

NorDig 20 years anniversary (1997 – 2017)

Please enjoy this summary and description of the work within NorDig for the last 20 years. Looking back at history is an inspiration to continue the work and face the challenges of the future!

As present chairman for Nordig Excom, I would like to thank the following for their contribution to this historic review; Anders Appelqvist (secretary), Hans Fjøsne (former chairman of Nordig-T), Per Tullstedt (current chairman of Nordig-T) and Jan-Olof Gurinder (former chairman of ExCom).

Ingve Bjerknes

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NorDig 20 years

Brief summary

NorDig was established at the early days of digital TV-distribution, expected to replace 50 years of analogue TV. During 1997, the Odense declaration by broadcasters stated that there should be unified rules in the Nordic region, where the combined size of the market could influence manufacturers to have common solutions for the Nordic TV viewers. A press release in October 1997 stated the following objectives:

- that the nationwide channels of all the Nordic countries be accessible throughout the Nordic region;
- that a uniform set of criteria and specifications regarding receiver apparatus be set out for the benefit of manufacturers and providers of service; and
- that viewers be given the greatest possible freedom of choice of channels, services and distribution systems.

The organizations behind NorDig selected a working group and set a timetable aiming to take decision at the Annual Meeting of the Board of Directors (CEOs) in end 1998. An executive committee (ExCom) organized the work, and did from the beginning set up a Technical Subcommittee (NorDig/T) to start the work on new specifications. Another Subcommittee addressed interactivity together with commercial, regulatory and legal issues. These issues became more a part of the discussion in ExCom. Each member contributed with 100.000 DKK to get things started with a possibility of deciding additional funding in the future. Today NorDig is still alive with a yearly budget.

Members were initially Nordic broadcasters and distributors. In 2008 broadcaster and DTT distributor from Republic of Ireland joined NorDig and extending NorDig's scope. From the beginning, the industry has been invited to influence the work in NorDig/T and were in a later stage invited to be represented in ExCom.

Many individuals have made a significant contribution to the work during these 20 years but to point out a few Jan-Olof Gurinder (SVT) was the chair of ExCom for many years while Hans Fjösne (Canal Digital/Telenor) also for many years was the chair of NorDig/T providing ExCom with a number of proposals and changes. Since then, Per Björkman, Ingve Bjerknes, Henri Caddeo and Per Tullstedt have followed the chair roles.

In a more globalized market, it has been important for NorDig not to make unique standards for the Nordic and Irish region, but to build on international/European standards developed by DVB and unify issues which is believed to be important for the viewers in the Nordic and Irish region.

An important achievement of NorDig is that common decisions has led to unified products for the region leading to reduced consumer prices, higher performance and combined the requirements for all classical distribution forms (satellite, cable and terrestrial) into one and the same receiver specification. NorDig has also established common Rules of Operation and Test plan, the latter to verify fulfilment of the requirements. NorDig has chosen to make all published specifications open available for all at NorDig website (www.nordig.org). The NorDig specifications now has influenced other countries even to the other side of the globe giving NorDig a much wider international reach than the Vikings ever achieved.

Since technical development never stops, NorDig has proven to be vital for keeping the specifications up to date to ensure that future broadcast is in line with international standards and consumer behavior. One challenge for the future is the ongoing change from only direct viewing of broadcast to interactive applications and a rapid growth of OTT consumption. The possibilities to share content in other ways than broadcast may also lead to contact with new stakeholders and distribution alternatives.

General background and international trends

Broadcasting underwent profound changes in the decade before NorDig was established. Digital terrestrial distribution (DTT) opened for additional broadcasters, distribution over cable networks (CATV) opened for multichannel reception and satellite distribution (DTH) opened for easy international and wide-area distribution of broadcast signals. These developments lead to a rapid growth of new commercial TV-channels, based on advertisement and pay-tv financing.

The Nordic countries were among the pioneers in these developments, both with developments of CATV and DTH as well as distribution of public and commercial channels, based on financing via advertisement and pay-TV. The broadcast formats were analogue and for satellite; the hybrid digital-analogue format, MAC.

The transition from analogue to pure digital broadcast formats was in rapid development, with the establishment of DVB in the early 90s playing an important role. DVB grew out of EBU, but included both broadcasters, distributors as well as manufacturers as members. DVB produced a set of specifications and guidelines for broadcasting, covering all platforms, terrestrial, cable, satellite and (later) broadband. The DVB specifications were crucial for the success of switching the TV distribution from analogue to digital.

DVB specified methods to achieve specific functions related to various broadcasting methods and related to two-way transmission. These specifications included the relevant signals for transmission (front-end) and basic signal handling (decoding of signal components). In addition specifications related to API were established (initially MHP and later HbbTV), while issues related to CA were largely avoided, due to commercial sensitivity.

Digital broadcasts emerged first on satellite. The drivers were commercial distributors who found digital advantageous both for reducing transmission costs and for establishing efficient access control. These DTH distributors were both advertisement and pay-TV financed. The programme packets included both Public Broadcaster channels and new commercial channels. These new channels were introduced by new commercial distributors, like Viasat and Canal Digital in the Nordic region, BSkyB in UK and Canal+ in France.

The main players in this media world were public and commercial **broadcasters**, **TV distributors** (based on advertisement or pay-TV), **network operators** and **equipment manufacturers**. Some of the larger players could cover one or more roles (e.g. programme provider and /or TV-distributor and/or network operator). This created different business strategies for “Vertical integrated” operators and operators on “horizontal” integrated platforms.

DVB has had a large acceptance in the broadcast field, with acceptance far beyond Europe. However, DVB did not succeed with its two-way (broadband) specifications. The cable networks, both European and North American, selected Docsis specifications from CableLabs for their broadband services, while telco broadband networks used ITU-specifications. However, the use of IP-based protocols has given a common transmission protocol that covers both cable and telco networks (HFC/fibre/xDSL/mobile networks). The consequences of these standards are important for broadband/Internet and IPTV/OTT with associated systems.

Manufacturers of consumer TV-receivers, both STBs and TV sets, are aiming for the mass market. This allows few adaptations for the smaller markets, unless when providing special incentives. It was important for broadcasters and operators in the Nordic market to be in line with international developments, as the Nordic countries have relatively small populations. This also meant that the Nordic broadcasters and operators had to act as united as possible if they should motivate the international based manufacturers to support specific Nordic requirements. The same argument went for influence into the DVB-organisation, where coordinated inputs from Nordic members had a higher possibility for acceptance.

The Nordic players

Public broadcasters (PB) are license and advertisement financed.

They were originally monopolies in their own nations, tied to national terrestrial distribution. In the 90's the monopolies were gone and they were also carried via DTH and CATV to end users.

Commercial broadcasters (CB) are broadcasters without PB license (and PB obligations). Some of these have Nordic owners while others are part of international media houses.

DTT network operators and DTT pay-TV distributors for terrestrial distributed digital TV. DTT networks (outside Nordic) are often considered to be Free-To-Air (FTA), but the Nordic DTT networks have a mix of FTA and PayTV.

In the Republic of Ireland, all services in the network are FTA. Saorview is the name of the DTT network and RTÉNL is the network operator.

The Nordic DTT operations are organised with two (or more) operators; the **network operator(s)** (ref Teracom, Norkring, Digita, DNA) and the commercial **pay-TV-distributor** (ref Boxer TV Access, Riks-TV, DNA/PlusTV). Some DTT networks also have a co-ordinator (like NorgesTelevision and DigiTV). (In 2016/2017 Swedish cable operator ComHem has acquired Boxer Sweden and Danish cable operator Stofa has acquired Boxer Danmark).

DTH distributors distribute TV via satellite, both advertisement and pay-TV financed. In Nordic DTH networks, all TV services are normally scrambled. The pay-TV-packets included both PB-channels and commercial channels. There are two TV distributors competing in the Nordic marked, Canal Digital (Telenor) and Viasat (MTG).

CATV/IPTV operators were initially financed by user payment for TV-distribution (pay-TV), but are increasingly also based on income from broadband services (Internet). CATV-operators initially relayed channels from DTT and DTH into their networks, thus being both pay-TV-distributor (service provider) and network operator. .

Telcos, hardly present in TV-distribution in the initial years, but started with broadband services (Internet) and have later introduced TV as IPTV. Telcos typically operate both as network operator and pay-TV- distributor. The business models are quite close to the CATV operators.

OTT-distributors operate on open Internet. OTT distributions were not present in the initial years, but internationally based OTT distributors like Netflix and Social media companies like Facebook, are distributing content over open Internet. This distribution method has grown rapidly over the last few years.

NorDig work and external relations

Active participation from all players drove the work in NorDig. This was, and still is, essential in order to cover the interests of the members, as well as clarifying the conflicts of interests that were inherent between the various commercial players. This allows identification of functions that were suited for common minimum requirements, as well as omit operator specific functions. The work in ExCom was fundamental, as it had to resolve the main principles and limitations.

In order to strengthen the acceptance of the specifications, NorDig consults manufacturers of STBs and IDTV-sets, as well as the leading chip manufacturers about implementation feasibility and preferences. NorDig/T invites observers from these groups for participating in its meetings in order to ensure that the specifications were well within practical limits, as well as in line with international trends. Cooperation with the industry has been important especially when NorDig were implementing new minimum requirements and new specifications from DVB.

Furthermore, NorDig attempted to ensure common testing of new STBs and IDTV-sets, as well as common NorDig marking (logo), in order to ensure adherence to the NorDig specifications work.

Common test specifications were established, and especially Teracom, and later Labwise, made a great effort in both the establishment and execution of such test and in ensuring industry awareness of these tests.

In addition, the various commercial operators had their own tests, related to acceptance of procured STBs that should satisfy both the common NorDig and operator-specific specifications.

A NorDig task for a common testing for TV sets and STBs failed to succeed i.a. due to many commercial operators had their own additional and specific requirements that they preferred to test themselves. In this context, common testing refers to test once in one test facility for all relevant NorDig markets and platforms.

The initial challenges and early results

The challenges

The DVB specifications were not minimum requirements; it was up to the individual operator to select functions and establish the relevant platform, based on DVB and other specifications.

In the Nordic area (as elsewhere), the various operators started digital broadcasts at different times and with different commercial goals.

The two DTH-operators were the first who started with migrations towards digital platforms. Viasat and Canal Digital chose largely the same functionality and use of the DVB-specifications, but there were differences in the implementations, including different conditional access (CA) systems. On top of this, both operators had exclusive channels in their channel-bouquets.

For CATV-operators, that would retransmit both terrestrial and satellite signals this was troublesome, and they would tend to establish their own proprietary requirements for pay-TV receivers in their networks.

For broadcasters, to broadcast programmes on both terrestrial, satellite and cable networks this was negative, as their original signals had to be re-encoded to adapt to the various networks.

Early results

Concerns of the various broadcasters and operators led to the Odense agreement, where the parties agreed to aim for common minimum requirements for the receiver equipment in the digital broadcast world.

Technically this meant **common minimum performance requirements** for the various distribution platforms and **common Rules of Operation (RoO)**. In addition **common test specifications** in order to ensure common hardware/firmware functions.

Most function groups were not controversial and the common minimum performance requirements were established, based on input from members and harmonised after detailed study of options. These functions included front-ends and basic decoder functions like video, audio, teletext, subtitling, navigator and signalling.

Other functions as conditional access (CA) and application programming interface (API) proved more challenging due to different commercial interests.

The NorDig members attempted to establish a common CA-system, to be used by all operators, but these attempts stranded, except for Finland, where a common system was selected for use by the Finnish platforms.

The API issue was complicated, partly due to two different and non-compatible solutions that were already in use among NorDig members (OpenTV and Media Highway), and partly because there were no standardised applications available.

When DVB recommended MHP, NorDig selected this as API for new decoders. However, due to uncertainty of the near term need for the API, NorDig agreed to establish one profiles (NorDig Basic) without API and one with API (NorDig Enhanced). Later NorDig defined a third profile (NorDig Interactive and Internet Access), which specified two-way interaction, based on DVB's MHP interactive specification. HbbTV later replaced MHP.

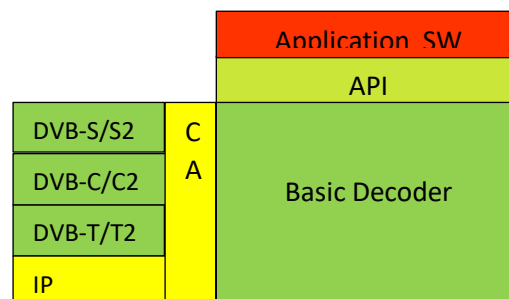


Figure 1. Main functions of the NorDig IRD. (Green: Common NorDig specifications, light green – recommended, not mandatory. Yellow: Mainly proprietary additions. Red: Outside the NorDig requirements.)

Developments

NorDig IRD (Integrated Receiver Decoder) specification history:



Figure 2. Front pages from a number of versions of the NorDig IRD specification since first publication 1998 until the latest version 3.0 inclusion of MPEG HEVC and UHDTV requirements, November 2017.

1998 - NorDig established *the NorDig I Digital Integrated Receiver Decoder Specification for use in cable, satellite and terrestrial networks* (aka NorDig I). *NorDig I* did not include any common or standardised API, instead members had their additions for a proprietary API.

2000 - NorDig published the first specification for IRD with a common API, DVB MHP, under the name *NorDig II Digital Integrated Receiver Decoder Specification* (aka NorDig II).

The two IRD specifications, NorDig I and NorDig II were maintained as separate documents.

2002 - The first NorDig **Unified** IRD specification was published and included the profiles; Basic TV, Enhanced, Interactive and Internet Access (replacing NorDig I and NorDig II). NorDig Basic was a subset without API (replacing NorDig I).

2008 - NorDig Unified IRD specification included the second generation of MPEG codec (MPEG4/AVC and HE-AAC audio & Dolby E-AC3), and the second generation of modulation scheme (DVB-S2 and DVB-T2). This opened the possibilities for HDTV in the distribution networks.

2009 – Unified IRD specification added PVR requirement with series recording capability.

2012 - HbbTV was first introduced as an addendum, but in 2013 HbbTV was included into the main Unified IRD specification and replaced DVB MHP.

2017 - NorDig is releasing its 3rd generation Unified IRD specification (v3.0) with the introduction of a new TV format and new codecs. New UHD TV format with High Dynamic Range and Wider Colour Gammut, new video codec MPEG-H HEVC, new subtitling format DVB TTML etc.

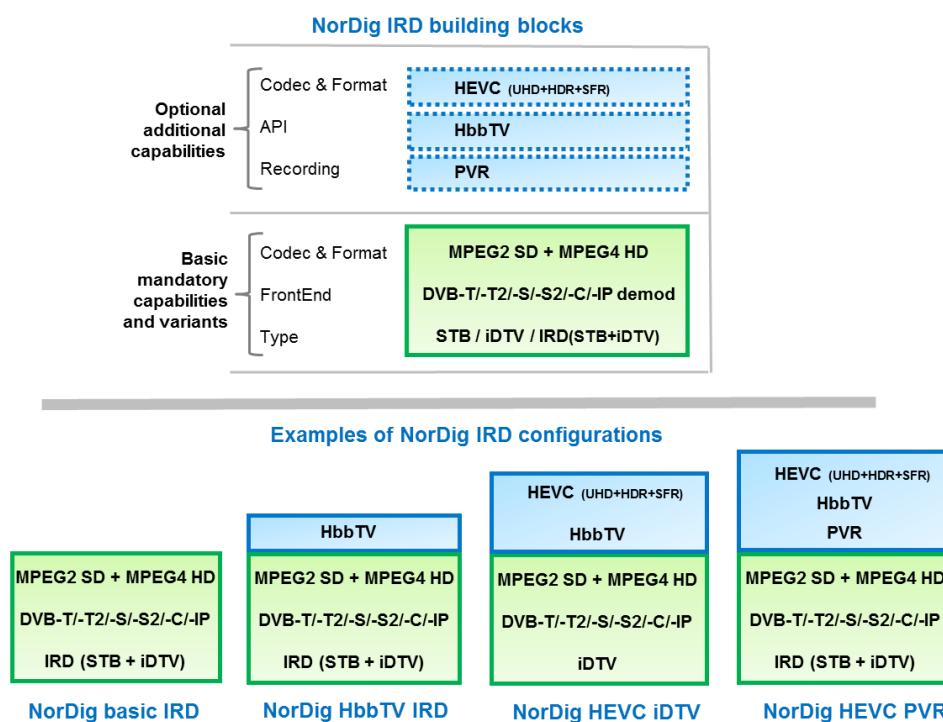


Figure 3. The new 2017 NorDig IRD/receiver model with the IRD/receiver variants and additional capabilities (PVR, HbbTV and HEVC), showing the main building blocks.

The development inside NorDig requirements through the years:

IRD types

IRD type: STB → STB + iDTV (initial specification was mainly targeting the STB implementation, later added TV-sets/iDTVs and all other digital TV/DVB receiver types)

Front-ends

These were upgraded in line with DVB upgrades and inputs from the relevant members:

- DVB-T → DVB-T2,
- DVB-S → DVB-S2 → extension DVB-S2X (optional),
- DVB-C, did not move to DVB-C2. DVB-C2 was specified by DVB, but hardly used, being replaced by IPTV over Docsis IP-transport
- DVB-IP (IP front-end), a NorDig/DVB standard IPTV format never took off, Most of this specification was later removed, leaving only basic technical requirements, for the IP front-end. Nordic IPTV-operators typically use STBs that are based on proprietary adaptations to the IP-front-end and selection layers, while the basic receiver follows NorDig Basic.

A/V decoder

- Video format: SDTV → HDTV → UHD TV with High Dynamic Range (HDR) and Wide Colour Gamut (WCG) and future plans for High Frame Rate (HFR).
- Video codec: MPEG2/H.262 → MPEG4/AVC/H.264 (for HDTV) → MPEG-H/HEVC/H.265 (for UHD TV)
- Audio format: Stereo → stereo & multichannel (5.1)
- Audio codec: MPEG 1 L-II → MPEG4 HE-AAC & Dolby AC3 → (future interest for adding Next Generation Audio, NGA)
- Audio type: normal, support for supplementary audio (e.g. Audio Description, Spoken Subtitling)
- **Subtitling tech:** Teletext → DVB Subtitling → DVB TTML
- **Teletext/PSI/SI/Navigator:** regularly updated in line with operator requirements
- **PVR: functions:** established and upgraded

Conditional Access

- Smart card interface: Lower levels of Smart card interfaces specified (additional requirements proprietary per operator)
- Common Interface: CI → CI+ (plans for replacing physical interface from today's complex PCMCIA to USB when this is ready at DVB).

API (Application Programming Interface)

At the start (late 90s), no API was included in the early NorDig specifications. Each operator/platform had additional requirement for their selected API.

In year 2000, DVB MHP became part of the NorDig requirements. However, the same dilemma applied for MHP as previous APIs (OpenTV and MediaHighway), it was i.a. too demanding for the receiver/STB hardware at that time and did not really take off in the mass market.

NorDig has replaced MHP by HbbTV in 2012/2013 as recommended API.

HbbTV is supported by the majority of the TV manufacturers and have a good traction in the "horizontal markets", including most DTT networks, but struggles to be adopted by more "vertical based markets" like DTH, CATV and telco based distributors.

NorDig members are also using other options derived from OTT-distributions (e.g. Android TV) for their managed TV

API software are in a rapid development, especially in the highly commercial and competitive OTT market.

Two-way interaction and OTT

Two-way interaction was specified for NorDig Interactive profile in year 2000. In these early days the “return channel” was e.g. via ISDN modem. With Ethernet and the growth of “connected homes”, two-way interaction plays an increasing role in cable and hybrid (broadcast & two-way) networks.

NorDig IRDs, supporting HbbTV, also include a “two-way interface” (typically Ethernet or WiFi) and the NorDig HbbTV IRD becomes a “connectable” IRD (i.e. Internet access). Two-way interaction and HbbTV are required for NorDig HEVC iDTV sets.

In cable networks, two-way interaction is merged with IP-based broadband. Cable broadband is based on IP (Docsis on coax or xPON on fibre), which gives a trend towards migrating the transport from DVB-C to IP-based transport (ref IPTV), where the basic receiver is maintained, but where the transport mechanism follow non-DVB specifications.

In telco networks, two-way interaction has always been on IP and combined with IPTV.

The development of broadband (via xDSL, cable, fibre and mobile networks) has opened for effective IP-based OTT-transmissions, with a set of new technical solutions.

Such OTT distributions were not present in the initial years, but internationally based OTT distributors are distributing content over broadband networks like xDSL/cable/fibre and mobile networks. This distribution method has grown rapidly over the last few years.

There is also a trend for “traditional” two-way distributors (telco, CATV) to distribute in OTT (unmanaged TV) as a supplement to their “Managed TV”, in order to provide distribution to “non-broadcast”/“companion” devices (e.g. Smartphones, tablets, computers etc) via other than their main networks. The API situation becomes even more complex when such OTT use becomes common, as the operators may have to use several types of APIs for “managed TV” and “unmanaged TV”.

For OTT, NorDig’s tool today is HbbTV. However, several of the NorDig Operators today have proprietary or non-HbbTV based software systems for their commercial OTT services.

In one-way networks (DTH and DTT) there, is a trend towards hybrid operations. DTH or DTT broadcasts combined with IP/Internet via wireless (mobile) or fixed networks. Such hybrid networks imply that the user can easily receive OTT-based transmissions; again implicating that OTT based solutions are important for the DTH and DTT

segments. For the DTT and DTH based distributors, there is also a trend for distribution of their own content in OTT-formats on other operators two-way network.

Future challenges

OTT-distribution is growing fast, in line with increasing capacity and quality of the open Internet/broadband networks. Such distribution is both advertisement and pay-Tv-financed.

International OTT distributors like Netflix and Social media companies like Facebook contribute to changes in the media consumption. This trend causes more competition to established content providers/distributors as well as to the “classical” broadcast networks, as more content is distributed as point-to-point.

For distributors in two-way networks, OTT causes increased competition in content (available programmes per distributor), in efficiency and user friendliness of the associated software systems, including both API, related applications and pay- (CA-) systems. This competition seems to increase trends towards bundled offers to the end-user, e.g. TV and/or Internet and/or Phone/mobile and/or Internet of Things.

For one-way based networks it is a challenge to establish efficient hybrid combinations (DTT/DTH combined with wireless or wired two-way networks), in order to provide for interaction related to broadcast services, but even more to integrate with the user’s need for broadband services. For service providers in these networks competition from both external OTT-distributors as well as various types of Internet-based services will increase.

For NorDig members this may lead to new roles and mergers in the various value chains. For NorDig’s work, this implies even closer ties between broadcast and Internet-based technology.