MDL Cell Format and Meta Signalling

Richard Black

25th February 1992

1 Introduction

This document describes the cell format and meta signalling used in Media Data Link (MDL), the implementation of MSDL used on the Cambridge Fast Ring (CFR), and the Cambridge Backbone Network (CBN).

The MDL protocol is based on fixed size cells, each having a four octet header and thirty two octets of user data. The layout of the cell is designed with bridge mode CFR and CBN hardware in mind.

1.1 History

This document, originally titled "MSNL/MDL Protocol Specification"[1], was originally given to ORL in January 1990 for discussion. Since then the primary changes have been to make it more verbose because it was found difficult to understand. The protocols described herein have not been substantially altered.

Some of the features of this protocol are in need of revision however since it took the Pandora's boxes *two years* to talk this protocol, we dare not change it....

1.2 Implementation

The actual MDL protocol is *de facto* defined to be what is present or implied by the implementation in Wanda. This document attempts to describe the protocol accurately, a difficult task considering the many bizarre behaviours of software and hardware alike, but the final authority rests with the bits that have travelled on the wire for the last two years.

If there is **any** confusion an expert should be consulted before code is implemented. In general an implementation should always be tested for stability against the *de facto* standard implementation.

2 Cell format

The cell consists of two octets of VCI, two octets of FAS and thirty two octets of user payload.

2.1 VCI

The VCI is a two octet quantity on the CFR. On the CBN it has an additional two bits which are not sent in the cell header but are implied by the time division slot in which it travels in the CBN frame. These two bits are known as the CBN Channel Number. They are allocated by a receiving entity as usual, which is a necessity on the CBN since a station may only receive on one channel.

[1] File mnet.tex

The sixteen bits of VCI space are statically partitioned to avoid collision. Six of the bits are called the "MDL Station Address", or simply "MDL Address". There are some restrictions on the values that the MDL address may take which are detailed in the appropriate implementation section.

The other ten bits of the VCI are known as the "associd". The arrangement of the MDL VCI is presented in table 1. Note this is the cell layout on the network. The actual interface will determine how this is read into memory. The current Wanda driver uses the opposite endian to the above, this is so a CBN read will give the Wanda format directly.[2]

Octet	7	6	5	4	3	2	1	0
0	associd		MDL Address					
1	associd							

Table 1: MDL VCI Format

2.1.1 CFR MDL Addresses

On the 68k and Arm hardware interfaces the MDL Address is read from a subset of the station mode address dip switches. The address is carefully tuned to the particular CMOS Chip, DRAM, and board combination and should not be changed.

On the Pandora interface the MDL Address comes from the "initfile".

Note that it is not permitted to statically bind an MSNL address to a MDL address for exactly the same reasons that on an ethernet it is not allowed to bind IP addresses and 48-bit hardware addresses.

2.1.2 CBN MDL Addresses

On the 68k CBN interfaces the MDL address, and the receiving channel number are read from some non-volatile configuration memory on the CPU board.

2.2 FAS

The *de facto* standard FAS used on MDL networks is SAR1. See the document on SAR for details.

2.3 Payload

The payload of an MDL cell is thirty two octets. On the CFR these are sent in order in the slot structure. On the CBN, because of a fault[3] in the hardware, 32-bit data is endian swapped between the host and the network. Since there is only one current interface, and since it suffers the same fault on both transmit and receive, the current driver code assumes that there is no such fault. The result is that data is received as sent but that on the network it travels as eight endian swapped 32-bit words with one endian swap occurring in each of the transmitting and receiving hosts.

[2] The CBN has interface has incorrect mapping of significance of octets to words such that all data is endian swapped when transferred from the machine to the wire. See the implementation section

[3] "feature"

3 Meta Signalling

3.1 VCI thereof

The promiscuous association for control information is defined to have an associd of all ones on the appropriate host. This requires knowing the MDL Address of the appropriate host. Clearly this information is already available once a circuit has been requested, however for connection setup the MDL station address of the remote MSNL address is not known so under these circumstances **only** a host may:

- Contact a lookup server at a well known address to resolve the address. Currently no such server exists.
- Use a cache. For example if I have a connection to MSNL address 128.232.2.232 using station address 42 and I wish to open another one to that host then it is acceptable to try to send the connection request cell to association 1023 on station 42. Currently Wanda machines do not perform such a caching due to the fluid nature of gateways!
- Send to all possible stations. This may be performed either by sending to each in turn or by using some sort of hardware optimisation such as MAC-layer broadcast. On the CFR the broadcast address 0xff,0xff, thus the VCI has the correct associd of all ones and a MDL station id of 0x3f. On the CBN the broadcast VCI is 0xc0,0xff which is a correct associd of all ones and a MDL station address of 0x00. The cell must be sent on all all four CBN channels.

Current Wanda implementations will in fact cope with receiving connection control cells (other than requests) which have been broadcast instead of directed, but such behaviour is considered bad practice because:

- On the CFR in bridge mode broadcast cells are always togged so there is no low level feedback to the sender about whether the real destination has received the cell.
- Reception of such a cell by other hosts will reduce their CMOS chip bandwidth - a scarce resource
- Reception of such a cell by other hosts will cause them to search their liaison tables etc., consuming valuable time and increasing interrupt latency. This is particularly a problem at a gateway which will have many simultaneous connections and a requirement for low interrupt latency.
- Suppression of diagnostic messages about the inability to find the association reduces the debugging ability.

3.2 FAS thereof

The FAS is expected to be an appropriate SAR1 structure. Since the cell is full no part-full indication should be present.

3.3 MDL Meta Signalling data.

The payload contains a single cell. The format adopted is as displayed in table 2. Unfortunately some endian assumptions are made by this structure. Such fields have "network endian".

Unfortunately for historical reasons the OrigChan and RespChan fields which are only meaning-full to the CBN must contain the value seven on the CFR.

Octet	Field	Description
0-1	Arptype	A 15 bit value. Bit 15 should be ignored.[4]
2-3	Prottype	A 16 bit field with value always 1
4,5	OrigVCI	The originator's munged VCI
6,7	RespVCI	The responder's munged VCI
8	OrigChan	The originator's channel number
9	RespChan	The responder's channel number
10-15	Argument	Appropriate argument to the Arptype eg. QoS
16-19	OrigAddr	Four octets of the originator's local address
20-23	OrigPort	Four octets of the originator's port
24-27	RespAddr	Four octets of the responder's local address
27-31	RespPort	Four octets of the responder's port

Table 2: MDL Meta Signalling Cell format

Additionally the VCIs present in this control structure are not in the same format as required in the cell header. The mapping of the bits in the header is described in table 1.

Octet	7	6	5	4	3	2	1	0
0	B	A	P	O	N	M	L	K
1	J	I	H	G	F	E	D	C

Table 3: VCI present in Cell Header

Octet	7	6	5	4	3	2	1	0
0	P	O	N	M	L	K	J	I
1	H	G	F	E	D	C	B	A

Table 4: VCI present in Control Structure

There is no justification for this perversity.

3.4 Meta Signalling Commands

The meta signalling commands used on MDL are identical to those used by all other current implementations of MSDL. They are therefore described in that generic document.

4 Implementation Details

4.1 CFR

There are a number of restrictions on the CFR.

- The CMOS chip has a broadcast ability on what it thinks of as a destination address of 0xffff. Under MDL this maps onto a station address of 0x3f and an association of 0xc0,0xff.

Thus station 0x3f may not use that association number. Note that this associd, all ones, is used for connection control - this prevents station 0x3f from existing at all!

- On networks which may contain both UDL and MDL entities UDL addresses 0xf800-0xfffe are reserved for old style UDL stations. Thus MDL stations 0x38-0x3f may not use ports with the top 2 bits of octet 0 both set, and thus have only 996 ports available. Again this prevents them from existing altogether.
- Metro Bridges use UDL on addresses **outside** the reserved range.

The following assignment of MDL addresses currently exist on the *shared* Pandora CFR ring.

Range	Administrative Domain / Use
0x00 - 0x0f	Pandora Machines
0x10 - 0x1f	Wanda Machines
0x20 - 0x37	Pandora Machines
0x38 - 0x3e	Unusable - UDL entities
0x3f	Unusable - Broadcast

Table 5: Pandora Ring MDL address assignment

4.2 CBN

On the CBN the VCI 0xc0,0xff is used for broadcast so it is not possible to have a MDL Station 0.

The other major brokenness on the CBN is that it endian swaps the data. This is alleviated by the assumption that all interfaces are the same - if ever there was an interface for a different type of machine then this would cause all manner of problems.