IP over MPEG-2/DVB (ip-dvb) WG

THURSDAY, August 5, 2004
1300-1500 Afternoon Session I

CHAIR:

Gorry Fairhurst <gorry@erg.abdn.ac.uk>

Active Drafts:

draft-ipdvb-arch-00.txt
draft-ipdvb-ule-01.txt

draft-collini-ipdvb-xule-00.txt
draft-fair-ipdvb-ar-01.txt

Agenda

1. Agenda Bashing (5 minutes) Chair
- Election of scribes

2. Working Group Status (10 minutes) Chair
- Review of milestones

3. Framework/Architecture (20 minutes) M-JM
draft-ipdvb-arch-00.txt

4. Ultra Lightweight Encapsulation (15 minutes) BC-N
draft-ipdvb-ule-01.txt

5. ULE Extension Headers (10 minutes) BC-N
draft-collini-ipdvb-xule-00.txt

6. Outstanding ULE Issues (10 minutes) Chair

Agenda

7. Address Resolution (15 minutes) M-JM
draft-fair-ipdvb-01.txt

8. Address Resolution with UDLR (10 minutes) IZ

9. Other Issues
- ATSC inputs
- Update on implementations

10. Close

Note Well

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Read RFC3368.

WG Status

Gorry Fairhurst <gorry@erg.abdn.ac.uk>

Welcome to the first IETF ipdvb WG meeting !!!

Mailing List

Mailing list: ipdvb@erg.abdn.ac.uk

To subscribe: subscribe ipdvb at
majordomo@erg.abdn.ac.uk

Archive: http://www.erg.abdn.ac.uk/ipdvb/archive

IETF Archive: :-(

Active IDs

Framework/Architecture ID (INFO)
draft-ipdvb-arch-00.txt

Ultra Lightweight Encapsulation (ULE) (STD)
draft-ipdvb-ule-01.txt
Need to decide on: draft-collini-ipdvb-xule-00.txt

Address Resolution Framework (INFO)
draft-fair-ipdvb-ar-01.txt

Address Resolution Protocol (STD)
No Draft

Milestones

Done Draft of a WG Architecture ID
Done Draft of a WG ID on Encapsulation (ULE)

Jul 04 Draft of a WG ID on AR Framework
Jul 04 Submit Architecture to IESG

Oct 04 Draft of a WG ID on AR Protocol
Oct 04 Submit Encapsulation to IESG

Apr 05 Submit AR Framework to IESG
Aug 05 Submit AR Protocol to IESG
Aug 05 Progress ULE RFC along IETF Standards Track

Sept 05 Recharter or close WG?

A Framework for transmission of IP datagrams over MPEG-2 Networks

draft-ipdvb-arch-00.txt

Marie-José Montpetit (ed.)
Gorry Fairhurst
Horst D. Clausen
Bernhard Collini-Nocker
Hilmar Linder

August 5 2004

Progress Since Last Version

- Individual draft progressed to rev -05
  - This was adopted as the a WG draft on 9th July
- Change from “requirements” to “framework” and provide an architectural basis for the work
- Move from a more encapsulation oriented requirements document to a framework of IP networking over MPEG-2 networks
- Major edit and establishment of network requirements

Overview

- Prime focus is the efficient and flexible delivery of IP services over those subnetworks that use the MPEG-2 transport stream
- Compatibility with services based on DVB and ATSC and provided over different physical media (satellite, terrestrial and cable)
- Use the broadcast nature of MPEG-2 based networks when applicable

Overview

- Take into account the various scenarios:
  1. Broadcast TV/Radio
  2. Broadcast Networks used for ISP
  3. Uni-directional Star
  4. Datacast Overlay
  5. Point-to-point
  6. Bi-directional IP
- Use the nature of the TS logical channels
  - TDM based
  - Identified by a PID
  - TS Multiplexing (and potentially re-multiplexing) with other MPEG-2 streams that contain data or information
- Use the SI tables when appropriate

What the Framework Provides (1)

- Guidance on which MPEG-2 features are pre-requisites for the IP service, and identification of any optional fields that impact performance/correct operation
- Standards to provide an efficient and flexible encapsulation scheme with a type field and a mechanism to signal which encapsulation is used on a certain PID

What the Framework Provides (2)

- Standards to associate a particular IP address with a Network Point of Attachment (NPA) (AR)
- Standards to associate a MPEG-2 TS interface with one or more specific TS Logical Channels (PID, TS Multiplex).
- Standards to associate the capabilities of a MPEG-2 TS Logical Channel with IP flows maybe using AR
- Guidance on Security for IP transmission over MPEG-2.
- Options (not chartered – flows naturally)
  - Management of the IP transmission, including standardised SNMP, MIBs and error reporting procedures

Encapsulation Requirements

- Easy access to the type of encapsulated protocol
- Easy processing by hardware devices
- Low overhead/managed overhead
- A fully specified algorithm that allows a sender to pack multiple packets per SNDU and to easily locate packet fragments
- Extensibility
- Compatibility with legacy deployments
- Ability to allow link encryption, when required
- Capability to support a full network architecture including data, control and management planes

Address Resolution Requirements

- Use of a table based approach to promote AR scaling. This requires definition of the frequency of update and volume of AR traffic generated.
- Mechanisms to install AR information at the server (unsolicited registration).
- Mechanisms to verify AR information held at the server (solicited responses). Appropriate timer values need to be defined.
- An ability to purge client AR information (after IP network renumbering, etc.).
- Support of IP subnetwork scoping.
- Appropriate security associations to authenticate the sender.
- Support for extra features associated with flow management

Multicast Requirements

- Seamless end-to-end multicasting
- Encapsulating multicast packets for transmission using a MPEG-2 TS
- Mapping IP multicast groups to the underlying MPEG-2 TS Logical Channel (PID) and the MPEG-2 TS Multiplex
- Provide AR information to allow a Receiver to locate an IP multicast flow within an MPEG-2 TS Multiplex
- Error Reporting

Open Issues

- Should there be some requirements (hence a future solution) for end to end management of IP flows and enable operators to better configure, verify and distribute policies regarding specific flows (heritage from PacketCable)
- Should address resolution be used to map specific addresses to PIDs with special features
- Should extension headers can carry information about the cell content over the portion of the link that supports IP over MPEG-2

Evolution to WG Last Call

- New edits necessary:
  - Remove redundant AR information and clarify AR requirements
  - Remove AR appendix
  - Add end to end management requirements (if approved)
  - Fix last inconsistencies
- Propose resubmit to list and fast WGLC of rev. 01 (1-2 weeks)

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Extra Slides

Why a New Framework?

- Since the deployment of initial MPEG-2 based network the nature of the Internet and the services over these networks has changed
  - Efficient support is needed for extended range of IP protocols (v.g. IPv6)
  - Efficient support is needed for typical network configurations especially Ethernet-based (bridging)
  - ISPs want to deploy end to end services that ensure quality of service and efficient/flexible provisioning
  - Security/privacy is at the basis of new all IP networks

MPEG-2 Structure

```
+---------+-+-+-+-+------+--------+---+--+--+
|         |T|V|A|O|  O   |        | O |S |O |
|         |e|i|u|t|  t   |        | t |I |t |
|         |l|d|d|h|  h   |   IP   | h |  |h |
|Protocols|e|e|i|e|  e   |        | e |T |e |
|native   |t|o|o|r|  r   |        | r |a |r |
|over     |e| | | |      |        |   |b |  |
|MPEG-2 TS|x| | | |      |   +----+-+ |l |  |
|         |t| | | |      |   | MPE  | |e |  |
|         | | | | |   +--+---+------+ |  |  |
|         | | | | |   | AAL5 |Priv. | |  |  |
|         +-+-+-+-+---+------+      +-+--+--+
|         |  PES  |  ATM     |Sect. |Section|
+---------+-------+----------+------+-------+
|               MPEG-2 TS                   |
+---------+-------+-------+-----------------+
|Satellite| Cable | D-TV  |    Other PHY    |
+---------+-------+-------+-----------------+
```

Figure 1: Overview of the MPEG-2 protocol stack

Motivation

- The architecture will support:
  - IPv4 Unicast packets, destined for a single end host
  - IPv4 Broadcast packets, sent to all end systems in an IP network
  - IPv4 Multicast packets
  - IPv6 Unicast packets, destined for a single end host
  - IPv6 Multicast packets
  - Packets with compressed IPv4 / IPv6 packet headers
  - Bridged Ethernet frames
  - Other (MPLS, IPv6 anycast, potential new protocols

Ultra Lightweight Encapsulation (ULE) for transmission of IP datagrams over MPEG-2/DVB networks

draft-ietf-ipdvb-ule-02.txt

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Changes since rev01☺

- Corrected CRC-32 to follow standard practice in DSM-CC. * Removed LLC frame type, now redundant by Bridge-Type (==1) * Defined D-bit to use the reserved bit field (R) - Gorry, Alain, Bernhard * Changes to description of minimum payload length. ñ Gorry * MPEG-2 Error Indicator SHOULD be used ñ Hilmar & Gorry * MPEG-2 CC MAY be used (since CRC-32 is strong anyway) ñ Hilmar & Gorry * Corrected CRC-32 to now follow standard practice in DSM-CC - Gorry, Hilmar, Alain. * Changed description of Encapsulator action for Packing, Gorry & Hilmar. * Changed description of Receiver to clarify packing, Gorry & Alain. * Stuff/Pad of unused bytes MUST be 0xFF, to align with MPEG ñ Hilmar/Bernhard. * Recommend removal of section on Flushing bit stream - Gorry * Updated SNDU figures to reflect D-bit and correct a mistake in the bridged type field - Alain * Reorganised section 5 to form sections 5 and 6, separating encapsulation and receiver processing ñ Gorry, Hilmar, Alain. * Added concept of Idle State and Reassembly State to the Receiver. Renumbered sections 5,6 and following, - Gorry. * Nits from Alain, Hilmar and Gorry. Moved security issue on the design of the protocol to appropriate sections, since this is not a concern for deployment: Length field usage and padding initialisation. * Changed wording: All multi-byte values in ULE (including Length, Type, and Destination fields) are transmitted in network byte order (most significant byte first) ñ old NiT from Alain, now fixed. * Frame byte size in diagrams now updated to ñstandard- format, and D bit action corrected, as requested by Alain. Expires November 2004 [page 3] * Frame format diagrams, redrawn to 32-bit format below: 0 1 2 3 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 * Additional diagram requested by Alain for D=0 bridging (added, and subsequent figures renumbered). * Diagrams of encapsulation process, redrawn for clarity (no change to meaning) ñ Gorry. * Reworded last para of CRC description. * Clarification to the statements in the CRC coverage ñ to make it clear that it is the entire SNDU (header AND payload) that is checksummed. (Fritsche@iabg.de, hlinder@cosy.sbg.ac.at). * References added for RCS (spotted by Alain) and AAL5 (provided by Anthony Ang). * Removed informative reference to MPEG part 1 ñ Alain. Spelling correction -> Allain to Alain. * Added description of Receiver processing of the address field.- Gorry * Added caution on LLC Length in bridged Packets thanks ñ Gorry/wolfgang * Removed Authors notes from text after their discussion on the list ñ Gorry, * Corrected text to now say maximum value of PP = 182 in ULE ñ Gorry, * Tidied diagrams at end (again) ñ Gorry, Revision with following changes: * Re issue as working group draft (filename change) * Refinement of the text on CRC generation to be unambiguous. * Revised CC processing at Encapsulator (BC-N/GF/A.Allison) * Revised CC processing at Receiver (from List: A.Allison; et al) * Corrections to length/PP field in Examples (M Sooriyabandara, Alain) * Corrections to pointer in Example 3 SNDU C (M Jose-Montpetit) * Section 4.5 only SHARED routed links require D=0 * Packing Threshold defined * Next-Layer-Header defined * Addition of Appendix B (to aide verification of SNDFU format) Issues addressed: * Typographical * Types > 1500 should be passed to the next higher protocol (Hilmar) * The second part of the Type space corresponds to the values 1500 COMMENT: ~Range should be 1536 Decimal Decimal to 0xFFFF. * IANA has already defined IP and IPv6 types ñ corrected text! Added more security considerations (-01d). * Should we allow an Adaptation Field within ULE (request for DVB- RCS compatibility)? Requirement to be clarified! Implementation impact to be evaluated! Current Recommendation: The current spec does not preclude use of AF, it simply says that this is not the standard for ULE. The use- case and requirement for this mode are not currently clear, based on this there is no current intention to add this to ULE ñ text for requirements would be welcome. * Verify the minimum value allocated to DIX Ethernet Header Types. Draft updated to align with IEEE Registry assignments.

Changes since rev01

- Improvement of clarity
- Refinement of the text on CRC generation to be unambiguous.
- Revised CC processing at Encapsulator and Receiver
- Corrections to length/PP field in Examples
- Corrections to pointer in Example 3
- Only SHARED routed links require D=0
- Packing Threshold defined
- Next-Layer-Header defined
- Addition of Appendix B

Issues addressed in rev02

- Typographical
- Types > 1500 should be passed to the next higher protocol
- The second part of the Type space corresponds to the values 1500
- IANA has already defined IP and IPv6 types corrected text! Added more security considerations (-01d)
- Verify the minimum value allocated to DIX Ethernet Header Types. Draft updated to align with IEEE Registry assignments.

Open Issues 1/2

- MPEG-2 related
  - Optional non-default CC processing – Doc now conforms to MPEG-2 Spec
  - Support AF usage – Doc conforms to MPEG-2 Spec

Open Issues 2/2

- IP related
  - Code point value for Ethernet Bridging – IEEE-format bridging has extra padding inserted to do
  - Should ULE support FEC – See XULE
  - Should ULE support Encryption – See XULE

Status

- Stable draft
- Existing implementations
- Comments from DVB-S, DVB-RCS, DVB-C, DVB-T, DVB-H
- Authors would like to rev and move to WGLC

Thats´s it

- Thanks.

Ultra Lightweight Encapsulation (ULE) Extension Header

draft-collini-ipdvb-xule-00.txt

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Motivation 1/2

- Several requests to add options or optional headers for encryption (DVB-S/RCS), FEC (DVB-H), …
- there was much discussion on the list about **HOW**to do extensions - how to know there are extensions - how to encode them - how much overhead - how many may be used - etc
- This draft came out of this debate and includes ideas and points raised by various people.

Motivation 2/2

- Ideas distinct from the ULE Spec itself
- Wrote a separate draft
- Check people understood the implications - and of course to provide the opportunity to review comments / competing viewpoints (although it seems we may now have it right – because we've got generally positive feedback)

Extensions

- `←--------------------------   SNDU   --------------------------→`
- ```
  +---+---------------------------------------------------+--------+
  |D=0| Length |  Type   |              PDU               | CRC-32 |
  +---+---------------------------------------------------+--------+
  ```
- `←  ULE base header   ->`

- In ULE, the Type field is assigned an IANA assigned value. All values above 1535 (decimal) follow the IEEE/DIX type assignments for Ethernet. Values less than 1536 (decimal) indicate a next-layer-header and are assigned from a separate IANA registry for ULE.

- `←--------------------------   SNDU   --------------------------→`
- ```
  +---+--------------------------------------------------+--------+
  |D=0| Length | H1 | T1 | ...| Hn | Tn | Type |   PDU   | CRC-32 |
  +---+--------------------------------------------------+--------+
  ```
- ← ULE base header ->

Structure

- ```
  ←--------------------------   SNDU   --------------------------→
  ```
- ```
  +---+---------------------------------------------------+--------+
  |D=0| Length | H1 | T1 | T2 | H2 | Type |       PDU      | CRC-32 |
  +---+---------------------------------------------------+--------+
  ```
- ```
  ←  ULE base header   ->
  ```
- The 16-bit ULE next-layer-header field is used in place of the Type value. It is organised as a 5-bit zero prefix, a 3-bit H-LEN field and an 8-bit H-Type field, as follows:
-
- ```
  +----+-----+--------+
  |0000|H-LEN| H-TYPE |
  ```
- ```
  +----+-----+--------+
  ```
  ```

H-LEN Assignment

- 0 Mandatory Extension Header
- 1 Optional Extension Header of len 2B
- 2 Optional Extension Header of len 4B
- 3 Optional Extension Header of len 6B
- 4 Optional Extension Header of len 8B
- 5 RESERVED for future use
- >=6 the combined H-LEN and H-TYPE values indicate the Ethertype of a PDU that directly follows this Type field.
- A H-LEN of zero indicates a Mandatory Extension Header. Each specific Mandatory Extension header has a pre-defined length, that is not communicated in the H-LEN field. No additional limit is placed on the maximum length of a Mandatory Extension Header.

Mandatory Extension Headers

- 0x0000: Test SNDU, discarded by the Receiver
- 0x0001: Bridged Ethernet Frame
- 0x0002: Mandatory Odd Encryption Header
- 0x0003: Mandatory Even Encryption Header
- More to come?

Optional Extension Header(s)

- 0x0100: Null Option, this header MUST be skipped by the Receiver.
- More to come?

Example: encryption

```
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|1 |     Length  (2B)    |     Type = 0x00WW     |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                                                |
=                                                =
|          (Link encryption control block)       |
|                                                |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                                                |
=                                                =
|                   (PDU - IPv4)                 |
|                                                |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                                                |
+                 ULE CRC-32  (4B)               +
|                                                |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
```

Example: bridging

```
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|1 |     Length  (2B)    |     Type = 0x0001     |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          MAC Destination Address  (6B)        |
+                       +--+--+--+--+--+--+--+--+
|                       |                       |
+--+--+--+--+--+--+--+--+                       +
|            MAC Source Address  (6B)           |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|     EtherType (2B)    |                       |
+--+--+--+--+--+--+--+--+                       |
=                                               =
|        (Contents of bridged MAC frame)        |
|                                               |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|                                               |
+                 ULE CRC-32  (4B)              +
|                                               |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
```

Open Issues 1/3

- Encryption to go to separate document
- FEC to go to separate document
- Avoid „reserved“ H-TYPE
- Merge ULE with XULE?

- Use H-TYPE as code point, H-TYPE to define H-LEN, allocate 8bit for IANA?

Open Issues 2/3

- Current wording of the XULE ID proposes just one IANA registry, but 12 bits?
- has a fairly complicated IANA assignment policy for the sepcific numbers (i.e. Separate areas of the registry depending on the length of the extension type) - this allows for MANY extension types! But there is at the moment a very low density of use of some of the classes (most are empty sets ;-)
- Can we simplify this?

Open Issues 3/3

- One proposal is to define just two registry areas for H-types, thus, simpler allocation, still 256 H-types per area:
  - one mandatory
  - one optional

- **Other proposals?**

Done

- Thanks.

Outstanding ULE Issues

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Extensions?

Three Issues

1. Is the extension mechanism in XULE good enough for ULE?
2. Are the proposed extensions the correct set?
3. Are there other constraints on extension order/numbering?

How close are we to WG LC?

Proposal:

- Fix ULE Issues
- Update with XULE outcome
- Re-issue as a WG Draft

Address Resolution For IP Datagrams Over MPEG-2 Networks

draft-fair-ipdvb-ar-01.txt

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August 5 2004

WG AR Items

- WG RFC on AR Techniques (INFO)
  - covers generic issues in how to do AR, and particularly in scenarios which co-exist with MPEG-2 Video transmission
- WG RFC on AR Protocol (STANDARD)
  - covers IP-centric networks and provides much more IP functionality
- This presentation targets progress on both items

Progress since rev.-00

- On the individual draft (current)
  - Major editing of document
  - Closer integration into the ARCH draft
  - Focus on "what exists" and how it is used
  - Current version is: draft-fair-ipdvb-ar-01
- On the AR protocol (no current draft)
  - Focus on "what is needed"
    - Announced and On Demand approaches
  - Refinement of the dynamic AR concept
    - Virtual access point definition (related Network Point of Attachment)
  - Investigation of "above IP" mechanisms for AR specification:
    - SOAP/XML
    - Based on OMA approaches
    - Extensible to more concepts (security, management)

draft-fair-ipdvb-ar-01: AR over MPEG-2 Networks

- Current methods based on pre-assigned or table-assigned mappings
  - INT – Internet Notification Tables – DVB Standard
  - MMT – Multicast Mapping Table – DVB-RCS preferred method
  - AIT - Application Information Table - MHP
- Need to resolve IPv4/v6 address to:
  - MPEG-2 TS PHY
  - MPEG-2 TS PID
  - MPEG-2 Receiver ID (NPA) / MAC Address

draft-fair-ipdvb-ar-01: AR over MPEG-2 Networks

- Tables:
  - Are used to locate IP (and MAC) flows in a MPEG-2 based network
  - Support to MPE *and* ULE
  - Are used to map IP addresses to PIDs
  - INT the DVB standard
  - AIT and MMT for specific applications
  - Dynamics and amount of information transmitted differs

draft-fair-ipdvb-ar-01: Next Version

- New inputs to be added to draft
- Table methods comparison
- How-to “Guides”:
  - Do DHCP over ULE
  - ND or ARP over ULE
    - Specifically How-To do AR for the IP -> MAC address
  - Other

  *** Inputs needed from the group ***
- Identify/resolve known issues
  - Dynamics
  - Scoping
  - Technology specific implementations

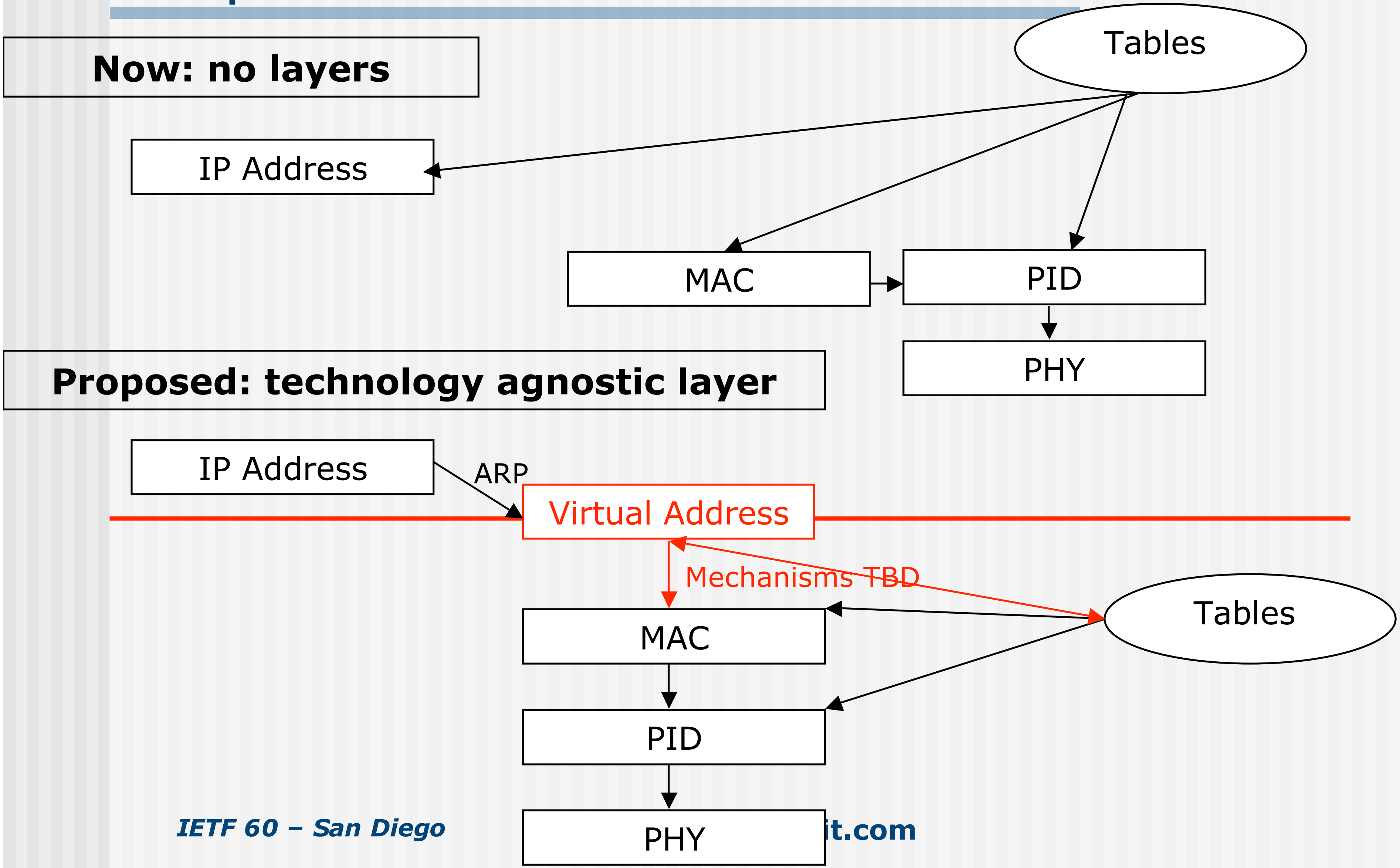
draft-fair-ipdvb-ar-01

- Can this become a WG Document?
- Informational Draft according to WG Charter

AR Protocol

- New approaches are necessary to make the assignment more easily integrated in ISPs configuration and provisioning and ensure end to end management of flows
  - Multi-level process needed with some dynamic assignment
  - Use of tables for L2 (and lower) mapping

AR protocol: Overview



AR Protocol: Requirements

- Support to current and proposed IP over MPEG-2 deployments
- Support to unicast *and* multicast addressing for IPv4 and IPv6
- Support to scoping (MPEG-2 network supporting multiple IP networks)

AR Protocol: New Individual Draft

- Concentrate on implementation
  - Goal is integration into a security/flow/session management framework
- Definition of the level 2 NPA format and scope
- Definition of signaling/control mechanisms
  - Heritage from OMA
  - Heritage from PacketCable
- Solutions for both unicast and multicast
  - But technology agnostic

AR Protocol: Open Issue

Operational Requirements: Who will implement this?

Inputs needed:
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IETF-60
ipdvb wg

Dynamic Address Resolution on IP over DVB environment

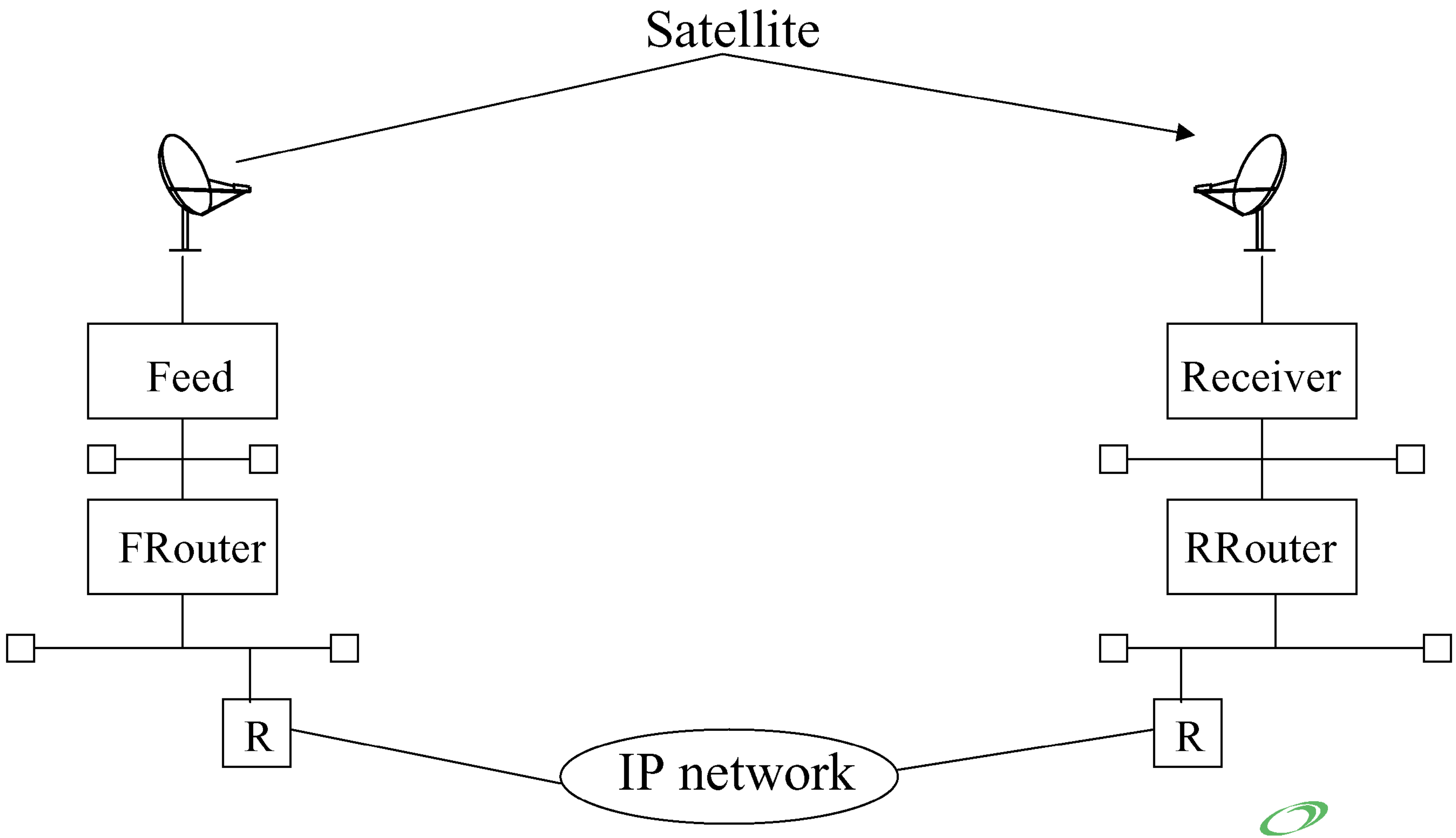
Hidetaka Izumiyama
WISHnet Inc.

WISHnet

Objectives

- To resolve the IP address to/from the subnetwork NPA(MAC) layer 2 address on IP over DVB link “**dynamically**”.
- Follow current Address Resolution standard
  - ARP(RFC826) for IPv4
  - Neighbor Discovery(RFC 2461) for IPv6
- PID vs IP address mapping is out of scope.Single PID is assigned statically.

Target Topology



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Terminology

- Feed
  - IP over DVB encapsulator
  - Sender of DVB UDL
  - Layer 2 bridge
- Receiver
  - IP over DVB decapsulator
  - Receiver of DVB UDL
  - Layer 2 bridge
- FRouter
  - Router or Host which can send the packet through UDL
- RRouter
  - Router or Host which can receive the packet through UDL

Our Approach

- Emulate Uni-Directional Link as Bi-directional link by using UDLR(RFC3077) Link Layer Tunneling Mechanism

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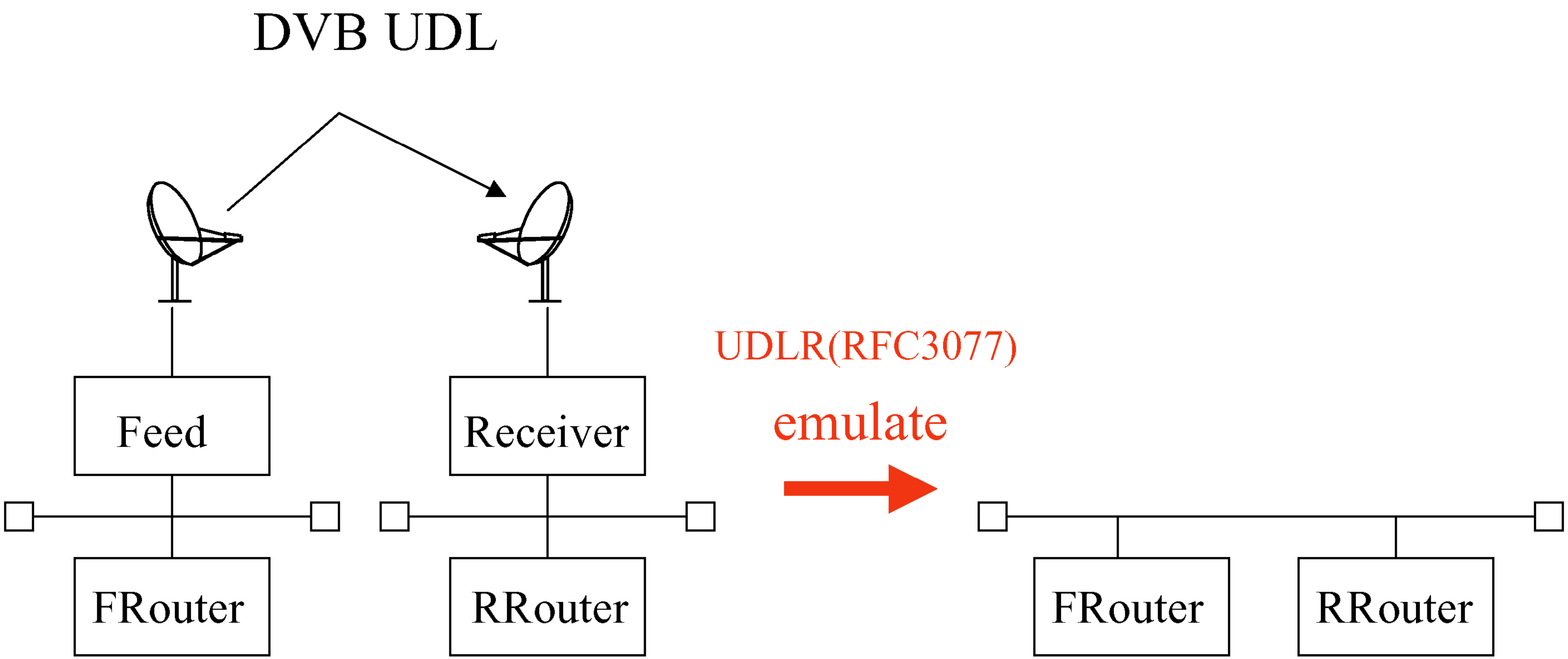
Overview


DVB UDL
UDLR(RFC3077)
emulate
Feed
Receiver
FRouter
RRouter
FRouter
RRouter

Evaluation

- Evaluate combination of UDLR and IP over DVB encapsulation

1. MPE
   A) LLC SNAP flag=0(Without LLC SNAP field)
   B) LLC SNAP flag=1(With LLC SNAP field)
2. ULE
   A) D bit = 0(with Destination Mac address field)
   B) D bit = 1(without Destination Mac address field)
3. Extended MPE
   – Our original extension to add “source MAC address” and “ether type field”

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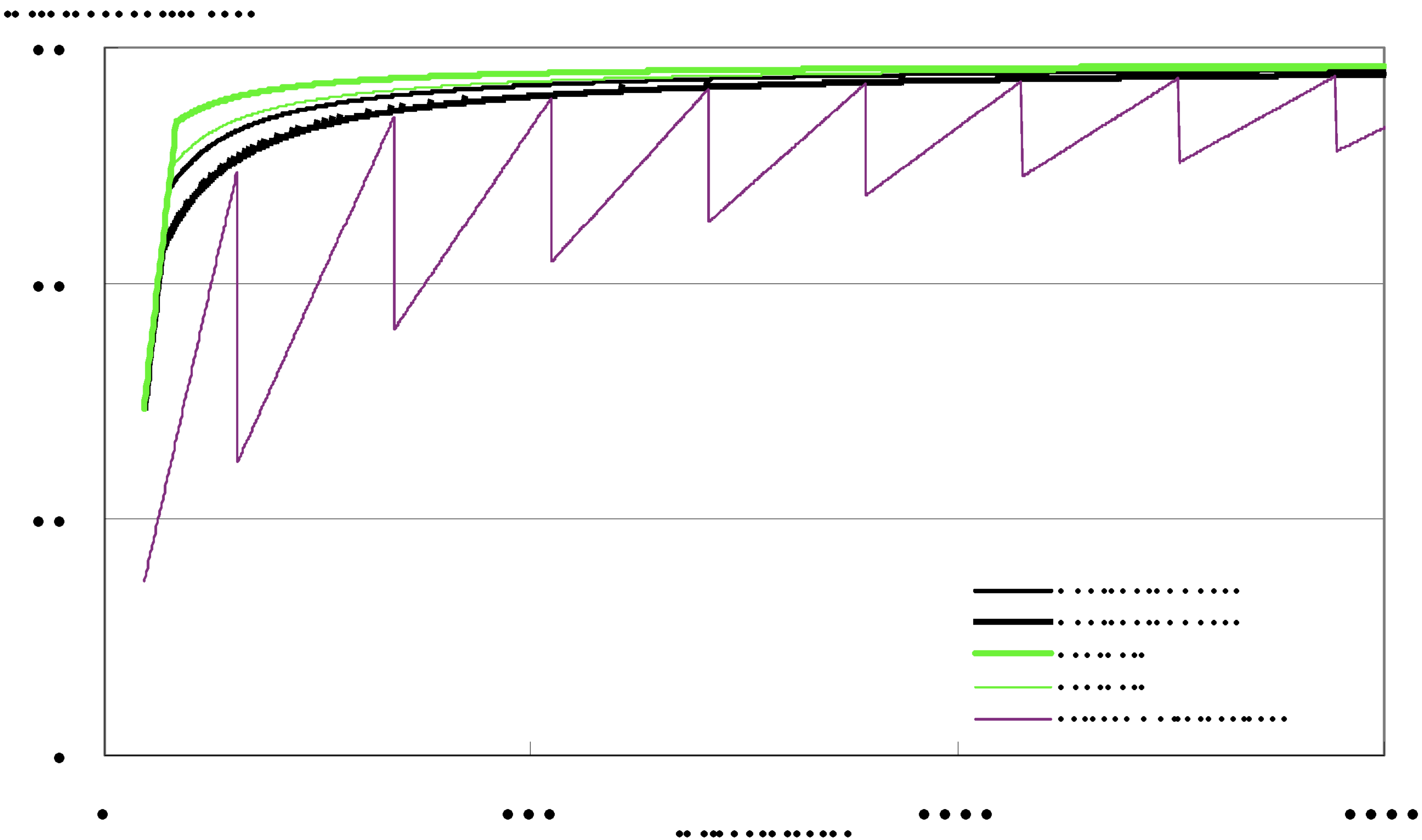
Efficiency



Note : TS rate = 30Mbps

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Address Resolution Functionality

- MPE without LLC/SNAP
  - ARP does not work, because ARP packet can not carry on UDL(lack of ethernet type field)
  - ND works fine, because ND use ICMPv6 on IPv6.
  - But need to modify the receiver driver to see IP version field on IP header.
- Extended MPE
  - Both ARP and ND works fine.
- ULE is not evaluated yet.

Summary of our evaluation (current status)

	IP encap		AR with UDLR	
	Overhead(byte)	Efficiency	ARP(IPv4)	ND(IPv6)
ULE(D=1)	8	1	?	?
ULE(D=0)	14(8+6)	2	?	?
MPE(LLC/SNAP=0)	16	3	×	○
MPE(LLC/SNAP=1)	24(16+8)	4	—	—
Extended MPE	24(16+2+6)	4	○	○

Conclusion

- Encapsulation and Address Resolution should be defined at the same time.
- ULE is efficient encapsulation format, and need to consider about Address Resolution.
- We will evaluate ULE with UDLR by next IETF.

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Question

- Is this evaluation useful ?
- If “YES”, will I write single I-D or merge into AR I-D or merge into ULE I-D ?

9. Other Issues

- ATSC inputs
- Update on implementations

Implementations

Implementor : WISHnet Inc.

Target platform/OS : Linux

Air-interface: DVB-S

Transmit : DVB MASTER FD ASI board + DVB mod.

Receive : Techno torend TT-PCline budget S1100

Implementation type: R&D

Status:

- (1)MPE implementation : Prototype operational
- (2)UDL implementation : Plan to start from Sept.

Implementations

Implementor : Efficient Channel Coding

Target platform/OS : P.C. based server / Linux

Air-interface: DVB-S2

Implementation type: Commercial

Status:Prototype complete, pilot systems operational

URL: www.eccincorp.com

ULE in OPAL, THALES' IP Gateway

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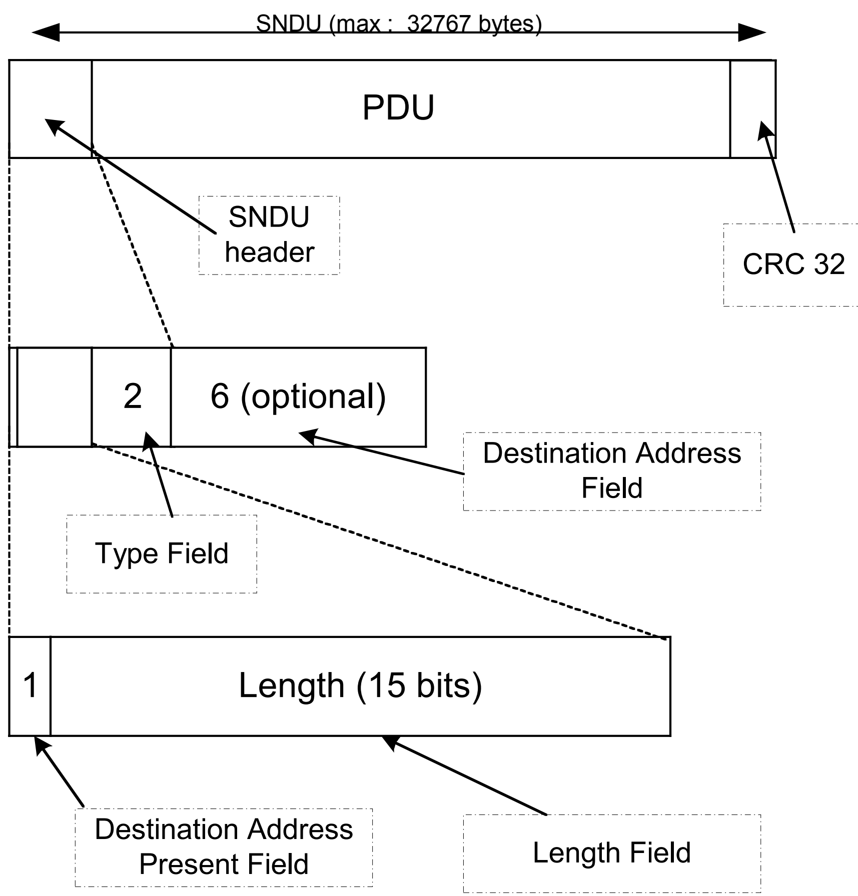
ULE Implementation in OPAL

Integrated within the OPAL's last commercial release

- One IP frame or one bridged Ethernet frame is encapsulated into one SNDU (Send Network Data Unit).
  - PDUs (IP packets and Bridged Ethernet frames) are encapsulated using ULE to form a SNDU. Each SNDU is sent as an MPEG-2 Payload Unit.
  - 3 encapsulation Kind :
    - Ethertype : the payload of the Ethernet frame is encapsulated into one SNDU
    - Bridged Ethernet : the whole Ethernet frame is encapsulated into one SNDU.
    - Test : the whole Ethernet frame is encapsulated into one SNDU. A Test SNDU kind is of type 0.



ULE Validation

- Local tests performed in THALES premises
  - ULE vs MPE : overhead improvement with ULE
- EC REPOSIT : define, implement demonstrate and validate a spectrum efficient interactive satellite (DVB-S) network with interconnection of terrestrial networks (DVB-T, ADSL, WLAN), using real time dynamic management of the available bandwidth
  - Field trials could be used to test the ULE implementation in order to optimize the DVB bandwidth
  - Any DVB/IP receiver ULE compliant can benefit from the REPOSIT field trials to validate its ULE implementation

Support of majors DVB-SI DAT encapsulation protocols :

Mailing list: ipdvb@erg.abdn.ac.uk

To subscribe: subscribe ipdvb at
majordomo@erg.abdn.ac.uk

Archive: http://www.erg.abdn.ac.uk/ipdvb/archive

Please do send copies of slides & minutes to: Gorry@erg.abdn.ac.uk