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Digital Video Broadcasting (DVB); IP Datacast: Implementation Guidelines for Mobility; Part 2: IP Datacast over DVB-SH

European Broadcasting Union



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Contents

Intellectual Property Rights	5
Foreword.....	5
Introduction	5
1 Scope	7
2 References	7
2.1 Normative references	7
2.2 Informative references.....	8
3 Definitions and abbreviations.....	8
3.1 Definitions	8
3.1.1 Bearer-related definitions	8
3.1.2 Infrastructure-related definitions	9
3.1.3 Geographical-related definitions.....	10
3.1.4 DVB Network-related definitions.....	10
3.1.5 Content-related definitions	10
3.1.6 Business-related definitions	11
3.1.7 Terminal-related definitions.....	11
3.2 Abbreviations	12
4 Background	12
4.1 Overview	13
4.2 Network ID and original network ID	14
4.3 Transport Stream (TS) ID.....	15
4.4 DVB service_id.....	15
4.5 Rules of Uniqueness.....	15
4.5.1 Original_network_id.....	15
4.5.2 Platform_id	16
4.5.3 Cell_id	16
4.5.4 Network_id	16
4.5.5 Transport_stream_id.....	16
4.5.6 DVB service_id	16
4.6 Handover concepts	16
4.7 TPS mobility support.....	17
4.8 Data loss avoidance	17
5 Handover use cases	17
5.1 Introduction	17
5.2 SFN intra handover use cases.....	18
5.2.1 SFN handover use cases	18
5.2.2 Detection of alternative service reception parameters	19
5.2.2.1 Use Case 1: Change of Cell or Sub-cell ID.....	19
5.2.2.2 Use Case 2: Change of Cell ID and Network ID.....	19
5.2.2.3 Use Case 3: Change of Cell ID and Transport Stream ID.....	20
5.2.2.4 Use Case 4: Change of Cell ID and Network ID and Transport Stream ID.....	20
5.2.2.5 Use Case 5: Change of Cell ID and Network ID and Transport Stream ID and Original Network ID	20
5.2.2.6 Use Case 6: Change of Cell ID, Transport Stream ID and Original Network ID	20
5.3 Non SFN intra-handover case	21
5.3.1 Non SFN handover use cases.....	21
5.3.2 Detection of alternative service reception parameters	23
5.3.2.1 Use Cases 1, 1': Change of Cell or Sub-cell ID, optional change of DVB service ID	23
5.3.2.2 Use Cases 2, 2': Change of Cell ID and Network ID, optional change of DVB service ID	25
5.3.2.3 Use Case 3: Change of Cell ID and Transport Stream ID.....	26
5.3.2.4 Use Case 4: Change of Cell ID and Network ID and Transport Stream ID	27
5.3.2.5 Use Case 5: Change of Cell ID, original network ID, TS ID, optional change of network ID	28
5.4 Handover between networks of different access type	29

5.4.1	Applicable handover procedures.....	29
5.4.2	Examples of handovers from DVB-H to DVB-SH non SFN.....	30
5.4.2.1	Example Scenario 2: Change of Cell ID and Network ID and Transport Stream ID.....	31
5.4.2.2	Example Scenario 3: Change of Cell ID and Network ID	32
History	34

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Foreword

This Technical Specification (TS) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECTrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

NOTE: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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The present document is part 2 of a multi-part deliverable covering IP Datacast: Implementation Guidelines for Mobility, as identified below:

Part 1: "IP Datacast over DVB-H";

Part 2: "IP Datacast over DVB-SH".

Introduction

IP Datacast over DVB-SH is an end-to-end broadcast system for delivery of any types of digital content and services using IP-based mechanisms optimized for devices with limitations on computational resources and battery. An inherent part of the IP Datacast system is that it comprises a unidirectional DVB broadcast path that MAY be combined with a bi-directional mobile/cellular interactivity path. IP Datacast is thus a platform that can be used for enabling the convergence of services from broadcast/media and telecommunications domains (e.g. mobile/cellular).

DVB-SH is a waveform specification enabling hybrid satellite and terrestrial mobile reception to handheld terminals. It introduces a number of features improving reception performance (interleaving, turbo code, new modulation schemes in both TDM and OFDM modulations) and enables dual reception of satellite and terrestrial signal using a common framing.

The present documents provides guidelines of IPDC mobility over DVB-SH network, and between DVB-H and DVB-SH networks in line with existing IPDC phase 1 mobility over DVB-H guidelines. To achieve this goal, the present document describes the SH constraints and scenarios using IPDC phase 1 mobility "toolbox" and wording.

The document is split into two main chapters:

- First, the contextual background introduction is given in clause 4 with definitions, abbreviations and numbering of most important identifiers in a mobility context.
- Then the description of handover DVB-SH scenarios in SFN and non SFN cases is given in clause 5; for each case, the actual list of handover is first introduced, then the actual procedure for achieving the handover from a terminal standpoint is given. A DVB-H to DVB-SH handover is given as a particular example.

1 Scope

The present document presents contextual information on handover required in DVB-SH networks. Handover is considered as the procedure used within one IP platform in order to continue IP Datacast service consumption under specific network modifications. The present document relies on the DVB-SH (see [12], [13] and [i.7]) and IP Datacast phase 1 (see [2] to [8]) set of specifications.

Roaming between IP platforms is not addressed by the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
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2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI EN 302 304: "Digital Video Broadcasting (DVB); Transmission System for Handheld Terminals (DVB-H)".
- [2] ETSI TS 102 468: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Set of Specifications for Phase 1".
- [3] ETSI TS 102 470-1: "Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI); Part 1: IP Datacast over DVB-H".
- [4] ETSI TS 102 611-1: "Digital Video Broadcasting (DVB); IP Datacast: Implementation Guidelines for Mobility; Part 1: IP Datacast over DVB-H".
- [5] ETSI TS 102 471: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Electronic Service Guide (ESG)".
- [6] ETSI TS 102 472: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Content Delivery Protocols".
- [7] ETSI TS 102 474: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Service Purchase and Protection".
- [8] ETSI TS 102 005: "Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols".

- [9] ISO/IEC 13818-1: "Information technology - Generic coding of moving pictures and associated audio information: Systems".
- [10] ETSI EN 300 468: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems".
- [11] ETSI EN 301 192 (V1.4.1): "Digital Video Broadcasting (DVB); DVB specification for data broadcasting".
- [12] ETSI TS 102 585: "Digital Video Broadcasting (DVB); System Specifications for Satellite services to Handheld devices (SH) below 3 GHz".
- [13] ETSI EN 302 583: "Digital Video Broadcasting (DVB); Framing Structure, channel coding and modulation for Satellite Services to Handheld devices (SH) below 3 GHz".
- [14] ETSI TS 102 470-2: "Digital Video Broadcasting (DVB); IP Datacast: Program Specific Information (PSI)/Service Information (SI); Part 2: IP Datacast over DVB-SH".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

- [i.1] IEEE proceedings: "Loss-free handover for IP datacast over DVB-H networks"; Gunther May.
- [i.2] ETSI TR 102 377: "Digital Video Broadcasting (DVB); DVB-H Implementation Guidelines".
- [i.3] ETSI TR 102 473: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Use Cases and Services".
- [i.4] ETSI TR 102 469: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Architecture".
- [i.5] ETSI TR 101 211: "Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)".
- [i.6] ETSI TR 101 162: "Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems".
- [i.7] ETSI TR 102 584: "Digital Video Broadcasting (DVB); DVB-SH Implementation Guidelines".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

3.1.1 Bearer-related definitions

multiplex: stream of all the digital data carrying one or more services within a single physical channel (characterized by parameters like carrier frequency and modulation modes)

partially available Transport Stream (paTS): TS where the SDT (actual) contains service_availability descriptors; in the DVB-SH case, the hybrid_delivery_system_descriptor can signal the potential presence of such paTS in the non SFN case only

section: syntactic structure used for mapping all services information into ISO/IEC 13818-1 [9]

service: sequence of programmes under the control of a broadcaster which can be broadcast as part of a schedule

signalling_field: plays the same role as the TPS in the TDM modulation scheme

sub table: comprised of a number of sections with the same value of table_id, table_id_extension and version_number

table: comprised of a number of sections with the same value of table_id

Transport Parameter Signalling (TPS): in the OFDM modulation scheme, represents the information signalled in the multiplex for easing the terminal determination of the multiplex radio configuration and ultimately the multiplex reception

NOTE: In particular the modulation main parameters such as code rates, modulation scheme, interleaver, etc. are transmitted as parts of the TPS. Also the cell_id identifying the cell identifier is transmitted as part of the TPS. By reading these parameters that are sent with a pre-defined configuration, the terminal can quickly learn important information for reception and handover purposes.

Transport Stream (TS): stream of transport_packets, as defined in ISO/IEC 13818-1 [9]

3.1.2 Infrastructure-related definitions

Complementary Ground Component (CGC): set of DVB-SH terrestrial transmitters having the duty to repeat the satellite signal and optionally transmit selective terrestrial-only signal

delivery system: physical medium by which one or more multiplexes are transmitted

IP Encapsulator: equipment in charge of encapsulating an IP flow into MPEG2 transport stream according to [11]

MFN network: network of transmitters that operate in different frequencies

NOTE: They are usually fed by different IP encapsulators and transport different content but some content MAY be shared in order to ensure seamless hand-over.

phase shifting: process of shifting in time the sending of burst between two adjacent IP encapsulators so that the handover can be made possible seamlessly, even for a mono-tuner receiver

NOTE: A description of such a process is described in [i.1].

Satellite Component (SC): set of DVB-SH terrestrial transmitters having the duty to send the satellite signal

SFN mode: situation where transmitters are time synchronized to ensure coherent radio demodulation at OFDM symbol and exactly same bits transmission over the air, including signalling like cell_id

SFN network: network of transmitters that operate in SFN mode

NOTE: We distinguish between two cases:

- SFN over hybrid frequency: transmitters modulating on hybrid frequency are synchronized, including the SC and the CGC ones, over their cell of belonging (size is the size of the satellite cell, also called beam);
- SFN over terrestrial frequency: transmitters modulating on a non-hybrid frequency are synchronized over their cell of belonging (size can be as small as the coverage of one individual transmitter).

transmitter: equipment in charge of modulating a TS according to DVB-SH or DVB-H specification

NOTE: In the DVB-SH case, the transmitters MAY be of two kinds, those modulating a signal transmitted over a satellite cell (also called a beam) that are part of the SC, and those transmitting a signal over a terrestrial cell that are part of the CGC.

transposer: equipment in charge of transposing a multiplex in another frequency; no demodulation/modulation is performed, only radio level operations are performed such as filtering, amplification, frequency shifting...

3.1.3 Geographical-related definitions

cell: geographical area that is covered with DVB-H or DVB-SH signals delivering one or more particular transport streams throughout the area by means of one or more transmitters

NOTE: In the DVB-SH case, a cell MAY have continental or nationwide extension if this TS is sent over the hybrid frequency - in this case it is also called a beam - or local extension if this TS is sent over the non-hybrid frequency. The cell is uniquely identified with the cell_id whose scope depends if this is DVB-H or DVB-SH network.

sub-cell: geographical area that is part of the cells coverage area and that is covered with DVB-SH signals by means of a transposer

NOTE: In this case, no remodulation of the signal is performed.

3.1.4 DVB Network-related definitions

DVB network: collection of MPEG-2 Transport Streams, each carried in a multiplex, and transmitted on a single delivery system

NOTE: DVB network is identified by network_id.

IP platform: set of IP flows managed by an organization

NOTE: The IP platform represents a harmonized IP address space that has no address collisions. An IP platform MAY span several Transport Streams within one or more DVB networks. Several IP platforms MAY co-exist in the same Transport Stream. IP platform is identified by platform_id. IP platform is usually used as a selector of the service provider but this is not an absolute rule and one service provider could use several IP platforms simultaneously.

Program Service information (PSI): digital data describing the DVB programs present in the TS and ways to find their identifier inside the TS (PID)

NOTE: Examples are PMT and PAT.

Service information (SI): digital data describing the delivery system, content and scheduling/timing of broadcast data streams, etc.

NOTE: Examples are NIT, SDT, INT. The NIT describes the network configuration, in particular the modulation parameters, the cells, their frequencies, etc... The hybrid_delivery_system_descriptor is in charge of giving the modulation parameters. The NIT is also used as a selector to know if the terminal has to perform pTS processing. If this is the case, the SDT gives details on the present DVB services.

3.1.5 Content-related definitions

content removal: technique used to enable content localization on the hybrid frequency

NOTE: The principle is that (DVB-H) time-sliced services are mapped on DVB services by the service injection point (IP encapsulator). The actual "virtual" larger TS having all DVB service is sent as is to all transmitters (including satellite and terrestrial) that individually process the TS to remove the non relevant DVB services by ad-hoc TS level processing. This process and its impact on PSI/SI is described in [14]. At reception side, the terminal can always make the link between the content and IP addresses via ESG, IP addresses and global path via the INT, DVB service availability and cells via the SDT and actual cell_id signalled via the TPS and finally global path and PID via PAT/PMT.

DVB-SH service: defined in [13], this is a fraction of a TS signalled via the SH-IP (SH Initialization Packet) to the modulator

NOTE: The SH service is used to perform synchronization and mapping between the service layer (e.g. DVB-H) and the physical layer in order to ease content removal process in specific conditions (see [14]). The DVB-SH service is of no interest for the terminal and has only an infrastructure scoping.

Global Content (GC): content sent over the satellite beam which constitutes a nation-wide cell and repeated by a CGC over local cells; in SH-A SFN, GC is always a complete TS but in non SFN it can be a partially available TS

Hybrid Frequency (HF): part of the frequency plan that is used to transport the GC

NOTE: HF transports GC but can additionally transport LC in non SFN case.

IP flow: flow of IP datagrams each sharing the same IP source and destination address

NOTE: An IP flow is identified within an IP platform by its source and destination addresses. IP flows on different IP platforms may have the same source/destination addresses, but are considered different IP flows. IP flows may be delivered over one or more IP streams.

IP stream: physical mapping of an IP Flow to transport_stream_id, original_network_id, service_id, component_tag, and IP source/destination addresses

NOTE: An IP stream is delivered on an MPE section stream.

Local Content (LC): complete or part of the transport stream that is sent over one or several terrestrial cells of the CGC

NOTE: Depending on infrastructure choices and radio planning, it MAY be a full TS or a partially available TS.

Non Hybrid Frequency (NHF): part of the frequency plan that is specifically not used to transport any GC

NOTE: NHF transports only LC.

service availability: characteristic of a DVB service to be present only in a fraction of the cells rather than all the cells where the TS is actually transmitted (see clause 6.2.33 in [10], clause 4.2.3.12 in [i.5] and also [14]); this enables to deliver a common SI shared by different TS/multiplexes, the terminal having the duty to identify the localization, id-est the binding between service and cell_id

NOTE: The concept of service availability is heavily used for managing all local content in non SFN configurations.

3.1.6 Business-related definitions

Electronic Service Guide (ESG): defined in [5], this is a set of standard IP flows giving semantic information on the programmes currently or in the near future available on actual TS

Service Provider (SP): owner of the service application as defined in [i.4], it generates its own ESG as well as its own ECM/EMM

Service Purchase and Protection (SPP): defined in [7], it defines the signalling required to protect the content sent over the broadcast medium

NOTE: This includes authentication of the user, credential checking, purchase processing, etc.

3.1.7 Terminal-related definitions

hand-over: process of achieving seamless (without any interruption) transition between two IP streams instantiating the same IP flow

NOTE: These IP streams MAY be located to different DVB networks, original or not, cell or sub-cell, multiplex, transport stream, same or different DVB services, but they usually (but this is not a strong requirement, only a best practise case) belong to the same IP platform and to the same service provider. Hand-over does not require re-processing of ESG nor SPP. Although theoretically possible, handover between two different IP platforms is not considered in the present document.

roaming: process of transitioning between two IP streams providing the same or related content that are distributed by different SP having contracted roaming agreement

NOTE: This induces a possible - but not necessarily - change of IP flow, potentially belonging to different IP platforms. This involves a change of service provider in the form of an ESG and/or SPP provider. We can cite the case of roaming within the same IP platform (between two service providers providing the same service) or IP platform roaming (different service provider providing same service over two IP platforms). Seamless roaming is usually not possible. Roaming is not considered in the present document.

zapping: process of transitioning between two different IP flows, potentially belonging to different IP platforms

NOTE: So they MAY carry different content stream. Zapping is not considered in the present document.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CBMS	Convergence of Broadcast and Mobile Services
CGC	Complementary Ground Component
DVB	Digital Video Broadcasting
DVB-H	DVB-Handheld [1]
DVB-SH	DVB Satellite to Handheld devices [12]
ESG	Electronic Service Guide [5]
GC	Global Content
HF	Hybrid Frequency
ID	check
INT	check
IP	check
IPDC	IP Datacast
IPE	IP Encapsulator
LC	Local Content
MFN	Multi Frequency Network
NHF	Non Hybrid Frequency
NIT	check
NW	Network
OFDM	check
PAT	check
paTS	partially available TS
PID	check
PMT	check
PSI	Program Service information
SC	Satellite Component
SDT	check
SF	Signalling Field
SFN	Single Frequency Network
SH	check
SH-IP	SH Initialization Packet
SI	check
SP	Service Provider
SPP	Service and Purchase Protection
TDM	check
TPS	Transport Parameter Signalling
TS	Transport Stream

4 Background

The focus of the present clause is to provide a brief introduction on PSI/SI tables, ESG and descriptors used in IPDC in DVB-SH Systems.

4.1 Overview

A DVB network is uniquely identified by a `network_id`. A DVB network consists of one or more Transport Streams, each being transmitted by one or more DVB signals. All emitting sites (`cell_ids`) of a network do not need to transmit all TSs of the network or all the DVB services part of present TS. Information about a DVB network is available within the NIT sub_table (identified by `network_id`). The NIT lists all TSs and DVB signals available within the DVB network. The NIT is carried within each Transport Stream in a DVB network and the NIT is unique throughout the network. Since there MAY be several adjacent networks, there MAY be several NITs. The network which the TS belongs to is described by NIT(actual) whereas other networks are described by NIT(other).

The INT identifies for each IP stream what are the 5-uplet required for its identification {`network_id`, `original_network_id`; `transport_stream_id`; `DVB service_id`; `component_tag`}. The number of DVB services per TS depends on the chosen configuration:

- for SFN configuration, the number of DVB service is usually limited to 1. Each service session that is time sliced is announced in the INT and the receiver can derive from the component tag the corresponding matching PID via the PSI tables (PAT and PMT);
- for non SFN configurations, the DVB service MAY be more than 1, in order to differentiate between their location. The service location information is delivered via the SI tables using SDT table together with DVB `service_id` and `service_availability` descriptor (see [14]).

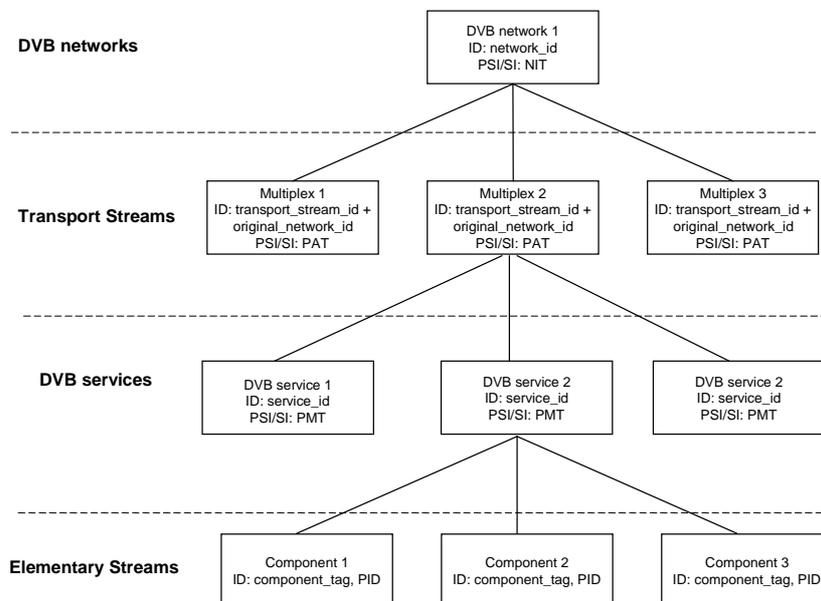


Figure 1: Services ID hierarchy with DVB-SH

An IP flow is a flow of IP datagrams, each sharing the same IP source and destination addresses enabling identification of the flow within the IP range managed by the IP platform. An IP flow belongs to exactly one IP platform. An IP stream represents an instantiation of such an IP flow defined by the 5-uplet {`transport_stream_id`, `original_network_id`, `network_id`, `service_id`, and `component_tag`}.

Note that an IP stream MAY be announced by multiple INT sub_tables within the same TS, possibly making it part of multiple IP platforms. In such a case some coordination is required between IP platforms. This case is not considered in the present document.

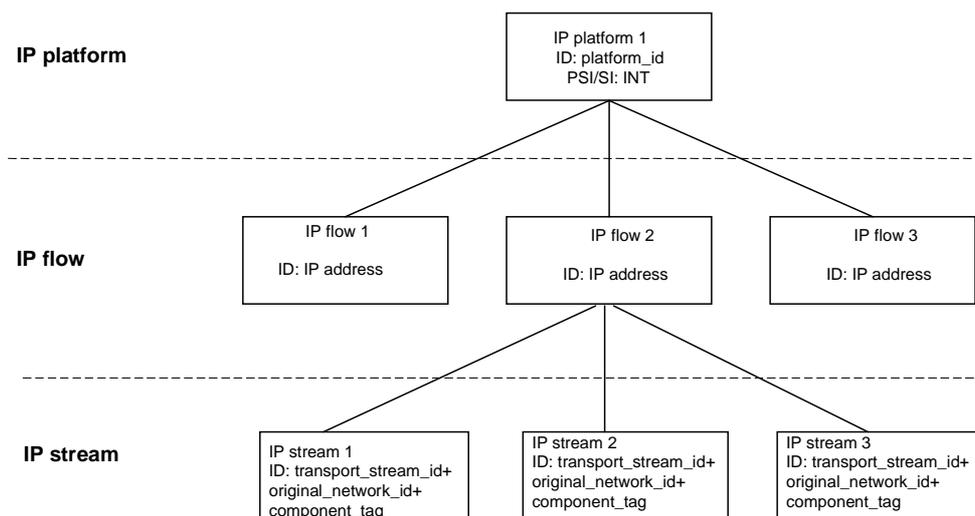


Figure 2: IP ID hierarchy

4.2 Network ID and original network ID

In DVB, the `original_network_id` is defined as the `network_id` of the network where the TS originated.

For terrestrial DVB the concept of an original network, with an `original_network_id`, could be interpreted as a sort of abstract hypothetical network feeding all real networks (in the sense of `network_id`) in e.g. a country. The `original_network_ids` are typically allocated by DVB on a per-country basis and enable to identify unambiguously the source of the TS on a worldwide basis among the 65 535 possible sources. On the contrary, `network_ids` are used by local physical networks to identify a local infrastructure that conveys the TS. So the `network_id` has a local scope and values could be reused in different areas of the world. It MAY happen that the `original_network_id` is the same as the `network_id` of the actual network but this is not the rule. Usually, `network_ids` are reused between countries using a pattern of colours. For specific cable networks, the same `network_ids` can be reused several times within a same country.

For satellite (and so for hybrid), the `original_network_id` corresponds to source of the TS and should be associated to the infrastructure of the service operator - typically some form of IP encapsulator, SPP and ESG infrastructure - that MUST be located in some specific country. If this is the case, the `original_network_id` of the TS sent over the HF does not follow the national country basis since the TS can be sent over different countries, but rather the continental basis. The `original_network_id` of the TS sent over the NHF could follow the same logic as HF but this is not a strong requirement: we could envisage having "local" to a specific country `original_network_id`, then falling into the usual geographical distinction relevant for the terrestrial original network id.

However for the satellite (and so for hybrid), the `network_id` on his side MUST be uniquely allocated on a worldwide basis within a pool of 8 192 (0x0001 to 0x2000) possible values references as "unique satellite" with [i.6] chapter table 2. The proposition is to allocate one `network_id` per spot beam so that the `network_id` will enable to discover over which satellite spot beam the signal is received. The same applies for the repeated signal for which it is also suggested to use the same `network_id` so that the `network_id` clearly references the infrastructure used to convey the signal, be it satellite (SC) or terrestrial (CGC).

To summarize for the DVB-SH:

- `Original_network_id` references the "service" source; the scope can be continental (HF) or national (NHF); value MUST be allocated in the table 1 of [i.6] among the 65 535 possible values.
- `Network_id` references the "network" used to distribute the information, including satellite beam and terrestrial repeating infrastructure; value MUST be taken within the 8 192 values reserved for the satellite on a worldwide basis.

4.3 Transport Stream (TS) ID

From the point of view of the DVB-SI specification a network is simply "collection of MPEG-2 Transport Stream (TS) multiplexes transmitted on a single delivery system", with no mentioning of requirements for emission in all cells of the network. From the point of view of [1] and [2] there are therefore no particular rules whether a TS needs to be broadcast in all cells of a network. It is perfectly in line with [1] and [2] to have e.g. a nationwide network with a number of regional TSs, each with unique `transport_stream_id` and content.

In the DVB-SH case however (see [12] and [i.7]), the TS within an original network MAY be transmitted on all the cells of the DVB-SH network, partially or completely (this is the case of the TS sent over HF that is sent over the satellite national cell matching with the beam and that has to be repeated on all the local cells of the same network) or not (this is the case of the terrestrial TS that are transmitted over a selection of particular terrestrial cells only).

4.4 DVB service_id

The DVB-SH [13] introduces the concept of DVB-SH services that enables to create logical partitions of the TS for a purpose of content localization in specific modes. The signalling of the DVB-SH service is done at the physical layer so that transmitters can determine which content needs to be modulated and where. For the mobility purpose, the DVB-SH services are completely superseded by the DVB services: only the DVB services are used in mobility conditions according to the following logic:

- All the DVB services present in the TS are listed by one SDT sub_table.
- For each DVB service, the SDT sub_table gives:
 - a) Data broadcast descriptor: it specifies DATA encapsulated using specific MPE for DVB-SH (see [11]).
 - b) In case the NIT signals a paTS, there is possibly a `service_availability_descriptor` that specifies on which `cell_id` the DVB service is actually present. This enables the terminal to quickly identify if a content is present in one particular cell. When `service_availability_descriptor` is not present for that service, it means that the service is present on all the cells transmitting the TS (general availability, like for the GC). If the `service_availability_descriptor` is present, the cells where the service is present (or not present) are listed.

4.5 Rules of Uniqueness

4.5.1 Original_network_id

The `original_network_id` uniquely identifies the source of the TS and this is in relation with the service infrastructure itself. Following cases are possible:

- There could be several sources in the DVB-SH system, so different `original_network_ids` could be found in the DVB-SH network.
- The same source could be distributed over different DVB-SH networks so the same `original_network_id` could span several DVB-SH networks.
- The original network could serve a national or continental area.

For all these reasons, there is a need for uniqueness and the `original_network_id` is allocated to the source with a global scope and references in [i.6], table 1.

4.5.2 Platform_id

The IP platform enables to identify the IP flows uniquely through the use of a common range of addresses. The IP platform is related to the application infrastructure (video encoders and data servers). There is no need to have only 1 IP platform, several can coexist in the DVB-SH infrastructure, in which case several INT would be generated. For instance, there could be one IP platform for the global content and one for the local content. Additionally, the IP platform can span over several networks which would be the case for instance for a network operator delivering services over different spot beams, or a network operator delivering simultaneous services over DVB-H and a DVB-SH networks.

4.5.3 Cell_id

In the definition found in [4], it is noted in clause 3.1 that "the cell_id that is used to uniquely identify a cell shall be unique within each original_network_id". This scope is fully compatible with handover mechanisms within a country having a coherent allocation of original_network_ids. However, ambiguity can arise in DVB-SH since original_network_ids do not follow country border as explained in clause 4: it is then highly likely that same cell_id could be reused at the border or even within the same country. This would make the cell_id information less relevant for handover and could lead to lengthier handover procedures or, what is even worse, handover failures. All these limitations could be fixed if the scope was stricter, for instance fixing the scope over a complete satellite system.

So it is proposed in DVB-SH, that cell_ids shall be made unique throughout all the DVB-SH infrastructure, this being true for all cells including the satellite beams. Numbering is done on a 16 bits basis enabling 65 536 cells. However, first 256 values (coded over 8 bits) are reserved for satellite beams according to [14].

4.5.4 Network_id

In DVB-SH the network_id is matching a satellite beam and is also unique with a global scope as the value is taken from the "unique satellite network ID" range. All infrastructure related to this beam (satellite transponder, terrestrial repeater) shall have the same network_id.

4.5.5 Transport_stream_id

A TS can be uniquely referenced through the path original_network_id/transport_stream_id [i.5]. In other words, a transport stream is unique in the scope of an original_network_id.

4.5.6 DVB service_id

DVB service_id is scoped by the TS that is transporting the service. The DVB service_id SHALL be scoped by the transport_stream_id and original_network_id.

4.6 Handover concepts

The basic mechanism for services access within IPDC over DVB-SH is the following, in 5/6 steps:

- 1) use the IP address for the service as provided by the ESG, received via the normal ESG bootstrap procedure;
- 2) via the INT find the global path(s) (5-uplet) {original_network_id, network_id, transport_stream_id, service_id, component_tag} for each IP stream corresponding to the target IP flow;
- 3) via the NIT find the cells and frequencies where the TS can be found;
- 4) for those TS that support paTS - as signalled by the NIT - , check via the SDT service_availability descriptor on which cell the relevant DVB service can be found;
- 5) via the cell_id signalled on TPS and SF, discover most appropriate signal in the terminal neighbourhood;
- 6) PSI tables (PAT, PMT) enable to find the PID on the relevant TS.

One could imagine, that, in the case the triplet {original_network_id / transport_stream_id / service_id} is identical, handover between network_ids would be more easily done without using this mechanism but there are several reasons why such a simplified handover approach relying on transport_stream_id and/or service_id would not in general work:

- In general a service_id MAY contain several component_tags, with one elementary stream on each. Knowing just the service_id is not sufficient to find the IPDC service.
- The service_id MAY even be different even if the transport_stream_id is same in paTS case.

This 5/6 steps mechanism is so assumed to be used in the remaining document.

4.7 TPS mobility support

Details on the TPS data used required for handover support with IP Datacast MAY be found in [i.2] and [i.7], clause 4.2.8.6. In addition to the TPS, the DVB-SH also provides information via the SF introduced in [13].

4.8 Data loss avoidance

Details on avoiding data loss when performing handovers MAY be found in [i.7], clause 6.

5 Handover use cases

5.1 Introduction

We recall that handover is related to the seamless reception of the same IP flow when some parameters are changing. Are not considered under this definition:

- the change of an IP flow as happens when we zap to a flow belonging to another IP platform;
- the roaming between IP platforms or two ESG/SPP providers.

In this clause we focus on the exhaustive review of all possible handovers. For the review of detailed physical configurations, please refer to [i.7] clause 5. The presentation has the following logic, splitting cases between intra-technology handover and inter-technology handover:

- SFN intra-handover (clause 5.2).
- Non SFN intra-handover (clause 5.3).
- An example of network change, DVB-H / DVB-SH handover (clause 5.4).

Selection of the SFN or non SFN handover procedure is done by reading the delivery_system_descriptor of the destination TS in the NIT:

- when this is a terrestrial or a hybrid_delivery_system_descriptor without paTS the procedure is the SFN one;
- when this is a hybrid_delivery_system_descriptor with a paTS, then the procedure MUST be the non SFN one.

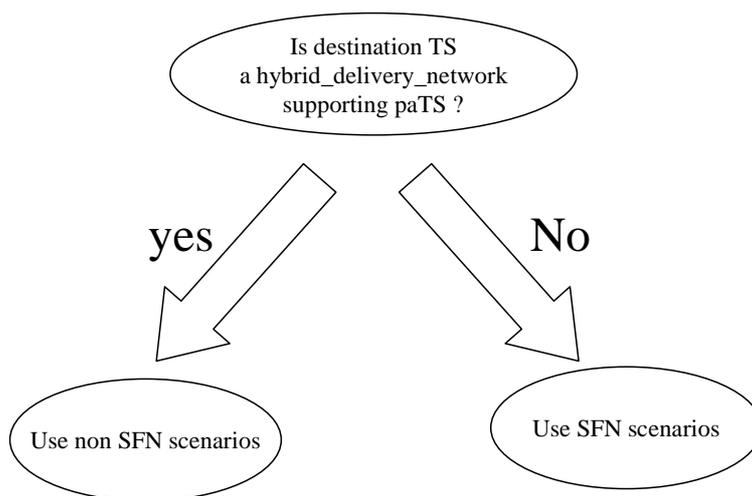


Figure 3: Selection of SFN/non SFN scenarios

5.2 SFN intra handover use cases

5.2.1 SFN handover use cases

The scenarios are enumerated based on the possible identifier variations. Table 5-1 describes the mobility scenarios for a terminal acquiring IP flows from a unique IP platform. Each handover use case requires the terminal to apply a strategy to maintain, whenever possible, service continuity (i.e. no user perceivable interruption of the IPDC service being consumed).

Table 5-1: Handover use cases

Case	Original Network ID change	Transport Stream ID change	Network ID change	Cell / Sub-cell ID change	Handover based on TPS and NIT	Handover based on INT, TPS, NIT,
0					N/A	N/A
1				X	Applicable	N/A
2			X	X	Applicable	N/A
3		X		X	Not applicable	Applicable under condition (I)
4		X	X	X	Not applicable	Applicable under conditions (I) to (II)
5	X	X	X	X	Not applicable	Applicable under conditions (I) to (II)
6	X	X		X	Not applicable	Applicable under condition (I)

Condition (I): Target NIT is available (by NIT_other or other means).

Condition (II): The INT announces IPDC services on other networks.

Case 0: the terminal moves to/from a satellite-only coverage to a CGC coverage inside the same satellite beam SFN cell; modulation is kept (OFDM), cell_id is strictly the same and equal to the satellite cell_id. For the terminal, this is not really a handover since there is no perceivable modification of any signalling parameters, only the received power will be improved (C/N for instance) or the used antenna MAY differ if two specific antennas are used for satellite and terrestrial reception.

Case 1: the terminal moves between two CGC cells while all other parameters are the same (in particular, transport_stream_id is kept the same, TS1). This usually happens when the frequency is changed between the two cells and the terminal has to tune to the target frequency. The NIT provides enough information on the availability of the TS on adjacent cells and their frequencies so that the terminal is able, by scanning the TPS, to discover the cell_id of the target cell.

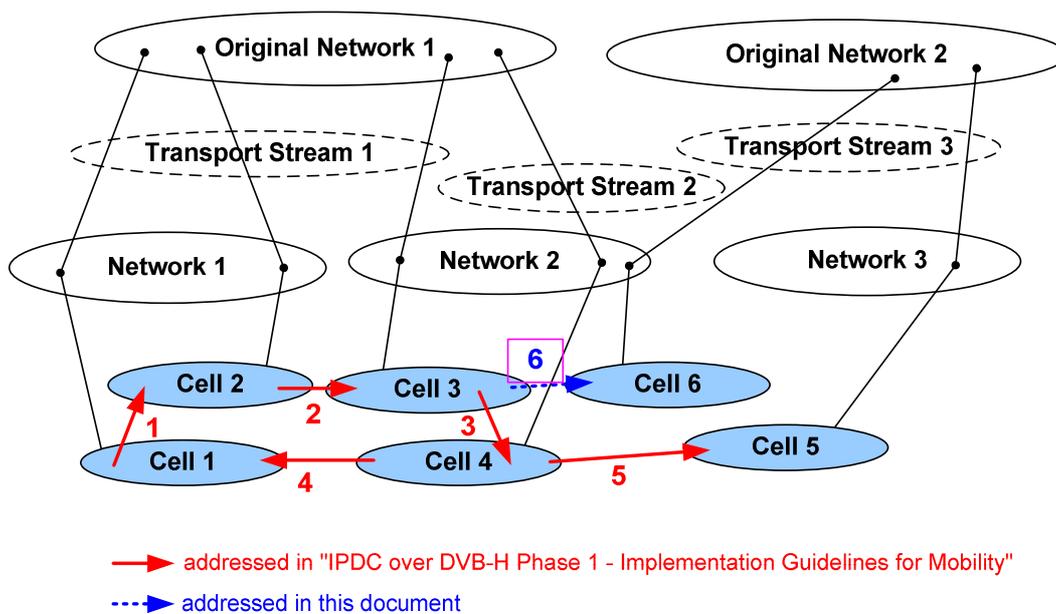
Case 2: the terminal moves between one satellite cell and a CGC cell while keeping `transport_stream_id` but changing `network_id`. In the DVB-SH case this implies also a change of spot beam because `network_ids` are related to a satellite beam. So this scenario is typical of a country borders crossing but, due to spot beam approximate country borders delineation, the transition MAY also occur within a country. There is no complex operation since the TS is maintained.

Case 3: the terminal moves from one to another CGC cell while changing the TS but keeping other parameters the same. This is a typical MFN scenario where handover MUST be ensured seamlessly through adequate mechanism (example: phase shifting). In this case, the INT of the target TS MUST be available. This requires also to pre receive the service information to be able to quickly derive the PID of the destination.

Case 4: the terminal moves between 2 cells while keeping `original_network_id` but changing `transport_stream_id` and `network_id`. This can happen when crossing the border between two countries or, due to the approximate shape of the beam, within a country and implies a change of `network_id` since the `network_ids` are related to the country. In this case the INT is needed and MUST be signalled for both networks. Also the target NIT MUST be delivered (via `NIT_other`).

Case 5: the terminal moves between two spot beams and changes everything (`original_network_id`, `transport_stream_id`, `network_id`). This happens when the user moves between two countries having different spot beams but some content in common.

Case 6: the terminal moves between two cells within the same network and receives content from different `original_network_id` and so different `transport_stream_id`. This happens because `original_network_id` can span several countries (especially those related to satellite operators). This case is similar to the case 5 in the processing.



[editor's note: Cell 2 is a satellite cell or CGC cell depending on the use case]

Figure 4: Handover use cases for SFN

5.2.2 Detection of alternative service reception parameters

5.2.2.1 Use Case 1: Change of Cell or Sub-cell ID

This scenario is similar in processing to IPDC over DVB-H handover scenario detailed in [4] "Use Case 1: Change of Cell or Sub-cell ID".

5.2.2.2 Use Case 2: Change of Cell ID and Network ID

This scenario is similar in processing to IPDC over DVB-H handover scenario detailed in [4] "Use Case 2: Change of Cell ID and Network ID".

5.2.2.3 Use Case 3: Change of Cell ID and Transport Stream ID

This scenario is similar in processing to IPDC over DVB-H handover scenario detailed in [4] "Use Case 3: Change of Cell ID and Transport Stream ID".

5.2.2.4 Use Case 4: Change of Cell ID and Network ID and Transport Stream ID

This scenario is similar in processing to IPDC over DVB-H handover scenario detailed in [4] "Use Case 4: Change of Cell ID and Network ID and Transport Stream ID".

5.2.2.5 Use Case 5: Change of Cell ID and Network ID and Transport Stream ID and Original Network ID

This scenario is similar in processing to IPDC over DVB-H handover scenario detailed in [4] "Use Case 5: Change of Original Network ID".

5.2.2.6 Use Case 6: Change of Cell ID, Transport Stream ID and Original Network ID

In this scenario, the terminal could find the same IP flow in another TS from the INT sub-table (i.e. as part of the same IP platform), and corresponding reception parameters in NIT(actual):

- i) The terminal could find each TS that carries the same IP flow by decoding the IP/MAC stream_location_descriptor in the INT sub-table.
- ii) The terminal could acquire information on all the frequencies and their cell_ids for these TSs by decoding the cell_frequency_link_descriptor in NIT(actual).
- iii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor in NIT(actual).

Based on this, the terminal could check the availability of the signals of the cells accessible where the terminal is located and select the ones with the best quality as candidates to handover to.

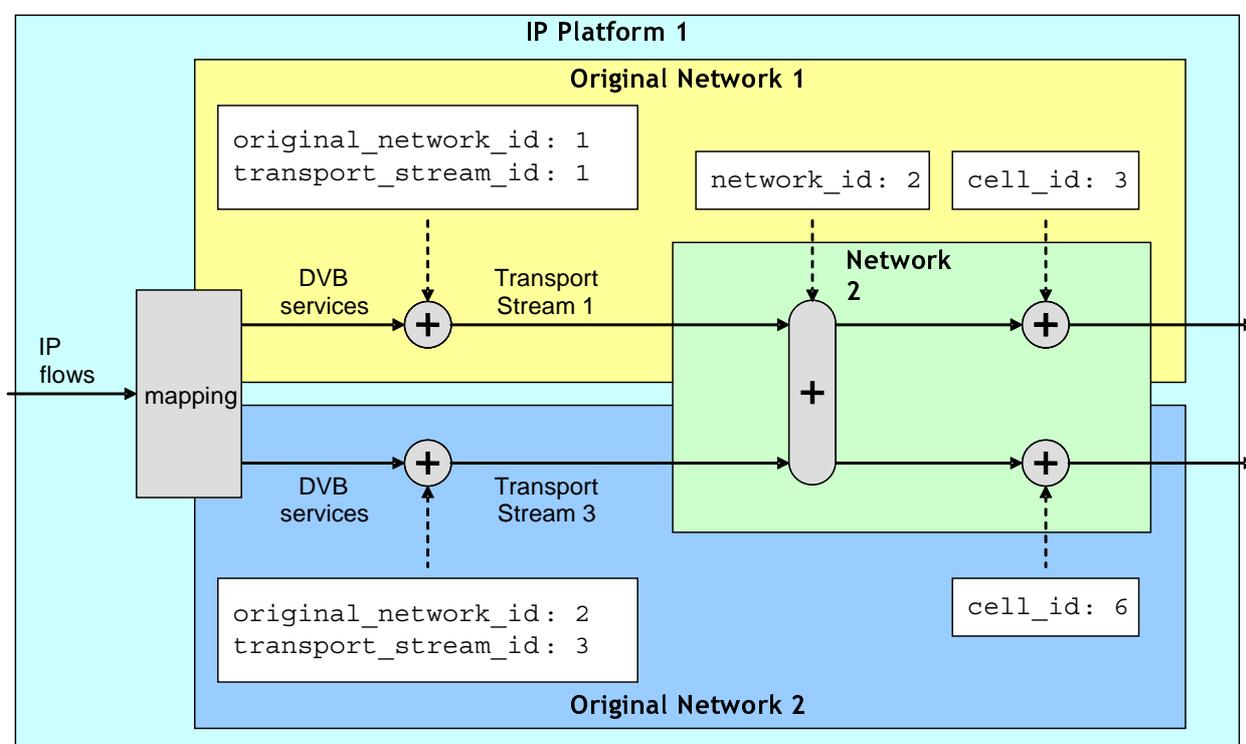


Figure 5: Handover scenario 6

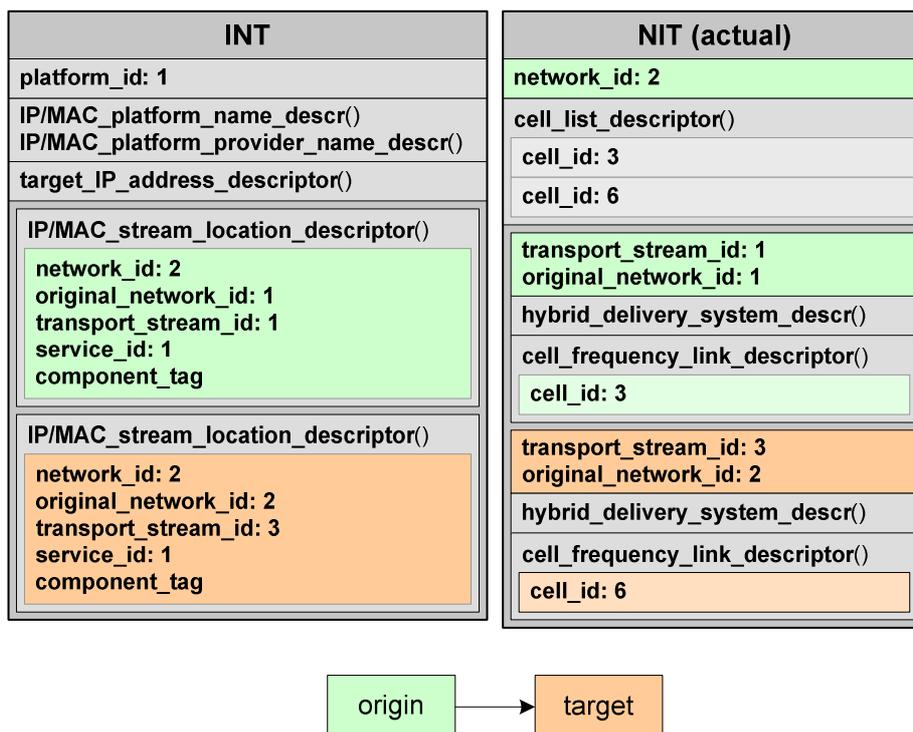


Figure 6: PSI/SI support for handover scenario 6

5.3 Non SFN intra-handover case

5.3.1 Non SFN handover use cases

Table 5-2 describes the mobility scenarios. In some cases, the variation of one particular parameter does not impact the terminal procedure. Crosses in brackets mean that the parameter could change but this does not affect the terminal procedure.

Table 5-2: Handover use cases

Case	Original Network ID change	Transport Stream ID change	Network ID change	DVB service change	Cell / Sub-cell ID change	Handover based on TPS/SF, NIT, SDT	Handover based on TPS/SF, NIT, SDT, INT
1					X	Applicable under condition (V)	N/A
1'				X	X	Not applicable	Applicable with (IV) (V)
2			X		X	Applicable under conditions (I) (V)	N/A
2'			X	X	X	Not applicable	Applicable under conditions (I) (IV) (V)
3		X		[X]	X	Not applicable	Applicable under conditions (III) (IV) (V) (VI)
4		X	X	[X]	X	Not applicable	Applicable under conditions (I) (II) (III) (IV) (V) (VI)
5	X	X	[X]	[X]	X	Not applicable	Applicable under conditions (I) (II) (III) (IV) (V) (VI)

Condition (I): NIT(other) announces the target network.

Condition (II): INT announces IPDC services on neighbour networks.

Condition (III): INT announces IPDC services on neighbour TS.

Condition (IV): INT announces IPDC services on all DVB services of actual TS.

Condition (V): SDT(actual) announces the availability of relevant DVB service on target cell.

Condition (VI): SDT(other) announces the availability of relevant DVB service on target TS.

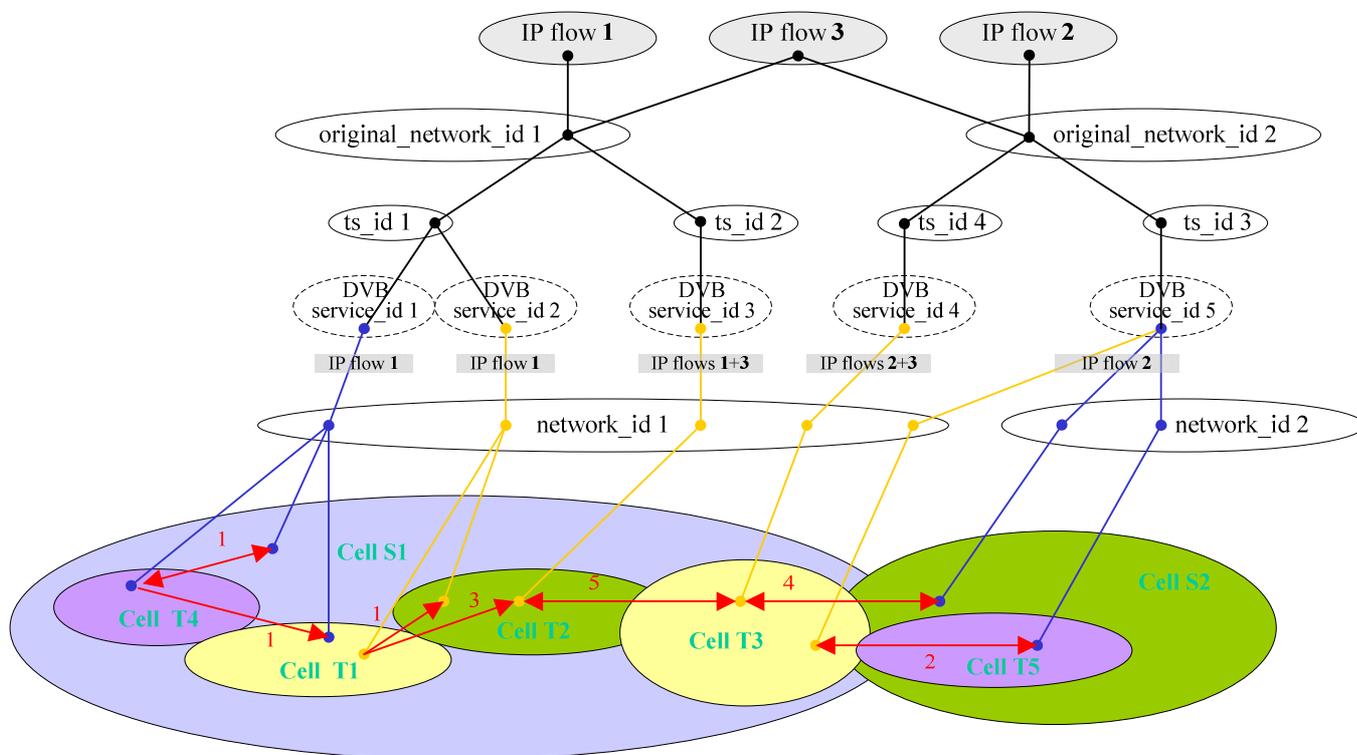


Figure 7: Handover use cases for non SFN

For correctly interpreting the figure:

- IP flow 1, 2, 3: they represent 3 set of IP flows belonging to the same IP platform; a common IP flow in the form of equal or different IP stream(s) MUST be received at both sides of one arrow to ensure seamless handover. In order to ease the reading, the transmitted IP flows are also presented on the modulated signal where the handover arrows are connected.
- Colours of the arrows represent the nature of the content (so of a group of IP streams). A blue line represents an IP stream of GC nature sent on a HF whereas a yellow line represents an IP stream of LC nature on HF (also NHF could be envisaged but is not represented here).
- Colours of the cells correspond to the frequency used by the multiplex. To ensure repeating of the TDM signal using OFDM, another frequency is required; this is the reason why no terrestrial cell within a specific satellite beam uses the same colour as the satellite beam one; for instance S1 does not have the same colour as T1, T2, T3 and T4. However, a frequency used by one terrestrial cell can be reused by another terrestrial frequency; for instance T1 and T3 use same frequency. Also the satellite frequency can be reused in another terrestrial cell belonging to another satellite beam, for instance T2 reuses the same frequency as S2. Ultimately, two non adjacent satellite beams could also use the same frequency.

Case 1: terminal receives IP flow 1 and moves to an adjacent cell where the same IP flow is present on the same TS.

Depending on the case:

- the IP flow could be GC or LC (both cases are presented on the figure);
- (**Case 1'**) in the case of local LC, the DVB service_id could be different (it is always the same for GC; in the example given on the figure, the IP flow is a GC so same DVB service_id).

Case 2: the terminal receives IP flow 2 and moves to an adjacent cell belonging to another network where the same flow can be found on the same transport_stream_id having same original_network_id.

This case happens:

- inside DVB-SH at the border of a country because network_ids are related to spot beams that usually fit a country coverage (case presented on the figure);
- between two broadcast networks of the same country like DVB-H and DVB-SH.

Depending on the case:

- this IP flow MAY be a GC or a LC (on the figure, the IP flow is GC on S2 but LC on S1);
- (**Case 2'**) in the case of local LC, the DVB service_id could be different (it is always the same for GC; in the example given on the figure, the IP flow is a GC so same DVB service_id).

Case 3: terminal receives IP flow 1 on a CGC cell and moves to an adjacent CGC cell where the same IP flow can be found on a different transport_stream_id with same original_transport_stream_id. This is a typical MFN scenario where handover MUST be ensured seamlessly through adequate mechanism (phase shifting) in order to receive IP flow 1 without any interruption.

Case 4: the terminal receives IP flow 2 and moves to an adjacent cell belonging to another network where the same flow can be found on another TS having same original_network_id.

This case happens:

- inside DVB-SH at the border of a country because network_ids are related to spot beams that usually fit a country coverage (case presented on the figure);
- between two broadcast networks of the same country like DVB-H and DVB-SH.

Depending on the case:

- this IP flow MAY be a GC or a LC.

Case 5: the terminal receives IP flow 3 and moves to an adjacent cell where the same flow can be found on another TS having a different original_network_id.

Depending on the case:

- this IP flow MAY be a GC or a LC (LC in the case presented on the figure);
- network_id MAY be maintained (as displayed on the figure) or not.

5.3.2 Detection of alternative service reception parameters

In all cases, the parsing of SDT is described in details in [14].

5.3.2.1 Use Cases 1, 1': Change of Cell or Sub-cell ID, optional change of DVB service ID

This scenario is similar in processing to [4] "Use Case 1: Change of Cell or Sub-cell ID except an additional check that the same service is available on target cell MUST be done since, due to the service_availability usage, same service could be present on one but not on the other cell.

Use Case 1 (no change of DVB service ID)

First, the alternative services reception parameters could be found in the NIT (actual) and stored by the terminal as follows:

- The terminal could acquire information on all other frequencies and their cell (sub cell) ids by decoding the cell_frequency_link_descriptor that follows the hybrid_delivery_system_descriptor.

- ii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor.

Second, the terminal was able to parse the list of DVB services using the SDT as follows:

- i) The terminal parses the SDT (actual) and lists all available DVB services carried by the actual TS.
- ii) The terminal checks in which cells the DVB services are available using the service_availability_descriptor:
 - a) If the DVB service is on the target cell, the terminal performs the handover on this cell and the procedure ends successfully.
 - b) If the DVB service is not present on the target cell, the terminal needs to investigate if there is another service where another stream transports the same IP flow and the procedure goes on with the third step.

Use Case 1' (change of DVB service ID), extending Use Case 1

Third, the terminal was able to parse the INT in order to obtain information on the IP flow it is interested as follows:

- i) The terminal parses the INT of its IP platform looking for its IP flow.
- ii) The terminal looks up in matching target_IP_address/slash_descriptor the IP/MAC_stream_location_descriptors the list of available IP streams.
- iii) The terminal locates another IP stream in another DVB service present on target cell.

Based on this, the terminal could check the availability of the DVB service to which the desired IP stream belongs in the cells where the terminal is and where terminal could make the handover.

NOTE: If the IP flow belongs to GC, it is repeated on all cells using the same service_id and there is no change of service_id. However, this could be different for an IP flow belonging to LC. If the DVB service_ids are different, the handover means that the IP flow will be present in two IP streams within the same TS, one IP stream for each DVB service. So the IP flow is sent duplicated on the TS. We give in the following figure an example of such a handover where two DVB service_ids are used.

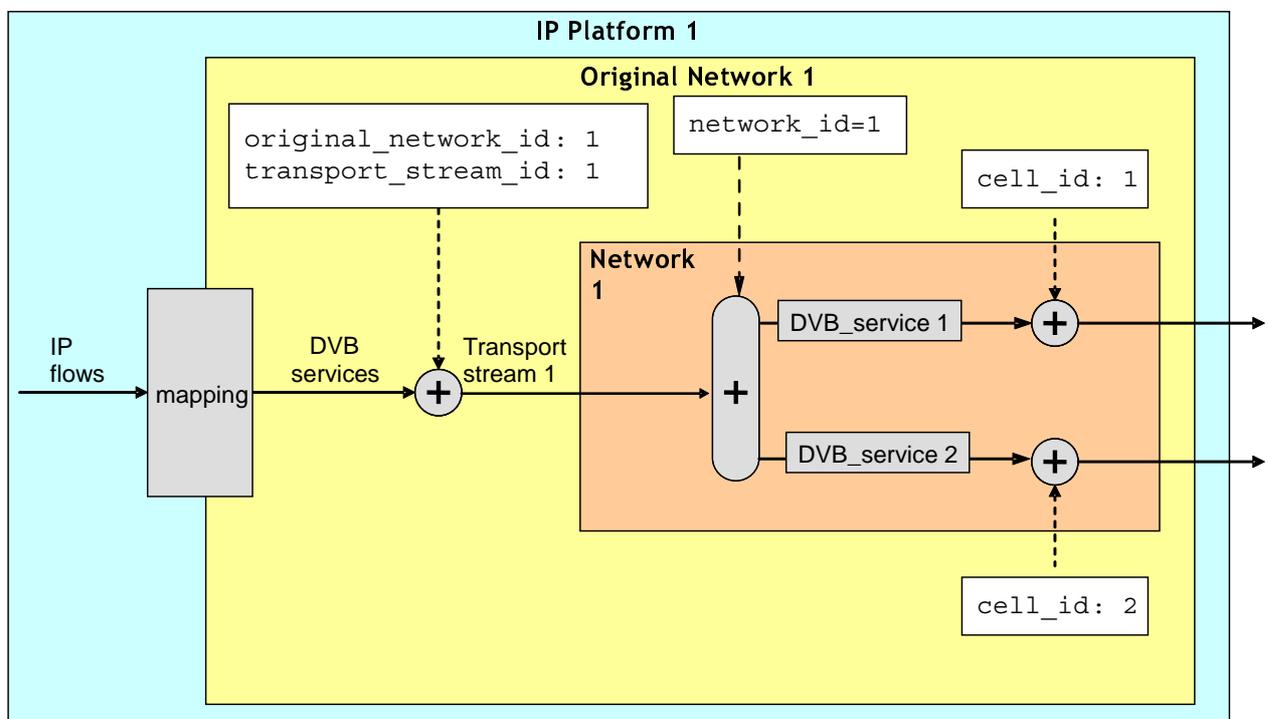


Figure 8: Handover use case 1

5.3.2.2 Use Cases 2, 2': Change of Cell ID and Network ID, optional change of DVB service ID

This scenario is similar in processing to [4] "Use Case 2: Change of Cell ID and Network ID" except an additional check **MUST** be done on availability of service is available on both source and target cells since, due to the service_availability usage, same service could be present on one but not on the other cell.

Use Case 2 (no change of DVB service ID)

First, the terminal could determine other networks in which the same TS is available:

- i) The other TS has the same transport_stream_id and original_network_id as the original one.
- ii) Their corresponding reception parameters could be derived from the NIT(other): the terminal finds the modulation parameters in the hybrid_delivery_system_descriptor and related frequencies from the cell_frequency_link_descriptor in the NIT(other).
- iii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor from NIT(other).

Second, the terminal was able to parse the list of DVB services using the SDT as follows:

- i) The terminal parses the SDT (actual) sub-table describing the actual TS and lists all available DVB services.
- ii) The terminal checks in which cells the DVB services are available using the service_availability_descriptor.
 - a) If the DVB service is on the target cell, the terminal performs the handover on this cell and the procedures ends successfully.
 - b) If the DVB service is not present on the target cell, the terminal needs to investigate if there is another service where another stream transports the same IP flow and the procedures goes on with step 3.

Use Case 2' (change of DVB service ID), extending Use Case 2

Third, the terminal was able to parse the INT in order to obtain information on the IP flow it is interested as follows:

- i) The terminal parses the INT of its IP platform looking for its IP flow.
- ii) The terminal looks up in matching target_IP_address/slash_descriptor the IP/MAC_stream_location_descriptors the list of available IP streams.
- iii) The terminal locates another IP stream in another DVB service present on target cell.

Based on this, the terminal could check the availability of the DVB service to which the desired IP stream belongs in the cells where the terminal is and where terminal could make the handover.

NOTE: Handover on an IP flow belonging to GC is necessarily on the same service_id whereas this is not the case for an IP flow of LC nature. Local content present in different DVB service_ids and subject of the handover is necessarily duplicated at IP streams level (same IP flow, 2 IP streams in 2 DVB services). This more complicated scenario is presented in the following figure.

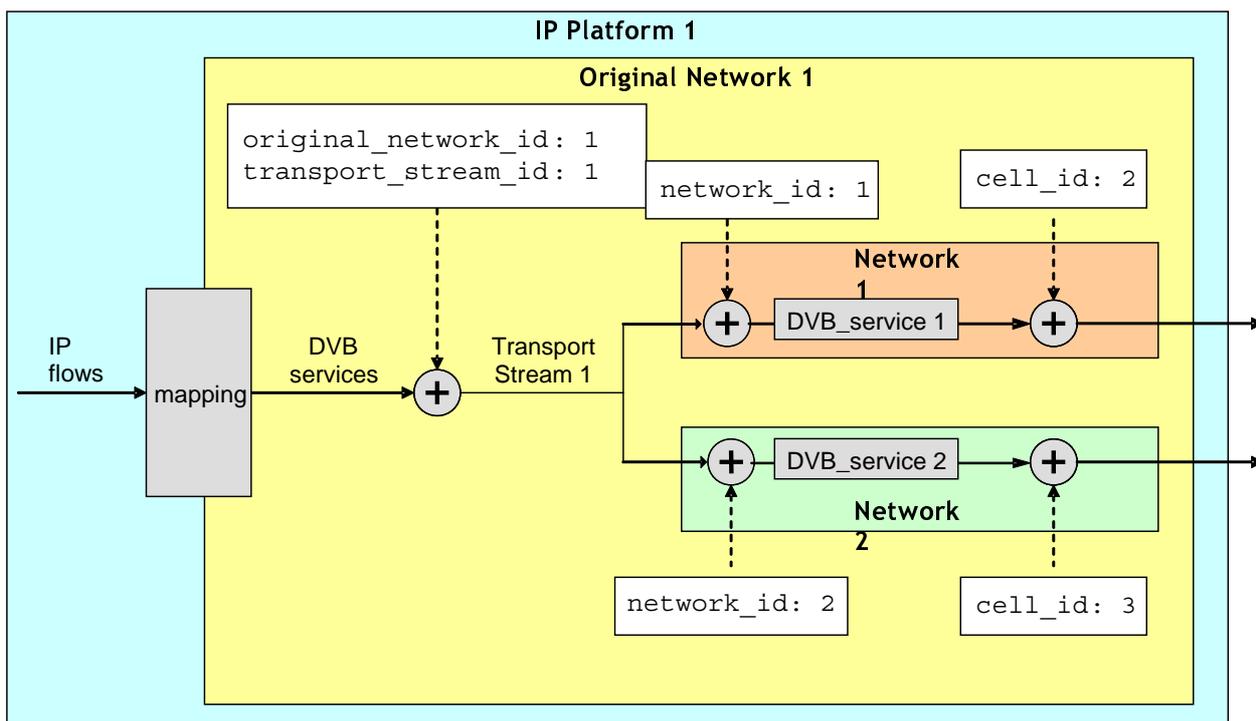


Figure 9: Handover use case 2

5.3.2.3 Use Case 3: Change of Cell ID and Transport Stream ID

This scenario is similar in processing to scenario detailed in [4] "Use Case 3: Change of Cell ID and Transport Stream ID", except for the additional check of the DVB service availability. Note that this scenario does not concern any GC:

- i) The terminal could find each TS that carries the same IP flow by decoding the IP/MAC stream_location_descriptor in the INT sub-table. This descriptor in particular gives the path original_network_id, network_id, transport_stream_id, DVB service_id, component_tag: the same IP flow could be found on another TS on an adjacent cell.
- ii) The terminal could acquire information on all the frequencies and their cell_ids for these TSs by decoding the cell_frequency_link_descriptor in NIT(actual).
- iii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor in NIT(actual).
- iv) The terminal was able to parse the list of DVB services using the SDT(other) as follows: the terminal parses the SDT (other) sub-table describing the TS and lists all available DVB services. The terminal checks in which cells the DVB services are available using the service_availability_descriptor.

Based on this, the terminal could check the availability of the signals of the cells accessible where the terminal is located and select the ones with the best quality as candidates to handover to.

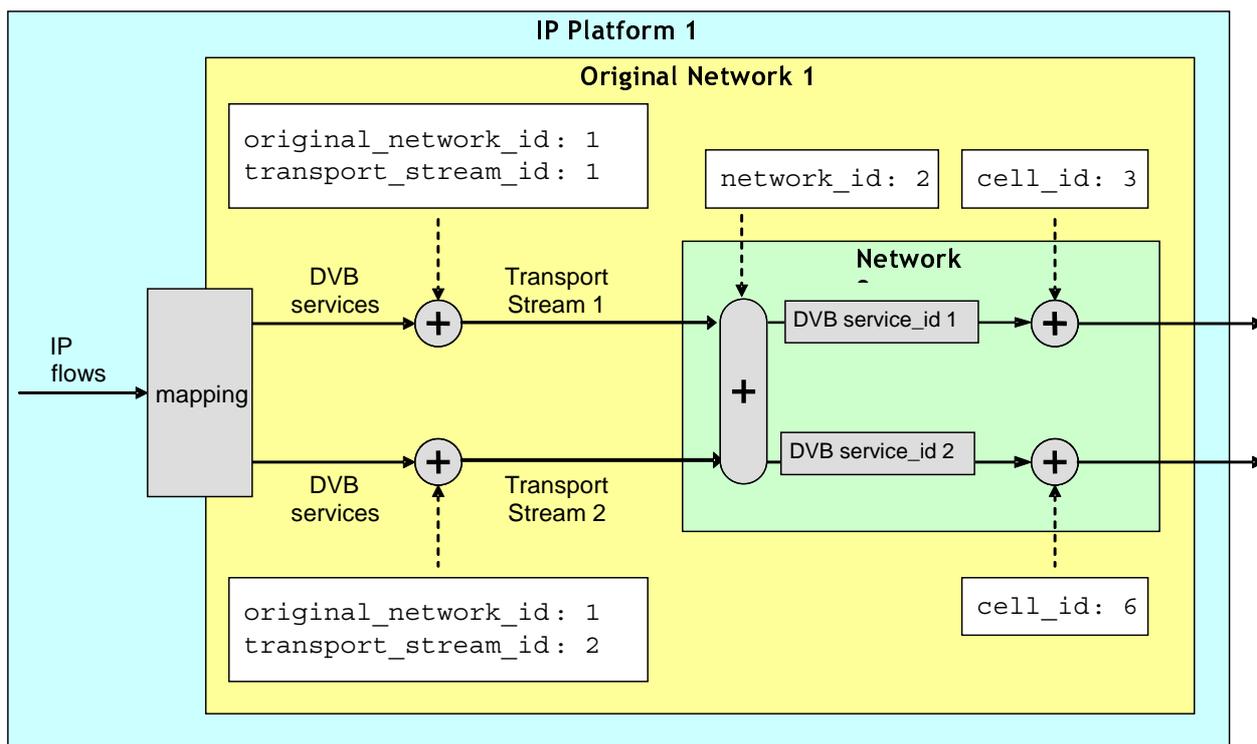


Figure 10: Handover use case 3

5.3.2.4 Use Case 4: Change of Cell ID and Network ID and Transport Stream ID

This scenario is similar in processing to scenario detailed in [4] "Use Case 4: Change of Cell ID, network ID, Transport Stream ID", except for the additional checking of DVB service availability:

- i) The terminal could find each TS that carries the same IP flow from the IP/MAC stream_location_descriptor in the INT sub-table, giving the path original_network_id, network_id, transport_stream_id, DVB service_id, component_tag: the same IP flow could be found on another TS on an adjacent cell of another network.
- ii) The terminal could acquire information on all the frequencies and their cell_ids for these TSs from the cell_frequency_link_descriptor in NIT(other).
- iii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor in NIT(other).
- iv) The terminal was able to parse the list of DVB services using the SDT(other) as follows: the terminal parses the SDT (other) sub-table describing the TS and lists all available DVB services. The terminal checks in which cells the DVB services are available using the service_availability_descriptor.

Based on this, the terminal could check the frequencies carrying the same TS in the neighbouring cells belonging to another network and select the one with the best quality.

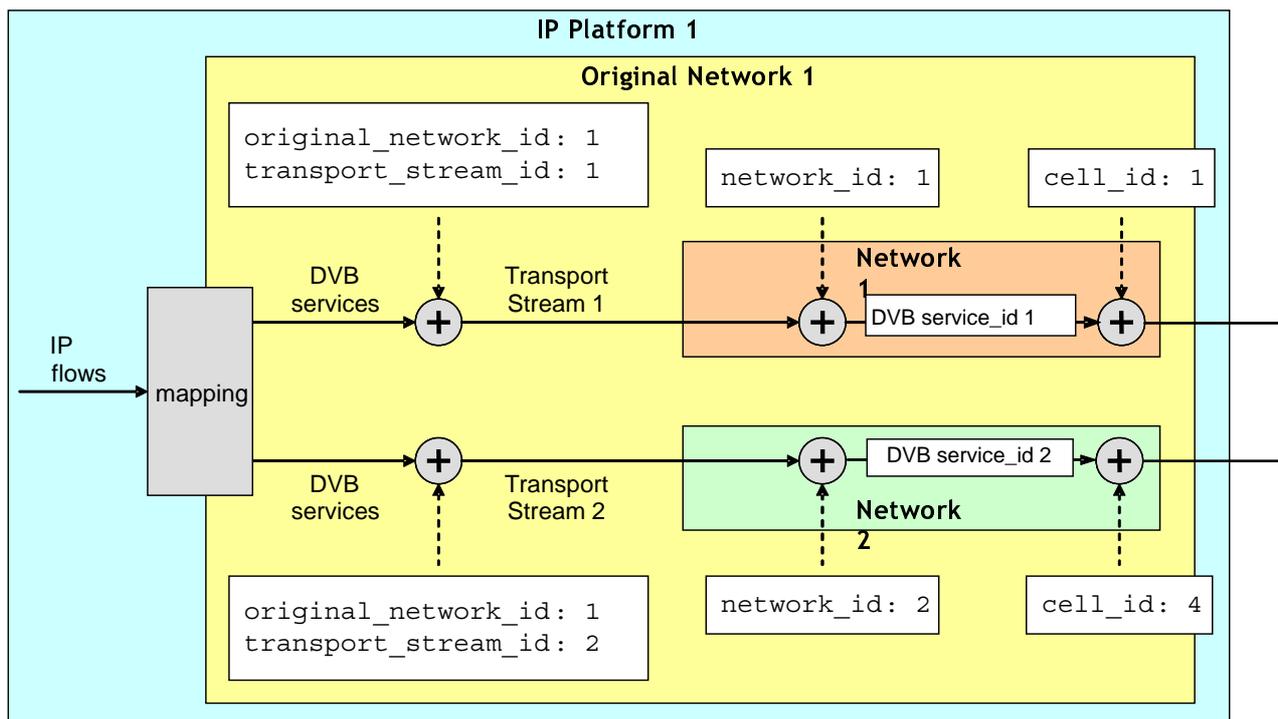


Figure 11: Handover use case 4

5.3.2.5 Use Case 5: Change of Cell ID, original network ID, TS ID, optional change of network ID

This scenario is similar in processing to scenario detailed in [4] "Use Case 5: Change of Cell ID, network ID, Transport Stream ID, original network ID", except for the additional check of the DVB service availability and the possible change of network:

- i) The terminal could find each TS that carries the same IP flow by decoding the IP/MAC stream_location_descriptor in the INT sub-table, giving the path original_network_id, network_id, transport_stream_id, DVB service_id, component_tag: the same IP flow could be found in another TS with a different original_network_id, possibly on another network.
- ii) The terminal could acquire information on all the frequencies and their cell_ids for these TSs by decoding the cell_frequency_link_descriptor in NIT(actual) or NIT(other) depending if the TS belongs to the same or to a different network.
- iii) The terminal could acquire information on the geographical location of such cells and the geographical location of the current cell by decoding the cell_list_descriptor in NIT(actual) or NIT(other) depending if the TS belongs to the same or to a different network.
- iv) The terminal was able to parse the list of DVB services using the SDT(other) as follows: the terminal parses the SDT (other) sub-table describing the TS and lists all available DVB services. The terminal checks in which cells the DVB services are available using the service_availability_descriptor.

Based on this, the terminal could check the availability of the signals of the cells accessible where the terminal is located and select the ones with the best quality as candidates to handover to.

The example given in the figure below relates to a change of network_id.

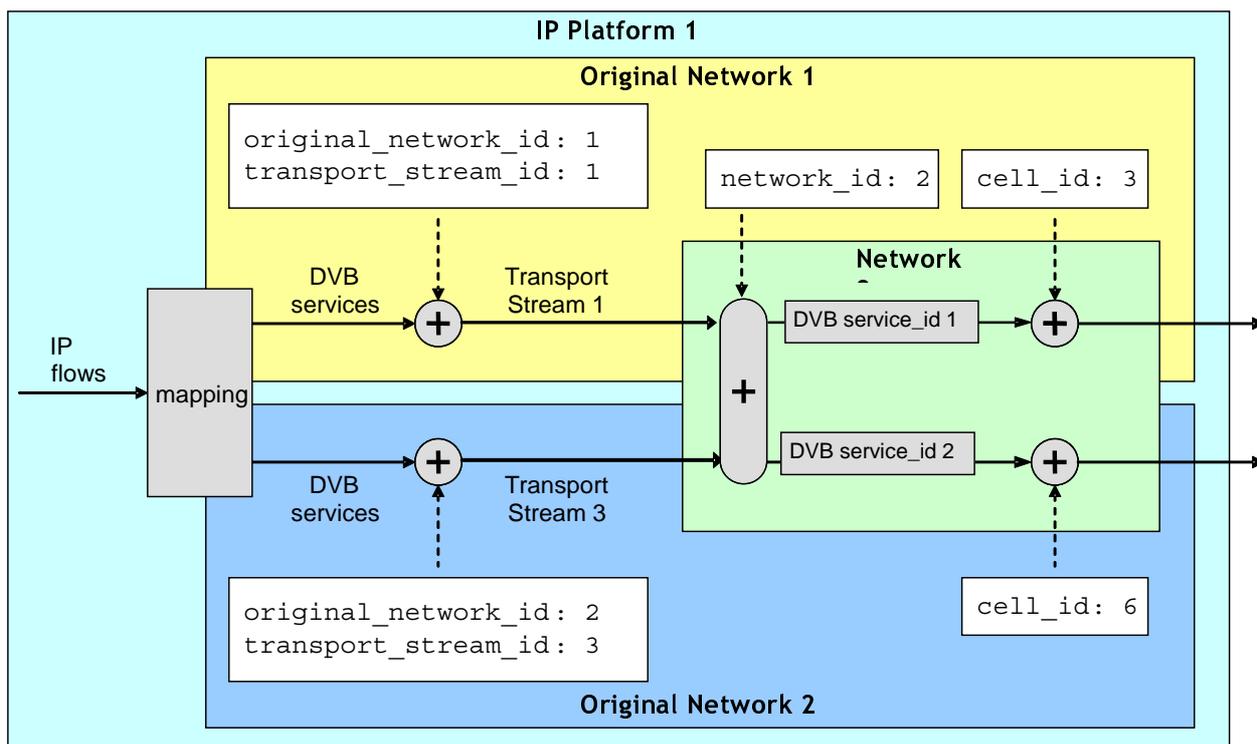


Figure 12: Handover use case 5

5.4 Handover between networks of different access type

5.4.1 Applicable handover procedures

From a PSI/SI perspective, handovers between two DVB IPDC networks of different access type (DVB-SH SFN, DVB-SH non-SFN, DVB-H) are performed identically to handovers between two DVB IPDC networks of same access type. In both cases, the handover procedures to be used are those defined for a handover between two networks of same access type (and involving a change of network_id). These "intra-technology" handover procedures have been defined in [4] and in clauses 5.2. and 5.3 of the present document, for respectively DVB-H, DVB-SH SFN, and DVB-SH non SFN configurations.

For a handover between two networks of different access type, the intra-technology handover procedure to be used depends on the type of target network, and not on the type of actual network. This procedure can be selected as follows:

- First, the terminal identifies the type of target network (DVB-SH SFN or DVB-SH non-SFN or DVB-H) by decoding the delivery system descriptor of the target Transport Stream in NIT(other).
- Second, the terminal selects among the procedures of handover between two networks of type of target network, the procedure covering the same transition case (change of cell_id and network_id, eventual change of original_network_id and/or transport_stream_id and/or service_id).

Example: for a handover from a DVB-SH network (in whatever configuration) to a DVB-H network, with the transition case "Change of Cell ID and Network ID", the applicable procedure will be "Change of Cell ID and Network ID" defined in [4] for a handover between two DVB-H IPDC networks.

Table below indicates which intra-technology handover procedure applies for each case of handover between DVB IPDC networks of different type.

Table 5-3

Intra-tech applicable procedure	Original Network ID change	Transport Stream ID change	Network ID change	DVB service change	Cell/Sub-cell ID change	Network access type		Comments
						Actual	→ Target	
[4] Use Case 2			X		X	DVB-SH SFN DVB-SH non SFN	DVB-H	To be used: intra DVB-H IPDC handover procedures involving a network_id change. Target delivery system described by a terrestrial_delivery_system descriptor.
[4] Use Case 4		X	X	X	X			
[4] Use Case 5	X	X	X	X	X			
[5.2.2.2] Use Case 2			X		X	DVB-H DVB-SH non SFN	DVB-SH SFN	To be used: intra DVB-SH (SFN) IPDC handover procedures involving a network_id change. Target delivery system described by a hybrid_delivery_system descriptor.
[5.2.2.4] Use Case 4		X	X	X	X			
[5.2.2.5] Use Case 5	X	X	X	X	X			
[5.3.2.2] Use Case 2			X		X	DVB-H DVB-SH SFN	DVB-SH non SFN	To be used: intra DVB-SH (non-SFN) IPDC handover procedures involving a network_id change. They all include a service availability check on the target cell. Target delivery system described by a hybrid_delivery_system descriptor.
[5.3.2.2] Use Case 2'			X	X	X			
[5.3.2.4] Use Case 4		X	X	X	X			
[5.3.2.5] Use Case 5	X	X	X	X	X			

5.4.2 Examples of handovers from DVB-H to DVB-SH non SFN

This clause illustrates some cases of IPDC handovers from a DVB-H to a DVB-SH network in non SFN configuration.

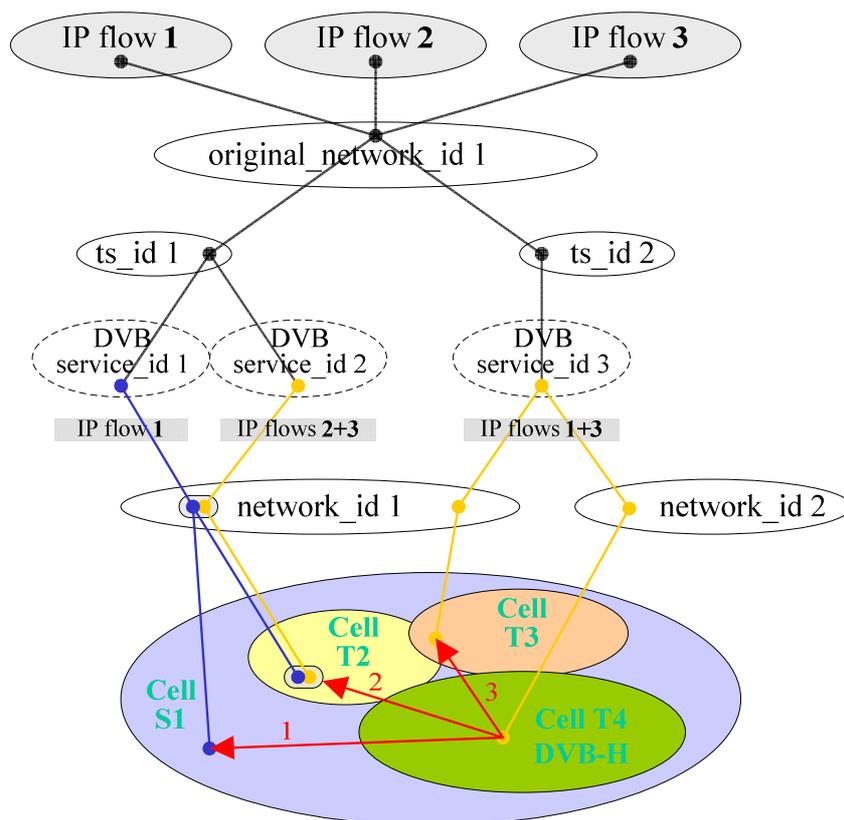


Figure 13: Some cases of handover from DVB-H to DVB-SH non SFN

Case 1: the terminal receives IP flow 1 on a DVB-H cell and goes out of reach of the terrestrial DVB-H network. It decides to move to a DVB-SH satellite cell where the same IP flow can be found on another TS having same original_network_id.

Case 2: the terminal receives IP flows 1 and 3 on a DVB-H cell and goes out of reach of the DVB-H terrestrial network. It decides to move to a DVB-SH CGC cell where the same IP flows can be found on another TS having same original_network_id.

Case 3: the terminal receives IP flows 1 and 3 on a DVB-H cell and goes out of reach of the terrestrial DVB-H network. It decides to move to a DVB-SH CGC cell where the same IP flows are present on the same TS.

5.4.2.1 Example Scenario 2: Change of Cell ID and Network ID and Transport Stream ID

This example scenario illustrates the handover procedure from a DVB-H network to a DVB-SH network in the situation when the Transport Stream changes (change of transport_stream_id). The detailed procedure is as follows:

- i) From the IP/MAC stream_location_descriptors of the INT sub-table, the terminal could determine that the same IP flows are carried by DVB services on another Transport Stream in another network.
- ii) From the NIT_other sub-table describing this network, the terminal could acquire the hybrid_delivery_system_descriptor as well as the cell_frequency_link_descriptor characterizing this other Transport Stream in this other network.
- iii) Using the service availability procedure specified in [14], the terminal could determine on which cells listed by this cell_frequency_link_descriptor the DVB services are actually available.
- iv) From the cell_frequency_link_descriptor, the terminal could acquire information on the frequencies of such cells.
- v) From the same NIT_other sub-table, the terminal could acquire information on the geographical location of such cells.

Based on this, the terminal could check the frequencies carrying the other TS in the neighbouring cells belonging to the other network and select the one with the best quality.

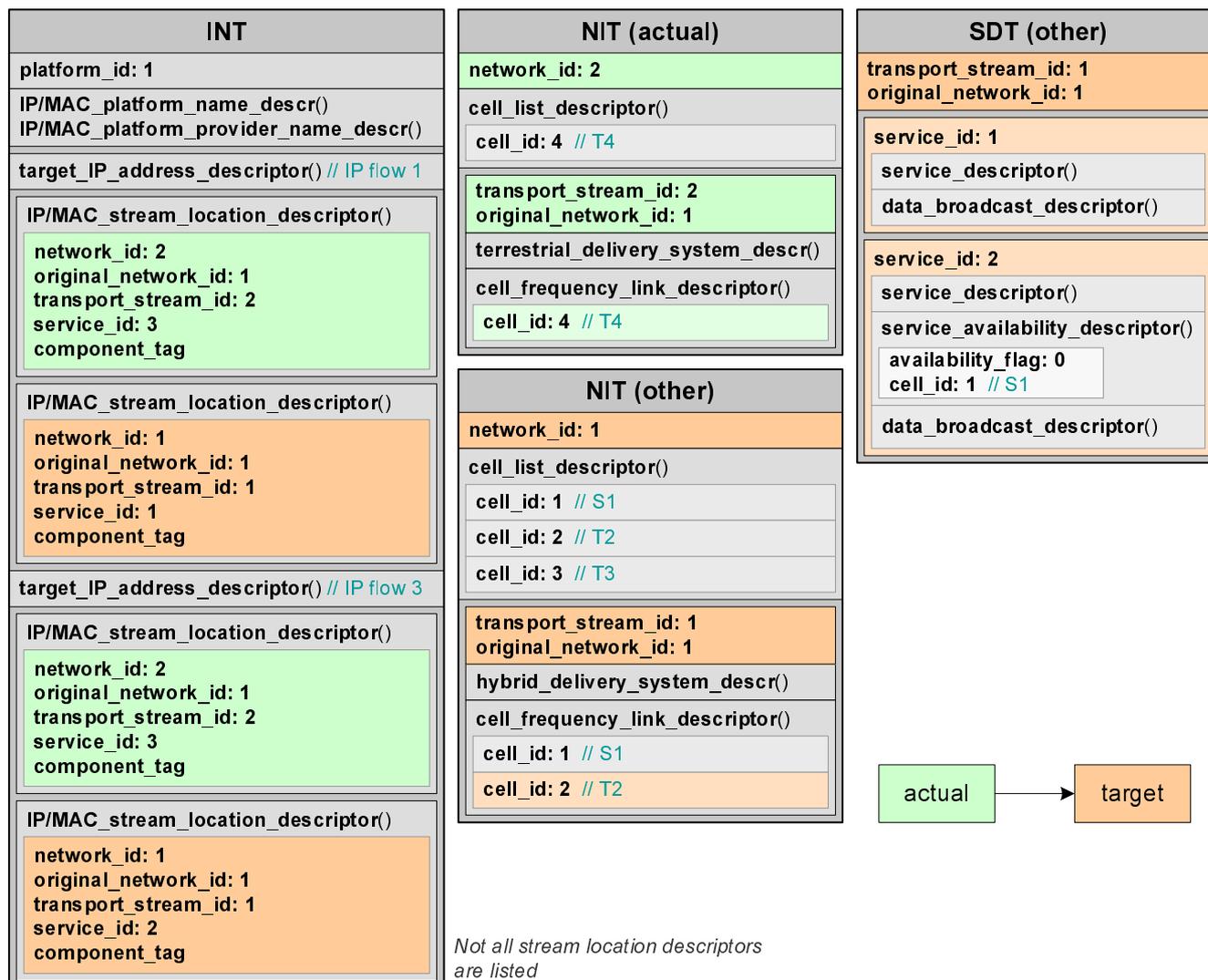


Figure 14: PSI/SI support for Example Scenario 2

5.4.2.2 Example Scenario 3: Change of Cell ID and Network ID

This example scenario illustrates the handover procedure from a DVB-H network to a DVB-SH network in the situation when the Transport Stream does not change. The detailed procedure is as follows:

- i) From a previous parsing of INT sub-table, the terminal could cache the service_id of the DVB service carrying the IP flows in the actual Transport Stream.
- ii) From NIT(other), the terminal could determine that the actual Transport Stream is also present in another network.
- iii) From the NIT_other sub-table describing this network, the terminal could acquire the hybrid_delivery_system_descriptor as well as the cell_frequency_link_descriptor characterizing the actual Transport Stream in this other network.
- iv) Using the service availability procedure specified in [14], the terminal could determine on which cells listed by this cell_frequency_link_descriptor the DVB service is actually available.
- v) From the cell_frequency_link_descriptor, the terminal could acquire information on the frequencies of such cells.

- vi) From the same NIT_other sub-table, the terminal could acquire information on the geographical location of such cells.

Based on this, the terminal could check the frequencies carrying the same TS in the neighbouring cells belonging to the other network and select the one with the best quality.

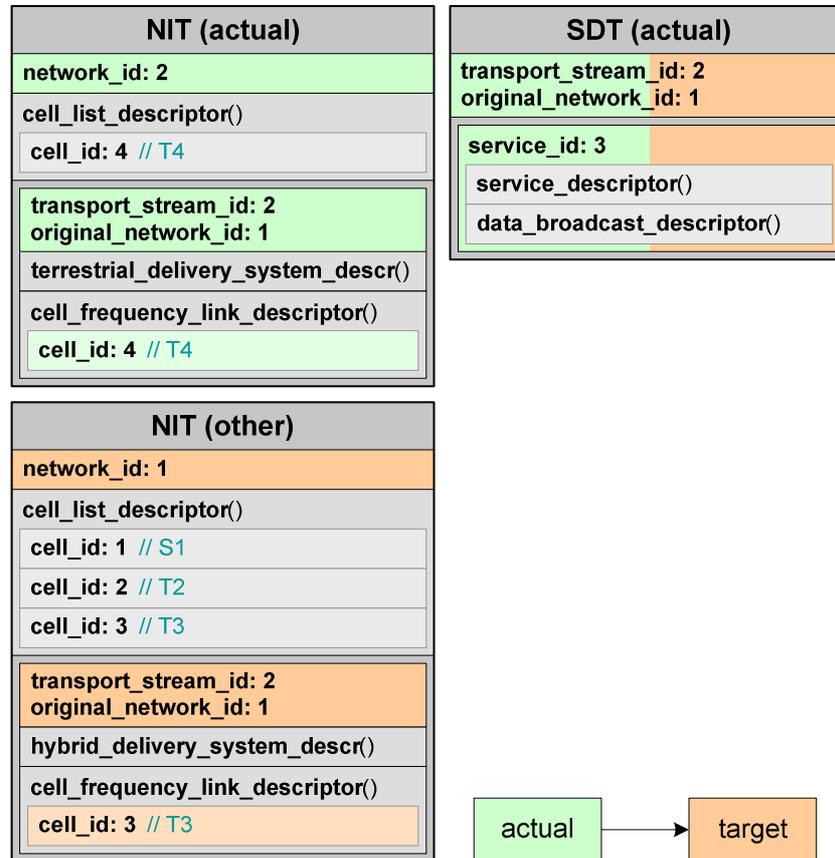


Figure 15: PSI/SI support for Example Scenario 3

History

Document history		
V1.1.1	April 2009	Publication