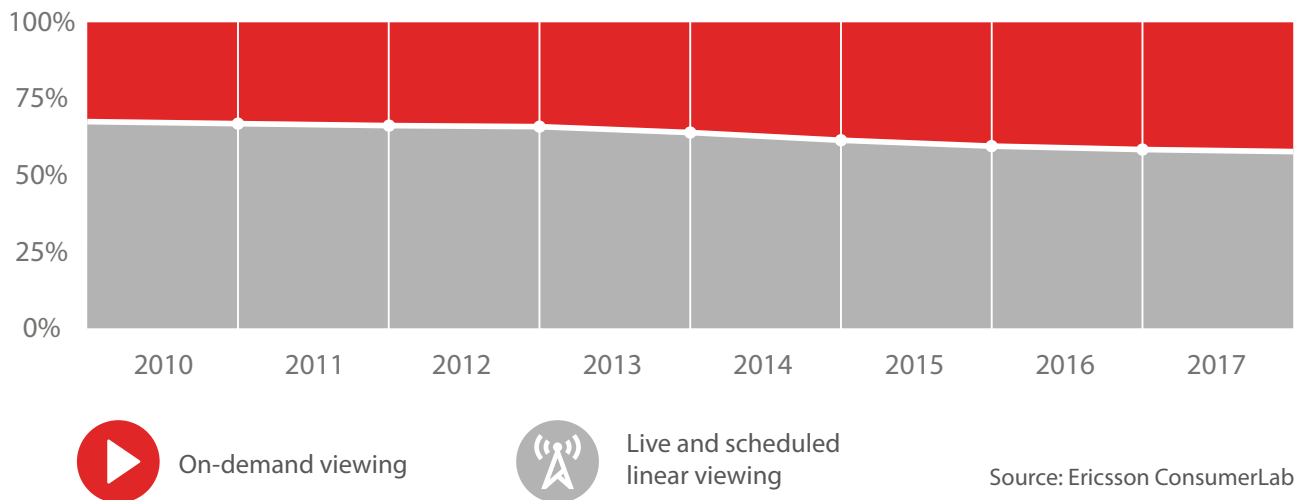
Source: Ericsson ConsumerLab

The choice of videos is now greater than ever. Consumers can watch traditional linear TV, video-on-demand, downloaded and pre-recorded content. This has had a significant impact on the life of viewers and is one of the reasons why they watch a record amount of video content, at 30 hours every week.

People do not only view a lot of videos, but they also change the ways of watching them: content-on-demand already accounts for over 40% of total TV service consumption.

Nevertheless, linear TV still offers the most viewed content by providing more than 9.5 hours of TV shows, movies, and programs every week. Besides, a high percentage of all linear TV views (34%) now accounts for real-time viewing, which is up 10% from 2016.

### Linear TV vs. Video-on-Demand

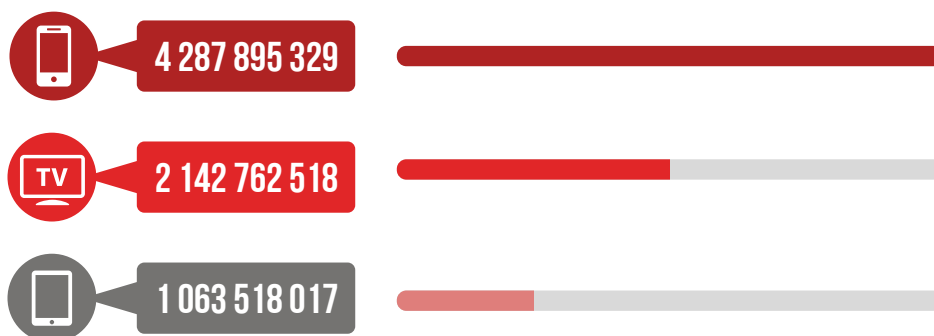


2017 has seen positive dynamics for all video content viewing devices. The number of tablet PCs used worldwide now exceeds 1 billion. Viewing on tablets reached 10.6% of all video views in Q2 — this is the highest recorded number. On the other hand, if growth in tablet supply is dropping globally, how can viewing on tablets increase?



Tablets remain a popular second screen in many families: 41% of tablet owners report watching streamed videos on their devices.

### The number of devices used in 2017



Source: Ericsson ConsumerLab

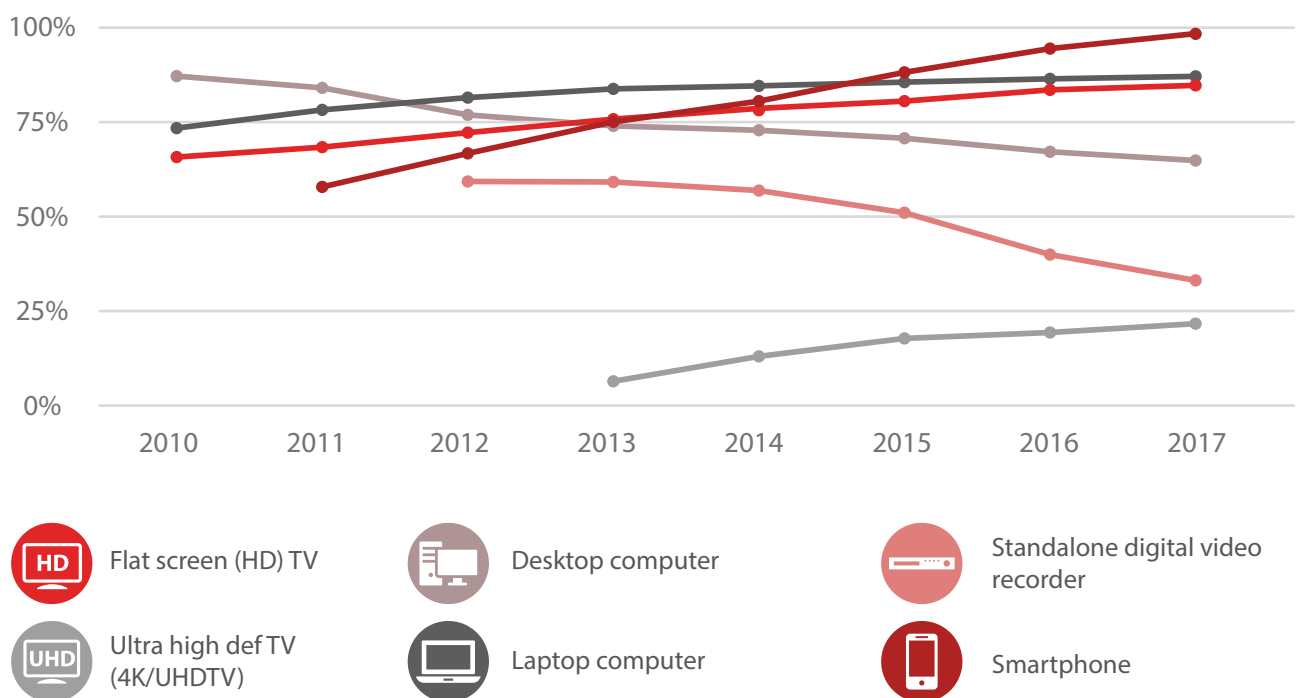


Not surprisingly, smartphones have become the most popular devices. Their popularity has grown from 70% to nearly 95% since 2012.

TVs with higher image quality are also becoming more and more popular — the share of HD TVs has increased from about 75% in 2012 to nearly 85% in 2017, whereas 4K/UHD TVs are now owned by every fifth household. By contrast, older devices such as desktop PCs and autonomous video players are no longer wanted so much: Their share dropped from 80% and 60% respectively in 2012 to 72% and 38% respectively in 2017.



### User preferences by devices for viewing

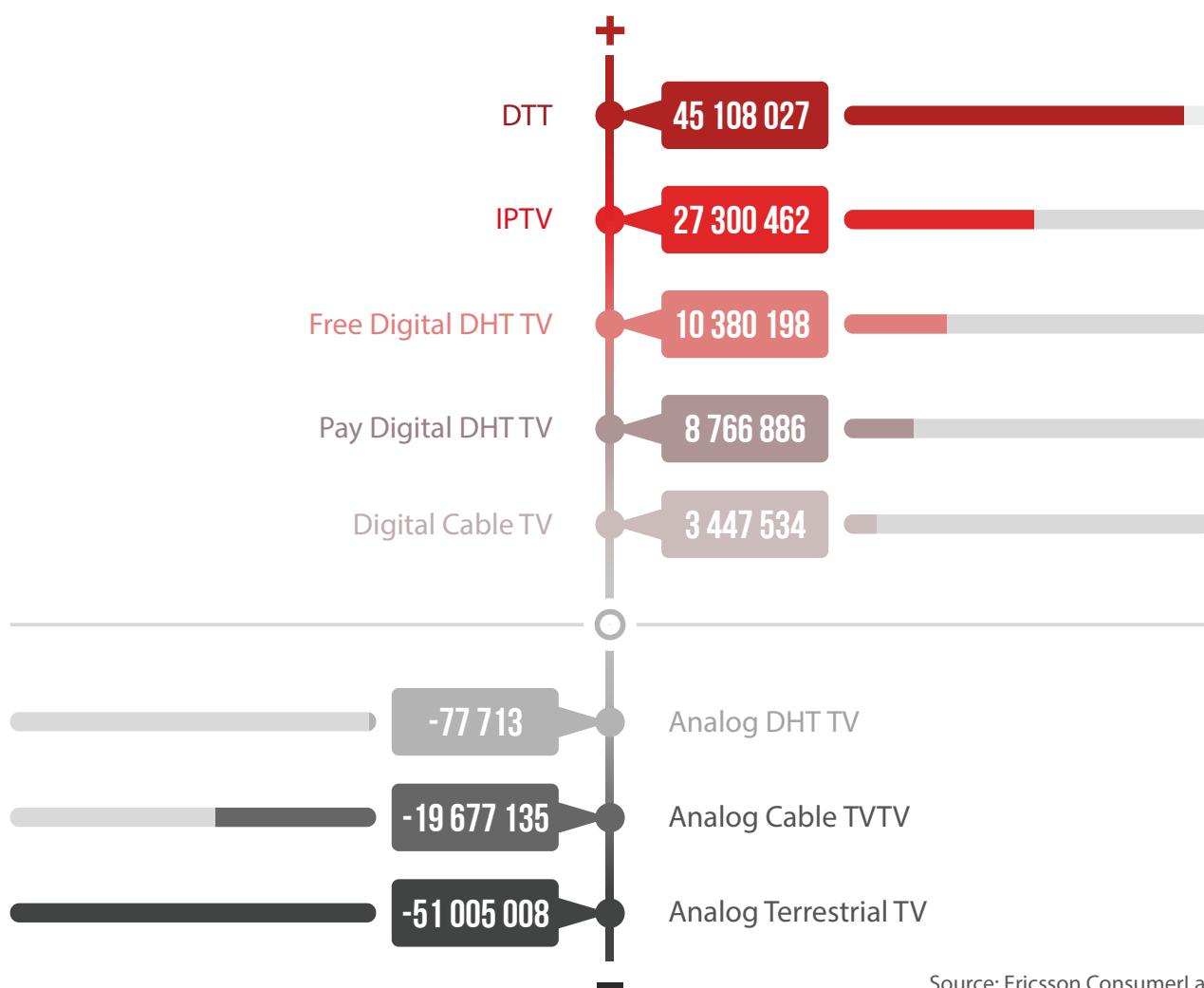


Source: Ericsson ConsumerLab



In 2017 the number of home TVs has grown considerably. This is mainly explained by increasing numbers of digital terrestrial TV and IPTV subscribers.

### 2017 User Dynamics by Types of TV



Source: Ericsson ConsumerLab

Compared to 2016, 2017 demonstrates positive dynamics for all types of analog television. There has been an exodus, which was quite predictable due to the global rejection of analog broadcasting and the switch to digital. Europe was one of the first to switch to digital broadcasting. In post-Soviet countries, this process is at the completion stage, which will continue next year. Interestingly, the increase in the segment of analog cable and terrestrial TV has been noted and is predicted in a number of developing countries. This is due to the fact that such a switch requires significant investment on the part of both consumers and suppliers.

It is remarkable that despite the fact that the USA is 2nd by number of IPTV subscribers, 2017 has seen an exodus. This is true not only for the IPTV sector.



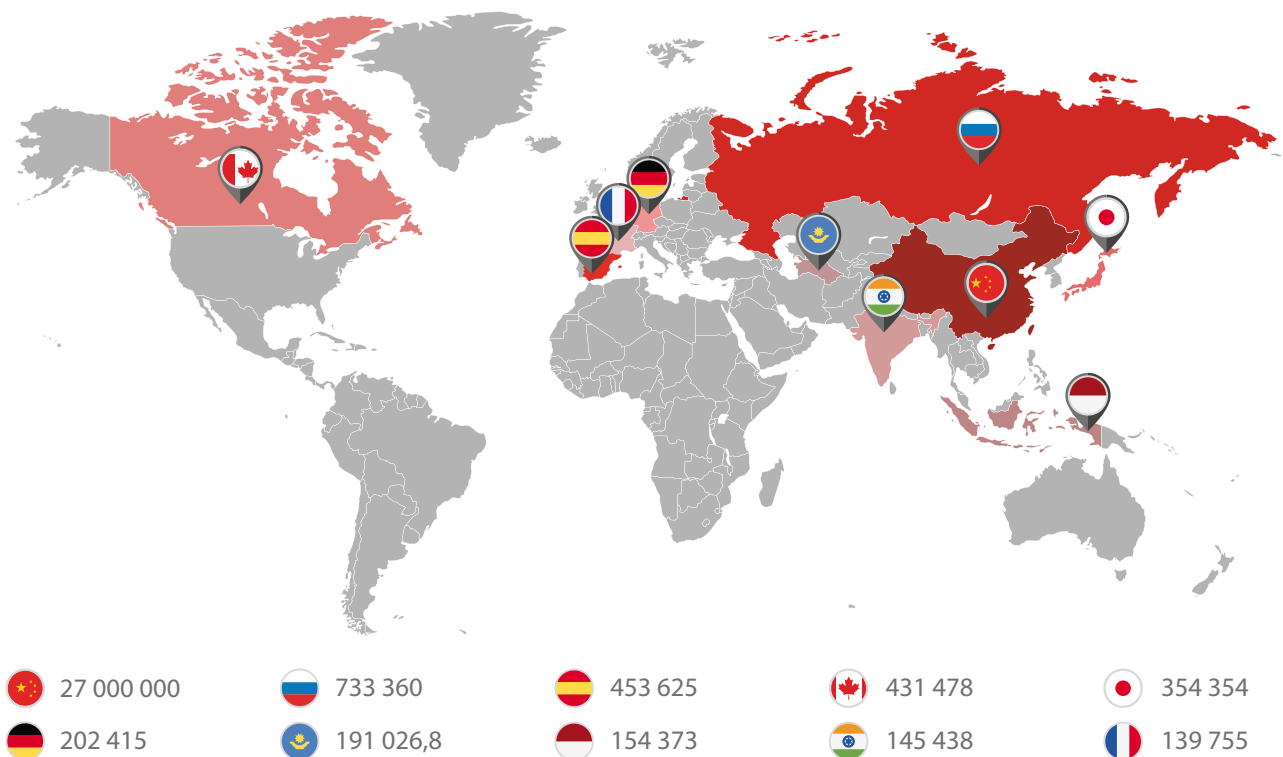
"The pay-TV industry continues to experience worldwide growth, but the North American market is experiencing a decline in penetration."

Brett Sappington, Senior Director of Research at Parks Associates.

A combination of factors, including high monthly subscription fees and a wide range of OTT services, puts consumers off traditional pay-TV. Now operators are being forced to change their strategies in this new environment, at the expense of partnering with other market players who provide OTT services. The study also shows that ads, free or subsidized devices for customers might motivate prospective rejectors to keep their subscription for the services.

China now sticks out in the IPTV segment — the number of subscribers reached 27M in 2017.

### The increment of IPTV subscribers in 2017



Source: OVUM

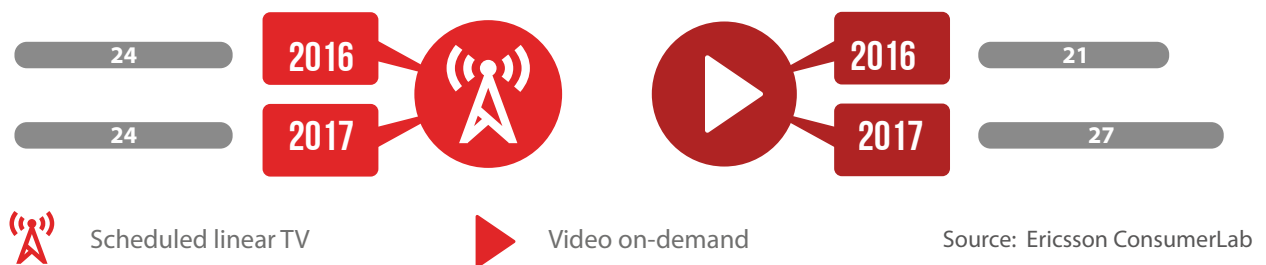
Over 63 million households with broadband access in the US subscribe to OTT services. 36% of them have at least one stream media player.



Today, customers have access to the largest ever amount of content. However, the market is more fragmented, which in its turn leads to a more fragmented user experience. Viewers all the time look for something new, something interesting to watch. The average number of services-on-demand in each household has increased from 1.6 in 2013 to 3.8 in 2017. Content search remains a problem as consumers think that available search methods are useless.

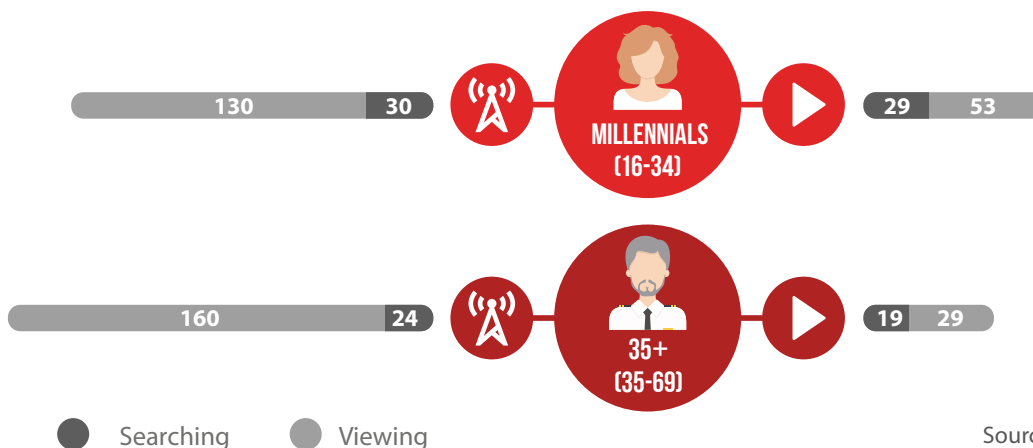
Average content search time has also increased from 45 min/day last year to 51 min/day this year.

#### Average content search time



There are also interesting age-related differences in terms of both viewing and searching. Millennials spend 50% more time searching for VODs than those aged 35+, and 80% more watching them.

#### Average content search time by age



## PREDICTIONS

According to Digital TV Research predictions, the number of pay-TV subscribers will grow by 134M from 2016 to 2022, when their total number will reach 1.09bn. As forecast, the number of pay-TV subscribers in 138 countries in early 2018 will reach 1 billion.

In the Asia-Pacific Region, the number of subscribers will grow by 92M from 2016 to 2022, whereas in Africa south of the Sahara Desert their number will double.

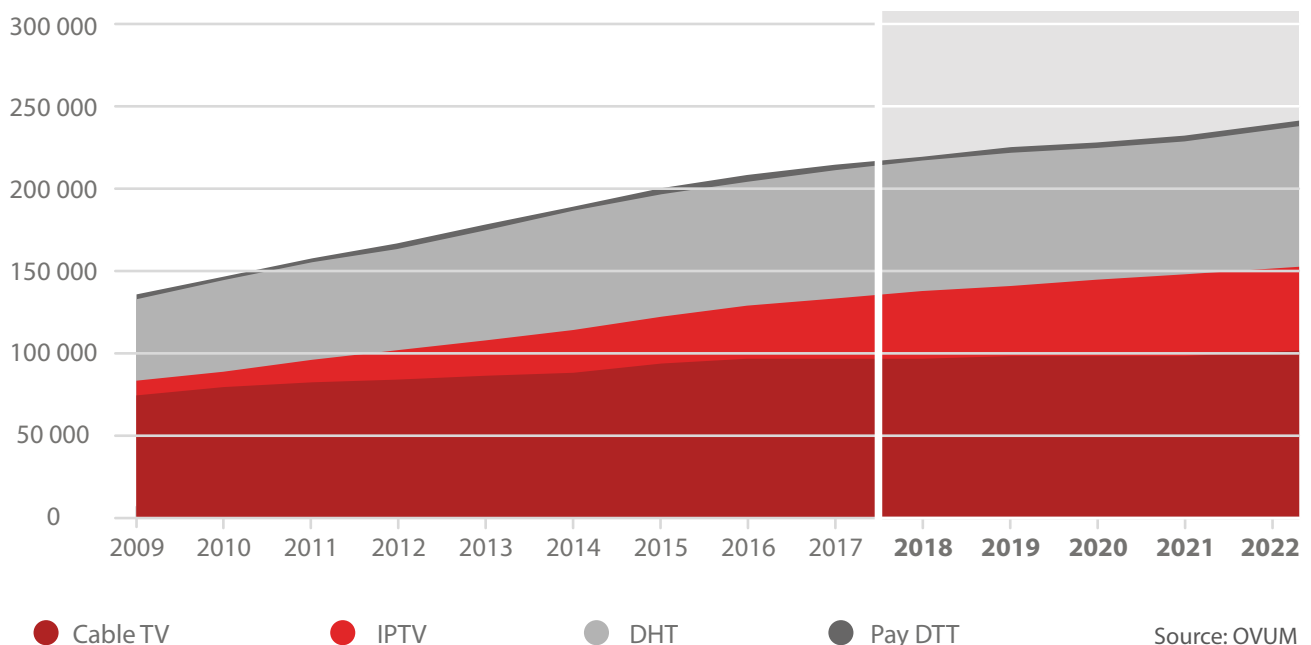
Global Pay TV Subscriber Forecasts analysts have excluded analog cable TV in their report and concluded that digital pay-TV growth is really impressive: This sector grew from 380M subscribers in 2010 to 852M subscribers by the end of 2016. The projection is for the number of digital pay-TV subscribers to reach 1.088bn by the year 2022.

China will account for a third of global pay-TV subscribers. India will add another 16% to the total by 2022. Thus, China and India together will ensure nearly half of all pay-TV subscribers in the world.

Earnings in the pay-TV market will reach over \$238bn.



Predicted earnings in the pa-TV market, millions of dollars

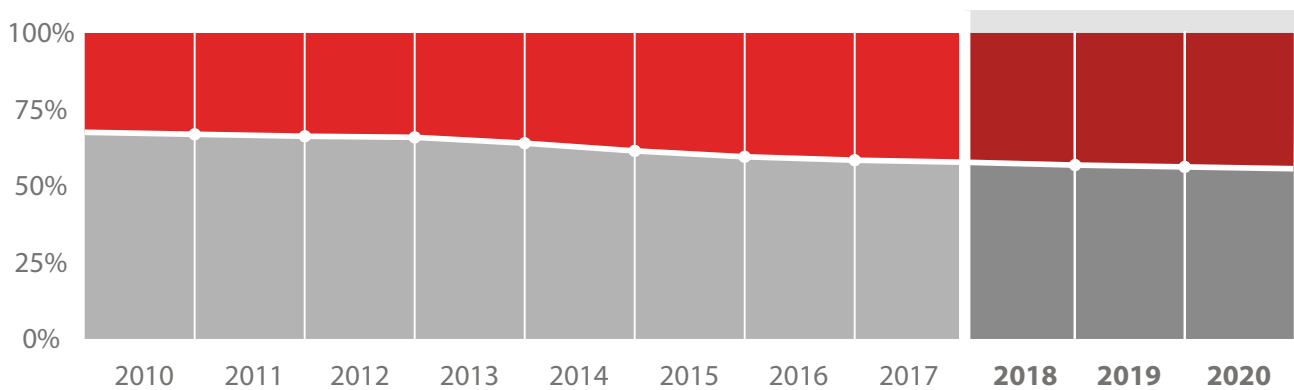


## GROWTH IN DEMAND FOR VOD

About 6 out of 10 consumers already prefer video-on-demand to traditional TV. This is expected to be 7 out of 10 by the year 2020. Views-on-demand will continue growing and will reach nearly half of total viewing time by 2020. For instance, 16 to 19-year-olds are expected to reach a share of views at 65%. Viewing time is predicted to reach 25 hours a week by 2020, which is up 180% from 2010.

A phenomenal growth in the number of consumers who pay for services-on-demand is noted. Nearly 40% now pay for VOD. This is up 26% from 2012.

Growth in demand for VOD



On-demand viewing



Live and scheduled  
linear viewing

Source: Ericsson ConsumerLab



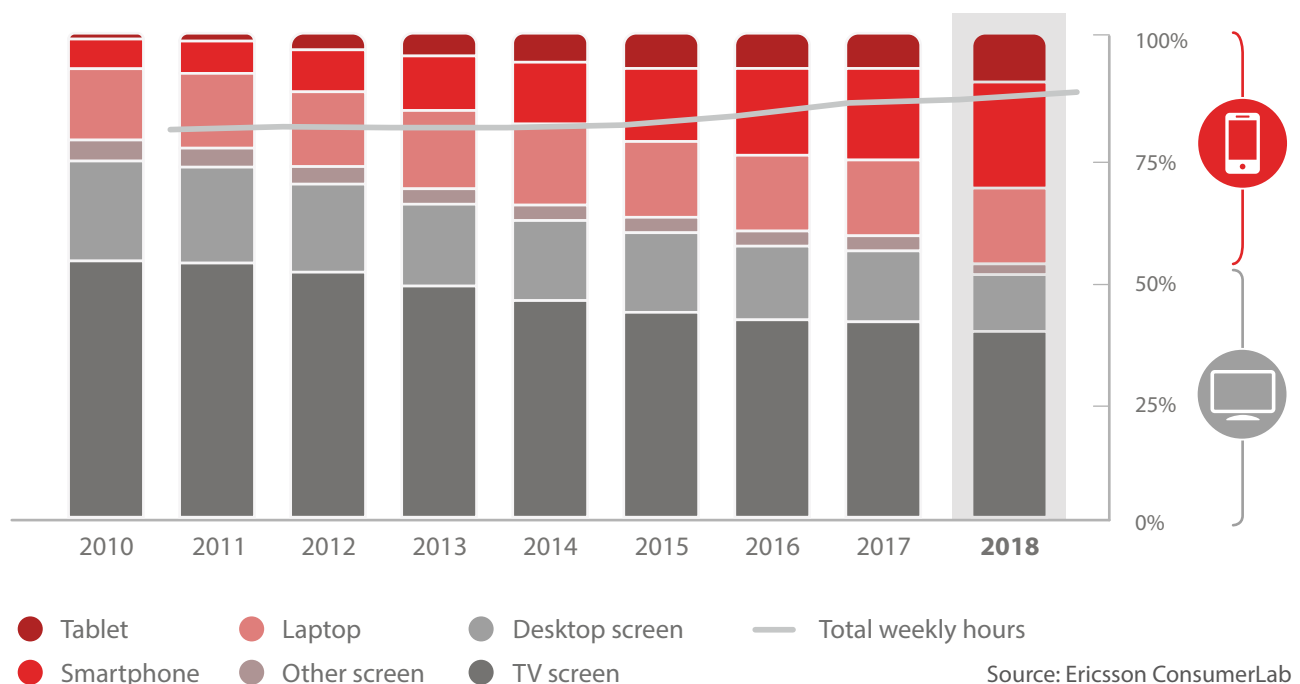
## MOBILE CONSUMPTION GROWTH



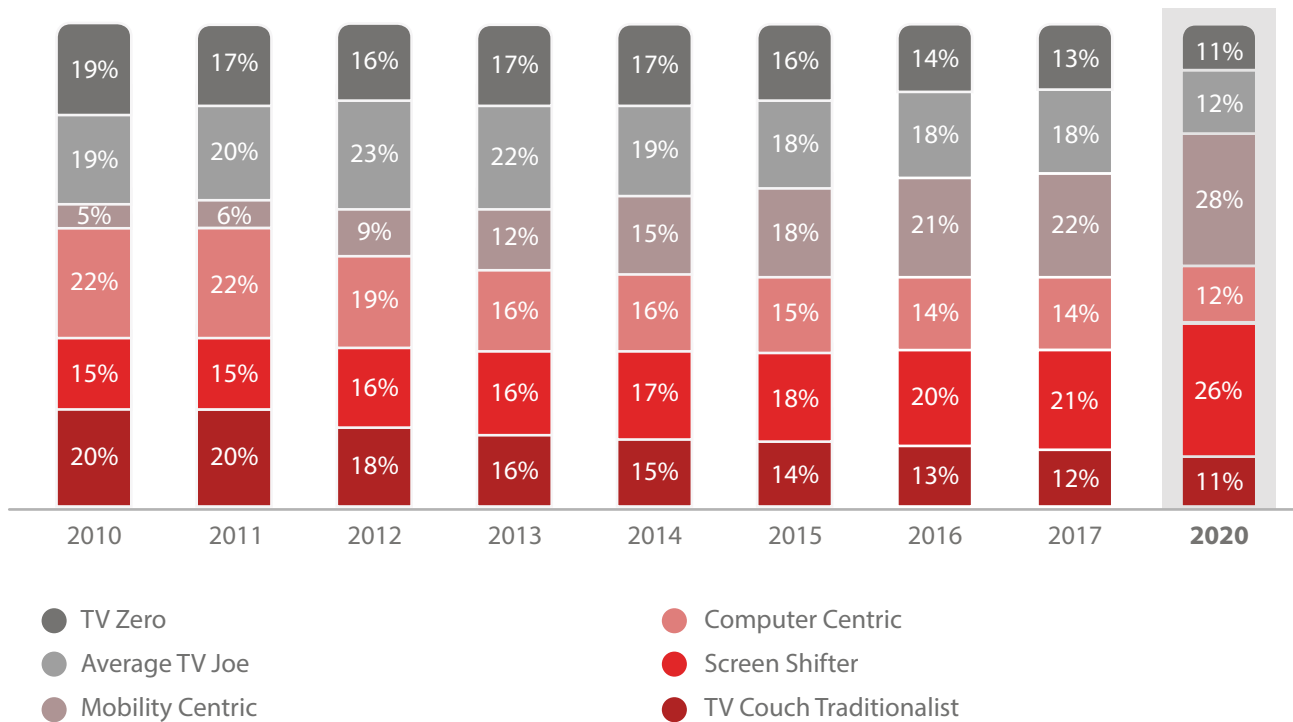
In general, the trend of viewing video content on a mobile screen will survive even after 2020. This means an increased need for content for mobile screens, higher network requirements, as well as new opportunities for monetization. We are also predicting that the majority of all consumers will consist of those who watch videos on a mobile screen or use a variety of devices.

Both scheduled linear TV and VOD might gain from this switch if they adapt their business models to serve mobile access.

Change in device preferences and viewing time per week



## Change in the number of TV service users by groups



Source: Ericsson ConsumerLab

## VIRTUAL REALITY

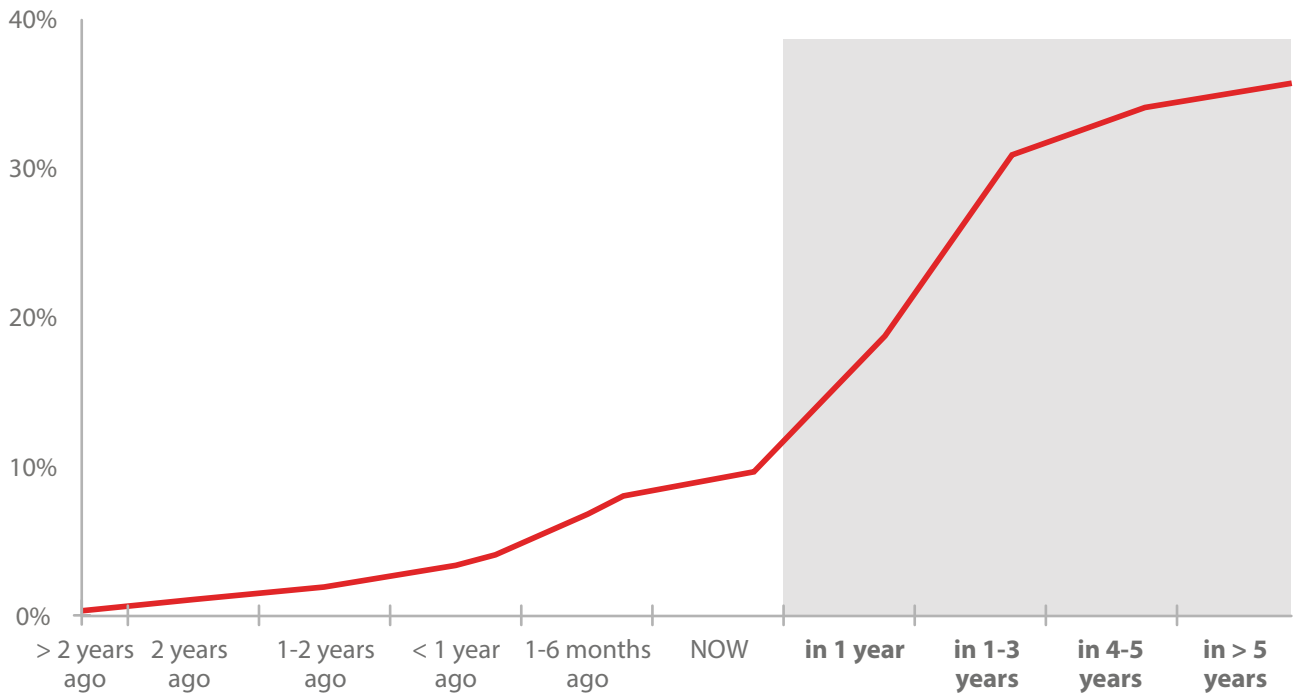
The growth of individual viewing due to active development of personal screens and VOD views may stop due to the capabilities of VR. Already now 2 in 5 VR users watch videos together with other people on virtual couches all over the world.

Most prospective VR users today think that VR will become an important element of TV and video in the future, whereas forecasts suggest that a third of consumers will become VR users by 2020.





## Predicted VR consumption growth



Source: Ericsson ConsumerLab

Despite the fact that VR devices are mainly bound to today's games, 30% of users say they are going to use VR for watching TV and videos in five-years time. Virtual reality completely changes the perception of a video: now friends can watch TV together in a VR living room; enjoy a football match or a music concert together with other fans on a VR arena as if they were actually there. All viewers can watch videos anywhere.

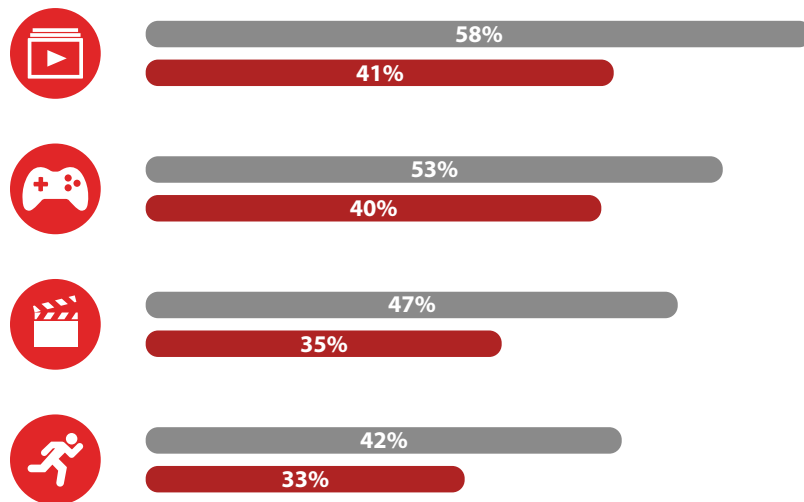


Over 40% of consumers reported they were going to use VR for watching exciting movies on a regular basis. More than a third want to watch sports events and music concerts online on a regular basis.

Prospective VR users believe that the technology will offer another benefit — an opportunity to watch 4K/UHD content without a large physical screen. Nearly half the respondents say they will use VR for this.

Expectations of the first VR users are relatively high — nearly 60% of them think VR is going to become a fundamental part of TV and video in the next 5 years.

## VR use distribution



Movies and TV programs



Gaming



Other video content



Sports



Alone in VR



Together with others in VR

Source: Ericsson ConsumerLab

A third of those who are planning to buy VR headsets claim they will start using the technology in less than a year. 50% think that VR is going to dominate within the next 3 years. Current VR users generally think that the use of VR will grow even more in the next few years.

If consumer interest in VR grows, several aspects will surely change in the market, including these:



55% of consumers who are planning to buy VR headsets would prefer headsets to be cheaper;



Nearly half the respondents think content should be more exciting;



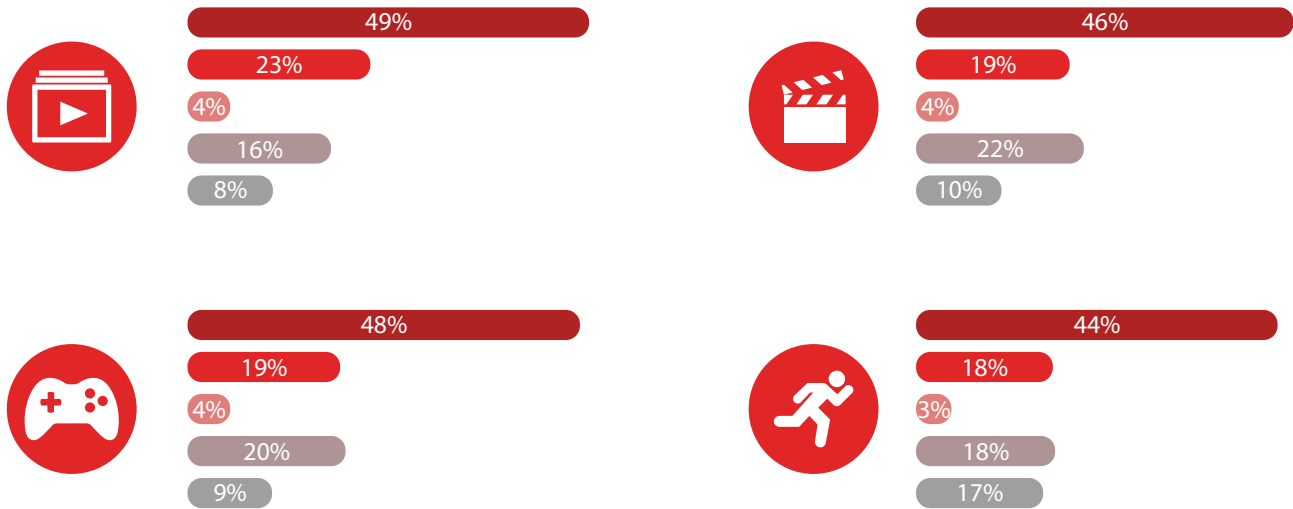
A third of respondents would be interested in VR if they could get a VR set from their TV provider.

There are other commonly known general barriers to VR: cumbersome headsets, low definition on cheap devices, and isolation from the physical world.

However, even considering these problems, it is not hard to believe that VR is going to completely change the rules of viewing and creating new content.



## How users see changes in VR consumption



Movies and TV programs



Gaming



Other video content



Sports



Will increase



Will reduce or stop



Never used, no intention to start



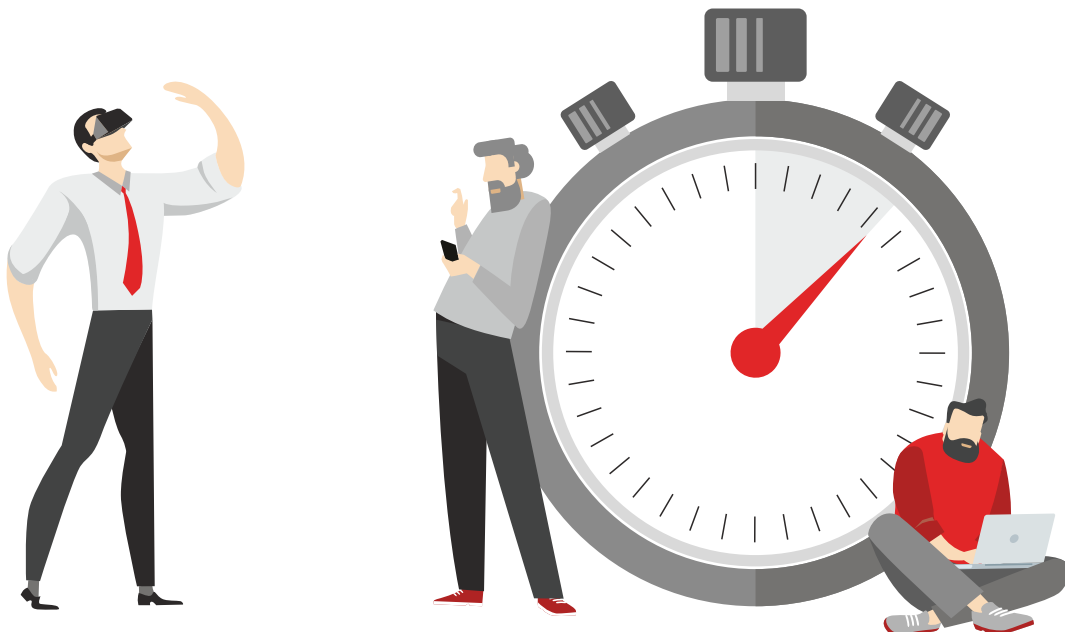
Will use at the same level



Have already stopped

Source: Ericsson ConsumerLab

Despite all the predictions, it is difficult to foresee what the years to come will bring — the world of technology is extremely dynamic. What's more important, user needs change instantly, while users become more and more picky and choosy in terms of both technology and content.



# THE INSIDE STORY: TIPS FOR SUCCESSFULLY MANAGING A SALES DEPARTMENT

How can you satisfy and keep your customers?  
Useful tips in an interview with Andrey Gavrushenko,  
Head of Sales at Infomir.

Interviewed by Maria Kovalenko



Continuing the topic of customer service from our previous issue, we talked to those who know our customers better than anyone else — sales managers and their immediate supervisor Andrey Gavrushenko.

**The price you pay for poor customer communications can be quite high. But, do you know you can turn these mistakes into a windfall? We've made many a wrong turn while building customer relations. But as a result, we have gained priceless experience and have built our own communications strategy, which we would like to share.**



Andrey Gavrushenko,  
Head of Sales  
Infomir

## What's the first thing a good manager should remember?

You aren't selling a product. You are selling a solution to a problem. What this means is that your product is not your customer's main goal. Their main goal is the qualities and tools your product possesses. Can they solve the customer's current problem?

Focusing on your customers' problems is the only way you can help solve them. But to do this, you need to be an expert in your field.

Your goal is to become a valuable specialist who adds to the company, rather than a mere sales manager. It is very important to be the person customers call as soon as they detect a problem.

This is a sign of trust — a key aspect of efficient communication.

## How do you interact with the outside world?

A manager's main tool for interacting with the outside world is a Customer Relationship Management (CRM) system.

Our system assigns tasks that are intuitive for all employees at every stage of customer relations, whether they are dealing with a new or regular customer.

When employees work with tasks, they are able to stay focused and the department manager can easily monitor their work.



Every day managers stay totally immersed in customer communication and company news. What insights into internal and external communication can you share with us?

### 1. Let me begin with the “golden rules” of our job:



Never forget about the customer. Never let the customer forget about you.



Care about the customers and they will care about you.



Remember: if you stop moving forward you will lag behind.

### 2. Use all available means of communication.

Our customers, for example, can choose Skype, telephone calls, or traditional e-mails.



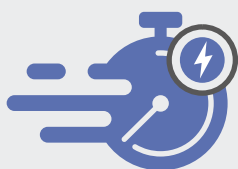
#### IMPORTANT: Don't change the e-mail subject

When you are corresponding with a customer by e-mail, don't change the subject line. It's convenient for people to read through the entire correspondence history by selecting Filter by Subject. Change just one character in the subject and the e-mail will be lost.



#### IMPORTANT: Short summary after a Skype conversation

After talking on Skype with your customer, e-mail them a short summary of your conversation. That way this information will be kept in the correspondence history and won't be lost.



#### IMPORTANT: Quick Replies

Reply to customers' e-mails quickly — ideally, in an hour or two. If the reply requires more time, still e-mail the customer. Confirm that you received their e-mail and let them know the anticipated reply time.

After talking on Skype with your customer, e-mail them a short summary of your conversation. That way this information will be kept in the correspondence history and won't be lost.

### 3. Collect customer information from open sources or social networking sites.

All details are important — the company, its business area and market presence, projects the company is engaged in, its partners, and future prospects.

With this, you can create the customer profile, so you won't need to bother the customer with unnecessary questions.

The information you find will certainly not be exhaustive, but it will help you evaluate the customer's needs at an early stage. This will improve your communication with the client, because you need to talk in a language he understands.



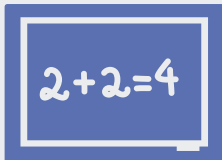
For example, our customers include huge nation-wide telecommunications companies, regional and municipal telecommunications providers, smaller local providers, nation-wide distributors and smaller businesses, equipment installers, content developers and distributors, content integrators, etc.

Naturally, all of them speak different languages and use different approaches to monetizing their business. So it is up to us to seek paths for fruitful cooperation.

#### 4. Introduce the customer to your company.

The information that is collected is transferred to customer service managers. Anyone who works with us knows their names — Yekaterina Shvets, Nikolay Cherny, and Andrey Stefishin. They are some of the first people our prospective customers talk to.

They are communication professionals with invaluable experience. They take customers by the hand and introduce them to the company. They help customers overcome any difficulties they might have with selecting the appropriate product. They explain how technical support and after-sales services work. They provide support to the customer at all stages of order placement and accompany them until they get the final product. They value and respect every customer.



##### **IMPORTANT: Fifth Grade Customer**

Treat the customer like a child who understands little about your job. Remember that what is obvious to you may not be obvious to the customer. Explain every detail and try not to use industry slang.



##### **IMPORTANT: Emotional Control**

If the customer begins to use insulting language, don't be rude. Instead, think about why they might be behaving like this and do what you can to alleviate the situation. When communicating with customers, don't let your emotions prevail over common sense.



##### **IMPORTANT: Talk to the customer like to a friend**

It isn't effective to speak too formally or use long, complex sentences. A communication style like this just pushes customers away because it's difficult to understand. Try simple phrases and short sentences, stick to the point, and add a little humor. Be respectful but not too familiar.



## 5. Build a solid relationship with the customer.

Later on the customers will be served by Customer Care Service. Customer Care Service employees symbolize the company's stability by caring about every customer.

If you receive an e-mail from your colleague in which they are handing their customer over to you, you need to study the entire correspondence history and keep the customer from noticing that their project is now being managed by someone else. Make sure your e-mail contains a full and exhaustive history too that will help the other manager to continue the relationship with the customer.

Igor Rabadzhy, Senior Account Manager



They provide personalized services to our regular customers. Irina Kondratyuk, Pavel Sluka, Gleb Kosmakov, and Igor Rabadzhy are always ready to support our customers. They are the ones who become regular contacts when customer problems need to be solved.



When reading through a customer's e-mail, always try to anticipate the next question and answer it. There are two benefits in doing this. First, fewer e-mails are needed, and second, the customer thinks "Wow! These guys really get me!". Do unto your customers as you would have other services do unto you.

Pavel Sluka, Key Account Manager

## It must have taken a long time to get to where you are today. How did this all start?

I was there at the inception of Infomir's Sales Department. From the beginning it was our goal to go global. We only had two products at our disposal: MAG200 and Stalker Middleware.

This is how we started conquering the market.

After a year, our team had already grown to four people. One of them eventually left, but the other three are still with us: Egor Malarov, who is now a Business Development Manager and leader of our office in the UAE; Andrey Stefishin; and Irina Kondratyuk. Pavel Sluka, Nikolay Cherny, Yekaterina Shvets, Gleb Kosmakov, Igor Rabadzhy, and our Department Administrator, Yelena Olenich, joined later. It's difficult to overestimate the role of any of them in our company. We are a team — this is what matters most.

We've had a lot of firsts — international exhibitions, new products, multi-million-dollar contracts, and of course, failures. The one thing that is still motivating us today is «a happy customer».

If we draw an analogy with sports (all of us are involved in some sport — karate, football, weight training), I would compare our team's work with a survival game. There's no task we can't handle.

There's no initiative we can't snatch. Each player is unique and pro-active. If a player can't get it right for whatever reason, the team will always give him/her a helping hand.

We aim to be like an investment bank for our customers — just as reliable, stable, and service-oriented, bringing them big returns on their investment.

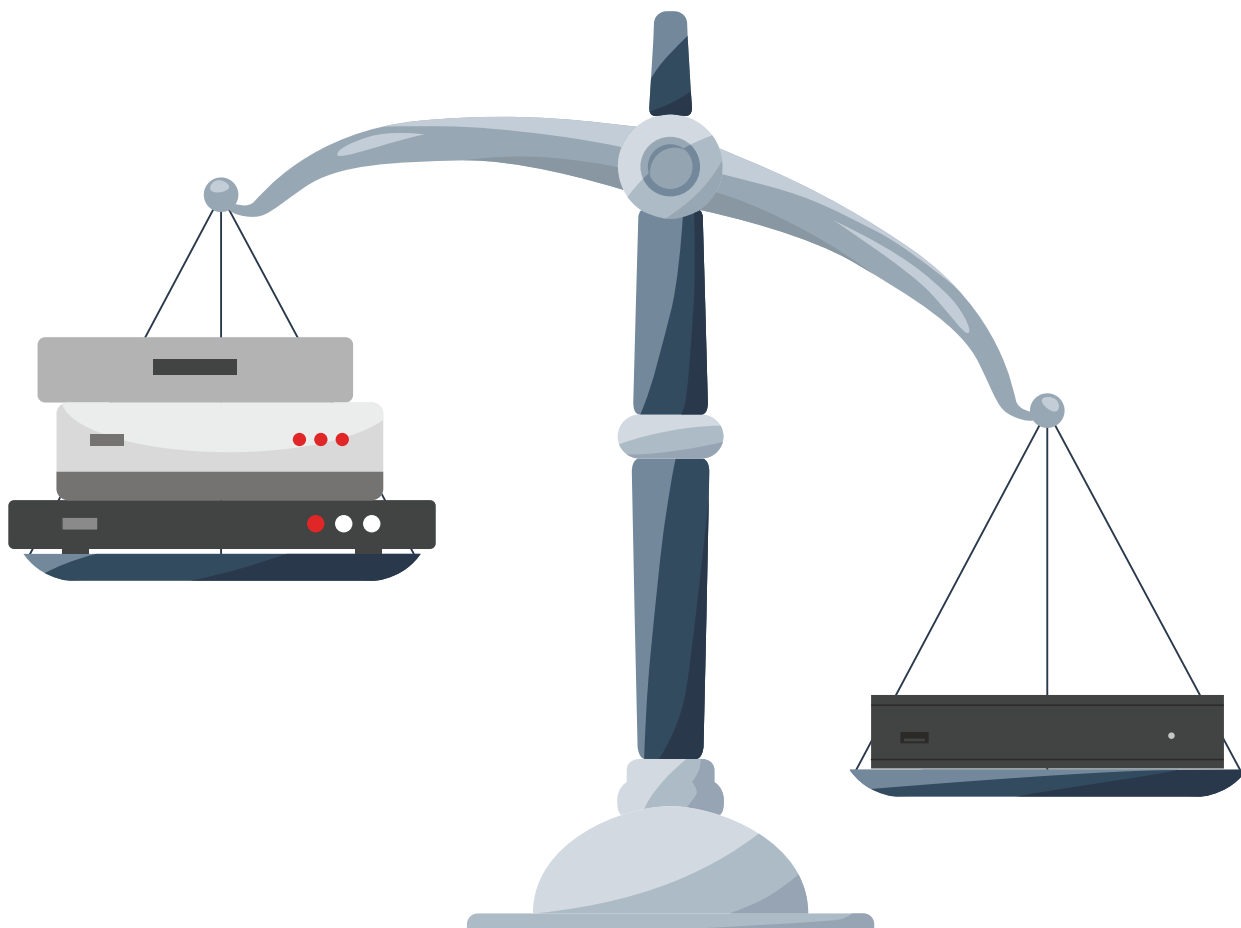


\*Faster, higher, stronger!

# HOW NOT TO PAY TWICE

What should you look at when choosing an IPTV/OTT set-top box? What are the key parameters and features? Do you save money when buying a low-end market product? Together, let's find the answers to these and other questions of the day.

Author: Denys Gorbunov





# THE Top-8 ASPECTS

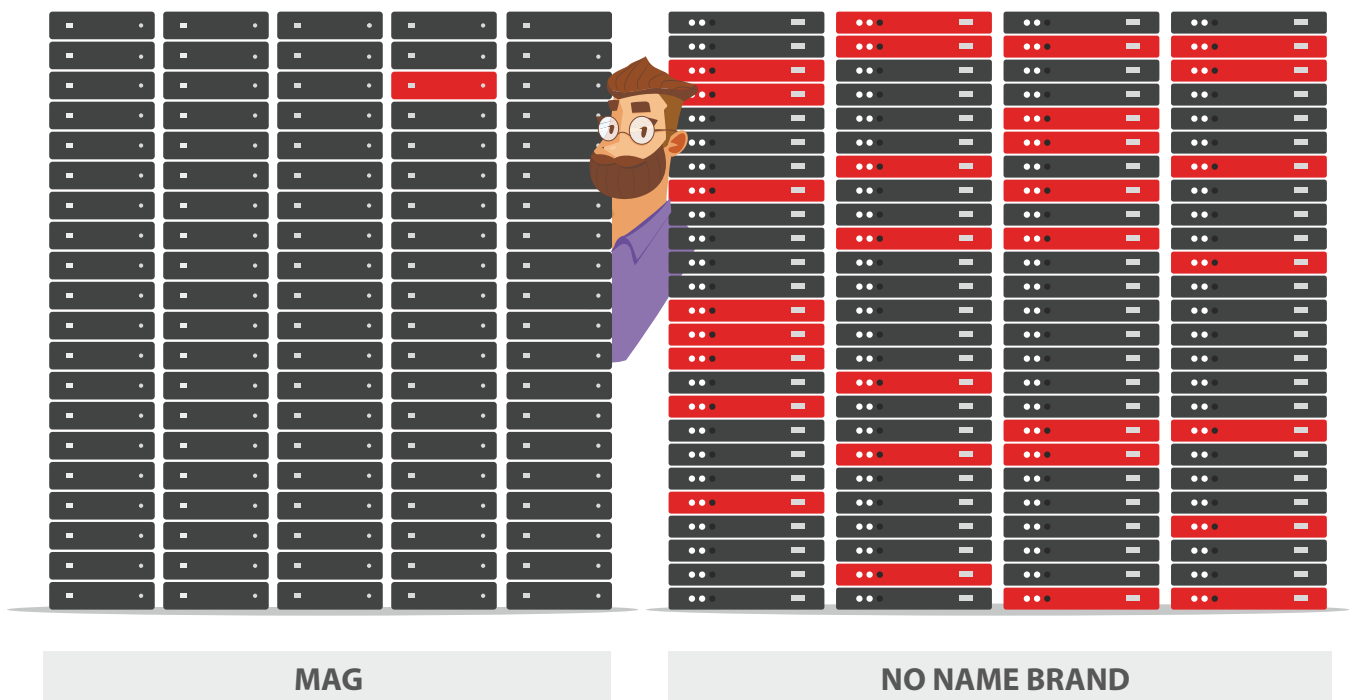
## of Choosing a Set-Top Box



# 01

## QUALITY STANDARDS

As a rule, customers don't differentiate between the quality of service and the quality of a device. When their set-top box breaks down and they can't watch, the only one they will blame is you. The more failed set-top boxes end up in your customers' hands, the busier your tech support team will be, increasing the negative feedback on your company which will reach your prospective customers. When you buy products with a high ratio of defects, you not only pay twice, you also damage your reputation.



MAG defect ratio is less than 1%, whereas No Name Brand defect ratio is up to 30%.



## 02 AFTER-SALES SERVICE

After-sales service has become an integral part of a high-quality service. If sellers don't provide a warranty for their products, this may indicate that these sellers doubt the quality. By agreeing to buy a product without a warranty you are playing a losing game. In this case, saving on the purchase will most likely cause unpredictable loss and surely cast imputations on the reputation of your service. Also to be considered is the fact that the availability of an after-sales service from the manufacturer does not always resolve the problem. Especially when the nearest service center is located somewhere in China and delivery is at your expense.



**MAG**



**NO NAME BRAND**



### Did you know that...?

More than half of all set-top boxes ending up at INFOMIR Service Center are returned to the customer right after a re-flash or replacement of accessories — batteries in the remote control, for example, or a twisted HDMI cable. Set-top boxes undergo a troubleshooting procedure, following which changes in production technology are introduced. This is one of the key ways to improve the quality of every subsequent model.





## 03 TECH SUPPORT

Problems do not, by any means, just amount to failures. A lot of questions arise in the course of setting up and starting to use a set-top box. There is always the option of looking for answers on the Internet; good — if they are out there. However, it is more likely you will spend a lot of time searching for the necessary information. On the other hand, if your partner is a manufacturer with a good tech support team, such problems simply won't arise. Think big! It's not only your money you need to save but also your resources and time. Otherwise, you end up suffering losses in the long run.



### Did you know that...?

We have a dedicated document portal, where tech support specialists regularly post answers to frequently asked questions. This is how we help our customers without needing to contact the tech support team directly, whereby regular request analysis is one of the key channels for future product improvements.



MAG



NO NAME BRAND



## 04 HIGH-QUALITY LOCALIZATION

This is not about localizing a set-top box into dozens of languages. What is important is a thorough localization of default settings into English. This is critical where a set-top box needs to be reset to defaults. In this case, the last thing you want is hieroglyphics (unless that is your native language, of course, or you are a polyglot): You should give preference to a fully localized product. Alternatively, you may have a good Chinese-speaking technical expert in-house, yet we want to help you find a more rational, cost-saving option: the latter is not really one of them.



MAG



NO NAME BRAND

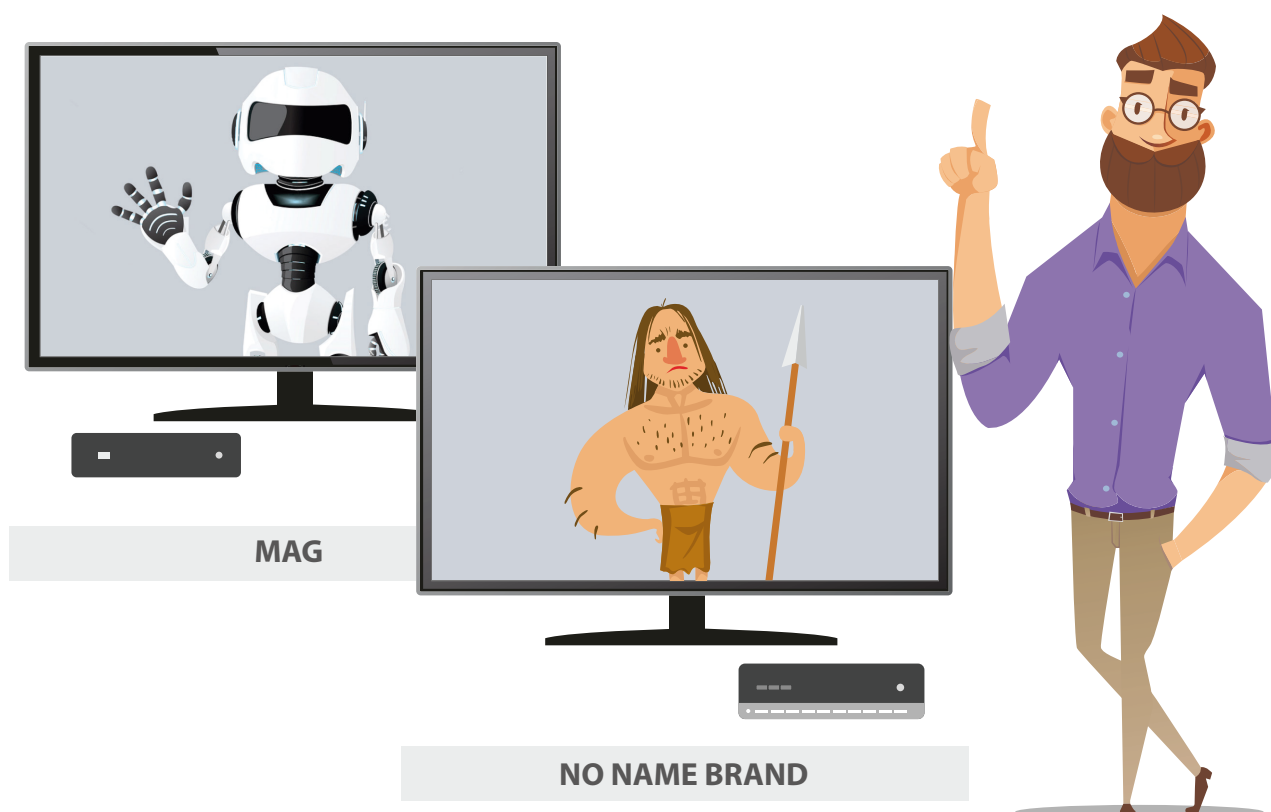






## 05 AVAILABILITY OF OWN SOFTWARE

When organizing an IPTV/OTT business, focus on how to select appropriate middleware. There is a myth, still current, that if you want to save you simply buy a batch of inexpensive set-top boxes and code the software for their integration all by yourself. Please consider that when opting for such an extraneous method the company will have to hire professional developers and then pay for an ever-lasting process of product creation and testing. Nor is it necessarily the case that everything will work properly from the get-go. You might have to modify and improve the product many times over time to cure multiple bugs. No one can say when the problems will end. Are you ready to save on your peace of mind?



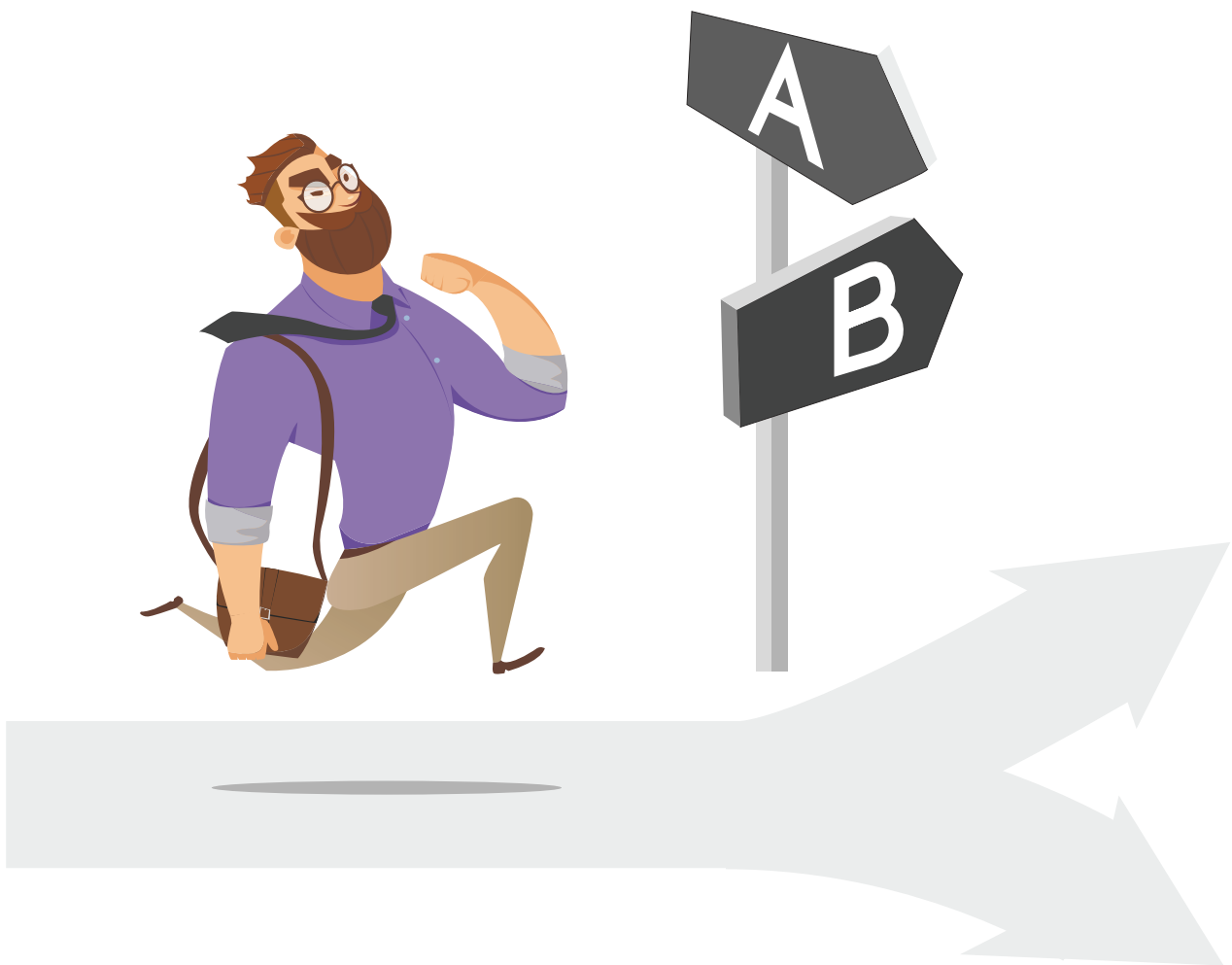
Infomir has own software for MAG set-top boxes, No Name Brand has an old version of our software.



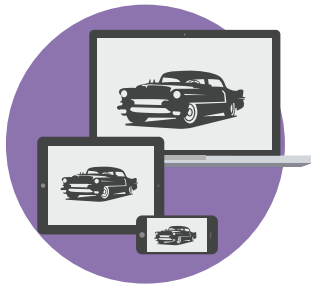
## 06 SOFTWARE AND SET-TOP BOX SYNCHRONIZATION

If we consider how cost-consuming the top 8 factors discussed in this article are, software development and its synchronization with set-top boxes would head the list.

**Who do you think will get better results** — operator A, who bought inexpensive equipment and tried to develop their own middleware, or operator B, who bought a complete, ready-made solution from the manufacturer?



**Correct:** operator B. This is not only true for the IPTV/OTT sphere. Companies spend years achieving perfect synchronization of devices and software. It is hopeless to expect that a few hired developers will be able to equal this result in the short-term or do better.



## 07 MODERN FEATURES

Let's proceed with the software. Do you know what the main difference between licensed and counterfeit software is?

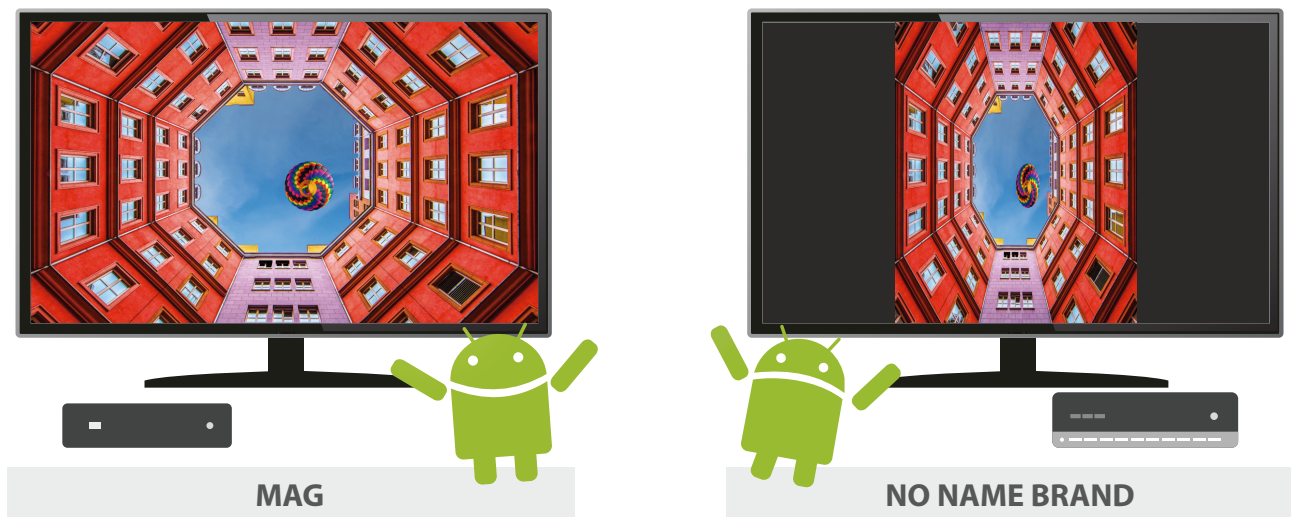
The answer is: "Updates". If you are in the IPTV/OTT business, you understand how important it is for your competitiveness to keep up with the latest technology. Incorporate new trends in a timely fashion to attract your target audience, ready to pay for new developments. Cash customers who buy expensive TV models want a set-top box to meet their needs. Don't disappoint them.





## 08 APP ADAPTATION

This is another factor which may give you and your customers headaches. It refers to operators who opt for a low-end market Android-based set-top box. As a rule, their suppliers use illegal access to Google Play. For this purpose, dishonest manufacturers use access certificates originally designed for mobile devices. As a result, when you watch videos using such applications, image quality worsens. The users will, of course, be annoyed. Guess where they will direct their ire?



The Android-based line of MAG STB's has its own store of licensed applications.

### Some History:

Many European and North American companies faced illegal copying of their products in their time. Copies of the bestseller MAG250, for example, were created by dozens of companies in China. The quality of those copies was significantly worse compared to the original product. Bearing that experience in mind, INFOMIR protects the equally popular MAG254 at the hardware level. As a result, the same dishonest companies were forced to switch to manufacturing low-quality set-top boxes — Android-based this time.



**What is included in the price of a MAG:**

Development



Royalty for technology



Service



Tech support



Security



Development of new models

**In Place of a Conclusion:**

Just like we mentioned at the top of the article — you decide! To conclude, we would like to share a funny story with you. Once, at one of the European online operator forums, someone created a topic for which representatives of various companies, in an informal setting, began fantasizing about the need to create an optimal set-top box for businesses. Guess what they came up with?

Therefore, carefully weigh all the pros and cons before reinventing the wheel, even if, on the face of it, it seems cheaper than buying a one proved over time.

# HEVC

## BETTER, FASTER, STRONGER

How the new compression standard works, where it is used, and how soon it will start to conquer the world.

Written by Anna Novikova



Back in the day, the H.264 standard was a real breakthrough. Its developers managed to gather people who worked with television, IP cameras, and conference calls around one table to develop a technology that would transfer large amounts of data for years to come.

## OUR EXPERTS:



**Anatoly Filatkin,**  
Head of Infomir Tech  
Support Department



**Max Lapshin,**  
CTO at Flussonic

Now that the market is overflowing with UHD TV, and even 4K content is starting to pop up, H.264 is no longer up to the challenge. We need a solution that can compress and distribute ultra HD video with maximum quality through channels that are not yet ready for such loads.

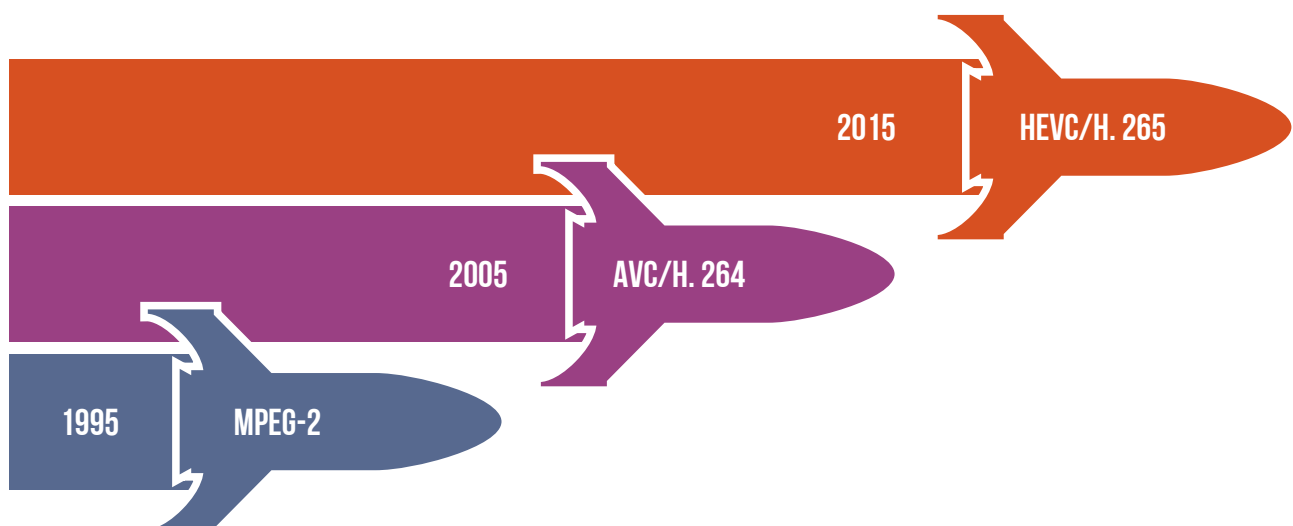
This solution has been called H.265 or HEVC, and was first introduced to the general public at MWC 2012 by Qualcomm.

The standard proved to be incredibly efficient even at that time:

H.265 video achieves a

**40 to 50%**

better video compression ratio than  
H.264 video.



In today's article we will explain how the developers managed to achieve such impressive results without compromising quality.

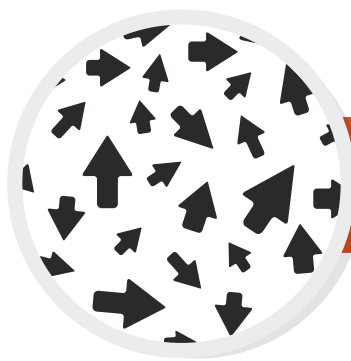
**Let's start with the basics...**

## HOW DOES **COMPRESSION** WORK?

To understand how most compression algorithms work, let's take the example of packing a suitcase.

When it gets too heavy, we take out any unnecessary things.

The same is true for video — the fewer repeated and unimportant elements it has, the easier it is to carry.



### 1 Entropy Coding

Imagine the following situation: you flipped a coin ten times and got heads every time. If you try to tell someone about it, you probably won't repeat the word "head" over and over. You will probably just say "I got heads 10 times." The meaning is the same, you just compressed it.

Information is just like that coin, but instead of heads and tails, you have ones and zeros.

```
0010010010010010010010010
0100100100100100100100100
1001001001001001001001001
0010010010010010010010010
0100100100100100100100100
```

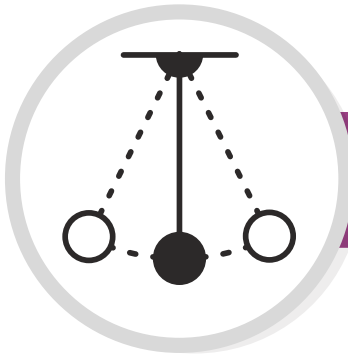


repeat (001)

This means that any ordered sequence can be grouped like this until there are no more data blocks left that can be compressed further. Or to say it another way, until the sequence of zeros and ones becomes absolutely random. This is why this type of coding has been named Entropy Coding.

It should be mentioned, though, that the information itself is not affected. We only transform how it is represented and reduce the redundancy.





## 2 Frequency Decomposition

Anyone who is at least a little bit familiar with Computer Science knows its main principle — data received in the form of zeros and ones can be converted into any other system, whether decimal, hexadecimal or even alphabetic.

A 2D image is also a particular type of data that can be converted from one coordinate system to another.

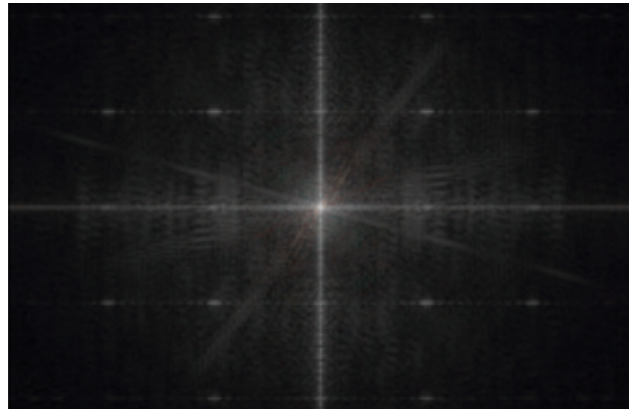
For example, we are used to viewing an image in X-Y coordinates (length-width). This type of representation is called a spatial domain. The value of each pixel in it is based on its position.

We can convert this image into a frequency domain, where we don't evaluate the position of pixels, but rather how their value changes relative to the neighboring ones. The higher the contrast of the areas, the higher their coordinate is on freqX-freqY axes.

This is how the same image looks when converted from the X-Y system to freqX-freqY.



Spatial Domain



Frequency Domain

In the frequency domain we can divide all image components into two groups.



**Low-frequency** components are located nearer to the center of our matrix. They are responsible for homogenous areas with gradual luma and chroma transitions.

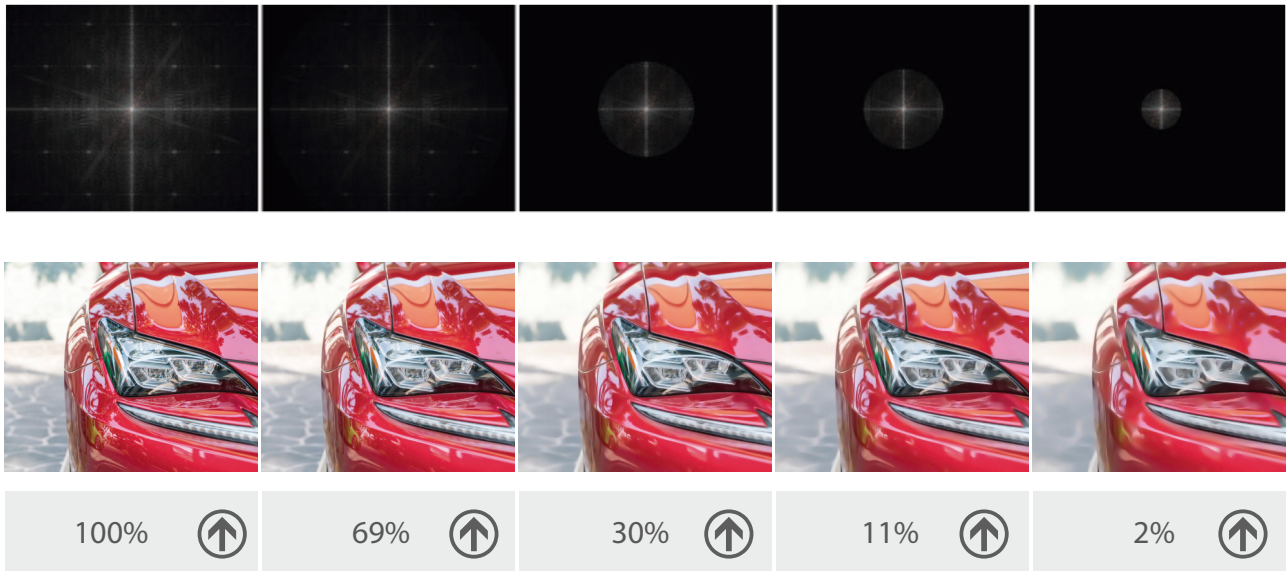


**High-frequency** ones are located closer to the edges. These include all contours, razor edges, and fine details.

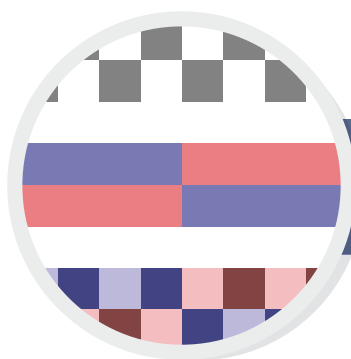
After this transformation, we can simply crop the edges of our matrix, or in other words, mask it. When we convert the image to the usual form, it will lose some details, but in general will remain similar to the original one.

When we select the necessary mask size and form, we can control these losses and the degree to which the final file is compressed.

Below is the same car, but now circular masks are applied to it.



The percentage shows the size of the received image as compared to the original.



### 3 Chroma Subsampling

When an image is transmitted to a TV screen, the RGB color scheme is converted into YCbCr, where Y is the luma component and Cb and Cr are the blue and red components of the color scheme, or chroma components.



### What's this all for?

A human eye can perceive even the smallest fluctuations in brightness, but it isn't as good at recognizing shades. Therefore, if we transmit luma information in full resolution, and the color component in reduced resolution, no one will notice, and bandwidth is reduced.

Coding a signal in Y'CbCr reduces the data volume almost by half.

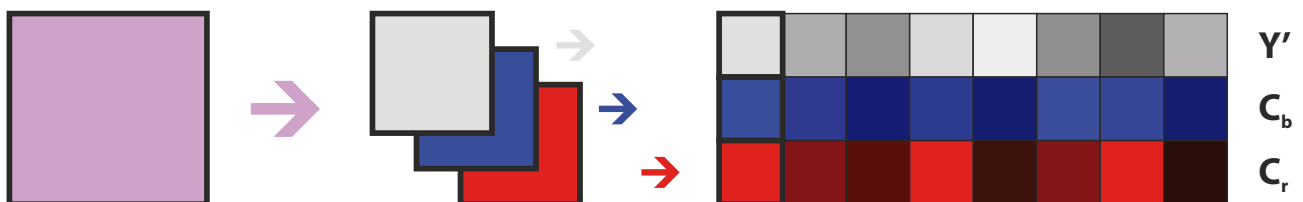
Another reason for adopting this standard is that in the past, it was used to transmit images to color and black-and-white TVs at the same time



There are several chroma subsampling methods. Each of them is designated by a numeric code that describes chroma resolution (2nd and 3rd) relative to luma resolution (1st).

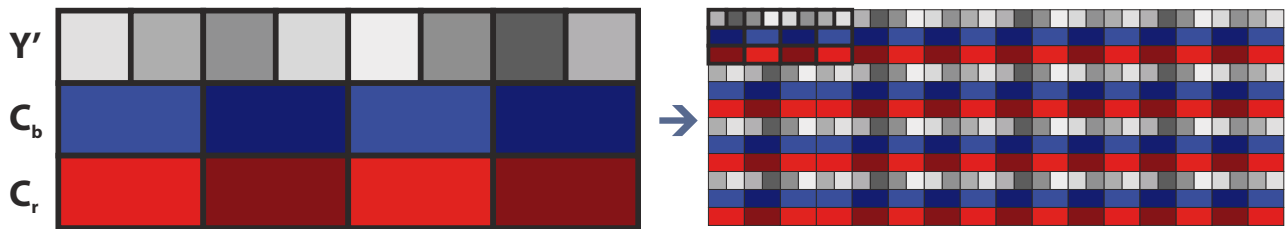
## 4:4:4 (YUV) FORMAT

The colored dot consists of luma (Y') and chroma (Cr and Cb) components.



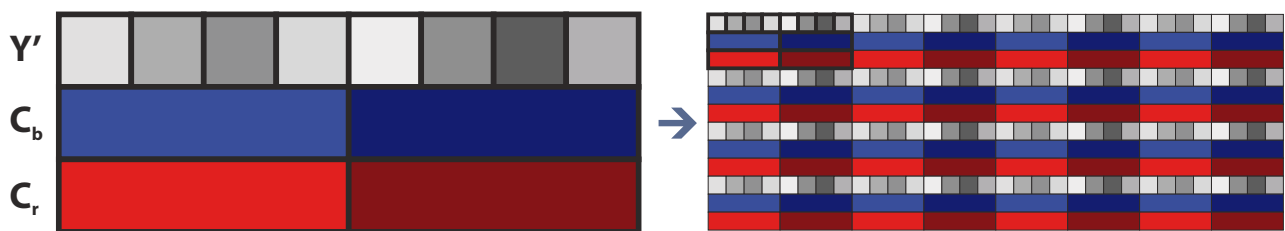
In this case, there are four components of each color for every four luma components. This is how non-compressed RGB images are usually represented. Theoretically, the 4:4:4 formula can be used in Y'CbCr, but there is no practical need for using this format.

## 4:2:2 (YUY2) FORMAT



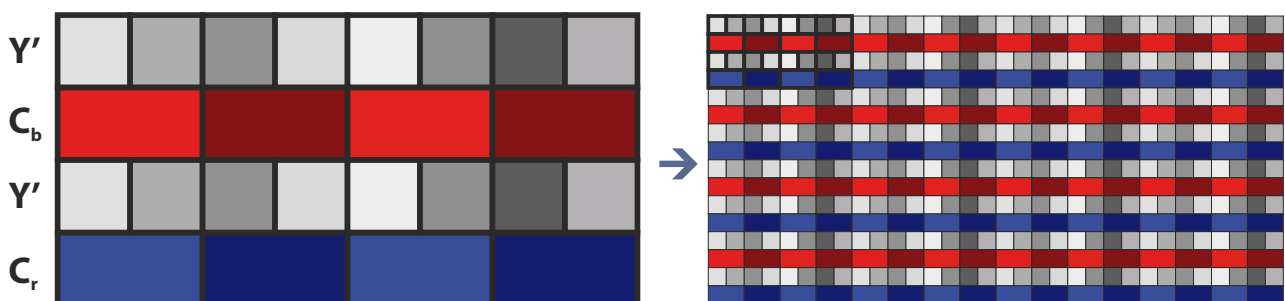
The ratio of luma resolution to chroma resolution is 4:2. This is the traditional broadcasting format used by DigiBeta, DVCpro50, and others.

## 4:1:1 (YV12) FORMAT



The ratio of chroma component resolution to luma is reduced by a factor of 4. This system is used in NTSC DV and PAL DVCPro.

## 4:2:0 (YV12) FORMAT



4:2:0 is a rather complicated method that has several variations. Component resolution depends on whether interlaced or frame scanning is used. It is often used for transmitting H264 via the Internet, PAL DV, MPEG2, and various software solutions.



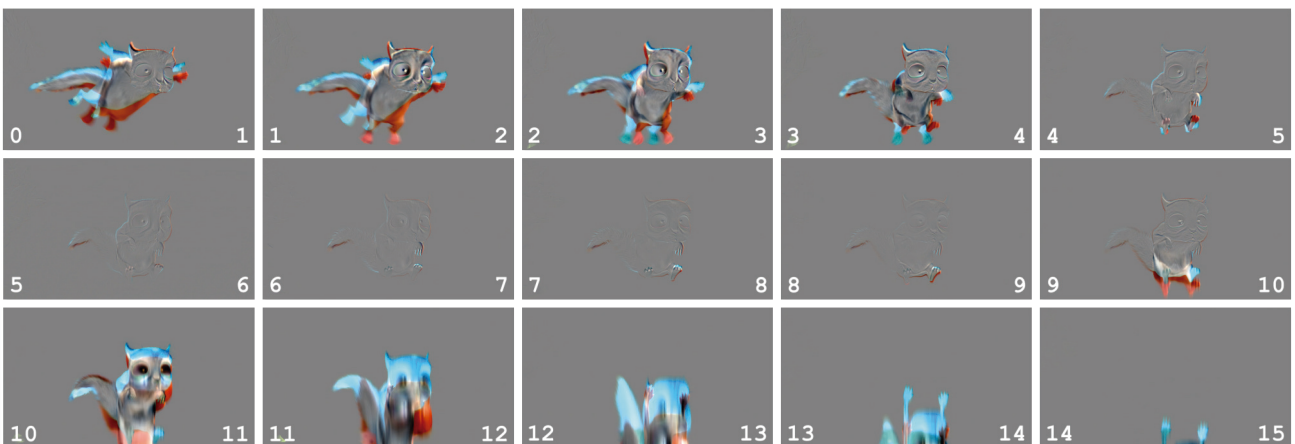
## 4 Motion Compensation

In almost any video, each frame is similar to the previous one. They have a common, nearly static background, and only some objects move relative to others. It seems quite natural to want to code only those elements that change, but not the ones that stay the same.

This example illustrates how similar all the subsequent frames are.



Here are examples of frame-to-frame difference showing you how few pixels actually change.

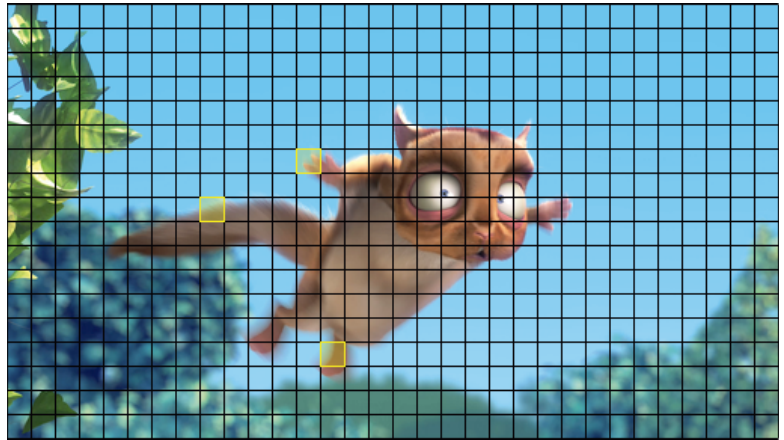




## HOW DOES THE ALGORITHM WORK?

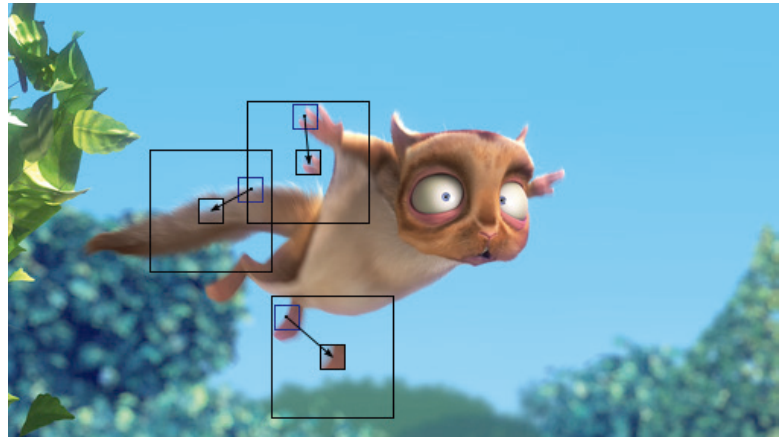
1

A frame is divided into blocks (for instance, 16×16).



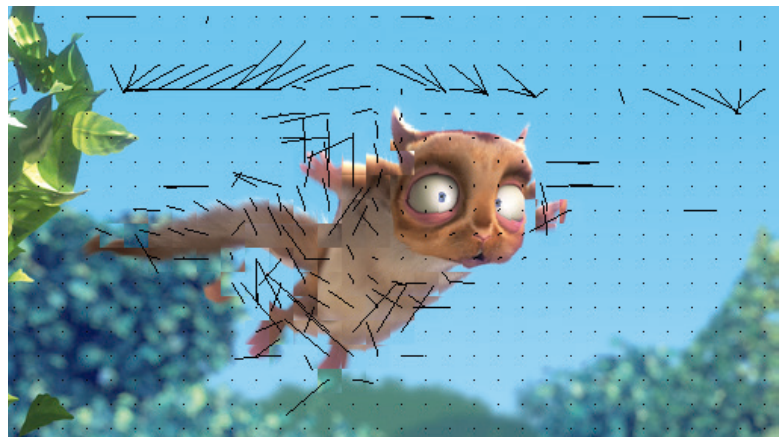
2

For each individual block, analysis the neighboring blocks is carried out to detect the most similar area on the previous frame.



3

As a result of the scan, we obtain a set of vectors that describes the blocks' "motion" between the frames. Using this, a compensated frame is created that consists entirely of the blocks of the previous frame that moved.



The last Figure shows a compensated frame with motion vectors for each block (dots are blocks that didn't change). You can see how similar it is to the original. With a high frame rate, our eyes don't notice any inaccuracies or angularities.

## H.265 VERSUS H.264

The above principles underlie both algorithms. So why does an H.265 coded video of maximum quality take up to 40-50 percent less bandwidth than the same H.264 video? What's more, the technology supports resolutions up to 8K and 10-bit color coding.

Such an impressive leap in efficiency has become possible due to three key structural improvements:



### 1. Clean Random Access.

Decoding a randomly selected frame does not require decoding previous frames. The H.265 format does not require inserting any intermediate frames (I-frames), which reduces the bit rate of a video.



### 2. Change in maximum block size.

With H.264, the maximum block size is 256 pixels (16x16). But with H.265, it increases 16-fold to 4,096 pixels (64x64), and the algorithm determines the block size automatically.



H.264



H.265



### 3. Parallel decoding.

The new format benefits from the characteristics of multi-core processors. H.265 can calculate different parts of the same frame simultaneously. The processing speed increases by several times.

What is more, H.265 features automatic scanning mode detection. The standard is designed for processing non-interlaced video (up to 120 frames), but has also proven itself to be good with interlaced scanning.

## WHERE IS **HEVC** ALREADY USED?

Most video files you can find on the Internet today are based on H.264. It has dominated the market since the beginning of the decade, is supported by most devices, and has works very well with Full HD. However, with the growing number of UHD TVs and 4K video, it is going to gradually be replaced by its successor.



**Let's have a look at the areas where H.265 is already an established standard rather than a revolutionary innovation.**



### 1. Coding

HEVC is currently supported on many software and hardware encoders like Nvidia NVENC and Intel QSV.

H265 can sometimes be seen on satellite television, IP cameras, and various devices for capturing and coding HDMI (this is especially popular with game streaming when you don't want to increase the load on your computer).





## 2. Broadcasting

You can currently encounter H.265 on IP cameras. Also, there are 30-megabit channels compressed into H.265 on satellites. Little by little, attempts are being made to implement it in various OTT services, where there is device control.

### Compatibility with data communication protocols:

- H.265 has been supported in HLS for a long time. A lot of set-top box and server manufacturers have embedded non-standard H.265 support in HLS; Apple did the same about 3 or 4 years ago and established it in the protocol.
- H.265 has been reliably standardized for transmitting in MPEG-TS for a long time, meaning it can be transmitted through UDP and HTTP.
- H.265 can also be transmitted through RTSP: there is compression in SDP and RTP.
- RTMP protocol does not support the new standard's codec.



## 3. Play Back

The format is gaining popularity especially quickly on set-top boxes and Smart TVs.

The situation with desktop browsers is less promising so far, in fact, only Microsoft Edge is currently able to play H.265.

On modern smartphones, H.265 is likely to be played on the processor, meaning your battery will die before you have finished watching even a short video.



Infomir was one of the first companies to embed HEVC technology in its set-top boxes. Due to this, we can already see the advantages of the standard in real-life examples.



**MAG410** is the first new generation model of economically efficient Android-based UHD set-top boxes. With HEVC, 4K video can be efficiently transmitted through modern fiber-optic networks. The reasonable price makes UHD broadcasting affordable even for smaller operators.



**MAG256** is a high-performance Full HD set-top box. Its H.265 codec allows users to view content in high definition in areas with poor Internet reception.



**MAG324/325** is a great example of high-quality HEVC support by both the hardware and software of a device.

MAG324/325 provides consistent play back of multiple video streams in multi-screen mode.

**Is HEVC going to revolutionize IPTV/OTT services? Probably not. Formats aren't replaced overnight. H.264 will remain an active market player for a long time, but will slowly give way to its logical successor. However, we can say with certainty that the future belongs to H.265. Be ready for it with Infomir!**

## EDITORIAL

BROADVISION magazine is a quarterly online periodical from Infomir's marketing specialists devoted to the IPTV/OTT industry and modern technology. We are happy to present our fourth, end-of-year issue.

This year has been busy and fruitful. Step by step we have been getting the hang of publishing a proper periodical, which is something new for us. We've been improving every issue by filling it with interesting and useful information.

We hope you like reading our magazine just as much as we like working on it. Sign up for our newsletter and share the issue on social networking sites. This is the best way to show us that we are doing the right thing.

Tell us what you would like to see on the pages of BROADVISION next year. E-mail us your suggestions and ideas at **[broadvision@infomir.com](mailto:broadvision@infomir.com)**. Let's grow together!

## PRODUCTION TEAM

### Project manager:



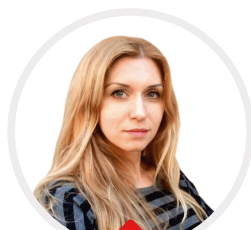
Igor Oklander

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We would like to thank **Victor Artyushchenko, Andrey Gavrushenko, Anatoly Filatkin, Max Lapshin, Pavel Sluka, and Igor Rabadzhy** for sharing their expertise and experience.

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