A "Whitepaper" about the Satellite reception basics and a design guideline for developing hospitality IPTV concepts

Preface

So first of all, if you need to design a new system or want to migrate from traditional SAT-to the rooms from SMATV or CATV to IPTV systems, you need to think about some basics about the reception of Satellite RF Signals and finally the transmission of these Transponder content as TV and Radio streams over IP networks. I am trying to describe this here as easy as possible…

First of all we need to mention that we are describing herein the thematic about Multicast networks because Unicast IPTV distribution has many disadvantages if the average receiver (IPTV client) numbers are exceeding significant numbers of parallel streams through the network.

IPTV streaming uses UDP regardless of losing some packets on its way. In addition to UDP there is RTP, used as a mechanism to 'mark' the right order number or "timestamp" into these packets so that the receiver can re-organize them if necessary – of course that needs extra processing capabilities and buffers while transmitting a 2nd stream on port-number 'even' +1 = 'odd'.

So forget about TCP because this protocol initially was designed for IP-packet transport regardless of the transmission path and <u>not intended</u> to use for streaming. TCP/IP packets can be routed through different hubs and different pathways. Example: You sent an email and its packets can go like: 1st packet via Frankfurt, 2nd packet via Tokio… The receiving Server or client will get these packets almost in non-correct order as they were sent out and will sort it back to the correct order to keep the complete data together and consistent.

Do not mix it up with 'pull' mode IP video watching, which e.g. Youtube / Netflix is using when you click to start streaming a stored video from WebPages. IPTV is continuously linear TV streaming where the client needs to 'jump' into an existing stream provided centralized from a so called Headend. These streams can be organized as P2P (Point to Point - Unicast) or P2MultiP Multicast. Both methods have their own advantages and disadvantages. I.e. Unicast safes bandwidth if the number of clients are low but needs intelligent CPE and Server communication skills, while Multicast outsources this intelligence to the Ethernet switches by "IGMP" usage (almost Layer3 technology – increased cost for Switches).

Please make yourself familiar with the above described abbreviations and the underlying technology since there are a lot of things to consider and you have simply scratched the surface of IPTV. ***Please don't think that you can provide high UHD quality streams over the public Internet w/o appropriate adaptive bitrate technology and a CDN in the background.***

So before you "IPTV":

Please notice, that IPTV is not the cheapest solution comparing to the 'old fashion' and traditional TV and Radio distribution over Coax cables. But synergies can be used simply by calculating cost for long distance copper and parallel installations if anyway a Network distribution system based on Ethernet technology is also planned nowadays. You can safe these parallel cabling and star- based distribution/splitting and amplifying equipment by using the same network – star cables and designs. Please also note, that distributing IPTV via WIFI is not a very good idea. OTT is another topic and differs because of adaptive bitrate-streaming.

We also need to talk about '**REDUNDANCY**' here because a high availability grade is always taken under consideration to nearly 100% serve your clients with IPTV channels. Imagine during a national sport event this particular channel will be disturbed… its annoying for the consumers or guests but signals can be disturbed and it is not a life critical circumstance – only TV entertainment. They are not living on the ISS where minimum 3 redundancy systems are considered for life support.

Frankly speaking: There is no 100% safe and redundant solution even with a high integration with double equipment installed. The complete signal chain from the TV-Studios through their SAT-uplinks via the Satellite itself and down again to all SAT receivers must be covered as full redundancy system and there are almost not two independent and automatic redundancy switched Satellites in the orbit which can do that! Than in the Headend -> IPTV the developers often only consider such methods like N+1 redundancy. This causes interruptions at all. The Network monitoring and managing systems based on SNMP (like eg. NAGIOS) would need to be programmed to switch complete configurations (in- and outputs) from a failing N receiver or module (we will talk about modular systems here also later on) so load their failing configs into a spare '+1' module (or receiver) from a standby into a hot environment. Of course this takes time and will not be possible in light speed time intervals. Also in opposite the recovering of a former failed receiver to again a running hot state has the same interruption periods to consider and needs extensive programming and thresholds / intervals to be adjusted. Also what happens if the 2nd receiver will fail in parallel and there is no +1+1 spare?

A more elegant way is the 1+1 automatic redundancy – and it this is a cost argument because you need exactly to double your equipment as a mirror system which in any failure case complete seamlessly switch over from a HOT unit to a SPARE unit by also swapping In- and outputs (Streams and there multicast addresses cannot be double existing in a network) simultaneously. So this method should be considered for the 'most needed' TV channels – the critical ones which are highly demanded with high priorities by the consumers – your clients. Of course in combination with a NMS and SNMP monitoring the failing (like SAT LNB's as the dish farm RF-Input is disturbed by a temporary sand- or thunderstorm) will cause an alarm Trap to your technicians -> So they will be aware immediately that there is a problem and they have to go to the headend searching for the causes and repair them.

So if you -as a system architect- need to consider **redundancy** for your client you need to consider:

- Cost increasing
- Balance between seamless switching and interrupting periods' by external software controlled
- Monitoring and handling
  Securing the full signal pathway or the most critical parts of it like design
  - SAT-dishes and Master-Slave Headend redundant concepts or
  - only Receiver-streamer Backup Solutions
- The Ethernet network redundancy features itself from headend output to the final client STB's (TV sets)
- A power supply redundancy concept is also to be determined if needed or not – like: There is no general UPS battery based system for the whole building – so why should every single Receiver or SAT-MS have a redundant PSU installed? That might be a philosophy based decision as well.

A small note about PAY-TV and streaming:

In general the PAYTV operators have a business model: Selling copyright content to consumer's home STB's or TV sets like Sport events they are paying for the rights to get them, prepare them in their studios and distribute this to their subscribers. Therefore they do not like to lose the control over their content distribution which of course is the case when the DVB-TV streams are decrypted in a Headend and streamed into a network unencrypted. So they have installed business models for hospitality networks selling their content according to the number of rooms in a hotel or hospital by calculating an average usage of this.

Usually they are renting their own or certified STB's with embedded decryption and SMART-Cards for subscription and decryption by the so called Conditional Access Systems. An advanced security is meanwhile done by the so called Conditional Interface (CI-Modules) and further on by TV set fitting CI+ Modules (incl. Smartcards).
Consumer **CI+ Modules are not intended to use in Headend receiver CI-Slots**!

Consumer CAM with max capacity for 2 TV services in parallel

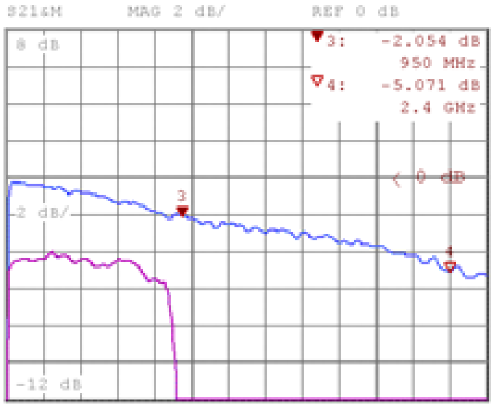
(Imagine a dual Tuner consumer STB/TV set with recording capability: Watch one channel and record a 2nd). **The DVB norm has explicitly excluded HE-Receivers from the CI+ norm & specification**

Headend receivers are using professional **m**ulti**s**ervice **d**ecryption CA-Modules (or CI w/o the '+' modules)!!! Abbreviation to remember: MSD CAM: These prof. ones can decrypt more than 2 TV. These prof. MSD CAMs usually can be obtained only from the PayTV operator for your system with a strict contract for securing their content rights to stay in your network and not being misused.

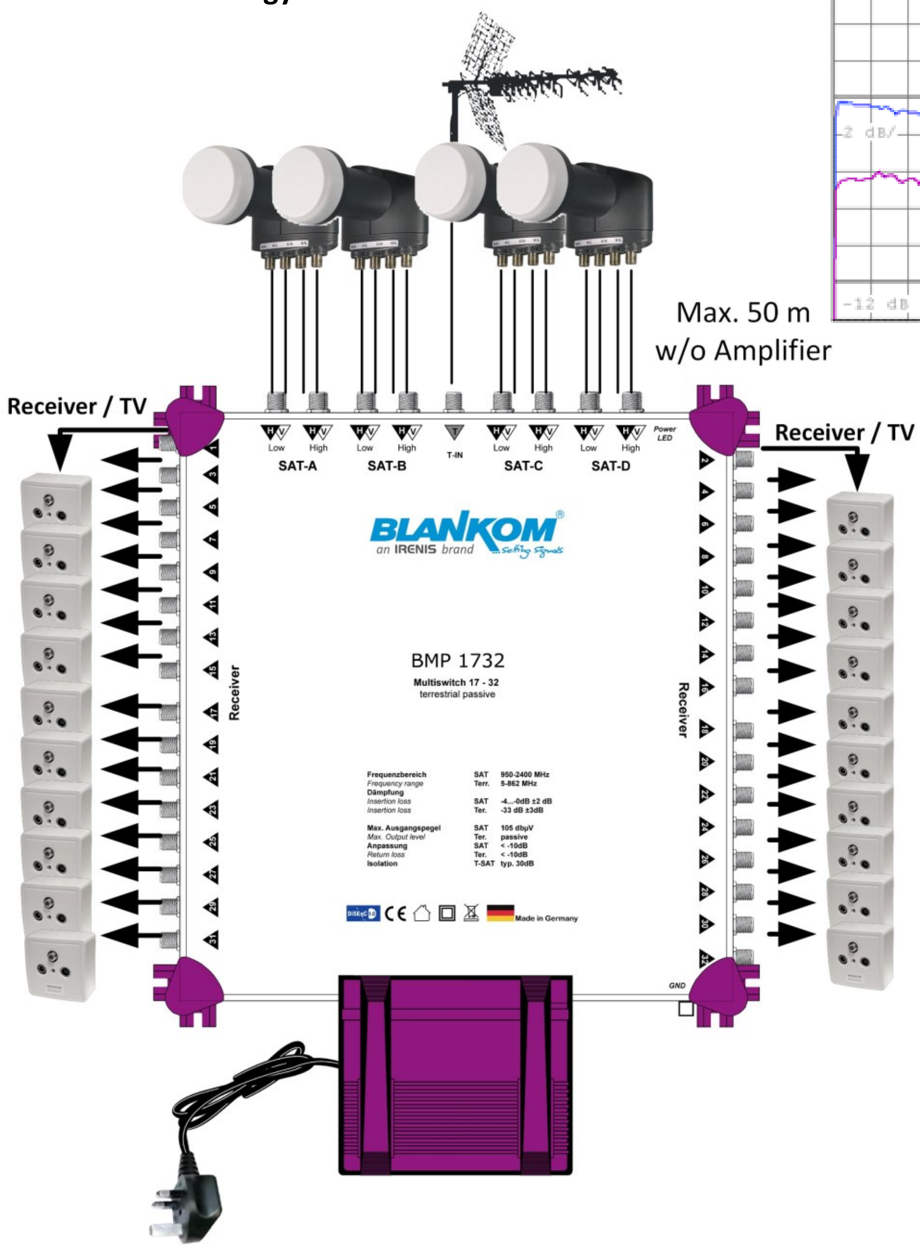
Satellite reception and distribution

Basically we are nowadays talking about DVB (Digital Video Broadcasting) which is based on RF modulation and -demodulation technologies. So the transport medium are electromagnetic waves.
(Remark: Even Ethernet Cable Networks are using RF modulation)
So the world seems to be digital but the transportation isn't.
We do not separate here between DVB-T/T2 over air, DVB-C via cable networks or DVB-S/S2x.

Coax cable has its limitation in length (attenuation and Slope effects). Amplifying this weak and sloped RF Signals is producing noise (S/N C/N) and reduces signal quality each time you do that. In that case, the higher frequencies must be more amplified than the lower ones -> Physical circumstances.
So we recommend to not use that technology anymore or only where the distances are low (i.e. < 50 meter) and the system itself is not that critical like in a household / consumer building with only a few recipients.

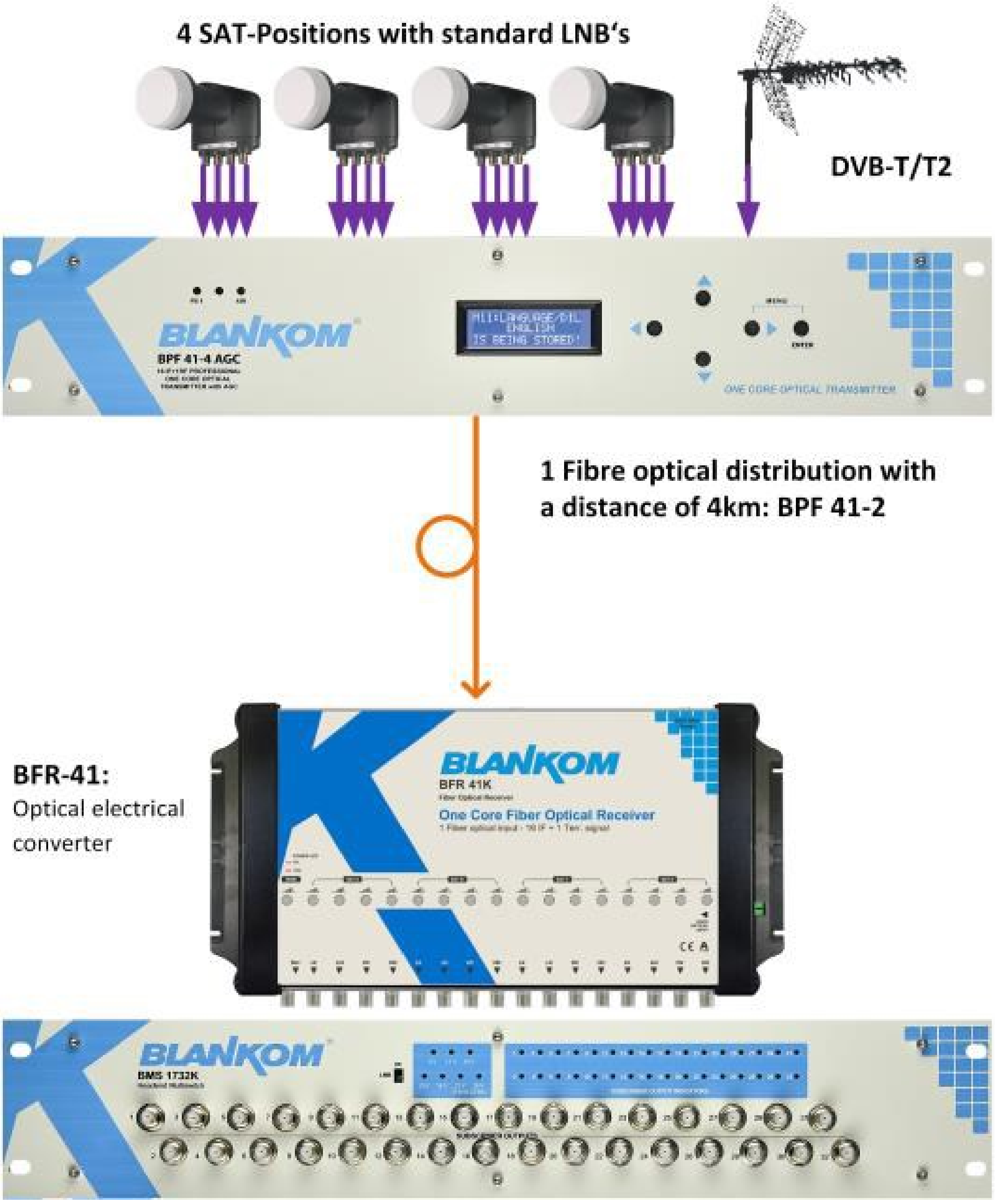


Traditional technology:



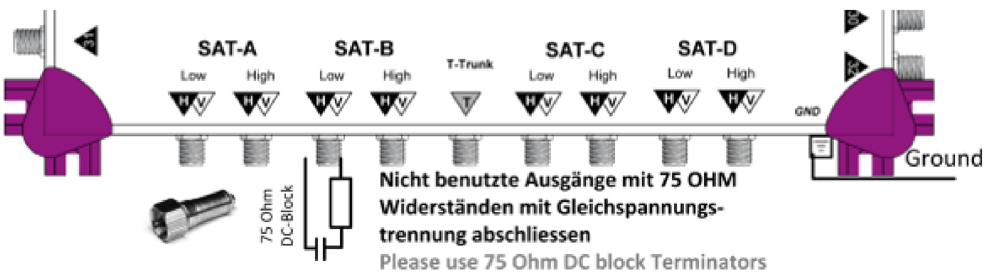
Modern SAT- technology: With fibre SAT-distribution optic systems

One core fibre with 17 CWDM wavelength (**Important:** Single/Mono-Mode fibres = RF)

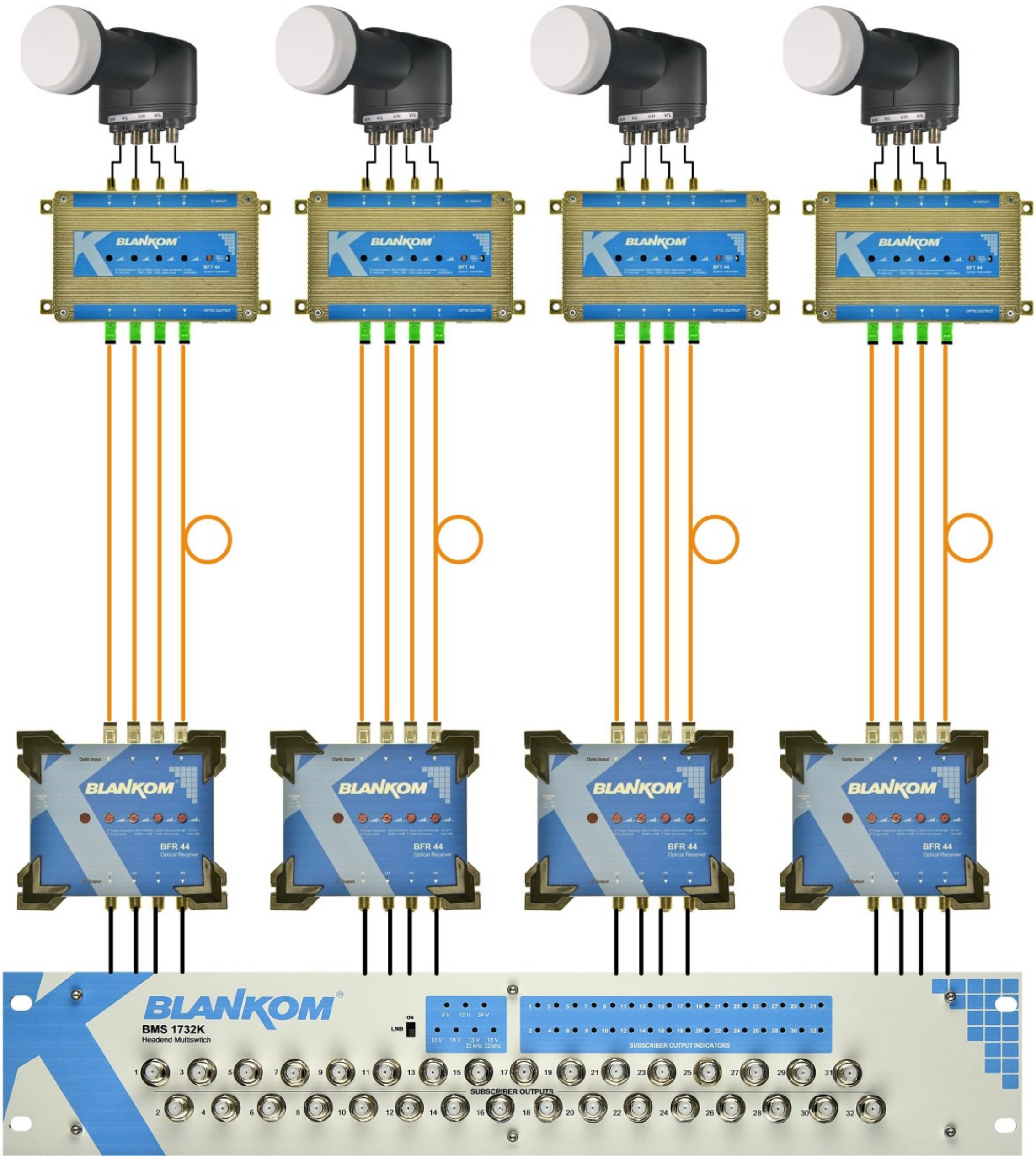


Remark: BFR-41 will be integrated in a 19'' Chassis soon

An important hint: **Cascaded Outputs** (Trunks) **if not in use**, should always be **terminated** by 75 OHM resistors **with DC-Blockers**:



With multiple mono-mode fibres (incl. terrestrial containing):

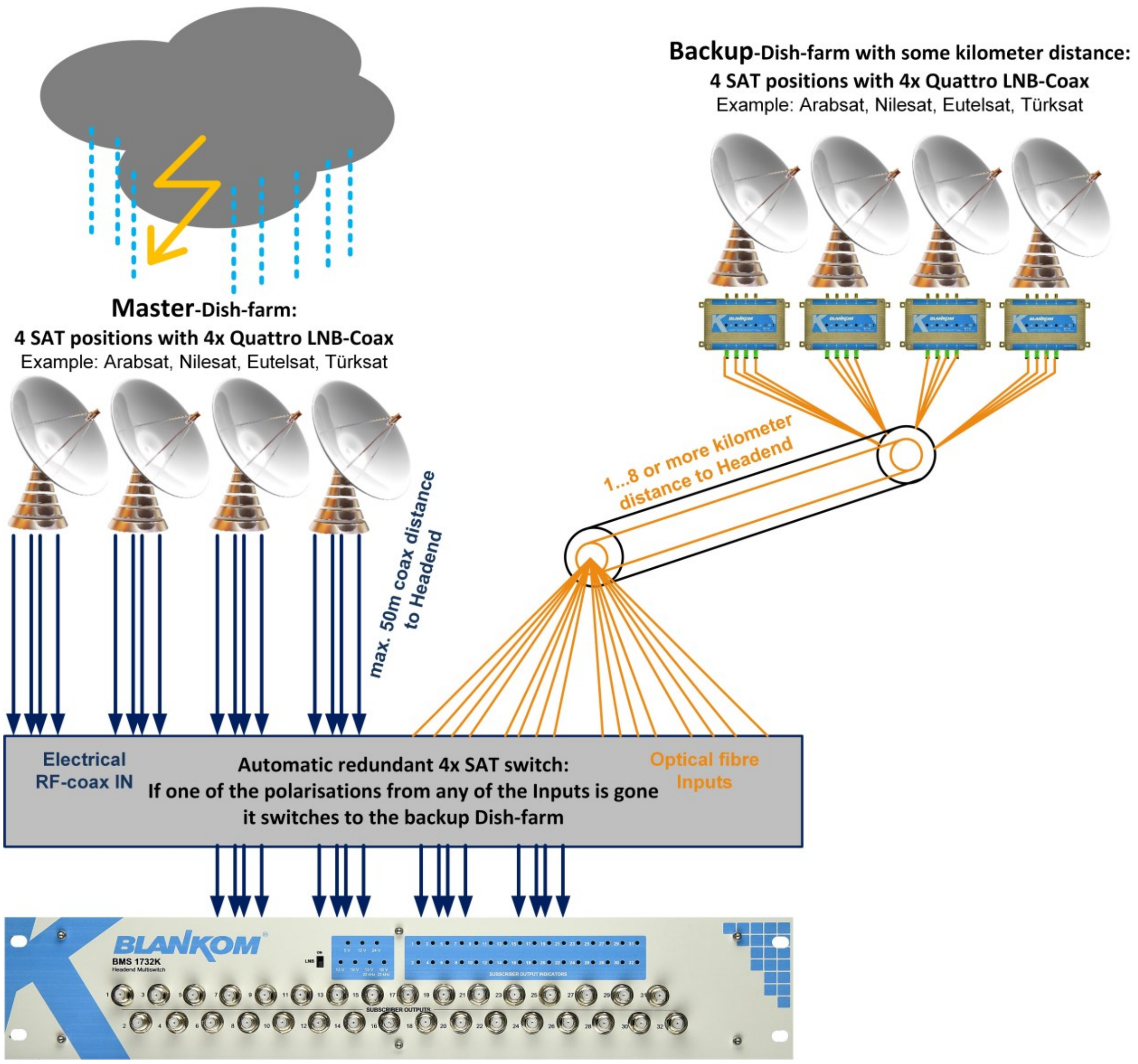


Roadmap: Optical System transmitter and Receiver parts will be integrated into 19'' chassis soon
Under development: an electrical/Optical redundancy switch in 19''.

An alternative is our **SAT Matrix** with RJ45 and Web-Interface - so remote accessible configuration BMM1716:

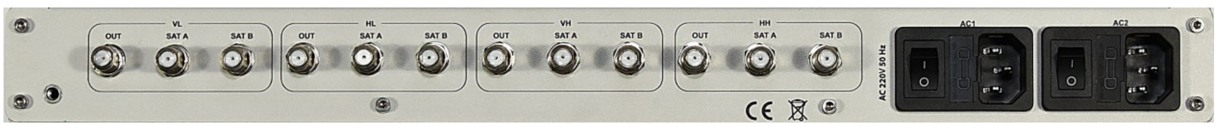
17 Inputs (4x4SAT +1x terr) and 16 outputs which can be configured to fixed programmed and even multiplied from the 16 SAT Inputs to individual RF-Output pathways.
Of course a passive network can be attached to each output to group your receivers…

Coming back to the REDUNDANCY:
We are currently designing a Master-Backup Dish-farm redundancy –switch device in 19'' form factor which can act automatically for up to 4 SAT-positions:



This multi-I/O redundancy Unit is already available:

The design is specified to be as Master Inputs with options:
Electrical coax and also optical fibre (seconds shot will be released soon)
While the Backup-Inputs will be optical only (in progress…), standard unit coax:



So for above 4-SAT-Positions you would need 4 units to fully auto-backup them. But some might only backup the 2 most important SAT-receptions … that's up to you. It operates manually or automatic.

Anyway, the system integrator must provide a set of tools and measurement instruments to check and adjust a) the dishes themselves -> The correct angle's and elevation's as well as the fixation (wind and weather influences…) and finally also the signal power and quality coming out from the LNB's -> the cabling (avoiding long distances or use fibre optic cables) the installation of the cables: The bending radius min. 5cm, the usage of professional F-connectors – please do not use this self-screw versions but better use CRIMP versions or self- install ones:

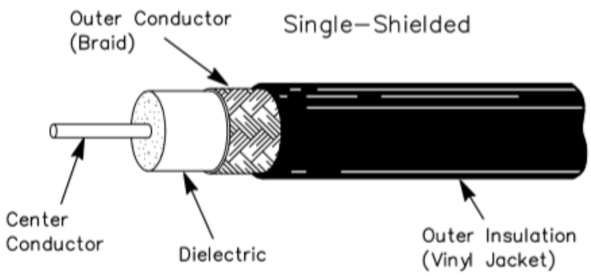
Or compression versions:

The connectors are made for different diameters of cables so bigger cables with higher isolation are almost better than the cheap ones which are almost OK for households but not for professional systems like we are talking here about…

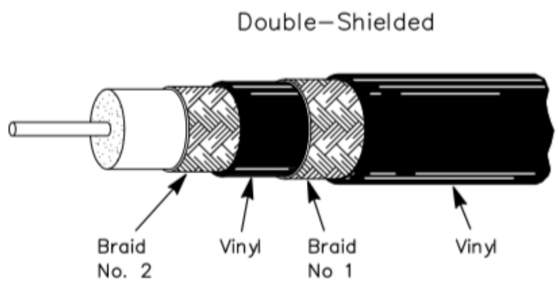
Picture:

A very thick mobile phone Master Antenna cable, and

RG174, RG58, H2000flex



So the cables are important as well as the handling and the connectors.



Fibre optic cable have some essential Advantages:

- no electromagnetic interferences
- long distance serving
- less attenuation

- low power consumption
- splitting to serve many hundred buildings possible
- do not have leaks disturbing other RF connections

Dis-Advantages:
- More expensive but reasonable nowadays
- Special equipment for splicing necessary
- Robustness (no sharp bending, buckling, …)

Same importance applies quality on **Ethernet CAT cables**: CAT6 or 7 to be preferred and in particular for Video streaming services: Double Shielded Twisted Pair (DSTP) are preferred!!!

The IPTV Headend

is -of course- the SOURCE for all of your streams. Here you should not cut any corners in your investment since this is the most critical piece of the system:

- Securing the reception,
- decryption (if necessary),
- stability,
- encoding,
- long-term design,
- quality of components and services,
- redundancy (PSU's and reception, processing) functions,
- lower maintenance cost
- availability of additional features (EPG, Channel-Lists by SAP, …)
- Picture quality assurance: this is one of the key requirements for consumers
- Zapping (channel switching) time must be much lower than 3 seconds
- only live real-time streaming or additional capabilities such as PVR, VoD, additional social media… and Digital Signage
- People are used to DVB-TV (or ATSC in US) and expect the same features or even more from IPTV

  So please rely on professional Headends and do not buy anything too cheap or from cheap Alibaba sources… to reduce OPEX by increasing CAPEX.

Design a Headend:

First of all: From where and how you need to receive your programs?

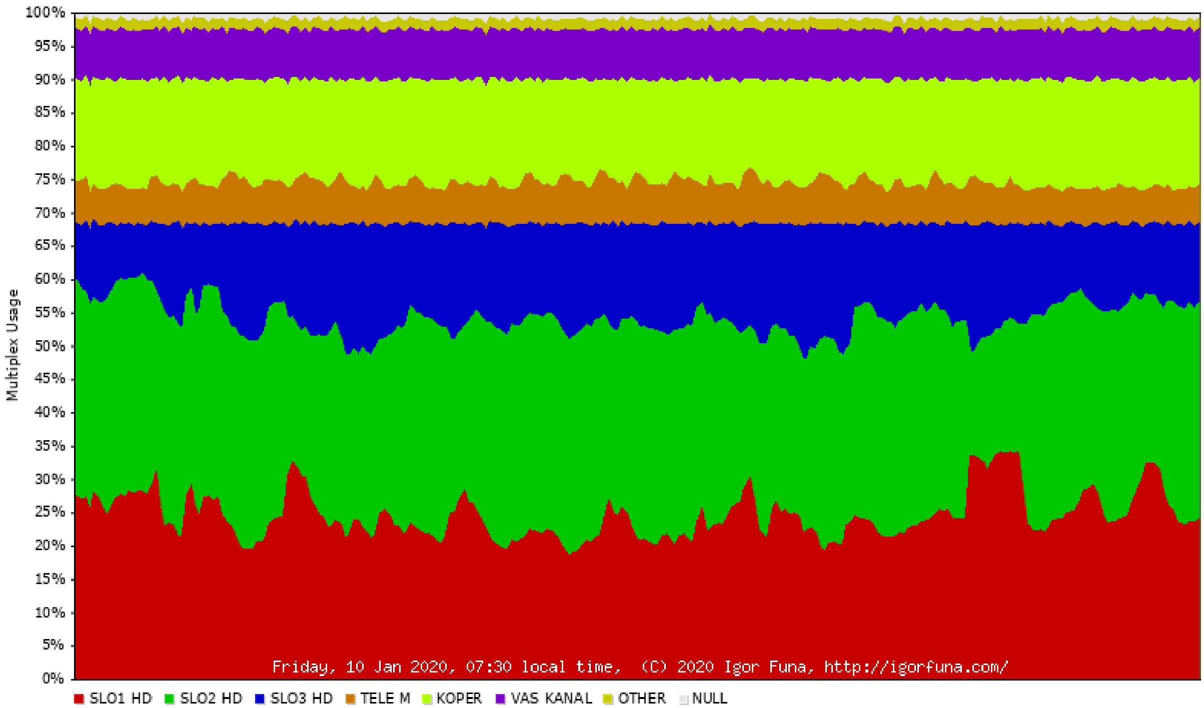
- From Satellite? (DVB-S/S2), is it necessary to specify the new DVB-S2x tuning capability?
- Should the Receiver/Streamer device be equipped with 32APSK Mode? Most Transponders are using QPSK, 8PSK and only a few UHD Transponders using the advanced modulation. An online calculator: https://www.satellite-calculations.com/Satellite/bitrates.htm
- From Terrestrial? (DVB-T/T2/ISDB-Tb) -> If end consumer has a triple tuner TV -> Needless to insert this into CATV or Streaming networks

- From CATV (DVB-C) or analog channels? -> DVB-C receiver-streamer + Analog encoder/streamer necessary
- Do you need to use SetTopBoxes with embedded decryption and smartcards (re-encoding)

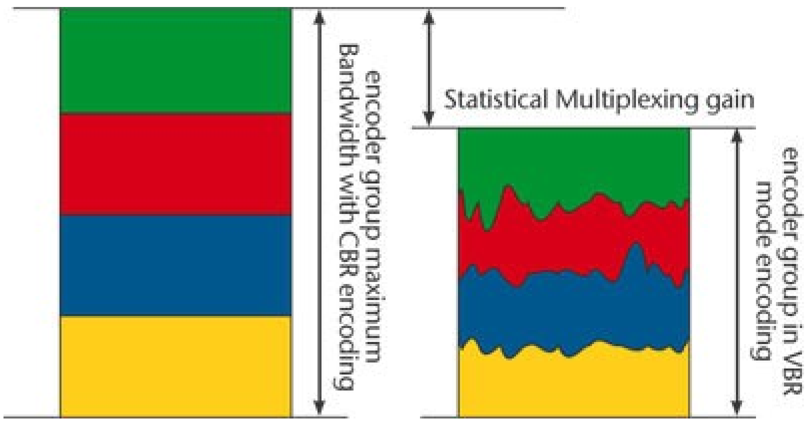
We from Blankom/IRENIS are often asked:
Do you have IPTV? -> YES WE DO!
Next question comes as usual:
How much does it cost for 100 channels? -> Needless to say 100 Bucks per channel or anything else

So you see the problem? How can you calculate a system, if you have no detailed and exact information about the reception, processing, maybe decryption, eventually re-encoding and even the selection of the programs that could be received via DVB-T/T2/S/S2/C Sat-Transponders and then cherry-picked from a big bunch of available TV services which are almost in a **so called Transportstream** (TS) – Bouquet on DVB-channels (RF). So it is often a mistake to mess up with 'Channels' and Transponders. A single TV channel is part of a TS coming from a Frequency (Transponder) and if there is the need to pick it from this **Bouquet**. The complete Transponder need to be received and 'De-Multiplexed' into its several TV-Service's which will be streamed as single program TS (SPTS).

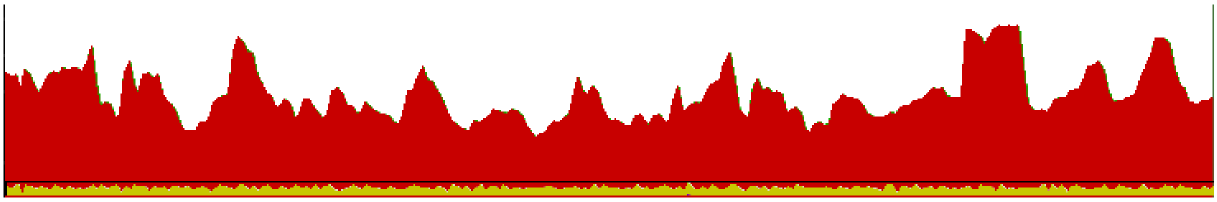
A multiplex or mux is a group of digital services (TV channels, Radio stations, teletext, signalling, etc.) that are mixed together for broadcast. For example, a TV channel has at least two services or streams. Video and Audio. Each DVB multiplex has capacity that depends on modulation and coding parameters. In principle there are two approaches used to combine digital services into multiplex: Constant Bit Rate (CBR) encoding and Variable Bit Rate (VBR) encoding.



Example for a TS in its Multiplex



Demultiplexed to a SPTS Variable bitrate (VBR) w/o filling up Null-Packets:



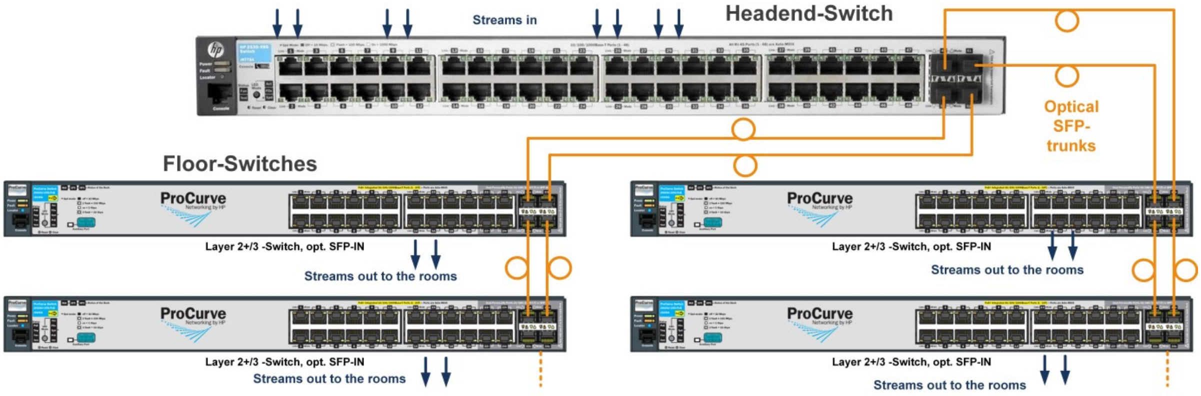
Additional Data-PIDs like tables, Teletext, Audio are fluctuating and aren't that constant…

So it is essential to know

- **The Number and orbital positions of the Satellites that carry the desired TV services** (ASTRA 19.2°, Eutelsat, Hotbird, Nilesat, Arabsat, etc…) because there are hundreds of Satellites with thousands of 'channels' - *in this case 'channel' means RF - Transponders*
- **The data of every transponder to be received** (Position, High- or Low-Band, Vertical/Horizontal, Frequency) -> needed in the calculation of the number and sizes of SAT-dishes as well as the determination of necessary Satellite Matrices or Multiswitch ports
- **The details of every TV-Service** (***Service*** is the right terminology – do not use channels or programs) you want to select from these Transponders for streaming to IP
- **The need of EPG data** to be streamed along with it or skip this as a basic packet does not do
- **The availability of Multi Service Decryption** (MSD) CAM's from the encrypted content provider (PayTV operators)
- If only **embedded decryption** is possible: you need to determine which SetTopBoxes you can use, which Smartcards are available and which requirements are coming from the Content providers?
- So we can go for **Encoders**… we have several different types, from single to multiple ones… Almost useful to insert own information channels like HotelTV, Restaurant, GYM, SPA, …
- **If Transcoding is necessary**:
  - Because of Limited Network speed, or Middleware capability or streaming method (MC or UC) and load
  - Is OTT or Multiscreen a must or a nice to have? -> Extra Middleware-Server needs
  - Are the same data needed for Transcoding? The exact number of streams and the conversion from which input format into what output format as well as the sampling rates (Picture Quality!) must be determined as they impact License cost and Hardware + SW capabilities
- If eventually **Re-encryption** (Verimatrix / AES or others) is required as embedded in the STB?

In Hotel systems often an integration into Building Management systems is demanded or into PMS systems for the reception: These are nice to have functions but are they really necessary for hospitality environments? We are talking about Television and not about life support systems.

If you are involved at the time of the set-up of the infrastructure of e.g. a new building or during a complete renovation, it is often worth to consider a fiber installation at least within the building to all of the floors because electrical CAT-cable has limitations as well for the COAX RF cables. So it is almost a good idea to plan the last-meters with CAT6/7 DSTP electrical and do the Headend to the floor-switch distribution by optical cable trunks like:



Collecting your Satellite Transponders from various SAT positions to the SAT-Streamer devices Input's:

For an example of a TV Services Reception sheet see https://lyngsat.com , Kingofsat or http://satbeams.com or satindex.de for gathering detailed SAT-information

	160°W-73°E	73°E-0°E	0°W-61°W	61°W-160°W
Satellites:	Asia	Europe	Atlantic	America
Packages:	Asia	Europe	Atlantic	America
HD TV:	Asia	Europe	Atlantic	America

Free TV:	Pacific	Asia	Middle East	Europe	Africa	South America	North America
Free Radio:	Pacific	Asia	Middle East	Europe	Africa	South America	North America

BLANKOM an IRENIS brand ... selling signals

Choose your region and satellites:

Asia | Main | Europe P | Europe HD | Europe | 3D | Headlines | Launches | Atlan

72.1°E	Intelsat 22	140220
70.5°E	Eutelsat 70B	131228
68.5°E	Intelsat 20	140320
66.0°E	Intelsat 17	140311
65.0°E	Amos 4	
64.2°E	Intelsat 906	131213
63.5°E	ABS 2i	
62.0°E	Intelsat 902	140313
60.0°E	Intelsat 904	140303
57.0°E	NSS 12	140307
55.9°E	Bonum 1 *(incl. 1.3°)*	140306
	DirecTV 1R *(incl. 0.7°)*	140308
55.0°E	Insat 3E	080220
	G-Sat 8	120325
	Yamal 402	140320
53.0°E	Express AM22	140319
52.5°E	Y1A	140213
50.5°E	NSS 5 *(incl. 0.8°)*	120920
50.2°E	Intelsat 5	130918
50.0°E	Türksat 4A	
49.0°E	Yamal 202	140117
48.0°E	Afghansat 1	
47.5°E	Intelsat 10	140223
46.0°E	AzerSpace 1/Africasat 1a	[illegible]

31.5°E	Astra 1G	140305
31.4°E	Astra 2B	
30.5°E	Arabsat 5A	140221
28.2°E	Eutelsat 28A	140313
	Astra 2A	140319
	Astra 2E	140312
	Astra 2F	140317
26.0°E	Badr 4	140319
	Badr 5	140316
	Badr 6	140301
25.5°E	Eutelsat 25B/Es'hail 1	140307
23.5°E	Astra 3B	140317
21.5°E	Eutelsat 21B	140318
20.0°E	Arabsat 5C	140304
19.2°E	Astra 1KR	140318
	Astra 1L	140320
	Astra 1M	140320
	Astra 1N	140320
19.2°E	Astra 2C	
17.0°E	Amos 5	140315
16.0°E	Eutelsat 16A	140318
13.0°E	Eutelsat Hot Bird 13B	140320
	Eutelsat Hot Bird 13C	140317
	Eutelsat Hot Bird 13D	[illegible]

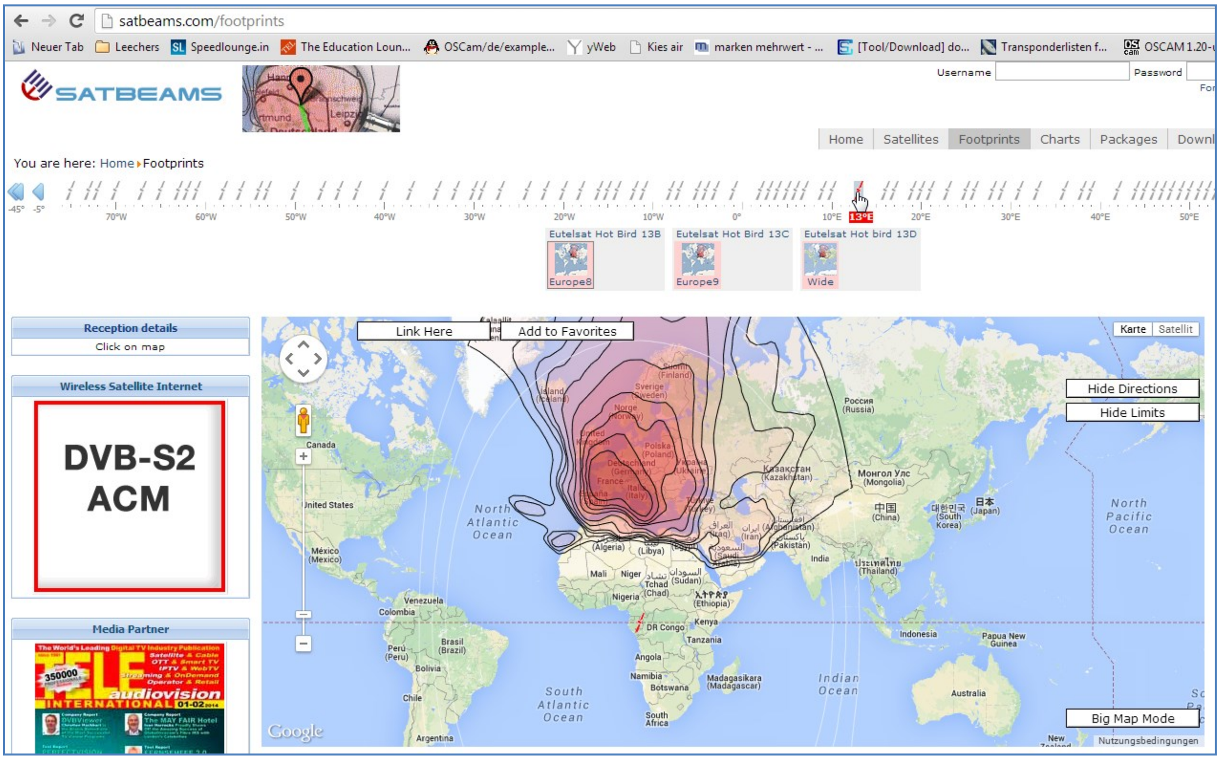
Get the transponder information data:

The EIRP values are for Germany

Astra 1KR/1L/1M/1N © LyngSat, last updated 2014-03-20 - http://www.lyngsat.com/Astra-1KR-1L-1M-1N.html

Freq. Tp		Provider Name Channel Name		System Encryption	SR-FEC SID-VPID		ONID-TID APID Lang.	Beam EIRP (dBW) C/N lock	Source Updated
10714 H tp 49								Europe 51	D Shimoni 120530
10729 V tp 50	CANAL+	*Canal +*	P	DVB-S2 MPEG-4/HD Nagravision 3	22000-2/3 8PSK		1-1050	Europe 51 6.6	D Shimoni Anonymous 140318
10744 H tp 51	ARD DIGITAL	*ARD Digital*	A	DVB-S	22000-5/6		1-1051	Europe 51 6.5	D Shimoni N Schlammer Anonymous 140320
		Tagesschau 24	T S A	F	28721	101	102 G		
		Einsfestival	T A	F	28722	201	202 G 203 orig 206 G		
		Eins Plus	T A	F	28723	301	302 G 303 orig 306 G		
		ARTE Deutsch	T A	F	28724	401	402 G 403 F		
		Phoenix	T A	F	28725	501	502 G 503 orig		
10758 V tp 52	CANAL+	*Canal +*	P	DVB-S Mediaguard 2 Nagravision 3	22000-5/6		1-1028	Europe 51 6.5	D Shimoni Anonymous 140313
		LTC	A	F	29853	163	92 Sp		
		[Canal + InfoDeporte test card]			29862	4160			
	SES	*SES*		DVB-S2	22000-3/4 8PSK		1-1053		
		Anixe	A	F MPEG-4/HD	21100	255	259 G		
		QVC Deutschland	T S A	F MPEG-4/HD	21103	1023	1027 G		

Check the reception and footprint of the sat-beams for your location to calculate the size of the dishes:



And finally prepare a SAT-and Service –listing like a simple Excel sheet:

*A short remark: **Documentation** of all of this installations and setups is very helpful not only for the future and the staff which comes after you… So better to begin with it even when planning? : YES…*

1	Programm	DISH-No	Transponder	Frequency [MHz]	Power [kV	Distance (Beam) [k	Orbital position	Polarisation	Symbolrate	FEC	Modulation	SID [dez.]	Language	Remarks	datarate [Mbit/s]
2	ARD Digital	ASTRA 1	51	10743,75			19,2° E	H	22000	5/6					33,8
3	ARD digital, ZDF Vision	ASTRA 1	11	11361,75			19,2° E	H	22000	2/3					42,6
4	Kabelkiosk Sky	ASTRA 1	65	11719,5			19,2° E	H	27500	3/4					38,0
5	Kabelkiosk	ASTRA 1	66	11739			19,2° E	V	27500	3/4	QPSK				38,0
6	BetaDigital	ASTRA 1	67	11758,5			19,2° E	H	27500	3/4					38,0
7	Digital+	ASTRA 1	68	11778			19,2° E	V	27500	3/4	QPSK				38,0
8	BetaDigital	ASTRA 1	69	11797,5			19,2° E	H	27500	3/4					38,0
9	ARD digital	ASTRA 1	71	11836			19,2° E	H	27500	3/4					38,0
10	Kabelkiosk Sky	ASTRA 1	75	11914,5			19,2° E	H	27500	9/10					38,0
11	ZDF vision	ASTRA 1	77	11954			19,2° E	H	27500	3/4					38,0
12	MTV Networks	ASTRA 1	78	11973			19,2° E	V	27500	3/4	QPSK			zeitpartagiert auf Satellit	38,0
13	Kabelkiosk Sky	ASTRA 1	79	11992,5			19,2° E	H	27500	9/10					49,2
14	Kabelkiosk Sky	ASTRA 1	81	12031,5			19,2° E	H	27500	3/4					38,0
15	Kabelkiosk Sky	ASTRA 1	83	12070,5			19,2° E	H	27500	3/4					38,0
16	ARD digital	ASTRA 1	85	12110			19,2° E	H	27500	3/4					38,0
17	RTL World	ASTRA 1	89	12187,5			19,2° E	H	27500	3/4	QPSK				38,0
18	SES Astra	ASTRA 1	91	12226,5			19,2° E	H	27500	3/4	QPSK				38,0
19	BetaDigital	ASTRA 1	92	12246			19,2° E	V	27500	3/4	QPSK			zeitpartagiert in Headend m	38,0
20	ARD digital	ASTRA 1	93	12265,5			19,2° E	H	27500	3/4					38,0
21	Kabelkiosk Sky	ASTRA 1	95	12304,5			19,2° E	H	27500	9/10					49,2
22	Kabelkiosk Sky	ASTRA 1	99	12382,5			19,2° E	H	27500	9/10					49,2
23	ARD digital	ASTRA 1	101	12421,5			19,2° E	H	27500	3/4					38,0
24	BetaDigital	ASTRA 1	103	12460			19,2° E	H	27500	3/4	QPSK				38,0
25	BetaDigital	ASTRA 1	104	12480			19,2° E	V	27500	3/4	QPSK				38,0
26	ProSiebenSat.1	ASTRA 1	107	12544,75			19,2° E	H	22000	5/6					33,8
27	SES Astra	ASTRA 1	108	12551,5			19,2° E	V	22000	5/6	QPSK			wkl: Bitrate überprüfen. Kin	42,6
28	KabelKiosk	ASTRA 1	66	11739			19,2° E	V	27500	3/4	QPSK				38,0
29	KabelKiosk	EB 9A	51	11747			9° E	H	27500	3/4	QPSK				38,0
30	KabelKiosk	EB 9A	53	11785			9° E	H	27500	2/3	8PSK				53,2
31	KabelKiosk	EB 9A	57	11862			9° E	H	27500	2/3	8PSK				53,2
32	KabelKiosk	EB 9A	58	11881			9° E	V	27500	2/3	QPSK				53,2
33	KabelKiosk	EB 9A	65	12015			9° E	H	27500	2/3	8PSK				53,2
34	KabelKiosk	EB 9A	71	12130			9° E	H	27500	3/4	QPSK				38,0

Headend Components:

The CREDO: A hotel always is forced to make the guests comfortable so that they will return to the hotel (chain) when coming back again: Come to us and feel like home.

We are facing 3 different system types:

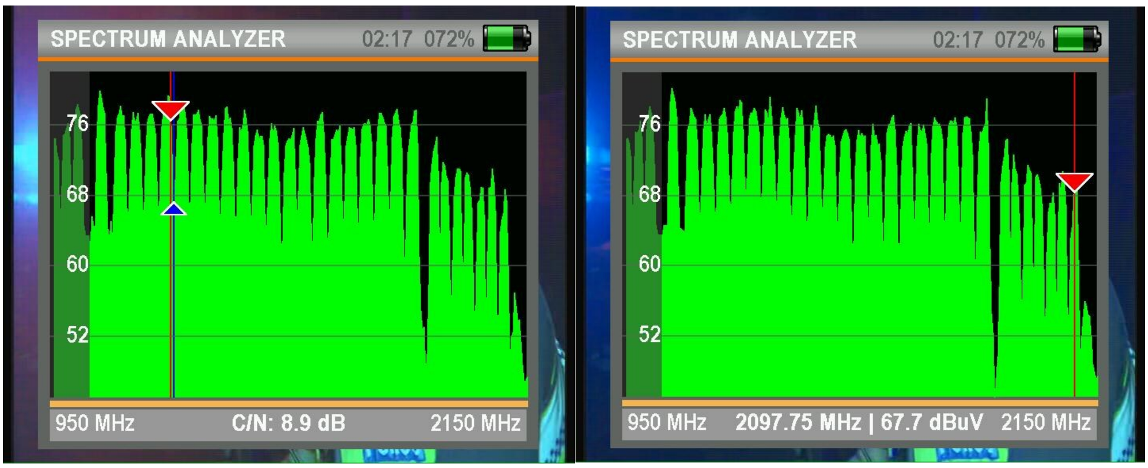
- Simple and low cost Linear IPTV ***Stars
- An advanced Linear TV system with a middleware-Server providing some interactive features to the Client/Room/SetTopBox/TVset ****Stars
- A fully featured system i.e. providing additional services like Video on Demand (VoD), PVR personal Video recording functions and Hospitality information pages i.e. Restaurant menus etc… *****Stars

But first we should concentrate on the content aggregation by having a needed and helpful tool to measure the output of the SAT-Multiswitch or -Matrix to make sure a qualitative Signal is coming out and will reach our SAT-Receiver-Streamers in a good shape:

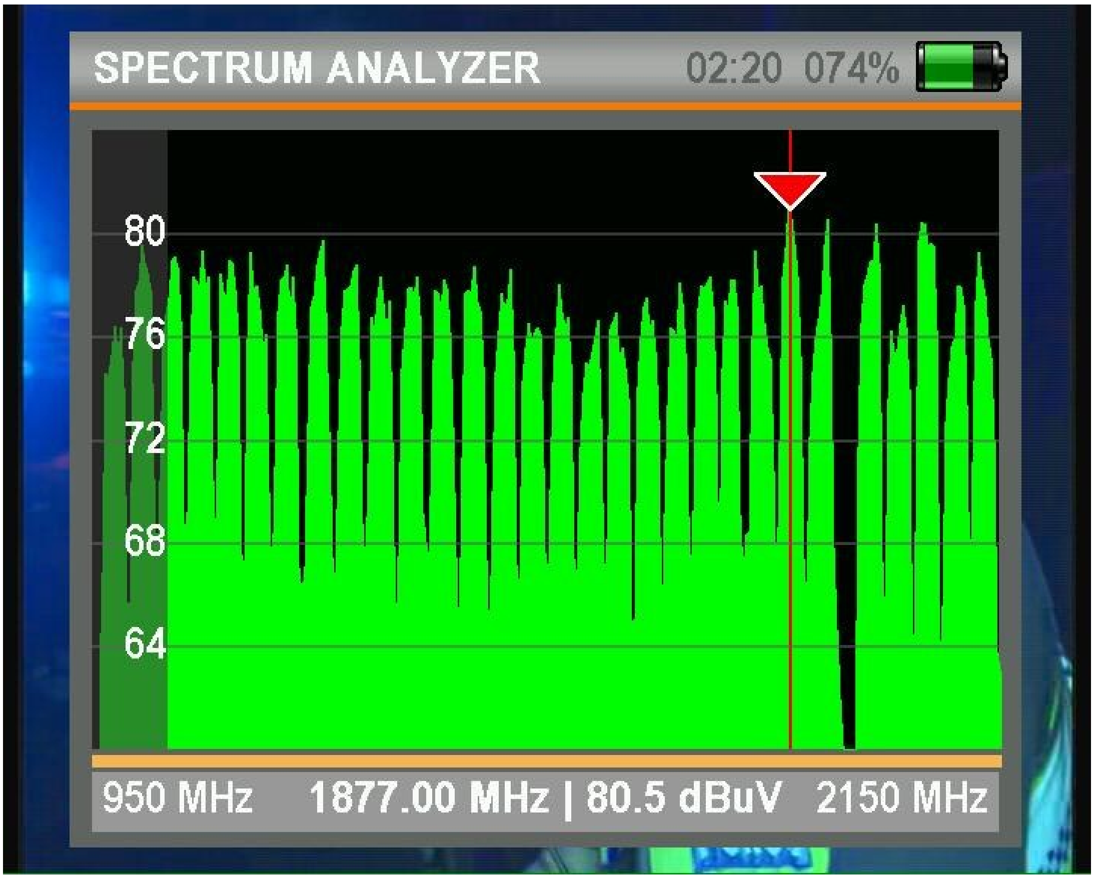
Using a handy instrument from i.e. PROMAX or for the cheaper controlling an ALPSAT:

Professional and Semi-professional

Example Spectrums:



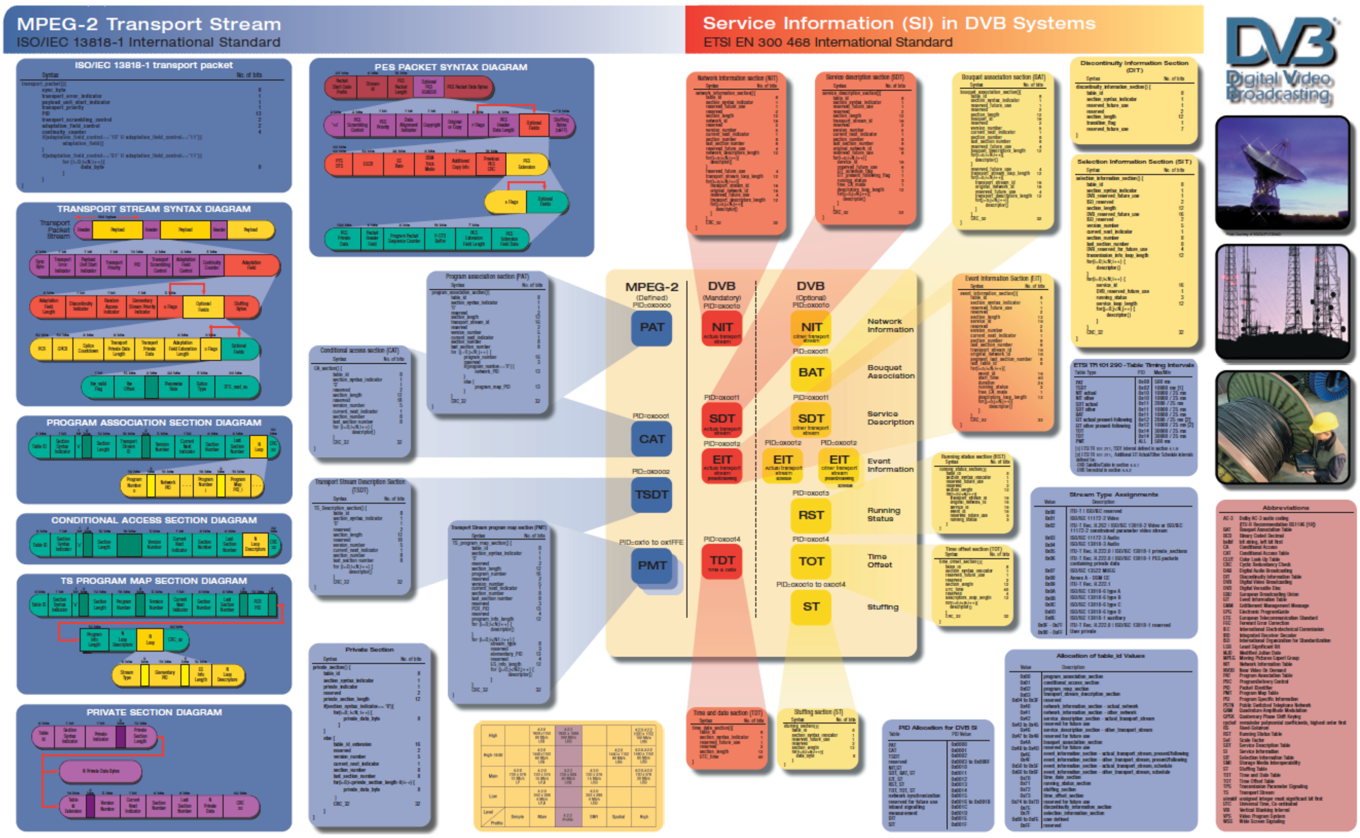
Left: C/N measuring. **You see the SLOPE** = higher attenuation on higher frequencies? Right: Level



Shown is a good quality output level of 80 dBµV directly from a BLANKOM 32 -> 32 -Multiswitch cascaded output. The first 2 showing ASTRA Satellite high band while the 3rd shows Eutelsat Hotbird 13°E on DiSEqC SAT Pos. 2 with a better adjusted LNB at the dish(es). So your signal quality depends on: Dish direction and angles, LNB focus and angle and also its LNB-quality and the cable length and quality.

Next we need to have a look into these received Transponders and coming from Multiple Program Transport Stream MPTS de-multiplexing the SAT Transponder (Transport Streams (TS)) to the Single Program Transport Streams (SPTS) for IPTV…

DVB is ‘somehow’ complex:



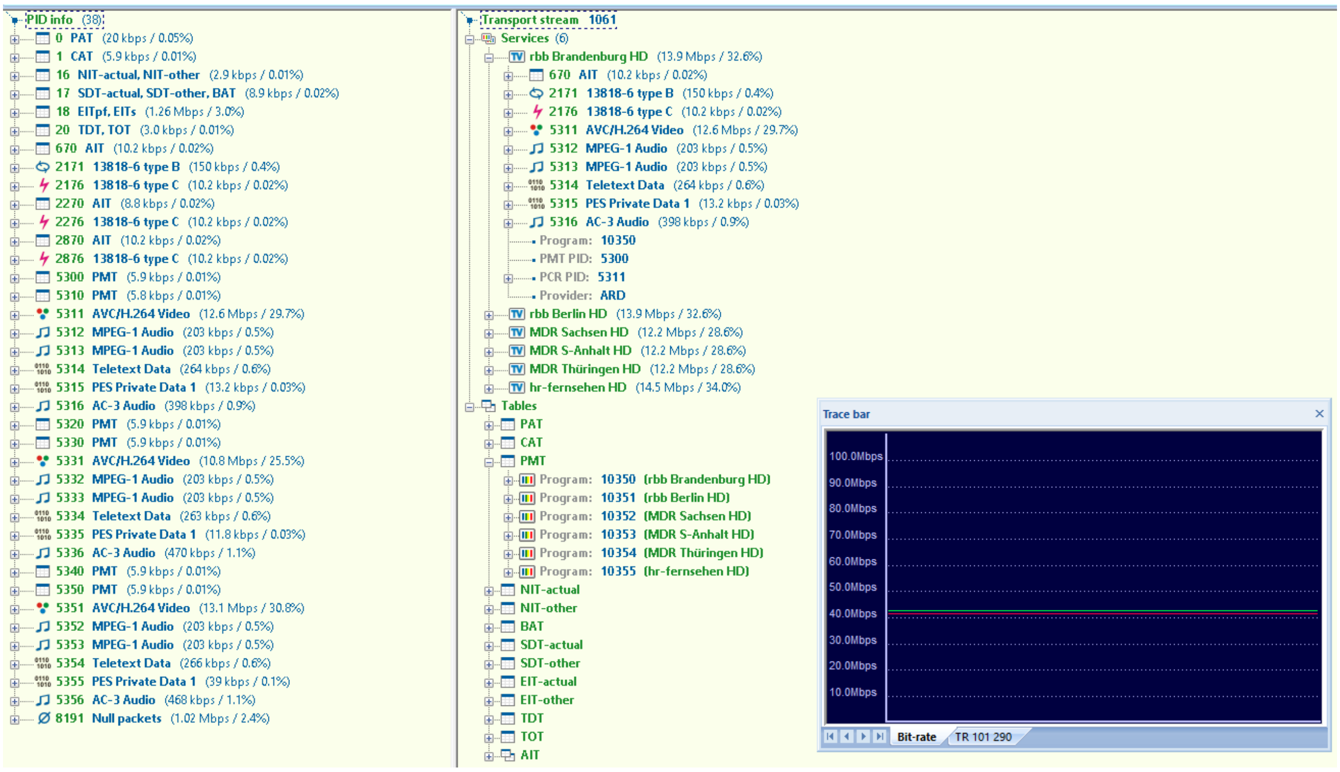
So we recommend to also check out what kind of content comes from the SAT-Transponders by using a DVB-Transportstream-Analyzer like we prefer for the PC’s/Laptop: DekTec Fantasi *(Can be ordered from us: IRENIS Germany or PROTEL Turkey)*

or as PC cards:

Because some broadcaster assigning wrong tables or delivering a set of false flag values in some tables and in the uplink TS to the Satellite Transponder which than goes down to the worlds regions…. You will detect that problems only by looking into them.

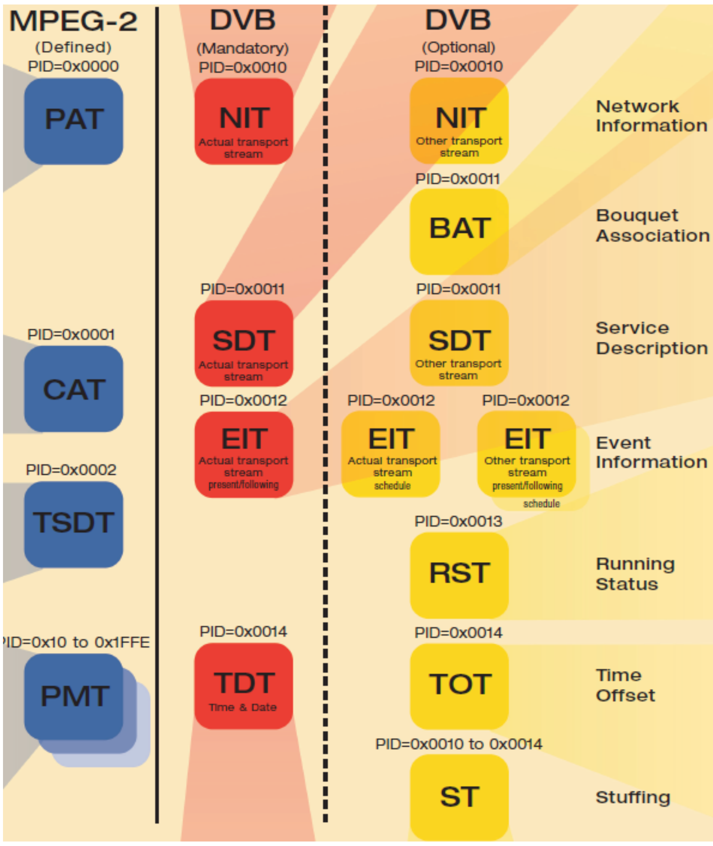
TSREADER from coolstf.com is also a PC -Tools but the light Version is not equal to the professional.

Streamer output to PC as MPTS (Multi Program TS) or via an ASI out if the Receiver has that equipped:



Here no Encryption is in progress, so no so called EMM's/ECM's are transmitted. The CAT (PID1) is nearly empty as well but DVB says this has to be transmitted ;-(. For FTA SPTS it is not necessary.

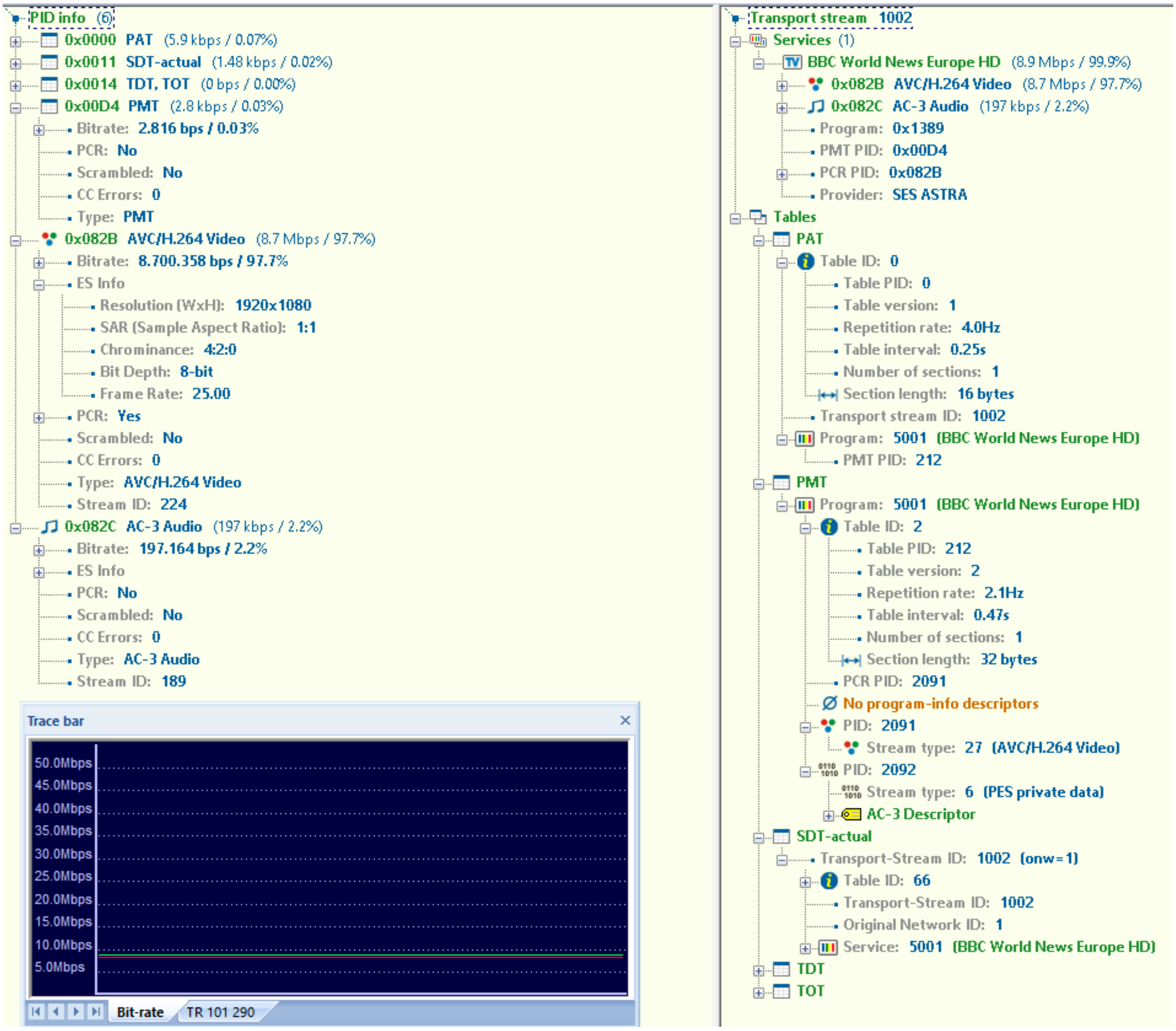
So the most important Tables to have a look onto:



PAT: Program Association Table (1x)
CAT: Conditional Access Table (PAYTV)
PMT: Program Map Table (dynamic or static) for every of the TV (or Radio) Services in the Bouquet
NIT: Network Information table – only needed in DVB-S/2-T/T2/C networks
SDT: Service Descriptor Table 1x for all Services in the TS *(SDT-other's table for other Transponders of that provider)*
TDT/TOT: Time and date and offset Table for synchronizing the time and date to the region broadcasts like Turkey= UTC+2 …
EIT: Event Information Table = EPG data = Electronic Program Guide (this needs the TDT/TOT to be correct)
AIT: Application Information Table = HbbTV is for SMARTVs -> Red-button Browser action

The rest is not that important for us.

All these are almost assigned to fixed (or also variable) PID's Packet Identifier (PID) (in HEX or DECimal) starting with '0' = PAT. EIT = PID 18dec = PID 0x0012hex up to PID 8191 = Zero- or NULL-Packet filling the TS (fixed max bitrate as a Constant Bitrate (CBR) TS for the DVB-Modulator capacity. I.e. DVB-C with QAM256 modulation has max CBR 51.6 Mb/s streaming rate. While the most Single streams IPTV SPTS) – de-multiplexed from the MPTS- are coming as Variable Bitrate streams (VBR) containing almost the only necessary tables (no NIT, no BAT, … because these are only for real DVB broadcasting). But needed Tables are as example (this time in HEX):

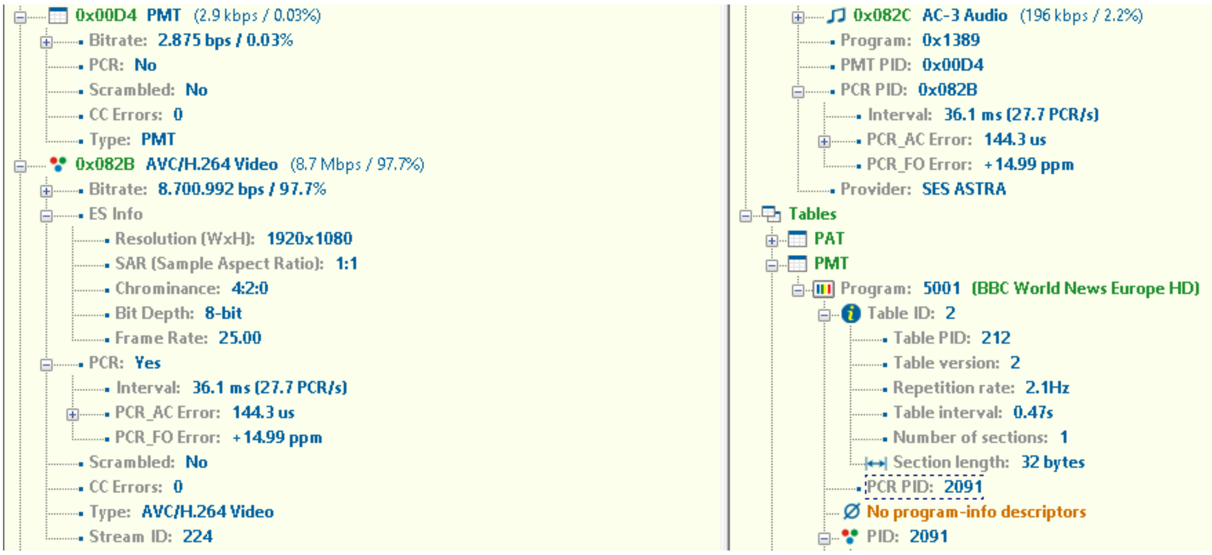


This SPTS Service BBC-HD is a nearly constant DataStream and it shows the many Information's are packed into these single tables…

Important to know about JITTER (over DVB or also over Ethernet): There is a method to measure and correct this jitter:

PCR = Program Clock Reference (PCR) is part of the DVB-Streams

To enable a decoder to present synchronized content, such as audio tracks matching the associated video, at least once each 100 ms a *program clock reference* (PCR) is transmitted in the adaptation field of an MPEG-2 transport stream packet. The PID with the PCR for an MPEG-2 program is identified by the pcr_pid value in the associated PMT. The value of the PCR, when properly used, is employed to generate a system_timing_clock in the decoder. The system time clock (STC) decoder, when properly implemented, provides a highly accurate time base that is used to synchronize audio and video elementary streams. Timing in MPEG2 references this clock. For example, the presentation time stamp (PTS) is intended to be relative to the PCR. The first 33 bits are based on a 90 kHz clock. The last 9 are based on a 27 MHz clock. The maximum jitter permitted for the PCR is +/- 500 ns.

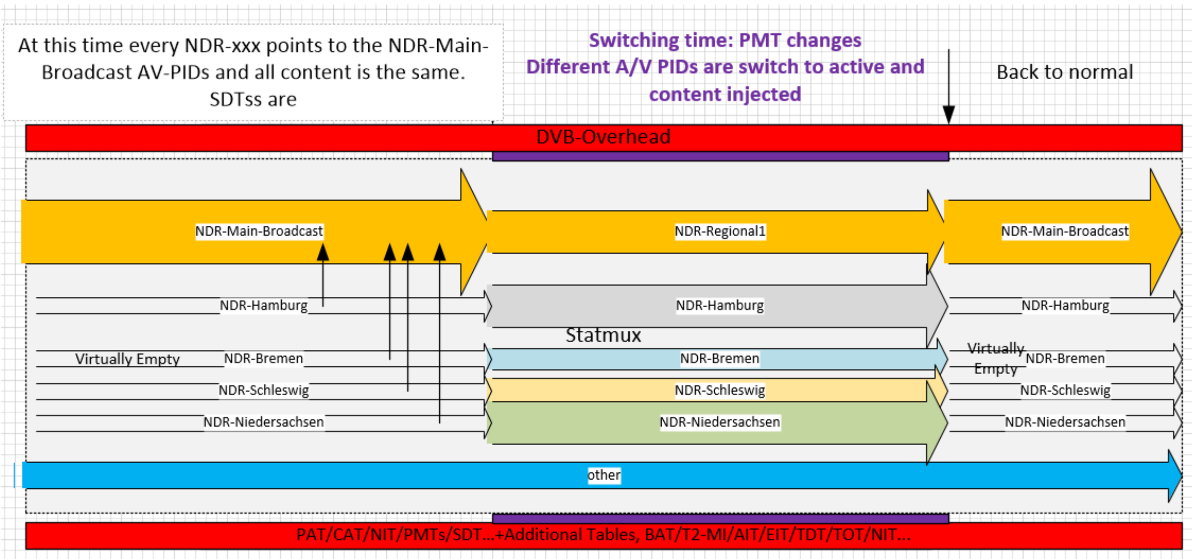


CC-Errors:

Continuity counter	4	0xf	Sequence number of payload packets (0x00 to 0x0F) within each stream (except PID 8191) Incremented per-PID, only when a payload flag is set.

If this CC errors are counting/adding in the Analyzer (see above Screenshot) in time, it is an indicator for a maybe too weak RF Input signal to the SAT receiver: Use shorter coax cables or an Amplifier or swap to optical SAT systems.

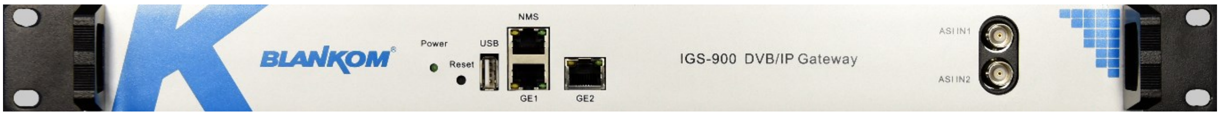
Example for a dynamic PMT TS: Here as a German broadcaster switching / adding local content to 18:00 -> 20:00 while the rest of the day the Main Broadcast is served and the other regional time-scheduled are 'Linked' to the Main in the PMT's (Program Map Table).



These above described functions and features are reflecting to such 3 classes of DVB-Receiver-Demultiplex-Streaming Equipment.

Deciding the Headend- CLASSES:

The low-cost **BASIC System** is i.e. not doing EIT de-multiplexing and does not follow Dynamic PMT's like ***BLANKOM IGS Series***:



The cheaper solutions are almost not equipped with a redundant PSU and are not modular designed. Often only with one RJ 45 Gigabit Ethernet (GbE) equipped for DATA-Streaming.

The **Mid – Class System** supports EIT demultiplexing and Dynamic PMT:
BLANKOM Modular BSS-Series, optional licenses for internal "Multiplexing", "BISS" decryption (broadcaster cases) and "Monitoring" which is Blind Scan Mode for SAT operators:
3x SAT-Input modules each with 4 = 12 Transponders with each 2 GbE outputs and 2 separate Management ports:

Front: 3x Modules with LCD and dual PSU

Rear = 12x RF independent Inputs, each 2x NMS, 2x GbE DATA = stream passway redundancy

The **High-Class System** with the modular Teleste Luminato platform *(for which we are the sole distributor for Middle East and Africa)* with technically up to 24 SAT Inputs w/ or w/o decryption CAM slots and supports all DVB related necessary functions like manipulating every PID and their content in the streams. It comes along with a mandatory Service Level Agreement of at least one year and the option for an autonomous 1+1 Redundancy feature and additional Backup-PSU set.

available as hospitality versions with included demultiplexing

2x NMS ports, 2x GbE ports (SFP) and a great number of different modules available, Scrambling (DVB-encryption as well as Stream-encryption), PSU-SI editor and many more professional features …

The output streams:

It might be a good idea now to choose a **Unicast or Multicast** system. It's a question of balance: Many IPTV Clients are online to the same time: Multicast is better. Only a few will be almost online: Unicast would be an advantage -> every user gets its own stream -> so you see: It's a question of bandwidth. Multicast needs IGMP management by the network switches – while Unicast don't because the stream will be addresses individually directly from the streamer source: The Headend – server – which makes the system more advanced in programming it. So we decided to go for MULTICAST with our partner IPTV system OmniscreenTV.

Recommendation 1: Video streaming Multicast addresses should be setup according to the IANNA recommendations skipping reserved addresses like in the ranges of the 239.x.y.z: 10000 and IP addresses should be different like counting 239.1.1.1 … 239.1.1.2 …. As well as the Portnumbers too (> 10000, 10001, 10002, 10003, ….)

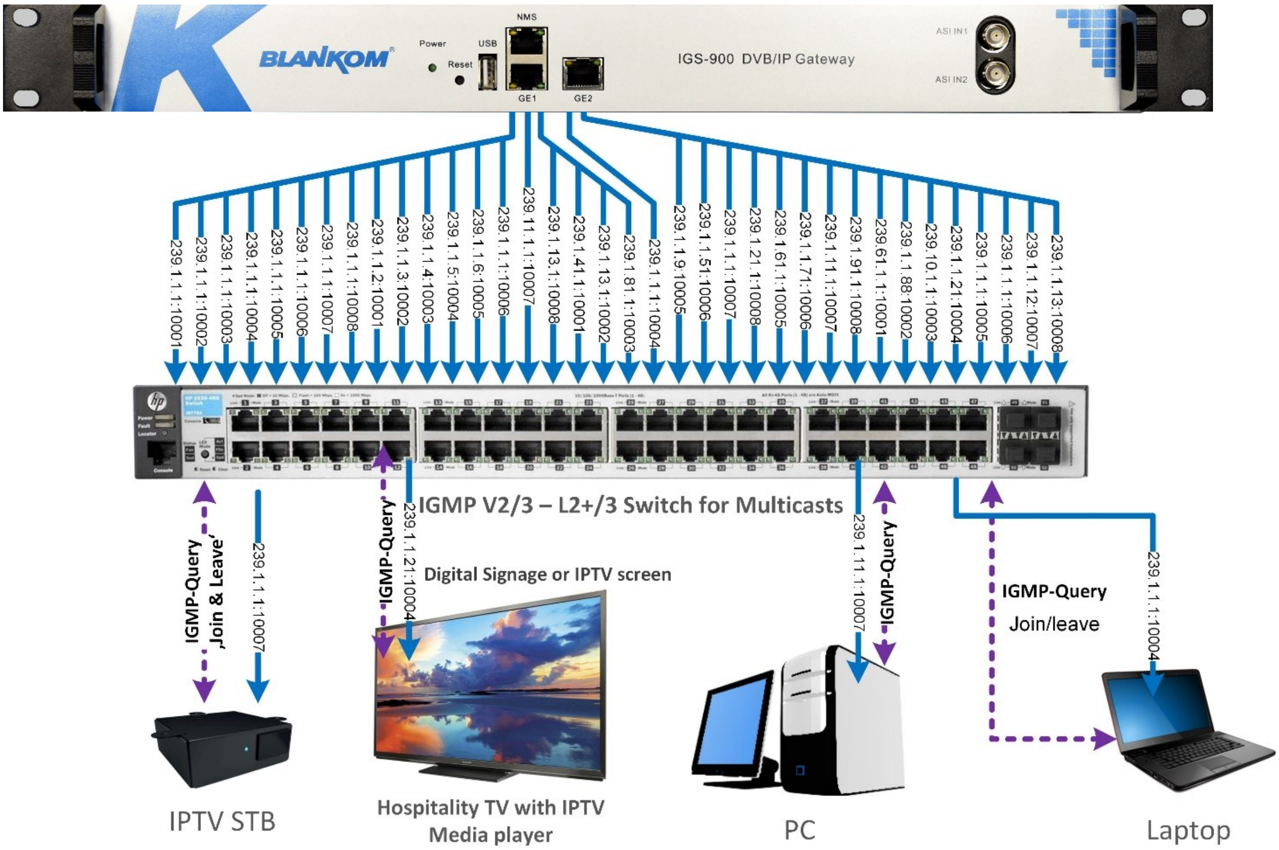
Note: We usually are not offering the network equipment for the projects because our partners -the local system- integrators- are almost serving this.

So highly recommendation for multicasts: IGMP is the key. Many STB's or TV sets have only 100BaseT Ethernet RJ45 and the Headend streams are almost in total up to 850-max 920 Mb/s so Gigabit-ports. If they would get all streams they will be overloaded. Example with 2 GbE output, 200 Streams with an average of 6-8 Mb/s (SD and HD TV Services mixed) = 1,4Gbit /s as streams.

What is IGMP Querying and IGMP Snooping and why would I need it on my network?

IGMP is a network layer (Layer 3) protocol used to establish membership in a Multicast group and can register a router to receive specific Multicast traffic. (Refer to RFC 1112 and RFC 2236 for information on IGMP versions 2 and 3) see also:
https://en.wikipedia.org/wiki/Internet_Group_Management_Protocol

Multicast aware switches are slowly making their way into the network cores for businesses and universities that have heavy traffic to move through their networks. Multicast filtering is achieved by dynamic group control management. By default, all Multicast traffic should be blocked until requested by a Multicast group member. (Default behaviour depends on switch manufacturer.) The master of the IGMP filter lists is the router or switch that is configured to act as the IGMP Queries. The responsibility of the Queries is to send out IGMP group membership queries on a timed interval, to retrieve IGMP membership reports from active members, and to allow updating of the group membership tables. A ***Layer 2*** switch supporting IGMP Snooping can ***passively snoop*** on IGMP Query, Report, and Leave (IGMP version 2) packets transferred between IP Multicast routers/switches and IP Multicast hosts to determine the IP Multicast group membership. IGMP snooping checks IGMP packets passing through the network, picks out the group registration, and configures Multicasting accordingly. See illustration:



Without IGMP Querying/Snooping, Multicast traffic is treated in the same manner as a Broadcast transmission, which forwards packets to all ports on the network. With IGMP Querying/Snooping, Multicast traffic is only forwarded to ports that are members of that Multicast group. IGMP Snooping generates no additional network traffic, which significantly reduces the Multicast traffic passing through your switch.

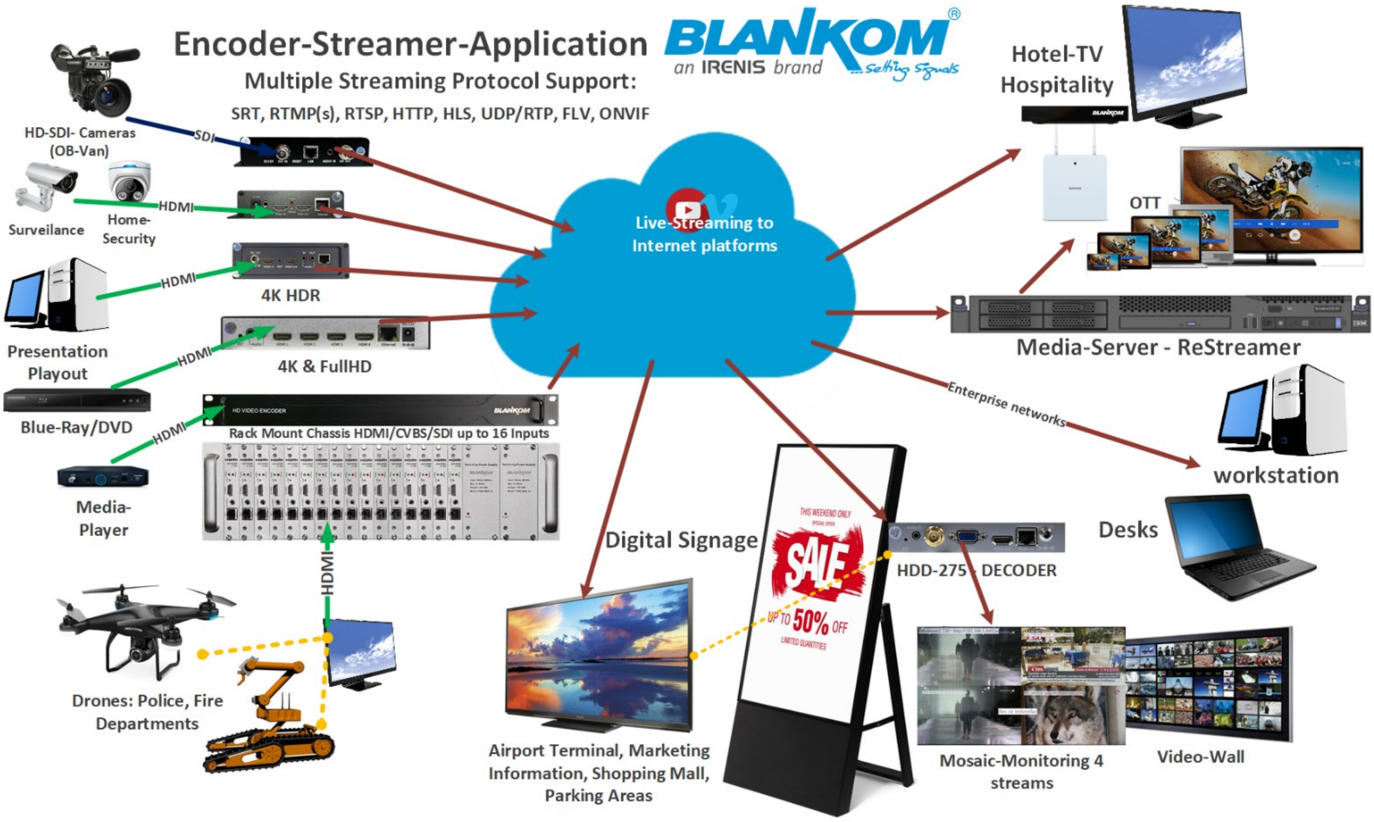
If your network distribution core does not support IGMP Querying/Snooping, the AVN streams will still function as designed but your network may be subjected to high traffic loads and condensed collision domain due to the broadcasting action used by the older switch or hub. If this is the case, you may wish to isolate the streaming nodes within the network so that the streams may be viewed without crossing the normal network traffic along its path.

Recommendation: Not only Snooping but IGMP V2 or V3 switches with Layer2+ (the + stand for extra features like IGMP full support) so better Layer 3 is the best solution.

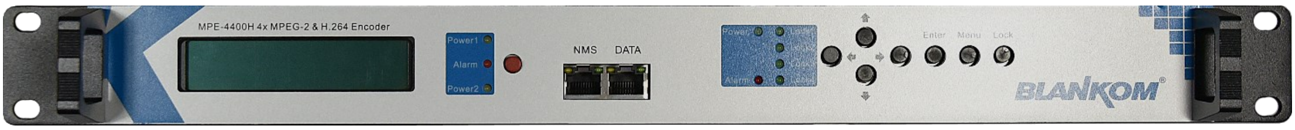
A small note: Consider public and private IPv4 addresses: Do not mess up when assigning your IPTV Multicast streams:
https://en.wikipedia.org/wiki/Reserved_IP_addresses

Address block	Address range	Number of addresses	Scope	Description
0.0.0.0/8	0.0.0.0–0.255.255.255	16 777 216	Software	Current network[3] (only valid as source address).
10.0.0.0/8	10.0.0.0–10.255.255.255	16 777 216	Private network	Used for local communications within a private network.[4]
100.64.0.0/10	100.64.0.0–100.127.255.255	4 194 304	Private network	Shared address space[5] for communications between a service provider and its subscribers when using a carrier-grade NAT.
127.0.0.0/8	127.0.0.0–127.255.255.255	16 777 216	Host	Used for loopback addresses to the local host.[3]
169.254.0.0/16	169.254.0.0–169.254.255.255	65 536	Subnet	Used for link-local addresses[6] between two hosts on a single link when no IP address is otherwise specified, such as would have normally been retrieved from a DHCP server.
172.16.0.0/12	172.16.0.0–172.31.255.255	1 048 576	Private network	Used for local communications within a private network.[4]
192.0.0.0/24	192.0.0.0–192.0.0.255	256	Private network	IETF Protocol Assignments.[3]
192.0.2.0/24	192.0.2.0–192.0.2.255	256	Documentation	Assigned as TEST-NET-1, documentation and examples.[7]
192.88.99.0/24	192.88.99.0–192.88.99.255	256	Internet	Reserved.[8] Formerly used for IPv6 to IPv4 relay[9] (included IPv6 address block 2002::/16).
192.168.0.0/16	192.168.0.0–192.168.255.255	65 536	Private network	Used for local communications within a private network.[4]
198.18.0.0/15	198.18.0.0–198.19.255.255	131 072	Private network	Used for benchmark testing of inter-network communications between two separate subnets.[10]
198.51.100.0/24	198.51.100.0–198.51.100.255	256	Documentation	Assigned as TEST-NET-2, documentation and examples.[7]
203.0.113.0/24	203.0.113.0–203.0.113.255	256	Documentation	Assigned as TEST-NET-3, documentation and examples.[7]
224.0.0.0/4	224.0.0.0–239.255.255.255	268 435 456	Internet	In use for IP multicast.[11] (Former Class D network).
240.0.0.0/4	240.0.0.0–255.255.255.254	268 435 455	Internet	Reserved for future use.[12] (Former Class E network).
255.255.255.255/32	255.255.255.255	1	Subnet	Reserved for the "limited broadcast" destination address.[3][13]

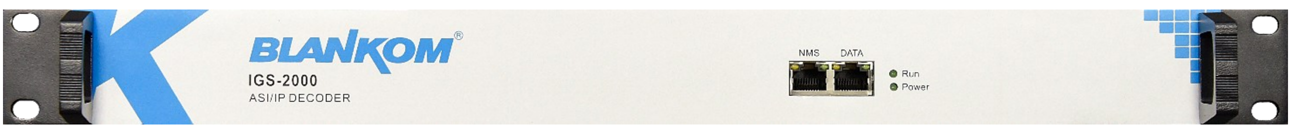
ENCODING:



These above are our multi-protocol-units. The Headend-Encoders/Decoders are supporting almost only UDP/RTP or some can RTSP/RTP. A Broadcast grade one (SDI and/or HDMI) is the MPE-4000:



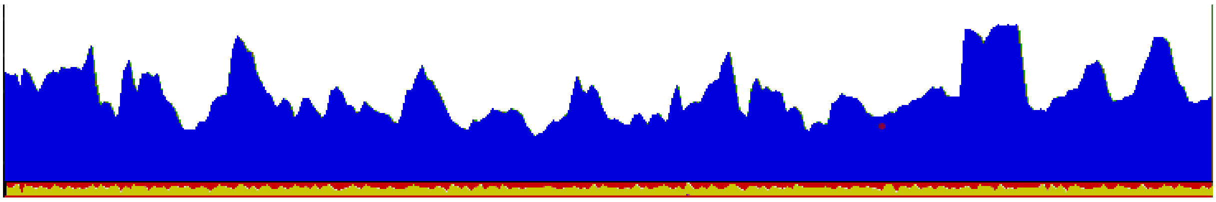
Counterpart: IP to HD-SDI – decoder IGA-2000/4000/6000 (2x – 4x – 6 x SDI outputs modular design)



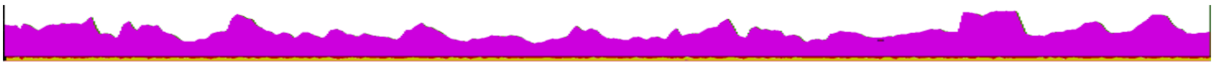
TRANSCODING

If bandwidth is an issue (e.g.: Hospitals with DSL 12Mb/s to the bed-terminals) in an existing network topology (corporate office networks…) and mechanism like VoIP / QoS priorities (or WIFI) has to be considered it might be necessary to transcode the streams to lower bitrates:

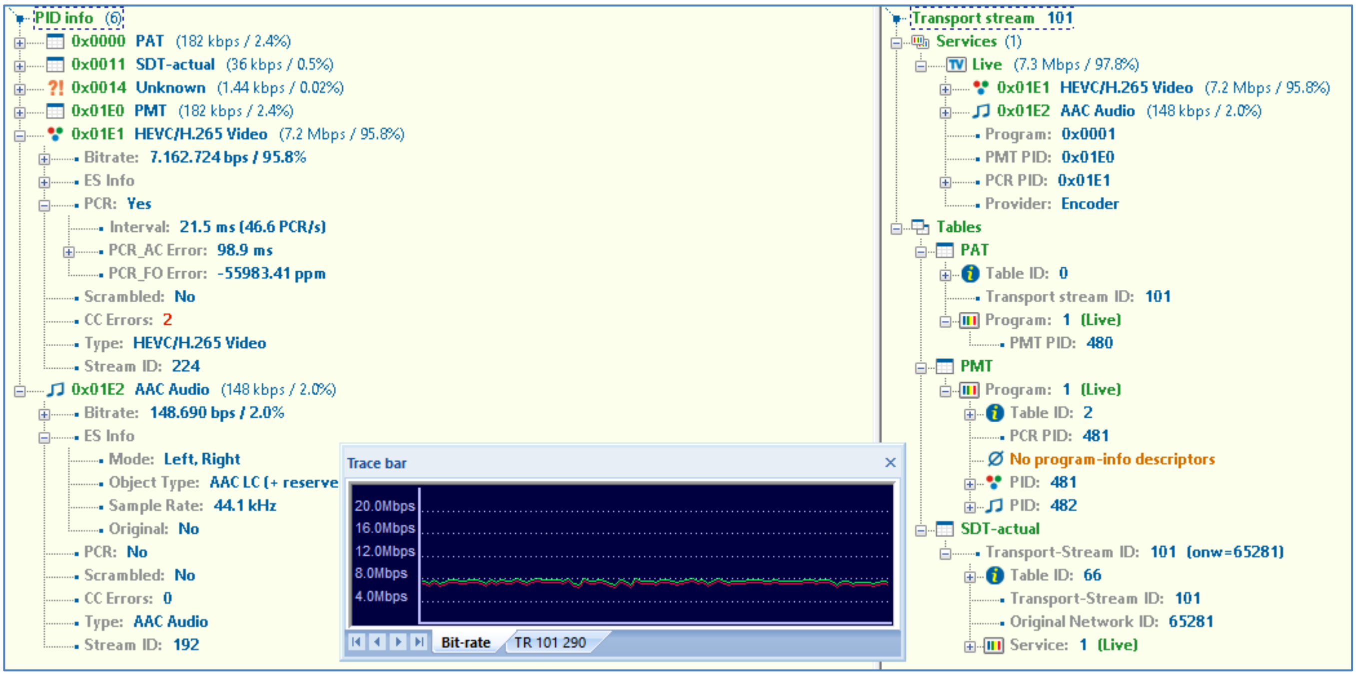
BTR-6000 Transcoder IP2IP



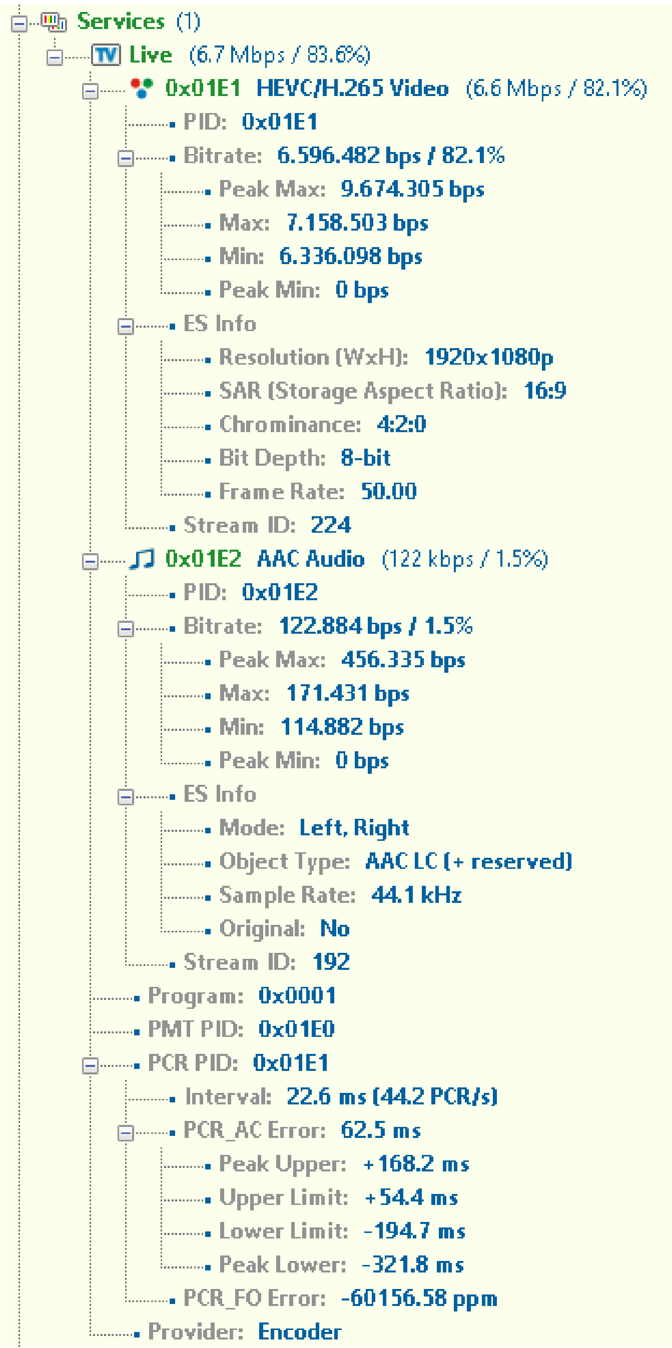
Re-transcode Bitrate, Video-Audio-Codecs (eg.: h.264 -> h.265 and Stereo MP1L2 to MP3…)



Minimum SPTS content: PAT, SDT, TDT (not mandatory), PMT and the Audio, Video- with including PCR:



Enhancing the information you see, that the Tables contains needful information about:



- **The Audio and Video Codecs in use**
- **The resolution and aspect ratio**
- **The colour scheme**
- **Bit-depth**
- **Stereo or surround sound (Dolby) mode**
- **Sample rates**
- **PCR Information**
- **Name of the broadcast stream**
- **And the Streaming provider**

All this information are at least the ones, the IPTV receiver inbuilt ‘Decoder-Chip’ needs to decode the A/V codecs and set it’s inbuilt de-codec parameters to get a proper Video and Audio over its external interfaces (HDMI, analog RCA , SP/DIF) out to the TV set Flatscreen Display.

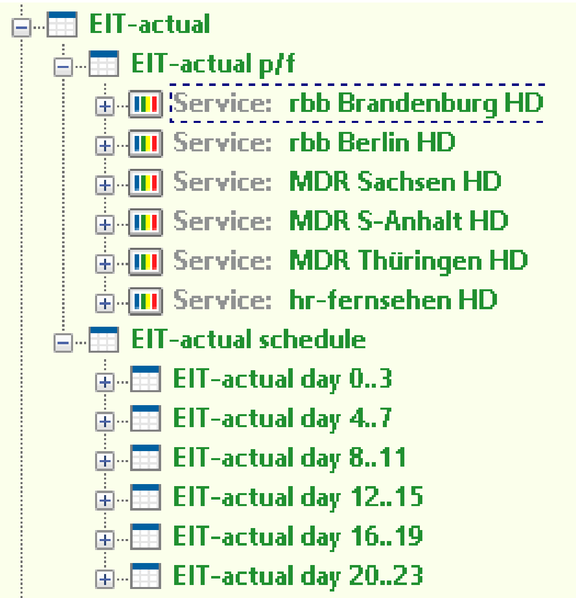
Regarding EPG = Electronic Program Guide in the EIT table:

The EIT is a combination of Information data in one table construct: The Event information Table in the TS on PID 18dec 12hex.
To ‘clamp’ this to the single SPTS it **must be de-multiplexed**. The EIT **is nested/linked** with the SDT containing ‘Flags’ ON or OFF means present or not. Also related to every Service ID

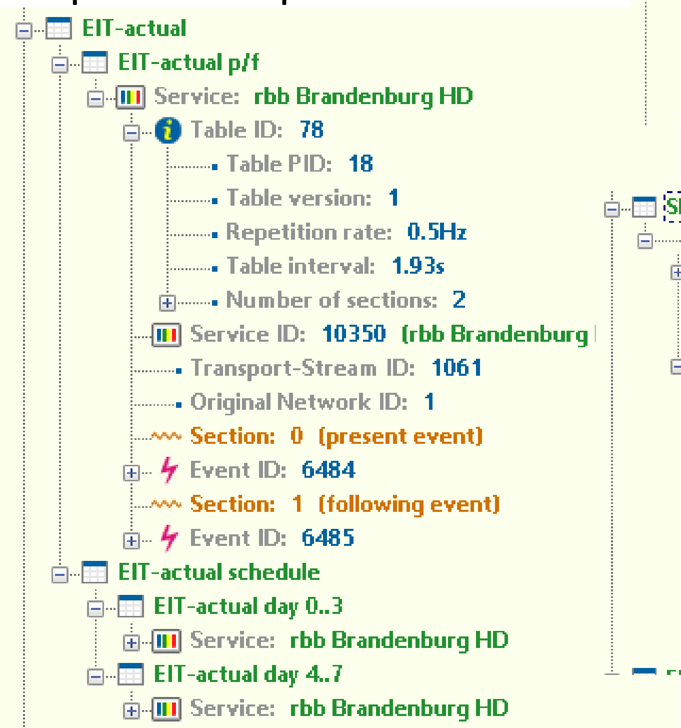
of a TV Service in the tables… So a SID remapping mode should follow in the EIT demultiplexing and rewriting it to the Stream Caroussel injected…

- The EIT is a data carousel which erases past information and add new ones periodically. So it's a dynamic table which processing occupies runtime CPU power.
- In Basic Linear IPTV system this works maximal partly with displaying present and following information if the STB does support this.
- The Middleware servers often generate their own EPG database for the STB's and showing these as html-tables. So it checks and extract them to update itself.
- The EPG is always necessary to make use of the PVR-Recording feature of the connected middleware server systems.

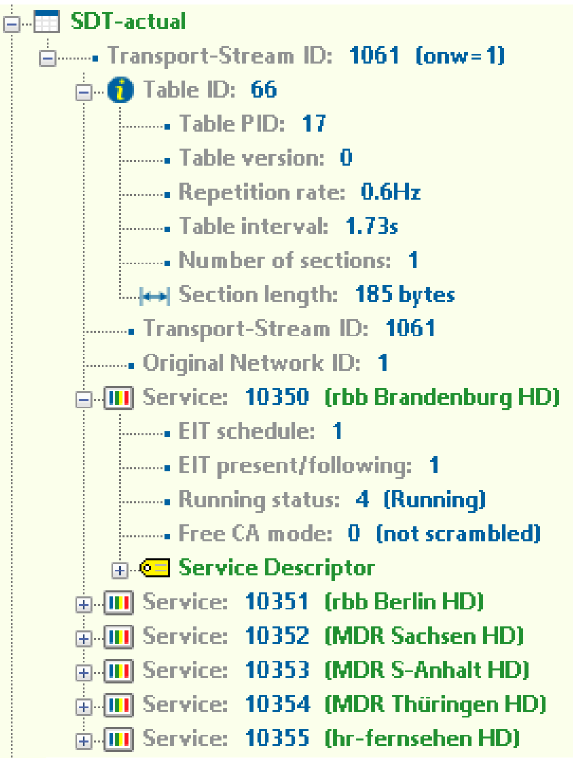
Example of the full MPTS EIT:

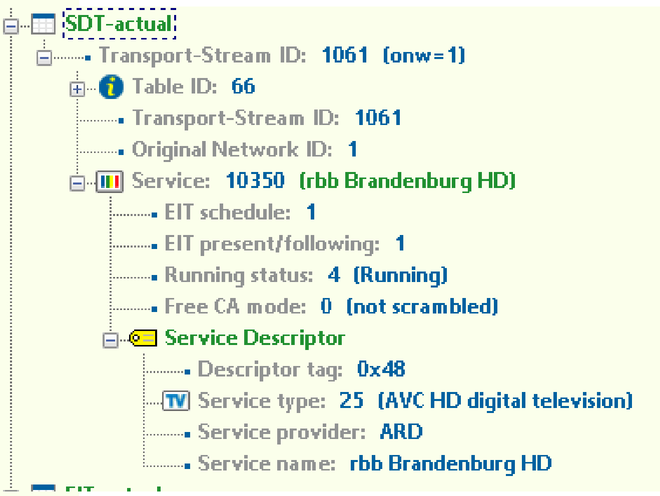


Example of a demultiplexed EIT in a SPTS:

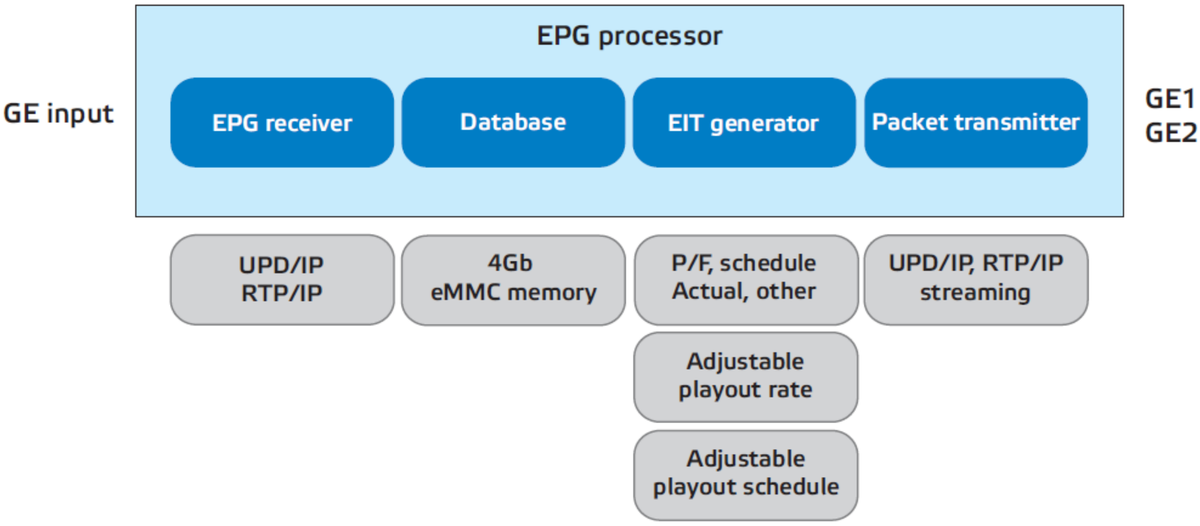


and it's FLAGS in the SDT set to 1





So the **High-class advanced IPTV Streamers** should make use of it like the Luminato. If you -as the operator- want to process EIT/EPG for your IPTV system: There is an extra Module available serving the EPG and also can Import XMLTV database files to process them and inject that data into your SPTS streams:



The EPG module creates full EPG information, including present/following and a schedule for actual and other transport streams. It makes it possible to control the playout rate and schedule and define languages in order of priority for the EPG stream. User-defined profiles make it possible to flexibly create and use outgoing EIT streams, thus giving efficient and optimized bandwidth usage.
Any Luminato receiver module can provide EIT information to the EPG processor module. In addition, the EPG module is capable of receiving EPG data over IP connections either from the operators' internal network or over the Internet. Sources for the EPG data include any hosted, Internet-based EPG data service. Also, file-based information (XMLTV) can be processed and played out using the EPG module.

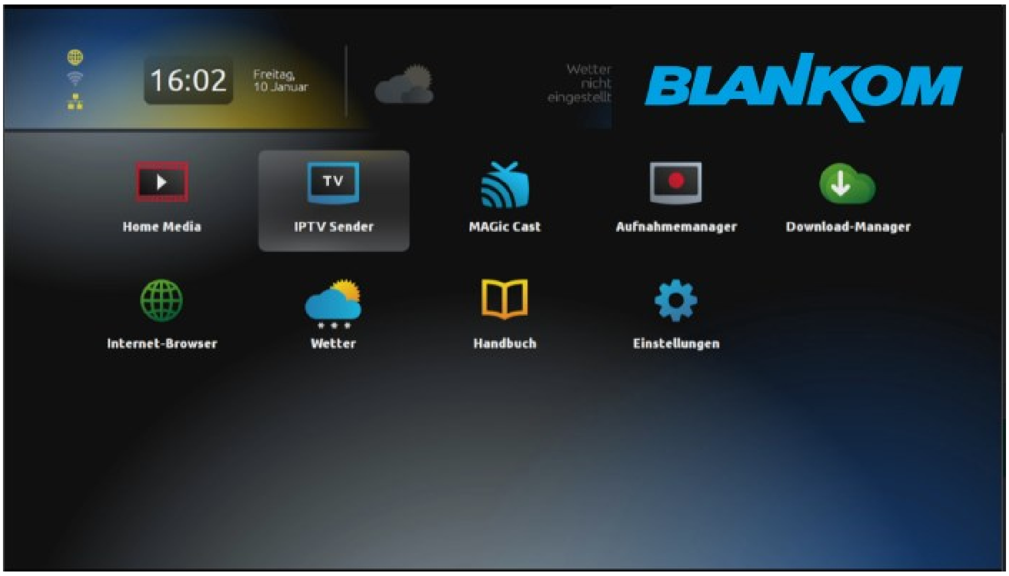
Therefore we are now coming to the **SetTopBoxes**:

There are different types available and with more or less modern or older chipset to a big range of cost – and features….

Digital Signage (DS):

For digital signage purpose like Display always the same content by IPTV served as an advertisement, news or information display (like in the terminals of an Airport or in a shopping mall) you need only a more or less stupid Box which i.e. obtains its address from a DHCP server automatically and has only one (or maybe some) Multicast -addresses installed like our M15:

- The box should start (after power up) always with its first program (multicast address) in its channel list w/o showing any interactive menus like other boxes do opening a portal:



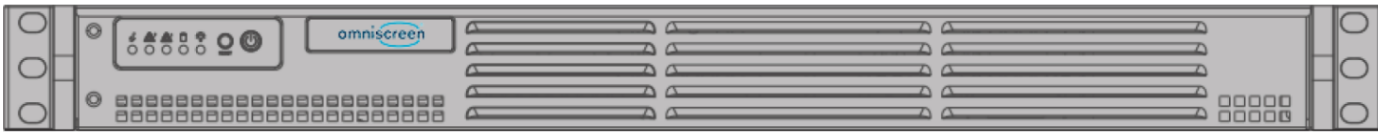
But the preprogrammed start address content:

Our non-expensive HD-MPEG4 decoder IPTV STB **Omniscreen M15 are supporting that**

can be configured by FTP transmitting a channel.json file to it… so these can be used for **Digital Signage in the basic linear IPTV system** as well as this BLANKOM STB's 6700+ (Support HEVC and 4K):

Mounting behind a Flatscreen is not a big issue… and the Infrared receiver diodes are almost sensitive also behind a TV set if the receiver hole of that diode is not covered somehow and is mounted behind the TV set and open to the ceiling… while this reflects the IR signal almost. Digital signage works also more comfortable with our other partner Amino based boxes…

doing that **only in combination with the OmniscreenTV Middleware server:**



This picture is not real, only as an example !!!

The server size and lookalike depends on the to be installed features and HDD capacities.

Advantage for the **mid class or high class system** design with OmniscreenTV Server:

- All of the DS-STB's can be managed remotely and content can be changed and scheduled automatically.

For the full details about the OmniscreenTV system please refer to its own brochure.

Following Hospitality TV sets are currently working with OmniscreenTV API:

- **Vestel MB90/95, MB110 (separate firmware management app required);**
- **Philips 5010, 5011, 7011, 5014 and 6014; xx14 series properly support Android apps and Chromecast**
- **LG Pro: Centric**
- **SONY**
- **Samsung AE690 series:**

And we are working on their new Tizen models….

Note: Technical issues are always a subject to change w/o further notifications

The final step is the question of additional services for your IPTV system:

A **scalable IPTV system** is available in different sizes like:

- A **BASIC** linear TV 'only TV Zapping' system (almost possible w/o any Middleware-Server)
- A **MID-Class** system providing add-on features like PMS-Interface, Info-Channels, basic Interactivity (Server needed)
- A **Premium 5-star** system with features like PMS, Timeshift, OTT, PVR, VoD, …) incl. WIFI to the rooms maybe …
  - One or even more servers needed
- A **Hybrid system** of DVB-C over Coax and additional IPTV and it's different services

All these have different approaches in technology and implementation as well as after-sales service and support considerations. Please do not expect a MERCEDES for the price of a FIAT 500.

But grow with your business: Is a concept - Starting with a Basic linear system can be later on enhanced with a Middleware Server, installing Digital Signage features as well as later on with an additional server for VoD or also OTT services.

Here we should note that the client's consumer receiver STB's or TV sets need to be considered from the beginning not to fall into traps. Example:

-SAMSUNG Smart- and Hospitality TV sets can operate as linear basic IPTV receiver but needs a tools for the Channel-Setup… later on when a middleware-server from OmniscreenTV will be installed, an App need to be installed in the supported TV sets.

- Basic standalone IPTV SetTopBoxes are not usually able to work with the middleware system – this needs to be considered from the beginning. Certainly we can adapt them for a fee of several man month working cost -> So that's not cheap….

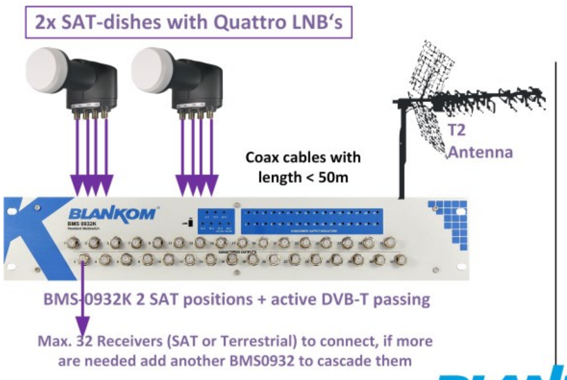
Please decide:

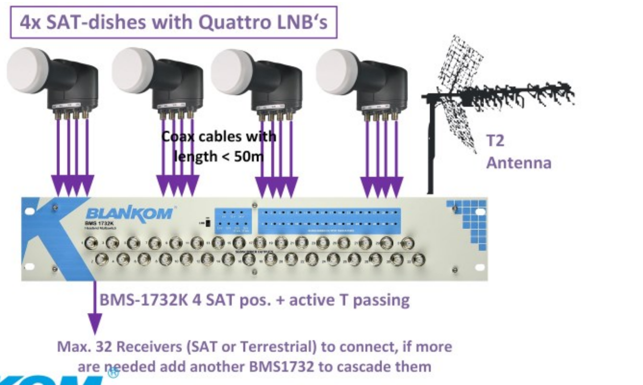
Simple Basic and cheap,

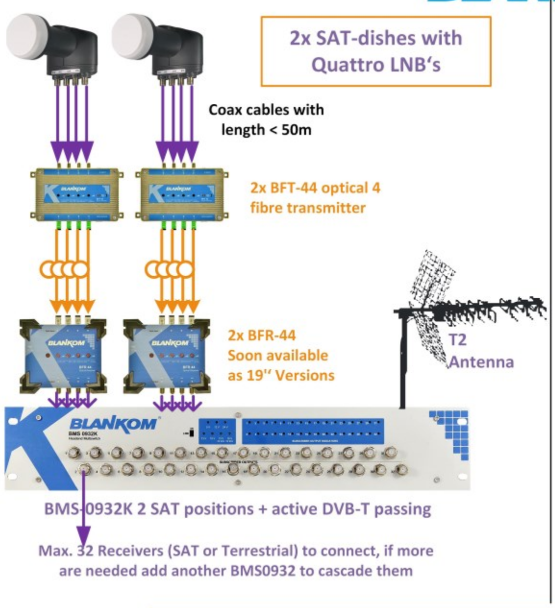
Mid-Class: with some added features like EPG support (Electronic Program Guide) **w/** or w/o a **middleware** server and the

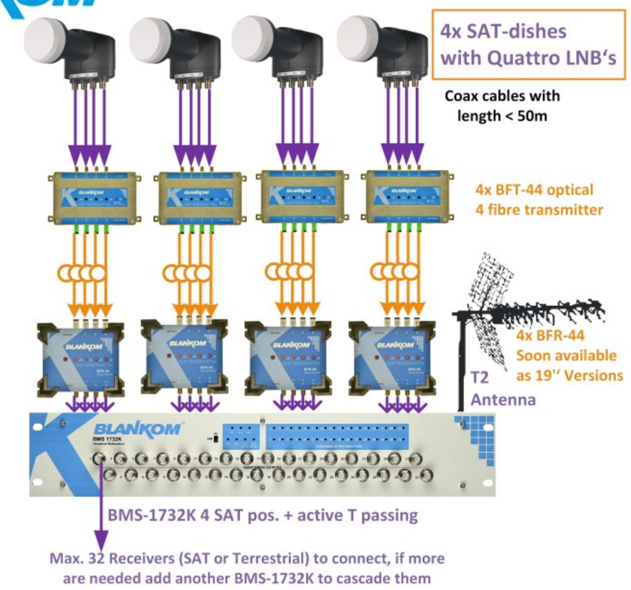
Advanced High Class system with more comfort which than comes into the price range of broadcaster equipment.

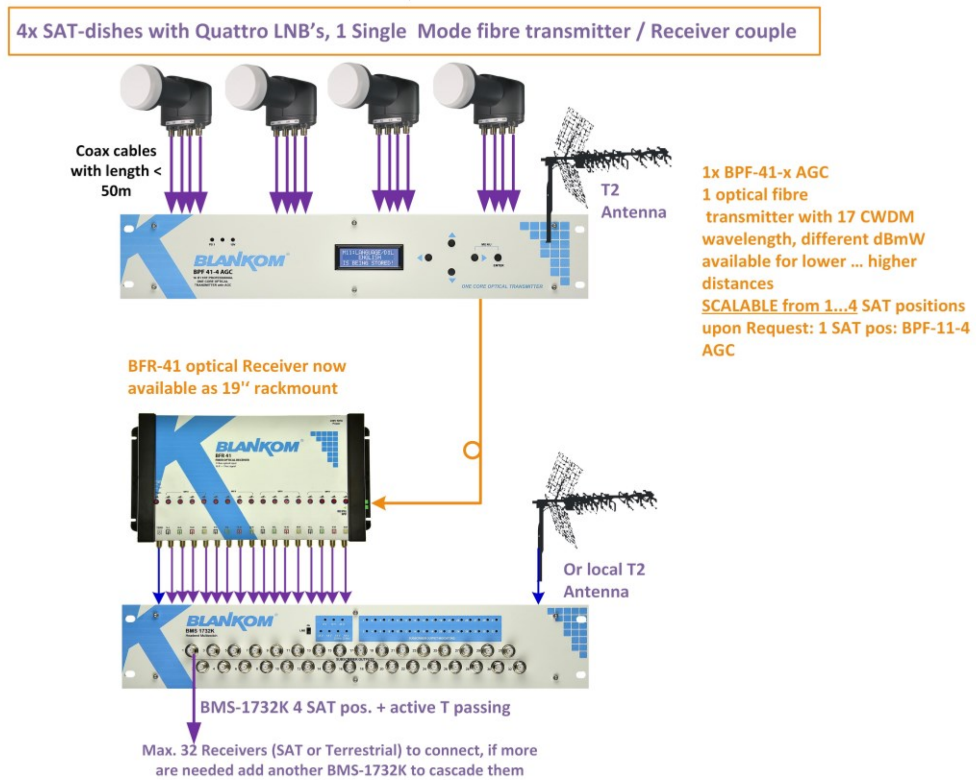
Following some more information about a) The SAT-concepts and b) the Headend's





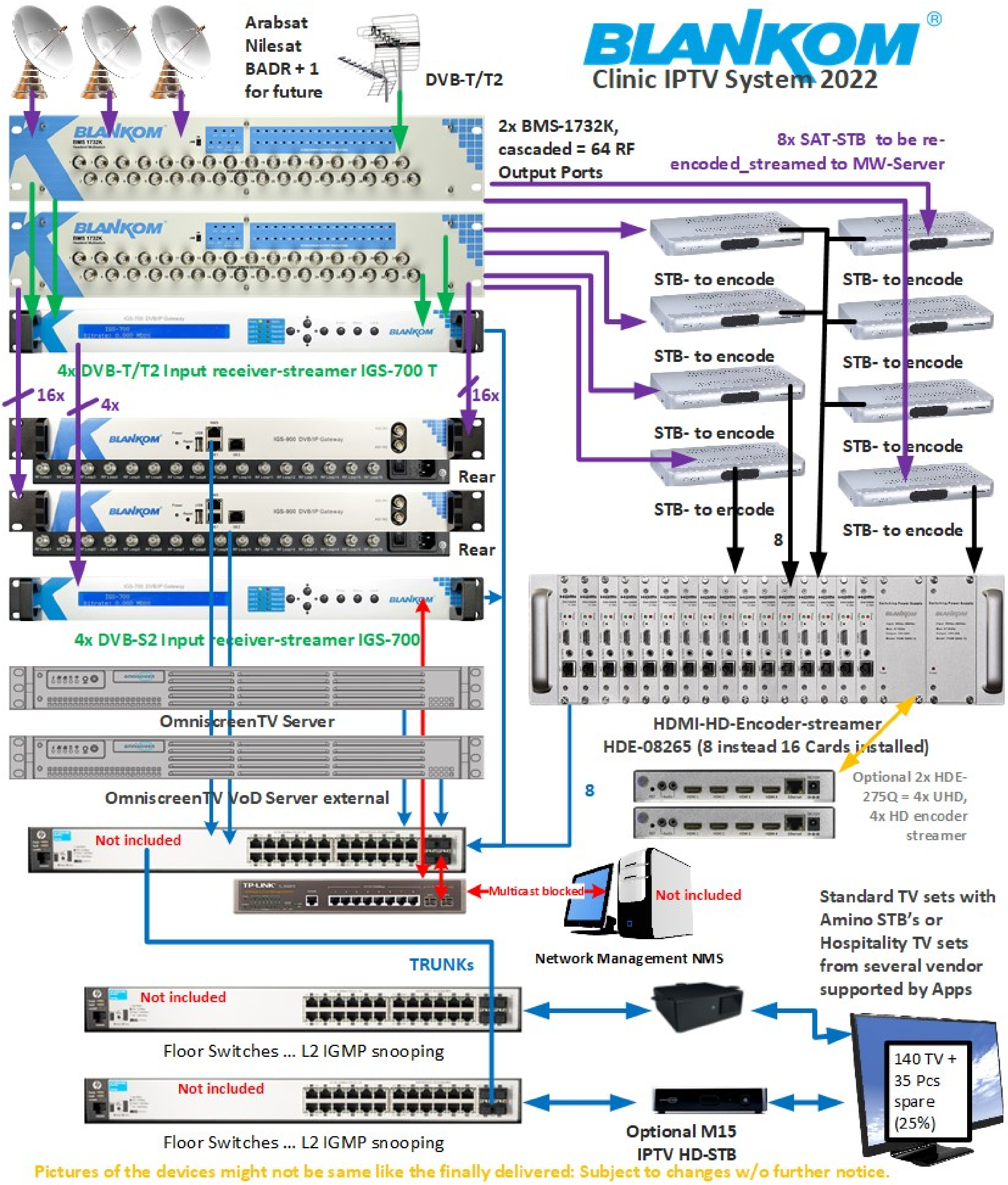






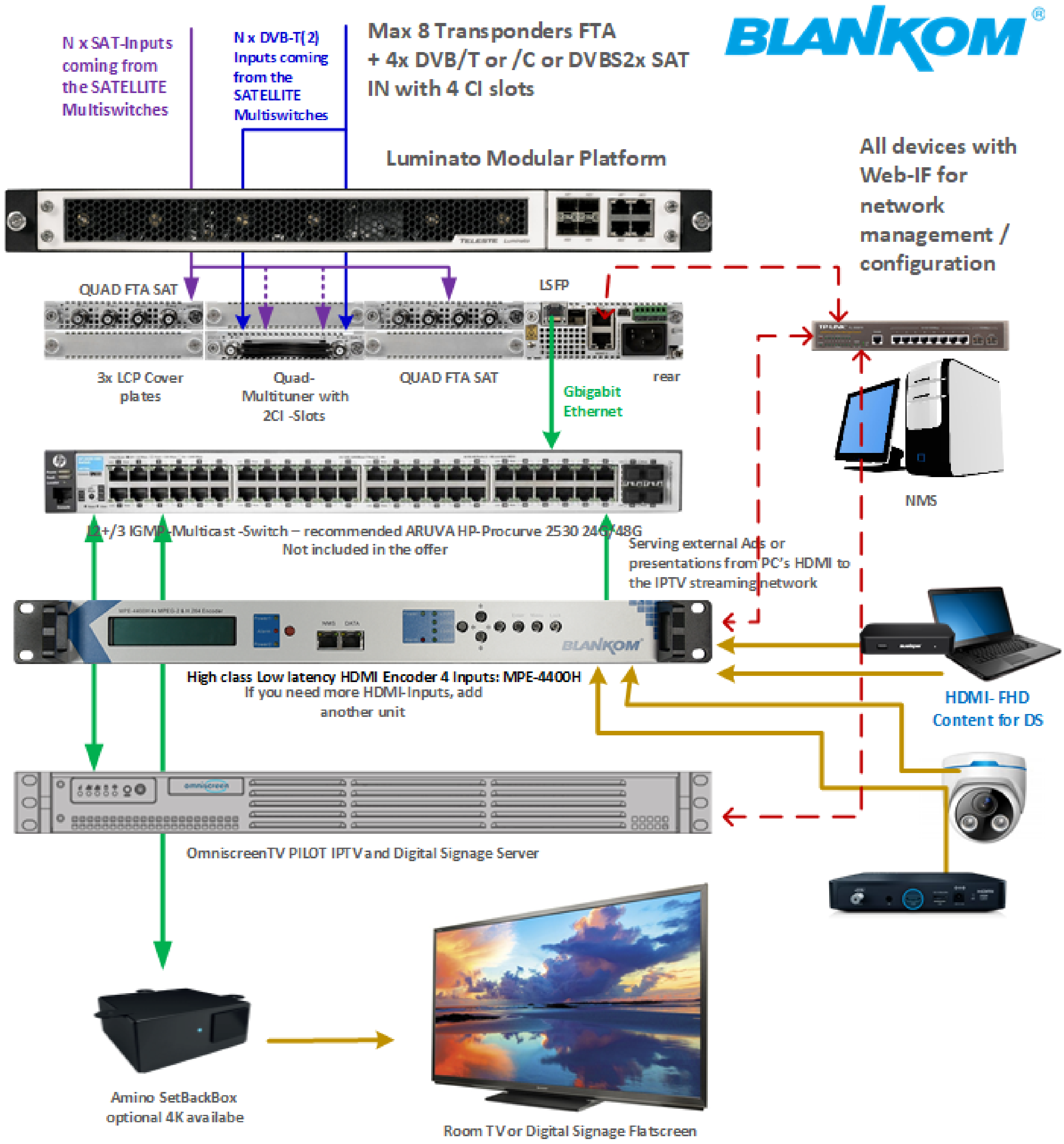
Coming soon: Electrical RF / Optical 2 SAT pos. Automatic and seamless Redundancy Switch for securing a ‚Master' & ‚Backup' 2 Dishfarm's (SAT-Backup Securing)

Examples:

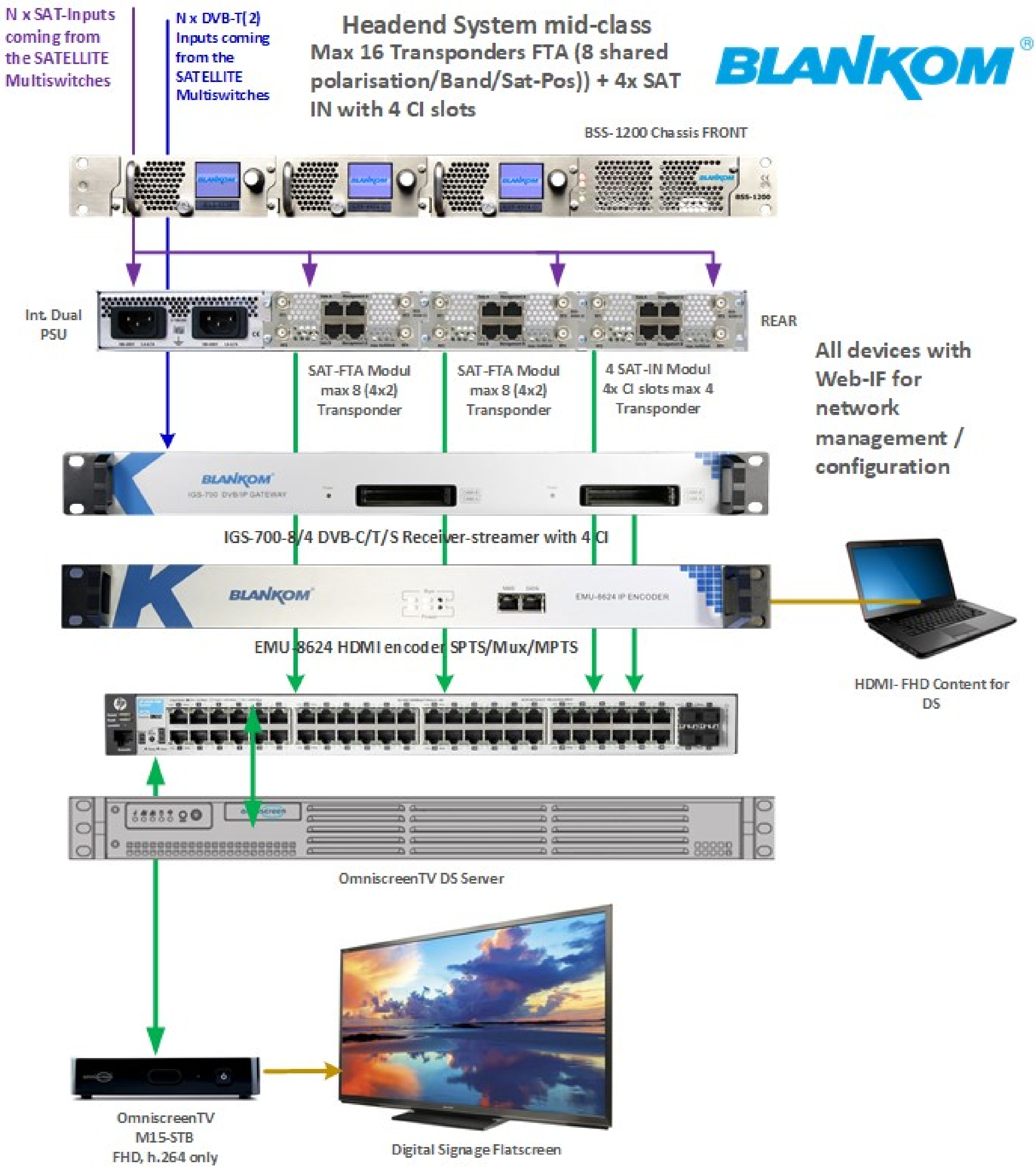


Arabsat
Nilesat
BADR + 1
for future
DVB-T/T2
BLANKOM
Clinic IPTV System 2022
2x BMS-1732K,
cascaded = 64 RF
Output Ports
8x SAT-STB to be re-encoded_streamed to MW-Server
STB- to encode
STB- to encode
STB- to encode
STB- to encode
STB- to encode
STB- to encode
STB- to encode
STB- to encode
4x DVB-T/T2 Input receiver-streamer IGS-700 T
16x
4x
16x
Rear
Rear
8
4x DVB-S2 Input receiver-streamer IGS-700
HDMI-HD-Encoder-streamer
HDE-08265 (8 instead 16 Cards installed)
OmniscreenTV Server
OmniscreenTV VoD Server external
8
Optional 2x HDE-275Q = 4x UHD, 4x HD encoder streamer
Not included
Multicast blocked
Not included
Network Management NMS
Standard TV sets with Amino STB's or Hospitality TV sets from several vendor supported by Apps
TRUNKs
Not included
Floor Switches ... L2 IGMP snooping
Not included
Floor Switches ... L2 IGMP snooping
Optional M15
IPTV HD-STB
140 TV + 35 Pcs spare (25%)
Pictures of the devices might not be same like the finally delivered: Subject to changes w/o further notice.

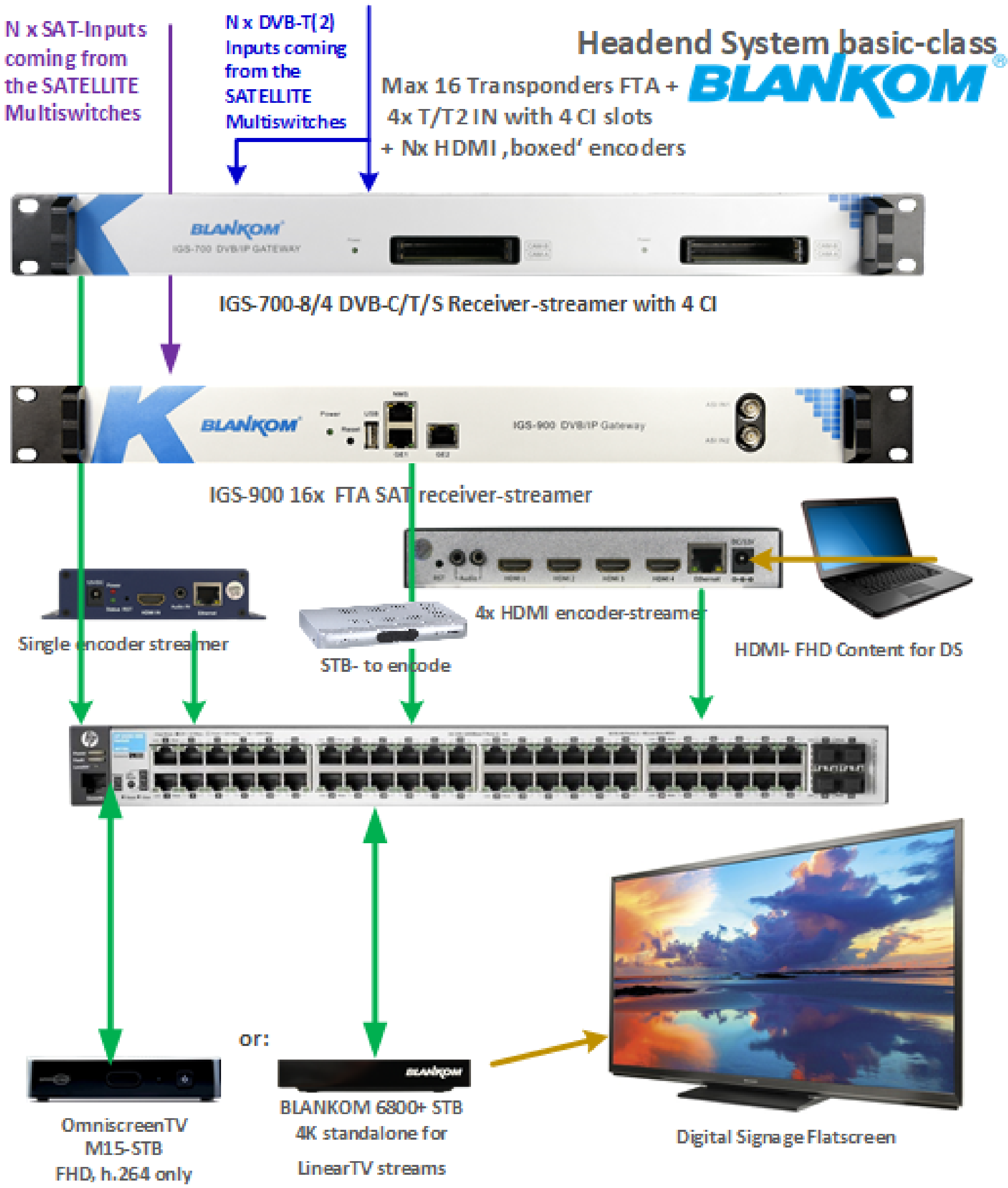
Having this data, we are able to provide you the appropriate professional Multi-Input HEADEND design, which may look like this system:



or this

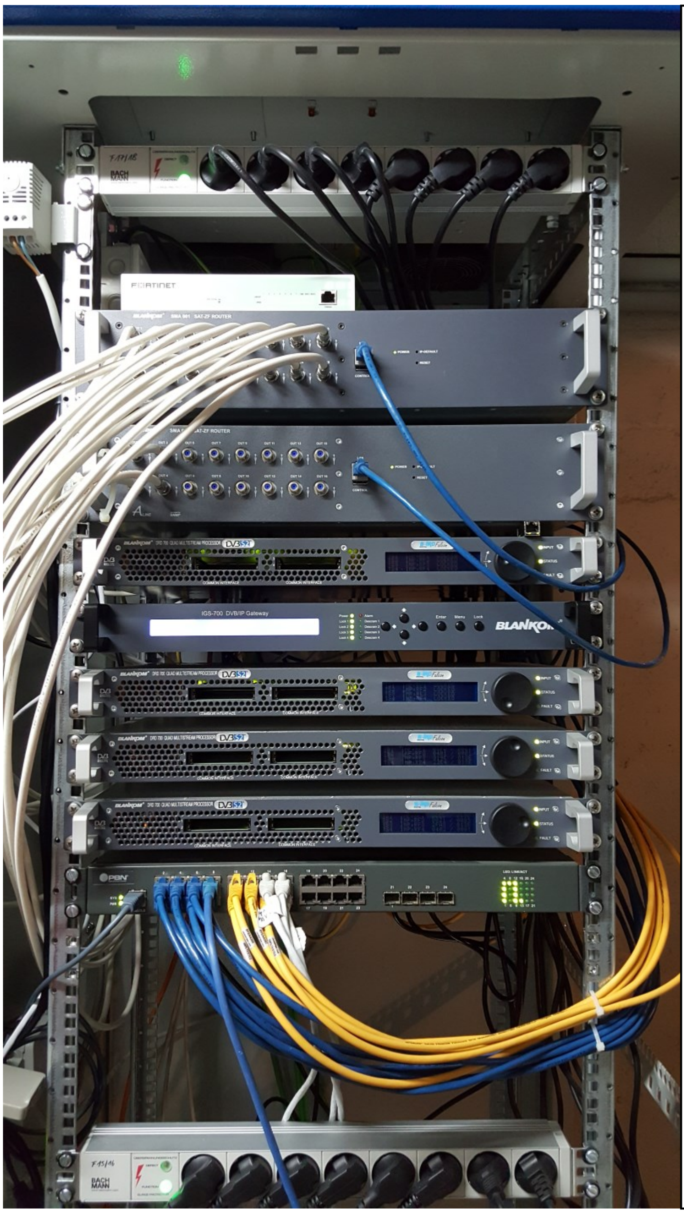

N x SAT-Inputs coming from the SATELLITE Multiswitches
N x DVB-T(2) Inputs coming from the SATELLITE Multiswitches
Headend System mid-class
Max 16 Transponders FTA (8 shared polarisation/Band/Sat-Pos)) + 4x SAT IN with 4 CI slots
BLANKOM
BSS-1200 Chassis FRONT
Int. Dual PSU
REAR
SAT-FTA Modul max 8 (4x2) Transponder
SAT-FTA Modul max 8 (4x2) Transponder
4 SAT-IN Modul 4x CI slots max 4 Transponder
All devices with Web-IF for network management / configuration
IGS-700-8/4 DVB-C/T/S Receiver-streamer with 4 CI
EMU-8624 HDMI encoder SPTS/Mux/MPTS
HDMI- FHD Content for DS
OmniscreenTV DS Server
OmniscreenTV M15-STB FHD, h.264 only
Digital Signage Flatscreen

Or this:



Basic LinearTV System w/o any management by a middleware server:
Just convert DVB-Input Transportstreams into single IPTV streams,
set up a channel-list in the STB and can be operated locally via an IR Remote Control.

If a management and remote handling is needed like for Digital Signage, just add the OMNISCREENTV server and use the M15-STB (HD, h.264 – see mid-class drawing)



Example for a BLANKOM basic Headend in a German 3 * Hotel:**

Older BLANKOM devices
mixed with a new one:

2 SAT-Positions

SAMSUNG HotelTV sets as clients

2x 19'' SAT Matrix cascaded

Layer 2+ Networks Switch
with IGMP V3

Streaming to the floors as Multicasts

appr. 125 TV services and several Radio streams

No Middleware server

No VoD

WLAN Hotel-management on top

Reserved Space for more
Receiver/Streamer for later upgrades

More questions?

Please contact our international Team from IRENIS - BLANKOM:

Contact:

Ralf RIEDEL

Director Technical Sales & Engineering (EU)

eMail: ralf.riedel@blankom.de

IRENIS GmbH
Hauptstr. 29
31171 Nordstemmen- Germany
Phone: +49 5069 4809781
IRENIS technical hotline VoIP +49 5069 4399 -860 or -8601
Managing Director: Dipl.Ing. Murad Önol
Commercial Register: HRB 206370 / District Court Hildesheim

Web: www.blankom.de E-Mail: info@blankom.de

Turkey and surrounding countries:

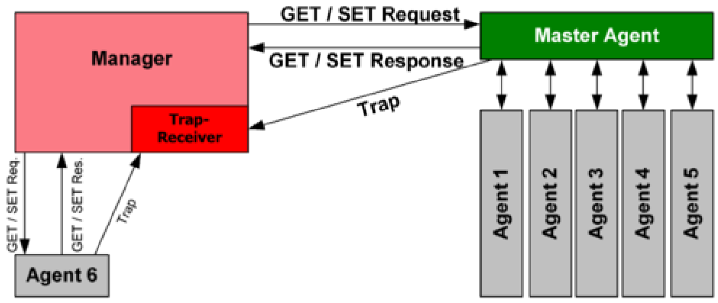
Murad Önol

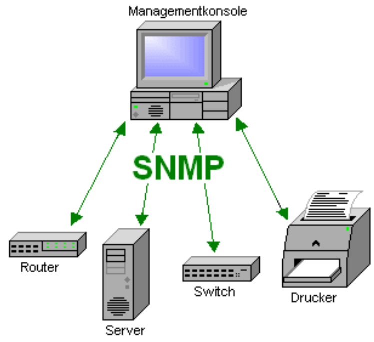
murad.onol@blankom.de

RoW:
Oliver.Vogel@blankom.de

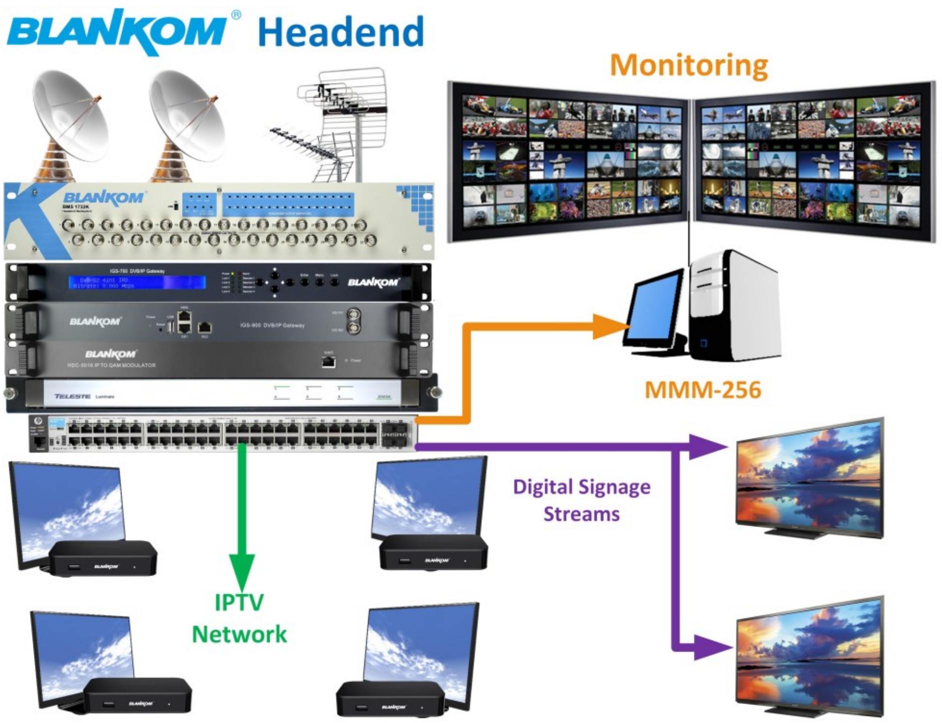
Extras: SNMP necessary?

Meanwhile the usage of web-browsers for configuring the Equipment is state of the art and a monitoring and configuration by SNMP (Simple Network Management Protocol) and a MIB-file supported by the network devices is not really necessary today but often demanded by network administrators – because they are lazy. SNMP is running on port 161 / 162 (traps) and was invented by 'lazy' networkers and need a monitoring / management tool or server which increases the cost of several thousands of € or $ …





Of course the modern head-end units are managed by Ethernet-TCP/IP http connections but we are talking about Television streams and not about critical life support systems… So if a Transponder is failing (See chapter about redundancy) who cares really? It's annoying but a more visual monitoring is fully enough for the TV streaming network like a Multiviewer (coming soon):



This can be installed in the headend itself, basically almost the IT room, in a cabin of the facility manager or wherever it is suitable. If a TV service will be BLACK your staff will recognize it after a while and can assign a technician to have a look at the headend and the SAT distribution: ADIDAS redundancy – means for the techie: Take on your sport shoes and run to the headend ;-) .

General notes about Streams:

RTP (Real-Time Transport Protocol)	
Familie:	Netzwerkprotokoll
Einsatzgebiet:	Transport von Medien-Streams
Port:	beliebiger freier, gerader Port größer 1024
RTP im TCP/IP-Protokollstapel:	
Standard:	RFC 3550 (RTP: A Transport Protocol for Real-Time Applications, 2003)

Anwendung	**RTP**				
Transport	UDP				
Internet	IP (IPv4, IPv6)				
Netzzugang	Ethernet	Token Bus	Token Ring	FDDI	…

any port (even, not odd > 1024, better 5004 and above)

Multicast streams:

Multicast Address Ranges:

We recommend, that the addressing of your Multicast streams should be in conjunction with this listings to avoid conflicts with other network equipment or protocols.

https://www.iana.org/assignments/multicast-addresses/multicast-addresses.xhtml

One small part from this:

IPv4 Multicast Address Space Registry

Last Updated

2018-01-05

Expert(s)

Stig Venaas

Note

Host Extensions for IP Multicasting [RFC1112] specifies the extensions required of a host implementation of the Internet Protocol (IP) to support multicasting. The multicast addresses are in the range 224.0.0.0 through 239.255.255.255. Address assignments are listed below.

The range of addresses between 224.0.0.0 and 224.0.0.255, inclusive, is reserved for the use of routing protocols and other low-level topology discovery or maintenance protocols, such as gateway discovery and group membership reporting. Multicast routers should not forward any multicast datagram with destination addresses in this range, regardless of its TTL.

Available Formats **XML** **HTML** **Plain text**

Registries included below

- Local Network Control Block (224.0.0.0 - 224.0.0.255 (224.0.0/24))
- Internetwork Control Block (224.0.1.0 - 224.0.1.255 (224.0.1/24))
- AD-HOC Block I (224.0.2.0 - 224.0.255.255)
- RESERVED (224.1.0.0-224.1.255.255 (224.1/16))
- SDP/SAP Block (224.2.0.0-224.2.255.255 (224.2/16))
- AD-HOC Block II (224.3.0.0-224.4.255.255 (224.3/16, 224.4/16))

- RESERVED (224.5.0.0-224.251.255.255 (251 /16s))
- DIS Transient Groups 224.252.0.0-224.255.255.255 (224.252/14))
- RESERVED (225.0.0.0-231.255.255.255 (7 /8s))
- Source-Specific Multicast Block (232.0.0.0-232.255.255.255 (232/8))
- GLOP Block
- AD-HOC Block III (233.252.0.0-233.255.255.255 (233.252/14))
- Unicast-Prefix-based IPv4 Multicast Addresses
- Scoped Multicast Ranges
- Relative Addresses used with Scoped Multicast Addresses

Multicast (as opposed to unicast) is used to send UDP packets from 1 source to multiple destination servers. This is useful for example for streaming from a satellite/DVB-T receiver to multiple receiving PCs for playback. Multicast can also be used on the output of an encoder to feed multiple streaming servers. Multicast only works with UDP and is not possible with TCP due to the 2 way nature of TCP, most commonly multicast is used with RTP and MPEG2-TS.

A multicast IP address must be chosen according to IANA information, we recommend using an address in the range **239.0.0.0 to 239.255.255.255** as this is reserved for private use. Using multicast addresses in the 224.0.0.0 range may clash with existing services and cause your stream to fail. For more details see http://www.iana.org/assignments/multicast-addresses/multicast-addresses.xml

Choosing a UDP port number for multicast streams is also important. Even if you use a different multicast IP for each of your streams, we strongly recommend using different UDP port numbers as well. This is because a server and all software running on the server receives ALL multicast traffic on an open port and extra processing is required to filter out the required traffic. If the each stream arrives on a different port, the server can safely ignore any traffic on ports that are not open. Port numbers MUST be chosen so that don't clash with any existing services or ephemeral ranges. The ephemeral range for Windows Vista, 7, 2008 is 49152 to 65535, for older Windows it is 1025 to 5000 and for Linux it is 32768 to 61000. For more information on Windows see http://support.microsoft.com/kb/929851 Care should also be taken to avoid system ports 0 to 1024. See http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml Generally one of the unassigned You Ports (**1024-49151**) should be used, you can run the ***netstat -abn*** (as admin under windows) command to see which ports are currently in use.

Registered port

A **registered port** is a network port (a sub-address defined within the Internet Protocol, in the range 1024–49151) assigned by the Internet Assigned Numbers Authority (IANA) (or by Internet Corporation for Assigned Names and Numbers (ICANN) before March 21, 2001,[1] or by USC/ISI before 1998) for use with a certain protocol or application.

Ports with numbers 0–1023 are called *system or well-known ports*; ports with numbers 1024-49151 are called *you or registered ports*, and ports with numbers 49152-65535 are called *dynamic and/or private ports*.[2] Both system and you ports are used by transport protocols (TCP, UDP, DCCP, SCTP) to indicate an application or service.

- **Ports 0–1023** – system or well-known ports
- **Ports 1024–49151** – you or registered ports
- **Ports >49151** – dynamic / private ports

https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers

Range for Ephemeral port

The Internet Assigned Numbers Authority (IANA) suggests the range 49152 to 65535 ($2^{15}+2^{14}$ to $2^{16}−1$) for dynamic or private ports.[1]

Many Linux kernels use the port range 32768 to 61000.[note 2] FreeBSD has used the IANA port range since release 4.6. Previous versions, including the Berkeley Software Distribution (BSD), use ports 1024 to 5000 as ephemeral ports.[2][3]

Microsoft Windows operating systems through XP use the range 1025–5000 as ephemeral ports by default.[4] Windows Vista, Windows 7, and Server 2008 use the IANA range by default.[5] Windows Server 2003 uses the range 1025–5000 by default, until Microsoft security update MS08-037 from 2008 is installed, after which it uses the IANA range by default.[6] Windows Server 2008 with Exchange Server 2007 installed has a default port range of 1025–60000.[7] In addition to the default range, all versions of Windows since Windows 2000 have the option of specifying a custom range anywhere within 1025–65535.[8][9]

Packet structure

UDP Header

Offsets	Octet	0								1								2								3							
Octet	**Bit**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
0	**0**	Source port																Destination port															
4	**32**	Length																Checksum															

The UDP header consists of 4 fields, each of which is 2 bytes (16 bits).[1] The use of the fields "Checksum" and "Source port" is optional in IPv4 (pink background in table). In IPv6 only the source port is optional (see below).

Source port number

This field identifies the sender's port when meaningful and should be assumed to be the port to reply to if needed. If not used, then it should be zero. If the source host is the client, the port number is likely to be an ephemeral port number. If the source host is the server, the port number is likely to be a well-known port number.[4]

Destination port number

This field identifies the receiver's port and is required. Similar to source port number, if the client is the destination host then the port number will likely be an ephemeral port number and if the destination host is the server then the port number will likely be a well-known port number.[4]

Length

A field that specifies the length in bytes of the UDP header and UDP data. The minimum length is 8 bytes because that is the length of the header. The field size sets a theoretical limit of 65,535 bytes (8 byte header + 65,527 bytes of data) for a UDP datagram. However the actual limit for the data length, which is imposed by the underlying IPv4 protocol, is 65,507 bytes (65,535 − 8 byte UDP header − 20 byte IP header).[4]

In IPv6 jumbograms it is possible to have UDP packets of size greater than 65,535 bytes.[5] RFC 2675 specifies that the length field is set to zero if the length of the UDP header plus UDP data is greater than 65,535.

Checksum

The checksum field may be used for error-checking of the header and data. This field is optional in IPv4, and mandatory in IPv6.[6] The field carries all-zeros if unused.[7]

RTP:

a part from: https://tools.ietf.org/html/rfc3550

Chapter 11:

RTP relies on the underlying protocol(s) to provide demultiplexing of RTP data and RTCP control streams. For UDP and similar protocols,

RTP SHOULD use an **even** destination port number and the corresponding
RTCP stream SHOULD use the next higher (odd) destination port number.

For applications that take a single port number as a parameter and derive the RTP and RTCP port pair from that number, if an odd number is supplied then the application SHOULD replace that number with the **next lower (even)** number to use as the base of the port pair. For applications in which the RTP and RTCP destination port numbers are specified via explicit, separate parameters (using a signaling protocol or other means), the application MAY disregard the restrictions that the port numbers be even/odd and consecutive although the use of an even/odd port pair is still encouraged. The RTP and RTCP port numbers MUST NOT be the same since RTP relies on the port numbers to demultiplex the RTP data and RTCP control streams.

In a unicast session, both participants need to identify a port pair for receiving RTP and RTCP packets. Both participants MAY use the same port pair. A participant MUST NOT assume that the source port of the incoming RTP or RTCP packet can be used as the destination port for outgoing RTP or RTCP packets. When RTP data packets are being sent in both directions, each participant's RTCP SR packets MUST be sent to the port that the other participant has specified for reception of RTCP. The RTCP SR packets combine sender information for the outgoing data plus reception report information for the incoming data. If a side is not actively sending data (see Section 6.4), an RTCP RR packet is sent instead.