IEN 158

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XNET Formats for Internet Protocol Version 4

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This IEN is intended to capture in print the formats used currently in the version 4 XNET protocol; most of the data is courtesy of Ray Tomlinson.

Version 4 XNET is identical with version 2.5 XNET with the exceptions listed below. The version 2.5 format is described in RFC 643. It should be noted that the manner in which the protocol is used by a user program (such as the PDP10 XNET program), and by the various target-machine XNET servers, is not defined herein. In particular there are several problems and heuristics in dealing with the operation of the protocol in the internet environment, where individual packets may be duplicated, lost, and reordered.

Changes from the version 2 formats include the following:

1) XNET header and data is embedded in a IN V4 packet instead of a V2.5 packet.

2) Packet format changed to add Port, Sequence number, and Checksum fields.

3) Change in asynchronous reply codes.

4) Addition of ACK bit to opcode field.

5) Positive acknowledgement of all messages.

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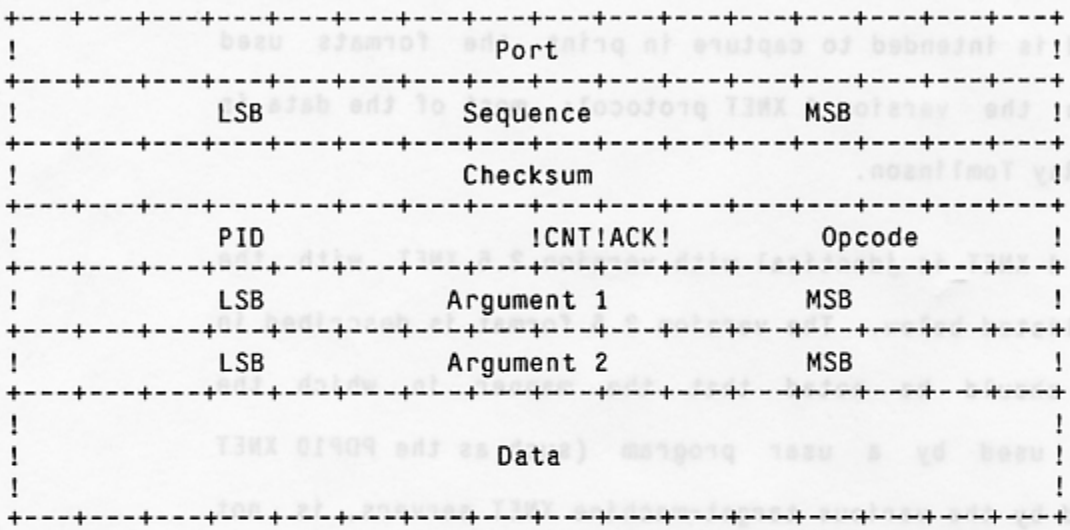
Packet Format



The IN protocol is set to the XNET protocol number (17 octal).

Host to target opcodes

NOP	0	No operation.
DEBUG	1	Start debugging a process or address space.
ENDBUG	2	End debugging a process or address space.
HALT	3	Halt the process.
DPOSIT	4	Deposit in memory.
RESUME	5	Resume execution of a process.
EXAM	6	Examine memory.
DSV	7	Deposit state vector (r0-r5,sp,pc,ps).
SETBPT	10	Set breakpoint.
REMBPT	11	Remove breakpoint.
ONESTP	12	Single step process (using trace trap).
PROCD	13	Proceed from breakpoint.
CREAP	14	Create a new process (or address space).
DSTROY	15	Destroy (delete) a process or address space.
XIOREP	16	Reply to XIO output (not used anymore).
XINREP	17	Reply to XIO input.
DEFALL	20	Define and allocate memory to an address space.
SAP	21	Start all processes.
SAVDSK	22	Save on disk.
GETDSK	23	Get from disk.
ENTRST	24	Enter address space into restart table.

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Opcodes from target to host machine.

HALTED	77	Process halted (FREEP with arguments of 0).
TRAPPED	76	Process trapped due to error.
TTRAP	75	Trace trap.
BPT	74	Breakpoint hit.
XIOIN	73	XIO input request.
XIOOUT	72	XIO output request.

Checksum

The checksum is the same as that for the IN header; ones complement of ones complement sum of words in the packet from Port field to last data word inclusive. In case of an odd number of data bytes, an additional byte of zeroes is assumed for checksum purposes.

Port number

The port number is a unique number relative to the host machine which appears in every packet for a particular debugging session. It is suggested that this number be derived from the time of day so that each session will be unique over a long period of time.

Sequence number

The first packet of a session (first use of a particular port number) is numbered 0. Subsequent packets increment by 1 modulo 2**16. Packets initiated by the target machine (opcodes

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72-77) are also numbered starting from 0. The target machine is allowed to execute packets out of order but must never execute a packet twice unless the effect is harmless. For example, an examine packet should be re-executed so that the data may be returned to the sender. Deposit or resume should not be re-executed. The host machine is responsible for correct ordering of critical functions. For example, it must not send a RESUME command until all prior deposits have been acknowledged.

Acknowledgements

Each packet must be acknowledged by the receiver. An acknowledgement consists of the original header plus any requested data (e.g. EXAM) with the ACK bit set. Acknowledgements are not cumulative; an acknowledgement acknowledges only the one packet with the matching sequence number. If the target debugger is incapable of performing the requested function, it should set the CNT (can't) bit instead of the ACK bit. Both bits may be set meaning that the function is available but the data required is no longer available. This might be the result of a duplicate packet.